66TH CONGRESS : : : 1ST SESSION

MAY 19–NOVEMBER 19, 1919

HOUSE DOCUMENTS

VOL. 20

WASHINGTON : : GOVERNMENT PRINTING OFFICE : : 1919

66TH CONGRESS, 1st Session } HOUSE OF REPRESENTATIVES { DOCUMENT No. 236

DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 485

SURFACE WATER SUPPLY OF HAWAII

JULY 1, 1917, TO JUNE 30, 1918

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Prepared in cooperation with the
TERRITORY OF HAWAII

WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

CONTENTS.

SURFACE WATER SUPPLY OF HAWAII, JULY 1, 1917, TO JUNE 30, 1918.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams and ditches and records of rainfall in the Territory of Hawaii made during the year ending June 30, 1918. The investigations leading to the report were made by the United States Geological Survey in cooperation with the Territory of Hawaii, under the general sanction of the organic law of the Survey (Stat. L., vol. 20, p. 394), which contains the following paragraph:

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

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

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

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

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

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

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

Section 1 of act 56 reads:

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

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

Section 1 of act 57 reads:

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

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

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

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

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

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

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

ACT 27.

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

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

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

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

COOPERATION.

COOPERATION WITH THE TERRITORY OF HAWAII.

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

The principal features of this agreement are:

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

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

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

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

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

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

OTHER COOPERATION.

Special investigations have been made in cooperation with the 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.

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[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., and Lihue Plantation Co.; Island of Oahu—United States Army Constructing Quartermaster Department, Wahiawa Water Co., Kahuku Plantation, and Laie Plantation; 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 four larger islands as the available appropriations would allow. It is essential that records of stream flow should be kept during a period of years long enough to determine within reasonable limits the range of flow from the maximum to the minimum. The length of such a period manifestly varies for different streams. Experience has shown that the records should be kept from 20 to 30 years.

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

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

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

FIELD METHODS OF MEASURING STREAM FLOW.

BASE DATA.

In making plans for power, irrigation, municipal water supply, and other projects involving the use of water from surface streams it is necessary to have data from which both the total flow of the stream and its distribution from day to day throughout the year can be

obtained. The data necessary for obtaining such information are daily gage heights, which give the fluctuations of rise and fall of the stream, and measurements of discharge at various stages, from which a rating curve and table can be prepared giving the discharge for any stage. Such a rating is possible from the fact that so long as the conditions at the controlling section in the stream remain the same the discharge will be approximately the same for any given gage height.

Points at which discharge measurements are made and records of daily fluctuations of stage are kept for determining the daily flow are termed gaging stations.

Gaging stations may be divided into two classes, known as weir stations and velocity-area stations. At weir stations the head of water on the crest of the weir is measured and the discharge computed by means of a formula. The discharge at velocity-area stations is obtained by measuring the velocity of the current and the area of cross section, the product of the two giving the discharge.

The data presented in this paper were collected at both weir and velocity-area stations.

WEIR MEASUREMENTS.

Unquestionably a weir properly constructed and of a type for which accurate coefficients have been determined is one of the most convenient and reliable means of measuring small quantities of water. In practice, however, weirs rarely conform to the requirements imposed by the experimenter who derived the coefficients. If the crest of the weir is sharp and clean and sufficiently high above the bottom of the leading channel, if the end contractions are complete and the velocity of approach is wanting or negligibly small, and if the head on the crest is measured at a distance back of the overfall at least as great as the length of the weir crest length, the Francis formula will give good results. On the other hand, if these essential conditions are not complied with—if the weir is improperly constructed and there is leakage around and under it, and especially if the velocity of approach is considerable and the contractions are imperfect, the Francis formula will not give accurate results.

Observations made on various types of weirs in Hawaii show that not all the weirs in use in the Territory are giving accurate results. If the error is known, so that corrections can be made, the trouble is largely mitigated, but faulty weir records are too often accepted without investigation as to their accuracy.

VELOCITY-AREA METHOD.

The velocity-area method of measurement consists in determining the mean or average velocity of the water past a given cross-section

area. The area of the cross section at right angles to the direction of flow is ascertained by soundings which are taken at such distances apart as will show the contour of the stream bed. The depths are recorded and also their distances from some arbitrarily chosen initial point on one side of the stream.

The method of making the soundings depends on the size and stage of the stream. On ditches and small streams, where the depths and velocities are not large, a graduated rod may be used; on large streams, which must be measured from bridges or cables, a lead weight and sounding line must be used. The size of weights depends on the swiftness of the current and depth of water. The weights are torpedo shaped, so as to offer as little resistance as possible to the moving water.

On streams whose beds are permanent or nearly so a standard cross section is usually constructed from careful soundings and referred to the zero of the gage, so that the depths for any stage can be found by adding the gage height at that stage to the depths below the zero of the gage. This method is especially useful at high stages, when it is difficult to make accurate soundings.

After the cross-section area of the stream has been measured by soundings and horizontal distances, the velocity is determined at a number of points. These measurements of velocity should be made at frequent intervals across the stream and close enough to take account of any abrupt change in the velocity. For convenience, the velocities are usually observed in the same verticals at which soundings are made. On some streams fairly good measurements of velocities may be made by means of subsurface floats. This method is applicable, however, only to channels of uniform cross-section area over a considerable distance, and is very unsatisfactory for use on natural streams like those of Hawaii.[1]

The velocity of flow is best determined by the current meter, which is a form of water wheel actuated by the current and of such size and shape that it can easily be placed at any point in the stream.

The penta-recording current meter consists of six cups attached to a vertical shaft which revolves on a conical hardened-steel point when immersed in moving water. The revolutions are indicated electrically or acoustically. The rating, or relation between the velocity of moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity in feet per second of moving water for any number of revolutions in a given time. The ratio of revolutions per second

[1] Further information regarding the float method is given in Water-Supply Paper 95 and in textbooks on stream flow.

to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of velocities at 0.22 and 0.79 depth will give closely the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives very closely the mean velocity of water flowing in open channels; and that in a completed measurement it seldom varies as much as 1 per cent from the result obtained by the vertical velocity-curve method. It is very extensively used by the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical-velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from

unity in individual measurements is, however, greater than in the 0.2 and 0.8 method and the general results are not so satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind of other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be, in general, from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements or for measurements when the velocity is so great that the meter can not be kept in the correct position for using the other methods.

The vertical integration method consists in moving the meter at a slow but uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods but should not be used with the Price meter, which will revolve when it is moved vertically.

In practical work on rough streams, such as many of those in Hawaii, the meter should be held at 0.6 depth if the stream is less than 1 foot deep. For depths of 1 foot or more the meter should be held at two points in the vertical, 0.2 and 0.8 from the surface.

When the mean velocities in the different verticals have been found, the average of two adjacent means is taken as the mean velocity for that individual section. The area of the section is computed by multiplying the width of the section by the mean depth. The discharge of each section is then the product of the area multiplied by the mean velocity, and the total discharge of the stream results from summing up the discharge of the individual sections. In practice the work is tabulated in such a way as to render the computation very simple.[1]

Current-meter measurements are not practicable where there are eddies, cross currents, swirls, or passages for the water underneath stones. It is usually possible, however, to improve the channel by removing boulders and rocks, so that a satisfactory measuring section may be obtained, even on rough, steep streams such as exist in Hawaii.

Three kinds of velocity-area gaging stations are in general use in Hawaii, classified according to the means provided for making the observations of depth and velocity. They are wading, bridge, and cable stations.

A wading station is one at which measurements are made only by wading—that is, no means exist for getting above the water at any

[1] For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.

stage except by wading. Such stations are usually on ditches or wide shallow streams, which do not fluctuate greatly. On many streams, however, measurements are made at low stages by wading, even though other means exist for making measurements at higher stages.

A bridge station is one at which the meter is used from a bridge. In some places highway or other bridges are available from which to make measurements, but generally they are not at the right place on the stream. Special bridges are then built.

A cable station is one at which measurements are made from a cable spanning the stream. Cable stations are used on large streams, such as Hanapepe, Wailua, and Hanalei rivers on the island of Kauai, and Wailuku River on the island of Hawaii. The cable supports the car from which a man works above the water. Distances are marked off on the cable itself or on a small auxiliary cable stretched taut above it.

A suitable place for a gaging station having been selected, a staff gage is set in the edge of the stream, either vertical or inclined, but graduated into tenths, half-tenths, or two-hundredths of feet vertically. The gage is securely fastened to rocks or trees to prevent displacement by floods and is so placed that the zero, or reference datum, is well below extreme low water. The datum is also referred to a permanent bench mark as an additional precaution. A water-stage recorder is then installed or an observer is engaged to record the heights of water morning and evening, and the mean of the two readings is used as the mean gage height for the day. Owing to the rapid rise and fall of most of the streams in Hawaii, two gage-height readings a day will not as a rule give a true mean for the 24 hours. For this reason, and also owing to the fact that many of the gaging stations are necessarily situated in the mountains at points remote from all habitations and difficult of access, it has generally been found necessary to use water-stage recorders. These instruments are of various types, some requiring weekly visits and others operating for a month without attention.

The essential features of water-stage recorders comprise a float free to rise and fall with fluctuations of the water surface, a device for transferring the motion of the float to the record sheet (either directly or through a reducing mechanism), the recording device, and the clock. The instruments may be designed for any range of stage.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated more or less definitely with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as "second-feet," "gallons per minute," "gallons per

day," "miner's inches," and "run-off in second-feet per square mile," and (2) those which represent the actual quantity of water, as "run-off in depth in inches," "million gallons," and "acre-feet." They may be defined as follows:

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

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

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

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

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

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

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

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

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

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For a part of a month multiply discharge for one day by the number of days.

1,000,000 United States gallons per day equals 1.55 second-feet.

1,000,000 United States gallons equals 3.07 acre-feet.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet, or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot for one year (365 days) equals 724 acre-feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day covers 1 square mile 0.3719 inch deep.

1 second-foot for one day equals 1.983 acre-feet.

1,000,000 cubic feet equals 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.

1 inch deep on 1 square mile equals 2,323,200 cubic feet.

1 inch deep on 1 square mile equals 0.0737 second-foot per year.

1 foot equals 0.3048 meter.

1 mile equals 1.60935 kilometers.

1 mile equals 5,280 feet.

1 acre equals 0.4047 hectare.

1 acre equals 43,560 square feet.

1 acre equals 209 feet square, nearly.

1 square mile equals 2.59 square kilometers.

1 cubic foot equals 0.0283 cubic meter.

1 cubic foot equals 7.48 gallons.

1 cubic foot of water weighs 62.5 pounds.

1 cubic meter per minute equals 0.5886 second-foot.

1 horsepower equals 550 foot-pounds per second.

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1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.
To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of water-stage record sheets, daily gage heights, discharge measurements, and notes from observers' books, are assembled. The measurements are plotted on cross-section paper, and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharge, and from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the kinds of channels which they represent. The discharge measurements for all classes of stations, when plotted with gage heights in feet as ordinates and discharge in million gallons per day as abscissas, define rating curves which are generally more or less parabolic in form.

For every rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating, as stated in the footnote to each table, is not applicable for periods during which the channel was obstructed; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposits of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will, for all practical purposes, be a true index of the discharge. Discharge measurements made at such stations usually

plot within 2 or 3 per cent of the mean discharge curve, and the rating developed from that curve represents a very high degree of accuracy.

Class 2 comprises mainly stations on rough, mountainous streams with steep slopes. The beds of such streams are, as a rule, comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the period of actual change in conditions of flow.

Class 3 includes those stations where the stream bed is of a shifting character, or the controlling section below the gage frequently changes, owing to cutting out by the current and the filling in of sand, gravel, and drift. In some places in Hawaii changes are caused by the growth of vegetation in the stream bed. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly from the measurements made in the current year, the engineer being guided largely by the history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper they will define a mean curve which may be called a standard curve. It has been found in practice that if after a change caused by high stage a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to ordinates or gage heights. This law of the parallelism of rating curves is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is, of course, fundamentally due to change in the channel caused by cut or fill, or both, at or near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when

referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) If a cut or fill occurs at the measuring section, there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect, and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) If change along the crest of a weir or rocky control is uniform, the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

In actual practice, of course, such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another, and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of rating curves. In complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most accurate results.

At low or medium stages slight changes of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered excellent for stations of this class.

Class 4 comprises stations on streams that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency ranging from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that the rating curve is different for every day of the year and that the curves are parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is assumed that the

rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course then to be pursued.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing data are filled in, so far as feasible, by means of comparison with records for adjacent streams. The attempt is made to complete records for years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the daily and monthly discharge tables.

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 mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column of "Minimum" the quantity given is the mean

flow for the day when the mean gage height was lowest. The columns headed "Mean" give the average flow in million gallons per day and in cubic feet per second during the month. The "Total in million gallons" and "Total in acre-feet" given in the columns under these heads are computed from the mean discharge in million gallons per day.

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

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

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

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

DIVISION OF WORK.

The data were collected and prepared for publication under the direction of C. T. Bailey, acting district engineer, Honolulu, Hawaii, by James E. Stewart, office engineer, W. V. Hardy, R. D. Klise, H. A. R. Austin, W. C. Woodward, J. B. Mann, A. H. Wong, E. E. Goo, John Kaheaku, and Earl Smith. The manuscript has been prepared by James E. Stewart and reviewed by C. T. Bailey.

GAGING STATIONS MAINTAINED IN HAWAII.

The following list comprises the gaging stations maintained in Hawaii by the United States Geological Survey and cooperative parties. The stations are arranged by stream basins and appear in systematic order for the several islands, tributaries of main streams being indicated by indention. The dates show the years or parts of years for which records are available. A dash following the date indicates that the station was being maintained June 30, 1918.

KAUAI ISLAND.

Waimea River near Waimea, 1910–
Poomau River:
Kawaikoi Stream near Waimea, 1909–1917.
Waiakoali Stream near Waimea, 1909–1912.
Mohihi Stream near Waimea, 1909–1912.
Waiahulu Stream near Waimea, 1916–
Koaie Stream near Waimea, 1916–
Waialae River near Waimea, 1910–1916.
Waialae River at elevation 800 feet, near Waimea, 1916–
Kekaha ditch at Camp No. 1, near Waimea, 1910–1915, 1917–
Kekaha ditch at flume No. 3, near Waimea, 1910–1912.
Kekaha ditch at flume No. 4, near Waimea, 1916–17.
Kekaha ditch at siphon near Waimea, 1910–1912.
Kekaha ditch at tunnel No. 12, near Waimea, 1910–1914.
Kekaha ditch below tunnel No. 12, near Waimea, 1916–
Waimea ditch near Waimea, 1911–1913, 1916–
Kamenehune ditch near Waimea, 1911–
Makaweli River near Waimea, 1911–1917.
Halekua Stream near Waimea, 1912–13.
Olokele River near Waimea, 1915–1917.
Olokele ditch at tunnel No. 12, near Makaweli, 1904–1917.
Olokele ditch at weir, near Makaweli, 1912–1917.
Poowaiomahaihai ditch near Waimea, 1911–1913.
Hanapepe River above Hanapepe Falls, near Eleele, 1911–12.
Hanapepe River at Koula, near Eleele, 1910–1916, 1917–
Hiloa ditch near Eleele, 1911–1915.
East Branch Hanapepe River below Hanapepe Falls, near Eleele, 1911–12.
Hanapepe ditch at Hanapepe Falls, near Eleele, 1911–1915.
Hanapepe ditch at Koula, near Eleele, 1910–
Hanapepe ditch at weir near Hanapepe, 1910–1917.
Manuahi Stream near Eleele, 1917–
Huleia River near Lihue, 1912–1915.
Hanamaulu River at Kapaia, near Lihue, 1911–1914.
Wailua River:
South Fork of Wailua River at siphon near Lihue, 1910–11.
South Fork of Wailua River near Lihue, 1911–
Hanamaulu ditch near Lihue, 1910–
Lihue ditch near Lihue, 1910–
North Fork of Wailua River near Lihue, 1910–1914.
North Fork of Wailua River at elevation 650 feet near Lihue, 1914–
Kanaha ditch near Lihue, 1910–
East Branch of North Fork of Wailua River near Lihue, 1912–
Uhau Iole Stream at elevation 750 feet, near Lihue, 1912.
Keahua Stream at elevation 750 feet, near Lihue, 1912.
Kawi Stream at elevation 750 feet, near Lihue, 1912.
Konohiki Stream at Makakualele weir (mauka) near Kapaa, 1911–1913.
Kaehulua Stream at Kuhinoa (mule stable) weir, near Kapaa, 1911–1913.
South Fork of Kaehulua Stream at Wainamuamu weir, near Kapaa, 1911–12.
North Fork of Kaehulua Stream at Wainamuamu weir, near Kapaa, 1911–1913.

Kapaa River near Kealia, 1910–
Akulikuli Spring near Kealia, 1911–1913.
Kapahi ditch near Kealia, 1909–
Tunnel ditch at Kapahi, near Kapaa, 1909–1911.
Kapaa ditch at Kapahi, near Kapaa, 1909–1911.
Pipe ditch at Kapahi, near Kapaa, 1909–1911.
Kealia Stream:
Kaneha ditch near Kealia, 1909–1913.
Anahola River at elevation 1, 140 feet near Kealia, 1912.
Anahola River near Kealia, 1910, 1912–
Anahola River at Kiokala dam, near Kealia, 1910–1912.
Anahola ditch above Kaneha reservoir, near Kealia, 1914–
Anahola ditch at Kiokala, near Kealia, 1909–1914.
Anahola ditch at Makai weir, near Kealia, 1909–1911.
Kalihiwai River near Hanalei, 1914–
Kalihiwai River near Kilauea, 1912–1914.
Hanalei River at elevation 625 feet, near Hanalei, 1914–
Hanalei River near Hanalei, 1911–
China ditch near Hanalei, 1911–
Kuna ditch near Hanalei, 1912–13, 1916–
Lumahai River near Hanalei, 1914–1917.
Lumahai River near Wainiha, 1912.
Waioli Stream near Hanalei, 1914–
Wainiha River near Hanalei, 1914–1917.
Wainiha River, East Channel, near Wainiha, 1912–1916.
Wainiha River, West Channel, near Wainiha, 1911–1916.
Wainiha canal at intake, near Wainiha, 1910–1916.
Wainiha canal at tunnel No. 18, near Wainiha, 1911.
Wainiha canal at tailrace, near Wainiha, 1911.

OAHU ISLAND.

Kalihi Stream near Honolulu, 1913–
Nuuanu Stream at Laukaha weir in upper Nuuanu Valley, near Honolulu, 1903, 1910–1913.
Nuuanu Stream below Reservoir No. 2 wasteway, near Honolulu, 1913–
Nuuanu Stream at Kuakini Street, near Honolulu, 1911–12.
Lulumaha ditch at upper Nuuanu reservoir, near Honolulu, 1911–1913.
Maole ditch, mauka station, near Honolulu, 1917–
Maole ditch, makai station, near Honolulu, 1917–
Pauoa Stream at upper Pauoa Valley, near Honolulu, 1911–1913.
Kahuawai Spring, near Honolulu, 1912–1914.
Manoa Stream at upper Manoa Valley, near Honolulu, 1910–1913.
Manoa Stream at College of Hawaii, near Honolulu, 1909–
West Branch of Manoa Stream near Honolulu, 1913–
East Branch of Manoa Stream near Honolulu, 1913–
East Manoa ditch near Honolulu, 1915–16, 1918–
Palolo Stream:
Pukele Stream at Mahoe springs, near Honolulu, 1912–13.
Waiomao Stream at upper Palolo Valley, near Honolulu, 1911–1913.
Waiomao Stream above Pukele, near Honolulu, 1911–12.
Waimanalo ditch below main reservoir, near Waimanalo, 1912–13.
Pump ditch near Waimanalo, 1912.
Makawao ditch near Kailua, 1912–1916.

Kailua Stream near Kailua, 1912–1916.
Wong Leong's ditch near Kailua, 1912–1916.
Makawao Stream near Kailua, 1912–1916.
Makawao Spring near Kailua, 1914–1916.
Kaimi Stream near Kailua, 1912–1916.
Main spring near Kailua, 1914–1916.
Kamakalepo Stream near Kailua, 1912–1916.
Pohakea Stream near Kailua, 1912–1914.
Kahanaiki Stream in Kailua Valley, near Kailua, 1912.
Kahanaiki Stream near Kailua, 1914–1916.
South Branch of Kahanaiki Stream near Kailua, 1913–14.
North Branch of Kahanaiki Stream near Kailua, 1913–14.
Kahanaiki ditch in Kailua Valley, near Kailua, 1912–13.
Kaneohe Stream near Kaneohe, 1914–1916.
Young Mau ditch near Kaneohe, 1914–1916.
Ahlo ditch near Kaneohe, 1914–1916.
Hooleinaiwa Stream near Kaneohe, 1914–1916.
Piho Stream near Kaneohe, 1914–1916.
Kuou Stream near Kaneohe, 1914–1916.
Kuou ditch near Kaneohe, 1914–1916.
Luluku Stream near Kaneohe, 1914–1916.
North Luluku ditch near Kaneohe, 1914–1916.
Kawa Stream near Kaneohe, 1914–1916.
Heeia Stream:
Wing Wo Tai ditch near Heeia, 1914–1916.
Hop Tuck ditch near Heeia, 1914–1916.
Lee ditch near Heeia, 1914–1916.
Haiku Stream near Heeia, 1914–
Reservoir ditch near Heeia, 1914–1916.
Waipio ditch near Heeia, 1914–1916.
Iolekaa Stream near Heeia, 1914–1916.
Waiahole Stream below power house near Waiahole, 1915.
Waiahole Stream near Waiahole, 1911–1916.
Waiahole Stream at Waiahole, near Waikane, 1911–12.
Waihi Stream near Waikane, 1911.
Halona Stream near Waikane, 1911.
Waianu Stream near Waikane, 1911.
Waikane Stream near Waikane, 1911–12.
Kahana Stream near Kahana, 1914–1917.
East Branch of Kahana Stream near Kahana, 1914–1917.
Punaluu Stream at elevation 539 feet, near Punaluu, 1915–1918.
Punaluu Stream at elevation 250 feet, near Punaluu, 1914–1918.
Punaluu Stream near Hauula, 1906–7.
Waihoi Stream near Punaluu, 1915–1917.
Kaluanui Stream near Hauula, 1906–7, 1915–1917.
Kaipapau Stream near Hauula, 1906–7.
Koloa Stream near Laie, 1914–
Wailele Stream near Laie, 1914–
East Branch of Kahawainui Stream near Laie, 1914–1918.
East Branch of Malaekahana Stream near Kahuka, 1914–1918.
Middle Branch of Malaekahana Stream near Kahuka, 1914–1918.
Kaukonahua Stream:
North Fork of Kaukonahua Stream near Wahiawa, 1911.
Right Branch of North Fork of Kaukonahua Stream near Wahiawa, 1913–
Left Branch of North Fork of Kaukonahua Stream near Wahiawa, 1913–

Kaukonahua Stream—Continued.
South Fork of Kaukonahua Stream above United States Army reservoir, near Wahiawa, 1911, 1913–1917.
United States Army ditch at reservoir, near Wahiawa, 1914–15.
South Fork of Kaukonahua Stream below United States Army reservoir near Wahiawa, 1914–1917.
Wahiawa reservoir ditch near Wahiawa, 1910–11.

MAUI ISLAND.

WEST MAUI.

Iao Stream near Wailuku, 1910–1915.
Maniania ditch near Wailuku, 1909–1913.
Waiehu Stream:
South Waiehu Stream near Wailuku, 1910–1917.
South Waiehu ditch near Wailuku, 1912–1915.
North Waiehu Stream near Wailuku, 1912–1917.
North Waiehu ditch near Wailuku, 1910–11, 1916–17.
Waihee Stream near Waihee, 1910–1912, 1913–1917.
Waihee canal near Waihee, 1910–1912.
Waihee canal at weir, near Wailuku, 1911–12.
Spreckels ditch near Waihee, 1910–1913.
Spreckels ditch at Waiale weir, near Wailuku, 1910–11.
Kahakuloa Stream at Kahakuloa, near Waihee, 1912–13.
Kahakuloa Stream near Honokahau, 1913–14.
Honokahau Stream near Honokahau, 1913.
Honokahau ditch at intake, near Honokahau, 1907–1913.
Honokahau ditch above Honolua Stream, near Honokahau, 1910–11.
Honokahau ditch at Honokawai weir, near Lahaina, 1910–1912.
Honolua Stream at Honolua ranch, 1911.
Honolua Stream near Honokahau, 1913–1917.
Honolua ditch near Honokahau, 1911–12.
Honokawai Stream near Lahaina, 1911; 1912–1917.
Honokawai Stream at weir No. 1, near Lahaina, 1901.
Honokawai ditch near Lahaina, 1912–1917.
Kahoma Stream near Lahaina, 1911–12; 1913–1917.
Kahoma Stream at weir No. 1, near Lahaina, 1901.
Kahoma Stream at weir No. 2, near Lahaina, 1901.
Kahoma development tunnel near Lahaina, 1911–1917.
Lahainaluna Stream above pipe line intake, near Lahaina, 1916–
Lahainaluna Stream near Lahaina, 1911–1916.
Lahainaluna weir No. 1 near Lahaina, 1901.
Lahainaluna weir No. 2 near Lahaina, 1901.
Lahainaluna ditch near Lahaina, 1913–14.
Kauaula Stream near Lahaina, 1912; 1913–1917.
Kauaula Stream at weir No. 3, near Lahaina, 1901.
Kauaula ditch near Lahaina, 1911–1917.
Kauaula Stream, North Fork, at weir No. 1, near Lahaina, 1901.
Kauaula Stream, South Fork, at weir No. 2, near Lahaina, 1901.
Launiupoko Stream near Lahaina, 1911–1917.
Olowalu Stream near Olowalu, 1913–1916.
Olowalu ditch near Olowalu, 1911–
Ukumehame Stream near Olowalu, 1911–12; 1913–
Waikapu Stream near Waikapu, 1910–1917.
Palolo (Everett) ditch near Waikapu, 1910–1917.
South Side Waikapu ditch near Waikapu, 1910–1917.

EAST MAUI.

Koolau ditch region:
- Hanawi Stream near Nahiku, 1914–15.
- West Kopiliula Stream near Keanae, 1914–1917.
- East Wailuaiki Stream near Keanae, 1913–1917.
- West Wailuaiki Stream near Keanae, 1914–1917.
- East Wailuanui Stream near Keanae, 1914–1917.
- West Wailuanui Stream near Keanae, 1913—1917.
- Koodau ditch near Keanae, 1910–1912, 1917–
- Koolau ditch at Alo division weir, near Huelo, 1908–1911.

Spreckles ditch region:
- Honomanu Stream near Keanae, 1913–
- Haipuaena Stream near Huelo, 1910–
- Puohakamoa Stream near Huelo, 1910–
- Alo Stream near Huelo, 1910–
- Waikamoi Stream, near Huelo, 1910–
- Oopuola Stream, near Huelo, 1910–1915.
- Spreckels ditch at station No. 1, near Huelo, 1910–1913.
- Spreckels ditch at station No. 2, near Huelo, 1911–1913.
- Spreckels ditch at station No. 3, near Huelo, 1910–1913.
- Spreckels ditch at station No. 4, near Huelo, 1910–1913.
- Spreckels ditch at station No. 5, near Huelo, 1911–1913.
- Spreckels ditch at station No. 6, near Huelo, 1911–1913.
- Spreckels ditch below Kaaiea gulch, near Huelo, 1917–
- Spreckels ditch at station No. 7, near Huelo, 1911–1912.
- Spreckels ditch at station No. 8, near Huelo, 1911–1913.

Center ditch region:
- Manuel Luis ditch at Puohakamoa gulch, near Huelo, 1917–
- Center ditch at Waikamoi, near Huelo, 1918–
- Center ditch, near Huelo, 1910–1912.

Hamakua ditch region:
- Nailiilihaele Stream, near Huelo, 1910–1912; 1913–1918.
- Kailua Stream, near Huelo, 1910–1912; 1913–1918.
- Oanui Stream, near Huelo, 1910–11; 1913–1916.
- Hoolawaliilii Stream, near Huelo, 1911–
- Hoolawanui Stream, near Huelo, 1911–
- Honopou Stream, near Huelo, 1910–
- Halehaku Stream at dam, near Huelo, 1910–11.
- Halehaku Stream weir, near Huelo, 1910–1912.
- Opana Stream, near Huelo, 1910–1912.
- Opana ditch, near Huelo, 1910–1912.
- New Hamakua ditch at Nailiilihaele weir, near Huelo, 1910–1912.
- New Hamakua ditch at Halehaku weir, near Huelo, 1910–
- New Hamakua ditch at station No. 1, near Huelo, 1912.
- New Hamakua ditch at station No. 2, near Huelo, 1912.
- New Hamakua ditch at station No. 3, near Huelo, 1912.
- New Hamakua ditch at station No. 4, near Huelo, 1912.
- New Hamakua ditch at station No. 5, near Huelo, 1912.
- New Hamakua ditch at Honopou, near Huelo, 1918–
- Old Hamakua ditch at Honopou, near Huelo, 1918–
- Old Hamakua (Kauhikoa) ditch at Opana weir, near Huelo, 1910–
- Kaluanui ditch at Puuomalei, near Hamakuapoko, 1910–1912.
- Lowrie ditch at Opana weir, near Huelo, 1910–
- Haiku ditch at Peahi weir, near Huelo, 1910–

MOLOKAI ISLAND.

Halawa Stream, near Halawa, 1917–

HAWAII ISLAND.

Hilo group:
- 81 stations at elevation 2,700 feet, in forest back of Hilo, 1911–1913.
- Wailuku River, near Hilo, 1911–1913, 1918–
- Hilo Boarding School ditch, near Hilo, 1918–
- Honolii River at Kaiwiki, near Hilo, 1911–1913.
- Honolii ditch at Kaiwiki, near Hilo, 1911.
- Kawainui River at Kawainui, near Pepeekeo, 1911–12.
- 4 stations at Piihonua, near Hilo, 1912.

Hamakua group:
- Waipio River below Koiawe, near Waipio, 1911–12.
- Waipio River below Waima, near Waipio, 1911–12.
- Waipio River at elevation 360 feet, near Waipio, 1901–2.
  - New Hamakua ditch at Waima Stream, near Waipio, 1912.
  - Lower Hamakua ditch at main weir, near Kukuihaele, 1910–
  - Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, 1913–
  - Kawainui Branch of Waipio River, near Waipio, 1911–12.
  - Kawainui Stream at elevation 2,120 feet, near Waipio, 1901–2.
  - Kawainui Stream at elevation 1,435 feet, near Waipio, 1901–2.
  - Kawainui Stream at elevation 775 feet, near Waipio, 1901–2.
    - Branch No. 3 of Kawainui Stream at elevation 1,700 feet, near Waipio, 1901–2.
    - Branch No. 2 of Kawainui Stream at elevation 1,405 feet, near Waipio, 1901–2.
    - Branch No. 1 of Kawainui Stream at elevation 1,380 feet, near Waipio, 1901–2.
  - Alakahi Stream at elevation 1,200 feet, near Waipio, 1901–2.
  - Alakahi Stream at elevation 730 feet, near Waipio, 1901–2.
  - Koiawe Stream at elevation 610 feet, near Waipio, 1901–2.
  - Waima Stream at elevation 790 feet, near Waipio, 1901–2.
  - Waima Stream at elevation 385 feet, near Waipio, 1901–2.

Kohala group:
- Honokane Stream—
  - East Branch of Honokane Stream at elevation 1,300 feet, near Honokane, 1901.
  - East Branch of Honokane Stream at elevation 770 feet, near Honokane, 1901.
  - West Branch of Honokane Stream at elevation 1,370 feet, near Honokane, 1901.
  - West Branch of Honokane Stream at elevation 775 feet, near Honokane, 1901.
  - Kohala ditch above Honokane gulch, near Kohala, 1908–
  - Kohala ditch at Awini weir, near Kohala, 1907–1917.
  - Kohala ditch at Niulii weir, near Kohala, 1907–1917.
  - Kehena ditch at Honokane mauka, near North Kohala, 1912–13.
  - Kehena ditch, near Kohala, 1917–

Kau group:
- Waiohinu Springs, mauka station, near Naalehu, 1917–
- Waiohinu Springs, makai station, near Naalehu, 1917–

GAGING-STATION RECORDS.

ISLAND OF KAUAI.

WAIMEA RIVER NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—July 9, 1910, to June 30, 1918.

GAGE.—Vertical and inclined staff installed October 5, 1911, read by A. B. Blackstadt. July 9, 1910, to October 4, 1911, staff gage about a mile downstream.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 500 feet above and below gage; banks high; bed of stream sandy. Control composed of sand, gravel, and boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.6 feet at 4.30 p. m. October 16 (discharge, 4,700 million gallons per day, or 7,280 second-feet); minimum stage recorded, 4.35 feet September 12 and 13, October 10 and 12 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

1910–1918: Maximum stage recorded, 18.8 feet at 4.30 p. m. January 25, 1916 (discharge, computed from extension of the rating curve, about 10,700 million gallons per day, or 16,600 second-feet); channel practically dry at times, as all water diverted above.

DIVERSIONS.—Large number of diversions above station.

REGULATION.—By diversions.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves well defined July 1 to October 15 and October 16 to June 30, but date of change of stage-discharge relation uncertain. Gage read to hundredths twice daily. Records good, except those for October to January, which are fair.

Discharge measurements of Waimea River near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 12	4.80	11.7	7.6	Mar. 13	7.50	775	501
Jan. 24	7.00	516	333	Apr. 29	6.03	147	95
Feb. 20	6.60	304	196	May 28	5.20	38	25
				30	5.34	47	31

Daily discharge, in million gallons, of Waimea River near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	34	6.0	2.5	5.0	7.0	56	14	47	172	151	79	40
2	10	5.0	2.0	5.0	32	23	12	69	110	225	74	56
3	10	10	2.0	7.0	382	18	12	74	1,080	184	74	14
4	87	42	2.0	6.0	84	10	12	79	900	142	110	10
5	12	62	2.0	7.0	26	10	10	79	825	125	125	8.5
6	14	16	2.0	6.0	43	29	10	312	700	162	79	6.0
7	8.5	7.0	2.0	7.0	23	125	12	400	312	210	69	6.0
8	24	8.5	2.0	7.0	20	103	103	36	184	172	133	5.0
9	352	7.0	2.0	2.5	18	79	79	96	133	142	64	5.0
10	110	6.0	2.0	1.5	14	69	74	125	1,320	259	51	7.0
11	46	5.0	2.0	2.0	10	74	84	142	1,490	151	51	23
12	51	5.0	1.5	1.5	14	69	79	151	550	103	133	18
13	21	46	1.5	21	6.0	74	79	90	452	103	96	29
14	14	51	2.0	46	5.0	43	103	84	312	117	43	23
15	14	46	3.0	5.0	5.0	40	133	74	348	117	43	51
16	8.5	21	5.0	1,080	5.0	23	90	60	277	103	36	60
17	38	56	14	277	3.0	16	26	600	259	84	36	40
18	46	94	62	90	3.0	18	14	900	210	3,950	64	16
19	46	8.5	51	43	3.0	14	1,520	330	210	1,880	47	36
20	68	7.0	12	29	3.0	10	365	172	125	900	36	56
21	56	6.0	4.0	23	10	23	117	1,050	84	510	29	23
22	56	5.0	2.5	51	18	32	110	312	79	435	23	60
23	8.5	5.0	2.0	56	6.0	16	90	142	69	259	36	43
24	30	5.0	2.5	51	5.0	14	69	110	69	184	23	40
25	68	6.0	2.5	51	10	16	510	90	74	133	40	40
26	56	5.0	3.0	51	60	32	365	90	64	133	23	14
27	24	5.0	34	8.5	172	79	600	90	51	172	43	40
28	24	3.0	38	7.0	64	117	510	330	43	142	117	23
29	14	4.0	18	7.0	36	43	550	.....	36	90	96	16
30	12	3.0	18	7.0	60	23	242	.....	32	84	32	12
31	12	3.0	.....	18	.....	16	125	.....	125	.....	36	.....

Monthly discharge of Waimea River near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	352	8.5	44.3	68.5	1,370	4,210
August	94	3.0	18.0	27.8	559	1,710
September	62	1.5	9.96	15.4	299	917
October	1,080	1.5	63.8	98.7	1,980	6,070
November	382	3.0	38.2	59.1	1,150	3,520
December	125	10	42.4	65.6	1,310	4,030
January	1,520	10	197	305	6,120	18,700
February	1,050	36	219	339	6,130	18,800
March	1,490	32	345	534	10,700	32,800
April	3,950	84	381	589	11,400	35,100
May	133	23	62.6	96.9	1,940	5,960
June	60	5.0	27.4	42.4	820	2,520
The year	3,950	1.5	120	186	43,800	134,000

WAIAHULU STREAM NEAR WAIMEA, KAUAI.

LOCATION.—In Waimea Canyon, half a mile above confluence with Koaie Stream, 12 miles north of Waimea.

RECORDS AVAILABLE.—February 25 to October 21, 1916; October 25, 1917, to June 30, 1918.

GAGE.—Stevens water-stage recorder installed October 25, 1917, to replace original Gurley printing water-stage recorder destroyed by flood of December 18, 1916.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage; banks high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.71 feet at 12.45 p. m., April 18 (discharge, computed from extension of rating curve, 1,200 million gallons per day, or 1,860 second-feet); minimum stage recorded, 2.6 feet October 25 and 26 and January 10 (discharge, 24 million gallons per day, or 37 second-feet).

1915–1918: Flood December 18, 1916, reached a stage of about 15 feet (discharge not estimated); minimum stage recorded, 1.8 feet October 3 and 4, 1916 (discharge, 13 million gallons per day, or 20 second-feet[1]).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation changed by flood of April 10–11. Rating curves applicable as follows: October 25 to April 10, well defined below 100 million gallons per day and poorly defined above that point; April 11 to June 30, fairly well defined below 65 million gallons per day and poorly defined above that point. Operation of water-stage recorder satisfactory. Records good for low and medium stages, but poor for high stages.

Discharge measurements of Waiahulu Stream near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 17	2.77	24	15	Jan. 11	2.56	35	23
Oct. 12	2.73	22	14	Feb. 16	3.20	97	63
14	2.88	32	21	Mar. 28	3.11	89	57
17	3.59	152	98	May 7	3.08	70	45
17	3.32	109	71	8	3.39	99	64
18	2.99	70	45	June 25	3.05	61	39
19	2.81	52	34				

[1] Published as 26 second-feet in Water-Supply Paper 465.

Daily discharge, in million gallons, of Waiahulu Stream near Waimea, Kauai, for the year ending June 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	28	61	30	79	395	46	76	36
2	.....	70	50	30	70	415	74	67	33
3	.....	190	46	30	66	181	181	67	33
4	.....	70	42	28	61	150	285	81	30
5	.....	70	50	26	100	181	275	67	28
6	.....	57	74	26	173	143	100	48	28
7	.....	50	136	33	70	89	79	45	28
8	.....	74	61	33	100	74	79	72	26
9	.....	53	66	28	181	70	181	48	26
10	.....	50	61	24	84	66	715	52	33
11	.....	46	61	26	106	181	630	67	42
12	.....	39	50	42	136	143	325	140	39
13	.....	36	50	26	158	123	162	81	45
14	.....	33	46	39	100	130	126	59	33
15	.....	33	42	94	70	117	102	52	30
16	.....	33	39	42	106	143	92	52	39
17	.....	33	39	33	295	136	86	52	45
18	.....	33	36	33	428	84	568	56	33
19	.....	33	33	345	207	66	430	52	45
20	.....	33	36	235	130	66	335	48	81
21	.....	61	42	111	181	61	267	45	86
22	.....	53	50	136	165	61	212	45	67
23	.....	39	39	158	106	57	162	56	72
24	.....	53	39	79	89	53	133	48	45
25	24	50	39	70	84	53	120	59	42
26	24	89	46	216	79	53	114	45	39
27	26	111	50	652	74	53	133	45	45
28	26	70	89	198	136	57	97	48	45
29	26	57	53	136	.....	89	86	56	42
30	28	74	46	123	.....	70	76	59	42
31	28	.....	39	89	.....	53	.....	42	.....

Monthly discharge of Waiahulu Stream near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
October 24–31	28	24	26.0	40.2	182	559
November	190	28	57.4	88.8	1,720	5,280
December	136	33	52.0	80.5	1,610	4,950
January	652	24	102	158	3,170	9,700
February	428	61	130	201	3,630	11,200
March	415	53	117	181	3,610	11,100
April	715	46	209	323	6,270	19,200
May	140	42	59.0	91.3	1,830	5,610
June	86	26	41.9	64.8	1,260	3,860
The period	.....	.....	.....	.....	23,300	71,500

KOAIE STREAM NEAR WAIMEA, KAUAI.

LOCATION.—About one-third of a mile above confluence with Waiahulu Stream, 12 miles north of Waimea.

RECORDS AVAILABLE.—July 19, 1916, to June 30, 1918; record fragmentary.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; banks steep and high. Control composed of large boulders; shifting.

EXTREMES OF DISCHARGE.—1915–1918: Maximum stage recorded, 7.0 feet (staff gage reading) at 10 a. m. and 2 p. m. October 16, 1917 (discharge, approximately 700 million gallons per day, or 1,080 second-feet); minimum stage recorded, 1.45 feet June 30, 1918 (discharge, 0.3 million gallons per day, or 0.5 second-feet).

DIVERSION.—None.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane, rice, and taro and for power development and domestic supply.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined applicable as follows: July 1 to September 21; October 7 to January 26 and February 19 to June 30; January 27 to February 18. Operation of water-stage recorder satisfactory except September 22 to October 19. Staff gage readings October 7–19. Records fair.

Discharge measurements of Koaie Stream near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 18	2.35	30	19	Jan. 11	2.13	23	15
Oct. 12	2.15	25	16	Feb. 14	2.42	56	36
17	2.98	112	72	Mar. 29	2.48	55	35
18	2.57	62	40	May 7	2.38	44	28
19	2.35	44	29	8	2.84	94	61

Daily discharge, in million gallons, of Koaie Stream near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16.2	16.2	16.2	.....	12.2	14.0	30	27	43	24	27	4.0
2	16.2	16.2	16.2	.....	24	9.0	24	27	74	30	27	2.2
3	33	18.5	16.2	.....	62	7.5	18.5	24	79	94	30	1.5
4	50	18.5	16.2	.....	24	7.5	18.5	21.2	99	162	43	2.2
5	27	18.5	16.2	.....	18.5	12.2	18.5	27	84	114	33	4.0
6	21.2	16.2	16.2	.....	16.2	12.2	16.2	58	79	50	30	1.5
7	24	21.2	14.0	16.2	14.0	18.5	16.2	24	36	33	30	1.0
8	24	21.2	14.0	16.2	18.5	12.2	36	43	27	30	46	.5
9	79	18.5	14.0	16.2	14.0	21.2	24	46	24	43	27	1.0
10	40	18.5	14.0	16.2	16.2	14.0	16.2	24	24	220	24	3.0
11	30	18.5	14.0	16.2	14.0	12.2	16.2	89	114	235	24	1.5
12	27	40	14.0	16.2	14.0	9.0	43	50	70	138	50	1.0
13	21.2	43	18.5	21.2	14.0	27	21.2	58	58	99	40	18.5
14	18.5	62	24	21.2	14.0	10.5	58	43	70	70	24	12.2
15	18.5	30	24	18.5	14.0	7.5	30	27	50	46	18.5	12.2
16	18.5	43	24	528	14.0	4.0	14	54	66	36	21.2	12.2
17	33	33	18.5	109	12.2	4.0	10.5	99	58	33	33	10.5
18	27	24	24	36	12.2	3.0	12.2	150	33	169	30	4.0
19	24	21.2	21.2	27	12.2	5.0	114	84	27	150	21.2	2.2
20	18.5	21.2	12.2	21.2	12.2	9.0	66	54	21.2	104	14.0	9.0
21	16.2	18.5	10.5	18.5	16.2	16.2	40	89	21.2	84	9.0	27
22	16.2	18.5	.....	18.5	16.2	9.0	50	58	16.2	66	9.0	12.2
23	18.5	18.5	.....	21.2	12.2	2.2	66	30	12.2	54	7.5	4.0
24	18.5	24	.....	21.2	12.2	3.0	30	30	14.0	33	14.0	3.0
25	27	24	.....	18.5	14.0	4.0	24	24	18.5	40	9.0	3.0
26	24	18.5	.....	18.5	27	5.0	84	21.2	14.0	36	6.2	1.0
27	21.2	18.5	.....	16.2	58	62	156	21.2	12.2	40	12.2	10.5
28	18.5	16.2	.....	16.2	24	70	84	46	21.2	36	18.5	7.5
29	21.2	16.2	.....	16.2	14.0	36	62	.....	36	30	50	1.0
30	18.5	16.2	.....	16.2	24	27	62	.....	36	27	36	.3
31	16.2	16.2	.....	16.2	.....	27	40	.....	27	.....	9.0	.....

NOTE.—No gage-height record Sept. 22 to Oct. 6; discharge estimated from flow of Waialae River near Waimea as follows: Sept. 22–26, 10 million gallons per day; Sept. 27–30, 25 million gallons per day; Oct. 1–6, 20 million gallons per day.

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Monthly discharge of Koaie Stream near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	79	16.2	25.3	39.1	783	2,410
August	62	16.2	23.4	36.2	725	2,230
September	.....	.....	16.9	26.1	508	1,560
October	528	16.2	38.6	59.7	1,200	3,670
November	62	12.2	19.0	29.4	570	1,750
December	70	2.2	15.5	24.0	481	1,480
January	156	10.5	42.0	65.0	1,300	4,000
February	150	21.2	48.2	74.6	1,350	4,140
March	114	12.2	44.0	68.1	1,360	4,190
April	235	24	77.5	120	2,330	7,140
May	50	6.2	25.1	38.8	777	2,390
June	27	.3	57.9	89.6	174	533
The year	528	.3	31.7	49.0	11,600	35,500

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, 1918.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight in vicinity of gage; banks steep and high. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.47 feet at 6.30 a. m. April 11 (discharge, 670 million gallons per day, or 1,040 second-feet); minimum stage recorded, 0.9 foot September 4–12 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

Maximum stage recorded, 6.55 feet at 10.30 p. m. December 18, 1916 (discharge not estimated); minimum stage recorded, 1.1 feet June 27–30 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable as follows: July 1 to October 16, and March 12 to April 11; October 17 to January 19; January 20 to March 11, and April 12 to June 30. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of Waialae River at elevation 800 feet, near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	1.05	9.7	6.3	Feb. 14	1.42	39	25
Oct. 19	1.30	26	17	Mar. 27	1.36	24	16
25	1.10	16.4	11	May 2	1.28	29	18
Jan. 10	1.06	13.3	8.6	June 26	1.20	22	14
12	1.52	37	24				

Daily discharge, in million gallons, of Waialae River at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	7.5	7.5	4.8	5.5	7.5	15	10	32	50	10	19	12
2	7.5	6.5	4.8	8.8	12	10	8.8	29	128	15	19	10
3	19	7.5	4.8	8.8	65	7.5	7.5	26	76	50	17	10
4	38	7.5	4.0	10	21	7.5	7.5	24	121	88	21	8.8
5	15	8.8	4.0	8.8	19	17	7.5	24	82	50	21	8.8
6	10	7.5	4.0	6.5	15	21	7.5	60	82	19	17	8.8
7	12	10	4.0	6.5	10	19	12	26	46	13	21	8.8
8	12	10	4.0	5.5	12	13	21	21	35	13	26	7.5
9	76	6.5	4.0	4.8	10	35	13	35	32	32	17	7.5
10	24	5.5	4.0	4.8	12	26	8.8	26	35	196	15	7.5
11	17	5.5	4.0	4.8	12	24	8.8	35	230	256	13	7.5
12	13	21	4.0	5.5	7.5	26	21	42	94	114	21	7.5
13	10	26	6.5	13	6.5	32	12	46	65	128	21	15
14	10	38	10	17	6.5	19	42	29	94	55	15	15
15	8.8	12	10	10	6.5	15	21	19	50	32	13	17
16	7.5	19	10	221	6.5	12	13	70	88	29	12	19
17	21	13	10	55	5.5	12	10	82	65	38	19	13
18	15	8.8	19	24	5.5	8.8	13	221	32	440	19	10
19	12	7.5	15	17	5.5	8.8	188	82	24	256	13	10
20	8.8	6.5	7.5	13	6.5	8.8	70	65	19	212	12	17
21	7.5	5.5	5.5	13	7.5	12	35	196	26	121	12	24
22	7.5	5.5	5.5	13	8.8	10	46	70	19	70	12	13
23	7.5	7.5	4.8	19	6.5	7.5	60	82	17	50	12	12
24	6.5	12	4.8	13	5.5	7.5	29	35	19	42	10	17
25	8.8	7.5	4.8	10	7.5	10	32	32	19	35	10	12
26	12	6.5	6.5	8.8	19	15	150	29	17	32	13	8.8
27	8.8	5.5	24	8.8	60	70	164	26	15	29	46	24
28	8.8	5.5	15	7.5	26	42	76	60	15	26	21	13
29	7.5	4.8	12	7.5	19	17	70	.....	15	24	50	8.8
30	7.5	4.8	7.5	7.5	26	13	65	.....	15	21	29	7.5
31	7.5	4.8	.....	8.8	.....	12	38	.....	12	.....	15	.....

Monthly discharge of Waialae River at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	76	6.5	14.0	21.7	434	1,330
August	38	4.8	9.82	15.2	304	934
September	24	4.0	7.63	11.8	229	702
October	221	4.8	18.3	28.3	567	1,740
November	65	5.5	14.6	22.6	438	1,340
December	70	7.5	17.9	27.7	553	1,700
January	188	7.5	40.9	63.3	1,270	3,890
February	221	19	54.4	84.2	1,520	4,670
March	230	12	52.8	81.7	1,640	5,020
April	440	10	83.2	129	2,500	7,660
May	50	10	18.7	28.9	581	1,780
June	24	7.5	12.0	18.6	361	1,100
The year	440	4.0	28.5	44.1	10,400	31,900

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, 1918. Staff at Flume No. 4, 1 mile below intake, February 25, 1916, to August 2, 1917; weir, 85 feet above present site, November 8, 1907, to June 30, 1915.

GAGE.—Vertical staff, read by Manuel Arruda.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.40 feet at 8.30 a. m., March 27 (discharge, 63 million gallons per day, or 99 second-feet); water occasionally shut off.

1907–1918: 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 gate.

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

ACCURACY.—Stage-discharge relation permanent. Rating curves well defined for both stations. 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, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Jan. 10	2.94	82	53	Mar. 27	3.40	98	63
12	2.82	77	50	May 2	3.20	89	58
Feb. 14	3.34	98	63	June 26	3.10	87	56

Daily discharge, in million gallons, of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.
1	45	45	.....	42	62	53	29	54	62	54	25
2	46	44	.....	62	59	51	41	54	62	59	24
3	60	.....	.....	62	53	46	41	54	62	61	56
4	62	.....	.....	62	50	49	52	62	62	26	54
5	62	.....	.....	62	57	51	52	59	62	52	53
6	58	.....	.....	62	45	45	62	54	62	52	53
7	53	.....	.....	62	62	46	62	54	27	53	52
8	56	.....	.....	62	62	53	62	54	62	53	52
9	56	.....	.....	62	24	52	62	54	62	53	52
10	56	.....	.....	62	30	52	62	54	62	54	59
11	56	.....	.....	61	30	49	62	42	61	58	60
12	56	.....	.....	51	48	52	62	41	59	60	60
13	58	.....	.....	45	52	52	62	41	59	60	60
14	58	.....	.....	43	52	52	62	41	59	60	60
15	56	.....	.....	42	52	52	62	41	59	60	60
16	50	.....	.....	42	52	62	51	35	59	60	60
17	56	.....	.....	41	52	56	41	30	59	60	60
18	56	.....	.....	41	50	53	52	41	59	60	60
19	0	.....	.....	39	48	51	46	41	38	60	60
20	0	.....	.....	40	50	41	41	41	19	60	60
21	0	.....	.....	62	51	52	41	41	19	60	60
22	45	.....	.....	62	52	52	41	41	23	60	60
23	46	.....	.....	50	51	62	35	41	27	60	60
24	53	.....	.....	52	49	62	48	41	34	60	60
25	53	.....	.....	59	38	45	54	41	40	60	60
26	53	.....	44	54	52	30	54	62	41	60	59
27	53	.....	44	62	52	29	54	62	17	60	59
28	48	.....	43	62	52	29	54	62	22	60	60
29	45	.....	40	62	52	29	.....	62	52	59	57
30	45	.....	31	62	52	18	.....	62	52	57	53
31	45	.....	36	.....	52	18	.....	62	.....	60	.....

NOTE.—No record at either flume No. 4 or camp No. 1 Aug. 3 to Oct. 25.

Monthly discharge of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (28 days)	62	45	53.1	82.2	1,490	4,560
October 26–31	44	31	39.7	61.4	238	731
November	62	39	54.4	84.2	1,630	5,010
December	62	24	49.8	77.1	1,540	4,740
January	62	18	46.6	72.1	1,440	4,430
February	62	29	51.7	80.0	1,450	4,440
March	62	30	49.2	76.1	1,520	4,680
April	62	17	48.1	74.4	1,440	4,430
May	61	26	57.1	88.3	1,770	5,430
June	60	24	55.6	86.0	1,670	5,120

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

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

RECORDS AVAILABLE.—April 17, 1908, to June 30, 1914, and July 20, 1916, to June 30, 1918.

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, 3.54 feet at 8 a. m. March 5 and April 13 (discharge 49 million gallons per day, or 76 second-feet); minimum, water shut off occasionally.

1916–18. Maximum stage recorded, 3.6 feet December 1, 1916 (discharge, 50 million gallons per day, or 76 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.

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

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

Discharge measurements of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 12	3.12	64	41	Mar. 10	3.40	71	46
Jan. 24	3.47	72	47	Apr. 10	3.26	69	44
Feb. 6	3.36	71	46	May 30	3.12	65	42

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

Daily discharge, in million gallons, of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	37	36	29	31	32	43	38	18	45	41	34	39
2	40	36	30	29	32	42	38	26	45	41	37	.....
3	43	43	31	37	31	40	37	27	48	40	40	39
4	39	48	30	36	46	40	36	26	45	46	35	41
5	41	46	29	35	48	36	35	45	49	44	.....	40
6	41	40	29	32	48	32	35	46	43	42	38	40
7	37	46	30	32	46	43	34	45	44	.....	39	39
8	35	41	29	30	46	43	43	45	44	42	39	38
9	40	41	29	29	46	20	41	46	44	41	39	39
10	39	38	29	28	46	28	39	45	47	44	39	41
11	40	42	29	26	46	28	37	45	27	48	41	41
12	39	45	29	28	43	30	41	45	34	48	43	41
13	39	40	34	29	37	35	39	45	37	49	45	41
14	39	48	38	46	35	35	37	45	32	47	46	41
15	36	48	45	44	35	38	41	45	32	45	46	41
16	38	46	45	45	34	35	39	45	36	45	46	40
17	43	46	38	28	32	35	41	36	26	45	45	40
18	41	41	45	28	32	37	39	36	26	37	45	40
19	39	40	48	36	32	35	41	44	34	48	46	38
20	.....	37	40	48	32	35	41	35	31	16	45	40
21	.....	34	32	36	48	37	38	34	30	16	44	38
22	39	32	31	36	48	39	44	35	31	16	44	35
23	39	32	29	6	42	36	48	32	31	16	45	36
24	39	37	29	6	36	35	47	32	32	16	41	38
25	43	39	29	6	47	36	46	39	32	.....	46	37
26	40	36	30	.....	46	38	34	39	32	29	45	37
27	40	32	41	36	47	45	39	41	39	29	41	35
28	38	31	39	34	46	41	20	41	39	.....	41	37
29	34	31	46	34	44	39	26	.....	39	37	41	35
30	33	30	45	34	44	38	18	.....	41	37	39	35
31	37	30	.....	34	.....	38	18	.....	42	.....	39	.....

NOTE.—No flow on 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, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (29 days)	43	33	38.9	60.2	1,130	3,460
August	48	30	39.1	60.5	1,210	3,720
September	48	29	34.6	53.5	1,040	3,190
October (30 days)	48	6	31.3	48.4	939	2,880
November	48	31	40.9	63.3	1,230	3,770
December	45	20	36.5	56.5	1,130	3,470
January	48	18	37.1	57.4	1,150	3,530
February	46	18	38.7	59.9	1,080	3,330
March	49	26	37.3	57.7	1,160	3,550
April (27 days)	49	16	37.4	57.9	1,010	3,100
May (30 days)	46	34	41.8	64.7	1,250	3,850
June (29 days)	41	35	38.7	59.9	1,120	3,440
The year	.....	.....	.....	.....	13,500	41,300

WAIMEA DITCH NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—November 4, 1911, to September 30, 1913, and February 28, 1916, to June 30, 1918.

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.—Maximum stage recorded during year, 1.30 feet at 8 a. m. July 26 (discharge, 6.1 million gallons per day, or 9.5 second-feet); ditch occasionally dry.

1916–1918: Maximum stage recorded, 1.3 feet June 20, 1916 (discharge, 7.0 million gallons per day, or 11 second-feet); ditch occasionally dry.

DIVERSIONS.—Ditch diverts from Waimea River.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to half tenths twice daily. Records good.

Discharge measurements of Waimea ditch near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 12	0.80	4.3	2.8	Mar. 13	0.55	2.1	1.3
Jan. 24	.79	4.2	2.7	Apr. 30	.84	4.5	2.9
Feb. 20	.60	2.2	1.5	May 30	.80	4.0	2.6

Daily discharge, in million gallons, of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.4	4.7	3.3	4.7	2.7	3.6	.....	1.1	.....	3.3	2.7	2.7
2	3.0	3.3	3.3	4.7	3.6	3.3	1.1	1.1	.....	2.7	2.4	2.7
3	4.4	3.3	3.3	5.0	5.4	2.7	1.1	1.1	.....	2.1	2.4	2.1
4	5.4	2.4	3.3	5.0	4.0	3.0	1.1	2.1	.....	.9	3.3	2.1
5	4.7	.....	3.3	4.7	2.7	3.3	1.6	2.1	.....	.....	3.6	2.1
6	4.0	3.0	3.3	.....	3.6	3.0	1.4	2.1	.....	.....	2.7	2.7
7	3.6	2.7	3.3	.....	3.0	2.1	1.1	1.6	.....	.....	3.3	2.7
8	4.7	4.7	3.3	3.3	4.0	1.6	2.4	1.1	3.3	.....	4.0	2.7
9	4.7	3.6	3.0	3.6	4.7	2.1	.....	2.1	3.0	.....	2.4	2.7
10	4.0	3.0	3.0	3.6	4.0	1.6	.....	1.1	2.1	2.7	3.0	3.3
11	4.0	3.3	3.0	3.3	4.7	1.4	.....	1.4	3.6	1.1	3.0	3.6
12	4.0	3.3	3.3	3.3	2.7	1.6	.....	3.0	.....	.....	4.0	3.3
13	4.0	5.4	3.6	3.3	2.7	2.7	.....	.....	1.4	.....	3.3	4.4
14	3.6	5.4	4.7	5.4	2.7	2.7	.....	.....	.....	.....	2.7	4.7
15	4.0	4.0	5.0	5.4	2.7	2.4	.....	2.1	.....	.6	3.3	4.7
16	3.3	4.0	5.4	.....	3.0	1.6	.....	2.1	.....	.9	2.4	4.7
17	4.7	4.0	4.7	.....	3.0	1.6	.....	.....	.....	1.6	2.7	4.7
18	5.4	4.0	5.4	.....	2.7	1.1	.....	.....	.....	4.0	2.7	4.7
19	5.4	4.4	5.4	.....	2.7	1.1	.....	.....	2.1	.....	3.0	3.3
20	5.4	4.0	4.0	.....	2.7	1.1	.....	1.6	1.1	.....	2.7	4.0
21	5.4	4.0	4.0	2.4	3.3	2.1	.....	.....	.9	.....	2.1	4.7
22	4.4	4.0	3.6	2.7	4.0	2.1	.....	.....	.7	.....	2.1	4.0
23	3.3	4.0	3.3	3.0	3.0	1.1	.....	.....	.9	.....	3.3	4.0
24	4.0	4.0	3.6	3.0	3.3	1.1	2.7	.....	1.1	.....	2.7	4.0
25	5.4	4.7	3.6	2.7	4.0	.....	.....	.....	1.4	.....	3.3	4.0
26	6.1	4.0	4.0	2.7	3.0	1.6	.....	.....	2.1	.....	2.7	4.0
27	5.8	3.3	5.4	.....	3.0	1.6	.....	.....	1.6	.....	2.7	4.0
28	4.7	3.3	5.4	1.1	3.6	2.1	1.6	.....	1.6	.9	3.3	3.3
29	4.7	3.3	5.0	1.1	3.6	1.6	.....	.....	2.7	1.6	3.0	3.3
30	4.7	3.3	4.7	1.8	3.3	1.4	.....	.....	3.3	2.4	3.0	3.3
31	3.6	3.3	.....	4.7	.....	1.1	1.1	.....	3.0	.....	2.4	.....

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

Monthly discharge of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	6.1	3.0	4.48	6.93	139	426
August (30 days)	5.4	2.4	3.79	5.86	114	349
September	5.4	3.0	3.98	6.16	120	366
October (23 days)	5.4	1.1	3.50	5.42	80	247
November	5.4	2.7	3.38	5.23	101	311
December (30 days)	3.6	1.1	1.98	3.06	59	182
January (10 days)	2.7	1.1	1.52	2.35	15	47
February (15 days)	3.0	1.1	1.71	2.65	26	79
March (18 days)	3.6	.7	1.99	3.08	36	110
April (13 days)	4.0	.6	1.91	2.96	25	76
May	4.0	2.1	2.72	4.21	84	259
June	4.7	2.1	3.55	5.49	106	327
The year					905	2,780

KAMENEHUNE DITCH NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—October 9, 1911, to June 30, 1918.

GAGE.—Vertical staff on right bank read by A. B. Blackstad.

DISCHARGE MEASUREMENTS.—Made from plank.

CHANNEL AND CONTROL.—Straight for 50 feet above and 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, 1.60 feet at 4 p. m. May 27 (discharge, 3.8 million gallons per day, or 5.9 second-feet); minimum stage recorded, 0.6 foot January 17 and 18, February 3–5 and 8–9 (discharge, 0.2 million gallons per day, or 0.3 second-feet).

1911–1918: Maximum stage recorded, 1.8 feet at 7.30 a. m. July 4, 1916 (discharge, 5.5 million gallons per day, or 8.5 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts from Waimea River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined, applicable July 1 to May 24 and May 25 to June 30. Gage read to hundredths twice daily. Records poor below and fair above 1 million gallons per day.

Discharge measurements of Kamenehune ditch near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 12	1.11	2.9	1.9	Mar. 10	1.29	3.9	2.5
Jan. 13	.88	1.3	.85	Apr. 29	1.00	1.9	1.2
Feb. 16	0.82	0.95	0.6	May 30	1.27	4.5	2.9

Daily discharge, in million gallons, of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.5	1.7	1.3	1.9	1.7	2.1	1.1	0.7	1.7	2.1	1.3	2.5
2	1.7	1.5	1.5	2.1	2.1	1.7	1.1	.3	1.7	3.2	1.3	2.3
3	1.7	2.1	1.5	2.1	2.8	1.7	1.1	.2	2.3	3.0	1.5	1.3
4	2.3	2.5	1.5	2.1	2.5	1.5	1.1	.2	2.3	2.5	2.1	1.7
5	2.1	2.8	1.5	2.1	2.1	1.7	1.1	.2	2.5	2.3	1.9	1.7
6	1.7	2.1	.5	2.3	2.3	2.1	1.1	1.7	2.1	2.8	1.7	2.1
7	1.1	1.7	.7	2.1	1.9	2.3	.9	.4	1.9	3.4	1.3	2.8
8	2.1	2.1	1.5	2.3	1.9	2.3	2.3	.2	1.5	2.8	2.3	2.5
9	2.5	1.7	1.3	2.3	1.9	2.1	1.7	.2	1.3	2.3	1.5	2.5
10	2.1	1.7	1.7	2.1	1.7	2.1	1.3	.5	2.3	2.3	1.3	2.5
11	1.9	1.7	1.3	2.1	1.7	2.1	1.3	.9	1.9	1.7	1.7	2.5
12	2.1	1.7	2.3	1.3	1.7	2.5	.7	1.3	1.3	1.3	2.5	2.5
13	1.7	2.3	2.3	2.3	1.7	2.3	.7	1.1	1.1	1.7	2.5	2.5
14	1.5	2.8	2.5	2.1	1.3	1.1	1.5	.9	1.1	1.3	2.3	2.5
15	1.5	1.9	2.8	1.7	1.3	.7	1.7	.5	1.1	1.3	1.5	2.5
16	.9	1.7	2.1	1.5	1.3	.4	1.3	.5	.9	1.3	1.7	2.5
17	1.7	2.1	2.1	1.1	1.7	1.1	.2	2.3	.9	1.3	1.3	2.5
18	2.5	1.5	2.3	.9	1.7	1.3	.2	1.7	1.3	2.1	2.1	1.7
19	2.3	1.7	2.3	1.3	1.7	1.5	2.1	1.3	1.5	1.3	1.3	2.3
20	2.8	1.3	1.9	1.9	1.5	1.3	1.5	1.3	1.9	1.3	1.3	2.8
21	2.3	1.3	1.5	1.7	1.9	1.5	1.3	1.7	1.9	1.7	1.1	2.5
22	2.8	1.9	1.7	2.1	2.1	1.7	1.3	1.5	1.9	1.7	.9	2.8
23	.7	1.5	2.1	2.5	1.7	1.3	1.3	1.3	1.3	1.7	1.1	2.5
24	2.3	1.5	2.1	2.1	1.7	1.3	1.1	1.3	.9	1.7	.4	2.5
25	2.8	1.5	2.1	1.9	1.7	1.3	1.9	1.3	.5	1.3	2.1	2.1
26	2.5	1.3	2.1	1.9	2.1	1.9	1.5	1.3	.5	1.5	1.7	2.5
27	2.4	1.1	2.3	1.7	2.1	2.1	1.3	1.3	.9	1.7	3.0	2.5
28	2.5	.9	2.3	1.7	2.5	1.9	1.3	1.9	1.5	1.7	3.8	2.5
29	2.3	1.3	2.1	2.1	2.5	1.7	1.3	.....	1.3	1.3	3.4	2.5
30	2.1	1.7	1.9	1.7	2.1	1.3	1.3	.....	1.3	1.3	2.8	2.5
31	1.7	1.7	.....	1.9	.....	1.1	1.3	.....	2.5	.....	2.1	.....

Monthly discharge of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.8	0.7	2.04	3.16	63	194
August	2.8	.9	1.75	2.71	54	166
September	2.8	.5	1.84	2.85	55	169
October	2.5	.9	1.90	2.94	59	181
November	2.8	1.3	1.90	2.94	57	175
December	2.5	.4	1.65	2.55	51	157
January	2.3	.2	1.25	1.93	39	119
February	2.3	.2	1.00	1.55	28	86
March	2.5	.5	1.51	2.34	47	144
April	3.4	1.3	1.90	2.94	57	175
May	3.8	.4	1.83	2.83	57	174
June	2.8	1.3	2.37	3.67	71	218
The year	3.8	.2	1.75	2.71	638	1,960

HANAPEPE RIVER AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1918. August 18, 1910, to December 15, 1916, at old site half a mile above present gage.

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

DISCHARGE MEASUREMENTS.—Made by wading at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet at 9.10 a. m. March 11 (discharge, 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded, 0.6 foot May and June (discharge, 11 million gallons per day, or 17 second-feet).

1910–1918: 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). Minimum stage 0.95 foot December 30 and 31, 1913 (discharge, 7.1 million gallons per day, or 11 second-feet).

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

REGULATION.—By diversions only.

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

ACCURACY.—Stage-discharge relation not permanent, but a sufficient number of discharge measurements were secured to define rating curves fairly well. Rating curves applicable as follows: July 1 to January 19; January 20 to February 21; February 22 to March 11, and March 12 to June 30. Gage read twice daily to hundredths. Records fair for low and medium stages but may be considerably in error for high and fluctuating stages.

Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 27	0.96	28	18	Jan. 23	1.15	72	47
Aug. 23	.90	22	14	Feb. 18	2.12	257	166
Sept. 10	.88	21	14	Mar. 4	1.25	55	35
Oct. 1	.94	29	19	Apr. 9	.69	23	15
Nov. 13	.87	24	16	May 25	1.03	62	40
Dec. 29	1.52	87	56	June 27	1.22	88	57

Daily discharge, in million gallons, of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16	16	18	18	28	25	20	40	31	16	18	36
2	16	22	16	18	71	14	20	59	46	116	16	21
3	50	18	14	25	28	16	16	75	28	250	16	16
4	95	20	16	18	115	18	14	70	83	612	187	16
5	28	16	14	18	38	60	16	59	159	75	136	14
6	22	16	14	18	20	122	16	179	55	54	24	14
7	55	28	16	16	18	50	16	45	34	45	36	14
8	31	20	16	16	16	38	18	32	22	36	21	14
9	259	16	16	16	16	65	28	28	122	18	16	11
10	60	16	16	16	25	65	28	28	1,280	110	14	11
11	122	25	16	14	14	46	28	136	1,610	280	40	11
12	46	101	16	60	14	65	16	70	700	136	59	130
13	31	42	16	22	14	50	14	36	575	350	16	179
14	25	136	16	22	14	46	239	32	230	123	11	320
15	25	31	89	22	14	42	25	28	150	64	11	32
16	25	159	25	965	14	22	18	270	1,230	64	16	54
17	136	50	16	71	14	20	16	123	123	40	32	21
18	46	34	25	50	14	16	20	179	86	1,260	36	18
19	25	20	22	38	14	16	1,190	98	70	700	21	14
20	22	18	16	38	14	16	80	104	54	187	18	36
21	25	18	18	60	16	16	75	780	50	116	16	28
22	22	16	16	89	14	14	64	108	45	104	14	14
23	20	16	16	55	14	14	45	65	40	92	14	18
24	20	42	16	20	20	14	24	55	75	70	21	45
25	25	22	16	16	14	20	24	42	28	59	28	18
26	20	20	20	25	101	22	700	211	28	59	16	18
27	20	16	55	16	136	193	80	31	18	54	150	40
28	18	16	60	16	42	38	86	184	21	50	45	24
29	34	16	31	16	28	38	45	.....	18	24	750	16
30	18	16	20	20	50	31	59	.....	18	18	110	14
31	20	16	.....	16	.....	42	50	.....	16	.....	36	.....

Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	259	16	44.4	68.7	1,380	4,220
August	159	16	32.8	50.7	1,020	3,120
September	89	14	22.7	35.1	681	2,090
October	965	14	59.0	91.3	1,830	5,610
November	136	14	31.7	49.0	950	2,920
December	193	14	40.5	62.7	1,250	3,850
January	1,190	14	99.7	154	3,090	9,480
February	780	28	113	175	3,170	9,710
March	1,610	16	227	351	7,040	21,600
April	1,260	16	173	268	5,180	15,900
May	750	11	62.7	97.0	1,940	5,960
June	320	11	40.6	62.8	1,220	3,740
The year	1,610	11	78.8	122	28,800	88,200

HANAPEPE DITCH AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1918.

GAGE.—Vertical staff read by S. W. Holmer and D. E. Horner.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; straight for 20 feet above and below gage; some vegetable growth on bottom and sides of flume. Control fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.20 feet at 7 a. m. April 10 (discharge, 36 million gallons per day, or 56 second-feet); minimum stage recorded, 0.4 foot October 25 and April 24 (discharge, 2.3 million gallons per day, or 3.6 second-feet).

Maximum stage recorded during period of record, 4.97 feet November 30, 1913 (discharge, 67 million gallons per day, or 104 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanapepe River.

REGULATION.—By head gates.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths once daily. Records fair, except those for January and February, which are poor.

Discharge measurements of Hanapepe ditch at Koula, near Eleele, Kauai, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 13	W. V. Hardy	2.64	43	28
17	D. E. Horner	2.55	41	26
27	do	.74	8.3	5.3
Dec. 11	do	1.09	13.7	8.8
16	do	2.30	35	23
23[a]	do	2.38	40	26
29	W. V. Hardy	1.34	17.6	11
Jan. 30	do	3.09	54	35
Feb. 18[a]	do	2.10	27	17
Mar. 11	do	2.62	40	26
Apr. 9	do	3.06	51	33
May 25	do	3.03	51	33

[a] Measurement discredited by the other measurements made during year.

Daily discharge, in million gallons, of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	34	33	32	29	30	34	18	34	34	32	32	34
2	34	34	30	34	12	34	22	13	34	34	32	33
3	34	33	29	34	12	30	22	14	34	12	32	33
4	34	33	32	32	14	28	22	14	34	3.0	34	33
5	34	32	28	34	16	30	22	14	35	3.0	34	33
6	34	31	28	31	34	34	22	18	35	3.0	34	32
7	34	34	28	30	34	34	22	33	35	8.2	34	31
8	34	34	30	30	32	7.8	24	30	35	14	34	30
9	34	32	28	29	32	11	7.3	32	35	34	33	29
10	34	31	28	27	31	8.2	6.4	28	24	36	33	28
11	34	34	27	27	33	9.1	6.4	32	27	35	33	29
12	34	34	28	27	33	8.2	24	34	12	34	34	34
13	34	34	30	26	28	8.2	24	33	14	34	34	34
14	34	34	28	27	28	8.2	34	30	14	34	33	34
15	34	34	32	34	28	8.2	32	28	16	34	32	34
16	34	34	34	33	27	8.2	28	29	20	34	34	34
17	34	34	30	34	27	22	27	33	20	34	35	33
18	34	34	34	7.8	27	24	28	20	18	34	35	33
19	34	34	32	12	26	26	30	14	20	34	34	32
20	34	34	28	12	27	27	30	14	22	3.0	34	34
21	34	34	32	18	26	26	6.4	16	23	3.0	34	34
22	34	33	28	18	29	25	10	16	22	3.0	33	34
23	34	32	28	34	27	24	11	15	22	3.8	32	33
24	34	34	28	3.0	27	24	28	15	22	2.3	32	34
25	34	34	28	2.3	32	23	27	15	34	10	34	34
26	34	34	32	32	28	22	33	16	34	9.1	33	34
27	34	32	34	34	33	26	26	33	35	10	34	34
28	34	31	34	32	7.3	13	26	34	35	10	34	34
29	34	31	34	31	34	12	26	.....	34	11	34	33
30	34	30	33	30	33	14	34	.....	34	28	34	32
31	34	31	.....	34	.....	14	34	.....	33	.....	.....	.....

NOTE.—No gage-height record May 31; discharge interpolated.

Monthly discharge of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	34	34	34.0	52.6	1,050	3,230
August	34	30	33.0	51.1	1,020	3,140
September	34	27	30.2	46.7	907	2,780
October	34	2.3	26.4	40.8	818	2,510
November	34	7.3	26.9	41.6	807	2,480
December	34	7.8	20.1	31.1	624	1,910
January	34	6.4	23.0	35.6	712	2,190
February	34	13	23.5	36.4	657	2,020
March	35	12	27.3	42.2	846	2,600
April	36	2.3	19.3	29.9	579	1,780
May	35	32	33.5	51.8	1,040	3,190
June	34	28	32.8	50.7	983	3,020
The year	36	2.3	27.5	42.5	10,000	30,800

MANUAHI STREAM AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1918.

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, 3.60 feet at 5 p. m. March 11 (discharge, 200 million gallons per day, or 310 second-feet); minimum stage, 0.4 foot September 11 (discharge, 0.3 million gallons per day, or 0.45 second-feet).

DIVERSIONS.—No diversions before junction with Hanapepe River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 2 million gallons per day and well defined above that point, Gage read to hundredths twice daily. Records fair.

Discharge measurements of Manuahi Stream at Koula, near Eleele, Kauai, from May 13 1917, to June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
May 13	W. V. Hardy	0.49	2.1	1.4
24	do	.76	4.2	2.7
June 18	do	1.04	14.5	10.0
19	D. E. Horner	.95	8.3	5.3
July 27	W. V. Hardy	.66	3.1	2.0
Aug. 23	do	.58	2.5	1.6
Sept. 10	do	.45	.75	.5
Oct. 1	do	.63	2.4	1.5
Nov. 13	do	.55	1.6	1.0
17	D. E. Horner	.51	1.2	.8
Dec. 28	W. V. Hardy	.96	9.5	6.2
Jan. 22	do	1.00	11.8	7.7
Feb. 18	do	1.50	47	30
Mar. 10	do	1.15	23	15
Apr. 9	do	.63	2.8	1.8
May 25	do	.99	11.5	7.5
June 27	do	.72	3.8	2.5

Daily discharge, in million gallons, of Manuahi Stream at Koula, near Eleele, Kauai, from May 13, 1917, to June 30, 1918.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	33	1.7	1.7	1.2	1.6	2.0	3.5	1.3	3.5	4.4	2.3	2.6	2.3
2	.....	15	1.7	1.7	1.2	1.6	26	2.0	1.3	3.5	5.6	2.6	2.6	2.0
3	.....	12	2.0	1.5	.8	1.3	21	1.3	1.0	4.4	3.5	3.7	2.6	1.7
4	.....	15	3.1	1.5	1.1	1.6	16	1.6	.7	14	9.5	9.5	9.5	1.7
5	.....	14	2.3	1.3	.7	1.3	12	26	1.0	7.5	21	3.7	3.1	1.7
6	.....	17	2.0	1.3	.7	1.6	5.6	89	1.0	7.5	4.4	2.6	2.6	1.7
7	.....	11	2.6	2.0	.6	1.0	3.5	47	1.3	2.9	2.9	2.3	4.5	1.5
8	.....	20	2.0	1.7	.6	.7	1.6	4.4	2.0	2.9	2.0	2.0	2.3	1.5
9	.....	8.3	7.5	1.3	.5	.7	1.6	16	1.3	2.9	9.5	2.0	2.3	1.5
10	.....	6.3	5.7	1.3	.5	.7	1.6	16	1.0	2.4	21	2.3	2.0	1.3
11	.....	4.5	4.5	1.5	.3	.5	1.3	3.5	.7	2.9	200	26	2.0	1.3
12	.....	3.3	3.1	7.5	.5	2.4	1.3	12	2.0	2.4	143	21	2.3	1.3
13	1.4	3.3	3.1	2.6	.5	2.9	1.0	4.4	1.6	2.4	93	44	2.0	2.3
14	1.5	2.5	2.3	5.7	.5	2.9	1.0	4.4	74	2.0	50	12	1.7	2.0
15	1.5	2.5	2.6	3.1	9.5	4.4	.7	2.9	9.5	2.0	29	7.5	1.7	2.3
16	1.4	2.5	2.3	16	2.4	190	.7	2.0	3.5	93	134	4.5	2.0	2.6
17	3.9	2.6	3.1	9.5	.7	26	.7	2.0	2.4	35	29	3.1	12	1.7
18	74	4.9	4.5	4.5	5.6	26	.7	1.6	2.9	38	18	170	2.6	1.5
19	19	4.2	3.1	3.7	3.5	12	.7	1.3	134	21	12	113	2.3	1.3
20	14	2.8	2.3	2.6	1.6	12	1.0	1.6	24	16	9.5	50	2.0	1.3
21	4.2	2.3	2.6	2.3	1.6	2.9	1.0	1.6	9.5	161	7.5	35	2.0	1.3
22	4.5	2.1	2.3	2.0	1.3	16	.7	1.3	5.6	35	5.7	21	1.7	1.3
23	3.9	2.1	2.6	1.7	1.0	9.5	.7	1.3	3.5	18	4.5	16	1.7	1.3
24	3.1	2.0	2.3	1.7	1.0	4.4	1.0	1.3	2.9	12	9.5	12	1.7	1.3
25	2.5	1.9	2.6	1.5	.7	2.9	.7	1.6	2.9	7.5	3.1	7.5	3.1	1.3
26	2.3	1.7	2.3	1.5	1.0	2.4	2.0	2.0	78	5.6	3.1	5.7	1.7	1.3
27	3.1	1.6	1.7	1.3	5.6	2.0	26	12	21	4.4	3.1	4.5	12	2.0
28	3.3	1.6	1.7	1.3	14	1.6	5.6	5.6	14	7.5	2.6	4.5	4.5	1.0
29	2.9	1.7	1.7	1.3	7.5	1.6	2.9	3.5	5.6	.....	2.6	3.7	14	.7
30	31	1.7	1.7	1.3	2.0	2.0	5.6	2.9	5.6	.....	2.6	3.1	3.7	.7
31	34	.....	2.0	1.3	.....	1.6	.....	2.4	4.4	.....	2.4	.....	3.1	.....

NOTE.—No gage-height record March 31; discharge interpolated.

Monthly discharge of Manuahi Stream at Koula, near Eleele, Kauai, for the years ending June 30, 1917 and 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1917.						
May 13–31	74	1.4	11.1	17.2	212	647
June	33	1.6	6.78	10.5	203	624
The period	.....	.....	.....	.....	.....	1,270
1918.						
July	7.5	1.7	2.74	4.24	85	261
August	16	1.3	2.88	4.46	89	274
September	14	.3	2.29	3.54	69	211
October	190	.5	10.9	16.9	338	1,040
November	26	.7	4.87	7.54	146	448
December	89	1.3	8.97	13.9	278	853
January	134	.7	13.5	20.9	420	1,280
February	161	2.0	18.5	28.6	517	1,590
March	200	2.0	27.4	42.4	848	2,610
April	170	2.0	19.9	30.8	597	1,830
May	14	1.7	3.67	5.68	114	349
June	2.6	.7	1.56	2.41	47	144
The year	200	.3	9.72	15.0	3,550	10,900

SOUTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

LOCATION.—1 mile above Waiehu Falls and about 7 miles northeast of Lihue.

RECORDS AVAILABLE.—December 10, 1911, to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.85 feet at 9.30 a. m. March 11 (discharge, 17,800 million gallons per day, or 27,600 second-feet); minimum stage recorded, 2.5 feet January 5 and 7–12 (discharge, 12 million gallons per day, or 19 second-feet).

1911–1918: Maximum stage recorded during 1918; minimum stage recorded, 3.09 feet February 14 and 15, 1912 (discharge, 2.9 million gallons per day, or 4.5 second-feet).

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

REGULATION.—By diversions above station.

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

ACCURACY.—Stage discharge relation not permanent. Rating curves fairly well defined and applicable July 1 to August 16, August 17 to March 11, and March 12 to June 30. Operation of water-stage recorder satisfactory except for short period given in footnote to table of daily discharge. Records poor.

Discharge measurements of South Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Sept. 3	2.74	40.7	26
Apr. 24	3.89	184	119
June 7	3.53	129	83

NOTE.—A discharge measurement published in Water Supply Paper 430 has been revised as follows: Made by J. C. Dort: June 22, 1914: Gage height, 8.20 feet; discharge, 2,930 second-feet, or 1,890 million gallons per day.

Daily discharge, in million gallons, of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	26	45	110	37	29	70	41	82	145	112	.....	95
2	26	50	60	55	65	60	29	76	154	385	.....	84
3	50	45	29	55	274	55	23	70	182	805	.....	79
4	82	45	29	45	76	55	17	82	263	570	.....	79
5	37	45	29	29	76	.....	12	88	516	285	235	84
6	41	41	23	29	50	.....	14	192	469	143	100	79
7	50	76	23	29	41	.....	12	102	252	100	124	79
8	37	55	26	23	37	.....	12	88	222	90	95	74
9	212	55	23	17	37	136	12	102	296	106	74	69
10	136	50	23	17	55	118	12	88	726	245	69	64
11	192	65	20	17	33	127	12	136	2,540	590	84	64
12	82	136	20	23	29	110	12	136	2,100	335	100	136
13	45	88	29	33	29	110	14	82	1,890	430	79	188
14	41	182	29	60	33	118	163	65	610	298	64	130
15	41	370	127	45	29	102	29	65	650	188	59	95
16	37	880	88	424	23	110	20	118	1,400	196	180	.....
17	82	253	50	127	23	95	14	182	1,010	143	690	.....
18	70	202	50	50	23	88	14	274	360	955	136	.....
19	45	154	163	41	23	88	88	154	180	730	100	.....
20	55	136	154	37	29	88	55	172	112	205	118	.....
21	76	127	163	41	60	88	26	344	79	164	90	.....
22	65	118	154	76	33	88	23	308	100	59	124	.....
23	60	127	154	110	26	76	29	172	118	124	84	64
24	55	274	154	55	37	76	26	145	130	124	74	79
25	70	182	154	45	37	76	45	172	124	106	84	74
26	65	154	182	50	118	82	274	296	118	106	69	79
27	60	127	88	37	202	127	182	172	118	.....	118	100
28	60	118	60	33	102	127	172	212	124	.....	95	84
29	55	118	50	33	110	88	118	.....	118	.....	552	69
30	50	110	45	37	102	60	163	.....	112	.....	245	64
31	45	110	.....	37	.....	50	110	.....	106	.....	130	.....

NOTE.—Water-stage recorder not operating and discharge estimated, Dec. 5–8, 55 million gallons per day; Apr. 27 to May 4, 100 million gallons per day, and June 16–22, 80 million gallons per day. Discharge interpolated Mar. 30, no record.

Monthly discharge of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	212	26	66.1	102	2,050	6,290
August	880	45	146	226	4,540	13,900
September	182	20	77.0	119	2,310	7,090
October	424	17	56.4	87.3	1,750	5,370
November	274	23	61.4	95.0	1,840	5,650
December	136	50	86.7	134	2,690	8,250
January	274	12	57.2	88.5	1,770	5,440
February	344	65	149	231	4,180	12,800
March	2,540	79	494	764	15,300	47,000
April	955	59	266	412	7,990	24,500
May	690	59	141	218	4,370	13,400
June	188	64	85.7	133	2,570	7,890
The year	2,540	12	141	218	51,400	158,000

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, about 6 miles northwest of Lihue.

RECORDS AVAILABLE.—July 1, 1910, to June 30, 1918.

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 below gage. Control is rock section at end of flume; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.66 feet at 8.10 a. m. October 16 (discharge, 27 million gallons per day, or 42 second-feet); ditch dry December 6–11.

1910–1918: 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.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable July 1 to April 2 and April 3 to June 30. Gage read to hundredths once daily. Record fair.

Discharge measurements of Hanamaulu ditch near Lihue, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Sept. 2	2.24	30	19
Apr. 25	.92	5.5	3.5
25	.78	4.7	3.0

Daily discharge, in million gallons, of Hanamaulu ditch near Lihue, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	17	19	20	19	19	21	17	9.4	8.2	2.9	3.6	20
2	20	19	19	20	22	20	17	9.4	8.2	5.2	14	20
3	22	19	21	20	12	19	17	8.8	7.6	8.2	19	20
4	25	20	21	20	12	17	17	8.8	8.2	4.0	19	19
5	21	19	20	20	12	14	17	8.8	8.8	3.2	18	19
6	22	19	20	19	11	.....	17	10	7.1	2.9	19	19
7	22	21	20	19	18	.....	17	8.2	7.1	2.6	19	19
8	21	20	19	19	18	.....	18	8.2	6.6	2.3	17	19
9	24	19	19	19	18	.....	17	8.2	6.6	2.3	16	19
10	22	19	19	19	19	.....	16	7.6	7.1	4.0	14	18
11	22	20	19	19	19	.....	16	7.6	14	4.4	14	18
12	20	22	19	19	19	5.6	18	8.2	2.9	4.4	17	22
13	19	20	19	20	19	5.6	17	7.1	2.3	5.2	17	21
14	18	22	20	19	4.8	5.6	24	7.1	1.2	5.2	16	20
15	18	20	19	19	19	5.2	17	7.1	1.4	5.2	14	20
16	20	14	19	26	18	7.1	17	7.1	1.7	4.8	20	22
17	24	14	20	19	18	6.6	18	7.1	1.0	4.4	12	19
18	20	11	19	18	18	6.1	18	7.6	.8	8.2	21	18
19	20	21	19	18	17	8.2	23	7.1	.7	3.2	20	18
20	19	20	19	19	20	8.2	19	7.1	3.6	2.9	23	19
21	19	20	20	19	20	8.8	18	6.1	3.2	2.3	18	19
22	19	20	19	19	19	8.8	18	5.2	1.7	2.0	21	19
23	19	21	19	8.8	19	8.8	17	9.4	3.6	1.7	20	19
24	18	20	19	19	21	8.8	19	10	3.6	1.7	20	22
25	20	19	19	19	20	8.2	19	9.4	3.2	3.6	22	20
26	19	19	19	20	22	8.2	4.0	9.4	3.2	3.6	19	20
27	19	19	19	19	22	9.4	2.9	9.4	3.2	3.6	21	19
28	17	20	21	19	21	8.8	3.6	10	2.9	3.6	20	19
29	19	20	19	20	22	17	10	.....	2.9	3.2	12	19
30	20	20	19	20	20	17	10	.....	2.9	3.2	21	22
31	19	20	.....	19	.....	18	9.4	.....	2.9	.....	21	.....

NOTE.—Ditch dry Dec. 6–11.

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Monthly discharge of Hanamaulu ditch near Lihue, Kauai, for the year ending June, 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	25	17	20.1	31.1	624	1,910
August	22	11	19.2	29.7	596	1,830
September	21	19	19.4	30.0	583	1,790
October	26	8.8	19.1	29.6	592	1,820
November	22	4.8	18.0	27.8	539	1,660
December (25 days)	21	5.2	10.8	16.7	271	829
January	24	2.9	15.7	24.3	488	1,490
February	10	5.2	8.19	12.7	229	704
March	14	.7	4.46	6.90	138	424
April	8.2	1.7	3.80	5.88	114	350
May	23	3.6	17.7	27.4	548	1,680
June	22	18	19.6	30.3	587	1,800
The year					5,310	16,300

LIHUE DITCH NEAR LIHUE, KAUAI.

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

RECORDS AVAILABLE.—August 1, 1917, to June 30, 1918. July 1, 1910, to April 30, 1917, at old site 1 mile below present gage.

GAGE.—Vertical staff read by S. Koike.

DISCHARGE MEASUREMENTS.—Made in flume at gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.58 feet at 8.40 a. m. October 16 (discharge, 10.2 million gallons per day, or 15.8 second-feet); ditch occasionally dry.

1910–1918: Maximum stage recorded, 1.6 feet at old site, April, May, and June, 1916 (discharge, 14 million gallons per day, or 22 second-feet); ditch occasionally dry.

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

REGULATION.—By headgates.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 6 and 10 million gallons per day. Gage read to hundredths once daily. Record fair.

The following discharge measurement was made by W. V. Hardy:

September 2, 1917: Gage height, 1.28 feet; discharge, 10.9 second-feet, or 7 million gallons per day.

Daily discharge, in million gallons, of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1918.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May.	June.
1	8.2	8.2	7.2	7.2	7.7	7.2	.....	4.0	.....	5.3
2	8.2	8.2	7.7	7.7	7.7	7.2	.....	3.6	.....	4.4
3	8.2	7.2	7.7	8.8	7.2	6.7	.....	3.6	.....	4.4
4	8.8	7.2	8.2	8.2	7.2	6.7	.....	4.0	.....	3.6
5	8.2	7.7	7.7	8.2	8.2	6.7	.....	6.2	2.6	3.6
6	8.2	7.7	7.7	7.7	7.7	7.2	.....	5.3	2.6	3.2
7	9.8	7.7	7.7	7.7	7.2	7.2	.....	5.3	2.6	3.2
8	8.8	7.7	7.7	7.2	7.2	6.7	.....	5.3	2.9	5.8
9	8.2	7.7	7.2	7.2	7.2	6.7	.....	4.8	5.3	5.8
10	8.2	7.2	7.2	8.2	7.2	7.2	.....	5.3	5.3	5.3
11	8.2	7.7	7.2	7.7	7.2	7.2	.....	9.8	5.3	5.3
12	9.3	7.7	7.2	7.2	7.2	8.2	.....	1.6	5.3	8.2
13	8.8	7.7	8.2	7.2	6.7	7.2	.....	1.4	6.2	7.7
14	9.3	8.2	7.7	7.7	6.2	9.3	.....	1.1	6.2	7.7
15	9.8	7.7	7.2	7.2	6.2	6.7	.....	1.4	5.8	7.7
16	9.3	7.7	10.4	7.2	6.2	6.7	.....	1.6	7.2	8.2
17	7.2	7.7	7.7	7.2	6.2	7.2	.....	.7	8.2	7.2
18	7.2	7.7	7.2	6.7	6.2	7.2	.....	.7	6.2	6.7
19	8.2	7.7	8.2	7.2	6.7	9.3	.....	.7	6.2	6.7
20	8.2	7.7	8.2	8.2	6.2	7.7	.....	.7	7.7	7.2
21	7.7	8.2	8.2	8.2	8.2	7.2	.....	.6	6.7	5.3
22	7.7	7.7	8.2	7.7	7.7	7.2	.....	.6	7.7	5.3
23	8.8	7.7	8.8	7.7	7.7	7.2	.....	.6	6.7	5.3
24	8.8	7.7	8.2	8.2	7.7	7.7	.....	.....	6.2	5.3
25	8.2	7.2	8.2	8.2	7.2	7.7	.....	.....	7.2	6.7
26	8.2	7.7	8.2	8.8	7.2	.....	4.4	.....	6.7	6.7
27	7.7	7.7	7.7	8.2	8.2	.....	4.4	.....	7.2	6.2
28	8.2	8.2	7.7	8.2	7.7	.....	4.0	.....	6.7	6.2
29	8.2	7.7	7.2	8.2	7.7	.....	.....	.....	7.7	6.2
30	8.2	7.7	7.2	8.2	7.2	.....	.....	.....	7.2	7.2
31	8.8	.....	7.2	.....	7.2	.....	.....	.....	5.3	.....

NOTE.—No water in ditch Jan. 26 to Feb. 25 and Mar. 24 to May 4.

Monthly discharge of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
August	9.8	7.2	8.41	13.0	261	800
September	8.2	7.2	7.72	11.9	232	711
October	10.4	7.2	7.81	12.1	242	743
November	8.8	6.7	7.77	12.0	233	715
December	8.2	6.2	7.20	11.1	223	685
January (25 days)	9.3	6.7	7.33	11.3	183	562
February (3 days)	4.4	4.0	4.27	6.61	13	39
March (23 days)	9.8	.6	3.00	4.64	69	212
May (27 days)	8.2	2.6	5.96	9.22	161	493
June	8.2	3.2	5.92	9.16	178	545
The period	.....	.....	.....	.....	1,800	5,500

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

LOCATION.—2 miles above intake of Kanaha ditch and 10 miles northwest of Lihue.

RECORDS AVAILABLE.—September 21, 1914, to June 30, 1918. 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 water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.78 feet at 10.45 p. m., March 12 (discharge, 1,700 million gallons per day, or 2,640 second-feet); minimum stage recorded, 1.25 feet January 10, 11, and 17 (discharge, 19 million gallons per day, or 29 second-feet).

1914–1918: Maximum stage recorded, 9.5 feet at 6.30 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 2,200 million gallons per day, or 3,400 second-feet); minimum stage recorded, 1.3 feet April, 1916 (discharge, 13 million gallons per day, or 20 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory at times. Records fair 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, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 7	1.56	47	31	Apr. 19	3.12	355	230
28	1.47	41	26	19	3.90	636	411
Nov. 23	1.33	32	21	19	3.40	434	280
Apr. 19	2.39	166	107	June 6	1.77	75	49

Daily diasharge in million gallons of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	June.
1	28	28	30	.....	23	38	23	42	88	38	.....
2	28	28	25	.....	42	32	21	38	49	56	.....
3	49	25	25	.....	72	30	21	35	94	228	.....
4	56	28	25	.....	38	28	21	32	56	228	.....
5	32	25	23	25	46	32	21	46	158	128	.....
6	35	25	23	28	32	28	21	88	200	77	49
7	42	32	23	25	30	32	21	46	142	56	46
8	35	23	23	23	35	28	21	38	77	52	46
9	120	23	23	21	30	38	21	72	82	88	42
10	60	21	21	21	42	30	19	46	94	128	42
11	106	28	21	21	30	30	19	56	270	94	42
12	49	49	25	23	28	30	25	68	730	158	56
13	38	38	28	32	28	38	23	56	550	218	106
14	38	77	30	28	28	35	42	52	565	135	94
15	32	77	46	23	25	32	60	38	182	100	49
16	32	191	35	150	25	28	25	38	209	100	49
17	56	56	56	52	23	30	21	77	332	88	42
18	46	42	52	35	23	25	19	77	120	565	38
19	32	35	32	30	23	25	49	64	72	238	35
20	30	32	28	28	28	25	25	72	60	106	35
21	32	30	30	38	42	25	23	60	72	82	35
22	30	28	28	42	28	23	23	150	60	72	35
23	30	30	28	56	23	23	23	72	49	.....	35
24	30	82	30	30	28	23	23	56	46	.....	46
25	32	38	30	32	25	23	21	49	64	.....	49
26	30	32	.....	42	60	23	64	100	46	.....	46
27	28	28	.....	28	77	28	49	82	46	.....	42
28	46	28	.....	28	46	35	52	49	42	.....	42
29	30	32	.....	25	49	25	72	.....	46	.....	35
30	30	28	.....	25	60	23	88	.....	42	.....	32
31	30	28	.....	28	.....	23	49	.....	35	.....	.....

NOTE.—No gage height record Sept. 26 to Oct. 4 and Apr. 23 to June 5. Discharge estimated at 28 million gallons per day Sept. 26 to Oct. 4.

Monthly discharge of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	120	28	41.7	64.5	1,290	3,970
August	191	21	40.9	63.3	1,270	3,890
September	56	21	29.3	45.3	880	2,700
October	150	21	33.9	52.5	1,050	3,230
November	77	23	36.3	56.2	1,090	3,340
December	38	23	28.6	44.3	888	2,720
January	88	19	32.4	50.1	1,000	3,080
February	150	32	60.7	93.9	1,700	5,220
March	730	35	151	234	4,680	14,400
April 1–22	565	38	138	214	3,040	9,320
June 6–30	106	32	46.7	72.3	1,170	3,580

KANAHA DITCH NEAR LIHUE, KAUAI.

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

RECORDS AVAILABLE.—August 6, 1910, to June 30, 1918.

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

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, 2.56 feet at 10.20 a. m. October 16 (discharge, 20 million gallons per day, or 31 second-feet); no flow March 19–22.

1910–1918: Maximum stage recorded, 2.6 feet July 24–26, 1913 (discharge, 22 million gallons per day, or 34 second-feet); ditch occasionally dry.

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

REGULATION.—By head gates.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined and applicable July 1 to October 16 and October 17 to June 30. Gage read to hundredths once daily. Records fair.

Discharge measurements of Kanaha ditch near Lihue, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 28	1.93	25	16	Apr. 20	0.67	7.6	4.9
Sept. 3	2.06	27	18	June 7	1.88	23	14.7
Nov. 23	2.12	25	16				

Daily discharge, in million gallons, of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	14.3	15.2	17.0	17.9	17.0	17.9	10.6	9.1	6.0	6.7	7.5	15.8
2	14.3	16.1	16.1	18.4	18.7	17.4	10.6	9.1	6.0	7.1	7.1	15.4
3	17.0	16.6	17.4	18.8	17.9	17.0	13.0	9.4	5.6	9.1	9.8	14.2
4	17.9	19.7	18.4	18.8	17.4	17.0	13.0	9.1	6.4	6.7	11.0	15.4
5	16.1	16.6	17.0	18.8	17.0	17.9	13.0	9.4	6.7	6.4	11.4	15.4
6	14.3	16.1	17.0	18.8	17.0	17.0	14.6	10.6	6.0	6.4	9.8	15.0
7	15.6	19.2	17.9	18.8	17.0	17.9	13.4	9.4	5.6	6.0	12.2	14.6
8	16.1	25.6	18.4	17.9	17.0	17.0	13.8	9.4	5.6	6.0	11.4	15.4
9	19.7	16.1	18.4	17.9	17.0	17.0	12.2	9.8	5.2	6.0	12.6	15.0
10	18.4	16.1	16.1	17.4	17.0	17.0	12.6	9.4	5.2	6.7	12.2	15.0
11	19.2	17.0	17.4	17.9	16.6	16.2	12.2	9.8	4.0	6.7	12.6	14.6
12	17.0	19.2	17.9	19.2	16.2	14.2	15.0	9.8	3.7	7.1	14.2	16.2
13	17.0	17.9	17.9	19.2	15.8	14.2	13.8	9.4	3.3	6.7	13.4	15.4
14	16.1	17.0	18.8	18.8	15.4	13.8	16.6	9.1	3.7	6.4	13.0	15.4
15	15.2	18.8	19.7	18.4	17.0	13.4	13.0	9.1	3.7	6.0	13.0	16.2
16	16.6	17.9	18.8	22.0	16.2	13.4	14.2	9.1	3.7	6.0	14.2	16.2
17	20.2	17.4	17.9	17.0	16.6	12.6	12.2	9.4	2.9	6.0	15.0	14.6
18	17.0	17.0	17.9	16.2	15.8	12.2	13.8	9.4	2.9	7.1	13.8	14.6
19	17.0	15.6	17.4	17.0	16.2	11.8	15.8	9.4	.....	5.2	13.0	16.2
20	16.6	17.4	19.7	17.0	17.0	11.4	15.4	9.1	.....	5.2	13.8	16.2
21	16.1	17.4	19.2	17.4	17.9	11.4	14.6	8.7	.....	5.2	14.2	15.4
22	15.6	17.0	19.2	17.4	17.9	11.4	14.6	8.3	.....	5.2	13.0	15.8
23	15.2	17.0	18.8	17.9	16.6	10.6	13.8	8.3	2.9	7.1	13.8	15.8
24	16.6	19.2	18.4	16.2	18.7	10.6	13.8	7.9	2.9	6.7	14.6	16.2
25	17.9	18.4	17.9	15.4	18.3	10.6	14.2	8.3	2.6	8.3	15.4	16.2
26	17.0	17.4	17.0	15.8	18.7	10.2	15.8	7.5	7.5	8.3	14.2	16.2
27	16.1	17.4	19.7	15.0	18.7	11.4	15.4	6.7	7.1	7.9	15.4	15.8
28	18.4	16.1	17.0	14.6	18.7	11.4	13.8	6.4	7.5	7.9	14.2	14.6
29	15.2	18.4	19.2	14.2	18.7	11.0	9.8	.....	7.1	7.5	15.4	14.2
30	16.6	17.0	18.8	17.4	17.4	11.0	9.4	.....	7.1	7.5	13.2	13.8
31	16.6	17.0	.....	16.6	.....	10.6	9.4	.....	6.7	.....	15.8	.....

NOTE.—Ditch dry Mar. 19–22.

Monthly discharge of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	20.2	14.3	16.7	25.8	517	1,590
August	25.6	15.2	17.6	27.2	545	1,670
September	19.7	16.1	18.1	28.0	542	1,670
October	22.0	14.2	17.6	27.2	544	1,670
November	18.7	15.4	17.2	26.6	517	1,580
December	17.9	10.2	13.8	21.4	426	1,310
January	16.6	9.4	13.3	20.6	413	1,260
February	10.6	6.4	8.94	13.8	250	768
March (27 days)	7.5	2.6	5.10	7.89	138	423
April	9.1	5.2	6.70	10.4	201	617
May	15.8	7.1	12.9	20.0	401	1,230
June	16.2	13.8	15.4	23.8	461	1,420
The year					4,960	15,200

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

LOCATION.—400 feet above confluence with North Fork and about 8 miles north of Lihue.

RECORDS AVAILABLE.—July 27, 1912, to June 30, 1918.

GAGE.—Stevens water-stage recorder, December 31, 1914, to June 30, 1918; staff 250 feet below present site July 27, 1912, to September 30, 1914.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 30 feet above and 120 feet below gage; banks low and wooded. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.75 feet at 9.45 a. m. March 11 (discharge, about 1,600 million gallons per day, or 2,480 second-feet); minimum stage recorded, 1.8 feet September 10–12, October 10–13, and January 2 (discharge, 9.0 million gallons per day, or 14 second-feet).

1912–1918: Maximum stage recorded, 8.9 feet at 8 a. m. March 3, 1916 (discharge, about 3,000 million gallons per day, or 4,640 second-feet); minimum stage recorded, 1.6 feet March, 1915 (discharge, 7 million gallons per day, or 11 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of East Branch of North Fork of Wailua River, near Lihue, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 4	1.99	29	18	Apr. 18	3.45	349	225
27	1.95	26	17	18	4.25	731	472
Sept. 2	1.90	22	14	18	3.80	526	340
Nov. 23	1.88	17.8	12	20	2.60	115	74
Apr. 17	2.41	81	53	24	2.31	69	45
18	2.94	181	117	June 6	2.12	42	27

Daily discharge, in million gallons, of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	20	17	17	14	17	27	14	24	31	24	31	27
2	20	17	17	14	53	24	9	20	31	24	27	24
3	24	17	12	27	44	20	14	20	31	58	31	27
4	44	14	12	17	27	20	14	24	27	63	31	31
5	27	17	12	14	27	20	14	27	48	31	31	31
6	20	14	12	14	20	20	14	35	35	27	31	27
7	24	17	12	14	20	27	14	31	31	27	31	31
8	24	14	12	12	20	20	14	27	31	24	31	31
9	24	14	12	12	20	27	14	27	27	24	27	31
10	74	14	9	9	27	24	14	24	92	27	27	31
11	40	14	9	9	17	24	14	27	490	35	27	44
12	58	20	9	9	17	24	17	24	280	35	31	74
13	35	17	12	9	17	31	17	24	113	27	27	40
14	27	35	27	20	17	27	17	27	44	27	27	48
15	27	27	35	14	14	27	99	24	35	27	24	27
16	27	121	27	99	14	24	35	27	58	27	44	31
17	24	68	24	31	14	24	24	31	31	40	31	27
18	27	35	17	20	14	20	20	35	31	167	27	24
19	31	24	14	20	12	20	27	31	31	99	27	24
20	27	20	14	17	20	20	24	31	31	74	31	27
21	24	20	14	24	24	20	24	92	31	63	27	31
22	24	17	12	24	17	20	24	40	31	58	35	27
23	24	17	12	20	14	17	24	31	27	48	31	24
24	20	35	14	17	17	17	20	31	27	35	27	24
25	20	20	14	24	14	14	24	35	27	35	27	24
26	20	20	17	24	31	12	35	31	27	35	27	24
27	20	17	27	17	44	14	31	31	27	35	27	24
28	20	17	20	17	27	40	27	35	27	44	24	20
29	20	14	20	17	35	24	27	.....	27	35	35	20
30	20	17	17	17	40	20	35	.....	24	31	27	20
31	20	17	.....	17	.....	17	27	.....	24	.....	27	.....

Monthly discharge of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	74	20	27.6	42.7	856	2,630
August	121	14	19.6	30.3	607	1,860
September	35	9	16.1	24.9	482	1,480
October	99	9	19.8	30.6	613	1,880
November	53	12	23.1	35.7	694	2,130
December	40	12	22.1	34.2	685	2,100
January	99	9	23.5	36.4	727	2,240
February	92	20	30.9	47.8	866	2,660
March	490	24	58.9	91.1	1,830	5,600
April	167	24	43.5	67.3	1,310	4,000
May	44	24	29.3	45.3	908	2,790
June	74	20	29.8	46.1	895	2,740
The year	490	9	28.7	44.4	10,500	32,100

KAPAA RIVER NEAR KEALIA, KAUAI.

LOCATION.—A quarter of a 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 June 30, 1918. July 23, 1910, to May 16, 1915, at old station about a mile downstream.

GAGE.—Friez water-stage recorder; July 23, 1910, to May 16, 1915, vertical staff about a mile below present site.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; right bank vertical; left bank high with gentle slope. Control fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.52 feet at 4 p. m. March 16 (discharge, 750 million gallons per day, or 1,150 second-feet); minimum stage recorded, 1.75 feet October 8–12 and November 16–19 (discharge, 11 million gallons per day, or 17 second-feet).

1915–1918: 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, 1.65 feet August 28 and 29, 1915 (discharge, 11 million gallons per day, or 17 second-feet).

1910–1915: Maximum stage recorded, 13 feet, ascertained from flood marks, December 3, 1914 (discharge, roughly estimated by extension of previous rating curve, 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 water above station.

REGULATION.—Practically none.

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

ACCURACY.—Insufficient number of discharge measurements to make certain that stage-discharge relation was permanent. Rating curve fairly well defined Operation of water-stage recorder unsatisfactory at times as shown in footnote to table of daily discharge.

Discharge measurements of Kapaa River near Kealia, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Mar. 24	3.06	124	80
June 4	1.98	22	14

Daily discharge, in million gallons, of Kapaa River near Kealia, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	20	20	18	12	12	16	13	26	20	24	13	19
2	20	20	16	12	40	13	13	17	20	107	12	17
3	44	20	16	13	48	13	13	14	24	188	17	17
4	34	22	16	13	17	13	13	18	56	122	31	18
5	22	20	16	12	16	13	13	48	127	48	22	18
6	28	20	16	12	14	17	13	60	97	22	16	17
7	26	20	16	12	16	24	13	22	37	22	24	17
8	28	20	16	11	16	14	13	44	31	22	17	17
9	92	20	16	11	14	18	13	56	20	44	16	18
10	44	20	14	11	20	17	12	20	65	117	16	20
11	78	18	14	11	13	14	14	34	164	152	22	20
12	31	34	14	11	12	14	13	26	182	74	40	37
13	28	34	14	12	12	17	18	28	152	20	22	31
14	28	28	16	13	12	14	24	20	92	18	20	28
15	24	122	17	12	12	13	24	17	188	14	20	24
16	22	56	31	37	11	17	16	16	194	14	56	28
17	40	28	37	24	11	14	16	17	65	13	40	18
18	31	24	22	16	11	13	16	22	40	78	20	18
19	22	22	17	12	11	13	16	18	44	37	18	20
20	20	22	16	11	20	13	16	28	31	18	26	22
21	22	22	16	14	24	17	16	48	26	20	22	26
22	20	20	16	16	14	13	20	40	24	20	31	20
23	20	20	16	16	12	12	22	20	24	13	22	18
24	20	28	17	12	13	12	18	17	52	12	19	17
25	20	22	16	12	12	12	22	20	17	12	20	14
26	20	20	14	22	28	13	44	26	17	17	18	16
27	20	16	18	13	24	13	88	18	16	18	26	17
28	20	16	16	13	18	13	40	44	24	13	22	15
29	20	16	14	13	17	13	20	.....	31	13	37	15
30	20	16	13	16	24	13	26	.....	17	13	24	14
31	20	16	.....	14	.....	13	17	.....	14	.....	21	.....

NOTE.—Gage-height record Aug. 24–31, Oct. 17, 18, 27–29, Dec. 26 to Jan. 25, May 1, 6, 13, 18, 19, 21, 23–26–31, June 1, 4, and 27–30 believed unreliable; discharge for these periods acsertained by comparison with record of Kapahi ditch.

Monthly discharge of Kapaa River near Kealia, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	92	20	29.2	45.2	904	2,780
August	122	16	25.9	40.1	802	2,460
September	37	13	17.1	26.4	514	1,570
October	37	11	14.2	22.0	439	1,350
November	48	11	17.5	27.1	524	1,610
December	24	12	14.3	22.1	444	1,360
January	88	12	20.5	31.7	635	1,950
February	60	14	28.0	43.3	784	2,410
March	194	14	61.6	95.3	1,910	5,860
April	188	12	43.5	67.3	1,300	4,000
May	56	12	23.5	36.4	730	2,240
June	37	14	19.9	30.8	596	1,830
The year	194	11	26.3	40.7	9,590	29,400

KAPAHI DITCH NEAR KEALIA, KAUAI.

LOCATION.—500 feet below intake and about 4 miles west of Kealia.

RECORDS AVAILABLE.—April 15, 1909, to May 2, 1914; July 1, 1915, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by 20-foot sharp-crested weir immediately below gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.63 feet at 5.30 a. m. January 26 (discharge, 90 million gallons per day, or 139 second-feet); minimum stage recorded, 0.15 foot April 7 (discharge, 2.5 million gallons per day, or 3.9 second-feet).

Maximum stage recorded during period of record, 1.98 feet[1] at 2 a. m. September 16, 1915 (discharge, 120 million gallons per day, or 186 second-feet); water shut off November 23 and 24, 1916.

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

REGULATION.—Flow regulated by head gates.

UTILIZATION.—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 or worse for interpolated periods, owing to control of flow by head gates.

Daily discharge, in million gallons, of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	10.5	13.3	15.2	10.5	10.1	8.9	12.5	8.5	10.5	8.1	12.5	18.5
2	10.9	14.7	10.5	10.1	12.9	8.9	12.5	10.1	9.3	7.8	9.7	16.5
3	27.3	13.7	9.7	11.7	13.7	8.9	12.1	10.1	8.5	6.4	8.1	16.5
4	24.0	16.0	9.3	11.7	13.7	12.9	12.1	9.7	8.5	4.4	12.1	17.5
5	13.7	14.2	9.3	10.9	12.9	13.3	12.1	7.4	8.5	4.1	13.7	18.0
6	18.0	13.7	9.3	10.5	12.1	12.1	12.1	6.4	7.0	2.8	15.6	17.0
7	17.0	13.7	9.3	10.1	12.9	7.4	12.1	6.4	6.4	2.5	14.2	16.0
8	17.5	13.3	9.3	9.3	14.2	6.0	12.1	6.4	10.1	6.4	16.0	14.2
9	15.2	13.3	9.7	9.3	13.3	6.0	12.1	7.0	11.7	15.6	14.2	14.2
10	6.0	13.3	9.7	8.9	16.0	6.0	12.1	7.0	8.1	9.3	12.5	12.5
11	10.1	15.2	9.7	8.9	12.5	7.8	13.3	7.8	.....	5.0	18.5	13.7
12	11.7	26.8	9.7	9.3	11.7	10.5	12.9	8.1	.....	4.7	23.0	32.0
13	11.7	27.3	9.7	9.3	10.9	10.9	17.5	8.1	.....	4.4	22.0	18.5
14	11.7	25.2	12.5	12.5	10.5	10.9	22.5	11.7	.....	4.4	17.5	14.7
15	11.7	12.5	.....	10.9	10.5	10.9	22.5	12.9	.....	4.4	16.0	16.0
16	11.3	9.7	.....	28.4	10.5	11.3	14.7	8.9	.....	6.0	25.2	19.5
17	10.9	18.0	.....	22.5	9.3	11.3	14.2	6.0	.....	7.0	23.0	17.5
18	10.9	20.0	.....	15.2	9.7	11.3	13.7	6.0	3.8	6.4	19.5	14.7
19	10.9	17.0	.....	9.7	9.7	11.3	15.2	8.1	4.1	5.0	17.0	17.5
20	13.3	17.0	.....	8.9	17.0	11.3	16.0	8.9	.....	4.7	23.0	20.0
21	12.9	16.5	.....	12.5	24.0	11.7	15.6	7.0	.....	5.0	20.5	22.0
22	12.5	16.5	10.9	9.7	13.3	10.9	19.5	6.7	.....	5.0	19.0	17.0
23	12.5	15.6	9.7	10.9	11.3	11.3	20.5	8.9	10.1	6.4	22.0	17.5
24	12.5	27.3	9.7	11.7	12.9	11.3	16.0	10.1	8.1	6.7	19.0	17.0
25	13.3	21.5	9.7	8.9	11.3	11.7	20.0	10.1	7.0	5.6	20.0	13.3
26	15.2	17.0	10.5	11.7	24.0	12.1	39 8	10.1	9.3	5.6	17.5	14.7
27	14.2	15.6	17.5	12.9	12.1	12.5	12.5	10.1	9.3	5.6	42.0	16.5
28	14.2	15.2	14.7	12.1	9.3	12.9	7.4	10.5	6.7	5.6	22.0	14.2
29	13.7	14.7	13.3	12.9	9.3	12.5	7.4	.....	6.0	5.6	19.0	14.2
30	13.3	15.2	12.1	10.9	8.9	12.1	7.4	.....	5.6	7.8	23.5	13.7
31	13.3	15.2	.....	9.3	.....	12.1	7.0	.....	5.6	.....	21.0	.....

NOTE.—No gage-height record and discharge estimated Sept. 15–21, 11 million gallons per day; Mar. 11–17 and 20–22, 7 million gallons per day.

[1] Determinations of maximum discharge supersede those published in Water-Supply Paper 430, which were based on extension of rating curve.

Monthly discharge of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	27.3	6.0	13.6	21.0	422	1,290
August	27.3	9.7	16.7	25.8	518	1,590
September	17.5	9.3	10.9	16.9	328	1,000
October	28.4	8.9	11.7	18.1	362	1,110
November	24.0	8.9	12.7	19.6	380	1,170
December	13.3	6.0	10.6	16.4	329	1,010
January	39.8	7.0	14.8	22.9	457	1,410
February	12.9	6.0	8.54	13.2	239	734
March	11.7	5.6	7.55	11.7	234	718
April	15.6	2.5	5.94	9.19	178	547
May	25.2	8.1	18.1	28.0	561	1,720
June	32.0	12.5	16.8	26.0	505	1,550
The year	39.8	2.5	12.4	19.2	4,510	13,800

ANAHOLA RIVER NEAR KEALIA, KAUAI.

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

RECORDS AVAILABLE.—August 22 to November 2, 1910; December 28, 1912, to June 30, 1918. Fragmentary record December 15, 1910, to December 28, 1912, at dam a quarter of a mile below present site.

GAGE.—Friez water-stage recorder August 22 to November 2, 1910, and December 28, 1912, to June 30, 1918. From December 15, 1910, to December 28, 1912, an inclined staff.

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; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.40 feet at 5.30 p. m. March 16 (discharge, approximately 710 million gallons per day, or 1,100 second-feet); minimum stage recorded, 1.7 feet September 26 and 27 (discharge, 4.3 million gallons per day, or 6.7 second-feet).

Maximum stage recorded during period of record, 12.9 feet at 7.30 p. m. September 26, 1914 (discharge, estimated from extension of rating curve, 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 million gallons per day, or 3.1 second-feet).

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

REGULATION.—None except by diversions.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Three rating curves fairly well defined, applicable July 1 to August 15, August 16 to April 3, and April 4 to June 30. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Records fair.

Discharge measurements of Anahola River near Kealia, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug.	1.93	15.3	9.9	Mar. 25	2.12	18.2	12
27	1.88	10.3	6.7	June 3	2.00	11.2	7.2

Daily discharge, in million gallons, of Anahola River near Kealia, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	11	7.2	6.2	5.5	5.5	7.0	5.5	15	9.2	51	7.0	7.0
2	26	9.5	6.2	5.5	20	7.0	5.5	11	8.1	148	7.0	7.0
3	23	8.4	6.2	5.5	38	7.0	5.5	9.2	8.1	267	7.0	7.0
4	16	9.5	5.5	5.5	9.2	7.0	5.5	9.2	20	118	15	7.0
5	16	7.2	5.5	5.5	8.1	9.2	5.5	30	70	51	15	7.0
6	18	7.2	5.5	5.5	7.0	23	5.5	70	65	23	12	6.2
7	12	7.2	5.5	5.5	7.0	42	5.5	15	23	18	34	6.2
8	9.5	7.2	5.5	5.5	7.0	11	5.5	80	12	14	12	8.1
9	9.5	7.2	5.5	5.5	7.0	12	5.5	56	11	20	8.1	9.2
10	8.4	7.2	5.5	5.5	9.2	9.2	5.5	15	20	70	8.1	7.0
11	11	7.2	4.9	5.5	7.0	9.2	5.5	23	130	142	15	6.2
12	8.4	11	4.9	5.5	6.2	8.1	5.5	15	148	70	42	15
13	8.4	12	4.9	5.5	5.5	9.2	5.5	15	130	26	12	30
14	7.2	8.4	12	5.5	5.5	8.1	9.2	14	113	20	9.2	9.2
15	7.2	91	14	4.9	5.5	7.0	26	12	185	15	9.2	7.0
16	7.2	30	14	30	5.5	7.0	7.0	12	192	20	26	7.0
17	7.2	11	34	20	5.5	7.0	6.2	12	91	18	20	7.0
18	7.2	8.1	11	9.2	5.5	7.0	6.2	12	51	75	11	7.0
19	7.2	7.0	7.0	7.0	5.5	7.0	6.2	12	30	30	9.2	7.0
20	7.2	7.0	5.5	7.0	6.2	7.0	7.0	15	23	15	14	7.0
21	7.2	6.2	5.5	6.2	12	8.1	6.2	23	18	11	12	7.0
22	7.2	6.2	4.9	6.2	7.0	7.0	5.5	18	18	26	34	6.2
23	7.2	5.5	4.9	5.5	5.5	7.0	6.2	9.2	14	14	14	6.2
24	14	30	4.9	5.5	11	6.2	6.2	9.2	18	12	9.2	5.5
25	12	8.1	4.9	6.2	7.0	6.2	7.0	20	12	12	12	5.5
26	8.4	7.0	4.3	6.2	15	6.2	34	15	12	12	8.1	6.2
27	7.2	7.0	4.3	5.5	14	6.2	91	9.2	12	12	14	5.5
28	8.4	7.0	9.2	5.5	9.2	5.5	42	14	20	8.1	9.2	12
29	8.4	6.2	8.1	5.5	9.2	6.2	15	.....	56	8.1	34	9.2
30	8.4	6.2	6.2	5.5	15	5.5	14	.....	15	8.1	12	12
31	7.2	6.2	.....	5.5	.....	5.5	11	.....	12	.....	8.1	.....

NOTE.—No gage-height record Oct. 2–5; discharge interpolated.

Monthly discharge of Anahola River near Kealia, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	26	7.2	10.4	16.1	323	989
August	91	5.5	11.8	18.2	366	1,120
September	34	4.3	7.55	11.7	226	695
October	30	4.9	7.04	10.9	218	670
November	38	5.5	9.36	14.5	281	862
December	42	5.5	9.05	14.0	281	861
January	91	5.5	12.2	18.9	377	1,160
February	80	9.2	20.4	31.6	570	1,750
March	192	8.1	49.9	77.2	1,550	4,750
April	267	8.1	44.5	68.8	1,330	4,100
May	42	7.0	14.8	22.9	459	1,410
June	30	5.5	8.31	12.8	249	765
The year	267	4.3	17.1	26.4	6,230	19,100

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 30, 1915, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made from wooden footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is short straight stretch of open ditch cut in firm earth between two tunnels with a spillway 50 feet below gage. Control when spillway is closed is timber sill on check gate below spillway.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.68 feet at 7 p. m. March 16 (discharge, 52 million gallons per day, or 81 second-feet); minimum stage recorded, 1.1 feet October 15 and January 2–5 and 9–10 (discharge, 1.6 million gallons per day, or 2.5 second-feet).

1915–1918: Maximum stage recorded, 3.72 feet at 4.30 a. m. January 26, 1916 (discharge, 53 million gallons per day, or 82 second-feet); minimum stage recorded, 1.0 foot January 1, 1916 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

DIVERSIONS.—Diverts from Anahola River.

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

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

ACCURACY.—Stage-discharge relation not permanent. Curve used when spillway is closed, well defined below 20 million gallons per day; curve used when spillway is open, fairly well defined below 20 million gallons per day. Operation of water-stage recorder satisfactory except for 3 days in January. Record good when water was not wasting and recorder operating, fair at other times.

Discharge measurements of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 2	1.51	7.7	5.0	Jan. 29	1.46	10.4	6.8
27	1.31	5.3	3.5	Mar. 25	1.52	7.4	4.8
Sept. 28	1.69	16.5	11				

Daily discharge, in million gallons, of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.2	3.4	3.4	1.9	1.9	4.4	1.9	6.4	6.4	11.2	3.9	5.4
2	2.6	4.4	2.6	2.2	9.6	3.4	1.6	5.4	6.4	16.2	3.9	4.9
2	6.4	2.6	2.2	3.0	8.2	3.4	1.6	4.4	6.4	13.6	4.9	4.9
4	7.0	4.9	2.2	3.0	6.4	3.4	1.6	3.9	9.6	13.6	9.6	4.4
5	3.0	2.6	2.2	2.6	5.4	3.4	1.6	7.0	13.6	10.4	13.6	6.4
6	3.0	2.2	1.9	2.2	4.4	6.4	2.2	8.9	13.6	8.2	9.6	4.4
7	4.9	2.2	1.9	2.2	3.9	7.0	1.9	3.0	11.2	7.6	7.0	3.9
8	5.4	2.2	1.9	1.9	3.0	6.4	1.9	7.6	8.9	7.6	6.4	5.4
9	12.8	2.2	1.9	1.9	3.4	7.0	1.6	7.6	7.6	13.6	6.4	7.0
10	9.6	2.2	1.9	1.9	4.9	6.4	1.6	6.4	8.9	16.2	12.8	4.9
11	12.0	2.2	1.9	1.9	3.0	5.9	3.0	7.6	9.6	14.5	11.2	4.4
12	8.2	5.9	1.9	1.9	2.6	5.4	2.2	6.4	6.4	12.0	12.0	8.2
13	8.9	6.4	2.6	1.9	2.2	4.9	2.6	7.0	6.4	10.4	8.2	8.2
14	8.2	3.4	7.6	1.9	2.6	5.4	6.4	5.4	5.9	10.4	5.9	7.0
15	6.4	11.2	7.0	1.6	2.2	3.9	7.6	4.4	7.6	10.4	5.4	6.4
16	10.4	11.2	4.9	8.9	1.9	3.9	2.6	4.9	24.0	10.4	9.6	5.9
17	5.4	7.0	7.0	10.4	1.9	3.4	2.2	4.4	13.6	12.8	9.6	6.4
18	3.9	4.9	4.4	3.0	1.9	3.0	2.2	4.9	12.0	15.4	6.4	4.4
19	3.9	3.9	3.4	2.6	1.9	3.0	2.2	5.4	8.9	9.6	5.4	5.4
20	5.4	3.4	3.0	2.6	2.2	2.6	4.4	6.4	5.4	6.4	7.6	6.4
21	4.4	3.0	3.9	2.6	6.4	2.6	2.6	6.4	6.4	6.4	5.4	7.6
22	2.2	3.0	3.0	3.0	3.4	2.6	2.6	9.6	5.4	6.4	5.9	4.9
23	3.0	3.0	2.6	2.6	2.2	2.6	4.9	5.9	5.4	6.4	8.2	5.4
24	3.4	9.6	4.9	2.2	4.9	2.2	2.6	5.4	7.6	5.9	13.6	5.4
25	7.0	4.9	3.9	3.0	3.0	2.2	6.3	8.2	5.4	5.4	8.9	3.9
26	4.4	3.0	2.6	2.6	5.9	2.2	9.9	7.0	4.9	7.0	5.9	4.4
27	3.9	3.0	4.4	2.2	7.6	2.2	13.6	4.9	5.9	7.6	8.2	4.9
28	3.9	2.6	8.2	2.2	4.9	2.2	12.0	7.6	10.4	4.9	7.6	3.9
29	3.4	2.6	6.4	2.2	4.4	1.9	7.0	.....	9.6	4.4	9.6	3.4
30	3.0	2.6	4.9	3.9	4.9	1.9	7.0	.....	9.6	4.4	8.2	3.9
31	2.6	2.2	.....	2.6	.....	1.9	7.0	.....	7.6	.....	6.4	.....

NOTE.—No gage height record Jan. 25, 26, and 30; discharge interpolated. Water wasting below gage, July 11–21, Sept. 28–30, Nov. 2–7, Dec. 6–12, Jan. 27–29, Feb. 10–14, Feb. 21 to Mar. 19, Mar. 30 to Apr. 6, and Apr. 11–23.

Monthly discharge of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	12.8	2.2	5.51	8.53	171	524
August	11.2	2.2	4.13	6.39	128	393
September	8.2	1.9	3.69	5.71	111	340
October	10.4	1.6	2.86	4.43	89	272
November	9.6	1.9	4.04	6.25	121	372
December	7.0	1.9	3.78	5.85	117	360
January	13.6	1.6	4.14	6.40	128	394
February	9.6	3.0	6.16	9.53	172	529
March	24.0	4.9	8.73	13.5	271	830
April	16.2	4.4	9.64	14.9	289	888
May	13.6	3.9	7.98	12.3	247	759
June	7.6	3.4	5.40	8.36	162	497
The year	24.0	1.6	5.50	8.51	2,010	6,160

KALIHIWAI RIVER NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—March 13, 1914, to June 30, 1918.

GAGE.—Stevens 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, 6.07 feet at 8 p. m. March 12 (discharge, about 1,160 million gallons per day, or 1,800 second-feet); minimum stage recorded, 0.8 foot August 10–12 (discharge, 8 million gallons per day, or 12 second-feet).

1914–1918: Maximum stage recorded, 14.4 feet at 6.30 a. m., September 25, 1914 (discharge, computed from extension of rating curve, about 4,000 million gallons per day, or 6.200 second-feet); minimum stage recorded, 0.95 foot March 13, 1914 (discharge, 6.5 million gallons per day, or 10 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory, especially after March 10. Records fair when water-stage recorder was operating.

Discharge measurements of Kalihiwai River near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Aug. 6	0.93	15.9	10
Dec. 22	1.28	40	26
Apr. 22	1.32	47	30

Daily discharge, in million gallons, of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	15	15	15	17	17	20	13	27	22	22
2	15	15	12	20	68	17	13	20	24	63
3	34	15	12	27	89	15	13	15	24	166
4	34	17	10	34	30	13	13	15	73	125
5	20	12	10	24	24	13	13	53	119	68
6	20	12	10	.....	20	20	13	95	101	34
7	22	12	10	.....	20	34	13	30	48	34
8	20	12	9	.....	17	15	12	89	30	24
9	83	12	9	.....	15	24	12	95	34	53
10	43	12	8	.....	22	20	13	38	107	151
11	73	12	8	.....	15	17	15	58	.....	278
12	30	22	8	.....	13	15	15	38	.....	138
13	22	30	9	.....	17	17	22	43	.....	131
14	22	24	20	.....	17	15	53	30	.....	95
15	20	78	20	.....	12	13	38	24	166	68
16	20	58	20	131	12	13	20	24	.....	63
17	34	24	15	73	12	12	13	22	.....	58
18	27	20	13	58	12	10	13	22	.....	83
19	20	15	13	53	12	10	15	27	.....	63
20	17	13	12	53	12	10	15	34	.....	43
21	20	13	12	73	22	10	15	48	.....	34
22	17	13	12	68	13	12	15	43	.....	.....
23	15	13	20	63	12	13	20	24	.....	.....
24	15	43	15	48	20	13	13	20	.....	.....
25	22	20	13	63	15	13	12	27	.....	.....
26	20	17	24	58	38	12	34	38	.....	.....
27	17	15	27	53	48	12	107	22	.....	.....
28	15	13	22	20	24	13	48	34	27	.....
29	15	13	17	20	22	13	24	.....	43	.....
30	15	12	17	24	38	13	34	.....	24	.....
31	15	12	.....	20	.....	13	20	.....	17	.....

NOTE.—No gage height record Sept. 14–15, Oct. 1 and 6–15; discharge estimated. Mean discharge, Oct. 6–15, 20 million gallons per day.

Monthly discharge of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	83	15	25.1	38.8	777	2,390
August	78	12	19.8	30.6	614	1,880
September	27	8	14.1	21.8	422	1,300
October	131	17	38.7	59.9	1,200	3,680
November	89	12	23.6	36.5	708	2,170
December	34	10	14.8	22.9	460	1,410
January	107	12	22.2	34.3	689	2,110
February	95	15	37.7	58.3	1,060	3,240
April 1–21	278	22	85.4	132	1,790	5,500

HANALEI RIVER AT ELEVATION 625 FEET, NEAR HANALEI, KAUAI.

LOCATION.—2 miles west of Kauai Electric Co.'s power line and 10 miles south of Hanalei. Trail to station leaves power line at pole No. 485.

RECORDS AVAILABLE.—January 26, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder; datum raised 6.0 feet January 15, 1915.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage. Stream bed rough; right bank steep and high; left bank slopes gently. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.01 feet at 7.10 p. m. March 12 (discharge, 1,630 million gallons per day, or 2,530 second-feet); minimum stage recorded, 0.35 foot January 6 and 10 (discharge, 14 million gallons per day, or 22 second-feet).

1914–1918: Maximum stage recorded, 9.7 feet (new datum) September 26, 1914 (discharge, computed from extension of rating curve, about 3,800 million gallons per day, or 5,880 second-feet); minimum stage recorded during 1918.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Irrigation and domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Operation of water-stage recorder unsatisfactory, causing frequent gaps in record. Record fair.

Discharge measurements of Hanalei River at elevation 625 feet, near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Aug. 5	0.72	54	35
Oct. 6	.69	53	35
Apr. 21	1.27	162	105

Daily discharge, in million gallons, of Hanalei River at elevation 625 feet, near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	24	31	35	27	.....	53	24	65	43	43	35	65
2	27	27	35	27	.....	43	21	48	59	110	35	48
3	65	27	31	35	.....	35	21	43	43	305	35	39
4	94	27	31	35	.....	31	21	43	190	585	148	43
5	65	43	35	39	.....	27	18	102	338	338	190	43
6	53	39	35	35	.....	35	14	168	262	148	94	43
7	48	48	35	35	.....	72	15	72	72	86	94	39
8	43	39	39	31	.....	43	15	110	72	72	110	43
9	158	39	39	27	.....	59	16	148	119	65	65	43
10	128	39	39	27	.....	43	14	79	212	.....	48	43
11	128	43	39	27	.....	43	24	102	860	.....	53	43
12	86	53	43	27	.....	48	24	79	860	.....	110	72
13	59	65	59	35	.....	53	48	86	670	.....	94	94
14	43	148	179	35	.....	53	119	65	305	.....	65	79
15	39	94	224	31	.....	43	53	43	320	.....	53	79
16	31	236	224	212	.....	43	39	39	465	.....	59	86
17	48	102	236	86	31	.....	39	59	224	.....	262	65
18	43	65	276	53	27	.....	39	86	119	.....	128	43
19	39	39	212	48	27	.....	94	59	94	.....	86	39
20	35	31	179	43	35	.....	65	94	94	.....	79	43
21	31	24	148	.....	53	.....	59	158	65	110	65	48
22	27	21	138	.....	39	.....	72	138	53	102	94	39
23	27	18	138	.....	35	.....	94	53	48	72	102	39
24	27	119	128	.....	43	.....	65	43	86	65	65	65
25	31	59	128	.....	35	.....	86	79	79	59	72	53
26	35	43	53	.....	110	.....	179	86	72	59	65	48
27	31	43	94	.....	148	.....	390	35	53	72	79	59
28	35	43	59	.....	79	.....	212	65	65	53	72	48
29	43	35	48	.....	65	.....	119	.....	102	48	565	39
30	27	35	31	.....	94	.....	138	.....	94	43	190	39
31	27	35	.....	.....	.....	27	72	.....	53	.....	94	.....

NOTE.—No gage height record Jan. 7 and 8; discharge interpolated.

Monthly discharge of Hanalei River at elevation 625 feet, near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	158	24	51.5	79.7	1,600	4,900
August	236	21	55.2	85.4	1,710	5,250
September	276	31	99.7	154	2,990	9,180
October 1-20	212	27	45.8	70.9	915	2,810
November 17-30	148	27	58.6	90.7	821	2,520
January	390	14	71.3	110	2,210	6,780
February	168	35	80.2	124	2,250	6,890
March	860	43	200	309	6,190	19,000
May	565	35	107	166	3,310	10,200
June	94	39	52.3	80.9	1,570	4,820

HANALEI RIVER NEAR HANALEI, KAUAI.

LOCATION.—About 5 miles up river from Hanalei.

RECORDS AVAILABLE.—December 28, 1911, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 500 feet above and below gage; banks low, wooded, and not subject to overflow. Control composed of boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.72 feet at 4.10 p. m. April 3 (discharged, 4,800 million gallons per day, or 7,440 second-feet); minimum stage recorded, 6.4 feet August 22 (discharge, 63 million gallons per day, or 98 second-feet).

1911–1918: Maximum stage recorded, 17.52 feet at 4 p. m. September 26, 1914 (discharge, computed from extension of rating curve, about 14,000 million gallons per day, or 21,700 second-feet); minimum stage recorded, 6.21 feet March 25, 1914 (discharge, 26 million gallons per day, or 40 second-feet).

DIVERSIONS.—China ditch diverts water above station.

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

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

Discharge measurements of Hanalei River near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 26	6.74	154	100	Mar. 7	7.42	469	303
Nov. 30	7.23	314	203	May 23	7.10	270	174
Dec. 5	6.76	135	87	June 14	7.10	273	176
Feb. 12	7.16	255	165				

Daily discharge, in million gallons, of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	85	82	85	92	85	109	75	118	68	155	92	155
2	85	92	80	92	590	100	75	109	129	555	92	140
3	205	85	75	85	520	100	75	100	155	3,600	100	129
4	188	109	75	80	170	92	85	92	1,160	625	625	118
5	109	85	75	85	155	100	75	85	2,230	400	1,120	118
6	118	82	75	80	118	92	75	520	315	205	225	118
7	129	85	75	80	109	170	75	170	268	170	118	109
8	109	82	75	80	118	109	85	340	225	140	140	109
9	129	82	75	75	109	268	75	315	490	370	129	109
10	155	82	75	75	140	109	92	155	660	1,540	118	100
11	625	85	72	75	129	109	80	245	2,590	2,350	340	109
12	155	188	80	75	109	140	85	155	2,650	840	430	225
13	140	170	92	80	85	140	80	340	1,340	1,590	140	245
14	129	290	520	80	85	118	370	72	1,300	520	109	170
15	109	155	520	75	85	100	140	129	800	290	225	140
16	109	555	100	2,830	80	100	92	129	2,180	205	590	155
17	170	129	555	140	80	92	85	140	370	140	170	129
18	118	109	245	109	80	92	80	155	205	590	140	109
19	92	92	92	92	80	85	245	140	155	290	129	118
20	92	92	85	109	80	92	129	340	170	245	155	155
21	100	85	85	129	140	92	92	555	140	170	68	290
22	92	63	85	92	100	85	85	225	68	205	2,410	170
23	92	80	80	85	80	85	118	155	118	140	155	129
24	100	660	85	85	140	80	92	129	109	118	129	118
25	225	100	80	400	92	80	100	188	245	109	205	245
26	109	92	92	315	490	80	430	155	155	129	155	72
27	109	85	225	109	315	80	1,040	72	140	155	188	118
28	140	85	100	109	170	80	625	225	118	100	155	205
29	109	92	129	92	140	80	140	.....	460	92	1,840	118
30	100	85	92	92	340	75	340	.....	155	92	1,490	109
31	92	85	.....	92	.....	75	140	.....	1,490	.....	245	.....

Monthly discharge of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	625	85	139	215	4,320	13,200
August	660	63	137	212	4,240	13,000
September	555	72	139	215	4,180	12,800
October	2,830	75	196	303	6,090	18,600
November	590	80	167	258	5,010	15,400
December	268	75	104	161	3,210	9,890
January	1,040	75	173	268	5,380	16,400
February	555	72	198	306	5,550	17,000
March	2,650	68	666	1,030	20,700	63,400
April	3,600	92	538	832	16,100	49,500
May	2,410	68	394	610	12,200	37,500
June	290	72	144	223	4,330	13,300
The year	3,600	63	250	387	91,300	280,000

CHINA DITCH NEAR HANALEI, KAUAI.

LOCATION.—Just below intake, about 5 miles south of Hanalei.

RECORDS AVAILABLE.—March 17, 1914, to June 30, 1918. December 28, 1911, to September 30, 1913, at old station a quarter of a mile below present station.

GAGE.—Vertical staff on left bank read by D. Kamaka.

DISCHARGE MEASUREMENTS.—Made from plank.

CHANNEL AND CONTROL.—Cut in clay and gravel; subject to growth of grass and weeds which affects stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.09 feet at 8 a. m. April 3 (discharge, 56 million gallons per day, or 87 second-feet); minimum stage recorded during year, 1.4 feet December 28–31 and 11 days between January 1–17 (discharge, 11 million gallons per day, or 17 second-feet).

1911–1918: Maximum stage recorded during 1918; ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanalei River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 10 and 25 second-feet and applicable July 1–8, July 9 to November 30, and December 1 to June 30. Gage read to hundredths twice daily. Records fair.

Discharge measurements of China ditch near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 26	1.88	34	22	Feb. 12	1.71	27	18
26	1.30	23	15	Mar. 7	1.81	31	20
26	.78	15.4	10	May 23	1.66	26	17
Nov. 30	1.72	26	17	June 14	1.69	30	19
Dec. 5	1.50	21	13				

Daily discharge, in million gallons, of China ditch near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	18	19	22	21	22	15	11	18	15	19	19	19
2	18	20	21	21	23	14	11	16	15	32	19	18
3	22	20	21	20	22	14	11	15	18	44	20	16
4	22	20	21	20	20	13	12	15	25	30	15	16
5	20	20	21	21	19	13	11	19	27	24	27	16
6	20	19	20	20	17	13	11	21	21	19	24	15
7	20	20	20	21	17	18	11	19	24	18	20	15
8	19	19	21	20	17	14	12	20	24	18	21	15
9	23	19	20	20	17	18	11	20	53	18	20	19
10	20	20	20	20	19	14	11	18	33	27	19	15
11	22	21	20	20	16	13	11	20	35	32	24	16
12	20	22	21	20	16	14	12	18	36	25	14	22
13	18	22	22	20	16	14	11	19	30	28	20	22
14	18	20	24	20	16	13	18	15	27	20	19	18
15	18	20	22	20	16	13	13	13	25	19	22	16
16	19	13	21	27	16	13	12	15	28	18	27	18
17	22	23	24	21	16	12	11	19	16	16	22	15
18	20	22	24	19	16	12	13	19	13	22	21	14
19	20	22	21	17	16	12	21	20	13	19	21	18
20	20	22	21	18	16	12	22	24	15	18	24	18
21	20	22	20	15	15	13	20	14	14	16	20	20
22	20	22	20	19	16	12	30	18	13	18	25	18
23	19	22	20	16	16	12	20	16	13	19	15	16
24	20	25	20	18	18	12	16	16	12	21	14	18
25	21	23	20	20	16	12	18	19	19	21	15	18
26	20	22	20	20	21	12	22	18	14	21	13	18
27	20	22	21	17	20	12	15	16	14	22	15	19
28	19	22	20	17	19	11	24	19	18	21	14	18
29	19	22	22	17	18	11	18	.....	16	20	26	16
30	19	22	22	17	20	11	20	.....	20	20	27	16
31	19	21	.....	17	.....	11	16	.....	18	.....	21	.....

Monthly discharge of China ditch near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	23	18	19.8	30.6	615	1,880
August	25	13	20.9	32.3	648	1,990
September	24	20	21.1	32.6	632	1,940
October	27	16	19.4	30.0	602	1,850
November	23	16	17.8	27.5	535	1,640
December	18	11	13.0	20.1	403	1,240
January	24	11	15.0	23.2	465	1,430
February	24	13	17.8	27.5	499	1,530
March	53	12	21.4	33.1	664	2,040
April	44	16	22.2	34.3	665	2,040
May	27	13	20.1	31.1	623	1,910
June	22	14	17.3	26.8	518	1,590
The year	53	11	18.8	29.1	6,870	21,100

KUNA DITCH NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—July 1, 1916, to June 30, 1918. January 17, 1912, to September 30, 1913, at old site 500 feet below intake.

GAGE.—Vertical staff read by D. Kamaka.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Channel about 5 feet wide, 3 feet deep, cut in firm earth straight for 25 feet above and 50 feet below gage. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.32 feet at 8.30 a. m. July 4 (discharge, 29 million gallons per day, or 45 second-feet); minimum stage recorded, 1.44 feet at 12.30 p. m. December 5 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

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

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

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to hundredths twice daily except as noted under daily discharge table. Records fair.

Discharge measurements of Kuna ditch near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 26	2.86	32	21	Dec. 5	1.65	9.3	6.0
Aug. 26	2.62	27	17	5	1.44	6.2	4.0
Dec. 5	1.87	12.6	8.1	Mar. 7	2.43	27	17
5	2.03	13.6	8.8	June 14	2.70	31	2.0

Daily discharge, in million gallons, of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	21.4	17.7	19.1	18.4	8.6	9.2	7.5	8.6	13.6	19.8	20.6	21.4
2	22.1	19.8	16.3	17.7	25.0	8.6	7.5	8.0	13.6	23.7	20.6	20.6
3	25.0	18.4	16.3	17.7	25.0	8.0	7.5	7.0	14.2	23.7	22.1	19.8
4	27.0	19.8	16.3	17.0	14.2	7.5	8.6	7.0	25.0	23.7	23.7	14.2
5	22.1	19.8	15.6	17.0	13.6	7.5	8.0	9.2	25.0	23.7	23.7	22.9
6	22.1	19.1	14.9	17.0	9.2	8.0	8.0	25.0	25.0	13.0	22.9	21.4
7	22.1	20.6	14.2	17.7	9.2	25.0	7.5	20.6	14.9	12.3	21.4	18.4
8	22.1	17.7	14.9	15.6	8.0	9.2	9.2	25.0	14.2	11.0	22.9	18.4
9	25.0	17.7	14.2	14.9	8.0	25.0	7.5	25.0	25.0	17.7	22.9	19.1
10	24.5	17.0	14.2	14.9	9.8	9.8	7.0	7.5	25.0	23.7	22.9	18.4
11	25.0	17.7	14.2	14.9	9.2	9.2	8.0	25.0	25.0	23.7	23.7	19.8
12	23.7	20.6	16.3	14.2	8.0	9.2	8.0	18.4	25.0	23.7	23.7	22.9
13	23.7	20.6	19.8	14.9	8.0	10.4	8.6	25.0	25.0	23.7	22.9	23.7
14	22.9	25.0	25.0	15.6	8.0	8.6	12.3	17.0	25.0	23.7	22.1	20.6
15	22.9	19.8	25.0	14.9	7.5	9.2	9.8	16.3	25.0	23.7	22.9	20.6
16	22.9	25.0	17.0	25.0	7.5	8.6	8.6	17.0	25.0	13.0	23.7	19.1
17	26.2	22.1	25.0	16.3	7.5	8.0	8.0	16.3	25.0	11.6	18.4	18.4
18	24.5	21.4	25.0	12.3	7.5	8.0	8.0	17.0	11.0	23.7	22.9	17.7
19	20.6	20.6	17.0	8.6	7.5	8.0	8.0	16.3	12.3	23.7	22.1	19.1
20	20.6	20.6	16.3	9.2	7.0	8.0	9.2	25.0	14.2	18.4	17.7	22.1
21	20.6	19.1	16.3	9.2	9.8	8.6	8.6	25.0	18.4	13.0	21.4	23.7
22	19.8	18.4	15.6	10.4	9.2	8.0	8.6	17.0	22.9	12.3	21.4	20.6
23	19.8	17.7	15.6	8.0	8.0	8.0	6.5	14.9	22.1	6.0	10.4	19.8
24	20.6	25.0	17.0	9.8	9.8	8.0	5.5	13.0	22.1	7.5	22.9	23.7
25	25.3	20.6	14.9	9.8	8.0	8.0	5.0	12.3	25.0	17.0	20.6	20.6
26	21.4	19.8	15.6	9.2	25.0	7.5	6.5	13.6	14.2	16.3	10.4	19.8
27	19.8	18.4	20.6	8.6	13.6	7.5	25.0	13.0	14.2	18.4	20.6	23.7
28	22.1	18.4	14.9	9.8	11.0	7.5	25.0	12.3	20.6	18.4	10.4	19.8
29	20.6	19.8	19.1	9.2	9.8	7.5	9.8	.....	25.0	16.3	23.7	19.1
30	21.4	19.1	18.4	9.2	10.4	7.5	11.0	.....	19.1	15.6	23.7	19.1
31	19.8	18.4	.....	8.6	.....	7.5	9.2	.....	18.4	.....	22.1	.....

NOTE.—Gage could not be reached and gage-height record was not recorded July 3, 9, 11, Aug. 14, 16, 24, Sept. 14,15, 17, 18, Oct. 16, Nov. 2, 3, 26, Dec. 7, 9, Jan. 27, 28, Feb. 6, 8, 9, 11, 13, 20, 21, Mar. 4–6, 9–17, 25, and 2 9. Ditch probably running nearly to capacity for days given above. Discharge estimated at 25 million gallons per day, which is probably within 15 per cent of actual discharge.

Monthly discharge of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	27.0	19.8	22.2	34.3	688	2,110
August	25.0	17.0	19.9	30.8	616	1,890
September	25.0	14.2	17.5	27.1	525	1,610
October	25.0	8.0	13.4	20.7	416	1,270
November	25.0	7.0	10.8	16.7	323	994
December	25.0	7.5	9.38	14.5	291	892
January	25.0	5.0	9.28	14.4	288	883
February	25.0	7.0	16.3	25.2	457	1,400
March	25.0	11.0	20.3	31.4	630	1,930
April	23.7	6.0	18.1	28.0	542	1,670
May	23.7	10.4	21.0	32.5	651	2,000
June	23.7	14.2	20.3	31.4	608	1,870
The year	27.0	5.0	16.5	25.5	6,040	18,500

LUMAHAI RIVER NEAR HANALEI, KAUAI.

LOCATION.—About 6 miles above mouth and 10 miles by road and trail from Hanalei.

RECORDS AVAILABLE.—May 23, 1914, to October 11, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and 100 feet below gage; stream bed very rough; right bank vertical; left bank slopes gently. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.27 feet at 1 a. m. October 8 (discharge, 940 million gallons per day or 1,460 second-feet); minimum stage recorded, 0.2 foot August 19–23 (discharge, 33 million gallons per day, or 51 second-feet).

1914–1917: Maximum stage recorded, 9.0 feet at 3 a. m. December 19, 1916 (discharge, computed from extension of rating curve, about 4,600 million gallons per day, or 7,120 second-feet); minimum stage recorded, 0.6 foot April, 1915 (discharge, 20 million gallons per day, or 31 second-feet).

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Operation of water-stage recorder satisfactory. Records fair.

No discharge measurements made during year.

Daily discharge, in million gallons, of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	39	43	43	39	16	56	47	39	.....
2	43	52	43	39	17	47	39	39	.....
3	113	43	43	39	18	39	36	39	.....
4	101	47	39	39	19	47	33	39	.....
5	52	43	39	39	20	43	33	39	.....
6	47	39	39	43	21	43	33	47	.....
7	56	39	39	77	22	77	33	61	.....
8	95	39	39	120	23	83	33	61	.....
9	156	66	39	43	24	56	56	39	.....
10	133	61	43	39	25	47	39	36	.....
11	83	113	39	39	26	47	39	36	.....
12	56	56	56	.....	27	43	39	36	.....
13	52	66	47	.....	28	47	39	36	.....
14	47	47	66	.....	29	43	39	39	.....
15	61	47	39	.....	30	52	39	39	.....
					31	47	43	.....	.....

Monthly discharge of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	156	39	62.9	97.3	1,950	5,980
August	113	33	45.8	70.9	1,420	4,360
September	66	36	42.6	65.9	1,280	3,920
October 1–11	120	39	50.5	78.1	556	1,700
The period	.....	.....	.....	.....	5,210	16,000

WAIOLI STREAM NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—June 30, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder.

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

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 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, 4.60 feet at 1.50 a. m. February 4 (discharge, 550 million gallons per day, or 852 second-feet); minimum stage recorded, 0.9 foot May 1 and 2 (discharge, 5.5 million gallons per day, or 8.5 second-feet).

1914–1918: Maximum stage recorded, 6.15 feet at 6.30 a. m. December 19, 1916 (discharge, computed from extension of rating curve about 1,200 million gallons per day, or 1,860 second-feet); minimum stage recorded, 0.6 foot July 22, 1914 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined but date of shift somewhat uncertain. Curves applicable July 1 to September 16 and September 17 to June 30. Operation of water-stage recorder satisfactory, except for short periods given in footnote to table of daily discharge. Records poor July to September and fair October to June.

Discharge measurements of Waioli Stream near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 27	1.54	26	17	May 22	1.90	59	38
Dec. 4	1.20	13.4	8.6	22	1.98	70	45
Feb. 10	1.57	29	19	June 13	2.07	80	51
Mar. 5	2.27	107	69				

Daily discharge, in million gallons, of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16	22	14	9.5	8.0	8.6	6.8	10.4	18	13	5.5	20
2	14	11	8.0	8.6	42	8.6	6.8	8.6	16	34	5.5	16
3	35	16	8.0	8.6	103	8.6	6.8	7.3	25	73	6.3	11.7
4	39	11	8.0	8.0	22	8.6	7.3	28	42	181	7.3	9.5
5	28	11	8.0	9.5	20	8.6	6.8	8.0	132	110	6.3	8.0
6	16	11	8.0	8.6	13	20	6.8	8.0	103	46	6.3	8.0
7	22	11	8.0	8.6	8.6	50	6.8	8.0	31	20	6.3	8.0
8	25	11	8.0	8.0	8.6	14	7.3	8.6	20	20	6.3	10.4
9	94	10	8.0	7.3	8.0	22	6.8	13	20	18	7.3	22
10	43	10	10	7.3	10.4	13	6.8	20	14	22	6.8	25
11	11	10	16	7.3	8.0	13	13	34	172	132	6.3	22
12	11	11	28	7.3	8.0	14	10.4	25	164	50	6.3	46
13	19	11	19	9.5	7.3	18	10.4	25	63	38	5.9	42
14	14	10	14	9.5	7.3	16	28	14	63	14	6.8	25
15	11	28	10	8.6	7.3	10.4	28	10.4	96	11.7	7.3	23
16	11	35	45	46	18	9.5	10.4	9.5	96	11.7	9.5	25
17	11	19	.....	16	16	8.6	8.6	13	68	10.4	8.6	16
18	11	14	.....	10.4	10.4	8.6	8.0	14	22	11.7	8.0	13
19	11	11	.....	8.6	11.7	8.0	11.7	14	16	8.6	.....	16
20	11	11	.....	8.6	11.7	8.0	16	22	13	8.6	.....	22
21	16	11	.....	8.6	13	11.7	10.4	63	11.7	8.6	.....	28
22	14	11	.....	8.0	8.6	8.0	14	25	10.4	8.0	.....	16
23	11	10	.....	9.5	8.6	8.0	14	13	9.5	7.3	28	14
24	28	16	.....	8.0	13	7.3	10.4	10.4	10.4	7.3	25	13
25	28	11	.....	8.6	9.5	7.3	10.4	10.4	63	7.3	18	10.4
26	39	10	.....	10.4	8.6	7.3	28	14	22	6.3	22	11.7
27	16	10	17	8.6	8.6	7.3	172	11.7	18	6.3	31	13
28	11	8.0	18	8.0	8.0	7.3	31	20	18	6.3	38	10.4
29	11	8.0	18	9.5	9.5	7.3	16	.....	31	5.9	63	8.6
30	14	8.0	11.7	10.4	8.0	7.3	18	.....	63	5.9	42	7.3
31	11	8.0	.....	8.6	.....	7.3	13	.....	18	.....	25	.....

NOTE.—No gage height record Sept. 15–27 and May 19–22; discharge estimated from neighboring streams Sept. 15, 16, and 27 as given; Sept. 17–26 and May 19–22 at 20 million gallons per day.

Monthly discharge of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	94	11	21.0	32.5	652	2,000
August	35	8.0	12.7	19.6	395	1,210
September	.....	8.0	16.2	25.1	485	1,490
October	46	7.3	10.1	15.6	314	961
November	103	7.3	14.8	22.9	445	1,360
December	50	7.3	11.7	18.1	362	1,110
January	172	6.8	17.8	27.5	551	1,690
February	63	7.3	16.7	25.8	468	1,440
March	172	9.5	47.4	73.3	1,470	4,510
April	181	5.9	30.1	46.6	903	2,770
May	63	5.5	16.0	24.8	495	1,520
June	46	7.3	17.4	26.9	523	1,600
The year	181	5.5	19.3	29.9	7,060	21,700

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, 1918.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
July 5	Olokele	Makaweli	3.04	2.0	1.3
12	Mohihi	Waimea	3.92	4.2	2.7
12	Waiakoali	do		3.2	2.1
11	Kawaikoi	do	2.38	39	25
13	do	do	1.54	9.2	5.9
16	do	do	1.57	12.5	8.1
Sept. 10	Rice ditch	15 feet below intake, at Koula, near Eleele.	.83	.8	.5
Oct. 1	do	do	.63	.35	.25
Nov. 13	do	do	.70	.35	.25
Dec. 30	do	do	.62	.5	.35
Jan. 23	do	do	.44	.25	.15
Feb. 19	do	do	.71	.55	.35
Mar. 4	do	do	.88	.8	.5
Apr. 9	do	do	.88	.3	.2
May 25	do	do	.92	1.1	.7
Sept. 29	Old Anahola ditch	At intake		11.7	7.6
29	do	50 feet below old Weir location		9.4	6.1
29	Lower Anahola ditch	Station 42 + 45		7.4	4.8
Apr. 8	McBryde Sugar Co. Pump 3A and 3B ditch.	Near Weir near Eleele		31	20

NOTE.—First six measurements made at former gaging station.

ISLAND OF OAHU.

KALIHI STREAM NEAR HONOLULU, OAHU.

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

RECORDS AVAILABLE.—September 8, 1913, to June 30, 1918.

GAGE.—Gurley weight-driven water-stage recorder installed December 4, 1913. Friez recorder in use September 8 to November 22, 1913.

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 in solid rock, with steep, high banks; two channels for gage heights of 6.0 feet and over. The high-water control is solid rock but gravel sometimes collects in the low-water control and affects the stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9 feet at 2.15 and 4.30 a. m. April 4 (discharge, 260 million gallons per day, or 403 second-feet); minimum stage recorded, 2.15 feet October 18-20 and 26-27 (discharge, 0.25 million gallons per day, or 0.40 second-foot).

1913–1918: Maximum stage recorded, 12.5 feet at 1 a. m. March 19, 1917 (discharge, about 400 million gallons per day, or 619 second-feet); minimum stage recorded October, 1917.

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to January 29 well defined between 1 and 3 million gallons per day. Poorly defined outside of those limits. Rating curve used January 30 to June 30 well defined between 2 and 30 million gallons per day; fairly well defined outside of those limits. Operation of water-stage recorder satisfactory except no gage height record April 14–28, May 6, 8, and 18–20. Discharge estimated from neighboring streams for these periods. Records fair when water-stage recorder was operating; poor at other times.

Discharge measurements of Kalihi Stream near Honolulu, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 23	R. D. Klise	2.85	1.9	1.3
Oct. 8	do	2.26	.7	.45
Nov. 1	W. C. Woodward	2.24	.5	.3
1	R. D. Klise	2.24	.5	.35
Feb. 20	do	3.17	19.3	12
Apr. 19	do	3.80	37	24
29	do	2.80	8.0	5.2
May 7	J. B. Mann	2.72	8.2	5.3
7	do	2.72	8.6	5.5
June 25	R. D. Klise	2.52	4.5	2.9

Daily discharge, in million gallons, of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.7	1.3	0.9	0.4	0.3	1.5	0.9	6.6	4.4	3.7	5.1	4.4
2	1.7	1.3	.9	.4	.3	1.2	.9	5.8	5.8	15	4.4	3.7
3	1.7	1.3	.8	.4	.5	1.2	.8	5.1	5.1	26	13	3.7
4	1.7	1.3	.8	.4	.65	1.3	1.3	4.4	5.1	74	5.1	3.7
5	1.5	1.2	.8	.4	2.6	1.3	1.0	9.8	15	23	5.8	3.2
6	1.7	1.2	.8	.5	9.0	6.8	.9	6.6	12	17	5.8	3.2
7	1.5	1.3	.9	.35	2.0	2.3	3.5	5.1	6.6	12	5.8	3.2
8	1.7	1.2	.9	.35	1.0	1.5	1.8	12	5.1	8.2	5.1	3.2
9	2.3	1.2	.6	.35	.8	1.2	1.1	22	17	20	4.4	4.4
10	2.6	1.3	.65	.35	.9	6.8	1.0	8.2	38	72	4.4	4.4
11	1.7	1.8	.6	.6	.7	2.3	1.1	6.6	68	72	3.7	3.7
12	1.5	1.7	.8	.6	.65	1.3	1.0	5.8	27	20	3.7	17
13	1.5	1.5	1.5	.6	.6	1.2	.9	6.6	34	40	3.2	5.1
14	1.5	1.3	.8	.5	.6	1.1	.9	5.1	20	28	3.2	4.4
15	1.5	1.3	.6	.4	.6	1.0	4.0	4.4	38	9.8	3.2	18
16	1.5	1.3	.6	.35	.6	1.0	1.1	6.6	62	9.8	19	9.0
17	1.5	1.2	.8	.35	.6	1.0	1.0	18	20	8.2	14	5.1
18	1.3	1.2	.6	.25	.5	.9	7.5	5.8	14	5.1	5.1	3.7
19	1.3	1.2	.5	.25	.5	.9	3.5	9.0	12	14	4.4	3.2
20	1.5	1.2	.5	.25	.5	.9	2.0	17	9.8	9.8	4.4	5.8
21	1.3	1.2	.5	.3	.8	.9	1.3	7.4	8.2	9.0	3.7	5.8
22	1.3	1.3	.4	.35	.6	1.1	1.1	6.6	7.4	9.8	8.2	7.4
23	1.3	1.5	.4	.3	.5	.8	1.1	5.1	6.6	9.0	14	3.7
24	1.3	1.3	.4	.3	1.2	.8	1.3	5.1	8.2	8.2	14	3.2
25	1.5	1.2	.4	.3	.8	.8	1.3	7.4	6.6	7.4	7.4	2.8
26	1.3	1.2	.4	.25	3.5	1.0	6.0	12	5.1	6.6	6.6	2.8
27	1.3	1.2	.4	.25	1.5	3.5	1.7	5.1	5.1	5.8	9	2.5
28	1.3	1.2	.4	.3	1.1	1.2	1.3	6.6	4.4	5.1	11	2.5
29	1.3	1.1	.4	.3	1.1	1.5	4.5	.....	3.7	5.1	7.4	2.8
30	1.5	1.0	.4	.35	12	1.1	22	.....	4.4	4.4	4.4	2.5
31	1.5	.9	.....	.3	.....	1.0	9.0	.....	3.7	.....	5.1	.....

Monthly discharge of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.6	1.3	1.54	2.38	48	147
August	1.8	.9	1.27	1.96	39	121
September	1.5	.4	.32	.50	9	30
October	.6	.25	.37	.57	11	35
November	12	.3	1.57	2.43	47	145
December	6.8	.8	1.63	2.52	50	155
January	22	.8	2.80	4.33	87	266
February	22	4.4	8.06	12.5	226	693
March	68	3.7	15.6	24.1	482	1,480
April	74	3.7	18.6	28.8	558	1,710
May	19	3.2	6.89	10.7	214	655
June	18	2.5	4.94	7.64	148	455
The year	74	.25	5.26	8.14	1,920	5,890

NUUANU STREAM BELOW RESERVOIR NO. 2 WASTEWAY, NEAR HONOLULU, OAHU.

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

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

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

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

CHANNEL AND CONTROL.—Channel 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, 4.95 feet at 5.30 a. m. April 19 (no estimate of discharge possible as entire weir was overflowed); minimum stage recorded, 0.1 foot September 30 to November 2 and November 13–20 (discharge, 0.15 million gallons per day, or 0.25 second-foot).

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

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

REGULATION.—Amount diverted above station varies.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below and fairly well defined above 4 million gallons per day. Operation of water-stage recorder satisfactory except April 1–12, May 3, 4, and 18, for which periods there is no record and discharge has been estimated by comparison with Kalihi Stream. Records fair when water-stage recorder was operating and poor when there was no record.

Discharge measurements of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
May 8	1.40	22	14
June 27	1.16	11.7	7.5

Daily discharge, in million gallons, of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.0	1.5	0.25	0.15	0.15	1.8	1.8	4.8	1.5	8.9	15	10
2	4.3	1.1	.25	.15	.15	1.5	1.8	3.7	1.5	14	13	8.9
3	4.3	1.1	.25	.15	1.3	1.5	1.8	3.4	1.8	21	13	8.9
4	4.8	1.1	.25	.15	.9	1.3	1.5	3.4	1.5	80	14	8.9
5	4.3	1.1	.25	.15	4.0	2.8	1.8	3.4	10	20	15	8.9
6	4.3	1.1	.25	.15	4.3	1.3	4.3	2.8	8.9	16	13	8.9
7	4.0	1.3	.25	.15	.4	1.1	3.7	3.7	4.0	14	13	7.6
8	3.7	1.3	.25	.15	.25	1.1	2.0	2.5	4.0	10	13	7.6
9	4.0	1.1	.25	.15	.25	1.1	2.0	6.5	16	16	13	7.6
10	3.4	1.1	.25	.15	.25	1.1	1.8	4.3	34	50	13	8.9
11	3.4	1.1	.25	.15	.25	1.3	1.8	3.4	80	50	13	7.6
12	2.8	1.1	.25	.15	.25	1.5	1.8	2.5	45	16	13	10
13	2.5	1.5	.25	.15	.15	1.5	1.5	3.1	28	26	11	8.9
14	2.3	1.5	.25	.15	.15	1.8	1.5	3.4	15	20	11	8.9
15	2.0	1.5	.25	.15	.15	1.5	10	3.7	11	18	11	15
16	2.0	1.5	.25	.15	.15	1.1	3.4	4.0	26	20	16	10
17	3.7	.4	.25	.15	.15	1.1	2.5	11	16	18	13	8.9
18	2.8	.25	.25	.15	.15	1.3	8.9	4.0	15	16	12	8.9
19	2.5	.25	.25	.15	.15	1.3	3.4	10	15	45	11	8.9
20	2.3	.25	.25	.15	.15	1.5	3.1	5.6	15	20	11	8.9
21	2.0	.25	.25	.15	.55	1.5	2.3	4.0	15	18	11	8.9
22	1.8	.25	.25	.15	.25	1.5	2.3	4.3	15	20	13	8.9
23	1.5	.25	.25	.15	.25	1.3	2.0	4.3	13	18	11	8.9
24	1.5	.25	.25	.15	.9	1.5	3.7	4.3	11	18	11	7.6
25	1.5	.25	.25	.15	.55	1.8	2.8	4.3	11	16	11	7.6
26	1.5	.25	.25	.15	1.1	1.8	7.6	7.6	11	16	11	7.6
27	1.3	.25	.25	.15	.75	1.8	2.8	4.0	11	16	11	6.5
28	1.3	.25	.25	.15	.55	2.0	2.8	3.7	11	15	15	6.5
29	1.3	.25	.25	.15	1.3	2.0	3.7	.....	11	15	13	6.5
30	1.5	.25	.15	.15	3.4	1.8	3.7	.....	11	15	10	6.5
31	1.5	.25	.....	.15	.....	1.8	3.1	.....	10	.....	10	.....

Monthly discharge of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.8	1.3	2.71	4.19	84	258
August	1.5	.25	.77	1.19	24	73
September	.25	.15	.25	.39	7	23
October	.15	.15	.15	.23	5	14
November	4.3	.15	.78	1.21	23	72
December	2.8	1.1	1.53	2.37	47	146
January	10	1.5	3.14	4.86	97	299
February	11	2.5	4.49	6.95	126	386
March	80	1.5	15.5	24.0	479	1,470
April	80	8.9	22.2	34.3	666	2,040
May	16	10	12.4	19.2	384	1,180
June	15	6.5	8.59	13.3	258	791
The year	80	.15	6.03	9.33	2,200	6,750

MAOLE DITCH, MAUKA STATION, NEAR HONOLULU, OAHU.

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

RECORDS AVAILABLE.—October 6, 1917, to June 30, 1918.

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. At the gage a section 50 feet long, 4 feet wide, and 2¾ feet high was constructed of concrete, with an elliptical concrete control 15 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.86 feet at 5.30 a. m., April 19 (discharge, estimated from extension of rating curve, 29 million gallons per day, or 45 second-feet); minimum stage recorded, ditch occasionally dry.

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

REGULATION.—By head gates.

UTILIZATION.—City water supply and power development.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Records good for low stages, but may be considerably in error for high and fluctuating stages.

Discharge measurements of Maole ditch, mauka station, near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Oct. 14	0.12	0.04	0.03	May 3	1.07	7.9	5.1
Nov. 6	.52	1.6	1.0	3	.98	6.9	4.5
6	.52	1.7	1.1	3	.84	5.1	3.2
7	.39	.75	.5	3	.27	.3	.2
May 3	.86	5.6	3.6	3	.76	4.1	2.6
3	.87	5.1	3.3	3	.72	3.6	2.3

Daily discharge, in million gallons, of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	.....	0.15	0.10	0.67	0.13	0.23	0.23	0.12
2	.....	.....	.12	.08	.17	.15	2.04	.19	.11
3	.....	0.03	.21	.08	.12	.19	3.30	2.50	.10
4	.....	.17	.21	.31	.10	.17	4.44	.71	.10
5	.....	1.38	.15	.11	.90	2.04	2.98	.90	.09
6	0.12	1.62	1.32	.09	.34	1.26	1.50	.34	.09
7	.01	.55	.63	1.00	.52	.37	1.12	.17	.09
8	.01	.14	.19	.49	1.56	.21	.80	.13	.11
9	.....	.11	.12	.11	1.88	2.50	2.74	.12	.40
10	.....	.19	.90	.08	.34	2.66	5.50	.28	.55
11	.08	.08	.31	.19	.25	1.44	2.32	.21	.13
12	.10	.04	.11	.06	.37	1.08	1.88	.13	.37
13	.13	.04	.10	.08	.55	1.12	4.60	.14	.63
14	.04	.03	.10	.08	.21	1.00	2.58	.10	.40
15	.03	.03	.08	.55	.13	.85	1.26	.19	1.80
16	.03	.03	.08	.09	.25	1.74	1.68	2.04	.55
17	.12	.02	.07	.06	1.26	.95	1.12	.37	.21
18	.04	.01	.07	.90	.25	.52	.90	.25	.17
19	.02	.02	.07	.34	.80	.52	5.50	.21	.28
20	.02	.01	.06	.25	1.08	.37	1.20	.13	.71
21	.03	.17	.09	.10	.46	.31	.67	.12	.80
22	.03	.03	.34	.08	.40	.28	2.20	.52	.59
23	.03	.01	.08	.07	.19	.25	.59	.28	.19
24	.01	.10	.07	.12	.17	1.12	.49	.21	.15
25	.01	.19	.05	.28	.34	.43	.40	.34	.12
26	.01	.90	.19	.90	.75	.31	.40	.13	.10
27	.....	.25	1.00	.21	.19	.25	.43	.12	.11
28	.....	.13	.28	.11	.21	.23	.31	.40	.12
29	.....	.28	.49	1.00	.....	.43	.52	.63	.21
30	.....	1.68	.15	.95	.....	.19	.31	.75	.17
31	.....	.....	.21	.37	.....	.17	.....	.21	.....

NOTE.—No gage-height record Nov. 24 and May 7–10; discharge interpolated Nov. 24, estimated from makai station May 7–10. No flow for days when discharge is not given.

Monthly discharge of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
October (19 days)	0.13	0.01	0.046	0.071	0.9	2.7
November (28 days)	1.68	.01	.294	.455	8.2	25.3
December	1.32	.05	.258	.399	8.0	24.5
January	1.00	.06	.298	.461	9.2	28.4
February	1.88	.10	.516	.798	14.5	44.3
March	2.66	.13	.750	1.16	23.2	71.4
April	5.50	.23	1.80	2.78	54.0	166
May	2.50	.10	.421	.651	13.0	40.1
June	1.80	.09	.319	.494	9.6	29.4
The period	.....	.....	.....	.....	141	432

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; about 6½ miles from Honolulu post office.

RECORDS AVAILABLE.—October 5, 1917, to June 30, 1918.

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 recorded, 3.45 feet at 4 a. m., April 19 (discharge, 32 million gallons per day, or 50 second-feet); minimum stage recorded, ditch occasionally dry.

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

REGULATION.—By head gates.

UTILIZATION.—City water supply and power development.

ACCURACY.—Stage-discharge relation permanent, except during unusually high stages, when the concrete control is not effective on account of large amount of silt carried. A large number of discharge measurements were secured and rating curve is fairly well defined below 14 million gallons per day. Records good for low stages, but subject to considerable error for medium and high stages.

Discharge measurements of Maole ditch, makai station, near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Oct. 14	0.13	0.04	0.03	Jan. 18	0.99	6.7	4.3
Nov. 6	.70	4.5	3.0	18	.99	5.6	3.6
6	.62	3.3	2.1	18	.87	5.3	3.5
6	.59	2.6	1.7	18	.78	4.1	2.7
6	.55	2.0	1.3	18	.77	3.7	2.4
7	.40	.65	.4	18	.75	4.2	2.7
7	.36	.55	.35	18	.77	4.2	2.7
Dec. 10	.99	8.6	5.6	Mar. 11	2.89	48	31
10	.90	7.0	4.6	11	2.75	29	19
Jan. 18	1.39	12.6	8.2	11	2.47	27	18
18	1.11	7.2	4.7	11	2.00	22	14
18	1.06	7.6	4.9	11	1.84	18	12
18	1.04	7.3	4.7	11	1.64	15	10
18	1.03	6.9	4.5	11	1.35	10.9	7.0
18	1.04	7.0	4.5				

Daily discharge, in million gallons, of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	.....	0.19	0.13	0.90	0.14	0.18	0.19	0.13
2	.....	.....	.10	.11	.18	.16	1.50	.16	.13
3	.....	0.06	.16	.11	.12	.20	2.80	1.86	.10
4	.....	.20	.14	.34	.10	.22	5.84	.45	.09
5	0.04	1.41	.14	.14	.90	2.45	2.73	.58	.10
6	.08	1.65	1.56	.09	.25	1.92	1.14	.24	.10
7	.01	.48	.50	.78	.70	.32	.50	.19	.09
8	.01	.20	.32	.45	1.32	.45	.35	.14	.12
9	.....	.13	.19	.14	3.04	2.10	1.68	.13	.50
10	.....	.22	.94	.06	.38	6.27	5.04	.30	.50
11	.09	.07	.40	.13	.25	5.20	1.86	.22	.20
12	.10	.04	.24	.10	.25	2.17	1.20	.14	3.60
13	.14	.02	.22	.08	.48	1.86	4 24	.14	.66
14	.08	.02	.22	.10	.25	1.14	2.66	.13	.38
15	.07	.02	.20	.58	.24	3.60	1.08	.13	2.17
16	.06	.02	.18	.13	.24	5.84	1.74	2.88	.38
17	.13	.02	.18	.10	1.68	1.02	.78	.32	.19
18	.08	.02	.18	1.14	.24	.50	.66	.18	.13
19	.04	.02	.18	.35	.50	.42	5.84	.28	.16
20	.02	.02	.18	.24	.90	.24	1.08	.14	.54
21	.02	.25	.20	.10	.35	.22	.58	.13	.58
22	.02	.06	.30	.09	.25	.19	2.59	.58	.74
23	.02	.04	.10	.08	.19	.19	.40	.30	.22
24	.01	.14	.08	.13	.19	.66	.32	.22	.14
25	.....	.28	.08	.20	.32	.38	.30	.30	.14
26	.....	.90	.14	1.02	.90	.28	.32	.18	.10
27	.....	.32	.82	.14	.24	.20	.32	.16	.12
28	.....	.20	.25	.08	.25	.20	.24	.50	.13
29	.....	.22	.35	.70	.....	.35	.40	.58	.18
30	.01	1.62	.18	1.26	.....	.19	.25	1.02	.16
31	.....	.....	.22	.25	.....	.16	.....	.22	.....

NOTE.—No gage-height record Nov. 3-6, 22-24, and Jan. 2,4; discharge estimated from flow of Mauka station. No flow on days for which discharge is not given.

Monthly discharge of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
October (19 days)	0.14	0.01	0.054	0.084	1.0	3.1
November (28 days)	1.65	.02	.309	.478	8.6	26.6
December	1.56	.08	.295	.456	9.1	28.1
January	1.26	.06	.302	.467	9.4	28.7
February	3.04	.10	.558	.863	15.6	47.9
March	6.27	.14	1.27	1.96	39.2	121
April	5.84	.18	1.62	2.51	48.6	149
May	2.88	.13	.419	.648	13.0	39.9
June	3.60	.09	.426	.659	12.8	39.2
The period	.....	.....	.....	.....	157	484

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

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

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

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

DISCHARGE MEASUREMENTS.—Made by wading.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.50 feet at 4 p. m. April 10 (discharge, 80 million gallons per day, or 124 second-feet) minimum stage recorded, 0.55 foot September 6 (discharge, 0.65 million gallons per day, or 1.0 second-foot).

1909–1918: Maximum stage recorded, 9.0 [1] feet from high-water mark of flood of March 19, 1917 (discharge, from extension of rating curve, 850 million gallons per day, or 1,320 second-feet); minimum daily discharge, March, 1914 (0.2 million gallons per day, or 0.3 second-foot).

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

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to November 5 fairly well defined between 2 and 20 million gallons per day; poorly defined outside these limits. Rating curve used November 6 to June 30 poorly defined. Gage read twice daily to tenths. Records fair July to October and poor after October.

Discharge measurements of Manoa Stream at College of Hawaii, near Honolulu, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 22	College of Hawaii students	0.87	2.9	1.9
22	do	.86	2.8	1.8
May 9	R. D. Klise	1.09	7.4	4.8
June 24	do	1.39	12.7	8.2

[1] Supersedes maximum published in Water-Supply Paper 465.

Daily discharge, in million gallons, of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.
1	0.9	0.7	0.8	0.8	0.9	5.6	3.8	7.0	8.5	8.5	4.4	5.6
2	.8	.75	.75	.8	1.0	6.3	3.3	5.6	8.5	8.5	3.3	10
3	.8	.75	.75	.8	1.0	5.6	3.3	6.3	8.5	43	3.3	7.0
4	.8	.8	.75	.8	1.0	7.0	2.8	7.8	7.0	34	5.6	2.3
5	.8	.8	.7	.8	2.9	5.6	2.3	7.0	6.3	32	5.6	2.3
6	.8	.75	.65	.8	7.0	7.0	2.3	5.6	7.0	25	7.8	2.3
7	.8	.7	.75	.8	5.0	7.0	4.4	7.8	7.0	19	7.8	2.3
8	.8	.7	.7	.8	5.6	7.0	4.4	8.5	8.5	16	7.0	2.8
9	.8	.8	.75	.8	3.8	5.6	3.8	9.2	8.5	18	5.6	2.3
10	.8	.8	.8	.75	3.8	5.6	4.4	7.8	8.5	68	5.6	2.3
11	.8	.8	.8	.75	5.0	5.6	4.4	8.5	10	51	6.3	3.3
12	.8	.8	.75	.75	5.6	4.4	3.8	7.0	8.5	37	3.8	5.0
13	.8	.8	.8	.8	2.8	5.6	4.4	5.6	11	37	3.3	7.8
14	.8	.75	.8	.8	2.3	5.6	5.0	8.5	9.2	25	3.3	5.6
15	.9	.75	.8	.8	1.5	6.3	3.8	6.3	8.5	30	3.3	5.6
16	1.0	.8	.8	.8	1.5	5.6	6.3	5.6	8.5	41	8.5	5.6
17	.9	.8	.8	.8	1.5	7.0	5.6	5.6	8.5	22	7.0	7.0
18	1.0	.8	.8	.8	1.2	7.0	4.4	6.3	8.5	22	7.0	5.6
19	1.0	.8	.9	.8	1.2	7.0	6.3	5.6	8.5	14	5.6	5.6
20	.75	.8	.8	.8	1.5	8.5	24	7.8	8.5	11	5.6	6.3
21	.8	.8	.8	.8	1.5	7.8	14	7.0	8.5	10	5.6	3.8
22	.8	.8	.8	.8	1.5	6.3	11	7.0	9.2	9.2	3.3	3.3
23	.75	.8	.8	1.0	4.4	5.6	10	5.6	8.5	8.5	2.3	2.3
24	.75	.8	.75	1.0	3.8	5.6	8.5	6.3	9.2	8.5	2.3	2.3
25	.75	.8	.8	1.0	3.3	5.6	10	5.6	9.2	7.0	2.8	2.3
26	.75	.8	.8	1.0	2.3	6.3	9.2	7.0	8.5	7.0	3.3	4.4
27	.75	.75	.8	1.0	2.3	8.5	9.2	9.2	10	4.4	3.3	3.8
28	.75	.8	.8	1.0	2.3	7.8	7.8	10	8.5	4.4	2.8	3.3
29	.75	.8	.8	1.0	5.0	7.0	7.0	.....	9.2	4.4	3.8	4.4
30	.8	.8	.8	1.0	5.6	6.3	7.0	.....	8.5	4.4	5.6	4.4
31	.75	.8	.....	1.0	.....	7.0	5.6	.....	8.5	.....	5.0	.....

Monthly discharge of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.0	0.75	0.81	1.25	25	77
August	.8	.7	.78	1.21	24	74
September	.8	.65	.78	1.21	23	72
October	1.0	.75	.85	1.32	26	81
November	7.0	.9	2.94	4.55	88	271
December	8.5	4.4	6.41	9.92	199	610
January	24	2.3	6.52	10.1	202	620
February	10	5.6	7.04	10.9	197	605
March	11	6.3	8.57	13.3	266	815
April	68	4.4	21.0	32.5	630	1,930
May	8.5	2.3	4.83	7.47	150	460
June	10	2.3	4.36	6.75	131	401
The year	68	.65	5.37	8.31	1,960	6,020

WEST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.

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

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Watson water-stage recorder in use June 17 to October 20, 1914; replaced October 20, 1914, by a Friez water-stage recorder; replaced May 9, 1915, by a Stevens 8-day water-stage recorder which was replaced February 28, 1916, by a Stevens continuous water-stage recorder. Vertical staff gage (at different datum) 150 feet upstream from highway bridge, about 25 feet above a small irrigation ditch diverting from right bank, read from May 29, 1913, to June 16, 1914.

DISCHARGE MEASUREMENTS.—Made by wading.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.10 feet at 3 p. m. March 11 (discharge, 400 million gallons per day, or 620 second-feet); minimum stage recorded, 1 foot at various times during August, September, and October (discharge, 0.3 million gallons per day, or 0.45 second-foot.).

1913–1918: Maximum stage recorded, 4.65 feet 12.15 a. m. March 20, 1917 (discharge, 540 million gallons per day, or 837 second-feet; revised); minimum stage recorded, December, 1913, (discharge 0.05 million gallons per day, or 0.08 second-foot).

DIVERSIONS.—None.

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

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 million gallons per day. Operation of water-stage recorder satisfactory, except November 26 to December 2. Discharge estimated for this period from flow of East Branch of Manoa. Records fair.

Discharge measurements of West Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 25	R. D. Klise	1.04	0.8	0.5
Sept. 5	do	1.01	.45	.3
Oct. 9	do	1.02	.45	.3
Dec. 17	W. C. Woodward	1.06	1.3	.85
Apr. 19	R. D. Klise	1.77	35	22
May 7	J. B. Mann	1.14	3.0	1.9

Daily discharge, in million gallons, of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.4	0.3	1.4	0.6	0.6	2.3	1.4	2.3	1.4	3.2	2.3	1.4
2	1.4	.3	.6	.6	.6	2.3	1.4	1.4	1.4	6.7	2.3	1.4
3	1.4	.3	.6	.6	2.3	1.4	1.4	1.4	1.4	8.0	19	1.4
4	.6	.3	.6	.6	4.3	1.4	1.4	.6	.6	17	5.4	1.4
5	.6	.3	.3	.6	11	3.2	.6	2.3	5.4	5.4	5.4	1.4
6	.6	.3	.3	1.4	11	4.3	.6	1.4	4.3	5.4	3.2	1.4
7	.6	.6	.6	.3	6.7	3.2	3.2	2.3	1.4	4.3	2.3	1.4
8	.6	.3	.6	.3	3.2	1.4	1.4	3.2	1.4	3.2	2.3	1.4
9	3.2	.3	.6	.3	2.3	1.4	1.4	8.0	15	6.7	2.3	1.4
10	3.2	.6	.6	.3	3.2	4.3	.6	3.2	15	19	2.3	2.3
11	1.4	2.3	.6	.6	2.3	2.3	1.4	2.3	46	8.0	2.3	1.4
12	.6	1.4	.6	.6	1.4	1.4	1.4	1.4	15	8.0	1.4	8.0
13	.6	1.4	1.4	1.4	1.4	1.4	1.4	1.4	11	13	1.4	3.2
14	.6	1.4	.6	.6	1.4	1.4	1.4	1.4	5.4	11	1.4	3.2
15	.6	2.3	.6	.6	1.4	1.4	3.2	1.4	8.0	6.7	1.4	8.0
16	1.4	.6	1.4	1.4	1.4	.6	1.4	2.3	19	10.5	13	4.3
17	2.3	.6	2.3	3.2	1.4	.6	1.4	5.4	5.4	5.4	4.3	2.3
18	1.4	.6	1.4	1.4	1.4	.6	3.2	1.4	4.3	4.3	2.3	1.4
19	.6	.3	.6	1.4	1.4	.6	2.3	4.3	3.2	21	2.3	1.4
20	.6	.3	.6	.6	1.4	.6	2.3	4.3	3.2	6.7	1.4	3.2
21	.6	.3	.6	.6	1.4	.6	1.4	2.3	3.2	21	1.4	2.3
22	.6	.6	.6	.6	1.4	2.3	1.4	2.3	2.3	4.3	2.3	3.2
23	.6	1.4	.3	.6	1.4	.6	1.4	1.4	2.3	3.2	1.4	2.3
24	.6	1.4	.3	.6	2.3	.6	.6	1.4	6.7	3.2	1.4	2.3
25	.6	.6	.3	.6	1.4	.6	1.4	1.4	3.2	3.2	2.3	1.4
26	.6	.6	.6	.6	3.2	.6	4.3	2.3	2.3	3.2	1.4	1.4
27	.6	.6	.6	.6	2.3	4.3	1.4	1.4	2.3	2.3	1.4	1.4
28	.6	.6	.6	.6	1.4	2.3	1.4	1.4	2.3	2.3	4.3	1.4
29	.6	.6	.6	.6	2.3	5.4	3.2	.....	2.3	3.2	3.2	1.4
30	.6	.6	.6	.6	4.3	2.3	4.3	.....	2.3	2.3	2.3	1.4
31	.6	.6	.....	.6	.....	1.4	1.4	.....	1.4	.....	1.4	.....

Monthly discharge of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.2	0.6	0.98	1.52	30	93
August	2.3	.3	.73	1.13	23	69
September	2.3	.3	.71	1.10	21	65
October	3.2	.3	.77	1.19	24	73
November	11	.6	2.72	4.21	82	250
December	5.4	.6	1.84	2.85	57	175
January	4.3	.6	1.77	2.74	55	168
February	8.0	.6	2.34	3.62	66	201
March	46	.6	6.40	9.90	198	609
April	21	2.3	7.39	11.4	222	680
May	19	1.4	3.25	5.03	101	309
June	8.0	1.4	2.33	3.60	70	215
The year	46	.3	2.60	4.02	949	2,910

EAST BRANCH OF MANOA STREAM NEAR HONLOULU, OAHU.

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

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Watson water-stage recorder from May 5, 1913, to September 28, 1914. 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. Both banks are fairly steep and covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.05 feet at 5.30 a. m. April 19 (discharge, 195 million gallons per day, or 302 second-feet); minimum stage recorded, 1.35 feet at various times from October to March (discharge, 0.9 million gallons per day, or 1.4 second-feet).

1913–1918: Maximum stage recorded, 5.2 feet at 4 p, m. March 19, 1917 (discharge, from extension of rating curve, 470 million gallons per day,[1] or 727 second-feet); minimum daily discharge occurred during March, 1914, and in 1917–18.

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

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves well defined below 30 million gallons per day applicable July 1 to April 18 and April 19 to June 30. Operation of water-stage recorder satisfactory except July 12 to August 6, May 21–24, and June 12–20. Discharge for these periods estimated from West Branch of Manoa. Records fair when water-stage recorder was operating, poor at other times.

Discharge measurements of East Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 5	R. D. Klise	1.40	1.65	1.1
Oct. 8	do	1.37	1.65	1.1
Apr. 19	do	2.09	26	16
May 2	J. B. Mann	1.44	3.3	2.1
June 21	R. D. Klise	1.54	5.6	3.6

[1] Supersedes maximum published in Water-Supply Paper 465.

Daily discharge, in million gallons, of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.7	1.2	1.7	1.2	0.9	1.7	0.9	1.2	1.2	2.8	2.4	3.8
2	1.7	1.2	1.2	1.2	.9	1.7	.9	.9	1.2	8.8	2.4	3.0
3	2.2	1.2	1.2	1.2	1.7	1.2	.9	.9	1.2	16	17	2.4
4	2.2	1.2	1.2	2.2	2.8	1.2	.9	.9	.9	18	6.2	2.4
5	1.7	1.2	1.2	1.2	7.8	1.2	.9	2.2	4.2	5.9	7.2	3.0
6	1.7	1.2	1.7	1.7	7.8	2.8	.9	1.2	2.8	5.9	4.5	3.0
7	1.7	1.2	1.7	1.2	2.8	2.2	1.7	1.7	1.2	3.5	3.8	2.4
8	1.7	1.2	1.2	1.2	2.2	1.7	1.2	2.8	1.2	3.5	2.4	2.4
9	4.2	1.2	1.2	.9	1.7	1.2	1.2	5.9	5.9	6.8	2.4	3.0
10	3.5	1.2	1.2	.9	2.2	2.8	.9	1.7	7.8	16	3.8	3.8
11	1.7	2.2	1.2	1.2	1.7	1.7	1.2	1.2	22	6.8	3.0	3.0
12	1.7	1.7	1.2	1.7	1.7	1.2	1.2	1.2	6.8	5.9	3.0	9.4
13	1.7	1.7	1.7	1.2	1.2	1.2	1.2	1.7	5.0	7.8	3.0	4.5
14	1.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.2	6.8	2.4	4.5
15	1.7	1.7	1.2	1.2	1.2	.9	2.2	.9	8.8	5.0	3.0	9.4
16	2.2	1.2	2.2	1.7	1.2	.9	1.2	1.7	24	6.8	15	6.2
17	2.8	1.2	1.7	2.8	1.2	.9	1.2	4.2	9.9	5.0	3.8	3.8
18	2.2	1.2	1.2	1.2	1.2	.9	2.2	1.2	3.5	3.5	3.0	3.0
19	1.7	1.2	1.2	1.2	1.2	.9	2.2	2.2	2.8	19	3.0	3.0
20	1.7	1.2	1.2	1.2	1.2	.9	1.7	2.8	2.8	7.2	3.0	4.5
21	1.7	1.2	1.2	1.2	1.7	.9	1.2	1.2	2.2	5.4	3.0	5.4
22	1.7	1.7	1.2	1.2	1.2	1.7	1.2	1.2	2.2	8.2	3.8	4.5
23	1.7	2.2	1.2	1.2	.9	.9	.9	1.2	1.7	4.5	3.0	3.8
24	1.7	1.7	1.2	1.2	2.2	.9	.9	1.2	6.8	3.8	3.0	3.8
25	1.7	1.2	1.2	1.2	1.2	.9	.9	1.2	2.8	3.0	3.0	3.0
26	1.7	1.2	1.2	.9	2.8	.9	1.7	1.2	2.2	3.0	3.0	3.0
27	1.7	1.2	1.2	.9	1.7	2.8	.9	1.2	2.2	2.4	3.0	3.0
28	1.7	1.2	1.2	.9	1.2	1.2	.9	1.2	2.2	2.4	4.5	3.8
29	1.7	1.2	1.2	.9	1.7	3.5	2.2	.....	2.2	3.0	4.5	3.0
30	1.7	1.2	1.2	.9	5.0	1.2	2.2	.....	1.7	3.0	5.4	3.0
31	1.7	1.7	.....	.9	.....	1.2	.9	.....	1.7	.....	3.8	.....

Monthly discharge of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.2	1.7	1.94	3.00	60	185
August	2.2	1.2	1.36	2.10	42	129
September	2.2	1.2	1.32	2.04	40	122
October	2.8	.9	1.25	1.93	39	119
November	7.8	.9	2.11	3.26	63	194
December	3.5	.9	1.44	2.23	44	137
January	2.2	.9	1.28	1.98	40	122
February	5.9	.9	1.69	2.61	47	145
March	24	.9	4.69	7.26	145	446
April	19	2.4	6.66	10.3	200	613
May	17	2.4	4.33	6.70	134	412
June	9.4	2.4	3.89	6.02	117	358
The year	24	.9	2.66	4.12	971	2,980

EAST MANOA DITCH NEAR HONOLULU, OAHU.

LOCATION.—1,000 feet below intake. Ditch diverts from East Branch of Manoa Stream about 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 to June 30, 1918.

GAGE.—Gurley weekly water-stage recorder. Vertical staff May 24, 1915, to December 31, 1916.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.53 feet at 9 a. m., April 10 (discharge, not estimated, weir flooded); minimum stage recorded, 0.27 foot, April 23 (discharge, 0.75 million gallons per day, or 1.2 second-feet).

1915–1918: Maximum stage recorded April 10, 1918; minimum stage recorded, 0.75 foot January 22–24, 1916 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent. Some velocity of approach, probably making published discharge too small. Operation of water-stage recorder satisfactory for record published. Records fair.

Discharge measurements of East Manoa ditch near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Feb. 19	0.40	2.1	1.4
May 2	.43	2.3	1.5

Daily discharge, in million gallons, of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1918.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	0.9	0.95	1.1	1.5	1.6	16	.....	1.2	.....	.....	3.0	1.8
2	.....	.85	.9	1.6	1.5	1.5	17	.....	1.9	1.6	.....	2.0	1.5
3	.....	.8	.....	2.2	2.4	1.5	18	.....	1.1	1.3	.....	1.8	1.5
4	.....	.85	.....	2.3	.9	1.5	19	.....	1.6	1.2	.....	1.8	1.5
5	.....	1.6	.....	1.6	1.1	1.5	20	.....	1.7	1.1	.....	1.7	2.0
6	.....	1.4	.....	1.5	.8	1.5	21	.....	1.2	1.1	0.9	1.7	1.9
7	.....	1.6	.....	1.3	1.3	1.5	22	.....	1.1	1.0	1.1	1.7	1.7
8	.....	1.8	.....	1.1	1.9	1.5	23	.....	1.0	.95	.75	1.4	1.5
9	.....	2.9	.....	1.8	1.9	1.7	24	.....	1.0	1.6	1.2	1.4	1.4
10	.....	1.4	.....	.....	2.2	1.8	25	.....	.95	.95	1.9	1.8	1.4
11	.....	1.1	.....	.....	1.8	1.5	26	1.4	1.0	1.0	1.9	1.8	1.4
12	.....	1.1	.....	.....	1.8	2.3	27	.85	.9	1.0	1.9	1.6	1.4
13	.....	1.3	.....	.....	1.8	1.7	28	.85	1.1	1.0	1.8	1.8	1.4
14	.....	.9	.....	.....	1.7	1.5	29	1.2	.....	1.0	1.9	1.7	1.3
15	.....	.95	.....	.....	1.8	2.4	30	1.4	.....	.95	1.6	2.1	1.3
							31	.95	.....	.9	.....	1.6	.....

Monthly discharge of East Manoa ditch near Honolulu, Oahu, for the year ending June 30,1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January 25–31	1.4	0.85	1.11	1.72	7	20
February	2.9	.8	1.26	1.95	35	108
May	3.0	.8	1.72	2.66	53	164
June	2.4	1.3	1.60	2.48	48	147

HAIKU STREAM NEAR HEEIA, OAHU.

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

RECORDS AVAILABLE.—January 29, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder installed April 28, 1914, at same location and datum as staff gage; original staff gage datum was raised 0.88 foot March 29, 1914.

DISCHARGE MEASUREMENYS.—Made by wading or from footbridge.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.36 feet at 12.05 a. m. April 4 and at 6.15 p. m. April 11 (discharge, 180 million gallons per day, or 279 second-feet); minimum stage recorded, 0.7 foot frequently throughout the year (discharge, 2.2 million gallons per day, or 3.4 second-feet).

1914–1918: Maximum stage recorded, 6.5 feet at 1 a. m. March 20, 1917 (estimated discharge, 250 million gallons per day, or 390 second-feet); minimum stage recorded, 0.6 foot July 16, 1916, and February 9–12, 1917 (discharge, 1.4 million gallons per day, or 2.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2.5 and 12 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, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons. per day.
July 3	H. A. R. Austin	0.75	3.9	2.5
Oct. 1	R. D. Klise	.76	4.1	2.6
Apr. 12	do	1.18	15.5	10
May 1	do	.73	4.1	2.6

Daily discharge, in million gallons, of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.2	2.6	2.6	2.6	2.6	2.6	2.2	3.2	2.2	3.2	2.6	2.6
2	2.2	2.6	2.6	2.6	2.6	2.2	2.2	2.6	2.2	5.6	2.6	2.6
3	2.6	2.6	2.6	2.6	2.6	2.6	2.2	2.6	2.2	13	7.3	2.6
4	2.6	2.6	2.6	2.6	2.6	3.2	2.2	2.6	2.6	32	3.2	2.6
5	2.6	2.6	2.6	2.6	3.2	2.6	2.2	2.6	4.0	7.3	4.8	2.6
6	2.6	2.6	2.6	2.6	4.0	4.0	2.2	2.6	4.8	5.6	3.2	2.6
7	2.6	3.2	2.6	2.6	2.6	3.2	4.8	2.6	3.2	4.0	2.6	2.6
8	2.6	3.2	2.6	2.6	2.2	2.6	3.2	2.6	2.6	4.0	2.6	2.6
9	2.6	3.2	2.6	2.6	2.2	2.6	2.6	3.2	2.6	4.8	2.6	3.2
10	2.6	3.2	2.6	2.6	2.2	2.6	2.6	2.6	4.8	13	2.6	3.2
11	2.6	3.2	2.6	2.6	2.2	2.6	2.6	2.2	4.8	16	2.6	2.6
12	2.6	3.2	2.6	2.6	2.2	2.2	2.2	2.2	4.0	9.1	2.6	4.8
13	2.6	3.2	3.2	2.6	2.2	2.2	2.2	2.2	16	5.6	2.2	3.2
14	2.2	2.6	3.2	2.6	2.2	2.2	2.2	2.2	9.1	7.3	2.2	2.6
15	2.2	2.6	2.6	2.6	2.2	2.2	4.8	2.2	10	4.0	2.6	3.2
16	2.2	2.6	3.2	2.6	2.2	2.2	2.6	2.6	18	5.6	4.8	3.2
17	2.2	2.6	2.6	2.6	2.2	2.2	2.6	4.8	7.3	4.0	2.6	2.6
18	2.2	2.6	2.6	2.6	2.6	2.2	7.3	2.6	4.8	3.2	2.2	2.6
19	2.2	2.6	2.6	2.6	2.2	2.2	4.0	3.2	6.4	15	2.2	2.6
20	2.2	2.6	2.6	2.6	2.6	2.2	3.2	6.4	4.0	4.8	2.2	2.6
21	2.6	2.6	2.6	2.6	2.6	2.2	2.6	3.2	3.2	4.0	2.2	2.6
22	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	3.2	9.1	4.8	3.2
23	2.6	3.2	2.6	2.6	2.6	2.2	2.6	2.6	3.2	4.0	2.6	2.6
24	2.6	2.6	2.6	2.6	2.6	2.2	2.2	2.2	3.2	3.2	3.2	2.6
25	2.6	2.6	2.6	2.6	2.2	2.2	2.6	2.2	3.2	3.2	3.2	2.6
26	2.6	2.6	2.6	2.6	2.6	2.2	2.6	2.2	3.2	3.2	2.6	2.6
27	2.6	2.6	2.6	2.6	2.6	4.0	2.6	2.2	2.6	2.6	2.6	2.6
28	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.2	3.2	2.6	2.6	2.6
29	2.6	2.6	2.6	2.6	2.6	2.6	7.3	.....	4.0	3.2	4.0	2.6
30	2.6	2.6	2.6	2.6	2.6	2.6	5.6	.....	3.2	3.2	2.6	2.6
31	2.6	2.6	.....	2.6	.....	2.2	3.2	.....	2.6	.....	2.6	.....

Monthly discharge of Haiku Stream near Heeia, Oahu, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.6	2.2	2.48	3.84	77	236
August	3.2	2.6	2.75	4.25	85	262
September	3.2	2.6	2.66	4.12	80	245
October	2.6	2.6	2.60	4.02	81	247
November	4.0	2.2	2.51	3.88	75	231
December	4.0	2.2	2.52	3.90	78	240
January	7.3	2.2	3.12	4.83	97	297
February	6.4	2.2	2.76	4.27	77	237
March	18	2.2	4.85	7.50	150	461
April	32	2.6	6.85	10.6	205	631
May	7.3	2.2	3.01	4.66	93	286
June	4.8	2.6	2.79	4.32	84	257
The year	32	2.2	3.24	5.01	1,180	3,630

PUNALUU STREAM AT ELEVATION 539 FEET, NEAR PUNALUU, OAHU.

LOCATION.—About a quarter of a mile below confluence of Kalena and Pio branches, and 5 miles by road and foot trail south of Punaluu railroad station.

RECORDS AVAILABLE.—April 27, 1915, to April 11, 1918, when station was discontinued.

GAGE.—Friez water-stage recorder substituted for 8-day Stevens recorder February 16, 1916.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 150 feet above gage.

CHANNEL AND CONTROL.—One channel at all stages, straight for several hundred feet above and below station; composed of boulders and gravel; right bank slopes sharply; left bank vertical; both banks fairly clean up to extreme flood stages. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—1915–1918: Maximum stage recorded, 6.6 feet at 9.20 p. m. April 11, 1918 (discharge about 700 million gallons per day, or 1,080 second-feet); minimum stage recorded, 0.67 foot October and November, 1917 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of low-water flow is diverted at low elevation for irrigation of sugar cane, rice, and taro. Station was established to determine the feasibility of a project to divert the water of the upper Punaluu Valley to augment the water diverted from the Kahana Valley by the Waiahole Water Co.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 6 million gallons per day. Operation of water-stage recorder satisfactory except January, 16–22, February 13, 16–20, and 23–26, no record; discharge estimated from flow at lower station. Records fair.

Discharge measurements of Punaluu Stream at elevation 539 feet, near Punaluu, Oahu, during the year ending June 30, 1918.

[R. D. Klise.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Oct. 17	0.67	2.3	1.5
Nov. 19	.68	2.5	1.6
Dec. 20	.73	3.1	2.0

Daily discharge, in million gallons, of Punaluu Stream at elevation 539 feet, near Punaluu, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	3.8	2.5	2.0	2.0	1.5	2.0	2.5	14	6.4	12
2	3.8	2.5	2.0	2.0	1.6	2.0	2.5	7.4	5.5	14
3	3.8	2.5	2.0	2.0	3.8	3.8	2.5	6.4	5.5	28
4	3.8	2.5	2.0	2.0	3.0	3.0	2.5	5.5	5.5	57
5	3.8	2.5	2.0	2.0	3.0	4.6	3.8	7.4	8.5	21
6	3.8	2.5	2.0	2.0	3.8	7.4	3.0	6.4	7.4	16
7	3.8	2.5	2.5	2.0	3.0	6.4	3.0	5.5	5.5	11
8	3.8	2.5	2.5	2.0	2.5	4.6	4.6	9.8	5.5	10
8	3.8	2.5	2.5	2.0	2.5	3.8	3.0	11	11	21
10	4.6	2.5	2.5	2.0	2.5	5.5	3.0	6.4	19	34
11	3.8	2.5	2.5	2.0	2.0	3.8	3.0	5.5	31	120
12	3.0	2.5	3.0	2.0	2.0	3.8	3.0	5.5	19	.....
13	3.0	3.0	3.0	2.0	2.0	3.8	4.6	5.5	34	.....
14	3.0	3.0	3.8	2.5	2.0	3.8	3.8	5.5	24	.....
15	3.0	3.0	3.0	2.0	2.0	3.0	5.5	5.5	21	.....
16	3.8	3.0	3.8	1.8	2.0	2.5	4.6	5.5	31	.....
17	3.0	2.5	3.8	1.5	2.0	2.5	3.8	8.5	17	.....
18	3.0	2.5	3.0	1.5	2.0	2.5	10	5.5	11	.....
19	3.0	2.5	2.5	1.6	2.5	2.0	10	6.4	9.8	.....
20	3.0	2.5	2.5	2.0	2.0	2.5	6.4	14	8.5	.....
21	3.0	2.5	2.5	3.0	2.0	2.5	4.6	12	7.4	.....
22	3.0	2.5	2.5	2.5	1.5	3.8	4.6	7.4	6.4	.....
23	3.0	3.0	2.0	2.0	1.5	2.5	4.6	6.4	6.4	.....
24	3.0	3.0	2.0	1.6	1.6	2.0	5.5	7.4	7.4	.....
25	3.0	2.5	2.0	1.6	2.0	2.0	9.8	10	6.4	.....
26	3.0	2.5	2.0	1.6	2.5	2.5	7.4	14	5.5	.....
27	3.0	2.5	2.0	2.0	2.5	4.6	5.5	7.4	5.5	.....
28	3.0	2.5	2.0	1.8	2.0	2.5	4.6	7.4	7.4	.....
29	3.0	2.5	2.0	1.6	2.0	2.5	14	.....	7.4	.....
30	3.0	2.5	2.0	1.5	2.0	2.5	14	.....	6.4	.....
31	3.0	2.5	.....	1.5	.....	2.5	8.5	.....	5.5	.....

Monthly discharge of Punaluu Stream at elevation 539 feet, near Punaluu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.6	3.0	3.34	5.17	103	318
August	3.0	2.5	2.60	4.02	80	247
September	3.8	2.0	2.46	3.81	74	226
October	3.0	1.5	1.92	2.97	60	183
November	3.8	1.5	2.24	3.47	67	206
December	7.4	2.0	3.33	5.15	103	317
January	14	2.5	5.43	8.40	168	517
February	14	5.5	7.83	12.1	219	673
March	34	5.5	11.5	17.8	358	1,090
April 1–11	120	10	31.3	48.4	344	1,060
The period					1,580	4,840

PUNALUU STREAM AT ELEVATION 250 FEET, NEAR PUNALUU, OAHU.

LOCATION.—About 1½ miles by road and horse trail south of Punaluu railroad station.

RECORDS AVAILABLE.—May 14, 1914, to June 30, 1918, when station was discontinued.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable, about 150 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for about 200 feet above and below gage; composed of large boulders; right bank slopes gradually and is covered with small trees and vegetation; left bank slopes sharply and is covered with vegetation. Control composed of large boulders; apparently permanent.

EXTREMES OF DISCHARGE.—1913–1918: Maximum stage recorded, about 8 feet (water-stage recorder not working, staff gage carried away) at 11 p. m. April 11, 1918 (discharge, 1,080 million gallons per day, or 1,670 second-feet); minimum stage recorded, 1 foot March, August, and September, 1915, and September, October, and November, 1917 (discharge, 10 million gallons per day, or 15 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of low-water flow is diverted for irrigation of sugar cane, rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to April 11 fairly well defined between 10 and 100 million gallons per day. Rating curve used April 12 to June 30 poorly defined. Operation of water-stage recorder satisfactory, except no record April 12–16. Discharge April 12 estimated from flow at Punaluu, at 539 feet elevation; discharge April 13–16 estimated from flow of neighboring streams. Records fair except those for April 13–16, which are poor.

Discharge measurements of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 10	H. A. R. Austin	1.16	27	18
Sept. 10	R. D. Klise	1.04	19.2	12
Dec. 20	do	1.06	17.1	11
June 6	do	.73	36	24

Daily discharge, in million gallons, of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16	14	12	10	10	12	12	38	19	50	19	28
2	16	14	12	10	12	12	12	25	19	50	19	25
3	16	14	12	10	16	19	12	22	19	79	46	25
4	16	14	12	10	14	22	12	19	19	146	31	25
5	16	14	12	10	14	22	19	25	25	55	31	25
6	16	14	12	10	16	34	16	22	25	42	28	22
7	16	14	12	10	14	42	16	19	19	31	22	22
8	16	14	12	10	12	25	19	25	19	28	22	22
9	16	14	12	10	12	22	16	28	28	46	19	22
10	22	14	12	10	12	25	14	22	42	64	19	22
11	16	14	12	10	12	22	16	19	60	150	19	22
12	14	14	12	10	12	19	14	19	46	200	19	31
13	14	14	14	12	12	16	16	19	79	50	19	25
14	14	14	14	12	12	16	16	16	69	70	19	25
15	14	14	12	12	12	16	31	16	64	40	19	25
16	16	14	16	12	12	14	19	19	94	50	64	25
17	14	14	19	10	10	14	16	28	64	46	31	22
18	14	14	14	10	10	14	31	19	42	34	25	22
19	14	12	12	10	10	12	31	22	34	64	25	22
20	14	12	12	12	10	12	22	38	28	38	25	22
21	14	12	12	14	12	14	19	31	25	31	22	22
22	14	12	12	14	12	16	19	25	22	34	25	22
23	14	14	12	12	10	14	19	22	22	28	34	19
24	14	14	12	12	12	12	22	25	22	25	28	22
25	14	12	12	12	12	12	28	31	22	25	28	22
26	14	12	12	12	14	14	28	38	19	25	25	22
27	14	12	12	12	14	22	22	25	19	25	25	22
28	14	12	12	12	12	16	19	22	22	22	31	22
29	14	12	12	12	12	14	55	.....	31	22	55	22
30	14	12	10	12	12	14	55	.....	25	19	31	19
31	14	12	.....	12	.....	14	31	.....	22	.....	28	.....

Monthly discharge of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	22	14	15.0	23.2	464	1,430
August	14	12	13.3	20.6	412	1,270
September	19	10	12.5	19.3	375	1,150
October	14	10	11.2	17.3	346	1,070
November	16	10	12.2	18.9	366	1,120
December	42	12	17.8	27.5	552	1,690
January	55	12	21.8	33.7	677	2,070
February	38	16	24.2	37.4	679	2,080
March	94	19	34.4	53.2	1,060	3,270
April	200	19	53.0	82.0	1,590	4,880
May	64	19	27.5	42.5	853	2,620
June	31	19	23.1	35.7	693	2,130
The year	200	10	22.1	34.2	8,070	24,800

KOLOA STREAM NEAR LAIE, OAHU.

LOCATION.—At elevation about 500 feet, 3 miles by horse trail southwest of Laie.

RECORDS AVAILABLE.—July 30, 1914, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by wading or from cable about 20 feet below gage.

CHANNEL AND CONTROL.—Channel straight for a hundred feet above station; right bank clean and perpendicular; left bank clean with gradual slope to above high-water stage. On October 23, 1915, a reinforced concrete control 33 feet long having a low-water notch 16 feet in length was completed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.35 feet at 11 p.m. April 3 (discharge computed by extension of rating curve, about 400 million gallons per day, or 620 second-feet); minimum stage recorded, stream dry at times August to November.

1914–1918: Maximum stage recorded 5.3 feet at 9 a. m. September 25, 1914 (discharge, about 755 million gallons per day, or 1,170 second-feet); minimum discharge, stream dry at times.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Stream is not perennial in its lower course. A small part of the flood discharge is diverted at low elevation for irrigation of sugar cane. Station was established to determine whether the total discharge of the stream would justify the construction of a large flood-water storage project in the vicinity.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 2 and 10 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Record fair above 2 million gallons per day when water-stage recorder was operating; poor below 2 million gallons per day and when water-stage recorder was not operating.

Discharge measurements of Koloa Stream near Laie, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Jan. 30	1.01	10.8	6.9	Apr. 26	0.43	2.2	1.4
Feb. 27	.53	2.8	1.8	June 5	.22	1.8	1.1

Daily discharge, in million gallons, of Koloa Stream near Laie, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.6	0.3	0.15	0.6	.....	1.0	0.4	6.8	1.5	12	1.2	1.5
2	.6	.3	.15	.3	.....	.6	.4	2.6	1.2	13	1.0	1.5
3	.6	.3	.15	.15	.....	1.0	.25	1.8	1.2	19	9.5	1.5
4	.6	.15	.15	.....	2.2	2.2	.25	1.8	2.6	20	3.5	1.5
5	.6	.15	.15	.3	3.1	2.2	2.6	4.5	4.0	9.5	4.5	1.5
6	.6	.15	.15	.3	3.1	13	1.5	4.5	4.5	7.4	2.2	.7
7	.6	.15	.15	.3	1.0	22	.7	2.6	1.5	5.6	1.8	.7
8	.6	.15	.15	.15	.6	2.6	5.0	4.0	1.2	4.5	1.5	.7
9	3.1	.15	.15	.....	.3	2.2	1.0	5.6	2.6	8.8	1.5	1.5
10	1.6	.15	.15	.....	.3	3.0	.55	2.2	6.8	12	1.5	2.6
11	1.6	.15	.15	.....	.3	2.2	.55	1.8	14	18	2.6	1.5
12	.6	.15	.3	.....	.3	1.5	.7	1.5	6.8	28	1.5	6.2
13	.6	.3	1.6	.....	.3	1.5	.55	1.8	12	14	2.6	4.0
14	.6	.3	1.6	.6	.15	1.2	1.0	1.5	8.8	10	1.5	1.5
15	.6	.3	1.0	.3	.15	.7	4.5	1.2	11	6.8	1.5	5.0
16	.6	.3	.6	3.1	.15	.55	1.0	1.2	19	13	9.5	4.0
17	.6	.6	.6	1.0	.....	.4	.7	6.8	10	8.1	4.0	1.5
18	.6	.3	.6	.3	.....	.4	3.0	1.8	5.0	6.2	1.5	1.5
19	.3	.15	.3	.15	.....	.25	3.5	1.8	4.0	12	1.5	1.5
20	.3	.....	.3	.15	.....	.25	5.0	10	3.0	4.0	1.5	2.6
21	.3	.....	.3	.15	3.1	.55	1.5	8.1	2.6	4.0	1.5	1.5
22	.3	.....	.15	.....	.6	1.2	1.5	4.0	2.2	7.4	1.5	1.5
23	.3	1.0	.05	.05	.6	.4	1.2	2.6	1.8	2.6	4.0	1.5
24	.3	1.6	.15	.15	.3	.25	4.0	2.2	3.0	1.5	7.4	1.5
25	.3	.6	.....	.....	1.0	.25	6.8	4.5	3.0	1.5	5.0	1.5
26	.3	.3	.....	.....	8.1	.25	5.0	5.0	1.5	1.5	5.0	1.5
27	.3	.15	.....	.....	3.1	3.0	1.8	2.2	1.2	1.8	4.0	1.5
28	.3	.15	.6	.....	1.6	1.0	1.2	1.5	2.2	1.5	4.0	1.5
29	.3	.15	1.0	.....	1.0	.55	5.0	.....	7.4	1.5	6.2	1.5
30	.3	.15	.6	.....	1.0	.4	7.4	.....	4.0	1.5	2.6	1.5
31	3	.15	.....	.....	.....	.4	3.0	.....	2.2	.....	2.6	.....

NOTE.—No gage-height record Sept. 5–11, Apr. 20–25 and May 9 to June 30; discharge estimated from flow of neighboring streams. No flow for days for which discharge is not given.

Monthly discharge of Koloa Stream near Laie, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.1	0.3	0.57	0.88	18	54
August	1.6	.0	.28	.43	9	27
September	1.6	.0	.38	.59	11	35
October	3.1	.0	.26	.40	8	25
November	8.1	.0	1.08	1.67	32	99
December	22	.25	2.16	3.34	67	205
January	7.4	.25	2.31	3.57	72	220
February	10	1.2	3.42	5.29	96	294
March	19	1.2	4.90	7.58	152	466
April	28	1.5	8.56	13.2	257	788
May	9.5	1.0	3.22	4.98	100	306
June	6.2	.7	1.93	2.98	58	178
The year	28	.0	2.41	3.73	880	2,700

WAILELE STREAM NEAR LAIE, OAHU.

LOCATION.—About 3 miles by horse trail southwest of Laie, about 525 feet above sea level.

RECORDS AVAILABLE.—July 30, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 20 feet above gage.

CHANNEL AND CONTROL.—Channel straight for about 50 feet above gage; right bank sloping and clean; left bank nearly vertical. Control consists of concrete slab 32 feet long with low-water notch 14 feet long.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, over 4.5 feet about 11 p. m. April 11, exact stage not known as pencil did not reverse (discharge, more than 390 million gallons per day, or 605 second-feet); minimum stage recorded, stream dry July 19 to August 13, October 21 to November 4 and November 10–20.

1914–1918: Maximum stage recorded, 4.85 feet at 9 a. m. September 23, 1914 (discharge, about 295 million gallons per day,[1] or 456 second-feet); stream occasionally dry.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Stream not perennial. A small part of the flood discharge is diverted at low elevations for sugar-cane irrigation. Station was established to determine whether the total flood discharge of streams at 500 feet above sea level will justify the construction of a large flood-water storage project in the vicinity.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 3 and 80 million gallons per day. Operation of water-stage recorder satisfactory except part of April. Records fair above 3 million gallons per day.

Discharge measurements of Wailele Stream near Laie, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Jan. 29	1.30	49	32
29	1.60	111	72
Feb. 27	.30	1.1	.75

[1] Probably much too low; rating curve very poorly defined at that stage.

Daily discharge, in million gallons, of Wailele Stream near Laie, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.4	.....	0.4	0.4	.....	0.4	0.4	4.4	0.8	9.3	0.8	0.8
2	.1	.....	.4	.1	.....	.1	.4	2.5	.8	7.4	.8	.8
3	.1	.....	.4	.1	.....	.4	.4	1.8	.8	23	7.4	.8
4	.1	.....	.4	.1	0.8	.8	.4	1.8	.8	36	2.5	.8
5	.1	.....	.1	.1	.8	.8	1.8	2.5	1.8	3.4	1.8	.8
6	.1	.....	.1	.1	1.2	5.8	1.2	3.4	1.8	1.8	1.2	.4
7	.1	.....	.1	.1	.4	5.8	.8	2.5	.8	1.2	1.2	.4
8	.1	.....	.1	.1	.1	.8	4.4	3.4	.4	.8	.8	.4
9	1.8	.....	.1	.1	.1	.8	1.2	4.4	.8	3.4	.8	.8
10	.8	.....	.1	.1	.....	1.2	.8	2.5	2.5	4.4	.8	1.2
11	.8	.....	.1	.1	.....	.8	.8	2.5	5.8	20	1.2	.8
12	.4	.....	.1	.1	.....	.4	.8	2.5	2.5	29	.8	3.4
13	.4	.....	.8	.1	.....	.1	.4	2.5	12	7.4	1.2	1.8
14	.4	0.4	.4	.1	.....	.1	.8	2.5	5.8	4.4	.8	.8
15	.4	.4	.4	.1	.....	.1	3.4	2.5	5.8	2.5	.8	2.5
16	.4	.4	.4	1.2	.....	.1	.4	2.5	26	7.4	9.3	1.8
17	.4	.4	.4	.8	.....	.1	.4	5.8	5.8	3.4	1.8	.8
18	.4	.4	.4	.4	.....	.1	1.8	1.8	1.8	1.8	.8	.8
19	.....	.4	.4	.4	.....	.1	1.2	1.8	1.2	7.4	.8	.8
20	.....	.1	.1	.1	.....	.1	1.8	12	1.2	1.8	.8	1.2
21	.....	.1	.1	.....	1.8	.1	.4	7.4	.8	1.8	.8	.8
22	.....	.1	.1	.....	.4	.8	.4	3.4	.8	4.4	.8	.8
23	.....	.4	.1	.....	.1	.4	.4	1.8	.8	1.2	1.8	.8
24	.....	.8	.1	.....	.1	.4	1.8	1.2	1.2	.8	4.4	.8
25	.....	.4	.1	.....	.1	.4	4.4	1.8	1.2	.8	2.5	.8
26	.....	.1	.1	.....	2.5	.4	2.5	2.5	.8	.8	2.5	.8
27	.....	.1	.4	.....	1.2	1.8	.8	.8	.4	.8	1.8	.8
28	.....	.1	.4	.....	.4	.8	.8	.8	.4	.8	1.8	.8
29	.....	.4	.4	.....	.4	.8	5.8	.....	4.4	.8	3.4	.8
30	.....	.4	.4	.....	.4	.4	7.4	.....	1.2	1.2	1.2	.8
31	.....	.4	.....	.....	.....	.4	2.5	.....	.8	.....	1.2	.....

NOTE.—No gage-height record Apr. 11-25; discharge estimated from East Branch of Kahawainui Stream. No flow on days for which discharge is not given.

Monthly discharge of Wailele Stream near Laie, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.8	0.0	0.24	0.37	7	23
August	.8	.0	.19	.29	6	18
September	.8	.1	.26	.40	8	24
October	1.2	.0	.15	.23	5	14
November	2.5	.0	.36	.56	11	33
December	5.8	.1	.83	1.28	26	79
January	7.4	.4	1.64	2.54	51	156
February	12	.8	3.05	4.72	85	262
March	26	.4	2.97	4.60	92	283
April	36	.8	6.31	9.76	189	581
May	9.3	.8	1.89	2.92	59	180
June	3.4	.4	1.00	1.55	30	92
The year	36	.0	1.56	2.41	569	1,740

EAST BRANCH OF KAHAWAINUI STREAM NEAR LAIE, OAHU.

LOCATION.—Half a mile above junction with West Branch of Kahawainui Stream, 3 miles by horse trail southwest of Laie, about 500 feet above sea level.

RECORDS AVAILABLE.—July 29, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Datum raised 0.6 foot November 1, 1915.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 10 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for several feet above station; bed composed of large boulders; free from vegetation; right bank clean and nearly perpendicular; left bank sloping and fairly clean. Control prior to October 26, 1915, consisted of a natural dam of large boulders. On November 1, 1915, a reinforced concrete control, 32 feet long with a low-water notch 15 feet long was completed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.05 feet at 10 p. m. April 11 (discharge, about 440 million gallons per day, or 682 second-feet); channel frequently dry.

1914–1918: Maximum stage recorded, 5.1 feet at 7 a. m. September 25, 1914 (discharge, about 650 million gallons per day,[1] or 1,010 second-feet); channel frequently dry.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of the flood discharge is diverted at low elevations to irrigate sugar cane. Station was established to determine whether total flood discharge at this elevation is sufficient to justify a large flood-water storage project near Kahuku.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 3 and 80 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Record poor due to small amount of water.

The following discharge measurement was made by R. D. Klise:

April 24, 1917: Gage height, 0.31 foot; discharge, 1.0 second-foot, or 0.65 million gallons per day.

Daily discharge, in million gallons, of East Branch of Kahawainui Stream near Laie, Oahu, for the year ending June 30, 1918.

Day.	July.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1				0.2		2.1	0.4	5.0	0.4	0.4
2						.7	.4	4.2	.2	.4
3						.4	.4	11	4.2	.2
4			0.4	.4		.4	.4	17	2.1	.1
5			.4	.4	1.1	1.1	1.6	2.1	1.6	.1
6			.7	2.1	.7	1.1	2.1	1.1	1.1	.1
7			.2	3.5	.4	.7	.7	.4	.7	.1
8				.7	2.1	1.6	.4	.2	.4	.1
9	0.2			.4	.7	1.6	.7	1.6	.4	.4
10				1.1	.4	.7	2.1	4.2	.4	1.1
11	.7			.7	.4	.4	5.0	9.6	.7	.4
12				.4	.4	.4	2.8	15	.4	2.1
13				.4	.2	.4	7.2	4.2	.4	1.1
14				.2	.4	.4	5.0	2.8	.4	.4
15				.2	1.6	.2	4.2	1.6	.2	1.1
16				.2	.2	.2	17	4.2	5.0	1.6
17		0.2			.2	2.8	4.2	2.1	2.1	.4
18					1.1	.4	1.6	1.1	.4	.2
19					.7	.4	1.1	4.2	.4	.2
20					1.1	6.0	1.1	1.1	.2	.4
21			1.1		.2	2.8	.7	1.1	.2	.2
22			.2		.2	1.1	.7	2.8	.2	.2
23				.2	.2	.7	.7	.7	.2	.2
24					1.1	.4	.7	.4	2.8	.2
25					2.1	.7	1.1	.4	3.5	.2
26			2.1		1.1	1.1	.4	.4	.7	.1
27			1.1	.4	.4	.7	.4	.4	.7	.1
28			.2	.7	.4	.4	.4	.4	1.1	.1
29			.2	.2	2.8		2.8	.4	2.1	.1
30			.2		2.8		1.1	.4	.7	.1
31					1.1		.7		.4	

NOTE.—No gage-height record Nov. 4–21, Jan. 5–29, June 5 and 6; discharge estimated from record of Wailele Stream. No flow on days for which discharge is not given.

[1] Revised.

Monthly discharge of East Branch of Kahawainui Stream near Laie, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	0.7	0.0	0.03	0.05	1	3
October	.2	.0	.01	.02	0	1
November	2.1	.0	.23	.36	7	21
December	3.5	.0	.40	.62	12	38
January	2.8	.0	.78	1.21	24	74
February	6.0	.2	1.07	1.66	30	92
March	17	.4	2.20	3.40	68	209
April	17	.2	3.34	5.17	100	308
May	5.0	.2	1.11	1.72	34	106
June	2.1	.1	.41	.63	12	38
The year	17	.0	.79	1.22	288	890

NOTE.—No flow August and September.

EAST BRANCH OF MALAEKAHANA STREAM NEAR KAHUKU, OAHU.

LOCATION.—About three-quarters of a mile above junction with Middle Branch of Malaekahana Stream and 3½ miles, by horse trail, south of Kahuku, about 375 feet above sea level.

RECORDS AVAILABLE.—July 31, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Original staff gage, established on July 31, 1914, was washed out by flood September 24, 1914. From September 25, 1914, to May 28, 1915, a reference point consisting of 20-penny nail in kukui tree on left bank 50 feet upstream, at same datum as staff gage, was used to check gage heights. On May 28, 1915, a new staff gage was established at the original datum.

DISCHARGE MEASUREMENTS.—Made by wading or from cable about 5 feet upstream from staff gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for several hundred feet above gage; bed composed of loose boulders and gravel; right bank at gage clean and nearly vertical; left bank has gradual slope and above ordinary flood stages is covered with small trees and vegetation; cross section same for several hundred feet upstream. Reinforced concrete control completed November 9, 1915, is 33 feet long with a 14-foot notch for low water. Original control consisted of a concrete slab 2 feet wide, with a small notch for low flow, between larger boulders, about 6 feet below gage; this control was destroyed by the flood September 24, 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.5 feet at 10.15 p. m. April 11 (discharge, 320 million gallons per day, or 496 second-feet); channel dry most of time July to December.

1914–1918: Maximum stage recorded, 5.05 feet at 5 a. m. September 25, 1914 (discharge, about 378 million gallons per day, or 585 second-feet); channel frequently dry.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Stream not perennial. A small part of the flood discharge is diverted at low elevations for irrigation of sugar cane. Station was established to determine whether the total flood discharge at an elevation of about 350 feet above sea level will justify the construction of a large flood-water storage project near Kahuku.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 12 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records fair.

The following discharge measurement was made by R. D. Klise:

April 25, 1918: Gage height, 0.14 foot; discharge, 1.15 second-feet, or 0.75 million gallons per day.

Daily discharge, in million gallons, of East Branch of Malaekahana Stream near Kahuku, Oahu, for the year ending June 30, 1918.

Day.	July.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.3				0.3	1.8	1.0	4.5	1.0	0.3
2	.3				.3	1.0	1.0	4.5	1.0	.3
3	.3				.3	1.0	1.0	12	7.5	.3
4	.3		1.0		.3	1.0	1.0	24	2.6	.3
5	.3				1.0	1.0	1.8	5.5	2.6	.3
6			.3	2.6	1.0	1.8	2.6	2.6	1.8	.3
7				3.5	.3	1.0	1.8	1.8	1.0	.3
8				.3	3.5	1.8	1.0	1.8	1.0	.3
9	1.0			.3	1.0	2.6	1.0	4.5	1.0	.3
10	.3			1.0	.3	1.0	2.6	6.5	1.0	1.8
11				1.0	.3	1.0	5.5	15	1.0	1.0
12				.3	.3	1.0	3.5	17	1.0	2.6
13	.3					1.0	8.6	4.5	1.0	1.8
14						1.0	5.5	3.5	1.0	1.0
15					3.5	1.0	7.5	2.6	1.0	3.5
16					.3	1.0	17	5.5	7.5	2.6
17		0.2			.3	4.5	6.5	3.5	2.6	1.0
18					1.8	1.0	2.6	1.8	1.8	1.0
19					1.8	1.8	2.6	7.0	1.0	1.0
20					2.6	7.5	1.8	4.5	1.0	1.0
21			1.0		1.0	3.5	1.8	3.5	1.0	1.0
22			.3		1.0	1.0	1.8	4.5	1.0	1.0
23					1.0	1.0	1.8	3.5	1.8	1.0
24					2.6	1.0	1.8	2.6	6.5	1.0
25					6.5	1.0	1.8	1.0	3.5	1.0
26			1.8		3.5	1.8	1.0	1.0	1.8	1.0
27			1.0		1.8	1.0	.3	1.0	1.8	1.0
28			.3	1.0	1.0	1.0	.3	1.0	1.8	1.0
29				.3	7.5		2.6	1.0	2.6	1.0
30					5.5		1.8	1.0	.3	1.0
31					1.8		1.0		.3	

NOTE.—No gage height record Jan. 1–4, Apr. 19–24, and June 26–30; discharge estimated from records for neighboring streams. No flow on days for which discharge is not given.

Monthly discharge of East Branch of Malaekahana Stream near Kahuku, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.0	0.0	0.10	0.15	3	10
October	.2	.0	.01	.02	0	1
November	1.8	.0	.19	.29	6	17
December	3.5	.0	.33	.51	10	31
January	7.5	.0	1.69	2.61	52	161
February	7.5	1.0	1.65	2.55	46	142
March	17	.3	2.96	4.58	92	282
April	24	1.0	5.09	7.88	153	469
May	7.5	.3	1.99	3.08	62	189
June	3.5	.3	1.03	1.59	31	95
The year	24	.0	1.25	1.93	455	1,400

NOTE.—No flow August and September.

MIDDLE BRANCH OF MALAEKAHANA STREAM NEAR KAHUKU, OAHU.

LOCATION.—About a mile above junction with East Branch of Malaekahana stream, 3½ miles by horse trail south of Kakuku, and about 440 feet above sea level.

RECORDS AVAILABLE.—July 31, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Gage datum lowered 1 foot September 25, 1914, to avoid minus readings.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 15 feet downstream from staff gage.

CHANNEL AND CONTROL.—One channel at all stages; composed of loose boulders and gravel, free from vegetation, and straight for several hundred feet above gage; at the gage right bank clean and nearly vertical; left bank slopes gradually and above ordinary flood stages is covered with trees and vegetation. Reinforced concrete control completed November 20, 1915, replacing concrete control washed out September 24, 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.65 feet at 11.30 p. m. April 11 (discharge, 180 million gallons per day, or 279 second-feet); channel dry most of year.

1914–1918: Maximum stage recorded, 3.40 feet at 9.30 p. m. January 7, 1916 (discharge, about 200 million gallons per day, or 309 second-feet); channel dry greater part of the time.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Stream not perennial. A small part of the flood discharge is diverted at low elevations for irrigation of sugar cane. Station was established to determine whether the total flood discharge at an elevation of about 400 feet above sea level will justify the construction of a large flood-water storage project near Kakuku.

ACCURACY.—Stage-discharge relation assumed permanent. Rating curve fairly well defined for previous year. Operation of water-stage recorder satisfactory. Records poor.

No discharge measurements made during year.

Daily discharge, in million gallons, of Middle Branch of Malaekahana Stream near Kahuku, Oahu, for the year ending June 30, 1918.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.5	.....	1.2	0.5	.....	16	0.5	.....	16	2.5	.....	2.5
2	.....	1.2	.....	1.2	.5	.....	17	.....	2.5	5.8	2.5	.....	.5
3	.....	1.2	.....	8.0	2.5	.....	18	.....	1.2	1.2	.5	.....	.....
4	.....	1.2	.....	23	1.2	.....	19	.5	.05	1.2	5.8	.....	.....
5	.....	1.2	.....	2.5	1.2	.....	20	2.5	5.8	.5	1.2	.....	.....
6	.....	1.2	.....	.5	1.2	.....	21	.5	1.2	.5	.5	.....	.....
7	.....	1.2	0.05	.05	.5	.....	22	.....	.5	.5	1.2	.....	.....
8	0.05	1.2	.....	.....	.5	.....	23	.....	.5	.5	1.2	.....	.....
9	1.2	1.2	.....	.05	.5	.....	24	1.2	.5	.5	1.2	.....	.....
10	.....	1.2	.....	.5	.5	0.5	25	5.8	.5	.5	1.2	.05	.....
11	.....	1.2	1.2	4.0	.5	.....	26	2.5	.5	.5	.5	.....	.....
12	.....	.05	1.2	35	.5	.....	27	1.2	.5	.5	.5	.....	.....
13	.....	.....	5.8	5.8	.5	1.2	28	.05	.05	.05	.5	.....	.....
14	.....	.....	5.8	4.0	.....	.....	29	5.8	.....	.5	.5	.....	.....
15	1.2	.....	4.0	1.2	.....	.....	30	10	.....	.5	.5	.....	.....
							31	2.5	.....	.5	.....	.....	.....

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

Monthly discharge of Middle Branch of Malaekahana Stream near Kahuku, Oahu, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January	10	0.0	1.15	1.78	36	109
February	5.8	.0	1.01	1.56	28	87
March	16	.0	1.54	2.38	48	147
April	35	.0	3.58	5.54	107	330
May	2.5	.0	.36	.57	11	34
June	2.5	.0	.16	.25	5	15
The year					235	722

NOTE.—No flow July to December.

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

LOCATION.—About 200 feet upstream from intake of Wahiawa Water Co.'s tunnel, which is at confluence of right and left branches, or two main branches, of North Fork, about 8 miles northeast of Wahiawa.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1918.

GAGE.—Stevens 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.—Maximum stage recorded during year, 5 feet at 8.35 a. m. April 11 (discharge, 280 million gallons per day, or 434 second-feet); minimum stage recorded, 1.35 feet October 9 and 10 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

1913–1918: Maximum stage recorded, 6.9 feet 10 p. m. November 8, 1914, (discharge, estimated by extension of rating curve, 560 million gallons per day, or 866 second-feet); minimum daily discharge, March, 1914 (0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Drift lodged on control April 11 and was not removed until after June 30. Rating curve used July 1 to April 11 well defined between 2 and 200 million gallons per day. Curve used April 12 to June 30 fairly well defined. Operation of water-stage recorder satisfactory, except January 4–8 and March 29 to April 16, for which periods there are no gage heights. Discharge estimated from flow of Left Branch of North Fork of Kaukonahua January 4–8, March 29 to April 4, and April 10–16; discharge estimated April 5–9. Records fair when water-stage recorder was operating; poor at other times.

Discharge measurements of Right Branch of North Fork of Kaukonahua near Wahiawa, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	H. A. R. Austin	1.57	2.7	1.7
Oct. 2	R. D. Klise	1.42	.95	.6
Nov. 2	do	1.39	.65	.4
Mar. 5	do	2.27	25	16
May 14	do	1.75	3.5	2.2
June 20	do	2.14	15.6	10

Daily discharge, in million gallons, of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.0	0.8	1.6	0.8	0.5	1.6	1.1	16.5	5.9	4.4	3.1	7.3
2	1.6	.8	1.1	.5	.5	1.1	.8	5.2	5.2	7.5	2.3	5.0
3	3.1	.8	.8	.5	9.0	1.6	.8	4.4	5.2	20	8.5	5.0
4	3.8	.8	.5	.5	4.4	2.6	.8	3.8	6.8	75	7.3	3.9
5	2.0	.8	.5	.5	10.2	3.1	1.2	7.8	14.8	30	10.2	3.9
6	1.6	.8	.5	.8	13.2	5.9	1.2	6.8	11.7	12	7.3	3.1
7	1.6	1.6	.5	.5	3.8	4.4	2.0	7.8	6.8	4.4	3.1	1.8
8	2.6	.8	.5	.5	3.1	2.0	4.0	9.0	5.2	3.8	3.1	1.3
9	10.2	.5	.5	.4	2.0	2.0	1.1	26	36	18	2.3	3.1
10	13.2	.5	.5	.4	3.1	5.2	.8	5.9	33	75	2.3	6.1
11	5.9	2.6	.5	.8	1.6	2.6	3.8	5.2	102	65	3.1	3.1
12	3.1	3.1	1.6	.5	1.6	3.8	4.4	5.2	68	75	2.3	18
13	2.6	4.4	5.2	1.1	1.1	3.1	9.0	4.4	49	45	3.1	8.5
14	2.0	1.6	3.1	4.4	1.1	3.1	7.8	3.8	26	38	1.8	3.9
15	2.0	2.0	2.0	1.6	1.1	2.0	5.9	3.1	20	16	1.8	10.2
16	1.6	9.0	3.1	.8	1.1	1.6	2.6	3.1	33	20	12	8.5
17	7.8	2.0	5.2	.8	.8	1.1	2.0	14.8	14.8	18	5.0	3.9
18	2.0	1.1	2.0	.5	.8	1.1	11.7	3.8	11.7	12	2.3	2.3
19	1.6	.8	1.1	.5	.8	1.1	9.0	3.8	16.5	26	2.3	2.3
20	1.6	.8	1.1	3.1	.8	1.1	4.4	14.8	9.0	16	2.3	7.3
21	1.6	.8	1.1	5.9	.8	1.1	3.1	26	7.8	8.5	1.8	5.0
22	1.6	.8	.8	5.9	.8	6.8	2.6	10.2	6.8	10.2	1.8	3.9
23	1.6	5.9	.8	5.2	.8	1.6	3.8	6.8	5.9	7.3	2.3	5.0
24	1.1	5.2	.8	1.6	2.0	1.1	5.9	10.2	11.7	7.3	1.8	7.3
25	1.6	2.0	.8	1.1	3.8	1.1	6.8	18.2	9.0	6.1	14	3.9
26	1.1	1.1	1.1	1.1	3.8	1.1	6.8	7.8	5.9	6.1	2.3	3.1
27	1.1	1.1	2.6	.8	6.8	6.8	3.8	7.8	5.2	6.1	8.5	3.1
28	.8	1.1	1.1	.8	2.6	2.6	3.1	5.9	5.9	5.0	28	8.5
29	.8	1.1	1.6	.8	2.0	1.6	13.2	.....	5.2	3.9	33	3.1
30	1.6	1.6	1.1	.8	2.6	1.1	13.2	.....	4.4	3.1	18	2.3
31	1.1	1.6	.....	.8	.....	1.1	5.2	.....	3.8	.....	7.3	.....

Monthly discharge of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	13.2	0.8	2.77	4.29	86	264
August	9.0	.5	1.87	2.89	58	178
September	5.2	.5	1.46	2.26	44	134
October	5.9	.4	1.43	2.21	44	136
November	13.2	.5	2.89	4.47	87	266
December	6.8	1.1	2.45	3.79	76	233
January	13.2	.8	4.58	7.09	142	436
February	26	3.1	8.86	13.7	248	761
March	102	3.8	17.8	27.5	552	1,690
April	75	3.1	21.5	33.3	645	1,980
May	33	1.8	6.59	10.2	204	627
June	18	1.3	5.12	7.92	154	471
The year	102	.4	6.41	9.92	2,340	7,180

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, or two main branches of North Fork, about 8 miles northeast of Wahiawa.

RECORDS AVAILABLE.—May 25, 1913, to June 30, 1918.

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

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

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

EXTREMES OF DISCHARGE.—1913–1918: Maximum stage recorded, 8.48 feet at 2.45 p. m. April 12, 1918 (discharge, 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, 0.85 foot February 9 and 19, 1915 (discharge, 0.25 million gallons per day, or 0.37 second-foot). Minimum stage recorded during year, 0.9 foot November 2 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable July 1 to April 11 and April 12 to June 30. Operation of water-stage recorder satisfactory, except for the following periods which have been estimated from flow of Right Branch of North Fork of Kaukonahua Stream, July 3–5, August 6–9, 11, 12, February 10, 11, and March 14–22. No record April 5–9; discharge estimated. Records fair when water-stage recorder was operating and poor at other times.

Discharge measurements of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1918.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	H. A. R. Austin	1.12	4.1	2.7
Oct. 2	R. D. Klise	1.00	1.95	1.2
Nov. 2	do	.91	1.1	.7
Mar. 5	do	2.08	58	37
May 14	do	1.28	4.9	3.2
June 20	do	1.84	29	19

Daily discharge, in million gallons, of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.5	1.5	2.5	2.0	1.0	2.5	1.5	7.5	5.5	6.5	4.6	6.5
2	2.5	1.5	1.5	1.5	.7	2.0	1.5	4.6	4.6	10	3.8	5.5
3	5.5	1.5	1.5	1.5	17	2.5	1.5	3.8	5.5	30	24	4.6
4	6.5	1.5	1.5	1.5	6.5	3.8	1.5	3.8	6.5	109	21	3.8
5	3.8	1.5	1.5	2.5	19	3.2	2.0	5.5	21	40	12	3.2
6	3.8	1.5	1.5	4.6	17	13	2.0	5.5	17	17	7.5	3.8
7	3.8	1.5	1.5	1.5	5.5	6.5	3.2	4.6	7.5	6.5	4.6	3.2
8	3.8	1.5	1.5	1.0	4.6	3.8	6.5	10	5.5	5.5	3.8	3.2
9	19	1.5	1.5	1.0	3.8	3.8	2.0	48	24	27	4.6	3.8
10	27	1.5	1.5	1.0	4.6	8.8	1.5	7.5	48	109	6.5	5.5
11	8.8	3.8	1.5	2.0	2.5	5.5	1.5	6.5	217	99	7.5	3.2
12	5.5	5.5	3.2	1.5	2.5	7.5	3.2	6.5	136	109	5.5	40
13	4.6	10	24	2.5	2.5	10	3.2	5.5	70	70	6.5	12
14	3.8	3.2	6.5	6.5	2.5	6.5	4.6	4.6	33	56	3.8	5.5
15	3.8	15	3.8	2.5	2.0	5.5	3.8	3.8	24	21	3.8	17
16	5.5	13	5.5	2.0	2.0	4.6	2.5	3.8	48	24	30	10
17	6.5	3.8	6.5	1.5	2.0	3.8	2.0	19	17	19	10	5.5
18	3.8	2.0	3.2	1.5	1.5	3.8	4.6	4.6	13	12	5.5	5.5
19	3.2	2.0	2.0	1.5	2.0	3.8	4.6	3.8	19	36	5.5	4.6
20	2.5	2.0	2.0	3.8	2.0	3.2	2.5	17	10	15	5.5	12
21	2.5	1.5	2.0	6.5	2.0	3.2	2.0	21	8.8	10	4.6	10
22	2.5	3.2	1.5	7.5	2.0	10	2.0	8.8	7.5	12	4.6	10
23	2.5	8.8	1.5	6.5	2.0	3.2	2.5	6.5	7.5	8.8	5.5	10
24	2.5	4.6	2.0	3.2	4.6	2.5	3.8	6.5	13	7.5	5.5	10
25	3.2	2.0	2.0	2.5	5.5	2.5	3.8	13	17	6.5	24	5.5
26	2.0	1.5	3.8	2.0	6.5	2.0	4.6	40	10	6.5	7.5	4.6
27	2.0	1.5	5.5	2.0	8.8	7.5	3.2	7.5	7.5	7.5	21	4.6
28	2.0	1.5	2.5	2.0	4.6	3.8	2.5	6.5	7.5	6.5	27	21
29	1.5	1.5	3.8	2.0	4.6	2.5	12	.....	7.5	4.6	36	8.8
30	3.2	2.5	2.5	2.0	5.5	2.0	7.5	.....	6.5	4.6	15	7.5
31	2.0	2.5	.....	2.0	.....	1.5	4.6	.....	5.5	.....	7.5	.....

Monthly discharge of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	27	1.5	4.91	7.60	152	467
August	15	1.5	3.43	5.31	106	326
September	24	1.5	3.38	5.23	101	311
October	7.5	1.0	2.63	4.07	82	250
November	19	.7	4.91	7.60	147	452
December	13	1.5	4.67	7.23	145	444
January	12	1.5	3.36	5.20	104	320
February	48	3.8	10.2	15.8	286	876
March	217	4.6	26.8	41.5	830	2,550
April	109	4.6	29.9	46.3	896	2,750
May	36	3.8	10.8	16.7	334	1,030
June	40	3.2	8.35	12.9	250	769
The year	217	.7	9.41	14.6	3,430	10,500

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, 1918.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
July 9	Kahana	Near Kahana	0.91	24	16
10	Kaluanui	At elevation 1,900 feet, near Hauula	1.37	3.9	2.5
Aug. 24	Maole	Hillebrand Glen, 200 feet below diversion dam		.06	.04
Apr. 22	South Fork of Kaukonahua	Below United States Army Reservoir near Wahiawa	1.34	34	22
May 22	do	do	.46	3.0	1.9
Aug. 9	Wahoi	Near Hauula	.77	5.9	3.8
Dec. 20	do	do	.62	4.0	2.6
Feb. 27	do	do	.72	4.2	2.7
June 6	do	do	.82	8.7	5.6

NOTE.—Measurements made at former gaging stations, except Maole.

ISLAND OF MAUI.

HONOKAHAU STREAM NEAR HONOKAHAU, MAUI.

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

RECORDS AVAILABLE.—March 6, 1913, to June 30, 1918.

GAGE.—Stevens 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 and 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, 6.50 feet at 6.30 a. m. April 3 (discharge, about 1,100 million gallons per day, or 1,700 second-feet); minimum stage recorded, 1.4 feet December 11-13, 17 and 18 (discharge, 6.0 million gallons per day, or 9.3 second-feet).

1913-1918: Maximum stage recorded, 8.25 feet at 7.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 1,900 million gallons per day, or 2,940 second-feet): minimum stage recorded (see preceding paragraph).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 10 well defined between 6 and 60 million gallons per day; curve used March 11 to June 30 poorly defined. Operation of water-stage recorder satisfactory except no record, or only part record July 17–19, 23–27, August 10, 11, 14–24, and April 11–13; discharge estimated from flow of neighboring streams. Records fair when water-stage was operating properly July 1 to March 10; poor for other periods.

Discharge measurements of Honokahau Stream near Honokahau, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 31	1.57	16.0	10	Feb. 8	1.43	10.2	6.5
Nov. 11	1.51	13.5	8.7	May 10	2.58	125	81

Daily discharge, in million gallons, of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	14	17	9.7	11	8.4	12	7.2	16	16	33	23	25
2	14	19	9.7	8.4	8.4	9.7	7.2	7.2	33	112	21	21
3	12	14	9.7	8.4	8.4	8.4	7.2	7.2	40	196	25	19
4	17	14	9.7	8.4	16	8.4	8.4	7.2	54	33	112	19
5	21	14	9.7	9.7	17	7.2	8.4	7.2	30	80	36	19
6	14	14	9.7	14	17	7.2	8.4	7.2	14	107	23	19
7	12	19	9.7	9.7	36	7.2	7.2	7.2	21	33	23	19
8	12	14	9.7	8.4	14	7.2	16	8.4	21	58	23	19
9	23	14	9.7	8.4	12	7.2	11	155	25	170	19	19
10	25	12	9.7	8.4	14	7.2	8.4	43	54	232	43	36
11	14	23	8.4	8.4	8.4	6.0	40	40	232	40	23	36
12	11	14	9.7	8.4	8.4	6.0	11	33	170	21	66	98
13	11	21	36	8.4	8.4	6.0	8.4	14	33	21	43	28
14	11	19	12	8.4	7.2	9.7	9.7	11	19	62	23	19
15	11	17	9.7	8.4	7.2	11	7.2	9.7	17	62	25	98
16	14	16	9.7	8.4	7.2	7.2	12	36	66	28	33	40
17	14	14	8.4	8.4	7.2	6.0	7.2	88	30	23	25	21
18	11	14	8.4	8.4	7.2	6.0	12	28	16	21	19	17
19	11	12	9.7	8.4	7.2	7.2	8.4	43	14	21	19	17
20	11	12	9.7	8.4	7.2	8.4	14	43	14	23	19	40
21	11	11	9.7	8.4	7.2	25	7.2	43	14	33	28	33
22	11	19	9.7	8.4	14	43	8.4	16	14	28	21	40
23	11	14	9.7	8.4	17	14	11	12	14	21	19	40
24	11	11	9.7	8.4	17	8.4	8.4	11	50	19	17	23
25	11	11	9.7	8.4	8.4	14	7.2	11	162	21	33	23
26	11	11	11	7.2	46	9.7	7.2	9.7	28	21	28	23
27	11	11	9.7	7.2	14	8.4	7.2	14	21	33	36	28
28	11	11	9.7	11	8.4	11	7.2	46	17	23	98	28
29	11	11	11	12	17	8.4	7.2	.....	16	40	25	25
30	14	11	11	12	58	8.4	30	.....	19	54	36	33
31	14	9.7	.....	8.4	.....	7.2	17	.....	21	.....	21	.....

Monthly discharge of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	25	11	13.2	20.4	410	1,260
August	23	9.7	14.3	22.1	444	1,360
September	36	8.4	10.7	16.6	320	985
October	14	7.2	8.99	13.9	279	855
November	58	7.2	14.5	22.4	434	1,340
December	43	6.0	10.1	15.6	313	961
January	40	7.2	10.9	16.9	337	1,040
February	155	7.2	27.6	42.7	774	2,370
March	232	14	41.8	64.7	1,300	3,980
April	232	19	55.6	86.0	1,670	5,120
May	112	17	32.4	50.1	1,000	3,080
June	98	17	30.8	47.7	925	2,840
The year	232	6.0	22.5	34.8	8,210	25,200

HONOKAWAI DITCH NEAR LAHAINA, MAUI.

LOCATION.—250 feet below junction with Amalu wooden flume, 1,000 feet below intake, 2 miles above Pioneer Mill Co.'s power house, and about 7 miles northeast of Lahaina.

RECORDS AVAILABLE.—July 1, 1912, to December 31, 1917, when station was discontinued.

GAGE.—A graduated rod placed in center of flume at each visit; read by Wamura.

DISCHARGE MEASUREMENTS.—Made in flume near gage.

CHANNEL AND CONTROL.—Semicircular galvanized-iron flume 3 feet in diameter; straight for 100 feet above and below gage; flume clean and uniform in section and grade. Stage-discharge relation stable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.35 feet at 3 p. m. September 13 (discharge, 7.8 million gallons per day, or 12 second-feet); minimum stage recorded, 0.85 foot November 19–22 and frequently in December (discharge, 2.8 million gallons per day, or 4.3 second-feet).

1912–1917: Maximum stage recorded, 1.67 feet August 12, 1913 (discharge, 15 million gallons per day, or 23 second-feet); minimum stage recorded, 0.80 foot May 15, 1913 (discharge, 2.4 million gallons per day, or 3.8 second-feet).

DIVERSIONS.—Ditch diverts all low-water flow from Honokawai and Amalu streams.

REGULATION.—Flow controlled by head gates.

UTILIZATION.—Power development and irrigation of sugar cane.

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

No discharge measurements made during year.

Daily discharge, in million gallons, of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	4.5	3.2	3.2	3.2	4.0	16	4.0	3.6	3.2	3.2	3.2	2.8
2	4.0	6.0	3.2	3.2	3.2	3.2	17	4.0	3.6	3.2	3.2	3.2	2.8
3	4.0	4.0	3.2	3.2	3.2	2.8	18	4.0	3.6	3.2	3.2	3.2	2.8
4	4.0	3.6	3.2	3.2	4.0	2.8	19	4.0	3.6	3.2	3 2	2.8	2.8
5	5.5	3.6	3.2	3.2	5.5	2.8	20	3.6	3.2	3.2	3.2	2.8	2.8
6	4.0	3.6	3.2	3.2	4.0	2.8	21	3.6	3.2	3.2	3.2	2.8	4.0
7	3.6	5.0	3.2	3.2	7.2	2.8	22	3.6	4.0	3.2	3.2	2.8	5.0
8	3.6	4.0	3.2	3.2	4.0	2.8	23	3.6	4.0	3.2	3.2	4.0	3.2
9	6.0	4.0	3.2	3.2	3.6	2.8	24	3.6	3.6	3.2	3.2	4.0	2.8
10	5.5	3.6	3.2	3.2	4.0	2.8	25	3.6	3.6	3.2	3.2	3.2	4.0
11	4.0	5.0	3.2	3.2	3.2	2.8	26	3.6	3.6	3.2	3.2	6.0	3.2
12	3.6	6.0	3.2	3.2	3.2	2.8	27	3.6	3.6	3.2	3.2	4.0	2.8
13	3.6	6.6	3.2	3.2	3.2	2.8	28	3.6	3.6	3.2	3.2	3.2	3.2
14	3.6	4.0	3.2	3.2	3.2	2.8	29	3.6	3.2	3.2	3.2	6.0	2.8
15	3.6	3.6	3.2	3.2	3.2	5.0	30	3.6	3.2	3.2	3.6	7.2	2.8
							31	3.6	3.2	.....	3.2	.....	2.8

Monthly discharge of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	6.0	3.6	3.93	6.08	122	374
August	6.6	3.2	3.98	6.16	124	379
September	3.2	3.2	3.20	4.95	96	295
October	3.6	3.2	3.21	4.97	100	305
November	7.2	2.8	3.88	6.00	116	357
December	5.0	2.8	3.11	4.81	96	296
The period	.....	.....	.....	.....	654	2,010

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

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

RECORDS AVAILABLE.—February 29, 1916, to June 30, 1918.

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, 3.43 feet at 2.30 a. m. February 17 (discharge, about 340 million gallons per day, or 527 second-feet); minimum stage recorded, 1.00 foot February 4–8 and June 6–11 and 29 (discharge 2.5 million gallons per day, or 3.8 second-feet).

1916–1918: Maximum stage recorded, 3.3 feet at 11.30 p. m. December 21, 1916 (discharge, about 300 million gallons per day, or 464 second-feet); minimum stage recorded February and June, 1918.

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined below 15 million gallons per day. No gage height recorded September 3 to October 6 and June 6–30; intake pipe plugged March 4–29. Discharge interpolated September 3 to October 6. Discharge estimated from records for Ukumehame stream for periods in March and June. Records fair when water-stage recorder was operating satisfactorily; poor at other times.

Discharge measurements of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 27	1.09	5.0	3.2	Feb. 7	1.00	3.8	2.5
Aug. 30	1.07	4.2	2.7	May 11	1.08	4.7	3.1
Dec. 9	1.03	3.7	2.4				

Daily discharge, in million gallons, of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.6	3.7	2.8	2.8	2.8	4.2	2.8	3.2	5.0	2.8	3.2	2.8
2	4.2	5.0	2.8	2.8	2.8	3.2	2.8	2.8	5.0	5.8	3.2	2.8
3	4.2	3.2	2.8	2.8	2.8	3.2	2.8	2.8	5.0	31	2.8	2.8
4	4.6	3.2	2.8	2.8	13	2.8	2.8	2.5	5.8	3.7	5.8	2.8
5	5.0	3.2	2.8	2.8	11	2.8	2.8	2.5	4.2	7.2	3.7	2.8
6	3.2	3.2	2.8	2.8	5.8	2.8	2.8	2.5	4.2	8.6	3.2	2.5
7	3.2	3.2	2.8	2.8	26	2.8	2.8	2.5	3.2	3.2	3.2	2.5
8	3.2	3.2	2.8	2.8	5.0	2.8	5.0	2.5	3.2	3.7	3.2	2.5
9	5.0	3.2	2.8	2.8	3.7	2.8	2.8	4.2	3.2	37	2.8	2.5
10	4.2	3.2	2.8	2.8	3.7	2.8	2.8	5.8	3.7	77	5.0	2.5
11	3.2	5.0	2.8	2.8	3.2	2.8	13	17	31	4.2	2.8	2.5
12	3.2	3.7	2.8	2.8	2.8	2.8	3.2	8.6	21	3.2	3.7	3.2
13	3.2	5.8	2.8	2.8	2.8	3.2	2.8	3.2	7.2	3.2	3.2	2.8
14	3.2	3.7	2.8	2.8	2.8	3.2	2.8	2.8	5.8	143	2.8	2.8
15	3.2	3.2	2.8	2.8	2.8	2.8	2.8	2.8	4.2	5.8	2.8	4.2
16	4.2	3.2	2.8	2.8	2.8	2.8	2.8	8.6	4.2	3.7	2.8	3.2
17	3.7	3.2	2.8	2.8	2.8	2.8	2.8	56	5.0	3.2	2.8	2.8
18	3.2	3.2	2.8	2.8	2.8	2.8	3.7	8.6	5.8	3.2	2.8	2.8
19	3.2	3.2	2.8	2.8	2.8	2.8	3.2	17	4.2	3.2	2.8	2.8
20	3.2	3.2	2.8	2.8	2.8	2.8	4.2	7.2	3.7	3.2	2.8	3.2
21	3.2	3.2	2.8	2.8	2.8	2.8	2.8	5.8	3.7	3.2	2.8	3.2
22	3.2	5.0	2.8	2.8	5.8	3.2	2.8	3.2	3.7	3.2	2.8	3.2
23	3.2	3.7	2.8	2.8	5.0	2.8	2.8	2.8	3.7	3.2	2.8	2.8
24	3.2	3.2	2.8	2.8	4.2	2.8	2.8	3.7	4.2	3.2	2.8	2.8
25	3.2	3.2	2.8	2.8	2.8	5.0	2.8	2.8	13	3.2	2.8	2.8
26	3.2	3.2	2.8	2.8	7.2	2.8	2.8	2.8	5.8	3.2	3.2	2.8
27	3.2	3.2	2.8	2.8	3.2	2.8	2.8	8.6	4.2	3.2	7.2	2.8
28	3.2	2.8	2.8	2.8	3.2	5.0	2.8	43	4.2	2.8	7.2	2.8
29	3.2	2.8	2.8	4.2	11	2.8	2.8	.....	3.7	3.7	3.2	2.5
30	3.2	2.8	2.8	3.2	43	2.8	5.0	.....	2.8	5.8	2.8	2.8
31	3.2	3.2	.....	2.8	.....	2.8	5.0	.....	2.8	.....	2.8	.....

Monthly discharge of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.0	3.2	3.55	5.49	110	338
August	5.8	2.8	3.48	5.38	108	331
September	2.8	2.8	2.80	4.33	84	258
October	4.2	2.8	2.86	4.43	89	272
November	43	2.8	6.44	9.96	193	593
December	5.0	2.8	3.05	4.72	95	290
January	13	2.8	3.44	5.32	107	327
February	56	2.5	8.42	13.0	236	724
March	31	2.8	6.01	9.3	186	572
April	143	2.8	13.0	20.1	391	1,200
May	7.2	2.8	3.41	5.28	106	324
June	4.2	2.5	2.84	4.39	85	261
The year	143	2.5	4.90	7.58	1,790	5,490

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, 1918. August 12, 1911, to June 30, 1916, for old station, in tailrace of power house.

GAGE.—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.—1916–1918: Maximum stage recorded, 1.20 feet at 5.30 a. m. December 26, 1917 (discharge, 9 million gallons per day, or 14 second-feet); minimum stage recorded, 0.2 foot March 5–8, 1918 (discharge, 1.9 million gallons per day, or 2.9 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 8 well defined between 2 and 6 million gallons per day, excepting for last part of September and for October; observer removed grass from channel on September 24; curve used March 9 to June 30 fairly well defined. Operation of water-stage recorder satisfactory. Records fair, July, August, September, and November to February; poor for October and March to June.

Discharge measurements of Olowalu ditch near Olowalu, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
July 28	0.47	5.4	3.5
Feb. 6	.33	4.1	2.6
May 21	.76	7.3	4.7

Daily discharge, in million gallons, of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.7	4.0	3.0	2.2	2.2	5.1	3.7	4.0	6.6	6.2	6.2	4.8
2	3.7	4.0	3.0	2.2	2.2	4.4	3.7	3.7	7.0	6.2	5.8	4.8
3	3.7	3.7	3.0	2.4	2.2	3.7	3.0	3.7	7.0	6.6	5.8	4.8
4	3.0	3.7	3.0	2.2	3.0	3.0	3.0	3.4	4.4	6.2	6.2	4.8
5	3.0	3.7	3.0	2.2	2.7	3.0	3.0	3.4	1.9	6.2	6.2	4.8
6	4.0	3.4	3.0	2.4	2.7	3.0	3.0	3.0	1.9	6.6	6.2	4.8
7	4.0	3.4	3.0	2.4	6.2	5.1	2.7	2.7	1.9	6.6	5.8	4.4
8	3.7	3.0	3.0	2.2	3.7	4.8	6.6	3.0	1.9	6.6	5.8	4.0
9	3.7	3.7	3.0	2.2	3.4	3.0	6.2	6.2	4.0	6.6	5.4	3.7
10	3.4	3.7	3.0	2.2	2.4	3.0	5.4	6.6	4.4	6.6	5.4	3.7
11	3.4	4.4	3.0	2.2	2.4	3.0	5.8	7.0	5.8	6.6	5.4	3.7
12	3.7	4.8	3.0	2.7	2.4	2.7	5.8	7.4	6.6	6.2	5.4	5.8
13	3.7	4.4	3.0	2.4	2.2	2.7	5.4	7.0	5.8	5.8	5.4	6.2
14	3.7	3.7	3.7	2.2	2.2	2.7	4.8	6.2	5.1	5.4	5.1	5.8
15	3.7	3.7	3.4	2.2	2.2	2.7	4.8	6.2	4.4	4.8	4.8	6.2
16	4.0	3.7	3.7	2.4	2.2	2.7	4.0	7.0	4.4	4.8	5.1	6.2
17	4.0	3.7	3.4	2.4	2.4	2.7	4.0	7.0	3.7	5.4	5.1	5.8
18	4.0	3.4	3.0	2.2	2.4	2.7	5.4	6.2	2.7	6.2	5.1	5.8
19	4.0	3.4	3.0	2.2	2.2	2.4	6.6	7.0	2.4	6.6	5.1	5.1
20	4.0	3.4	3.0	2.2	2.4	2.7	6.2	7.0	2.4	6.2	4.8	4.8
21	3.7	3.7	3.0	2.2	2.2	2.7	5.4	3.0	3.4	6.2	4.8	5.1
22	3.7	4.4	3.0	2.2	2.7	2.7	4.8	4.4	5.1	6.2	5.1	4.8
23	3.7	4.8	2.7	2.2	3.0	2.7	4.8	4.4	5.8	5.8	5.1	4.4
24	3.4	4.0	2.7	2.2	3.4	2.7	4.4	4.0	6.2	5.4	4.8	4.4
25	3.4	3.4	2.4	2.2	2.4	9.0	4.0	4.0	6.6	5.4	4.8	4.0
26	3.4	3.7	2.4	2.2	4.4	9.0	4.0	4.0	6.6	5.1	5.1	5.1
27	3.4	3.7	2.4	2.2	5.1	8.6	4.0	4.0	6.6	4.8	5.1	5.1
28	3.4	3.4	2.4	2.2	3.7	8.6	4.0	5.4	6.6	4.8	5.1	5.1
29	3.4	3.4	2.2	2.4	5.1	7.0	3.7	.....	6.2	5.4	5.1	5.1
30	3.7	3.0	2.2	2.2	5.8	3.7	4.4	.....	6.2	6.2	4.8	5.4
31	3.4	3.4	.....	2.2	.....	5.8	4.0	.....	6.2	.....	4.8	.....

Monthly discharge of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.0	3.0	3.64	5.63	113	346
August	4.8	3.0	3.74	5.79	116	356
September	3.7	2.2	2.92	4.52	88	269
October	2.4	2.2	2.26	3.50	70	215
November	6.2	2.2	3.05	4.72	92	281
December	9.0	2.4	4.12	6.37	128	392
January	6.6	2.7	4.54	7.02	141	432
February	7.4	2.7	5.03	7.78	141	432
March	7.0	1.9	4.83	7.47	150	460
April	6.6	4.8	5.92	9.16	178	545
May	6.2	4.8	5.31	8.22	165	505
June	6.2	3.7	4.95	7.66	148	456
The year	9.0	1.9	4.18	6.47	1,530	4,690

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 June 30, 1918.

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, 2.44 feet at 10.30 a. m. April 3 (discharge, 120 million gallons per day, or 186 second-feet); minimum stage recorded, 0.45 foot frequently in July to February (discharge, 3.2 million gallons per day, or 5.0 second-feet).

1911–1918: Maximum stage recorded, 9.0 feet estimated gage height of flood of January 18, 1916; discharge not estimated; minimum stage recorded, 0.60 foot October 4 and 5, 1913 (discharge, 2.3 million gallons per day, or 3.6 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 10 fairly well defined. Rating curves used March 11 to April 9 and April 10 to June 30 poorly defined. Operation of water-stage recorder satisfactory. Records fair July 1 to March 10; poor March 11 to June 30.

Discharge measurements of Ukumehame Stream near Olowalu, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 27	0.47	5.7	3.7	Mar. 30	0.49	13.3	8.6
Aug. 30	.47	5.1	3.3	May 9	.48	10.6	6.9
Oct. 7	.45	4.8	3.1	June 8	.41	7.6	4.9
Feb. 9	.92	23	15				

Daily discharge, in million gallons, of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.9	3.9	3.2	3.2	3.2	4.9	3.9	3.9	11	7.6	7.5	6.0
2	3.9	3.9	3.2	3.2	3.2	3.9	3.9	3.9	11	10	7.5	6.0
3	3.9	3.2	3.2	3.2	3.2	3.9	3.9	3.9	9.5	44	6.0	4.8
4	3.9	3.2	3.2	3.2	3.2	3.2	3.9	3.9	12	20	14	4.8
5	3.9	3.2	3.2	3.2	3.2	3.2	3.9	3.9	9.5	20	12	4.8
6	3.9	3.2	3.2	3.2	3.2	3.2	3.9	3.9	8.2	34	9.1	4.8
7	3.9	3.2	3.2	3.2	7.0	4.9	3.2	3.2	5.8	16	7.5	4.8
8	3.9	3.2	3.2	3.2	3.9	3.9	11	3.2	4.9	16	7.5	4.8
9	3.9	3.2	3.2	3.2	3.2	3.2	5.8	12	4.9	32	7.5	4.8
10	3.9	3.2	3.2	3.2	3.2	3.2	4.9	11	7.0	44	9.1	4.8
11	3.9	3.9	3.2	3.2	3.2	3.2	8.2	29	27	27	7.5	4.8
12	3.2	3.9	3.2	3.2	3.2	3.2	5.8	19	34	18	9.1	11
13	3.2	3.9	3.9	3.2	3.2	3.2	5.8	9.5	16	14	9.1	7.5
14	3.2	3.2	3.9	3.2	3.2	3.2	4.9	7.0	12	16	7.5	6.0
15	3.2	3.2	3.2	3.2	3.2	3.2	4.9	5.8	10	18	7.5	14
16	3.2	3.2	3.2	3.2	3.2	3.2	3.9	27	10	12	7.5	11
17	3.2	3.2	3.2	3.2	3.2	3.2	3.9	34	11	11	6.0	7.5
18	3.2	3.2	3.2	3.2	3.2	3.2	7.0	21	12	11	6.0	6.0
19	3.2	3.2	3.2	3.2	3.2	3.2	5.8	27	8.9	9.1	6.0	6.0
20	3.2	3.2	3.2	3.2	3.2	3.2	8.2	16	7.6	9.1	6.0	11
21	3.2	3.2	3.2	3.2	3.2	3.2	5.8	12	7.6	9.1	6.0	11
22	3.2	4.9	3.2	3.2	3.9	3.2	4.9	8.2	7.6	7.5	6.0	9.1
23	3.2	3.9	3.2	3.2	3.9	3.2	4.9	7.0	7.6	7.5	6.0	7.5
24	3.2	3.9	3.2	3.2	3.9	3.9	3.9	5.8	8.9	7.5	6.0	6.0
25	3.2	3.2	3.2	3.2	3.2	8.2	3.9	4.9	30	7.5	6.0	6.0
26	3.2	3.2	3.2	3.2	5.8	7.0	4.9	4.9	14	7.5	6.0	6.0
27	3.2	3.2	3.2	3.2	4.9	5.8	3.9	4.9	10	6.0	6.0	6.0
28	3.2	3.2	3.2	3.2	3.9	11	3.9	11	8.9	6.0	7.5	6.0
29	3.2	3.2	3.2	3.2	3.9	7.0	3.9	.....	7.6	9.1	6.0	4.8
30	3.2	3.2	3.2	3.2	5.8	5.8	7.0	.....	7.6	12	6.0	7.5
31	3.2	3.2	.....	3.2	.....	4.9	4.9	.....	7.6	.....	6.0	.....

Monthly discharge of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.9	3.2	3.45	5.34	107	328
August	4.9	3.2	3.41	5.28	106	324
September	3.9	3.2	3.25	5.03	97	299
October	3.2	3.2	3.20	4.95	99	304
November	7.0	3.2	3.70	5.72	111	341
December	11	3.2	4.28	6.62	133	407
January	11	3.2	5.12	7.92	159	487
February	34	3.2	11.0	17.0	307	945
March	34	4.9	11.3	17.5	350	1,080
April	44	6.0	15.6	24.1	468	1,440
May	14	6.0	7.34	11.4	227	698
June	14	4.8	6.84	10.6	205	630
The year	44	3.2	6.49	10.0	2,370	7,270

WEST KOPILIULA STREAM NEAR KEANAE, MAUI.

LOCATION.—600 feet above Koolau ditch crossing and highway bridge, 4½ miles by trail east of Upper Keanae, and 6 miles east of Keanae post office.

RECORDS AVAILABLE.—January 3, 1914, to September 17, 1917, when station was discontinued.

GAGE.—Friez water-stage recorder.

DICHARGE MEASUREMENTS.—Made by wading or from footbridge 300 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a large pool at foot of falls; banks rock and nearly vertical. Control at outlet of pool composed of large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.95 feet at 6 p. m. August 22 (discharge, about 29 million gallons per day, or 45 second-feet); minimum stage recorded, 0.6 foot September 15–17 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

1914–1918: Maximum stage recorded, 9.25 feet at 5.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded, September 15–17, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 500 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

The following discharge measurement was made by H. A. R. Austin:

September 7, 1917: Gage height, 0.72 foot; discharge, 1.55 second-feet, or 1.0 million gallons per day.

Daily discharge, in million gallons, of West Kopiliula Stream near Keanae, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	3.3	1.8	1.0	11	2.8	2.3	1.0	21	1.8	1.8	.....
2	2.8	2.3	1.0	12	2.3	2.3	1.4	22	2.8	9.0	.....
3	3.3	1.8	1.0	13	2.3	2.8	1.8	23	3.3	1.2	.....
4	3.8	1.8	1.0	14	2.3	2.3	1.0	24	2.8	3.8	.....
5	5.0	1.4	1.0	15	2.3	1.8	.6	25	2.3	1.4	.....
6	3.3	1.4	1.0	16	2.3	1.8	.6	26	2.3	1.4	.....
7	2.8	1.4	1.0	17	2.3	1.4	.6	27	1.8	1.0	.....
8	2.8	1.4	1.0	18	1.8	1.4	.....	28	1.8	1.0	.....
9	3.8	1.8	1.0	19	1.8	1.4	.....	29	1.8	1.0	.....
10	3.8	1.8	1.0	20	1.8	1.4	.....	30	2.3	1.0	.....
								31	1.8	1.0	.....

Monthly discharge of West Kopiliula Stream near Keanae, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.0	1.8	2.63	4.07	82	250
August	12	1.0	2.26	3.50	70	215
September 1–17	1.8	.6	1.0	1.55	17	52
The period	.....	.....	.....	.....	169	517

EAST WAILUAIKI STREAM NEAR KEANAE, MAUI.

LOCATION.—1,000 feet above Koolau ditch crossing and trail, 3¾ miles east of Upper Keanae, and about 6¼ miles east of Keanae post office.

RECORDS AVAILABLE.—December 21, 1913, to October 23, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder, installed April 17, 1914, to replace original Friez recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 800 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a large pool at foot of falls; banks are nearly vertical walls of rock. Control composed of large boulders and rock ledge; fairly permanent.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 1.35 feet at 4 p. m. July 5 (discharge, about 17 million gallons per day, or 26 second-feet); minimum stage recorded, 0.5 foot October 22 and 23 (discharge, 1.0 million gallons per day, or 1.55 second-feet).

1913–1917: Maximum stage recorded, 8.35 feet at 8 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 1,900 million gallons per day, or 2.940 second-feet); minimum stage recorded (see preceding paragraph).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 15 million gallons per day. Operation of water-stage recorder unsatisfactory August 5 to September 7; no gage height record August 6–23 and August 26 to September 6, only part record August 5, 24, 25, and September 7; discharge estimated from records of flow of nearby streams and from gage heights for parts of days. Records fair.

The following discharge measurement was made by H. A. R. Austin:

September 7, 1917: Gage height, 0.68 foot; discharge, 2.9 second-feet, or 1.9 million gallons per day.

Daily discharge, in million gallons, of East Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	5.0	3.2	2.6	1.4	16	4.1	2.6	1.4	1.2
2	5.0	4.1	2.0	1.2	17	3.2	2.0	1.4	1.2
3	6.0	3.2	2.0	1.2	18	3.2	2.0	1.4	1.2
4	8.2	3.2	2.0	1.2	19	2.6	2.0	1.4	1.2
5	11.0	2.6	2.0	1.2	20	2.6	2.6	1.2	1.2
6	7.0	2.6	2.0	1.2	21	2.6	2.6	1.2	1.2
7	6.0	2.6	2.0	1.2	22	5.0	30	1.2	1.0
8	6.0	2.6	2.0	1.0	23	5.0	9.4	1.2	1.0
9	7.0	3.2	1.7	1.0	24	3.2	3.2	1.2	.....
10	8.2	3.2	1.7	1.2	25	3.2	3.2	1.4	.....
11	6.0	3.2	1.4	1.2	26	4.1	3.2	1.7	.....
12	5.0	3.2	2.0	1.2	27	3.2	3.2	1.7	.....
13	5.0	4.1	2.0	1.2	28	3.2	2.6	1.7	.....
14	4.1	4.1	1.4	1.2	29	3.2	2.6	1.7	.....
15	4.1	2.6	1.4	1.2	30	4.1	2.6	1.7	.....
					31	4.1	2.6	.....	.....

Monthly discharge of East Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	11	2.6	4.85	7.50	150	461
August	30	2.0	4.00	6.19	124	381
September	2.6	1.2	1.66	2.57	50	153
October 1-23	1.4	1.0	1.17	1.81	27	83
The period	.....	.....	.....	.....	351	1,080

WEST WAILUAIKI STREAM NEAR KEANAE, MAUI.

LOCATION.—500 feet above Koolau ditch crossing and trail bridge, 3 miles east of Upper Keanae, and 5½ miles east of Keanae post office.

RECORDS AVAILABLE.—January 1, 1914, to October 22, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 100 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a large deep pool at foot of low waterfall; banks are nearly vertical walls of rock to above high water. Control at outlet of pool composed of rock ledge and large boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.35 feet at 4.30 p. m. August 22 (discharge, about 49 million gallons per day, or 76 second-feet); minimum stage recorded, 0.6 foot October 8–12 and 18–22 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1913–1917: Flood of January 18, 1916, carried away gage shelter and must have reached a stage of about 13 feet (discharge, possibly 4,000 million gallons per day, or 6,190 second-feet); minimum stage recorded in October, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 600 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

The following discharge measurement was made by H. A. R. Austin:

July 24, 1917: Gage height, 0.99 foot; discharge, 5.9 second-feet, or 3.8 million gallons per day.

Daily discharge, in million gallons, of West Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	4.2	2.5	1.6	1.2	16	3.0	2.0	0.8	0.8
2	4.2	3.0	1.6	.8	17	2.5	1.6	.6	.6
3	5.0	2.5	1.2	.6	18	2.5	1.6	.6	.4
4	6.5	2.0	1.2	.6	19	2.0	1.6	.6	.4
5	8.5	2.0	1.2	.6	20	2.5	2.0	.6	.4
6	5.0	2.0	1.2	.8	21	2.5	2.0	.6	.4
7	4.2	2.0	1.2	.6	22	5.8	2.3	.6	.4
8	3.5	2.0	1.2	.4	23	7.5	7.5	.6	.....
9	5.8	2.5	.8	.4	24	4.2	3.5	.6	.....
10	6.5	2.5	.8	.4	25	3.5	3.0	1.2	.....
11	4.2	2.5	.8	.4	26	3.5	2.5	2.0	.....
12	3.5	2.5	2.0	.4	27	2.5	2.0	1.6	.....
13	3.0	3.0	2.0	.6	28	2.0	2.0	2.0	.....
14	3.0	3.0	1.2	.6	29	2.0	2.0	2.5	.....
15	3.0	2.0	.8	.6	30	2.5	1.6	2.0	.....
					31	2.5	1.6	.....	.....

Monthly discharge of West Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	8.5	2.0	3.91	6.05	121	372
August	23	1.6	3.08	4.77	96	293
September	2.5	.6	1.19	1.84	36	110
October 1–22	1.2	.4	.56	.87	12	38
The period					265	813

EAST WAILUANUI STREAM NEAR KEANAE, MAUI.

LOCATION.—1,000 feet above Koolau ditch crossing, 2½ miles east of Upper Keanae, and 5 miles east of Keanae post office.

RECORDS AVAILABLE.—January 1, 1914, to October 23, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder.

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

CHANNEL AND CONTROL.—Channel at gage a small deep pool at foot of rapids; right bank vertical wall of rock; left bank steep and high. Control at outlet is ledge of rock; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.83 feet at 1 p. m. August 22 (discharge, 16 million gallons per day, or 25 second-feet); minimum stage recorded, 0.7 foot October 14 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

1914–1917: Maximum stage recorded, 5.1 feet at 5.45 a. m. December 23, 1916 (discharge, computed from extension of rating curve, about 430 million gallons per day, or 665 second-feet); minimum stage recorded October 14, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

The following discharge measurement was made by H. A. R. Austin:

September 7, 1917: Gage height, 0.89 foot; discharge, 0.95 second-foot, or 0.6 million gallons per day.

Daily discharge, in million gallons, of East Wailuanui Stream near Keanae, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	1.6	1.0	0.7	0.3	16	1.3	0.7	0.5	0.25
2	1.3	1.3	.7	.25	17	1.3	.7	.5	.25
3	2.0	1.0	.7	.25	18	1.0	.7	.3	.25
4	2.5	.7	.7	.25	19	1.0	.7	.3	.25
5	3.7	.7	.7	.25	20	1.0	.7	.3	.25
6	2.0	.7	.7	.25	21	1.0	.7	.3	.25
7	1.6	.7	.7	.25	22	1.6	8.0	.3	.25
8	1.6	.7	.7	.25	23	1.6	1.6	.3	.3
9	2.0	.7	.7	.25	24	1.0	1.3	.3	.....
10	2.0	.7	.7	.25	25	1.3	1.3	.5	.....
11	1.6	1.0	.5	.25	26	1.6	1.3	.3	.....
12	1.3	1.3	.7	.25	27	1.0	1.3	.3	.....
13	1.3	1.6	.7	.25	28	1.0	1.0	.3	.....
14	1.3	1.3	.5	.2	29	1.0	1.0	.3	.....
15	1.3	1.0	.5	.25	30	1.0	1.0	.3	.....
					31	1.0	.7	.....	.....

Monthly discharge of East Wailuanui Stream near Keanae, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.7	1.0	1.48	2.29	46	141
August	8.0	.7	1.20	1.86	37	114
September	.7	.3	.50	.77	15	46
October 1–23	.3	.2	.25	.39	6	18
The period					104	319

KOOLAU DITCH NEAR KEANAE, MAUI.

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

RECORDS AVAILABLE.—November 2, 1917, to June 30, 1918. Discharge January 1, 1910, to December 31, 1912, computed from gage heights obtained by East Maui Irrigation Co.

GAGE.—Friez water-stage recorder installed November 2, 1917. East Maui Irrigation Co. has obtained staff gage readings at this location since about 1904.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

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

EXTREMES OF DISCHARGE.—1910–1912 and 1917–1918: Maximum stage recorded, 6.06 feet at 6 a. m. November 30, 1917 (discharge, 142 million gallons per day, or 220 second-feet); minimum stage recorded, water occasionally shut off.

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

REGULATION.—By gates at intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent for published record. Rating curve well defined between 8 and 50 million gallons per day. Operation of water-stage recorder satisfactory, except that for short periods when intake pipe became partly clogged and December 7–9 no record, discharge interpolated. Records fair.

Discharge measurements of Koolau ditch near Keanae, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Dec. 8	2.12	55	35
Jan. 31	.90	12.8	8.3
May 15	1.66	38	25

Daily discharge, in million gallons, of Koolau ditch near Keanae, Maui, for the year ending June 30, 1918.

Day.	Nov.	Dec.	Jan.	Feb.	Apr.	May.	June.
1	.....	68	24	10	.....	22	12
2	.....	78	20	6.6	.....	16	10
3	.....	65	22	5.8	.....	21	9.2
4	41	54	22	5.0	.....	27	8.4
5	21	47	8.4	5.0	.....	21	7.5
6	32	45	2.6	.....	.....	15	6.6
7	40	41	2.2	.....	.....	14	5.8
8	65	38	7.5	.....	.....	12	5.8
9	34	35	5.8	.....	.....	11	3.2
10	28	32	7.5	.....	.....	16	2.6
11	21	30	5.0	.....	.....	12	9.2
12	16	48	1.2	.....	.....	20	37
13	15	58	1.0	.....	.....	20	21
14	14	66	2.2	.....	.....	19	22
15	13	52	3.2	.....	.....	24	37
16	13	37	13	.....	.....	22	44
17	12	33	3.8	.....	.....	19	36
18	18	30	4.4	.....	.....	15	26
19	33	27	4.4	.....	.....	12	20
20	37	33	4.4	.....	.....	9.2	21
21	30	49	4.4	.....	.....	10	18
22	71	56	12	.....	.....	11	35
23	99	33	5.8	.....	.....	12	22
24	75	25	12	.....	.....	14	19
25	78	20	12	.....	.....	12	21
26	74	30	6.6	.....	.....	13	20
27	59	27	6.6	.....	12	19	22
28	60	25	5.0	.....	19	16	19
29	104	22	6.6	.....	19	6.6	14
30	71	21	20	.....	24	8.4	12
31	.....	20	12	.....	.....	14	.....

Monthly discharge of Koolau ditch near Keanae, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
November 4–30	104	12	43.5	67.3	1,170	3,600
December	78	20	40.2	62.2	1,240	3,820
January	24	1.0	8.63	13.4	268	821
February 1–5	10	5.0	6.48	10.0	32	99
May	27	6.6	15.6	24.1	483	1,480
June	44	2.6	18.2	28.2	546	1,680

HONOMANU STREAM NEAR KEANAE, MAUI.

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

RECORDS AVAILABLE.—November 15, 1913, to June 30, 1918.

GAGE.—Stevens water-stage recorder.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.62 feet at 6.30 p. m., April 2 (discharge, about 1,120 million gallons per day, or 1,740 second-feet); minimum stage recorded, 1.9 feet September 18–24 and October 4, 5, and 25–27 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1913–1918: Maximum stage recorded, 9.9 feet at 9 p. m. May 1, 1916 (discharge computed from extension of rating curve, about 1,200 million gallons per day, or 1,860 second-feet); minimum stage recorded, 2.20 feet April 7 and 8, 1915 (discharge, 0.25 million gallons per day, or 0.4 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 2 and 20 million gallons per day applicable July 1 to November 29, November 30 to April 2, and April 3 to June 30. Operation of water-stage recorder satisfactory. Records poor.

Discharge measurements of Honomanu Stream near Keanae, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 6	1.95	0.85	0.55	Mar. 5	3.22	31	20
Dec. 7	2.27	4.0	2.6	May 14	2.83	16.9	11
Jan. 31	2.84	16.9	11				

Daily discharge, in million gallons, of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.3	1.7	0.9	0.9	2.5	18	1.7	9.7	41	25	12	9.7
2	2.9	5.7	.7	.7	9.7	7.1	1.4	5.0	134	271	8.7	8.7
3	2.9	2.5	.7	.55	3.3	7.1	1.4	3.8	195	425	18	6.4
4	4.3	1.7	.7	.4	14	7.1	2.1	3.3	83	59	28	5.0
5	7.9	1.4	.55	.4	5.7	3.8	2.5	2.9	28	51	12	4.3
6	3.3	1.4	.55	2.9	3.8	3.3	2.5	2.9	13	179	7.1	4.3
7	2.5	1.4	.55	1.1	35	2.5	1.4	2.9	35	51	6.4	3.8
8	2.1	1.4	.55	.55	23	2.9	6.4	7.9	20	51	5.7	3.8
9	2.9	2.9	.55	.55	9.7	2.9	18	307	16	435	6.4	4.3
10	4.3	2.5	.55	1.1	3.3	2.1	3.8	114	47	375	21	15
11	2.5	2.5	.55	2.5	2.5	2.1	89	68	227	78	8.7	30
12	2.1	3.3	.7	.9	2.1	2.9	7.9	89	78	21	25	55
13	1.7	5.7	1.7	.7	1.7	6.4	3.8	13	25	15	51	12
14	1.7	3.3	1.1	.7	1.7	5.0	2.9	7.1	28	51	14	7.9
15	1.7	2.5	.7	.7	1.4	9.7	3.3	5.0	14	18	16	95
16	1.7	2.1	.7	3.8	1.4	3.8	15	4.3	47	11	32	47
17	1.7	1.7	.55	1.7	1.1	2.9	4.3	44	30	7.9	14	30
18	1.4	1.4	.4	.9	1.1	2.5	4.3	7.9	11	7.1	7.1	8.7
19	1.4	1.4	.4	.7	1.4	2.5	4.3	30	7.1	6.4	6.4	6.4
20	1.4	1.7	.4	.7	2.1	5.7	4.3	289	5.7	9.7	5.7	7.1
21	1.4	2.1	.4	.55	1.4	3.3	3.8	59	4.3	11	6.4	8.7
22	3.8	32	.4	.55	15	13	13	14	3.8	11	7.1	18
23	7.9	5.7	.4	.55	18	6.4	6.4	9.7	3.8	6.4	7.1	8.7
24	2.9	2.5	.4	.55	30	3.3	7.1	6.4	7.9	5.7	41	7.1
25	2.1	1.7	.7	.4	12	2.5	6.4	5.0	253	5.7	38	7.1
26	1.7	1.7	1.4	.4	7.1	2.1	3.8	4.3	35	6.4	13	7.1
27	7.1	1.4	1.4	.4	5.0	2.1	4.3	6.4	12	14	35	7.9
28	4.3	1.4	1.1	.7	5.0	1.7	2.9	68	9.7	12	89	7.9
29	1.7	1.1	1.7	2.5	51	1.7	2.9	.....	6.4	20	89	9.7
30	1.7	1.1	1.7	3.8	187	1.7	44	.....	8.7	32	12	9.7
31	1.7	1.1	.....	1.7	.....	1.4	14	.....	16	.....	8.7	.....

Monthly discharge of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.9	1.4	2.90	4.49	90	276
August	32	1.1	3.23	5.00	100	307
September	1.7	.4	.77	1.19	23	71
October	3.8	.4	1.11	1.72	35	106
November	187	1.1	15.3	23.7	458	1,410
December	18	1.4	4.50	6.96	140	428
January	89	1.4	9.32	14.4	289	887
February	307	2.9	42.5	65.8	1,190	3,650
March	253	3.8	46.6	72.1	1,450	4,430
April	435	5.7	75.7	117	2,270	6,970
May	89	5.7	21.0	32.5	652	2,000
June	95	3.8	15.2	23.6	456	1,400
The year	435	.4	19.6	30.3	7,150	21,900

HAIPUAENA STREAM NEAR HUELO, MAUI.

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

RECORDS AVAILABLE.—October 19, 1913, to June 30, 1918; 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 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.—1913–1918: Maximum stage recorded, 5.92 feet at 3.15 a. m. April 3, 1918 (discharge, computed from extension of rating curve, 430 million gallons per day, or 666 second-feet); minimum stage recorded, 0.1 foot October 26, 1917 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 2 million and 150 million gallons per day applicable July 1, July 26 to November 29, and February 9 to June 30, November 30 to February 8. Operation of water-stage recorder unsatisfactory; no gage height record July 2–25, November 3, 4, January 30 to February 26, and May 6–15; discharge estimated from flow of Puohakamoa Stream, except November 3 and 4, which was interpolated. Records fair when water-stage recorder was operating; poor for other periods.

Discharge measurements of Haipuaena Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
July 25	0.48	2.8	1.8
Dec. 7	.59	3.2	2.1
Mar. 6	.96	12.4	8.0

Daily discharge, in million gallons, of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.0	2.2	1.6	1.3	1.0	7.6	2.2	8.6	15	20	9.5	4.5
2	3.0	4.0	1.3	1.0	5.2	4.0	1.6	3.4	49	123	6.8	4.5
3	3.0	2.2	1.3	1.0	4.8	4.0	2.2	3.0	62	230	12	4.0
4	5.2	1.8	1.3	1.0	4.4	3.4	2.5	2.5	35	22	24	3.4
5	9.5	1.6	1.3	1.0	4.0	2.5	2.2	2.2	16	26	11	3.4
6	4.5	1.6	1.2	1.8	3.4	2.2	1.8	2.2	8.6	81	9.5	3.0
7	3.4	1.8	1.2	1.2	20	2.2	1.6	2.2	15	26	8.6	3.0
8	3.0	1.8	1.2	1.0	11	2.2	5.2	3.0	11	30	7.6	3.0
9	3.4	2.5	1.2	.9	6.8	1.8	9.5	136	12	110	5.9	3.4
10	4.5	2.2	1.3	1.2	3.4	1.8	3.0	46	26	170	13	9.5
11	3.0	2.2	1.0	1.8	2.5	1.8	40	35	101	43	7.6	16
12	2.5	2.5	1.3	1.2	2.5	2 2	5.2	40	46	15	13	38
13	2.2	4.0	1.8	1.0	2.2	3.4	3.4	13	15	11	38	9.5
14	2.2	3.0	1.6	.9	1.8	4.5	3.0	8.6	13	28	9.5	6.8
15	2.2	2.2	1.2	1.0	1.8	4.0	4.0	6.8	8.6	20	13	43
16	2.2	1.8	1.0	2.2	1.8	2.5	9.5	5.2	30	9.5	20	24
17	2.2	1.8	1.0	1.3	1.6	1.8	3.4	13	22	7.6	11	16
18	1.8	1.6	1.0	1.0	1.6	1.8	3.0	5.9	8.6	6.8	6.8	7.6
19	1.8	1.6	1.0	.9	1.8	1.8	3.0	12	5.9	5.9	5.2	5.9
20	1.8	1.8	1.0	.9	1.8	4.5	3.4	85	5.2	6.8	4.5	5.9
21	1.8	1.8	1.0	.8	1.6	5.2	2.5	32	4.5	8.6	4.0	5.9
22	3.0	16	1.0	.8	9.5	9.6	6.8	13	4.0	11	4.5	12
23	5.9	4.5	1.0	.9	14	4.0	4.0	9.5	4.0	5.9	5.2	7.6
24	2.5	2.5	1.0	.9	14	3.0	4.5	9.5	5.2	5.2	16	6.8
25	2.2	2.2	1.6	.8	6.8	2.2	4.5	7.6	101	4.5	16	6.8
26	2.2	2.2	4.5	.7	5.2	2.2	3.4	5.2	22.	5.2	5.2	5.9
27	3.4	1.8	5.9	.8	3.4	1.8	3.4	5.2	8.6	8.6	16	7.6
28	3.0	1.8	1.3	1.0	4.0	1.8	2.5	30	7.6	8.6	38	6.8
29	1.8	1.6	1.8	1.6	30	1.6	3.0	.....	5.9	11	9.5	6.8
30	1.8	1.6	1.8	2.5	52	1.6	13	.....	7.6	20	5.9	7.6
31	1.8	1.6	.....	1.2	.....	1.6	7.6	.....	12	.....	5.2	.....

Monthly discharge of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	9.5	1.8	3.06	4.73	95	291
August	16	1.6	2.64	4.08	82	251
September	5.9	1.0	1.52	2.35	46	140
October	2.5	.7	1.15	1.78	36	109
November	52	1.0	7.46	11.5	224	687
December	9.6	1.6	3.05	4.72	95	290
January	40	1.6	5.32	8.23	165	506
February	136	2.2	19.5	30.2	546	1,680
March	101	4.0	22.2	34.3	687	2,110
April	230	4.5	36.0	55.7	1,080	3,310
May	38	4.0	11.7	18.1	362	1,110
June	43	3.0	9.61	14.9	288	885
The year	230	.7	10.2	15.8	3,710	11,400

PUOHAKAMOA STREAM NEAR HUELO, MAUI.

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

RECORDS AVAILABLE.—June 13, 1913, to June 30, 1918 (new station); December 18, 1910, to June 18, 1913 (old station).

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

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

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

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

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

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 million gallons per day. Operation of water-stage recorder satisfactory except August 29 to December 7, during which time water was below intake, station being reconstructed or water-stage recorder not operating; discharge estimated for this period from flow of Haipuaena Stream. Record fair between 2 and 100 million gallons per day when water-stage recorder was operating properly; poor at other times.

Discharge measurements of Puohakamoa Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 25	1.02	3.9	2.5	Jan. 30	1.96	17.2	11
Sept. 6	.67	1.6	1.0	May 16	2.57	41	27
Dec. 7	1.27	6.2	4.0	16	3.02	93	60

Daily discharge, in million gallons, of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.4	3.0	1.2	1.2	0.7	13	4.0	12	26	46	19	12
2	4.0	6.0	1.2	.7	7.8	7.8	3.0	6.8	87	236	13	12
3	4.4	3.4	1.2	.7	7.2	7.8	3.7	5.6	132	436	20	10
4	7.3	2.4	1.2	.7	6.6	6.8	5.2	4.8	80	63	54	7.8
5	13	2.4	1.2	.7	6.0	5.2	4.4	4.4	42	63	29	7.3
6	6.8	2.4	1.0	2.4	5.2	4.4	3.0	4.4	18	220	14	6.8
7	4.8	2.4	1.0	1.0	35	4.4	2.4	4.0	29	74	12	6.0
8	4.4	2.4	1.0	.7	15	3.7	6.8	6.0	24	80	11	5.6
9	5.2	3.7	1.0	.55	10	3.7	19	336	22	272	8.8	6.8
10	6.8	2.7	1.2	1.0	5.2	3.4	5.6	108	50	436	32	14
11	4.0	3.0	.7	2.4	3.7	3.0	80	74	263	116	15	24
12	3.4	4.0	1.2	1.0	3.7	4.0	11	94	108	42	32	80
13	3.0	6.8	2.4	.7	3.0	7.3	6.4	19	35	29	94	26
14	3.0	4.4	1.9	.55	2.4	8.8	5.2	12	29	63	24	13
15	3.0	2.4	1.0	.7	2.4	7.3	5.6	9.4	19	54	29	68
16	3.0	2.4	.7	3.0	2.4	4.4	19	7.8	68	24	46	50
17	2.7	2.4	.7	1.2	1.9	3.7	6.4	20	50	19	22	42
18	2.4	2.2	.7	.7	1.9	3.4	5.6	8.8	18	15	14	15
19	2.4	2.2	.7	.55	2.4	3.0	5.6	18	12	13	12	12
20	2.4	2.2	.7	.55	2.4	8.8	6.4	220	10	15	9.4	10
21	2.4	2.4	.7	.45	1.9	7.8	4.8	68	8.8	18	8.8	12
22	4.4	26	.7	.45	13	20	8.8	19	7.8	22	10	18
23	8.8	6.0	.7	.55	20	8.8	6.8	14	7.3	13	11	15
24	3.7	3.0	.7	.55	20	6.0	6.8	14	8.8	11	19	12
25	2.7	3.0	1.9	.45	10	4.8	7.8	11	245	9.4	38	12
26	2.4	2.4	6.8	.4	7.8	4.0	5.2	8.3	50	9.4	13	12
27	3.7	2.4	6.8	.45	7.2	3.7	5.2	9.4	20	16	38	12
28	4.4	2.4	1.2	.7	6.0	3.0	4.4	58	15	16	87	11
29	2.2	1.9	2.4	1.9	58	3.0	4.0	.....	12	19	26	12
30	2.4	1.9	2.4	3.7	156	2.7	26	.....	13	46	16	13
31	2.4	1.9	.....	1.0	.....	2.4	14	.....	24	.....	13	.....

Monthly discharge of Puohokamoa Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	13	2.2	4.19	6.48	130	399
August	26	1.9	3.75	5.80	116	357
September	8.8	.7	1.61	2.49	48	148
October	3.7	.4	1.02	1.58	32	97
November	156	.7	14.1	21.8	423	1,300
December	20	2.4	3.81	8.99	180	553
January	80	2.4	9.75	15.1	302	928
February	336	4.0	42.0	65.0	1,180	3,610
March	263	7.3	49.5	76.6	1,530	4,710
April	436	9.4	83.2	129	2,500	7,660
May	94	8.8	25.5	39.5	790	2,430
June	80	5.6	18.6	28.8	557	1,710
The year	436	.4	21.3	33.0	7,790	23,900

ALO STREAM NEAR HUELO, MAUI.

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

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1918.

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

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.91 feet at 6.30 a. m. April 3 (discharge, about 490 million gallons per day, or 760 second-feet); minimum stage recorded, 0.35 foot September 24 and frequently in October (discharge, 0.3 million gallons per day, or 0.5 second-foot).

1910–1918: Maximum stage recorded, 4.35 feet at 7 p. m. December 9, 1916 (discharge, computed from extension of rating curve, approximately 550 million gallons per day, or 850 second-feet); minimum stage recorded, 1.34 feet (old datum) November 4, 1911 (discharge, 0.06 million gallons per day, or 0.1 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 50 million gallons per day. Operation of water-stage recorder satisfactory except December 20–26; discharge estimated from records of flow of neighboring stations. Record fair between 2 and 50 million gallons per day when water-stage recorder was operating; poor at other times.

Discharge measurements of Alo Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 5	0.41	0.65	0.4	Mar. 6	0.83	6.3	4.1
Dec. 6	.61	2.0	1.3	Apr. 7	1.10	12.7	8.2

Daily discharge, in million gallons, of Alo Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.1	1.1	0.6	0.4	0.4	3.5	2.3	3.5	1.8	18	3.5	2.9
2	.8	.6	.6	.4	1.4	2.3	1.1	2.3	7.6	134	2.9	2.3
3	1.1	.6	.6	.4	.6	2.3	2.9	1.8	5.7	95	5.7	1.8
4	1.8	.6	.4	.3	1.4	1.8	3.5	1.4	16	10	21	1.8
5	3.5	.6	.4	.3	.8	1.4	1.8	1.4	8.7	21	4.9	1.4
6	1.4	.6	.4	.4	.6	1.4	1.4	1.4	4.2	47	2.9	1.4
7	1.1	.8	.4	.3	2.3	1.1	1.1	1.4	4.9	12	2.3	1.1
8	1.1	.6	.6	.3	1.4	1.1	4.2	2.3	4.9	12	1.8	1.4
9	1.4	1.1	.6	.3	1.1	1.1	3.5	126	8.7	88	1.8	1.8
10	1.1	.6	.6	.3	.8	.8	2.3	12	18	118	4.9	7.6
11	.8	1.1	.4	.3	.8	.8	14	12	95	12	2.3	5.7
12	.8	1.1	.8	.3	.6	1.1	3.5	7.6	47	6.5	5.7	38
13	.8	1.8	.8	.3	.6	1.4	2.3	3.5	8.7	6.5	16	5.7
14	.8	.8	.6	.3	.6	2.9	1.8	2.9	6.5	18	4.9	3.5
15	.8	.6	.4	.8	.6	1.1	3.5	2.3	6.5	7.6	10	18
16	.8	.6	.4	.6	.6	.8	4.2	1.8	34	4.9	7.6	7.6
17	.8	.6	.4	.4	.4	.8	1.8	4.2	7.6	4.2	4.9	5.7
18	.6	.6	.4	.3	.6	.8	1.8	1.8	3.5	2.9	3.5	3.5
19	.6	.6	.4	.3	.6	.8	1.4	6.5	2.3	2.3	2.9	2.9
20	.6	.6	.4	.3	.6	6.5	2.3	57	1.8	4.2	2.3	2.9
21	.6	.6	.4	.4	.6	1.8	1.4	10	1.4	4.2	2.3	2.9
22	.8	6.5	.3	.3	.8	4.2	2.9	2.9	1.4	5.7	2.3	4.9
23	1.4	1.4	.4	.4	2.9	2.9	1.4	1.8	1.4	2.9	4.2	4.2
24	.6	1.1	.3	.3	2.9	2.3	4.2	1.4	5.7	2.3	2.3	2.9
25	.6	.8	.4	.3	1.1	1.8	3.5	1.1	62	1.8	2.9	2.9
26	.6	.8	.4	.3	2.9	1.4	2.3	1.4	7.6	1.8	2.3	1.8
27	.6	.8	.6	.3	1.4	1.4	1.8	1.4	4.2	4.9	4.9	2.3
28	.4	.8	.6	.4	1.4	1.1	1.4	3.5	2.9	4.2	27	2.9
29	.6	.6	.8	.6	5.7	1.1	1.8	.....	2.3	4.9	4.2	1.8
30	.6	.6	.8	1.1	14	1.1	4.9	.....	5.7	10	3.5	3.5
31	.6	.6	.....	.4	.....	.8	3.5	.....	10	.....	2.9	.....

Monthly discharge of Alo Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.5	0.4	0.94	1.45	29	89
August	6.5	.6	.97	1.50	30	92
September	.8	.3	.51	.79	15	47
October	1.1	.3	.39	.60	12	37
November	14	.4	1.68	2.60	50	155
December	6.5	.8	1.73	2.68	54	165
January	14	1.1	2.90	4.49	90	276
February	126	1.1	9.88	15.3	277	849
March	95	1.4	12.8	19.8	398	1,220
April	134	1.8	22.2	34.3	667	2,040
May	27	1.8	5.50	8.51	171	523
June	38	1.1	4.90	7.58	147	451
The year	134	.3	5.31	8.22	1,940	5,940

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, 1918.

GAGE.—Friez water-stage recorder installed October 14, 1913, at new datum, to replace original staff.

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, 4.80 feet at 2.45 p. m., April 2 (discharge, about 800 million gallons per day, or 1,240 second-feet); minimum stage recorded, −0.15 foot September 23 and 24 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1910–1918: Maximum stage recorded, 7.57 feet at 5 a. m., January 18, 1916 (discharge, computed from extension of rating curve, about 1,800 million gallons per day, or 2,780 second-feet); minimum stage recorded, 1.08 feet 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.

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 between 2 and 100 million gallons per day, applicable July 1 to November 29, November 30 to April 3, and April 4 to June 30. Operation of water-stage recorder satisfactory except December 21–26, for which period discharge was interpolated. Records fair.

Discharge measurements of Waikamoi Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 23	0.66	11.8	7.7	Jan. 29	0.49	5.0	3.2
Sept. 5	.06	1.2	.8	May 16	.90	20	13
Nov. 7	1.93	145	94				

Daily discharge, in million gallons, of Waikamoi Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.7	3.5	1.6	1.9	2.2	18	3.0	8.7	25	18	12	8.7
2	4.0	4.7	1.4	.8	7.4	10	2.2	5.4	119	172	7.4	10
3	4.0	4.7	1.4	.4	5.4	7.4	3.5	4.0	148	229	12	7.4
4	6.4	3.0	1.2	.4	16	6.4	4.0	3.5	77	28	28	5.4
5	12.0	1.9	1.2	.4	10	4.7	3.0	3.0	20	45	12	5.4
6	6.4	1.9	1.0	.4	6.4	4.0	2.6	3.0	10	99	6.4	4.7
7	4.7	2.2	1.0	.8	34	3.5	2.2	3.0	13	34	5.4	4.7
8	4.0	2.2	1.0	.8	22	3.5	6.4	4.7	14	42	4.7	4.0
9	4.7	3.5	.8	.4	20	3.5	14	172	14	189	4.7	5.4
10	6.4	3.0	1.0	.6	6.4	3.0	4.7	72	16	360	45	13
11	4.0	3.5	.6	3.0	4.7	3.0	67	53	93	45	8.7	22
12	3.5	4.0	1.2	1.2	4.0	3.5	10	58	28	22	22	62
13	3.0	6.4	2.2	.6	3.0	6.4	5.4	14	6.4	14	49	14
14	3.0	4.7	1.6	1.6	2.6	5.4	4.0	8.7	6.4	31	13	10
15	3.0	3.0	1.0	6.4	2.6	3.5	4.7	5.4	3.0	25	16	67
16	3.0	2.2	.6	4.7	2.2	3.0	16	4.7	25	12	20	38
17	2.6	1.9	.4	2.6	1.9	2.6	5.4	49	20	8.7	13	28
18	2.2	1.6	.4	1.2	1.9	2.6	4.7	7.4	7.4	7.4	8.7	10
19	1.9	1.6	.4	1.0	2.2	3.5	53	31	5.4	6.4	6.4	7.4
20	1.9	2.2	.4	.8	1.9	3.5	7.4	218	5.4	7.4	5.4	7.4
21	2.2	2.2	.4	.8	1.6	3.5	53	45	4.7	10	5.4	8.7
22	4.7	25	.4	.8	13	3.5	12	13	4.7	13	6.4	12
23	10	10	.4	.8	25	3.5	6.4	8.7	4.0	7.4	7.4	8.7
24	4.7	4.7	.4	.8	25	3.5	7.4	6.4	10	6.4	25	7.4
25	3.0	3.5	.6	.8	14	3.5	7.4	5.4	133	5.4	31	8.7
26	2.6	3.0	2.2	.8	12	3.5	4.7	4.7	25	5.4	8.7	7.4
27	2.6	2.6	2.2	.8	7.4	3.0	4.7	6.4	12	10	25	8.7
28	7.4	2.2	1.9	.8	8.7	3.0	4.0	42	7.4	10	67	7.4
29	3.5	1.9	2.6	1.6	62	2.6	4.0	.....	6.4	14	18	7.4
30	3.0	1.9	3.5	4.7	93	2.2	25	.....	7.4	38	12	8.7
31	3.0	1.9	.....	2.6	.....	2.2	12	.....	14	.....	8.7	.....

Monthly discharge of Waikamoi Stream near Huelo, Maui, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	12	1.9	4.26	6.59	132	405
August	25	1.6	3.89	6.02	121	370
September	3.5	.4	1.17	1.81	35	108
October	6.4	.4	1.46	2.26	45	139
November	93	1.6	14.0	21.7	418	1,290
December	18	2.2	4.35	6.73	135	414
January	67	2.2	11.7	18.1	364	1,110
February	218	3.0	30.7	47.5	860	2,640
March	148	3.0	28.5	44.1	885	2,710
April	360	5.4	50.5	78.1	1,510	4,650
May	67	4.7	16.6	25.7	514	1,580
June	67	4.0	14.0	21.7	420	1,290
The year	360	.4	14.9	23.1	5,440	16,700

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, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.63 feet at 3 p. m. April 2 (discharge, computed from extension of rating curve, approximately 96 million gallons per day, or 149 second-feet); minimum stage recorded, water occasionally shut off.

DIVERSIONS.—Ditch diverts water from a dozen or more streams east of Nailiilihaele.
REGULATION.—By gates at frequent intervals.
UTILIZATION.—For irrigation of sugar cane.
ACCURACY.—Stage-discharge relation practically permanent until April 2 when a slide in the ditch below gage caused backwater. Rating curve used December 15 to April 2 well defined between 6 and 50 million gallons per day. Rating curve used after April 2 fairly well defined. Operation of water-stage recorder satisfactory except April 3 to May 13 (no record). Records prior to April 2, good; after that date, fair.

Discharge measurements of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Dec. 14	0.87	9.3	6.0	Jan. 31	2.24	46	30
Jan. 28	1.30	19.2	12	Mar. 6	1.96	37	24
29	1.19	15.7	10	May 14	.80	4.2	2.7

Daily discharge, in million gallons, of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1918.

Day.	Dec.	Jan.	Feb.	Mar.	May.	June.	Day.	Dec.	Jan.	Feb.	Mar.	May.	June.
1	.....	16	28	27	.....	2.8	16	2.5	30	12	39	2.8	17
2	.....	9.8	17	32	.....	2.5	17	2.2	14	25	29	2.8	13
3	.....	17	14	34	.....	2.2	18	2.2	14	17	28	1.0	4.0
4	.....	23	11	35	.....	1.8	19	2.2	15	25	25	.2	2.5
5	.....	13	9.8	34	.....	1.6	20	9.0	20	48	20	.2	2.5
6	.....	7.6	8.3	25	.....	1.6	21	6.9	14	34	15	.2	2.8
7	.....	6.2	8.3	26	.....	1.6	22	17	24	27	14	.2	28
8	.....	16	10	27	.....	1.6	23	9.8	20	22	13	.8	25
9	.....	32	42	30	.....	1.8	24	3.6	24	17	18	.2	15
10	.....	13	36	32	.....	14	25	3.2	27	14	47	1.3	22
11	.....	36	35	46	.....	14	26	2.8	16	16	39	2.8	17
12	.....	27	34	38	.....	28	27	7.6	16	15	32	12	12
13	.....	15	26	28	.....	9.0	28	11	13	26	26	14	3.6
14	.....	12	18	27	2.5	3.2	29	9.8	11	.....	20	9.0	3.2
15	5.6	12	14	28	2.5	21	30	9.8	32	.....	27	4.0	14
							31	9.0	30	.....	38	2.8	.....

Monthly discharge of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
December 15–31	17	2.2	6.72	10.4	114	351
January	36	6.2	18.6	28.8	576	1,770
February	48	8.3	21.8	33.7	609	1,870
March	47	13	29.0	44.9	899	2,760
May 14–31	14	.2	3.29	5.09	59	182
June	28	1.6	9.61	14.9	288	885

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

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

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1918.

GAGE.—Stevens water-stage recorder.

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

CHANNEL AND CONTROL.—Weir basin 25 feet long, 8 feet wide, and 2 feet deep below crest of weir; made by enlarging tunnel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.96 feet April 2, 3, and 9 (weir flooded, discharge estimated at 82 million gallons per day, or 127 second-feet); minimum stage recorded, 0.15 foot December 16–19 (discharge, 0.55 million gallons per day, or 0.85 second-foot).

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

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—For discharges above 5 million gallons per day, there is an unmeasured velocity of approach at weir which increases with the stage. Records below 5 million gallons per day, excellent; from 5 to 20 million gallons per day, fair; above 20 million gallons per day, poor.

Daily discharge, in million gallons, of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1918.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.5	2.4	10.6	28	3.0	1.8
2	.....	1.1	2.0	31	56	2.3	1.4
3	.....	2.0	1.5	43	57	3.4	1.3
4	.....	2.6	1.4	34	28	18.0	1.1
5	.....	1.6	1.3	17.3	28	15.8	1.1
6	.....	1.4	3.5	3.8	49	8.1	.9
7	.....	1.2	3.4	12.0	32	5.6	.9
8	.....	2.7	3.4	8.4	35	4.3	.9
9	.....	6.9	59	17.3	56	2.6	.9
10	.....	1.6	35	28	67	15.8	7.6
11	.....	24	28	54	39	5.3	7.4
12	.....	2.9	31	40	21	5.3	27
13	.....	2.1	9.9	15.8	17.3	18.0	6.4
14	.....	1.6	9.2	12.0	26	3.3	3
15	2.4	2.3	9.9	6.9	26	9.0	22
16	.55	6.9	8.3	39	12.8	6.6	14.2
17	.55	2.1	17.3	23	9.0	3.4	9.9
18	.55	1.7	9.2	5.4	6.4	2.2	3.0
19	.55	1.6	19	3.0	5.4	1.9	2.1
20	5.5	1.9	53	2.2	8.7	1.6	1.8
21	4.2	1.4	30	2.3	13.5	1.7	1.9
22	11.3	3.8	8.8	1.6	16.6	2.1	3.5
23	2.9	2.2	5.5	1.4	6.0	4.0	2.2
24	1.7	3.4	3.7	5.3	2.2	6.7	1.5
25	1.2	4.6	2.6	52	1.1	5.0	1.9
26	1.0	2.6	2.6	17.3	1.3	1.8	1.8
27	.8	2.3	2.4	4.4	2.3	6.3	1.9
28	.9	1.9	21	2.7	2.7	20	1.3
29	1.0	1.9	.....	1.8	3.0	4.0	1.6
30	.9	8.2	.....	5.8	7.3	2.5	2.1
31	.9	2.8	.....	12.8	.....	1.9	.....

Monthly discharge of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
December 15–31	11.3	0.55	2.17	3.36	37	113
January	24	1.1	3.41	5.28	106	324
February	59	1.3	13.7	21.2	384	1,180
March	54	1.4	16.6	25.7	514	1,580
April	67	1.1	22.1	34.2	664	2,030
May	20	1.6	6.18	9.56	192	588
June	27	.9	4.48	6.93	134	412
The period					2,030	6,230

CENTER DITCH AT WAIKAMOI, NEAR HUELO, MAUI.

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

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

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sections of ditch trapezoidal; sides and bottom of hardpan and rock; straight for 30 feet above and 10 feet below gage. Control is plank set on edge in bottom of ditch 5 feet below gage.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 2.70 feet at 2 p. m., April 2 (discharge, 60 million gallons per day, or 93 second-feet); minimum stage recorded, 0.35 foot May 9 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

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

REGULATION.—By gates.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except March 12–14, April 7, 8, May 15 and 16; discharge for these periods estimated. Records good.

Discharge measurements of Center ditch at Waikamoi, near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Jan. 28	0.51	5.8	3.8
Mar. 5	2.19	64	41
May 14	.84	11.1	7.2

Daily discharge, in million gallons, of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1918.

Day.	Mar.	Apr.	Apr.	June.	Day.	Mar.	Apr.	May.	June.
1	.....	36	3.9	19	16	36	3.4	4.4	38
2	.....	43	2.9	15	17	28	2.9	3.4	34
3	.....	36	4.5	11	18	11	2.9	2.9	23
4	.....	26	18	9.7	19	7.5	2.4	2.9	17
5	.....	24	4.5	8.1	20	6.1	2.4	2.4	19
6	21	29	2.9	6.6	21	5.5	3.9	2.9	18
7	27	24	2.4	6.6	22	4.3	3.4	11	5.8
8	30	20	2.0	8.9	23	3.7	2.9	20	3.4
9	52	15	1.5	18	24	13	2.4	35	3.4
10	45	34	8.1	35	25	41	2.0	17	3.4
11	35	20	1.5	49	26	28	2.0	30	2.9
12	32	8.1	7.3	36	27	9.1	2.9	34	9.7
13	28	4.5	36	24	28	6.1	2.9	30	9.7
14	24	8.9	6.6	26	29	4.8	5.8	26	18
15	21	4.5	5.5	38	30	13	13	22	9.7
					31	22	.....	18	.....

Monthly discharge of Center ditch at Waikamoi, near Huelo, Maui, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
March (26 days)	52	3.7	21.3	33.0	554	1,700
April	43	2.0	12.9	20.0	388	1,190
May	36	1.5	11.9	18.4	370	1,130
June	49	3.4	17.5	27.1	526	1,610
The period	.....	.....	.....	.....	1,840	5,630

NAILILIHAELE STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above New Hamakua ditch, about 3 miles south of Huelo.

RECORDS AVAILABLE.—October 8, 1913, to June 30, 1918, when station was discontinued. Also at old staff-gage station below New Hamakua ditch from December 9, 1910, to December 31, 1912.

GAGE.—Stevens water-stage recorder installed December 13, 1917, replacing original Barrett & 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 composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.97 feet at 10.15 a. m. April 3 (discharge, about 900 million gallons per day, or 1,400 second feet); minimum stage recorded, 0.2 foot September 11–23 and October 24–31 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

1913–1918: Maximum stage recorded, 6.3 feet at 6.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, about 1,800 million gallons per day, or 2,780 second-feet); minimum stage in September and October, 1917.

DIVERSIONS.—Low flow of left branch of stream diverted above station by Old Hamakua ditch since about March 1, 1918.

REGULATION.—None.

UTILIZATION.—Ordinary flow is 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 November 30 well defined between 4 and 200 million gallons per day; curve used December 1 to April 2 and April 3 to June 30, poorly defined. Operation of water-stage recorder satisfactory except November 13 to December 13 and June 19–30; discharge estimated for latter period from records of flow of neighboring streams.

Discharge measurements of Nailiilihaele Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 6	0.28	4.8	3.1	Apr. 18	0.46	28	18
Jan. 29	.61	11.5	7.4	May 17	.62	47	30
Mar. 7	1.07	37	24				

Daily discharge in million gallons of Nailiilihaele Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	7.8	10	3.0	2.0	2.5	.....	7.8	18	26	58	23	18
2	6.6	9.0	3.0	2.5	4.6	.....	4.6	12	49	258	18	14
3	6.6	9.0	3.8	2.5	3.0	.....	9.0	9.0	53	367	29	14
4	14	9.0	3.8	2.5	5.6	.....	16	9.0	62	102	67	14
5	29	9.0	3.0	2.5	3.8	.....	7.8	7.8	45	130	32	14
6	14	9.0	3.0	2.5	3.0	.....	5.6	7.8	23	223	20	14
7	10	9.0	2.5	2.5	14	.....	4.6	7.8	32	116	20	10
8	9.0	9.0	2.5	2.5	5.6	.....	14	16	26	116	18	7.8
9	9.0	7.8	2.5	2.5	4.6	.....	16	231	32	249	18	10
10	10	6.6	2.5	2.5	3.0	.....	6.6	67	62	267	42	26
11	9.0	6.6	2.0	2.5	3.0	.....	67	62	207	84	20	29
12	7.8	6.6	2.0	2.5	3.0	.....	16	62	116	49	62	78
13	7.8	12	2.0	2.5	.....	.....	10	23	42	42	62	23
14	6.6	9.0	2.0	3.0	.....	14	7.8	18	35	67	29	18
15	6.6	6.6	2.0	4.6	.....	9.0	12	16	29	49	38	67
16	6.6	7.8	2.0	3.8	.....	6.6	20	12	96	32	42	35
17	6.6	6.6	2.0	3.0	.....	4.6	9.0	29	58	23	32	29
18	6.6	6.6	2.0	2.5	.....	4.6	7.8	12	26	20	23	18
19	6.6	6.6	2.0	2.5	.....	4.6	6.6	35	20	18	18	16
20	6.6	6.6	2.0	2.5	.....	12	14	183	16	23	18	16
21	6.6	6.6	2.0	2.5	.....	20	6.6	62	16	20	18	14
22	6.6	32	2.0	2.5	.....	20	7.8	26	14	29	18	14
23	7.8	12	2.0	2.5	.....	12	6.6	20	12	18	23	14
24	7.8	7.8	2.5	2.0	.....	9.0	9.0	18	32	16	26	14
25	7.8	6.6	2.5	2.0	.....	6.6	12	14	183	16	35	14
26	7.8	6.6	2.5	2.0	.....	6.6	6.6	14	45	14	18	12
27	7.8	5.6	2.5	2.0	.....	5.6	7.8	14	26	23	38	12
28	6.6	5.6	2.5	2.0	.....	4.6	6.6	42	20	20	84	12
29	6.6	4.6	2.0	2.0	.....	4.6	7.8	.....	16	29	26	10
30	6.6	4.6	2.0	2.0	.....	4.6	29	.....	26	53	18	10
31	6.6	3.8	.....	2.0	.....	4.6	20	.....	38	.....	18	.....

Monthly discharge of Nailiilihaele Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	29	6.6	8.56	13.2	265	814
August	32	3.8	8.33	12.9	258	792
September	3.8	2.0	2.40	3.71	72	221
October	4.6	2.0	2.50	3.87	77	238
November 1–12	14	2.5	4.64	7.18	56	171
December 14–31	20	4.6	8.53	13.2	154	471
January	67	4.6	12.3	19.0	382	1,170
February	231	7.8	37.4	57.9	1,050	3,210
March	207	12	47.8	74.0	1,480	4,550
April	367	14	84.4	131	2,530	7,770
May	84	18	30.7	47.5	953	2,920
June	78	7.8	19.9	30.8	597	1,830
The period					7,870	24,200

KAILUA STREAM NEAR HUELO, MAUI.

LOCATION.—About 800 feet above New Hamakua ditch crossing, 1 mile south of Huelo.

RECORDS AVAILABLE.—June 17, 1913, to June 30, 1918, when station was discontinued.

GAGE.—Stevens water-stage recorder installed March 7, 1918, replacing Barrett & Lawrence water-stage recorder installed October 1, 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; will seldom shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.22 feet at 5 a. m. May 28 (discharge, about 700 million gallons per day, or 1,080 second-feet); stage probably considerably higher a. m. April 3, float caught on water-stage recorder; minimum stage recorded, 0.6 foot May 11, 31, and June 1–7 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1913–1918: Maximum stage recorded, 9.5 feet May 1, 1916 (discharge computed from extension of the rating curve, about 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, in May and June, 1918.

DIVERSIONS.—Nearly all low-water flow diverted by Old Hamakua ditch above station after February 5, 1918.

REGULATION.—By diversion only.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined above 1 million gallons per day. Operation of water-stage recorder unsatisfactory. No attempt has been made to estimate flow for periods of missing gage record except June 27–30. Records fair above and poor below 1 million gallons per day.

Discharge measurements of Kailua Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 4	1.15	1.3	0.85	Mar. 4	2.36	74	48
Dec. 13	1.22	6.7	4.4	May 17	.72	.85	.55
Jan. 29	.96	2.5	1.6				

Daily discharge, in million gallons, of Kailua Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.
1	3.6	2.9	1.1	0.85	0.6	.....	.....	7.6	0.5	0.4
2	3.6	3.6	1.1	.85	2.2	.....	.....	.....	.5	.4
3	3.6	3.6	1.1	.6	2.9	.....	.....	.....	1.0	.4
4	5.3	2.2	.85	.6	10	.....	.....	.....	3.4	.4
5	12	2.2	.85	.6	6.4	.....	.....	.....	.5	.4
6	6.4	2.2	.85	.6	.....	.....	.....	.....	.45	.4
7	4.4	2.2	.85	.6	.....	.....	.....	45	.45	.4
8	3.6	1.6	.85	.6	.....	.....	5.6	45	.45	.45
9	3.6	1.6	.6	.6	.....	.....	1.9	.....	.45	.6
10	5.3	2.2	.6	.6	.....	.....	16	.....	2.4	2.4
11	3.6	1.6	.6	.6	.....	.....	.....	.....	.4	16
12	2.9	1.6	.6	.6	.....	.....	.....	.....	36	24
13	2.2	5.3	.6	.6	.....	4.0	.....	.....	28	.5
14	2.2	7.4	.6	.6	.....	3.4	.....	.....	1.0	24
15	2.2	3.6	.6	.6	.....	2.4	.....	.....	.8	39
16	2.2	2.2	.6	.6	.....	1.9	.....	.....	1.2	33
17	2.2	2.2	.6	.6	.....	1.2	.....	.....	.8	2.4
18	2.2	1.6	.6	.6	.....	1.5	.....	.5	.5	.5
19	1.6	1.6	.6	.6	.....	2.9	.....	.5	.5	.45
20	1.6	1.6	.6	.45	.....	13	.....	.5	.5	.5
21	1.1	1.6	.6	.45	.....	10	.....	.5	.5	.5
22	1.1	16	.6	.45	.....	5.6	.....	.8	.5	1.2
23	3.6	7.4	.6	.45	.....	3.4	.....	.5	.5	.45
24	3.6	3.6	.6	.....	.....	2.9	.....	.5	14	.45
25	3.6	2.2	.6	.....	.....	1.9	.....	.5	14	.6
26	2.9	2.2	.6	.....	.....	1.2	.....	.5	.5	.45
27	2.9	2.2	.6	.....	.....	1.2	.....	.5	13	.45
28	3.6	2.2	.85	.....	.....	1.2	.....	.5	91	.45
29	3.6	2.2	.85	.....	.....	1.2	45	1.2	2.4	.45
30	2.9	1.6	.85	.....	.....	.....	1.2	16	.45	.45
31	2.9	1.6	.....	.....	.....	.....	3.4	.....	.4	.....

Monthly discharge of Kailua Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	12	1.1	3.42	5.29	106	325
August	16	1.6	3.09	4.78	96	294
September	1.1	.6	.72	1.11	22	66
October 1–23	.85	.45	.60	.93	14	42
November 1–5	10	.6	4.42	6.84	22	68
December 13–29	13	1.2	3.46	5.35	59	181
May	91	.4	7.00	10.8	217	666
June	39	.4	5.07	7.84	152	467

HOOLAWALIILII STREAM NEAR HUELO, MAUI.

LOCATION.—400 feet above New Hamakua ditch crossing, about 4 miles by trail west of Huelo.

RECORDS AVAILABLE.—April 5, 1911, to June 30, 1918.

GAGE.—Stevens water-stage recorder installed June 19, 1914, at same site 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.—1911–1918: 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, 0.00 foot October 1 and 2, 1917 (discharge, 0.55 million gallons per day, or 0.85 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curves well defined between 2 and 30 million gallons per day. Operation of water-stage recorder satisfactory except August 2–22, for which period discharge was estimated from flow of Honopou Stream. Records good between 2 and 30 million gallons per day when water-stage recorder was operating; fair for other periods.

Discharge measurements of Hoolawaliilii Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Sept. 4	0.03	1.1	0.75
Jan. 25	.24	7.3	4.7
May 17	.24	7.6	4.9

Daily discharge, in million gallons, of Hoolawaliilii Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.2	1.3	0.8	0.55	0.8	2.7	2.2	5.2	5.2	11.7	6.9	5.2
2	2.2	1.3	.8	.55	.8	1.9	2.2	3.4	6.9	116	5.2	5.2
3	2.2	1.3	.8	.6	.75	1.7	5.2	3.4	6.9	285	5.2	3.4
4	2.2	.8	.8	.6	.8	1.4	3.4	3.4	15.4	33	11.7	3.4
5	3.2	.8	.8	.65	.8	1.4	3.4	3.4	15.4	33	6.9	3.4
6	3.2	.8	.8	.65	.8	1.4	2.2	3.4	6.9	78	5.2	3.4
7	2.2	.8	.8	.6	1.0	1.4	2.2	3.4	5.2	33	5.2	2.2
8	2.2	.8	.8	.65	.8	1.4	3.4	2.2	5.2	19	5.2	2.2
9	2.2	.8	.8	.6	.8	1.4	3.4	78	5.2	116	3.4	2.2
10	2.2	.8	.8	.6	.8	1.4	2.2	24	9.3	240	5.2	5.2
11	2.2	.8	.8	.65	.8	1.4	9.3	15.4	96	50	3.4	5.2
12	2.2	.8	.8	.7	.7	1.4	5.2	19	63	19	5.2	33
13	2.2	1.3	.8	.7	.7	1.4	3.4	9.3	24	11.7	15.4	9.3
14	2.2	1.3	.8	.8	.7	1.4	3.4	6.9	15.4	19	6.9	6.9
15	2.2	.8	.8	.85	.7	1.4	5.2	5.2	9.3	15.4	6.9	15.1
16	2.2	.8	.65	.8	.75	1.4	5.2	5.2	33	9.3	5.2	9.3
17	2.2	.8	.65	.8	.75	1.4	3.4	6.9	28	6.9	5.2	9.3
18	2.2	.8	.65	.8	.75	1.4	3.4	5.2	11.7	5.2	5.2	6.9
19	2.2	.8	.65	.8	.7	1.4	3.4	6.9	9.3	5.2	5.2	5.2
20	1.3	.8	.65	.8	.7	2.2	6.9	116	6.9	5.2	3.4	5.2
21	1.3	.8	.6	.8	.75	3.4	3.4	38	5.2	5.2	3.4	5.2
22	1.3	3.4	.6	.8	.75	3.4	9.3	11.7	5.2	5.2	3.4	5.2
23	2.2	.8	.6	.8	.8	3.4	5.2	9.3	5.2	5.2	5.2	5.2
24	2.2	.8	.6	.8	1.0	2.2	5.2	6.9	5.2	3.4	3.4	3.4
25	2.2	.8	.6	.8	.8	2.2	5.2	5.2	85	3.4	3.4	3.4
26	1.3	.8	.6	.8	1.0	2.2	5.2	5.2	19	3.4	3.4	3.4
27	1.3	.8	.6	.8	.9	2.2	3.4	3.4	9.3	3.4	5.2	3.4
28	1.3	.8	.65	.8	1.0	2.2	3.4	5.2	6.9	3.4	19	3.4
29	1.3	.8	.6	.8	1.7	2.2	3.4	.....	5.2	5.2	6.9	3.4
30	1.3	.8	.6	.85	6.9	2.2	5.2	.....	6.9	15.4	5.2	3.4
31	1.3	.8	.....	.8	.....	2.2	5.2	.....	6.9	.....	5.2	.....

Monthly discharge of Hoolawaliilii Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.2	1.3	2.03	3.14	62	193
August	3.4	.8	.96	1.49	30	91
September	.8	.6	.71	1.10	21	65
October	.85	.55	.73	1.13	23	69
November	6.9	.7	1.03	1.59	31	95
December	3.4	1.4	1.89	2.92	59	180
January	9.3	2.2	4.28	6.62	133	407
February	116	2.2	14.7	22.7	411	1,260
March	96	5.2	17.4	26.9	538	1,660
April	285	3.4	38.8	60.0	1,160	3,570
May	19	3.4	5.99	9.27	186	570
June	33	2.2	6.02	9.31	181	554
The year	285	.55	7.78	12.0	2,840	8,710

HOOLAWANUI STREAM NEAR HUELO, MAUI.

LOCATION.—500 feet above crossing of New Hamakua ditch, about 5 miles by trail west of Huelo.

RECORDS AVAILABLE.—December 12, 1910, to June 30, 1918.

GAGE.—Stevens water-stage recorder installed June 20, 1914, 200 feet upstream from original staff, which it 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, 5.05 feet at 9.45 a. m. April 3 (discharge, about 400 million gallons per day, or 620 second-feet); minimum stage recorded, −0.19 foot October 26 (discharge, 0.15 million gallons per day, or 0.2 second-foot.).

1910–1918: Maximum stage recorded, 5.4 feet at 11.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, about 440 million gallons per day, or 680 second-feet); minimum stage recorded October 26, 1917.

DIVERSIONS.—None.

REGULATION.—None.

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 July 9–22 and July 29 to August 23; discharge for these periods estimated from records of flow of neighboring streams. Records good between 2 and 60 million gallons per day, poor below 2 and above 60 million gallons per day.

Discharge measurements of Hoolawanui Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Sept. 4	−0.10	0.8	0.5
Mar. 7	.67	15.5	10
May 17	.53	10.8	7.0

Daily discharge, in million gallons, of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.8	0.8	0.5	0.4	0.35	5.0	2.2	5.9	10	12	7.9	6.8
2	1.8	.8	.5	.4	.5	2.8	1.4	4.2	19	88	6.8	5.9
3	1.8	.8	.5	.35	.5	2.2	3.4	3.4	23	166	6.8	5.0
4	2.2	.75	.5	.3	.7	1.8	3.4	2.8	35	42	13	4.2
5	3.4	.75	.5	.3	.65	1.8	2.2	2.8	23	37	7.9	4.2
6	2.2	.75	.5	.3	.5	1.4	2.2	2.8	13	67	6.8	4.2
7	1.8	.75	.5	.3	2.0	1.4	1.8	2.8	12	35	5.9	3.4
8	1.8	.75	.5	.3	.8	1.1	3.4	4.2	10	26	5.0	3.4
9	1.8	.75	.5	.3	.65	1.1	5.0	80	7.9	88	5.0	4.2
10	1.8	.65	.5	.35	.6	1.1	2.2	30	14	171	9.0	5.9
11	1.8	.65	.5	.4	.5	1.1	21	28	67	58	5.0	7.9
12	2.2	.65	.6	.35	.4	1.1	5.9	30	44	28	14	24
13	2.2	1.1	.5	.3	.4	1.4	4.2	16	23	19	23	10
14	1.8	1.1	.5	.4	.4	1.8	3.4	10	18	28	10	7.9
15	1.8	.8	.5	.65	.3	1.4	5.0	7.9	13	23	9.0	24
16	1.8	.75	.5	.6	.3	1.1	9.0	6.8	24	14	9.0	16
17	1.8	.65	.5	.35	.3	1.1	4.2	12	21	12	7.9	14
18	1.8	.65	.5	.3	.3	1.1	4.2	5.9	13	10	6.8	10
19	1.4	.5	.5	.3	.3	.9	3.4	14	10	7.9	5.9	7.9
20	1.4	.5	.5	.3	.3	2.8	10	91	7.9	7.9	5.0	7.9
21	1.1	.5	.45	.3	.3	4.2	4.2	37	6.8	6.8	5.0	6.8
22	1.1	1.8	.4	.2	.5	6.8	5.9	19	5.9	7.9	5.0	7.9
23	1.2	1.1	.5	.2	1.1	5.0	5.0	13	5.0	5.9	5.0	6.8
24	.85	.7	.4	.2	2.2	2.2	5.0	10	9.0	5.0	6.8	5.9
25	.8	.65	.5	.2	.8	1.8	4.2	7.9	74	5.0	10	5.9
26	.8	.65	.6	.15	1.1	1.8	3.4	6.8	23	4.2	5.0	5.9
27	.75	.55	.5	.2	.8	1.8	3.4	5.9	14	5.0	6.8	5.0
28	.75	.5	.65	.4	.8	1.8	2.8	13	10	5.0	37	4.
29	.75	.5	.6	.5	4.2	1.8	3.4	.....	7.9	7.9	14	4.2
30	.75	.5	.5	.6	19	1.4	7.9	.....	9.0	19	10	4.2
31	.75	.5	.....	.4	.....	1.4	5.9	.....	10	.....	7.9	.....

Monthly discharge of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean)	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.4	0.75	1.55	2.40	48	147
August	1.8	.5	.74	1.14	23	70
September	.65	.4	.50	.77	15	46
October	.65	.15	.34	.53	11	32
November	19	.3	1.38	2.14	42	127
December	6.8	.9	2.05	3.17	64	195
January	21	1.4	4.79	7.41	149	456
February	91	2.8	16.9	26.1	473	1,450
March	74	5.0	18.8	29.1	582	1,790
April	171	4.2	33.7	52.1	1,010	3,100
May	37	5.0	9.1	14.1	282	866
June	24	3.4	7.79	12.2	234	717
The year	171	.15	8.04	12.4	2,930	9,000

HONOPOU STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above New Hamakua ditch crossing, about 6 miles west of Huelo.

RECORDS AVAILABLE.—December 10, 1910, to June 30, 1918.

GAGE.—Stevens water-stage recorder, installed June 19, 1914, at same site and datum as original staff.

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

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; right bank is overflowed during floods; left bank steep and high. Control an old iron weir set in concrete; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.55 feet at 8 a. m. April 3 and at 12.01 a. m. April 10 (discharge, about 152 million gallons per day, or 236 second-feet); minimum stage recorded, 0.05 foot September, October, and November (discharge, 0.2 million gallon per day, or 0.3 second-foot).

1910–1918: Maximum stage recorded, 3.7 feet at 10 p. m. May 1, 1916 (discharge, computed from extension of rating curve, about 160 million gallons per day, or 248 second-feet); minimum stage recorded in September, October, and November, 1917.

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 2 and 6 million gallons per day. Operation of water-stage recorder satisfactory, except May 8–12, for which discharge was estimated from flow of neighboring streams. Records fair between 2 and 6 million gallons per day; poor below 2 and above 6 million gallons per day.

Discharge measurements of Honopou Stream near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Sept. 4	0.08	0.4	0.25
Jan. 25	.33	3.6	2.3
May 13	.50	9.6	6.2

Daily discharge, in million gallons, of Honopou Stream near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.5	0.8	0.5	0.5	0.5	2.4	1.8	2.4	3.8	6.5	3.0	3.0
2	.5	.8	.5	.5	.5	1.3	1.3	2.4	5.5	32	2.4	3.0
3	.5	.8	.5	.5	.5	1.3	3.8	1.8	4.6	56	2.4	3.0
4	.8	.5	.5	.5	.5	1.3	3.8	1.8	9.5	15	5.5	2.4
5	1.3	.5	.5	.5	.5	.8	1.8	1.8	7.5	15	3.0	2.4
6	.8	.5	.5	.2	.5	.8	1.8	1.8	5.5	34	2.4	2.4
7	.5	.5	.5	.2	.8	.8	1.3	1.3	4.6	20	2.4	2.4
8	.5	.5	.5	.2	.5	.8	1.8	1.3	4.6	14	2.4	2.4
9	.5	.5	.5	.2	.5	.8	2.4	26	3.8	42	1.8	2.4
10	.5	.5	.5	.2	.5	.8	1.8	11	6.5	75	5.5	3.8
11	.5	.5	.5	.2	.2	.8	6.5	8.5	26	32	2.4	3.8
12	.8	.5	.2	.2	.2	.8	3.8	11	20	17	4.6	14
13	.8	.8	.2	.2	.2	.5	2.4	6.5	11	12	5.5	6.5
14	.5	.8	.2	.2	.2	.8	2.4	5.5	8.5	14	4.6	4.6
15	.5	.5	.2	.5	.2	.8	3.0	4.6	7.5	12	3.8	11
16	.5	.5	.2	.5	.2	.8	3.8	3.8	13	8.5	3.8	7.5
17	.5	.5	.2	.2	.2	.8	2.4	6.5	11	6.5	3.0	7.5
18	.5	.5	.2	.2	.2	.8	2.4	3.0	7.5	5.5	3.0	5.5
19	.5	.5	.2	.2	.2	.8	2.4	6.5	6.5	4.6	2.4	5.5
20	.5	.5	.2	.2	.2	3.0	6.5	40	5.5	3.8	2.4	4.6
21	.5	.5	.2	.2	.2	2.4	3.0	17	4.6	3.8	1.8	4.6
22	.5	2.4	.2	.2	.5	3.0	7.5	9.5	3.8	3.8	1.8	4.6
23	.8	.5	.2	.2	.8	3.0	3.8	7.5	3.9	3.0	2.4	3.8
24	.8	.5	.2	.2	1.8	1.8	3.8	5.5	6.5	2.4	2.4	3.0
25	.8	.5	.2	.2	.8	1.8	3.8	4.6	28	1.8	2.4	3.8
26	.8	.5	.5	.2	.8	1.3	2.4	3.8	11	1.8	1.8	3.8
27	.5	.5	.5	.2	.8	1.3	2.4	3.8	7.5	1.8	2.4	3.0
28	.5	.5	.5	.2	.8	1.3	1.8	3.8	6.5	1.3	14	3.0
29	.5	.5	.5	.5	2.4	1.3	2.4	.....	5.5	3.0	5.5	3.0
30	.5	.5	.5	.5	5.5	1.3	3.0	.....	5.5	7.5	4.6	3.0
31	.8	.5	.....	.5	.....	1.3	2.4	.....	6.5	.....	3.8	.....

Monthly discharge of Honopou Stream near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.3	0.5	0.61	0.94	19	58
August	2.4	.5	.61	.94	19	58
September	.5	.2	.36	.56	11	33
October	.5	.2	.30	.46	9	29
November	5.5	.2	.72	1.11	22	66
December	3.0	.5	1.32	2.04	41	126
January	7.5	1.3	3.02	4.67	94	287
February	40	1.3	7.25	11.2	203	623
March	28	3.0	8.41	13.0	261	800
April	75	1.3	15.2	23.5	456	1,400
May	14	1.8	3.52	5.45	109	335
June	14	2.4	4.44	6.87	133	409
The year	75	.2	3.77	5.83	1,380	4,220

NEW HAMAKUA DITCH AT HALEHAKU WEIR, NEAR HUELO, MAUI.

LOCATION.—Just above crossing of Halehaku Stream, about 7 miles by trail west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 25-foot Cippoletti weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly discharge table.

DIVERSION.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	42.9	22.7	.....	67.5	41.5	20.0	46.7	56.2	69.8	68.7
2	39.2	20.5	.....	64.8	35.3	15.7	47.4	56.9	70.6	68.7
3	34.4	28.3	.....	64.4	35.1	14.5	45.3	56.3	70.5	65.0
4	41.8	20.6	.....	64.1	68.6	13.7	46.9	54.1	71.6	60.4
5	52.4	15.7	.....	58.3	61.5	14.2	46.1	56.1	70.7	56.4
6	56.2	16.3	.....	48 7	43.6	17.2	44.8	56.2	67.6	53.4
7	38.3	19.3	.....	42.2	35.7	16.5	66.6	56.1	67.1	49.7
8	33.2	17.9	.....	38.5	48.3	16.0	56.5	56.2	68.9	48.1
9	30.6	22.5	.....	32.3	70.3	62.4	56.5	56.8	68.0	49.9
10	38.5	22.2	.....	28.9	54.7	62.0	56.9	55.8	72.6	57.7
11	29.1	20.3	.....	28.0	67.7	57.8	57.2	55.8	68.8	68.2
12	22.9	25.9	.....	32.1	69.9	61.5	56.2	35.3	70.2	69.1
13	21.0	39.5	.....	47.2	62.8	49.8	56.2	26.4	69.6	69.0
14	20.7	38.0	.....	50.8	52.0	42.7	56.2	12.7	68.8	69.0
15	22.6	23.1	.....	56.2	35.9	35.0	56.2	54.0	69.2	69.3
16	24.2	18.5	.....	43.8	56.6	30.7	56.2	47.3	68.9	68.2
17	23.1	17.2	.....	36.8	54.3	48.8	56.2	41.9	68.9	69.0
18	20.3	8.0	.....	28.3	42.4	33.0	56.2	38.5	68.8	69.0
19	19.7	.....	.....	26.8	44.0	44.7	56.2	51.6	68.6	68.5
20	18.1	.....	.....	51.1	63.6	71.3	56.2	55.7	68.8	68.7
21	17.7	.....	.....	52.6	50.9	45.5	55.9	56.1	68.1	68.9
22	22.3	1.7	.....	70.2	50.9	44.7	56.1	56.0	70.9	69.2
23	39.1	.....	.....	69.8	65.6	38.4	55.8	56.9	69.1	69.0
24	35.8	.....	15.4	64.3	57.3	32.3	56.2	60.1	69.4	69.0
25	25.0	.....	59.2	59.4	45.9	28.1	56.9	57.0	69.4	59.3
26	22.3	.....	61.3	43.4	43.4	26.2	56.2	58.5	68.6	68.4
27	20.9	.....	60.4	36.7	46.5	23.7	56.2	64.7	69.1	68.9
28	31.5	.....	56.2	35.2	42.2	35.2	56.2	66.4	70.7	68.4
29	20.9	.....	61.1	34.5	27.7	.....	56.2	69.8	68.5	67.2
30	19.6	.....	69.4	34.8	26.1	.....	56.2	72.8	69.0	69.1
31	20.2	.....	.....	34.5	19.3	.....	56.2	.....	68.8	.....

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, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	42.9	17.7	29.2	45.2	904	2,780
August (19 days)	39.5	1.7	21.4	33.1	407	1,250
November (7 days)	69.4	15.4	54.7	84.6	383	1,180
December	70.2	26.8	46.6	72.1	1,450	4,430
January	70.3	19.3	49.0	75.8	1,520	4,660
February	71.3	13.7	35.8	55.4	1,000	3,080
March	66.6	44.8	54.7	84.6	1,690	5,200
April	72.8	12.8	53.3	82.5	1,600	4,910
May	72.6	67.1	69.3	107	2,150	6,590
June	69.3	48.1	65.1	101	1,950	5,990
The year	.....	.....	.....	.....	13,100	40,100

NEW HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—300 feet below Honopou Stream crossing and about 7½ miles by road and trail west of Huelo.

RECORDS AVAILABLE.—January 25 to June 30, 1918.

GAGE.—Stevens 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, 4.57 feet at 8.45 a. m. May 28 (discharge, 96 millions gallons per day, or 149 second-feet); minimum stage recorded, 1.0 foot February 4 (discharge, 12 million gallons per day, or 19 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.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent prior to April 2, when a slide occurred in the ditch below gage causing backwater. Rating curve January 25 to April 1 well defined; April 2 to June 30 fairly well defined. Operation of water-stage recorder satisfactory. Records prior to April 2 good; April 2 to June 30 fair.

Discharge measurements of New Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Oct. 9	0.85	15.0	9.7	Mar. 8	3.89	117	77
Jan. 25	3.72	111	72	May 10	4.28	116	76

Daily discharge, in million gallons, of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	------	18	69	78	70	75	16	------	29	80	54	75	76
2	------	14	80	70	70	74	17	------	46	78	50	75	76
3	------	13	69	70	70	68	18	------	33	78	43	74	75
4	------	12	80	59	74	62	19	------	44	76	51	74	75
5	------	13	77	68	70	59	20	------	80	72	66	70	74
6	------	16	58	70	68	55	21	------	72	68	66	68	72
7	------	15	78	69	70	52	22	------	49	66	67	72	74
8	------	14	77	68	72	51	23	------	38	60	62	69	74
9	------	74	77	72	67	61	24	------	32	62	61	70	72
10	------	60	78	74	75	75	25	74	26	82	62	75	72
11	------	56	82	68	74	75	26	60	26	80	61	75	72
12	------	61	80	36	74	78	27	58	23	78	66	75	70
13	------	45	80	35	75	76	28	44	44	76	66	78	70
14	------	40	78	61	75	75	29	24	------	72	68	76	69
15	------	35	77	64	75	76	30	23	------	75	69	76	69
							31	17	------	77	------	75	------

Monthly discharge of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January 25–31	74	17	42.9	66.4	300	922
February	80	12	36.7	56.8	1,030	3,150
March	82	58	74.8	116	2,320	7,120
April	78	43	62.5	96.7	1,870	5,750
May	78	67	72.8	113	2,260	6,930
June	78	51	70.1	108	2,100	6,450
The period					9,880	30,300

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 to June 30, 1918.

GAGE.—Stevens 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 year, 3.17 feet at 6.15 p. m. March 11 (discharge, 60 million gallons per day, or 93 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch heads at Nailiilihaele Stream and picks up water from streams west of that point.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except February 22–27, clock stopped; discharge estimated from maximum and minimum pencil record at 1.0 million gallons per day. Records good.

Discharge measurements of Old Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.
Jan. 25	0.92	6.6	4.3
Mar. 8	2.07	40	26
May 13	2.13	41	27

Daily discharge in million gallons of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	une.
1	.....	0.6	8.0	28	17	8.8	16	.....	1.0	36	1.0	21	32
2	.....	.6	12	34	11	5.2	17	.....	2.7	29	.8	18	34
3	.....	.8	1.3	30	14	2.0	18	.....	1.0	28	.8	13	25
4	.....	.6	16	20	28	1.0	19	.....	4.6	22	1.6	7.2	17
5	.....	.6	10.3	13	19	1.0	20	.....	29	13	5.8	2.3	12
.....	.....	.6	1.6	24	16	.8	21	.....	14	5.8	5.8	2.0	13
7	.....	.6	28	19	9.6	1.0	22	.....	.....	2.7	16	4.6	18
8	.....	.8	27	12	3.1	.8	23	.....	.....	1.0	2.0	4.6	18
9	.....	34	29	28	3.1	1.0	24	.....	.....	4.6	2.3	5.8	10
10	.....	7.2	40	28	22	22	25	6.5	.....	32	2.0	18	11
11	.....	4.1	52	20	5.8	26	26	1.0	.....	27	2.0	8.0	13
12	.....	5.8	34	26	28	34	27	.8	.....	26	16	20	10
13	.....	1.3	32	14	27	30	28	.6	5.8	20	16	28	10
14	.....	1.3	34	8.8	22	21	29	.6	.....	11	26	27	8.0
15	.....	1.0	29	3.1	22	29	30	.8	.....	16	28	19	9.6
							31	.6	.....	27	.....	12	.....

Monthly discharge of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January 25-31	6.5	0.6	1.56	2.41	11	335
February	34	.6	4.43	6.85	124	381
March	52	1.0	21.1	32.6	655	2,010
April	34	.8	14.5	22.4	434	1,340
May	28	2.0	14.8	22.9	458	1,410
June	34	.8	14.1	21.8	424	1,300
The period	.....	.....	.....	.....	.....	6,980

KAUHIKOA DITCH[1] AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance below crossing of Opana Stream, about 8 miles by road west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—By 25-foot sharp-crested weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

[1] New alinement of Old Hamakua ditch west of Halehaku Gulch.

103502°—19—WSP 485——10

Daily discharge, in million gallons, of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	.....	.....	13.6	12.4	10.1	15.3	.....	4.7	.....
2	.....	.....	12.7	8.6	21.2	2.8	.....	2.9	.....
3	.....	.....	12.2	7.6	24.9	1.0	8.8	2.2	.....
4	.....	.....	11.7	7.2	29.8	.5	13.3	1.9	.....
5	1.0	.....	11.6	6.8	44.0	.3	1.8	1.5	.....
6	.7	.....	11.3	7.7	30.4	.2	.....	1.3	1.9
7	.....	.....	11.2	9.3	47.8	.1	.....	1.0	33.3
8	.....	.....	10.8	7.9	53.4	.....	.....	.8	.....
9	.....	.....	10.7	7.0	51.3	.....	.....	82.7	.....
10	.....	.....	10.7	6.8	46.7	.....	.....	42.5	.....
11	.....	.....	10.8	7.8	32.1	.....	20.8	33.9	.....
12	.....	.....	11.4	7.7	18.8	.....	11.1	48.2	.....
13	.....	.....	15.6	6.8	14.8	.....	3.0	21.5	.....
14	.....	.....	13.7	9.5	13.6	.....	1.4	14.3	.....
15	.....	.....	10.9	24.2	13.0	.3	1.8	10.4	.....
16	.....	.....	10.6	20.6	11.7	.....	13.7	8.5	.....
17	.....	.....	10.1	11.7	10.7	.....	3.5	23.4	.....
18	.....	7.6	9.4	8.8	9.8	.....	.5	10.6	.....
19	.....	16.1	8.9	7.6	16.1	.....	.....	22.6	.....
20	.....	16.3	8.8	7.2	24.3	1.4	14.4	83.1	.....
21	.....	17.2	8.8	7.1	13.9	2.9	4.7	28.5	.....
22	.....	50.7	7.0	6.7	26.4	22.2	19.5	.....	.....
23	.....	58.5	8.3	6.4	53.5	14.8	11.4	.....	.....
24	.....	41.7	8.3	6.6	53.5	1.5	16.7	.....	.....
25	.....	29.3	8.2	6.0	2.7	.....	36.7	.....	.....
26	.....	21.1	11.2	5.6	.2	.....	20.3	.....	.....
27	.....	18.4	12.9	5.2	.....	.....	15.0	.....	.....
28	.....	16.3	17.4	7.0	.....	.....	6.4	.....	.....
29	.....	15.1	14.7	13.0	5.7	.....	1.5	.....	.....
30	.....	14.2	15.8	26.5	47.5	.....	9.2	.....	.....
31	.....	14.2	.....	14.4	.....	.....	7.2	.....	.....

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

Monthly discharge of Kauhikoa ditch at Opana weir, near Huelo, Maui, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (2 days)	1.0	0.7	0.85	1.32	2	5
August (14 days)	58.5	7.6	24.0	37.1	337	1,030
September	17.4	7.0	11.3	17.5	339	1,040
October	26.5	5.2	9.60	14.9	298	913
November (28 days)	53.5	.2	26.0	40.2	728	2,230
December (13 days)	22.2	.1	4.87	7.54	63	194
January (23 days)	36.7	.5	10.6	16.4	243	748
February (21 days)	83.1	.8	21.3	33.0	446	1,370
March (2 days)	33.3	1.9	17.6	27.2	35	108
The year	.....	.....	.....	.....	2,490	7,640

LOWRIE DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance west of Halehaku Gulch, about 7 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir 16⅓ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool back of weir.
EXTREMES OF DISCHARGE.—See monthly discharge table.
DIVERSIONS.—None.
REGULATION.—By gates at frequent intervals.
UTILIZATION.—Irrigation of sugar cane.
ACCURACY.—Records good.
COOPERATION.—Daily discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	45.2	31.7	15.1	13.1	9.3	53.5	42.4	36.5	35.7	57.9	56.9	57.9
2	33.2	33.1	14.9	9.2	30.9	41.5	22.7	34.2	42.0	58.7	54.1	57.4
3	37.5	22.8	14.2	8.7	32.6	55.1	35.6	35.5	41.6	55.4	57.3	55.0
4	47.7	19.3	13.5	8.1	35.0	49.5	45.5	33.1	45.8	31.6	57.7	47.1
5	46.4	20.7	12.9	7.7	33.9	51.3	53.8	32.8	46.5	24.1	57.7	39.4
6	40.9	19.9	12.7	11.1	21.4	47.5	29.6	32.2	41.2	33.0	57.6	36.8
7	33.8	24.0	13.2	9.7	41.7	42.3	27.2	35.2	58.6	33.9	57.9	38.4
8	28.8	21.6	13.5	7.5	46.9	35.7	38.3	33.0	59.4	32.4	56.6	39.6
9	32.2	29.7	12.9	7.3	49.2	36.0	54.1	51.8	58.5	33.9	48.6	37.3
10	41.4	20.5	13.2	7.5	42.3	34.3	14.9	49.4	57.3	25.6	56.0	48.0
11	26.2	25.3	11.4	11.8	27.9	34.6	45.0	43.5	58.3	15.3	58.1	57.4
12	26.0	37.2	15.1	7.8	15.6	42.5	52.3	44.0	55.1	14.3	58.3	57.6
13	24.8	47.6	21.5	7.0	16.8	56.7	35.1	42.9	57.7	12.8	58.4	57.3
14	23.9	38.9	13.1	8.1	15.9	52.6	24.8	39.2	58.9	12.2	58.0	56.9
15	30.5	21.3	12.7	22.0	15.1	53.5	21.1	40.4	57.7	12.0	58.1	57.3
16	27.4	19.8	11.9	19.2	13.2	46.7	51.3	42.3	58.6	10.5	58.1	57.6
17	26.0	18.5	11.1	11.1	14.4	37.1	45.1	53.7	57.6	8.6	57.9	57.2
18	24.2	15.9	10.7	8.6	15.1	33.8	41.8	53.7	56.9	8.0	57.7	56.7
19	21.7	15.6	10.6	8.6	13.1	33.7	43.8	57.1	57.4	8.8	57.5	50.7
20	20.9	20.0	10.9	8.1	20.7	49.5	52.8	56.8	57.9	14.8	56.1	46.7
21	24.0	17.7	10.5	7.8	15.5	47.7	39.3	35.7	57.7	23.4	52.8	56.3
22	34.0	50.2	10.4	7.0	24.0	55.9	50.1	20.2	57.5	21.7	51.4	55.9
23	50.7	48.2	10.2	7.3	51.3	54.2	45.7	19.4	55.7	16.5	48.9	57.8
24	23.7	33.4	9.0	7.2	55.8	51.6	42.8	21.5	50.6	13.8	50.9	58.0
25	27.6	21.8	10.7	6.2	52.6	52.5	50.3	21.0	58.5	32.8	56.8	53.9
26	27.3	19.7	15.9	5.7	49.9	42.3	41.3	20.3	57.3	46.4	52.3	55.3
27	22.6	19.7	15.1	5.9	46.3	41.7	40.6	22.1	57.5	54.3	58.2	55.1
28	29.1	18.0	15.5	11.7	48.2	37.1	37.6	28.6	57.8	57.8	58.1	53.6
29	20.5	17.5	20.3	24.3	54.9	31.5	43.3	.....	57.8	58.7	58.0	52.5
30	24.3	16.9	17.3	36.9	56.9	26.5	55.6	.....	57.9	58.7	58.0	51.6
31	23.7	18.0	.....	12.0	.....	24.9	57.8	.....	58.0	.....	58.0	.....

Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	50.7	20.5	30.5	47.2	946	2,900
August	50.2	15.6	25.3	39.1	784	2,410
September	21.5	9.0	13.3	20.6	400	1,220
October	36.9	5.7	10.8	16.7	334	1,030
November	56.9	9.3	32.2	49.8	966	2,960
December	56.7	24.9	43.7	67.6	1,350	4,160
January	57.8	14.9	41.3	63.9	1,280	3,930
February	57.1	19.4	37.0	57.2	1,040	3,180
March	59.4	35.7	54.5	84.3	1,690	5,180
April	58.7	8.0	29.6	45.8	888	2,730
May	58.4	48.6	56.2	87.0	1,740	5,350
June	58.0	36.8	52.1	80.6	1,560	4,800
The year	59.4	5.7	35.6	55.1	13,000	39,800

HAIKU DITCH AT PEAHI WEIR, NEAR HUELO, MAUI.

LOCATION.—In Peahi, about 8 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir, 16⅓ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of Haiku ditch at Peahi weir, near Huelo, Maui, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	13.0	1.5	1.1	0.8	0.7	60.3	11.1	79.7	43.2	67.6	4.0	26.0
2	8.9	1.8	1.1	.8	.7	35.2	2.1	67.6	39.8	84.1	4.0	21.6
3	7.3	1.4	1.0	.8	.9	33.6	14.7	34.3	34.7	39.4	4.0	12.8
4	14.8	1.5	1.0	.8	18.1	23.8	37.3	13.8	38.7	16.8	3.8	17.4
5	35.4	1.1	1.0	.8	14.8	8.8	15.6	34.9	39.0	16.8	11.6	18.4
6	15.9	1.1	1.0	.7	7.0	5.4	2.7	32.7	36.8	24.1	58.4	18.0
7	7.0	1.2	.9	.7	32.2	9.2	1.5	29.9	63.2	23.5	34.4	19.8
8	5.5	1.2	.9	.7	29.3	7.1	8.0	19.7	76.4	25.3	24.3	18.9
9	5.4	1.2	.9	.7	28.4	1.3	55.8	76.6	88.8	26.9	12.9	15.2
10	5.5	1.2	.9	.7	1.7	.9	12.0	79.8	51.2	28.1	65.1	64.4
11	2.1	1.1	.8	.7	1.1	.8	71.5	59.6	28.5	18.0	39.9	70.9
12	1.6	1.2	.8	.7	.7	3.0	51.8	38.4	25.9	14.6	25.6	88.1
13	1.6	4.5	.8	.7	.7	18.8	13.7	35.4	46.5	13.6	82.1	82.9
14	1.8	2.9	.8	.7	.7	20.5	11.4	27.4	62.4	13.5	85.2	34.5
15	1.7	1.3	.8	.8	.6	32.4	18.4	19.1	68.8	13.1	20.3	63.3
16	1.6	1.2	.8	.7	.6	2.2	56.8	13.6	78.6	13.0	81.5	87.8
17	1.6	1.2	.8	.7	.6	.9	9.0	24.7	71.1	12.9	71.7	78.1
18	1.5	1.1	.8	.7	.6	.8	4.8	24.3	72.9	12.4	42.2	34.9
19	3.9	1.1	.8	.7	.6	.7	5.5	22.8	63.8	12.8	22.4	31.9
20	1.3	1.1	.8	.7	.8	22.3	53.7	27.2	63.8	12.9	15.6	37.7
21	1.2	1.1	.8	.7	.6	10.0	10.1	24.9	55.4	23.0	9.7	39.7
22	1.4	40.8	.8	.7	6.4	68.4	16.3	27.4	38.3	45.8	23.3	53.4
23	22.8	34.5	.8	.7	40.7	53.8	38.1	29.2	22.8	67.6	13.1	63.0
24	3.5	12.8	.8	.7	59.7	17.2	25.5	28.6	27.0	7.3	33.7	19.7
25	1.4	7.2	.8	.7	45.5	7.9	45.9	28.3	86.9	3.8	83.4	47.7
26	1.4	1.6	.8	.7	38.4	1.7	26.1	33.6	74.1	3.4	43.3	55.6
27	1.4	1.4	.8	.7	13.3	1.4	22.8	36.5	57.6	2.9	79.2	42.0
28	1.6	1.2	.8	.7	16.0	1.9	14.7	42.3	54.4	13.3	88.1	26.1
29	1.5	1.1	.8	.7	25.5	14.8	15.5	.....	56.0	66.4	86.0	30.0
30	1.6	1.1	.8	.8	81.7	.7	76.3	.....	55.0	4.8	64.1	21.1
31	1.5	1.1	.....	.7	.....	.7	75.7	.....	65.3	.....	33.3	.....

Monthly discharge of Haiku ditch at Peahi weir, near Huelo, Maui, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Millions gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	35.4	1.2	5.70	8.82	177	542
August	40.8	1.1	4.32	6.68	134	411
September	1.1	.8	.86	1.33	26	79
October	.8	.7	.72	1.11	22	68
November	81.7	.6	15.6	24.1	469	1,440
December	68.4	.7	15.5	24.0	466	1,470
January	76.3	1.5	26.6	41.2	824	2,530
February	79.8	13.6	36.2	56.0	1,010	3,110
March	88.8	22.8	54.4	84.2	1,690	5,180
April	84.1	2.9	24.3	37.6	728	2,240
May	88.1	3.8	40.8	63.1	1,270	3,880
June	88.1	12.8	41.4	64.1	1,240	3,810
The year	88.8	.6	22.1	34.2	8,060	24,800

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, 1918.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
July 21	Waihee	Near Waihee	2.20	42	27
24	West Wailuanui	Near Keanae	.80	3.0	1.9
Aug. 24	do	do	.75	2.7	1.8
Feb. 7	Kouala	Near Lahaina	.54	4.9	3.1
Dec. 11	Spreckels ditch	Above Puohakamoa stream, near Huelo.		33	22
Mar. 27	Old Hamakua ditch	250 feet below Oanui intake of Kailua stream, near Huelo.		31	20
27	do	150 feet above Hoolawaliilii Stream, near Huelo.		32	21
27	Middle Halawa	Kailua side of Hoolawanui, 25 feet above Old Hamakua ditch intake near Huelo.		.1	.06
27	Branch of Waipio	First stream east of Hoolawaliilii, 150 feet above New Hamakua ditch intake near Huelo.		.4	.25
27	do	Second stream east of Hoolawaliilii, 30 feet above New Hamakua ditch intake near Huelo.		.35	.25
27	do	Third stream east of Hoolawaliilii, 30 feet above New Hamakua ditch intake near Huelo.		.25	.15
27	Huelo stream	75 feet above New Hamakua ditch, near Huelo.		1.4	.9
27	Branch of Huelo	At trail crossing near Huelo. No water diverted into New Hamakua ditch.		1.05	.7
27	Branch of Hoolua	First stream west of first camp west of Kailua, 50 feet above New Hamakua ditch near Huelo.		.5	.35
27	do	First wasteway west of Kailua, 100 feet above New Hamakua ditch near Huelo.		.2	.15
27	Honawana	25 feet above New Hamakua ditch, near Huelo.		.95	.6
27	Branch of Honawana	6 feet above New Hamakua ditch, near Huelo.		.6	.4
28	Branch of Nailiilihaele	100 feet above New Hamakua ditch, near ditchman's house near Huelo.		.4	.25
28	Branch of Papaea	First stream west of Nailiilihaele, 50 feet above New Hamakua ditch, near Huelo.		.25	.15

Miscellaneous measurements on Maui during the year ending June 30, 1918—Continued.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
Mar. 28	Branch of Papaea	Second stream west of Nailiilihaele, at camp, 125 feet above New Hamakua ditch, near Huelo.		0.5	0.3
28	do	Third stream west of Nailiilihaele, 10 feet above New Hamakua ditch, near Huelo.		.5	.3
28	West branch Oopuola	200 feet above New Hamakua ditch, near Huelo.		.6	.4
28	Branch of Oopuola	20 feet above trail crossing and intake, near Huelo.		.6	.4
28	Main Oopuola	200 feet above New Hamakua ditch, near Huelo.		1.75	1.1
28	Branch of Makanale	50 feet above New Hamakua ditch, near Huelo.		.11	.07
28	Main branch of Makanale	20 feet above fall and intake into tunnel of New Hamakua ditch, at Korean camp, near Huelo.		.45	.3
28	Koaiea	Under trail bridge below New Hamakua ditch, near Huelo. No water diverted into ditch.		5.0	3.2
28	Branch of Kolea	Under trail bridge, near Huelo		.3	.2
28	Left branch of Kolea	30 feet above New Hamakua ditch, near Huelo. Right branch not measured, estimated the same.		.65	.45
28	Right branch of Alo	20 feet above Spreckels ditch, near Huelo.		.55	.35
28	Branch of Puohakamoa	First tributary, 75 feet above Spreckels ditch, near Huelo.		.5	.35
Apr. 4	Puohakamoa	500 feet above Haiku-uka boundary		10.6	6.8
5	do	do		6.9	4.5
15	do	do		5.4	3.5
16	do	do		4.4	2.8
4	East branch of Waikamoi	At trail crossing near Haiku-uka boundary.		8.3	5.4
5	do			4.4	2.9
15	do			4.8	3.1
16	do	do		3.3	2.1
4	West branch of Waikamoi	do		18	12
5	do	do		15	9.5
15	do	do		14	9.0
16	do	do		6.5	4.2
4	Nailiilihaele No. 1	do		.75	.5
5	do	do		.5	.35
15	do	do		.5	.3
16	do	do		.4	.25
4	Nailiilihaele No. 2	do		1.75	1.15
5	do	do		1.65	1.05
15	do	do		1.7	1.1
16	do	do		.85	.55
4	Nailiilihaele No. 3	do		.25	.15
5	do	do		.14	.09
15	do	do		.25	.15
16	do	do		.15	.1
4	Nailiilihaele No. 4	do		.75	.5
5	do	do		.5	.35
15	do	do		.45	.3
16	do	do		.4	.25
4	Kailua	do		11	7
5	do	do		8.5	5.5
15	do	do		7.9	5.1
16	do	do		4.2	2.7
18	Halehaku	125 feet above Kouhikoa ditch, near Huelo.		.35	.2
18	do	150 feet above intake to side ditch, near Huelo.		1.6	1.1
19	Kapaloalaca	Just above Lowrie ditch flume, near Huelo.		8.2	5.3
19	Lowrie ditch	Above tunnel with outfall into Halawa stream, near Huelo.		7.7	5.0
19	Waihee ditch	In wasteway above gate in ditch, 1,000 feet above Lowrie ditch, near Huelo.		2.9	1.9

NOTE.—Streams 50 to 75 per cent above normal Mar. 27 due to showers night of Mar. 26. Streams slightly above normal Mar. 28 due to light showers night of Mar. 27.

ISLAND OF MOLOKAI.

HALAWA STREAM NEAR HALAWA, MOLOKAI.

LOCATION.—250 feet below confluence of two main branches, 2 miles above mouth of stream and Halawa school house.

RECORDS AVAILABLE.—July 1, 1917, to June 30, 1918.

GAGE.—Stevens 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, 7.5 feet at 8 a. m. April 4 (discharge, from extension of rating curve, 730 million gallons per day, or 1,130 second-feet); minimum stage recorded, 0.35 foot October 13–15 and 19 (discharge, 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of taro and for domestic supply.

ACCURACY.—Stage-discharge relation permanent except for change made by flood of March 11. Rating curves applicable as follows: August 28 to March 11 well defined between 2.0 and 15 million gallons per day; March 12 to June 30 well defined between 4.0 and 100 million gallons per day. Rating curves fairly well defined outside of limits given. Operation of water-stage recorder unsatisfactory; no record July 1 to August 27, August 30 to September 9, September 11 to October 7, October 20–26, October 28 to November 4, November 6–18, and February 19–23. Records good within above limits of rating curves, when water-stage recorder was operating. Records poor when discharge was estimated.

Discharge measurements of Halawa Stream near Halawa, Molokai, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 19	0.51	2.3	1.5	Mar. 12	1.98	84	55
19	.52	2.7	1.7	Apr. 22	1.69	59	38
20	.48	2.1	1.4	22	1.54	49	32
Jan. 21	1.06	12.7	8.2	23	1.15	29	19
22	.99	10.4	6.7	June 3	.75	11.1	7.2

Daily discharge, in million gallons, of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1918.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.2	.....	.....	5.8	15.5	30	13.4	53	21.3	9.1
2	.....	2.2	.....	.....	4.5	21.5	8.4	15.2	140	15.3	9.9
3	.....	2.2	.....	.....	4.3	11.0	5.8	14.0	236	78	7.7
4	.....	2.1	.....	.....	10.6	5.8	5.0	37	208	24	6.6
5	.....	2.1	.....	.....	19.2	4.5	4.3	39	199	21.3	6.2
6	.....	2.1	.....	.....	11.5	4.2	4.2	32	124	15.3	5.6
7	.....	2.0	.....	.....	44	7.3	4.2	15.6	64	11.9	5.3
8	.....	2.0	1.3	.....	18.4	8.0	4.0	10.6	30	10.3	6.3
9	.....	2.0	1.2	.....	25	4.5	137	41.0	155	9.1	9.3
10	.....	1.9	1.2	.....	5.1	4.3	38	100	200	12.9	59
11	.....	.....	1.5	.....	4.0	11.2	12.2	187	81	11.2	23
12	.....	.....	1.3	.....	3.5	28	12.8	112	38	37	46
13	.....	.....	1.0	.....	3.0	7.1	7.7	135	50	38	20.6
14	.....	.....	.9	.....	2.9	8.0	6.1	72	45	12.2	14.0
15	.....	.....	1.4	.....	3.0	5.5	5.2	40	28	42	92
16	.....	.....	2.3	.....	2.6	6.0	64	158	55	78	29
17	.....	.....	1.7	.....	2.5	17.2	107	124	29	20.0	15.6
18	.....	.....	1.0	.....	2.3	5.5	19.4	32	16.8	13.4	10.7
19	.....	.....	1.0	1.6	2.2	31	135	20.3	16.8	11.0	8.7
20	.....	.....	.9	1.7	2.0	28	.....	16.2	49	9.3	17.4
21	.....	.....	.9	1.4	2.0	9.7	.....	12.2	17.4	8.3	50
22	.....	.....	.9	1.4	1.9	9.5	.....	11.2	56	8.7	46
23	.....	.....	.8	1.2	1.9	12.1	100	9.9	16.8	19.1	18.0
24	.....	.....	.8	2.1	13.5	7.9	38	54	13.7	23	18.0
25	.....	.....	.8	8.0	22	10.0	17.7	122	11.2	25	11.5
26	.....	.....	.7	42	9.1	14.1	11.2	25	11.0	26	13.2
27	.....	.....	.7	15.0	23	6.1	11.7	14.5	38	18.3	10.7
28	2.3	.....	.....	4.5	34	4.7	16.1	18.3	40	46	18.0
29	2.3	.....	.....	6.5	10.9	27	.....	38	94	34	42
30	2.3	.....	.....	18.2	9.3	12.5	.....	49	94	13.7	24
31	2.3	.....	.....	.....	4.0	7.9	.....	56	.....	11.0	.....

NOTE.—Discharge estimated as follows: Sept. 11–15, 4.0 M. G. D.; Sept. 16 to Oct. 7, 1.5 M. G. D.; Oct. 28–31, 2.0 M. G. D.; Nov. 1–3, 1.5 M. G. D.; Nov. 4–10, 5.0 M. G. D.; Nov. 11–18, 1.8 M. G. D.; Feb. 19 and 23 as given, Feb. 20–22, 50 M. G. D. Discharge interpolated at other times when water stage recorder was not operating.

Monthly discharge of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July [a]	.....	.....	2.50	3.87	77.5	238
August [a]	.....	.....	2.50	3.87	77.5	238
September [a]	.....	.....	2.11	3.26	63.3	201
October [b]	2.3	.7	1.32	2.04	40.8	126
November [b]	42	.....	5.25	8.12	158	483
December	44	1.9	9.93	15.4	308	945
January	31	4.2	11.5	17.8	356	1,090
February	137	4.0	34.1	52.8	955	2,930
March	187	9.9	52.4	81.1	1,620	4,990
April	236	11.0	73.6	114	2,210	6,780
May	78	8.3	23.4	36.2	725	2,230
June	92	5.3	21.8	33.7	653	2,010
The year	236	.7	19.8	30.6	7,240	22,300

[a] Estimate based on comparison with Honokahau Stream, Maui.
[b] Partially estimated by comparison with Honokahau Stream, Maui.

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, 1918.

Date.	Stream.	Location.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
Jan. 22	Right branch of Halawa.....	15 feet above confluence with left branch of Halawa.	0.99	7.3	4.7
22	First ditch on right side of Halawa.	One quarter of a mile below gaging station on Halawa.	.....	1.1	.7
22	Taro ditch on right side of Halawa.	300 feet below intake, and 800 feet below crossing of Halawa.	.....	.4	.25
22	Ditch on left side of Halawa..	150 feet below intake and 350 feet below crossing of Halawa.	.....	1.8	1.2

ISLAND OF HAWAII.

WAILUKU RIVER NEAR HILO, HAWAII.

LOCATION.—Below confluence of all main branches, 300 feet above intake of Hilo Electric Light Co.'s power canal and 1½ miles above Hilo.

RECORDS AVAILABLE.—March 21, 1911, to July 21, 1913, and January 2 to June 30, 1918.

GAGE.—Stevens water-stage recorder. March 21, 1911, to July 21, 1913, Barrett & 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; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 24.5 feet, high-water mark of flood, February 19 (discharge, estimated from extension of rating curve, 9,000 million gallons per day, or 13,900 second-feet); minimum stage recorded, 6.2 feet January 9 (discharge, 68 million gallons per day, or 105 second-feet).

Maximum stage during period of record February 19, 1918; 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 amounts of water above station.

REGULATION.—None.

UTILIZATION.—For power, fluming sugar cane, and irrigation of taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 90 and 3,000 million gallons per day. Operation of water-stage recorder satisfactory. Records good between 90 and 3,000 million gallons per day; fair above and below those limits.

Discharge measurements of Wailuku River near Hilo, Hawaii, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Feb. 21	14.35	4,100	2,650	Mar. 23	8.43	276	178
21	14.02	3,750	2,420	25	9.74	707	457
22	11.90	2,010	1,300	25	10.57	945	611
22	11.82	1,920	1,240	Apr. 25	8.12	213	137
23	10.85	1,210	785	May 1	7.50	152	98
23	10.75	1,080	698	June 11	7.56	153	99

Daily discharge, in million gallons, of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1918.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	568	411	160	98	334	16	85	.....	411	434	422	204
2	.....	389	304	389	106	284	17	80	.....	334	345	434	265
3	81	.....	256	470	568	212	18	78	.....	284	265	284	174
4	196	.....	188	518	1,550	174	19	76	.....	256	256	220	146
5	91	.....	188	506	568	153	20	74	.....	324	238	181	130
6	76	.....	188	334	356	130	21	72	.....	247	238	238	167
7	70	.....	140	265	265	118	22	70	1,280	204	181	256	196
8	68	.....	122	635	247	104	23	70	780	188	167	174	181
9	68	.....	115	1,810	220	100	24	90	708	174	146	153	204
10	69	.....	188	1,420	220	92	25	955	730	555	134	146	304
11	668	.....	446	830	181	100	26	1,680	1,000	542	130	134	265
12	212	.....	1,920	1,260	167	356	27	1,200	620	345	125	134	188
13	140	.....	1,200	1,490	174	212	28	446	482	256	118	378	174
14	118	.....	708	730	160	140	29	1,490	.....	204	115	730	140
15	94	.....	530	635	238	174	30	1,600	.....	167	106	555	146
							31	780	.....	153	.....	470	.....

Monthly discharge of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January 3–31	1,680	68	372	576	10,800	33,100
March	1,920	115	373	577	11,500	35,500
April	1,810	106	482	746	14,400	44,400
May	1,550	98	323	500	10,000	30,700
June	356	92	186	288	5,570	17,100

HILO BOARDING SCHOOL DITCH NEAR HILO, HAWAII.

LOCATION.—200 feet below upper crossing of county road at Piihonua, 3½ miles west of Hilo.

RECORDS AVAILABLE.—February 23 to June 30, 1918.

GAGE.—Gurley weekly 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 reduce velocity of approach.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.13 feet at 6 a. m. March 12 (weir overflowed); minimum stage recorded, 0.25 foot April 20 (discharge, 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—Ditch diverts from Wailuku River.

REGULATION.—By spillways.

UTILIZATION.—For irrigation and domestic supply.

ACCURACY.—Conditions at weir good for stages below 2.2 million gallons per day and are excellent; above that stage there is slight velocity of approach and records are fair.

Daily discharge, in million gallons, of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1918.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1	.....	1.5	1.7	1.8	16	3.0	0.95	1.6	2.3
2	.....	1.7	1.0	2.3	17	2.1	.95	1.6	2.4
3	5.5	1.6	2.5	2.2	18	1.6	.9	2.0	2.1
4	5.2	1.5	3.3	1.9	19	1.5	.85	3.1	2.0
5	4.7	1.4	1.8	1.4	20	1.6	.8	1.8	1.8
6	4.3	1.9	1.4	1.1	21	2.3	.85	1.8	2.1
7	4.4	2.5	1.4	.95	22	2.5	.9	2.1	2.3
8	3.8	1.6	1.7	1.0	23	2.1	.95	1.7	2.0
9	3.4	2.0	1.6	1.4	24	2.1	.9	1.6	2.3
10	4.9	2.1	1.6	1.2	25	2.0	.9	1.6	2.7
11	6.0	1.7	1.4	1.4	26	2.0	1.1	1.5	2.6
12	6.2	1.4	2.5	2.6	27	1.9	1.8	1.7	2.2
13	4.4	1.2	2.3	2.0	28	1.8	1.8	1.9	1.9
14	3.5	1.1	2.0	2.2	29	1.6	1.8	1.8	1.6
15	3.2	1.0	1.9	2.3	30	1.5	1.8	1.6	2.0
					31	1.5	.....	1.5	.....

NOTE.—No gage-height record Apr. 21, 22, 28, May 24, 25, and June 28, discharge interpolated.

Monthly discharge of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
March 3-31	6.2	1.5	3.12	4.83	91	278
April	2.5	.8	1.38	2.14	41	127
May	3.3	1.0	1.84	2.85	57	175
June	2.7	.95	1.94	3.00	58	179
The period	.....	.....	.....	.....	247	759

LOWER HAMAKUA DITCH AT MAIN WEIR, NEAR KUKUIHAELE, HAWAII.

LOCATION.—Just below portal of last tunnel from Waipio Gulch, half a mile southwest of Pacific sugar mill, at Kukuihaele. This ditch diverts all ordinary run-off from headwaters of the Waipio basin below the Upper Hamakua ditch.

RECORDS AVAILABLE.—July 18, 1910, to June 30, 1918.

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 determinations by weir formulas within 2 per cent.

EXTREMES OF DISCHARGE.—See monthly discharge table.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Records good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

Daily discharge, in million gallons, of Lower Hamakua ditch at main weir near Kukuihaele, Hawaii, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	34.6	29.9	27.5	25.6	32.0	42.0	25.2	33.2	33.6	34.7	33.6	34.6
2	37.6	34.1	27.3	25.5	38.3	37.4	25.2	29.9	34.1	34.6	35.0	34.4
3	34.9	32.3	27.2	27.8	51.0	33.3	25.8	28.1	33.7	34.2	34.0	34.4
4	31.2	29.9	27.9	27.9	52.4	33.0	31.7	26.9	34.5	34.6	35.0	32.3
5	40.4	28.3	28.6	27.1	47.5	29.3	36.2	26.3	33.7	34.0	35.0	31.6
6	44.7	27.8	27.2	25.5	3.42	29.3	28.3	26.9	33.7	34.6	34.9	31.6
7	45.1	27.9	26.9	25.7	53.0	43.8	25.5	29.3	34.7	35.3	34.9	31.5
8	35.1	28.1	26.9	25.5	51.7	31.7	26.3	26.3	33.3	34.0	35.1	31.4
9	32.9	28.1	27.1	25.3	52.4	28.1	35.0	34.2	33.5	31.1	35.3	31.4
10	31.9	27.9	26.8	25.3	40.7	28.3	35.9	29.9	35.6	7.5	34.9	33.1
11	30.9	27.9	26.3	25.3	48.9	27.5	42.7	23.3	34.3	2.3	34.8	34.4
12	30.1	28.1	27.8	25.0	40.7	26.9	37.4	.....	34.3	32.6	34.2	34.4
13	29.5	32.3	34.5	24.8	33.0	36.7	34.0	.....	33.0	34.6	34.2	31.6
14	29.0	42.0	58.0	24.8	29.9	34.9	34.9	.....	34.3	33.1	34.9	34.1
15	29.1	31.7	41.1	24.9	28.7	34.9	28.1	.....	34.3	35.7	35.0	34.7
16	28.9	28.9	31.3	26.1	28.1	23.8	37.4	3.6	35.0	23.6	34.9	34.7
17	29.3	28.1	29.8	30.3	26.9	28.5	33.0	33.6	34.6	33.2	35.0	34.6
18	29.1	27.5	28.9	26.5	26.9	28.9	30.5	34.2	34.3	34.4	34.2	34.4
19	29.9	27.6	28.3	25.6	26.3	38.7	28.1	34.2	34.3	34.0	34.2	34.7
20	28.9	28.1	27.8	25.3	26.3	33.0	27.5	33.0	33.7	34.7	33.8	35.0
21	28.9	29.6	27.5	25.0	25.8	25.8	26.5	32.3	32.5	34.6	33.6	34.7
22	29.5	49.2	27.2	27.2	26.3	40.7	27.5	34.2	32.5	34.9	35.0	34.8
23	32.9	43.9	27.2	38.2	33.0	36.8	27.5	33.0	33.1	34.6	35.0	31.9
24	30.7	32.3	27.2	34.6	43.4	30.9	26.3	33.6	35.0	34.2	35.0	33.5
25	29.6	29.9	26.9	28.1	41.4	28.1	26.3	31.7	34.5	33.8	34.3	34.2
26	28.9	28.9	26.9	26.9	36.1	27.1	31.1	31.7	33.1	35.5	36.2	34.6
27	28.6	28.4	27.2	28.6	36.1	26.6	33.6	32.0	35.3	34.4	36.1	34.2
28	28.1	27.8	26.9	27.1	36.8	27.7	28.6	32.9	35.2	33.7	32.2	34.1
29	29.3	27.5	26.9	26.2	33.0	27.3	26.0	.....	35.3	34.2	33.4	34.2
30	28.5	27.8	26.9	25.6	40.7	26.5	31.6	.....	34.7	35.0	36.7	34.8
31	28.4	27.2	.....	25.3	.....	25.5	36.1	.....	34.2	.....	35.0	.....

NOTE.—No discharge Feb. 12–15.

Monthly discharge of Lower Hamakua ditch at main weir near Kukuihaele, Hawaii, for year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	45.1	28.1	31.8	49.2	986	3,020
August	49.2	27.2	30.6	47.3	949	2,910
September	58.0	26.3	29.3	45.3	878	2,700
October	38.2	24.8	26.9	41.6	833	2,560
November	58.3	25.8	38.0	58.8	1,140	3,500
December	43.8	23.8	31.4	48.6	973	2,990
January	42.7	25.2	30.6	47.3	950	2,910
February (24 days)	34.2	3.6	29.8	46.1	714	2,190
March	35.6	32.5	34.1	52.8	1,060	3,240
April	35.7	2.3	31.9	49.4	958	2,940
May	36.7	32.2	34.7	53.7	1,080	3,300
June	35.0	31.4	33.7	52.1	1,010	3,100
The year	.....	.....	.....	.....	11,500	35,400

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, 1918. Records given herewith show the combined flow of the main ditch and its diversion to reservoir No. 3 which occurs above the main weir.

GAGE.—Watson water-stage recorder at each weir.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weirs with good stilling basins above.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—This ditch diverts all ordinary run-off from upper headwaters of Waipio Gulch.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Record good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

Daily discharge, in million gallons, of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1918.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.8	3.7	.....	.....	5.8	10.2	0.3	8.3	25.1	19.2	20.5	18.0
2	3.8	5.0	.....	.....	24.9	4.9	.3	2.0	25.7	33.6	17.7	18.6
3	2.8	4.2	.....	.....	10.1	3.5	.5	2.3	30.0	19.8	28.2	10.8
4	3.6	2.2	.....	.....	12.0	2.8	7.1	.9	22.7	17.5	27.2	7.5
5	16.8	1.8	.....	.....	10.1	1.6	4.0	.8	14.0	18.5	17.0	6.8
6	15.2	.8	.....	.....	5.0	4.8	1.3	1.4	9.5	15.5	10.8	5.5
7	12.8	.7	.....	.....	25.2	16.3	.7	2.3	9.4	21.1	9.4	5.9
8	5.4	.7	.....	.....	19.7	4.1	.5	1.6	6.0	29.9	7.0	5.1
9	2.8	.7	.....	.....	14.1	2.0	6.0	30.0	6.0	29.2	14.7	7.2
10	2.4	.7	.....	.....	6.2	1.0	5.6	29.0	15.0	24.5	17.5	7.1
11	2.0	.7	.....	.....	13.4	1.1	21.6	26.4	15.8	8.6	13.0	24.2
12	1.9	.7	5.7	.....	6.2	.9	5.0	27.1	18.5	7.1	20.0	27.7
13	.8	5.2	15.3	.....	4.8	2.8	2.8	15.7	17.5	10.7	25.0	18.9
14	.8	11.8	9.7	.....	3.4	3.0	4.2	11.4	15.5	11.2	25.6	14.8
15	1.7	5.5	2.9	.....	3.2	2.7	3.3	4.4	14.8	12.5	23.3	15.7
16	.9	3.4	.....	.....	1.8	2.0	18.4	3.6	11.2	11.1	22.4	17.1
17	1.0	1.9	.....	.....	1.7	1.2	6.4	8.8	9.0	7.2	24.4	19.0
18	1.1	.8	.....	.....	1.7	5.0	2.6	14.6	4.7	7.1	16.3	19.4
19	2.4	.8	.....	.....	1.5	6.7	2.0	18.3	3.6	5.7	12.9	17.5
20	2.1	1.0	.....	.....	.5	4.2	2.9	28.7	3.2	3.2	10.3	17.4
21	2.1	5.6	.....	.....	.5	3.1	3.1	13.9	2.7	17.3	8.3	25.2
22	2.3	20.0	.....	.....	.5	5.8	4.1	14.5	2.4	16.1	9.2	24.1
23	1.2	10.0	.....	5.5	1.0	2.5	4.0	24.1	2.5	7.9	11.1	18.9
24	1.3	4.6	.....	1.7	7.7	1.3	2.1	13.5	4.6	6.9	13.0	20.2
25	1.3	2.8	.....	.....	6.8	2.3	1.7	8.8	26.6	6.8	9.6	18.2
26	1.3	.7	.....	.....	5.0	.7	9.5	8.2	21.7	5.5	11.8	10.2
27	1.0	.7	.....	.....	3.1	.5	11.5	17.4	16.0	15.7	17.2	17.0
28	.9	.7	.....	.....	7.0	.5	4.7	19.8	13.9	8.7	20.1	11.3
29	1.5	.4	.....	.....	2.6	.5	1.9	.....	8.3	5.6	14.8	10.4
30	1.5	.4	.....	.....	23.8	.5	8.9	.....	3.6	21.3	18.6	19.0
31	2.0	.4	.....	.....	.....	.4	16.9	.....	3.9	.....	18.4	.....

NOTE.—No flow on days for which no discharge is given.

Monthly discharge of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	16.8	0.8	3.21	4.97	100	305
August	20.0	.4	3.18	4.92	99	303
November	25.2	.5	7.64	11.8	229	703
December	16.3	.4	3.19	4.94	99	303
January	21.6	.3	5.29	8.18	164	503
February	30.0	.8	12.8	19.8	358	1,100
March	30.0	2.4	12.4	19.2	383	1,180
April	33.6	3.2	14.2	22.0	425	1,310
May	28.2	7.0	16.6	25.7	515	1,580
June	27.7	5.1	15.3	23.7	459	1,410

KOHALA DITCH ABOVE HONOKANE GULCH, NEAR KOHALA, HAWAII.

LOCATION.—In crosscut of tunnel in Awini section of ditch, 2,000 feet above Awini weir, and 8 miles southeast of Niulii.

RECORDS AVAILABLE.—February 19 to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Probably permanent. Ditch is in tunnel cut in hard rock.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.34 feet at 6.15 p. m. April 9 (discharge, 32 million gallons per day, or 50 second-feet); minimum stage recorded, 0.65 foot April 12, 19 and 20 (discharge, 5.6 million gallons per day, or 8.7 second-feet).

DIVERSIONS.—Ditch diverts water from large number of small streams.

REGULATION.—By gates at intervals.

UTILIZATION.—For irrigation of sugar cane and for power development.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 6 and 30 million gallons per day. Operation of recorder fairly satisfactory for published record. Records fair for all stages.

Discharge measurements of Kohala ditch above Honokane Gulch, near Kohala, Hawaii, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Feb. 19	3.13	45	29	Apr. 29	1.00	12.9	8.3
Mar. 21	1.32	19.2	12	June 15	2.44	35	23

Daily discharge, in million gallons, of Kohala ditch above Honokane Gulch, near Kohala, Hawaii, for the year ending June 30, 1918.

Day.	Feb.	Mar.	Apr.	May.	June.	Day.	Feb.	Mar.	Apr.	May.	June.
1	.....	.....	.....	16	12.8	16	.....	26	6.4	14.6	17
2	.....	.....	.....	13.2	16	17	.....	13.6	6.0	13.6	19
3	.....	.....	.....	22	10.5	18	.....	17	6.0	12.3	18
4	.....	29	.....	.....	9.2	19	.....	14.1	5.6	11.0	13.2
5	.....	24	.....	.....	8.2	20	29	13.2	5.6	11.0	11.0
6	.....	22	.....	.....	6.9	21	28	11.4	6.0	11.0	14.1
7	.....	.....	20	11.4	6.4	22	26	10.5	6.0	11.0	19
8	.....	.....	24	10.5	.....	23	.....	10.0	6.0	10.5	12.3
9	.....	.....	25	11.8	.....	24	.....	11.0	6.4	12.3	11.0
10	.....	24	17	18	.....	25	.....	28	7.4	9.6	10.5
11	.....	28	6.0	11.4	.....	26	.....	28	8.2	8.7	10.5
12	.....	29	5.6	15	.....	27	.....	22	13.6	11.8	10.5
13	.....	24	6.0	22	.....	28	.....	21	11.0	17	11.4
14	.....	27	6.4	18	.....	29	.....	20	10.5	18	10.0
15	.....	26	6.4	13.6	.....	30	.....	.....	18	17	15
						31	.....	.....	.....	12.8	.....

KEHENA DITCH NEAR KOHALA, HAWAII.

LOCATION.—At old Honokane weir just below head of west branch of Honokanenui Gulch, about 13 miles by trail southwest of Kohala Ditch Co.'s headquarters at Howi.

RECORDS AVAILABLE.—December 28, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made from plank across ditch 100 feet above old weir.

CHANNEL AND CONTROL.—Weir basin has concrete walls and is about 25 feet long and 20 feet wide. Control is old wooden weir of three 5-foot panels, with imperfect contractions and no longer sharp crested.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.16 feet at 8.15 p. m. January 27 (discharge, 86 million gallons per day, or 133 second-feet); minimum stage recorded, 0.03 foot, April 20 and June 9 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—Ditch diverts water from several small streams.

REGULATION.—By head gates.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Operation of water-stage recorder satisfactory. Rating curve well defined below 4 million gallons per day and records good below that stage; curve for stages above 4 million gallons per day not based on discharge measurements, but on account of uniform conditions at weir, determinations of daily discharges by extensions of rating curve are fair.

Discharge measurements of Kehena ditch near Kohala, Hawaii, during the year ending June 30, 1918.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Feb. 16	0.14	2.4	1.6	Apr. 27	0.12	1.85	1.2
Mar. 20	.11	1.6	1.0	June 14	.20	4.5	2.9

Daily discharge, in million gallons, of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1918.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	0.7	26	35	6.3	8.1	8.1
2	.....	.7	9.6	42	39	3.9	9.6
3	.....	.0	4.4	28	24	20	5.2
4	.....	.0	2.8	20	18	39	3.4
5	.....	.9	2.6	11.2	22	33	3.0
6	.....	2.8	1.9	6.3	16	24	2.3
7	.....	1.5	3.4	4.4	15	16	2.3
8	.....	3.2	3.4	3.0	33	11.2	.5
9	.....	20	9.6	2.1	24	9.6	.2
10	.....	11.2	39	15	15	16	.5
11	.....	28	39	22	4.7	5.8	6.9
12	.....	6.6	44	22	1.7	7.5	26
13	.....	4.2	15	9.6	2.6	15	9.6
14	.....	3.9	5.2	20	1.7	15	3.2
15	.....	2.6	2.6	15	1.2	7.5	16
16	.....	26	1.7	5.2	1.0	8.1	12.9
17	.....	6.6	20	3.7	.7	8.1	16
18	.....	3.0	12.9	2.1	.4	4.9	12.9
19	.....	2.1	24	1.5	.3	2.3	9.6
20	.....	9.6	37	1.0	.2	1.9	11.2
21	.....	7.5	24	.9	1.0	2.1	12.9
22	.....	6.9	16	.9	3.0	6.6	11.2
23	.....	3.7	26	.9	1.5	4.7	7.2
24	.....	2.1	20	.9	1.0	3.9	6.3
25	.....	2.6	9.6	26	.9	2.3	9.6
26	.....	16	8.1	22	.9	2.6	6.9
27	.....	46	15	9.6	1.0	6.9	3.0
28	.....	51	35	4.4	1.2	8.1	2.6
29	7.8	33	.....	2.3	1.2	8.1	1.9
30	1.9	31	.....	1.7	15	8.1	8.1
31	.9	31	.....	1.7	.....	9.6	.....

Monthly discharge of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
January (29 days)	51	0.7	12.6	19.5	364	1,120
February	44	1.7	16.4	25.4	458	1,410
March	42	.9	11.0	17.0	340	1,050
April	39	.2	8.45	13.1	254	778
May	39	1.9	10.3	15.9	320	980
June	26	.2	7.64	11.8	229	703
The period					1,960	6,040

WAIOHINU SPRINGS, MAUKA STATION, NEAR NAALEHU, HAWAII.

LOCATION.—Below confluence of several small streams issuing from Waiohinu Springs (sometimes called Hoao Springs), 4 feet above intake to Waiohinu water-supply system, 6 feet above intake to pipe leading to Hutchinson plantation, 1 mile north of Waiohinu, and 3 miles by trail northwest of Naalehu.

RECORDS AVAILABLE.—November 29, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by 2.5 foot rectangular, sharp-crested weir, with full end contractions.

CHANNEL AND CONTROL.—Weir basin is about 6 feet wide and 10 feet long.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 0.67 foot at 3 a. m. February 20 (discharge, 2.8 million gallons per day, or 4.3 second-feet); minimum stage recorded, 0.10 foot December 1–6 and January 11 and 12 (discharge, 0.17 million gallons per day, or 0.26 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Operation of water-stage recorder satisfactory, except May 12–19 (no record); discharge estimated at 0.60 million gallons per day. Records good.

Daily discharge, in million gallons, of Waiohinu Springs, mauka station, near Naalehu, Hawaii, for the year ending June 30, 1918.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.17	0.54	1.17	1.04	0.54	0.66	0.54
2	.17	.58	1.08	.95	.54	.66	.47
3	.17	.40	.91	.91	.54	.66	.47
4	.17	.37	.86	.91	.54	.58	.47
5	.17	.37	.82	.91	.54	.62	.47
6	.17	.37	.78	.82	.54	.66	.47
7	.20	.31	.74	.78	.58	.66	.47
8	.20	.25	.70	.74	.62	.66	.47
9	.20	.22	.66	.70	.66	.66	.51
10	.20	.22	.58	.66	.78	.70	.58
11	.20	.17	.58	.66	.86	.70	.66
12	.20	.17	.58	.66	.82	.....	.70
13	.22	.28	.62	.66	.82	.....	.70
14	.22	.31	.54	.74	.74	.....	.70
15	.22	.34	.51	.99	.74	.....	.70
16	.22	.34	.54	1.17	.78	.....	.70
17	.31	.34	.62	1.13	.78	.....	.70
18	.40	.34	.91	.86	.78	.....	.70
19	.34	.34	1.37	.86	.78	.....	.70
20	.34	.28	1.82	.74	.78	.51	.70
21	.40	.28	1.66	.70	.66	.54	.70
22	.51	.25	1.41	.70	.47	.58	.66
23	.44	.28	1.17	.66	.47	.58	.54
24	.44	.28	1.04	.70	.51	.58	.54
25	.44	.37	1.04	.70	.54	.58	.54
26	.47	.70	1.04	.70	.51	.51	.58
27	.58	1.17	1.04	.70	.54	.51	.58
28	.62	1.17	1.04	.70	.58	.54	.54
29	.62	1.17	.....	.70	.62	.58	.54
30	.58	1.22	.....	.70	.62	.58	.47
31	.51	1.22	.....	.54	.....	.58	.....

Monthly discharge of Waiohinu Springs, mauka station, near Naalehu, Hawaii, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
December	0.62	0.17	0.326	0.504	10.1	31.0
January	1.22	.17	.473	.732	14.6	45.0
February	1.82	.51	.922	1.43	25.8	79.2
March	1.17	.54	.787	1.22	24.4	74.9
April	.86	.47	.643	.995	19.3	59.2
May	.....	.....	.603	.933	18.7	57.4
June	.70	.47	.586	.907	17.6	54.0
The period	.....	.....	.....	.....	130	401

WAIOHINU SPRINGS, MAKAI STATION, NEAR NAALEHU, HAWAII.

LOCATION.—At same location as old Hutchinson Plantation weir, 150 feet below intake to Waiohinu water-supply system, 1 mile north of Waiohinu and 3 miles by trail northwest of Naalehu.

RECORDS AVAILABLE.—November 29, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by a rectangular, sharp-crested weir 1.5 feet long.

CHANNEL AND CONTROL.—Weir basin is 8 feet long and 4 feet wide, made of redwood planks, and provided with set of baffles.

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EXTREMES OF DISCHARGE.—Maximum stage recorded, 0.4 foot at 12.10 a. m. March 16 (discharge, 0.77 million gallon per day, or 1.19 second-feet); minimum stage recorded, 0.10 foot December 1–6 (discharge, 0.10 million gallon per day, or 0.15 second-foot).

DIVERSIONS.—Pipe line supplying Waiohinu village and Kamaoa homesteads diverts water above station.

REGULATION.—By diversion only.

UTILIZATION.—For irrigation and fluming cane and for stock.

ACCURACY.—Stage-discharge relation practically permanent. Operation of water-stage recorder satisfactory, except May 12–18, no record, and discharge interpolated. Records good.

Daily discharge, in million gallons, of Waiohinu Springs, makai station, near Naalehu, Hawaii, for the year ending June 30, 1918.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.10	0.24	0.69	0.75	0.46	0.51	0.37
2	.10	.28	.69	.75	.46	.51	.37
3	.10	.28	.69	.72	.48	.51	.37
4	.10	.28	.69	.72	.53	.51	.37
5	.10	.24	.66	.72	.51	.44	.37
6	.10	.24	.64	.72	.51	.34	.37
7	.12	.24	.59	.69	.48	.34	.34
8	.12	.20	.56	.69	.51	.34	.37
9	.12	.18	.56	.66	.59	.34	.41
10	.12	.18	.51	.61	.69	34	.53
11	.12	.18	.48	.61	.72	.34	.56
12	.15	.18	.48	.64	.72	.35	.64
13	.15	.22	.46	.64	.69	.35	.66
14	.15	.24	.46	.66	.64	.35	.64
15	.15	.24	.44	.75	.64	.35	.61
16	.20	.24	.39	.77	.64	.36	.58
17	.24	.20	.48	.72	.64	.36	.53
18	.24	.20	.61	.72	.64	.36	.53
19	.28	.20	.66	.72	.64	.37	.51
20	.32	.18	.72	.66	.59	.34	.46
21	.37	.18	.75	.56	.51	.37	.39
22	.46	.18	.75	.48	.51	.39	.39
23	.46	.18	.72	.48	.51	.37	.41
24	.51	.20	.72	.51	.51	.39	.41
25	.51	.28	.72	.51	.51	.37	.43
26	.34	.41	.75	.51	.51	.37	.43
27	.34	.69	.75	.51	.51	.37	.41
28	.32	.69	.75	.46	.51	.39	.41
29	.32	.69	.....	.44	.51	.39	.41
30	.28	.69	.....	.44	.51	.39	.34
31	.28	.69	.....	.44	.....	.37	.....

Monthly discharge of Waiohinu Springs, makai station, near Naalehu, Hawaii, for the year ending June 30, 1918.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
December	0.51	0.10	0.234	0.362	7.3	22.3
January	.69	.18	.301	.466	9.3	28.6
February	.75	.39	.620	.959	17.4	53.3
March	.77	.44	.621	.961	19.3	59.1
April	.72	.46	.563	.871	16.9	51.8
May	.51	.34	.383	.593	11.9	36.4
June	.66	.34	.454	.702	13.6	41.8
The period	.....	.....	.....	.....	95.7	293

MISCELLANEOUS MEASUREMENTS.

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

Miscellaneous measurements on Hawaii during the year ending June 30, 1918.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
Sept. 24	Wailuku River	At old gaging station, near Hilo		2.3	15
29	do	do		18	11
24	Right Main Branch of Wailuku River.	Elevation about 1,125 feet, near Hilo		9.4	6.1
29	do	do		6.6	4.3
24	Kapehu	500 feet above trail crossing. Stream is also known as Middle Fork of Wailuku River.		2.4	1.5
29	do	do		3.5	2.3
29	Waiou	At outlet of pool below falls, elevation 1,000 feet. Stream also known as Left Branch of Wailuku River.		1.35	.85
24	Branch of Kapehu	At trail crossing, near Hilo		1.3	.85
24	Branch of Wailuku River	At trail crossing, near Hilo, elevation 1,225 feet.		.2	.15

RAINFALL.

GENERAL CONDITIONS.

The rainfall of the Hawaiian Islands is extremely variable, ranging from a few inches at several low-level, leeward localities to nearly 600 inches per annum, at elevations exceeding 2,000 feet on the windward sides of the islands. Valleys on the same sides of the islands and within a few miles of each other may have a variation in mean annual precipitation of several hundred per cent. The rainfall may also vary greatly in the same valley at different elevations. As a rule the zones of heaviest precipitation are on the windward sides of the islands, 2,000 to 3,000 feet above sea level.

Most of the daily rain gages maintained by the United States Weather Bureau are at low levels. Lack of funds and the absence of residents have prevented the bureau from maintaining stations at high levels, but it obtains a number of daily records from occupants and caretakers of mountain houses and ranches. The data furnished by the Weather Bureau are therefore generally of little value in determining stream run-off.

When high levels have been accessible and funds available high-level rain gages, which are read at monthly, bimonthly, or longer intervals, have been established by this office and some valuable records obtained. To determine the precipitation throughout the Territory accurately would require the installation of thousands of gages and the construction of hundreds of miles of trails. For this reason and because of the extreme and variable porosity of the soil,

it is impossible to determine any consistent relation between rainfall and stream run-off.

Acknowledgment for cooperation in furnishing rainfall data is due the following companies and individuals:

Kauai: Kekaha Sugar Co.; Hawaiian Sugar Co.; Grove Farm Plantation; W. F. Sanborn, of Princeville Ranch; Kauai Electric Co.; J. McClellan.

Oahu: F. Meyer; United States Army; Koolau Agricultural Co.; Hawaii Preserving Co.

Maui: Wailuku Sugar Co.; Honolua Ranch; Hawaiian Commercial & Sugar Co.; Maui Board of Supervisors; Pioneer Mill Co.; Olowalu Sugar Co.

The tables on pages 166–167 show the precipitation at stations maintained by the Geological Survey and precipitation data furnished from private sources which are not included in United States Weather Bureau records, to which those interested in further data are referred.

RAINFALL STATIONS IN HAWAII.

KAUAI.

1. Intake of Kauai Electric Co.'s canal, 6 miles back of Hanalei; 700 feet above sea level; records furnished by Kauai Electric Co.

2. About 50 feet below Kauai Electric Co.'s power house, at tailrace, 7 miles west of Hanalei; 125 feet above sea level; records furnished by Kauai Electric Co.

3. Summit Camp (Wainiha Ridge), Hanalei; about 30 feet southwest of house at Summit Camp on power line; 6 miles from Kapaka; 1,900 feet above sea level; gage ready by employee of Kauai Electric Co.

4. Kapaka, at lineman's camp, about 50 feet north of house, and 5 miles south of Hanalei; 635 feet above sea level; gage read by employee of Kauai Electric Co.

5. About 40 feet north of Sanborn's residence, 2 miles from Hanalei; 105 feet above sea level; records furnished by Princeville ranch.

6. Kaloko, on embankment of Kaloko reservoir, about 3 miles southeast of Kilauea; 740 feet above sea level. Gage read by Mr. Buch, an employee of Kilauea Sugar Plantation Co.

7. Residence of W. S. Newlun, about 4½ miles west of Kapaa; 375 feet above sea level.

8. Mount Nonou, near house of Elmer M. Cheatham on west slope of Mount Nonou, about 4 miles west of Kapaa; 350 feet above sea level.

9. North Wailua, at stream-gaging station on North Wailua River, about 1 mile upstream from Kanaha ditch intake, and about 10 niles northwest of Lihue; 650 feet above sea level.

10. At ditchman's house, 500 feet west of Papuaa Reservoir, 6 miles west of Lihue; 500 feet above sea level.

11. Hiloa-Manawaiopuna divide, on ridge between east and west branches of Hanapepe stream, about 10 miles northeast of Eleele; 2,080 feet above sea level.

12. Hanapepe Valley, on the left bank of Hanapepe ditch, 3 miles above Koula, and about 8 miles north of Eleele; 530 feet above sea level; records furnished by Hawaiian Sugar Co.

13. Olokele mauka, on ridge on left side of Olokele stream above intake of Olokele ditch, and about 18 miles by road and trail from Waimea; 2,100 feet above sea level; records furnished by Hawaiian Sugar Co.

14. Waimea, in Mr. J. McClellan's yard, 10 feet above sea level; Mr. McClellan aids in obtaining record.

15. At the stream-gaging station on Kalihiwai River, 10 miles from Hanalei via Kauai Electric Co.'s power-line trail; 700 feet above sea level.

16. At stream-gaging station in upper Hanalei Valley, about 2 miles north by foot trail of Summit Camp on power-line trail; about 700 feet above sea level.

OAHU.

1. Nuuanu Pali, on the water reservation near the Pali Road, about 200 yards toward Honolulu from top of Pali; 1,136 feet above sea level.

2. Manoa, at residence of E. H. Hipple, in upper Manoa Valley, about 500 feet west of highway bridge over the East Branch of Manoa Stream; 300 feet above sea level.

3. Residence of J. K. Maui, in upper Kalihi Valley; 550 feet above sea level.

4. At elevation 970 feet in upper Kalihi Valley, about 2 miles above Catholic orphanage.

5. Wahiawa Water Co.'s intake, about 150 yards downstream on left bank of North Fork of Kaukonahua Stream from Wahiawa Water Co.'s ditch intake, on trail 8 miles north of Wahiawa; 1,200 feet above sea level. (Described in Water-Supply Paper 430 as the Waialua Agricultural Co.'s ditch intake.)

6. Hawaiian Preserving Co.'s office, Wahiawa; 950 feet above sea level; records are furnished by Hawaiian Preserving Co.

7. Makaha, near Waianae, on property of Waianae plantation; 1,300 feet above sea level; records furnished by F. Meyer, manager Waianae plantation.

8. About 250 feet from Koloa Stream gaging station, 3 miles by trail southwest of Laie; 550 feet above sea level.

9. On left bank of Maole Stream, at head of first falls in Hillebrand Glen, about 2¼ miles from end of Nuuanu Valley street car line; 1,200 feet above sea level.

MAUI.

1. Waikamoi Gulch, on Kula pipe line at reservoir, 3 miles from Olinda and 7 miles from Makawao; 4,200 feet above sea level.

2. Puohakamoa, on Kula pipe line, about 1,000 feet below intake at Puohakamoa. Gulch; 4 miles east of Olinda and 8 miles from Makawao; 4,300 feet above sea level

3. Olinda, on Kula pipe line, 4 miles east of Makawao; 4,000 feet above sea level.

4. West slope of Puu Kukui, at top of left bank of Honokawai Gulch; about 6 miles east of Kaanapali and 10 miles from Lahaina; 4,300 feet above sea level.

5. West slope of Puu Kukui, about one-half of a mile south of Honokawai Gulch; about 4½ miles east of Kaanapali and 8½ miles from Lahaina; 2,500 feet above sea level.

6. On ridge between Honokahau and Kahakuloa gulches, beside trail leading to top of Mount Eke; about 12 miles from Honokahau; 2,300 feet above sea level.

7. Honokahau Gulch, at ditchman's house on left bank of stream, 150 feet below ditch intake; about 8 miles from Honokahau; 800 feet above sea level.

8. Rim of extinct crater of Mount Eke; 14 miles by trail from Honokahau; 4,500 feet above sea level.

Records of rainfall for the year ending June 30, 1918.

Island of Kauai.

No.	Station.	Records available.	Gage.	Readings.	Precipitation.												
					July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Year.
1	Intake Wainiha power canal.	Feb. 1, 1907–June 30, 1918	Records furnished by Kauai Electric Co.	Daily...	15.20	13.84	7.70	11.60	12.59	4.24	11.75	24.73	32.68	41.65	14.02	7.14	197.14
2	Power house, Wainiha.	....do....	....do....	...do....	8.92	6.25	4.90	8.04	9.23	9.76	13.43	12.48	27.85	24.20	15.34	7.35	147.75
3	Summit Camp, Hanalei.	Sept. 18, 1910–June 30, 1918	....do....	...do....	12.49	12.21	10.34	11.66	12.14	6.29	14.20	17.31	41.34	35.58	20.53	9.24	203.33
4	Kapaka	....do....	....do....	...do....	10.99	12.30	7.38	6.14	8.41	6.52	13.04	10.85	35.77	26.48	19.41	10.00	167.24
5	Sanborn's house, Hanalei.	Mar. 11, 1910–June 30, 1918	Records furnished by W. F. Sanborn.	...do....	5.81	7.89	4.61	4.78	6.94	4.56	11.13	6.07	25.89	17.47	11.64	4.74	111.53
6	Kaloko	June 1, 1914–June 30, 1918	Records furnished by T. B. Buch.	...do....	7.20	9.30	4.20	4.20	5.00	4.40	6.00	3.80	8.00	8.40	3.00	4.00	67.5
7	Newlun's house	....do....	....do....	...do....	6.21	5.39	8.45	4.96	5.49	3.17	8.03	7.46	17.92	14.35	4.56	3.90	89.89
8	Mount Nonou	Feb. 1, 1915–June 30, 1918	Records furnished by E. M. Cheatham.	Monthly	4.90	6.00	4.00	5.80	5.50	3.00	7.00	6.40	17.50	15.00	6.00	3.50	84.6
9	North Wailua	Sept. 25, 1914–June 30, 1918	2:1	Irregular													128.2
10	Papuaa	July 1, 1915–June 30, 1918	Records furnished by Grove farm.	Daily...	8.32	8.00	4.94	9.26	5.62	4.84	5.31	10.57	21.69	22.67	9.01	4.22	114.45
11	Hiloa-Manawaiopuna divide.	Aug. 24, 1910–June 30, 1918	2:1	Monthly	18.80	13.40	11.40	12.20	14.80	8.40	14.40	16.60	41.40	33.60	16.20	9.40	210.6
12	Hanapepe Valley.	Jan. 1, 1905–June 30, 1918	Records furnished by Hawaiian Sugar Co.	Daily...	10.29	7.49	8.02	9.44	7.91	7.48	10.41	9.09	23.56	19.27	8.22	4.80	125.98
13	Olokele mauka	Apr. 1, 1911–June 30, 1918	....do....	Monthly	11.85	10.20	9.60	12.50	11.30	12.74	15.15	17.60	22.50	22.30	9.50	4.50	159.74
14	Waimea	Jan. 1, 1913–June 30, 1918	Records furnished by Jas. McClellan.	Daily...	1.03	.11	.40	6.35	.66	3.94	5.33	2.68	2.82	6.52	.05	.00	29.89
15	Kalihiwai	May 26, 1914–June 30, 1918	2:1	...do....													200.4
16	Hanalei, at elevation 625.	June 27, 1914–June 30, 1918	8-inch 2:1	...do....													178.4

Island of Oahu.

1	Nuuanu Pali	Sept. 23, 1910–June 30, 1918	2:1	Monthly	2.80	4.20	6.00	4.40	10.20	13.10	16.60	8.60	27.00	28.90	12.80	5.00	139.6
2	Manoa	May 17, 1915–June 30, 1918	1:10	Daily	8.61	6.87	7.21	7.33	16.45	9.29	8.67	10.42	23.06	25.69	13.51	12.30	149.41
3	Kalihi	Sept. 8, 1914–June 30, 1918	1:10	do	4.81	5.52	5.80	3.96	12.90	10.34	11.39	11.20	17.71	20.76	8.97	7.99	121.35
4	Kalihi-mauka	Feb. 7, 1917–June 30, 1918	2:1	Monthly	5.80	6.20	11.29	3.60	13.00	9.80	14.20	13.60	24.40	32.60	14.80	10.40	159.60
5	Wahiawa Water Co.'s intake	May 30, 1913–June 30, 1918	2:1	Irregular													202.7
6	Hawaii Preserving Co.	Mar. 1, 1913–June 30, 1918	Records furnished by Hawaii Preserving Co.	Daily	2 35	1.17	5.55	2.83	3.80	8.48	8.57	5.23	5.88	9.34	2.59	.85	56.64
7	Makaha	Aug. 1, 1912–June 30, 1918	Records furnished by F. Meyer.	do	5.94	4.12	4.78	2.84	5.85	10.92	14.80	11.81	9.21	21.01	1.65	3.19	96.12
8	Koloa	Oct. 30, 1915–June 30, 1918	2:1	Irregular													108.2
9	Hillebrand Glen No. 2.	May 6, 1916–June 30, 1918	2:1	Monthly	5.60	8.00	7.80	6.00	17.00	14.20	16.20	12.40	27.20	31.80	13.00	14.20	173.4

Island of Maui.

1	Waikamoi Gulch	Oct. 12, 1910–June 30, 1918	Records furnished by Maui County engineer.	Daily	11.31	8.46	5.82	6.49	25.67	7.34	15.74	33.86	41.74	65.55	19.79	17.59	259.36
2	Puohakamoa	May 1, 1911–June 30, 1918	do	do	11.15	8.58	6.05	5.13	22.08	6.42	14.17	31.03	39.78	62.84	24.34	16.69	248.26
3	Olinda	Sept. 26, 1910–June 30, 1918	do	do	.99	2.90	2.88	3.19	7.56	3.32	13.34	11.13	12.96	16.78	3.74	1.39	80.18
4	Puukukui, upper slope.	Oct. 13, 1911–June 30, 1918	Records furnished by Pioneer Mill Co.	Monthly	7.0	16.0	5.0	15.0	44.0	26.0	32.0	54.0	56.0	72.0	29.0	45.0	401.0
5	Puukukui, lower slope.	do	do	do	.8	1.0	3.2	2.6	4.4	4.4	9.0	16.4	14.4	21.2	6.8	2.6	86.8
6	Honokahau Ridge	Mar. 10, 1913–June 30, 1918	2:1	do	3.6	4.4	1.6	38.0	6.6	9.4	10.6	20.6	29.0	49.0	13.0	12.8	198.0
7	Honokahau Gulch	Feb. 1, 1907–June 30, 1918	Records furnished by Honolulu ranch.	Daily	4.17	3.09	3.04	3.93	9.27	11.35	12.76	27.22	44.31	64.29	15.17	13.15	211.75
8	Mount Eke	Mar. 10, 1913–June 30, 1918	5:1	Monthly	9.0	10.5	5.5	50.0	13.5	13.0	11.5	35.0	60.5	60.0	20.5	30.5	319.5

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