Reports

State of Colorado

of the

State Engineer

(E. S. NETTLETON)

for

1885, 1886

THIRD

BIENNIAL REPORT

OF THE

State Engineer

OF THE

STATE OF COLORADO,

For the Years 1885-86.

TO THE GOVERNOR.

OFFICE OF THE STATE ENGINEER,
DENVER, COLO., December 1, 1886.

To His Excellency,

BENJAMIN H. EATON,

Governor of Colorado:

I have the honor to transmit to you the report of the transactions of this department during the two fiscal years ending November 30, 1886, together with such observations and discussions of subjects connected with irrigation as may help to advance the agricultural interests of the State.

I have the honor to be, sir,

Yours very respectfully,

E. S. NETTLETON,

State Engineer.

REPORT.

Summary of Work Performed during the Years 1885-'86.

The field work connected with this office has mainly been confined to those portions of the State which have been organized into water districts, wherein court decrees establishing water priorities and amount of appropriations have been made.

The gauging and rating of rivers, canals and ditches have been carried on wherever measuring flumes have been constructed. The continuous record of the heights and discharge of the Cache la Poudre river has been continued by the aid of self-registering apparatus in operation during the irrigating season, at the gauging station erected for this purpose. The results thus far obtained by the use of this method of gauging rivers have been very satisfactory. They are given in detail for each day during the irrigating seasons of 1884–85–86, with a diagram showing the exact stage of the water during the three years named, affording a ready method of comparing the flow of one year of water with another. The rough observations made on other mountain streams in Northern Colorado, show a similar variation in their annual flow during this period.

Section seven (7) of the act providing for the appointment of a State Engineer, and defining his duties, requires this officer to make, or cause to be made, careful measurements and calculations of the maximum and minimum

flow in cubic feet per second of the water in each stream from which water is drawn for irrigation purposes, commencing with those streams most used for irrigation.

Although there is but little water, as yet, drawn from the Arkansas river for irrigation purposes, when compared with its volume, and although there has been no necessity for dividing the waters of this stream among the canals and ditches on its entire length; yet, in view of the number of projected canals of large carrying capacity which are located in Pueblo and Bent counties, and also to comply with a request from the Pueblo Board of Trade desiring to obtain some reliable data regarding the capacity of this stream for irrigating purposes, I have thought it advisable to depart a little from the plan laid down in the law. A temporary gauging station was established in 1885 on the river at Pueblo, and one of the registering machines belonging to this department was set up in May, and the observations have been continued through the irrigating seasons of 1885–86, with a few interruptions. Approximate velocity measurements have been made, and the daily discharge during the irrigating season will be found in the report relating to Water District No. 14.

The rating of the measuring flumes in the several canals has been continued through the season of 1885–86. This work has consumed the greater part of the time and appropriation allowed for assistants. Owing to the very limited amount thus provided for the performance of field work, I have only been able to keep one assistant regularly employed, and he only during the summer months. In July, 1885, Professor Elwood Mead was appointed such assistant, and has so served in the field and office. When necessary to employ additional assistance, local engineers and others have been engaged from day to day, as the necessity required. Owing to the fact that this office contains so much data and so many records of matter in which so

many people of the State are interested, I have found that it requires the whole time of at least one person to answer the correspondence and furnish the information requested, not only from the people of our State, but those of other States and foreign countries as well.

It is somewhat gratifying to know that non-residents are making favorable comments on our irrigation laws and the system and methods of administering the laws. The Wyoming Legislature, at its last session, framed and adopted a full system of irrigation laws for the Territory. In most instances these laws are an exact copy of those adopted by our State and now upon its statute books. Nevada has wakened up to the importance of the subject, and it is expected that some legislation will be had the coming session, in the way of enacting irrigation laws.

In the first progress report of the royal commission on water supply, appointed by the Parliament of Australia, appears the following reference, of so gratifying a nature that it is embodied here as of general interest:

"In all matters relating to irrigation, the knowledge of what is to be avoided is of equal value with the knowledge of what is worthy of imitation, and this is particularly the case in regard to irrigation law. The enactments which have proved advantageous, and their particular deficiencies, are both worthy of close attention. The central government, having no jurisdiction in the matter of irrigation, it is dealt with by each State in accordance with its own conditions. As the laws of Colorado are by far the most successful, they may be fairly allotted the first place. By the Constitution of this State, granted as late as 1876, all streams within its boundaries were declared to be public property. By special enactment it next provided for the proving and registry of every water claim. These were allowed by the courts in the order of their priority and published as rights. * * * * By these and other simpler means, a host of difficulties and complexities were escaped; permanence was given to existing works, and

encouragement offered for the construction of new works. It is not surprising, therefore, that in mileage of canals or acreage irrigated, Colorado more than doubles any other State, or that its works are the greatest and most permanent, and are most rapidly extending."

The Water Commissioners generally are of the opinion that but little change in our present laws is required, as well as little need for additional legislation.

It seems very desirable that a report on the progress of canal construction should be continued from year to year. In my last biennial report for the years 1883–84, a list of all the canals in the State having had their priorities and amount of appropriations established by court decrees was given; also, as far as it was possible to obtain them, the names, date, amount of appropriation and location of such canals as were filed in the offices of the county clerks, under the requirements of section 1720 of the General Statutes of Colorado. This list included all the canals in the First Water Division, or South Platte drainage, with a few exceptions, which were of very small carrying capacity. Deeming it important to continue this record, a circular letter was sent to all the county clerks and clerks of the District courts, inviting them to supply this office with the names of canals, names of the owners, the size, grade, length, amount of appropriations claimed, name of stream from which water is drawn, and date of appropriation. To this request some of the county officers have kindly replied, giving the desired information. Some have failed to do so for want of time, while others have declined on account of not being obliged to do so by law. To those who have so kindly volunteered to help supply this important information, the grateful acknowledgments of the public are hereby tendered through this department, in the absence of any channel through which they can be conveyed. The tables from these returns will be found in another part of this report.

REPORT

OF

Elwood Mead, Assistant State Engineer.

HON. E. S. NETTLETON,

State Engineer,

Denver, Colorado.

DEAR SIR:

I have the honor herewith to submit my report of the gaugings made by me in the various districts in Water Division No. 1, during the irrigation seasons of 1884, 1885 and 1886, in accordance with your instructions, as follows:

INSTRUCTIONS TO ASSISTANTS FOR RATING MEASURING FLUMES.

First—Turn the water out of the canal and examine the flume; see that it is clean on the bottom. Examine the front end and see that no water can escape under or around the sides, and that there are no abrupt projections which will cause cross-currents or eddies.

Second—Measure the width exactly at the bottom, middle and high water line.

Third—Establish a datum point from which to measure the depth of water. When it is practical to do so, it is best to so locate this point that the measurements can be taken inside the lining of the flume, in order to avoid the effect of the unsteady surface of the running water. It is very important to record the exact height of the water during each observation. Note the depth of "dead" water in the flume, if there is any.

Fourth—Turn sufficient water into the canal to fill the flume about one-fifth of the capacity of the canal, and do not begin taking observations for velocities until the water

in the canal above and below the measuring flume has reached a point where it will remain stationary during the time the meter is used. Note the precise depth.

Fifth—Place the meter in the water on one side of the measuring flume; and, when ready, start the revolution counter and stop watch at the same instant; then move the meter slowly through the entire cross-section of the water area, passing the meter over equal spaces in equal time, going from surface to bottom and bottom to surface, each time advancing towards the opposite side of flume; when this side is reached, stop counter and watch at same instant. Record in a book properly prepared, the time and number of revolutions during the observation. Make at least three observations. Should the difference in the revolutions per second exceed one and one-half per cent., repeat the observations till this limit is reached. Before changing the depth of water, make three observations of one hundred seconds duration of the surface velocity in the center of the flume.

Sixth—Raise the water to another point equal to two-fifths of the height between bottom and high water mark, and proceed as directed before, and so continue the observation till the high water mark is reached. If the result from any observation appears to be incorrect, note it, with an explanation of its cause, if any can be made.

Seventh—At the head of the record, enter date, name of canal, name and duty of assistant, and the number of the meter used.

The work of 1884 embraced Districts Nos. 3 and 4, or the gauging of the canals diverting water from the Cache la Poudre and Big Thompson rivers. Nearly all the important ditches and canals on these streams are provided with measuring flumes built in accordance with the instructions furnished by your office. In the majority of cases these flumes were both well built and properly placed, and the gauging made accurate and reliable. The method

of gauging the discharge of these flumes has been throughout in accordance with the directions given by you for such work.

The number of depths at which each canal was gauged varied with the height to which it could be filled. The smallest number in any canal, for which a table was prepared, was three, the greatest eleven. The majority of canals were gauged at five different depths, the correctness of each gauging being verified by being repeated from three to five times, and, if there was any discrepency in the results, the gaugings were continued until correct results were obtained. In the final computation the average of the gaugings at each depth was taken.

Considerable difficulty was experienced in regulating the head-gates of the canals along the Cache la Poudre. Unless I chanced to meet the superintendent of each canal, and secured his services, the gauges were made with no assistance, a somewhat tedious and laborious performance at best, and aggravated in this case by the large number of railroad ties being floated down the river. These showed a perverse tendency to lodge under the head-gates, and gave me considerable trouble. On going to the Big Thompson, I secured the assistance of the Water Commissioner, who assisted me in about half the work done on that stream.

The season of 1885 was spent in gauging the canals in Districts Two, Six, Eight and Nine, that were provided with proper measuring flumes, or such flumes as could be used as a reliable substitute. In the last named district the work was intended to supplement that of yourself the year previous, but was not very successful, only two additions being made to the list gauged by yourself. Two or three other ditches were provided with measuring flumes, but a storm two days previous to my visit had destroyed the dams in the stream, preventing their being filled.

In District No. 6, I was able to gauge twelve out of the fifty recorded ditches of Boulder and South Boulder creeks. While gauging the canals of this district, my attention was very forcibly called to a matter to which it seems proper to refer. This is the wide discrepancy which often exists between the decreed and actual carrying capacity of ditches and canals. So great was this in some instances that the results of the gaugings and the decreed capacity seemed to have no connection with each other. Ditches were met with having decreed capacities of two, three and even five times the volume they were capable of carrying, ever have carried, or will probably ever need. Other ditches in the same district have decrees which fairly represent their actual needs. It needs no argument to show the worse than uselessness of these decrees as a guide to the Water Commissioner in the performance of his duties. On the other hand, the amount of uncertainty, difficulty and annoyance which they entail on that official can only be appreciated by those who have had some personal experience in the matter. When called upon to make a division of water among rival claimants, the Water Commissioner has the judicial decree to guide him in the performance of his duties; but to divide water in accordance with its terms, is, in many cases, a physical impossibility, and would work great hardship and injustice on others. He has, however, no legal sanction for exercising his discretion in such cases, and should he do so, becomes a violator of the law he was chosen to execute.

I am lead to speak of this matter because I do not think these errors are due to negligence or intentional misrepresentation, but to a radical defect in the law providing for taking testimony.

To accurately estimate the capacity of a ditch or canal requires considerable acquaintance with the laws of hydraulics, and some engineering experience and judgment,

and however painstaking the judge or referee may be, it is not desirable that he should be required to pass judgment upon the competency of the person or persons making the estimates submitted to him. In most cases it would be impossible for him to do it.

The majority of the decrees of smaller ditches are based on testimony of men having no engineering training or experience, and however honest the estimate may have been, it is in the majority of cases a mistaken one, being almost universally too large. The remedy would seem to be to permit no decrees to be rendered until the State had been represented and an estimate of the capacity of the ditch made by some competent and disinterested engineer, either the State Engineer or some one selected by him.

Although speaking of this matter in connection with the work in District No. 6, the criticism applies with greater or less force to every district visited. While on the subject, I will mention another defect of some decrees, which is the lack of precision or definiteness. This can best be illustrated by an example, which can be readily duplicated. Perhaps the most important ditch in District No. 5 has a decree for 6480 *customary inches*, running on a grade of eight feet to the mile. In this case "customary inches" means the number of square inches in the cross section. This ditch, as before stated, is an important one, supplying water to a large number of farmers, who have a vital interest in having the amount of water to which they are entitled designated as a definite volume, capable of being readily determined. In view of the constantly changing character of the regimen of ditches, the failure of this decree to meet such requirements is manifest.

The twelve ditches measured in District No. 6 comprised the larger and more important ones; the remainder were either without proper measuring flumes or were ex-

tremely small. Part of the canals on South Boulder creek could not be gauged to their full capacity, as low water in the streams prevented their being filled. I was assisted in my work by the Water Commissioner.

In District No. 7, only a small part of the canals were provided with measuring flumes, and after gauging two of these the work was abandoned.

Only two canals were gauged in District No. 8, these being the only ones found provided with proper measuring flumes. While I endeavored to visit every canal, it is possible that some were overlooked, as I was alone, and was not familiar with the district.

Considerable difficulty was experienced in properly gauging the canals of District No. 2. Large quantities of sand are carried from the stream and deposited on the bed of the canals during the irrigating season. This is constantly shifting its position and varying in amount, consequently the flow of water is not uniform or regular. The bottom of nearly every flume gauged was covered with sand, sometimes to a depth of several inches. It was removed, and the flume kept free during the gauging, but a few hours' time sufficed to replace it. The gaugings of this district, therefore, can only be regarded as close approximations. The amount which the discharge may vary from that given in the gauging tables is small; but, such as it is, it cannot be avoided.

1886.

It had been the intention during the summer of 1886 to complete the gaugings of those districts partially rated, and, as far as possible, complete the gaugings in Water Division No. 1, of all canals provided with measuring flumes. The work was begun in District No. 5, a number of the canals in this district having been rated during the summer

of 1884. In company with the Water Commissioner, I began the work early in June. After considerable traveling and loss of time, and finding no flume built in accordance with the specifications furnished by your office, and only four others which could be used as substitutes, I abandoned the work for a time, and the Water Commissioner prepared and had published in the local papers the following notice:

WATER.

LONGMONT, COLO., June 1, 1886.

To all Irrigating Canal and Ditch Companies, Owners thereof, and others interested in Water District No. 5:

The following is a copy of paragraph 1813, of the General Statutes of Colorado, for 1883:

SECTION 103 (12). "For the more accurate and convenient measurement of any water appropriated pursuant to any judgment or decree rendered by any court establishing the claims of priority of any ditch, or canal, or reservoir, the owners thereof shall construct and maintain under supervision of the State Engineer, a measuring weir or other device for measuring the flow, in cubic feet per second, of the water at the head of such ditch, canal or reservoir, or as near thereto as practicable. The State Engineer shall compute and arrange in tabular form the amount of water that will pass such weir or measuring device, in cubic feet per second at the different stages thereof, and he shall furnish a copy of a statement thereof to any water commissioner having control of such ditch, canal or reservoir." (Section 12, pages 121–2, Acts 1881.)

In pursuance of the above, in accordance with instructions issued by the State Engineer, "all who have not already complied therewith are hereby requested to construct, and maintain a measuring weir or flume as near the head-gate

as is practicable. It must be at least sixteen feet long, and the same width as the ditch. The top of the floor, or flume, must be as near to the grade line or bottom of the ditch as is practicable, and be truly level in every direction. The sides must be perpendicular and planked or boarded up on the inside of posts, and to be of sufficient height to carry the greatest quantity of water likely to flow in the ditch."

In consideration of the fact that there will be a scarcity of water this season, and urgent need of proper gauging of ditches, it is for the best interest of all that compliance herewith be made AT ONCE. In some cases where it seems impracticable, at this time, to construct flumes, as required by law, on account of present irrigation, it is urged that some present head-gate or other place may be arranged as near in the form of the flume required as is practicable, that it may be made to answer the purpose temporarily.

Of the seventy-three ditches and canals in this district, only a portion of them are known to me. I have records of them all, with the exception of location, owners and officers; and many minor ones of which I have not yet learned the location, I will be extremely grateful to the owners or officers if they will send me by mail, through the Longmont postoffice, a memorandum of the section, township and range upon which the head-gate is situated; as well as the name and postoffice address of the secretary, or other authorized person, through whom, as Water Commissioner, I may communicate. In each case being careful to give the incorporated or legal name of the ditch or company.

DICK RANSOM,

Water Commissioner District No. 5.

Approved:

ELWOOD MEAD,

Assistant State Engineer.

After a week's absence I returned to this district, and such ditches as could be learned of having flumes which could be utilized were gauged. Since that time several

ditches have constructed measuring flumes, and information has been received of one or two others of whose existence we were not at the time aware.

Nearly all the important ditches of District No. 7 were gauged the present season; in some cases the second set of head-gates being made to do service as a measuring flume. Two ditches possessed of flumes could not be gauged on account of the head-gates being out of order. I was assisted in this work by the Water Commissioner.

It is to be regretted that the law requiring the construction of measuring flumes has not been more generally complied with. The value of the tables prepared would be greatly enhanced if they embraced all the canals of a district. There ought also to be some provision made for the notification of your office of the construction and location of measuring flumes. It was always difficult, if not impossible, for me to get reliable information about this matter without making a personal visit, even when I had the co-operation of the Water Commissioner. This lack of definite information often caused me great loss of time. On several occasions, after traveling half a day to reach a canal, I have found my journey a fruitless one and lost the remainder of the day returning.

That ditch owners have not universally complied with the law requiring the construction of flumes is not, I think, altogether due to indifference or neglect, but to a mistaken belief that the rectangular cross-section of the head-gate flume will answer as a substitute—overlooking the fact that the variable pressure against the gates, due to the fluctuation in the height of the stream, renders the preparation of a table from such location impossible.

In regular measuring flumes the point where the measurement was made is always apparent upon inspection, but

in cases where other flumes were utilized as a substitute, I have designated the place of measurement in the notes. I have also in the notes, connected with each gauging, mentioned anything which would be likely to assist the Water Commissioner in the performance of his duties, and have called attention to defects in a few flumes in order that they may be remedied when rebuilt.

The greater portion of this work has been performed with Colorado Meter No. 70. Its work has been uniformly excellent, even in the gritty and sediment laden waters of Bear and Clear creeks. I am persuaded that no other form of meter, now in use, would have stood the test equally well.

Respectfully submitted,

ELWOOD MEAD,
Assistant State Engineer.

FORT COLLINS, COLO., December 1, 1886.

CIRCULAR LETTER TO WATER COMMISSIONERS REQUESTING INFORMATION.

OFFICE OF STATE ENGINEER,
DENVER, COLO., Oct. 11, 1886.

WATER COMMISSIONER,

District No. ____:

DEAR SIR:

I desire, at as early a date as convenient, an official report of your office as Water Commissioner of District No. ____, for the years 1885 and 1886, said report to embrace the topics mentioned below, and such additional ones as your experience may lead you to deem timely and important.

First—Date of first notice each year to divide water. From what part of the district did the first complaint come? What was the stage of water in the stream? Explain the course pursued in adjusting and dividing the flow of water.

Second—Give the time employed each year; also, time assistant was employed, if such was required. State why said assistant was required, and what instruction he received from you.

Third—Was it necessary to adjust the head-gates frequently during low water in spring and fall? If so, was it on account of fluctuations of the stream, or on account of the gates being opened and closed by persons not authorized to adjust them?

Fourth—What proportion of the ditches have complied with the law in erecting measuring flumes? Do you consider it of any benefit dividing water, to have measuring flumes gauged? Would it be of any service to have a measuring flume in the main stream, with an automatic registry of the daily amount of water in the stream?

Fifth—Is the combined capacity of the canals already constructed in your district equal to the discharge of the streams during the irrigating season; or is there need for more canals to utilize the surplus water? Would you consider the construction of additional canals in your distirict a benefit, or the reverse?

Sixth—Designate any defects or omissions in the present law which, in your judgment, should receive the attention of the next General Assembly.

Sincerely yours,

E. S. NETTLETON,
State Engineer

COPY OF CIRCULAR LETTER ADDRESSED TO CANAL OWNERS, CALLING ATTENTION TO THE LAW REGARDING MEASURING FLUMES.

SIR:

The following is a copy of paragaph 1813, of the Genal Statutes of Colorado for 1883:

SECTION 103 (12). For the more accurate and convenient measurement of any water appropriated pursuant to any judgment or decree rendered by any court establishing the claims of priority of any ditch, or canal, or reservoir, the owners thereof shall construct or maintain, under the supervision of the State Engineer, a measuring weir or other device for measuring the flow, in cubic feet per second, the water at the head of such ditch, canal or reservoir, or as near thereto as practicable. The State Engineer shall compute and arrange in tabular form the amount of water that will pass such weir or measuring device, in cubic feet per second, at the different stages thereof, and he shall furnish a copy of a statement thereof to any water commissioner having control of such ditch, canal or reservoir. (Section 12, pages 121–2, Acts 1881.)

In pursuance of the above, you are hereby requested to construct and maintain in your ditch, a measuring weir or flume, and to have the same completed on or before the _____next; said flume must be erected as near the head-gate of your ditch as is practicable.

It must be at least sixteen feet long, and the same width as the ditch. The top of the floor or flume, must be as near to the grade line or bottom of the ditch as is practicable, and be truly level in every direction. The sides must be perpendicular, and planked or boarded up on the inside of posts, and to be of sufficient height to carry the greatest quantity of water likely to flow in the ditch.

If you will send me a memorandum of the width of your ditch, near the head, and the depth of water when running to its full capacity, I will be pleased to send you plans and bill for material.

Respectfully,

E. S. NETTLETON,
State Engineer.

Water District No. 1.

This district comprises all lands irrigated from ditches from the South Platte river between its intersection with the State line of Colorado and Nebraska and the mouth of the Cache la Poudre.

Water Commissioner, WELLINGTON J. KRAM.

Appointed July 16, 1886. P. O. Address, *Brush, Weld Co.*

The Water Commissioner in this district, so recently appointed, was not, to my knowledge, called upon to divide water. This is the only district in the northern part of the State which has failed to have the priority and amount of appropriation of the canals therein adjudicated by the courts as is provided by our irrigation law. Steps are now being taken to have all the canals prove up their claims, and probably before the beginning of the next irrigating season court decrees will be rendered.

Two reasons may be assigned for delaying so long the adjudication of the rights and privileges of the lands in this district. The principal one is the abundance of water for early and late irrigation. This is due to the favorable location of the canals, as they take their waters from the lowest waters of the South Platte river lying within the State. This stream has been reinforced by all its tributaries constituting the mountain drainage system of northeastern Colorado; so that all the water remaining unused from the Cache la Poudre, St. Vrain, Clear Creek and Bear Creek, and a few other small tributaries, finds its way into the main stream, and much of it passes down to this district. This

amount is largely increased by seepage, which is continually going on and increasing each year, and also increasing as the area of irrigation is extended, thereby affording a more equal and continued supply for water, both early and late in the season—an advantage not enjoyed on the streams close to the mountains.

The second reason for so long delaying the adjudication of water rights in this district, is the small amount of land under cultivation compared with the amount of water at command. There are several large and well constructed ditches already built which cover large areas of fine lands, which are waiting to be occupied by settlers; both State and Government lands.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk in Weld county since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNERS.	STREAMS FROM WHICH WATER IS TAKEN	WIDTH OF DITCH.		Depth in feet.	Grade per mile in feet.	Length in miles.	Capacity in cubic feet per second.	Date of Appropriati'n		
			Bottom in feet	Top in feet					Day.	Month	Year.
The New England Ditch	Alfred T. Bacon	Crow Creek	6.0	10.5	1.5	3.7	2.0	26.23	1	Dec	1884
The Rockwell Ditch	The Rockwell Ditch Co	Little Thompson	6 0	10 0	2.0			48.98	1	Sept	1884
Little Crow Ditch	Luther D. Coggins,	Little Crow Creek	6 0	10.5	1.5			24.31	13	Jan.	1885
The Big Crow Ditch	Samuel A. Davison	Crow Creek	8.0	19.5	3.5	5.0		62.70	2	Feb	1885
The Donovan Ditch	Neal Donovan	Crow Creek	5 0	11.0	3.0		6.5	49 00	10	Nov	1884
The Law Ditch	Thomas W. Law	West branch Lone Tree	4.0	6.0	1.0	5.0		308 00	25	Nov.	1884
The Daisy Ditch	Thomas W. Law	West branch Lone Tree	4 0	6 0	1.0	5.0		308.00	25	Nov	1884
The Doke Ditch and Reservoir	Frank Doke	Reservoir	10x70	Rods	10.0			8.00	31	Mch	1885
The Western Ditch Company	The Western Ditch Co	Sand Creek	6 0	9.0	1.5			20 70	5	Nov	1884
The Ward Ditch	John and Union Ward	Owl Creek	6.0	9.0	1.5		0.75	20 00	25	April	1885
The Community Ditch and Res'vr Co.	The Community Ditch and Res'vr Co	Boulder Creek							6	Jan.	1885
The Camfield Ditch	The Crow Creek Irrigation Co.	Crow Creek	6.0		2.0			27.00	20	Dec	1884
The Ward and Russell Ditch	The Ward and Russell Ditch Co	Owl Creek,	8.0	12 0	2.0	3.2		45 90	21	Dec	1885
The Sanborn Ditch No. 1	Burton D Sanborn	Ashcroft Draw	3.5		1.2	3.7		10 41	20	Mch.	1886

DITCH AND CANAL APPROPRIATIONS—CONCLUDED

NAME OF DITCH OR CANAL.	NAME OF OWNERS.	STREAMS FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth in feet.	Grade per mile in feet	Length in miles	Capacity in cubic feet per second	Date of Appropriati'n		
			Bottom in feet	Top in feet.					Day.	Month	Year.
The Dennis Ditch	Richard S. Dennis	Seepage Water	3.0	5.0	1.0	5.0		7.86	8	Mch...	1886
The East and West Ewing Ditch	James L. Ewing	Quigley Draw	2.0	5.0	1.5	5.0		3.49	11	May..	1886
The Joe Newlin Ditch Co.'s Irrigating Ditch	Wm. S. McElroy, Joseph Wilkinson, Edward J. Rice.	Draw in Section 6	4.0	6.0	1.01	10.0		20.00	17	Aug...	1886
McCall's Supply Ditch	William McCall	Eaton's waste ditch	1.0	6.0	2.0	2.5		1.71	19	Dec...	1885

Water District No. 2.

This district consists of all lands taking water from the South Platte and its tributaries, except Big Thompson, St. Vrain and Clear Creek, between the mouth of the Cache la Poudre and the mouth of Cherry Creek.

Water Commissioner, A. C. TODD.

Appointed March 18, 1884. P. O. address, *Evans, Weld Co.*

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 2.

EVANS, COLORADO, November 16, 1886.

HON. E. S. NETTLETON,

State Engineer,

Denver, Colorado:

DEAR SIR:

I cannot make an intelligent report for the year 1885, because I kept no record and have forgotten dates, etc. If I remember right, I was not called upon at all in that year, there being an abundance of water for all.

I was called upon by Mr. Twombly, President of the Farmers' Independent Ditch Company, on July 4, 1886. The water in the river at that time was only seepage, each ditch taking all the water opposite the head-gate. Thus called upon to give the "Farmers' Independent," its priority rights, I shut down all the gates of ditches inferior, allowing only enough for domestic purposes.

I was employed, in all, twenty-two days. I employed

Mr. Koy Kendal, of Platteville, two days in July, because I had to visit the upper part of the district, and threats were made of opening the gates, etc., in my absence. I employed Samuel McAfee two days in August for similar reasons. They were instructed to ascertain the name of any person unlawfully interfering with the gates, and report to me.

I found it necessary to adjust the head-gates frequently during the summer of 1886, chiefly on account of the fluctuations of the stream.

I had no difficulty with unauthorized interferenee after my first tour of the district. Most of the ditches have some kind of measuring flumes, and nearly all have promised to have proper ones in before next year. I have taken the ground that without these, hereafter, their rights of priority will be disregarded.

I think it would be a benefit to have measuring flumes gauged, and also, if possible, to have one in the main stream, with automatic register.

Whether or not the combined capacity of the canals already constructed in District No. 2, is sufficient to utilize the water of the stream, depends upon whether the amount of water equitably belonging to the district, is permitted to flow in the river. If it was, I think that, in average years, additional canals would be required to utilize the water.

The fatal defect in the law at present is, in dividing the river into two or more water districts, thereby giving all the water in the river to the upper district. The Platte river, from the mountains to the mouth of the Poudre, should be one district, and provision made for two sub-Water Commissioners, and extra pay to the Water Commissioner of that district, as the present per diem would not pay traveling and hotel expenses. I think, too, that the

State Engineer should be clothed with ample powers as Water Commissioner-in-Chief.

All of which is respectfully submitted.

ANDREW C. TODD,
Water Commissioner District No. 2.

The canals in this district receive their water mainly from the South Platte river between Denver and Evans. This district is like some of those on the Arkansas river, situated on one of the main drainage channels from the mountain ranges in the central portion of the State; having a water district above it and one below, all on the same stream.

The water for irrigation is mainly that which escapes from No. 8, or the one immediately above, on the same stream, and that left to flow into it from the tributaries of Clear Creek and the St. Vrain, which latter stream is made up by the Big and Little Thompson and Boulder Creeks, each of these forming separate water districts; so that this is surrounded by districts all having separate and independent decrees respecting priority of appropriations. The law requires the Water Commissioner to divide the water in his district in accordance with the decrees of the court, giving to each canal the amount of water so decreed, if it is needed for irrigating purposes. The courts have separate and independent decrees on each stream or portion of stream, all of which streams furnish water for this district only after supplying their own needs. So it will be seen that all the water this district is entitled to under the existing laws is what is allowed to waste into it from the adjoining districts, save the seepage water which comes back into the stream, which in this case is not a large amount at present.

The season of 1886 was the first time under the existing

irrigation law where a conflict between water districts has arisen. The Water Commissioner says he was called out on the fourth of July to divide water, and found only seepage water to divide. Had this state of affairs occurred a few days earlier, the loss of crops from lack of water would have been considerable; but, as it happened, this shortage occurred between the irrigation of early and late crops. From the fourth of July to the twentieth, this district practically had no water. I shall refer again to this question in another part of my report.

Rating of Measuring Flumes and Records of Appropriations.

These tables show the discharge of water through measuring flumes at intervals of one-tenth of a foot up to the greatest depth gauged, or to the greatest depth which could be safely computed in such ditches and canals as have complied with the law, by erecting and maintaining a suitable device by which the intake of their ditches can be determined, together with a record of the priorities and amount of appropriation of each of these ditches and canals, and the depth of water in the measuring flumes, which will give the amount of water to correspond to each appropriation.

BRANTNER DITCH.

Table giving discharge through the measuring flume, as computed from gaugings made July 9, 1885:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0.8	.....	1.6	17 5	2.4	82.8
0.1	.....	0.9	.....	1.7	25.0	2.5	93.0
0.2	.....	1.0	.....	1.8	32.5	2.6	103 4
0.3	.....	1.1	1 7	1.9	40.0	2.7	116.5
0.4	.....	1.2	3 8	2.0	47.5	2.8	129.5
0.5	.....	1.3	6.3	2.1	55.0	2.9	143.0
0.6	.....	1.4	9 3	2 2	62.5	3.0	156 0
0.7	.....	1.5	13 0	2.3	72 8	3.1	169.0

NOTES—Gauging made at the second set of head-gates, there being no proper measuring flume. Ditch badly filled with sand at time of gauging, causing about one foot of "dead" water where rated.

Record of appropriation by the Brantner Ditch, as decreed by the court in the Second judicial district, approved April 28, 1883:

	Appropriation Priority—Number.	Year	No. of cubic feet per second in each appropriation	No. of cubic feet per second in each appropriation	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	1	1860	29.77	29.77	1.76
First enlargement.....	4	1863	5.93	35.70	1.85
Second enlargement.....	27	1872	12.18	47.88	2.01
Third enlargement.....	52	1881	63.30	111.18	2.65

FULTON DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made July 9, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in and and tenths	Discharge in cubic feet per second.
0.0	.....	0.9	11.3	1.8	69.2	2.7	169.0
0.1	.....	1.0	17.2	1.9	77.3	2.8	186.5
0.2	.....	1.1	22.5	2.0	86.2	2.9	204.5
0.3	.....	1.2	28.5	2.1	95.5	.....	.....
0.4	.....	1.3	34.3	2.2	105.5	.....	.....
0.5	.....	1.4	40.7	2.3	116.0	.....	.....
0.6	.....	1.5	47.4	2.4	127.0	.....	.....
0.7	3.3	1.6	54.0	2.5	139.4	.....	.....
0.8	7.2	1.7	61.3	2.6	152.7	.....	.....

NOTES—Flume properly built and located, but guaging slightly affected by the accumulated sand on the bottom of the canal. Gauged to a depth of 2.8 feet.

THE FULTON DITCH.

Record of appropriations of the Fulton Ditch, as decreed by the court in the Second judicial district, and approved April 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	No. of cubic feet per second in all appropriation	Depth or water in measuring flume to give corresponding quantity.
Original construction.....	8	1865	79.70	79.70	1.93
First enlargement.....	43	1876	74.25	153.95	2.61
Second enlargement.....	51	1879	50.23	204.18	2.90
Third enlargement.....	56	1882	244.52	448.80	.....

THE FARMERS' INDEPENDENT DITCH.

Table giving discharge through the measuring flume, as computed from gaugings made July 11, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0 9	26.5	1.8	98.0	2.7	170.5
0.1	.....	1 0	34.4	1 9	106.0	2.8	178.6
0.2	.....	1.1	42.4	2.0	114.0	2.9	186 6
0.3	.....	1.2	50.3	2.1	122.0	3.0	194.7
0 4	2.3	1.3	58.2	2.2	130.0	.....	.....
0.5	5.1	1.4	66.9	2.3	138.2	.....	.....
0.6	8.8	1.5	74.0	2.4	146 3	.....	.....
0.7	14.0	1.6	82.0	2.5	154.4	.....	.....
0.8	19.8	1.7	90.0	2.6	162.4	.....	.....

NOTES.—Canal gauged between the depths of 0.67 and 2.30 feet; the remainder are estimated quantities. Rating interfered with by sand in bottom of ditch; results only approximately correct.

Record of appropriations by the Farmers' Independent Ditch, as decreed by the court in the Second judicial district, and approved April 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	No. of cubic feet per second in each appropriation	Depth of water in measuring flume, to give corresponding quantity.
Original construction	10	1865	61.60	61.60	1 33
First enlargement.....	45	1876	85.40	147.00	2.41
Second enlargement	50	1879	373.00	520 00	.....

THE EVANS DITCH NO. 2.

Table giving the discharge through the measuring flume, as computed from gaugings made July 12, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0 0	0.0	0.8	55 1
0.1	1 7	0.9	61.9
0.2	4.4	1 0	68.4
0.3	9.8	1 1	74.6
0 4	20.8	1.2	81 0
0.5	30 8	1.3	88.0
0.6	40.0	1 4	96.2
0.7	48.0	1.5	106.0

NOTES.—This flume has aprons at both the upper and lower ends. The lower apron had sprung up in the middle, and interfered with the uniformity of the current through the flume and impaired the accuracy of the rating. But little sand had accumulated in the bed of the canal; it being a marked exception to the rule in this district. Not sufficient water to rate the flume higher.

Record of appropriations of the Evans Ditch No. 2, as decreed by the court of the Second judicial district, and approved April 28, 1883:

	Appropriation priority, number.	Year.	Number of cubic feet per second in each appropriation.	Number of cubic feet per second in each appropriation.
Original construction	25	1871	177 07	177 07
First enlargement	40	1875	226 98	404 05

BUCKER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made July 14, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0.8	30.0	1.6	83.9
0.1	3.9	0.9	35.0	.....	.....
0.2	6.1	1.0	40.4	.....	.....
0.3	9.6	1.1	45.6	.....	.....
0.4	13.2	1.2	54.0	.....	.....
0 5	16.8	1.3	61.4	.....	.....
0.6	20 9	1.4	68.8	.....	.....
0.7	25.2	1.5	76.2	.....	.....

NOTES—Flume to this canal in bad condition; canal should be re-rated. Not water sufficient to rate higher.

Record of appropriation by the Bucker Ditch, as decreed by the court in the Second judicial district, and approved April 28, 1883:

	Appropriation, number.	Year.	Number of cubic feet per second in each appropriation.	Number of cubic feet per second in all of the appropriations.
Original construction.....	49	1879	121.87	121.87

The object of gauging or more properly *rating* the measuring flumes in the head of canals is to afford ready means of ascertaining the quantity of water taken into the canal simply by observing the depth. With a gauge rod permanently fixed in the flume, and a table giving the discharge in cubic feet per second at any stage of water, a Water Commissioner or any other person can at a glance

tell the exact amount of water flowing in the canal, or can tell exactly when the canal is taking its legal appropriation or any proportional part thereof. Triplicate copies of the ratings are made in the above form. One is retained in this office, two are sent to the Water Commissioner, with instructions to deliver one copy to the owners of canal. The tables are of great service to the Water Commissioner, and entirely overcome the unsatisfactory results occasioned by guess work, besides being exceedingly convenient for the canal owners and their superintendents. The State Engineer hopes to induce some of the owners of large canals to attach to the measuring flumes of their canals an automatic registering machine, whereby a continuous record of the "intake" of their canals will be recorded. The benefits of having such a record can hardly be estimated, some of which will be to furnish accurate data from which can be determined the duty of water with great precision when the area of land irrigated is known, and to furnish the Water Commissioner an excellent "tell-tale" of any unauthorized interference with the head-gates of the canal.

To some, this attempt to measure water with so much precision may seem uncalled for. When we consider that water is yearly becoming more and more valuable for irrigation purposes in many parts of the State, and that a cubic foot per second is worth in perpetuity from $750 to $1,000, it will be seen that the quantity of water that some of our large canals carry represents large money value.

When water is plentiful it does not matter what amount is taken from the stream.

A rope was once thought good enough to measure land that now has become valuable and demands steel tape measurement.

Water District No. 3.

This district consists of all lands irrigated from ditches taking water from the Cache la Poudre and its tributaries.

Water Commissioner, B. S. LaGrange.

Appointed July 9, 1880. P. O. Address, *Greeley, Colo.*

Report of Water Commissioner of District No. 3.

Greeley, Colo, December 11, 1886.

E. S. Nettleton,

State Engineer,

Denver, Colorado.

Dear Sir:

Your circular, bearing date October 11, 1886, requesting an official report of my duties as Water Commissioner of District No. 3 for the years 1885–86, is at hand, and I respectfully submit the following in answer to the several questions therein propounded:

The date of first notice in 1885, to divide water, was the twenty-fifth of July, coming from the lower part of the district. The method of distributing the water according to priority of appropriation was, in this case, strictly adhered to; and, as the quantity of water was sufficient for all purposes when properly adjusted, the matter was regulated to the satisfaction of all concerned.

The time occupied by me in the dicharge of my duties during the year was thirty (30) days; that of my assistant, twenty-five (25) days.

During this year, there being an abundance of water for all the requirements of early irrigation, such as for the

grasses and cereals, I was not called upon until the date above mentioned, and then only to equally adjust the amounts among the several appropriators as their needs required. This adjustment continued, under the supervision of the Assistant Commissioner, until August 16, when I received a notice from the lower end of the district calling for an increased supply of water for the irrigation of corn, potatoes and alfalfa, these crops requiring later irrigation than the cereals, nine-tenths of the area of growing crops of this character being in the lower portion of the district, from twenty to forty miles from the foothills.

Immediately upon receiving this notice, I ascertained the amount in the weir at the head of the district, and proceeded to distribute the same to those canals where it was most needed for the growing crops, and instructed my assistant to always have due regard for all *prior claims whenever needed for actual use.*

During the balance of the season several slight changes were made from time to time in the canals at the upper end of the district, where my services in this particular were called for.

No losses or hardships occurred in this district for lack of water for irrigation of all crops grown during the year.

REPORT FOR THE YEAR 1886.

The number of days I was employed amounted to 80; that of my assistant was 25 days. To give you a better idea of the work for this year, I submit extracts from a diary kept during the season:

April 15—Received notice from State Engineer to meet him at Fort Collins and go with him to the measuring weir in the Cache la Poudre river, near the foothills, for the purpose of setting an automatic register in place for the ensuing season's work.

April 20—Assisted in setting register in place; adjusted same; examined weir, and found flow slightly raised at a point near the center of the cross-section, at lower edge; found it in need of repairs.

April 21—Examined all canal head-gates and weirs on south side of the river in Larimer county. Found all in good shape for accurate work except Pleasant Valley and Lake Canal. The weir is not level, has an excessive grade, and I doubt if accurate results could be obtained from it in its present condition.

April 22—Examined all canal head-gates and weirs on north side of the river in Larimer county, and found all in good shape, except the head-gates. Also began examination of head-gates and weirs in Weld county.

April 24—Finished examination in Weld county, and found head-gates and weirs in good condition for general use. Received notice from Baxter Hilton and others on Lone Tree creek that they were being deprived of the use of their claim to water from said stream by a subsequent claimant.

April 26, 27—Visited Lone Tree creek to make investigation. Found that the "subsequent claimant" had turned all the water of the creek, at a point above the other claimants, into quite a recently constructed ditch, running the same into and through the channel of said ditch, its entire length, and thence out on unbroken sod land, not enclosed; in my judgment, "a sheer piece of cussedness." There having been no adjudication of water made upon this stream, and no decrees rendered, I had no power to act in the premises. [Subsequently it was ascertained that this stream was not in District No. 3, not being a tributary of the Cache la Poudre. At the June term of the court in this district, a temporary injunction was applied for and granted to the parties aggrieved; and at the October term steps were taken for a final adjudication and settlement of all disputes among rival claimants on this creek.]

May 19—A call for a division of the water was made upon me by the officers of the canals in the lower part of the district. An examination showed that there was a sufficient supply for all uses when properly regulated, so I instructed my assistant commissioner to so adjust the headgates on some of the subsequent canals by partially diminishing their quantities, so that the needs of all were satisfied. It may not be out of place here to remark that the unusual and excessively high temperature all through the month of May caused the snow on the water shed, supplying the water for this district, to melt rapidly away and run off in large quantities before the usual season commenced, rapidly depleting the quantity required for early irrigation of cereals and grasses, which usually commences about June 1, and extends to July 20 or thereabouts. Also, this exceeding high temperature through the month had the effect of depleting our soil by evaporation of all moisture, necessitating an unusual early irrigation, which resulted in this early call for a divison of water.

June 8—No further call was made upon me until this date, when the officers of the town of Greeley, and the Greeley Irrigation Company called for a further division. As in the former instance, I instructed the assistant commissioner to reduce all subsequent canals again, to meet the requirements of previous claimants.

June 21—Under instructions previously given to my assistant to closely observe the state of water at the weir on main stream; and, if falling rapidly, to proceed at once to a closer division (always keeping prior rights in view), without further notice, he on this date began active operations. The water at the weir of main stream indicated only 1375 cubic feet per second. This necessitated a very close division and policing of the stream throughout the entire district.

June 23, 24—Made a closer inspection of all canals in the district and found that the present supply was inadequate

for all; and as the amount in Larimer County canal was being rapidly exhausted, I immediately notified the company of the situation and the necessity of immediately drawing from their reservoir, situated high up in the mountains at the head of the stream. A conference was held, and the situation discussed; it being ascertained that it would require about twelve or fourteen days to finish irrigating all crops under this canal, and an amount of at least 120 cubic feet per second be necessary for this purpose. The storage capacity of this reservoir is 114,000,000 cubic feet. The graduated amount for each consecutive 24 hours for fourteen days, having been ascertained, it was found that it would exhaust the reservoir at the end of that time. This tabulated statement of amount was immediately forwarded by courier to the agent in charge of the reservoir, some seventy-five miles away. Careful observations were to be made at wier in the cañon to obtain results; but owing to a very heavy rain storm on the North Fork of the Cache la Poudre, above the weir, no definite results could be obtained, the stream and the water from the reservoir amply supplying all the canals.

Returned to Greeley and conferred with County Commissioner Hotchkiss and others as to the advisability of appointing a deputy commissioner to assist in the distribution of water and to police the lower end of districts, to prevent waste, which was considered favorably.

June 26—Appointed E. E. Baker as Deputy Water Commissioner to act in my absence. He at once qualified and entered upon the discharge of his duties, being furnished with all the necessary instructions and records. From this date until August 4 there was a gradual decrease of the water supply in the stream. Distribution by priority of right had been in most cases adhered to through the month of July.

The method and character of the work the annexed table will best illustrate:

TABLE SHOWING THE METHOD OF KEEPING RECORDS OF CHANGES

Made in the "Intake" of Canals in District No. 3, while under the direction of the Water Commissioner.

NAME OF CANAL.	Date of adjusting head-gate.	Depth of water in measuring flume before adjusting—feet.	Amount of water passing through measuring flume—cubic feet per second.	Depth of water after adjusting head gate—feet.	Amount of water passing through flume after adjusting head gate—cubic feet per second.	Amount of water in Cache la Poudre river at gauging station at time of adjusting head gate—cubic ft. per second.	REMARKS.
Larimer and Weld Canal.....	June 23	3.9	413.	3 6	355.5	1,226.854	
Larimer and Weld Canal.....	June 24	3.6	355.5	3 4	314.	1,237.116	
Larimer and Weld Canal.....	June 28	3.65	362.	3.65	362.	1,311.135	
Larimer and Weld Canal.....	July 1	3.5	334.	3.2	279.	1,175.544	
Larimer and Weld Canal.....	July 3	3.1	261.	2.9	226.5	1,056.770	
Larimer and Weld Canal.....	July 8	3.	243.	2.	99.	873.360	
Larimer and Weld Canal.....	July 16	1 95	96.	1.95	. 96.	602.180	
Larimer and Weld Canal.....	July 26	2.35	140.	2.35	140.	538.646	
Larimer and Weld Canal.....	July 26	2.45	155	2.45	155.	538.646	
Larimer and Weld Canal.....	July 30	2.35	140.	1.95	96.	404.370	
Larimer and Weld Canal.....	July 31	1.75	72.	1.75	72.	392.580	
Larimer and Weld Canal.....	August 8.....	.....	.....	.....	.....	.....	Began the division of water by rotation.
Larimer and Weld Canal.....	August 13	2.2	122.	.....	.....	232.095	
Larimer and Weld Canal.....	August 21	2.6	186.	2.2	122.	342.596	

Larimer and Weld Canal	August 27	.9	16.	1.4	45.60	341.660	
Larimer and Weld Canal	August 28	.8	12.	.8	12.	347.128	
Larimer and Weld Canal	August 30	1.3	38.5	1.3	38.50	279.229	
Larimer and Weld Canal	September 4						
Larimer and Weld Canal	September 9	1.3	38.5	1.3	38.50	214.632	
Larimer and Weld Canal	September 14						Shut down to 20 cubic feet per second.
Larimer and Weld Canal	October 1						Shut down for the season, for repairs.
Pleasant Valley and Lake Canal	June 24	1.6	115.64	1.15	80.	1,237.116	
Pleasant Valley and Lake Canal	July 8	1.2	79.84	8	44.	873 360	
Pleasant Valley and Lake Canal	July 27	.66		.66	25.	465.942	
Pleasant Valley and Lake Canal	August 6			6	22.45	264.190	
Larimer County Ditch	June 24	2.6	159.4	2.	110.14	1,237.116	
Larimer County Ditch	June 27	2.3	134.8	2.3	134.8	1,398.035	
Larimer County Ditch	July 10			1.7	87.4	830.785	
Larimer County Ditch	July 12	.9	35.	.9	35.	699.778	
Larimer County Ditch	July 15			.6	20.2	609.385	
Larimer County Ditch	July 19			.75	26.	707.420	
Larimer County Ditch	August 4			.63	23.	289.255	
Larimer County Ditch	August 9						Shut off.
Larimer County Ditch	August 18	1.7	69.	1.7	87.4	1,475.980	
Larimer County Ditch	August 26						Shut off.
New Mercer Ditch	June 24	1.7	69.42	1.4	52 68	1,237.116	

TABLE SHOWING METHOD OF KEEPING RECORDS, ETC.—CONCLUDED.

NAME OF CANAL.	Date of adjusting head-gate.	Depth of water in measuring flume before adjusting—feet	Amount of water passing through measuring flume—cubic feet per second	Depth of water after adjusting head gate—cubic feet.	Amount of water passing through flume after adjusting head gate—cubic feet per second	Amount of water in Cache a la Poudre river at gauging station at time of adjusting head gate—cubic feet	REMARKS.
New Mercer Ditch	July 8	1.2	41.52	1.0	30 36	873.360	
New Mercer Ditch	July 22	.....	.....	.8	19.20	566.155	
New Mercer Ditch	August 4	.....	.....	7	14.60	289 255	
New Mercer Ditch	August 26	.....	.....	.....	.....	.....	Shut off.
Larimer Canal, No. 2	June 24	2.3	105 50	2.3	105.50	1,237 116	
Larimer Canal, No. 2	July 2	1 9	82 50	1 5	59 50	1,125 545	
Larimer Canal, No. 2	July 23	9	25.	.9	25.	552.182	
Larimer Canal, No. 2	August 4	.8	19.50	8	19.80	289.255	
Larimer Canal, No. 2	August 9	.....	.....	.....	.....	.....	Shut off.
Larimer Canal, No. 2	August 26	.9	25.	.9	25.	386.685	
Lake Canal	June 24	1.5	110 1	1.25	83 9	1,237.116	
Lake Canal	July 3	1.	50.	1.	50.1	1,056.770	
Lake Canal	July 8	.9	40.7	.9	40.7	873 360	
Lake Canal	July 23	.6	19.7	.6	19 7	552.182	

Lake Canal	July 27	.5	14.8	.5	14 8	465 942	
Lake Canal	August 8	.....	.....	.....	.....	.....	Shut off.
Lake Canal	August 25	.8	32.5	.8	32.5	416.160	
Cache la Poudre	June 26	3.75	365.	3 75	365.	1,386.900	
Cache la Poudre	July 27	1 65	80.	1.65	80.	465.942	
Cache la Poudre	August 9	.....	.....	.....	.....	.....	
Cache la Poudre	August 12	2.25	140.	2 25	140.	236.680	
Cache la Poudre	August 14	1.9	104.6	1.9	104 6	232 095	
Cache la Poudre	August 25	1.8	94.6	1.8	96 6	416 160	
Cache la Poudre	August 30	.....	.....	.....	.....	.....	Shut off for Greeley No 2.
Cache la Poudre	September 4	1.9	104 6	1 9	104.6	284.242	
Cache la Poudre	September 15	1.65	80.	1.65	80.	169 428	
Union Colony, No. 3, Town of Greeley	June 26	1.1	72.9	1.1	72.9	1,386 900	

August 5—Examined gauge at Hottel's mill; found not enough water going below to the lower portion of district. Examined all the canals in Larimer county; also weir in cañon, and found only 264 cubic feet per second at this point.

August 6—Gave instructions to deputy to send more water below, as parties were in need of it for the irrigation of the potato, corn and alfalfa crops.

At this time, there being only 264 cubic feet per second of water in the weir at the cañon, it became a question of grave doubt with the Commissioner whether the large area in crops at the east end of the district, as also the market gardeners at the upper end, would not prove an entire failure if the present method of distribution was adhered to. Domestic use from the canals was entirely out of the question; but the most important and vital one to the public interest was how to mature the late growing crops incident to this part of the season.

It became apparent that, to distribute the water on hand (264 cubic feet) for domestic use and for irrigation into three hundred miles of main canals, varying from eight to thirty feet in width, under a temperature up into the 80° from day to day, would result in its entire absorption and evaporation; but if the amount could be concentrated and alternated in the canals in greatest need of water, it would be to the general interest of all concerned. So a proposition of this kind was made to the parties interested in the upper part of the district and agreed to. The trustees of several canals at Greeley were consulted and a plan submitted, which resulted in the passage of resolutions leaving the matter entirely to my discretion.

August 9—The work of distribution by rotation commenced, shutting off all canals having least use, alternating with some of them every two or three days, as necessity

demanded. Amongst others, a larger period was required, reaching five or six days, as the distance from base of operation indicated. The lesson to be drawn from this is that the system of rotation in this district should be established when the volume of water in the stream has decreased to a certain amount; say 500 cubic feet per second. This method was continued up to September 1, when the limit prescribed by statute for compensation of Commissioners for services expired. But, as there was still need for a continuation of further services, the officers of the canals most interested agreed to compensate me for all time required to regulate the distribution and police the stream, which continued until September 16, an additional period of sixteen days.

The results were very satisfactory to all parties interested. So far as known, no hardship or loss of crops ensued in this district for the want of water.

I append herewith a table giving canals in this district requiring water late in the season.

TABLE GIVING THE NAMES OF CANALS

Which require late Water for Irrigation of Fruit and Shade Trees, Alfalfa, Corn and Potatoes, with the amount of the Appropriation applicable for such purposes.

NAME OF CANAL	Order of priority.	DATE OF PRIORITY.			Amount of each appropriation, in cubic feet per second.	Summation of appropriations of each ditch used for late irrigat'n from July 20 to Sept. 30. Cubic feet per second.	Total amount of appropriations for all purposes.
		Day.	Month	Year.			
Dry Creek Ditch	3	10	June	1861	11.66	.....	.....
First enlargement	36	21	Oct	1870	14 42	26.08	50.91
Pleasant Valley Lake Canal Co. Ditch	4	1	Sept	1861	10 96	.....	.....
First enlargement	11	10	June	1864	29.63	4 .59	137.92
Pioneer Ditch Co	5	1	March	1862	12.92	.....	.....
First enlargement	12	15	Sept	1864	16 66	29 58	29 58
Boyd & Freeman	6	15	March	1862	66.05	66 05	.....
The Whitney Irrigation Ditch	7	1	Sept	1862	48.32	48 32	.....
The Larimer and Weld Canal	10	1	June	1864	3 00	.....	.....
First enlargement	21	1	April	1867	16.66	.....	.....
Second enlargement	44	20	Sept	1871	75.00	94.66	719.99
William R. Jones' Ditch	24	1	Sept	1867	15.52	15 52	.....
The Josh Ames Ditch	25	1	Oct	1867	35.92	35.92	.....

The Cañon Canal Co. Ditch	28	15	March	1868	8.60	8.60	57.48
The Cache la Poudre Irrigating Co. Ditch	31	1	May	1869	62.08	62.08	82.50
The Fort Collins Irrigating Ditch	32	1	June	1869	1.66	.....	.....
First enlargement	38	1	April	1871	31.66	33.32	128.93
New Mercer Ditch Co. Ditch	33	1	Sept	1869	4 16	.....	.....
First enlargement	46	10	Oct	1871	8.33	12.49	163.49
Union Colony Canal	35	1	April	1870	52.00	.....	.....
First enlargement	45	1	Oct	1871	41.00	93.00	.....
Cache la Poudre Irrigating Co. Canal	37	25	Oct	1870	110.00	.....	.....
First enlargement	43	15	Sept	1871	170.00	280.00	585.00
The Lake Canal	53	1	Nov	1872	158 73	158 73	158 73
The Larimer County Canal, No. 2	56	1	April	1873	175 00	175 00	175.00
The Larimer County Ditch, supplemented by reservoir	89	25	April	1881	120.00	120.00	469 00
Total	.....	.....	.....	.....	1,299 94	1,299.94	2,758 53

The season of 1886 was characterized by an unusual, excessively high temperature, commencing early in May, and continuing throughout the irrigating season, making it necessary to irrigate oftener than in previous years. Still, notwithstanding the early depletion on our water shed of the snow upon which our supply of water so much depended and its rapid running off in the early part of May, before the beginning of the active irrigating season, it has been a period of great fruition for all of the agricultural undertakings in the district. This result is absolutely due to the very wise policy of the State in its supervisory and police powers, as delegated to the various officials connected with our irrigation system, directing them in the discharge of their duties. Although the system, as adopted, seems to be quite a success, yet there are other improvements that might be made which would render it more certain and effective.

All private and corporate canals, after the water has been segregated from the main stream, should be held more strictly accountable for its use, even after it has been distributed to the laterals from their canals. The present decrees and law, a copy of which is here annexed, and which has been served upon all owners of canals in this district, would seem to be sufficient.

NOTICE.

To the Trustees of Canal:

Your attention is hereby called to section seven (7) of the Decretal Order in adjudication of the priority of right to the use of water for irrigation in Water District No. 3, which is as follows, to wit:

"No part of this decree shall be taken or held as adjudg-"ing to any claimant, or present or future representatives "of any claim to any ditch or canal or reservoir, or any "party, holding, using or controlling the same, any right to "take and carry, by means of any canal, ditch or reservoir

"herein mentioned, or by virtue of any appropriation herein "adjudged, any water from any natural stream, except to be "applied *to the use for which such appropriation has been "made; nor allow any excess use or waste of water what-"ever; nor to allow any diversion of water except for lawful "and beneficial uses.*"

In accordance with the above order, and by virtue of the authority in me vested by the laws of Colorado, as Commissioner of Water District No. 3, I hereby give notice that the provisions of said order must be strictly observed.

B. S. LaGrange,
Commissioner.

Dated:
Fort Collins, Colo., Aug. 1, 1884.

The foregoing Decretal Order is based on the following statutory provisions, found on page 566 of the General Laws of the State of Colorado:

Sec. 1734. Running excess of Water forbidden.

During the summer season it shall not be lawful for any person or persons to run through his or their irrigating ditch *any greater quantity of water than is absolutely necessary for irrigating his or their said land*, and for domestic and stock purposes; it being the intent and meaning of this section to prevent the *wasting* and *useless discharge and running away of water.*

Sec. 1735. Penalty for 'Violation of this Act.

Any person who shall wilfully violate any of the provisions of this act, on conviction thereof before any court having competent jurisdiction, shall be fined in the sum of not less than one hundred (100) dollars. Suits for penalties under this act shall be brought in the name of The People of the State of Colorado.

It will be seen that police power is confined to the stream alone, and does not apply to any of the canals or

their laterals, and therefore cannot be made as effective as it should be. This is one of the defects in the present law which should be remedied. Such power should be made to embrace:

First—The State Engineer.

Second—The commissioners of all water districts.

Third—The superintendents of all canals and laterals.

Each accountable to and under the control of his superior in the order named. This would create a complete supervisory board of control over all water used for irrigating purposes and become certain and effective in its economical distribution.

The combined capacity of the canals already constructed in this district are not equal to the discharge of the stream during flood tide. The agricultural area could be doubled if a complete system of impounding the surplus water that escapes and runs to waste before the season of early irrigation commences. The combined intake of all our canals on the main stream does not exceed 3,000 cubic feet per second, and in most years the quantity flowing in the stream at flood tide is double this amount. About 600 cubic feet per second are used for the early irrigation of natural meadows lying along the stream.

When the season for the irrigation of cereals commences, the intake of the canals most used for this purpose amounts to 2600 cubic feet per second; an ample supply at this time for all lands in cultivation. At present we have all the canals needed to meet the requirements of our people.

For a period of fifteen years I have been closely connected with the development of our agricultural resources, and with the establishment and growth of the irrigation system by which this important and rapidly growing in-

dustry is fostered. At first there were no regulations and no system for the equitable or economic distribution of water. All was in a state of uncertainty. Each man attended to his own head-gate, and there were no defined rights he was bound to respect. There was no basis of credit in land and water holdings. All was uncertainty, confusion and anarchy. Since then, through legislation from time to time, such basis of credit has been established, and confidence restored under the very wise laws at present governing the administration of our water system. It has given general satisfaction in this district, and is acquiesced in and endorsed by all who desire good order, peace and harmony, which are so essential to success in any enterprise, public or private.

Our present laws are good, sound and wholesome ones, when properly understood and intelligently administered, and but very few changes are required to make them more effective and satisfactory.

Some of the most important changes are here noted:

First—The power and duties of the State Engineer should be better defined.

Second—The cubic foot per second should be established as a unit of measure. In our district this method of determining quantity is the accepted standard, and gives satisfaction to all concerned.

Third—Section 1714 of the General Statutes should be repealed. It is not practicable in connection with our subsequent laws regulating distribution, and practically has been superseded.

Fourth—To make our records certain and complete, all our main canals should have in their measuring weirs an automatic water register, so that certain and definite quantities can be ascertained at any hour or day, or for any

number of days that may be required during the irrigating season, as an attachment to our police regulations, and would be of great use in preventing an interference with the system of regulation.

I find the use of a measuring flume in the river an absolute necessity, and had it not been for the one in the stream, the difficulty of dividing the water in seasons of varying supply, to the satisfaction of all concerned, would have been such that I should have resigned my position rather than make the attempt to do justice to all concerned.

The indifference shown by many of the operators of canals to the law regarding measuring flumes in canals, indicate the necessity for some amendment to the present law by which their construction can be required under a suitable penalty, or the Water Commissioner be authorized to put such measuring flumes in at the expense of the owners of the canal, after due notice has been given. Many of the headgates on the canals in this district are not in proper condition for speedy and effective work. Too much time is required to adjust them. It seems to me that the canal companies, in their own interest, would feel it their duty to place them in good repair in order that their own safety might be insured, as well as an aid to the Water Commissioner in the exercise of his duties. It seems to me, where such large interests are dependent upon the success or failure of our agriculture by irrigation in this arid region, where the element upon which we so entirely depend is so variable and its volume of supply continues for so short a time, that every facility should be given the Water Commissioner for speedy and effective work; both by the State through its legislative enactments, and by the corporations and individuals directly interested therein.

Another matter of direct importance, which I desire to comment upon, is the "domestic use" of water from irrigating canals. The proper construing of this term presents a

difficulty often met with, especially during seasons of scarcity of water, and some method should be prescribed to meet the difficulty. It is a question whether "domestic use" applies at all to canals constructed for irrigating purposes; and, if so, what are its limitations—whether it applies to the supply of extensive herds of stock, gardens, orchards, etc., etc., or is strictly confined to domestic or house use. It is my opinion that the duties of a Water Commissioner do not cover the distribution of the water in canals for this purpose.

The maximum period of time in which Water Commissioners are legally paid for services performed, has proven too small in this district, as it doubtless is in similar large districts in the State. It should be increased, or the period be fixed by the County Commissioners, both for the Water Commissioner and his assistant. This is shown in an earlier paragraph reciting the fact that the canal companies continued my services after the period required by law had expired.

The necessity for the establishment of a bureau in the State Engineer's office, where all papers connected with the system of irrigation shall be a matter of record, is apparent to all who watch the growth and importance of the subject. All decrees, priorities, appropriations, etc., should be here preserved for reference by those interested; the whole under the control of the State.

Respectfully submitted,

B. S. LaGrange,
Water Commissioner.

The practical benefits of our irrigation laws are better exemplified in this district than in any other in the State, in the following respects:

First—The limit of four years in which to open any question concerning the priority and appropriation among claimants having expired, the decrees relating to over fifty ditches and canals are now fully established, and have become final.

Second—The river from which the canals draw their water has been accurately gauged, and records of the daily flow through the irrigating season of the last three years has been taken and filed for future reference.

Third—Nearly all the canals and ditches have been supplied with measuring flumes as well as the river itself. There thus follows an ease and certainty about the work of the Water Commissioner, and a confidence in his administration.

Fourth—The first Water Commissioner, appointed six years ago, has been continued in office, and has so familiarized himself with the needs of the irrigators in his district as to be able to do justice to all concerned, and to the satisfaction of irrigators in a district having many large canals within its boundaries. This results from a long experience and close observation which cannot be expected from such officers during their first or even second year of service. The people have confidence in the Commissioner to so great an extent that they believe what he does is for the general good, and they submit to his decisions, though he may at times deprive them of water which they might, under a strict construction of the law, have a legal claim upon, in order that he might make a more equitable use of the same under the assumed right he exercises in using discretionary power to determine its beneficial use as contemplated by law.

Irrigation Water of the Cache La Poudre River, and its Duty.

In my report for 1884, I gave an account of the method of gauging and recording continuously throughout the irrigating season, the discharge of the Cache la Poudre river. The report also contained a table, giving the discharge for that season.

This record has been continued throughout the season of 1885 and 1886, and, besides showing the remarkable fluctuation in volume of the stream in the three seasons in which the record has been kept, it furnishes reliable and important evidence on some obscure and vexed questions of our irrigation practice.

Some of these questions are intimately connected with the progress and development of our irrigation system, and will probably receive attention from the next General Assembly; and as the character of the soil and methods of agriculture which prevail in this district are very similar to those of the other water districts, in the eastern part of the State, I have thought it both proper and profitable to call attention to the more important features of this record.

The river begins to rise in April and attains its maximum discharge in June, after which it begins to decline, and continues to do so throughout the season, save when influenced by local storms. It has, in common with all mountain streams, a daily variation, or a rise and fall in each twenty-four hours, which is quite marked from about the first of May to the last of August. The cause lies in the more rapid melting of the snow on the mountins during the day. The greatest variation due to this cause within the time the records have been kept, was during the week ending July 1, 1884, which amounted to nearly eight inches in the height of the river, or a difference of 1,500 cubic feet

per second discharged. The hour at which the maximum discharge is reached changes as the season advances, and the snow melts from the lower ranges. In May the point of maximum discharge is reached about 4 a. m., the minimum about 7 p. m. Later in the season both hours are later, and by the last of July the maximum flow occurs at 1 p. m., the minimum at 3 a. m.

Of the fluctuations due to storms, the most noted in 1884 occurred during the night of May 20–21, when the river rose nearly two feet in six hours, increasing in volume from 3,153 cubic feet per second to 6,848 cubic feet per second. The most noteworthy storm of 1886 was on August 18, when the river rose from a depth of 2.2 feet to 5.7 feet in thirty minutes, reaching the highest point of the season. It subsided almost as quickly as it rose.

Beginning with 1884, each succeeding year shows a marked decrease in the volume discharged. Some idea can be had of the falling off in volume from the fact that more water passed through the measuring flume in one month (June) in 1884 *than was discharged during the entire season of 1886.*

The following table shows the total monthly discharges of the river in cubic feet during the irrigating season of the past three years:

MONTH.	1884.	1885.	1886.
May	6,783,093,640	3,799,719,158	3,505,642,848
June	12,490,290,864	7,543,921,392	4,861,777,075
July	5,711,910,320	4,972,772,031	1,824,376,457
August	2,020,116,252	1,758,447,619	906,394,367
September	789,995,808	705,681,072	479,258,526
Totals	27,795,406,884	18,780,541,272	11,577,449,273

It will be observed from the above, that the volume discharged during the irrigating season in 1884 was more than double that of the same time in 1886, and almost equal to the combined discharges of the two succeeding years.

Whether this decrease has any connection with the destruction of the forests that covered the water-shed of the river, it is too soon to determine. The probabilities are that it is accidental, or rather, the normal variation in volume which we may expect from season to season. The year 1884 was one of unusually abundant water supply, the largest of which we have any record. Whether we have reached the opposite extreme is to be doubted; the prevailing impression in the district being that there have been seasons of smaller discharge than the last, since irrigation began here. Nearly the whole of the discharge of the present season was utilized and needed for the cultivation of crops, and, as there are large areas of unoccupied lands under several of the existing canals, the era of beneficial canal building on this stream is probably past. Aside from the expansion of the irrigated area, by bringing the unoccupied lands, situated below existing canals, under cultivation, we must rely on the reinforcing of such streams as can be so increased, or by the construction of reservoirs, for the further extension of the agriculture of this district.

THE DUTY OF WATER.

The record and gaugings of this stream for the past two years furnish the most trustworthy data for estimating the duty of water, of any yet available in this State. During the season just closed, from the middle of June practically the whole of the volume was utilized, and was used in a careful and economical manner. We have the quantity of water used, and can determine closely the area on which

it was used. This area is about 125,000 acres in round numbers. The usual method of estimating the duty of water, is to average the amount required for the irrigating season, commonly considered in this State as extending over a period of one hundred days. In the following estimate, however, I have, for convenience, considered it as including the four months of May, June, July and August, computing the duty for each month separately, and then the average season. The table includes the entire discharge for both May and June, although a considerable percentage of the water ran to another district, and was used on other lands. The estimate is to that extent below the truth.

Table showing the duty of water from the Cache la Poudre river, in District No. 3, for 1886:

MONTH.	Average discharge in cubic feet per second.	Total number of acres under cultivation.	Duty of each cubic foot per second.
May	1,308.8	125,000	95.5
June	1,875.7	125,000	66.6
July	684.9	125,000	182.5
August	292.4	125,000	427.5
Average	1,040.4	125,000	193.0

It may be urged that this does not represent the normal duty of water which this year was high, because no more was to be had. So far as the scarcity having led to a more economical use than has hitherto been customary, it is undoubtedly true; but, taking the district as a whole, the percentage of loss, or shortage of crops, was very small, and was principally near the ends of the large canals. Much of this lack of water could have been averted by more efficient distribution and canal management. More water could have been used to advantage in July and August, but more than enough to supply this lack ran to waste in May and June. So that, while the duty was above

the average practice for the last two months of the season, it was undoubtedly below the truth for the first two. The average, therefore, cannot be considered excessive.

The usual method of estimating the duty of water only includes the quantity delivered from the main canal into the lateral, and does not take into account any portion of the loss from percolation and evaporation during the passage through the main canal from the head to the point where delivered. The canals on the Cache la Poudre vary in length from five to fifty miles, and the loss by evapora tion from their surfaces must be considerable. No correction for this loss was made, because a considerable portion of the water lost from canals by percolation and waste from flumes finds its way into other canals or the river, and is utilized. A large percentage of the waters escaping from canals in this manner, however, is lost, being evaporated from the surfaces of the marshes and overflowed lands between Fort Collins and Greeley, which collect this water. The total losses from this source were compensated for in part in the estimate of the duty of water by the double use of such water as found its way back to the river by percolation from irrigated fields. In lands contiguous to the river, underlaid as they frequently are with a gravelly subsoil, this amount is quite large, and in seasons of plenty, when no economy in use is necessary or is practiced, the amount would more than equal the losses from evaporation in canals. For the present season they were taken as being approximately equal.

The duty for the present season, therefore, was about three times as large as the estimate heretofore generally accepted. It is a matter of common experience, however, that the duty of water has increased greatly of late years. The reasons for this will be discussed in another portion of the report. That this duty is not exceptionally great, is shown by the experience of Utah under similar climatic

conditions, where a duty of 200 acres to the cubic foot per second is not unusual, while in California a much higher duty is attained. Few soils surpass those of the upper portion of the Cache la Poudre district in their capacity to retain moisture. Certain crops can be grown with fair success without irrigation. One of the best fields of corn I have ever seen in the State was grown near Fort Collins the present season in this manner.

In addition to whatever statistical value the records and gaugings of the river may possess, its chief worth lies in the aid it affords the Water Commissioner in dividing water in time of scarcity. With a knowledge of the amount of water to be divided, and possessed of tables giving the priorities and gauged capacities of all the important canals, he can perform his duties in the division of water with an ease and correctness not otherwise to be attained. Nor is it the least valuable feature of the aid it renders that his own confidence in the accuracy of his work is shared by those whom it affects. To render the system complete an automatic register, similar to that in the river, should be placed on the measuring flume of each important canal, to record the amount diverted by the canal from the main stream. It had been my intention to have begun this work the present season, and an instrument was designed for the purpose, but owing to delay in its construction, the work was necessarily postponed.

What has been accomplished in this river in the way of records and increasing the duty of water, and by reducing the work of dividing waters to a system which commends itself to all, can be done on other streams and in other water districts.

TABLE SHOWING THE HEIGHT AND DISCHARGE

Of the Cache-la-Poudre River at Gauging Station No. 1, for the years of 1884, 1885 and 1886, as Computed from the Records of the Automatic Registering Machine in operation during the Irrigating Seasons.

DATE.	Daily mean height.			Daily rate cubic feet per second.		
	1884.	1885.	1886.	1884.	1885.	1886.
March 15	0.58	.....	.....	72.5	.....	.....
16	0.57	.....	.....	71.2	.....	.....
17	0.55	.....	.....	66.7	.....	.....
18	0.53	.....	.....	62.0	.....	.....
19	0.55	.....	.....	64.0	.....	.....
20	0.60	.....	.....	77.5	.....	.....
21	0.65	.....	.....	92.3	.....	.....
22	0.47	.....	.....	48.3	.....	.....
23	0.55	.....	.....	64.0	.....	.....
24	0.57	.....	.....	70.0	.....	.....
25	0.576	.....	.....	71.5	.....	.....
26	0.59	.....	.....	76.2	.....	.....
27	0.556	.....	.....	64.7	.....	.....
28	0.50	.....	.....	54.6	.....	.....
29	0.48	.....	.....	49.7	.....	.....
30	0.54	.....	.....	63.3	.....	.....
31	0.59	.....	.....	75.0	.....	.....

Monthly mean height, 0.55.
Monthly mean rate of discharge, cubic feet per second, 67.2.

GAUGING STATION NO. 1—CONTINUED.

DATE.		Daily mean height.			Daily rate, cubic feet per second.		
		1884.	1885.	1886.	1884.	1885.	1886.
April	1	0.64	.....	.....	91.1	.....	.....
	2	0.59	.....	.....	75.5	.....	.....
	3	0.58	.....	.....	73 7	.....	.....
	4	0.57	.....	.....	71.2	.....	.....
	5	0.57	.....	.....	71.2	.....	.....
	6	0.56	.....	.....	68.0	.....	.....
	7	0.547	.....	.....	64.5	.....	.....
	8	0.57	.....	.....	71.2	.....	.....
	9	0.609	.....	.....	78.3	.....	.....
	10	0.609	.....	.....	78.3	.....	.....
	11	0.619	.....	.....	82.5	.....	.....
	12	0.65	.....	.....	92.2	.....	.....
	13	0.75	.....	.....	124.8	.....	.....
	14	0.729	1.05	.....	115.4	241.3	.....
	15	0 743	1.07	.....	120.0	250.4	.....
	16	0.77	1.12	.....	129 4	274.2	.....
	17	0.74	1.14	.....	121.5	284.2	.....
	18	0.93	1.20	.....	189.0	314.3	.....
	19	0.897	1.24	.....	176.0	336.2	.....
	20	0.892	1.28	.....	173.5	358.0	.....
	21	0.901	1.43	.....	176.5	446.9	.....
	22	0.96	1.37	.....	201.0	410.3	.....
	23	0.92	1.42	.....	185.5	440.6	.....
	24	1.138	1.35	.....	279.0	398.4	.....
	25	1.415	1.52	.....	438.5	504.8	.....
	26	1.566	1.60	.....	535.0	558.9	.....
	27	1.798	1.67	1.43	707.5	609.4	446.9
	28	1.792	1.69	1.39	701.7	623.8	416.1
	29	1.746	1.83	1.33	665.5	731.6	386.6
	30	1.66	1.94	1.30	602.0	822.3	369.0

Monthly mean height, 1884, 0.91.
Monthly mean height, 1885, 1.40.
Monthly mean height, 1886, 1.36.
Monthly mean rate of discharge, cubic feet per second, 1884, 218.6.
Monthly mean rate of discharge, cubic feet per second, 1885, 447.3.
Monthly mean rate of discharge, cubic feet per second, 1886, 404.6.

GAUGING STATION NO. 1—CONTINUED.

DATE.	Daily mean height.			Daily rate, cubic feet per second.		
	1884.	1885.	1886.	1884.	1885.	1886.
May 1	1.515	2.09	1.36	501.0	953.7	404.3
2	1.44	2.17	1.46	453.0	1028.6	465.9
3	1.507	2.21	1.55	495.5	1066.6	525.2
4	1.545	2.31	1.63	521.0	1165.3	580.5
5	1.478	2.33	1.68	477.0	1185.8	616.6
6	1.526	2.38	1.73	508.0	1237.1	653.9
7	1.545	2.42	1.82	521.0	1279.0	723.6
8	1.752	2.40	1.88	670.7	1257.6	772.0
9	2.102	2.59	2.00	965.1	1464.8	873.3
10	2.52	2.61	2.03	1386.9	1487.5	900.2
11	2.926	2.70	2.00	1845.0	1591.7	873.3
12	3.076	2.64	2.08	2067.1	1522.3	936.9
13	3.009	2.64	2.04	1977.8	1522.3	908.2
14	2.865	2.64	2.01	1792.4	1522.3	882.3
15	2.947	2.65	1.97	1897.0	1533.8	847.8
16	3.998	2.67	1.92	3490.7	1556.9	805.2
17	4.137	2.62	1.93	3738.4	1499.1	815.7
18	4.046	2.55	2.08	3575.5	1420.3	936.9
19	3.72	2.42	2.33	3021.8	1279.0	1185.8
20	3.931	2.43	2.59	3374.7	1289.7	1464.8
21	4.969	2.47	2.65	5392.8	1332.5	1533.8
22	4.432	2.59	2.90	4289.2	1464.8	1836.2
23	4.244	2.66	2.96	3932.7	1545.4	1913.5
24	4.436	2.70	3.06	3694.9	1591.7	2045.4
25	4.065	2.64	3.17	3609.4	1523.3	2194.5
26	4.187	2.65	3.32	3828.3	1533.8	2406.9
27	4.480	2.60	3.30	4381.7	1475.9	2377.7
28	4.595	2.64	3.45	4610.3	1522.3	2599.3
29	4.39	2.62	3.49	4214.6	1498.1	2659.6
30	4.148	2.76	3.44	3756.5	1663.7	2584.3
31	4.081	3.00	3.21	3637.4	1965.0	2250.0

Monthly mean height, 1884, 3.213.
Monthly mean height, 1885, 2.54.
Monthly mean height, 1886, 2.35.
Monthly mean rate of discharge, cubic feet per second, 1884, 2,536.6.
Monthly mean rate of discharge, cubic feet per second, 1885, 1,418 6.
Monthly mean rate of discharge, cubic feet per second, 1886, 1,308.8.

GAUGING STATION NO. 1—CONTINUED.

DATE.		Daily mean height.			Daily rate, cubic feet per second.		
		1884.	1885.	1886.	1884.	1885.	1886.
June	1	3.988	3.30	3.28	3473.6	2377.7	2349.3
	2	4.096	3.92	3.25	3597.8	3355.4	2306.7
	3	4.278	4.18	3.28	3996.1	3815.3	2349.3
	4	4 537	4.10	3.33	4493.4	3815.3	2421.6
	5	4.705	4.20	3.31	4834.5	3857.5	2392.3
	6	4.816	3.94	3.22	5063.9	3389.9	2264.2
	7	4.744	3.52	3.24	4913.5	2705.6	2292 5
	8	4.681	3 72	3.32	4785.1	2335.1	2406.9
	9	4.715	3.20	3.39	4854.1	2235.8	2509.4
	10	4.878	3.20	3.44	5195.9	2235.8	2584.3
	11	4.868	3.46	3.39	5177.0	2614.4	2509.4
	12	4.734	3.70	3.30	4894.0	2989.0	2377.7
	13	4.849	3.66	3.23	5135.0	2925.3	2278.4
	14	5 00	3.58	3.23	5458.5	2798.6	2278.3
	15	4.902	3.40	3.02	5247.7	2524.0	1992 8
	16	4.648	3.24	2.85	4720.0	2292.5	1784.0
	17	4 566	3.26	2.71	4553 0	2320.9	1703.7
	18	4.446	3.45	2.69	4318.0	2599.3	1580.1
	19	4.499	3.50	2.58	4421.0	2674.6	1453.7
	20	4.648	3.65	2.55	4720.0	2907.2	1420.3
	21	4.705	3.91	2 51	4833.0	3338.2	1375 7
	22	4.652	3.95	2.46	4723.0	3407.2	1321.8
	23	4.417	4.12	2.37	4259.0	3528.8	1226 8
	24	4.710	3.88	2.38	4838.0	3287.3	1237.1
	25	4.864	3.74	2 44	5159 0	3054.5	1250.4
	26	4 974	3 50	2 52	5404.0	2674.6	1386.9
	27	5 032	3.58	2.53	5530.0	2798.6	1398.0
	28	5.070	3.70	2 45	5611.0	2989 0	1311 3
	29	4.979	3.58	2.40	5415 0	2798.6	1257 6
	30	4.662	3.50	2.39	4747.0	2674.6	1247.3

Monthly mean height, 1884, 4.688.
Monthly mean height, 1885, 3 65.
Monthly mean height, 1886, 2 90
Monthly mean rate of discharge, cubic feet per second, 1884, 4,812.3
Monthly mean rate of discharge, cubic feet per second, 1885, 2,910 4
Monthly mean rate of discharge, cubic feet per second, 1886, 1,875.5.

GAUGING STATION NO. 1—CONTINUED.

DATE		Daily mean height.			Daily rate, cubic feet per second.		
		1884	1885.	1886	1884.	1885.	1886.
July	1	4.201	3.74	2 32	3852 0	3054 6	1175 [illegible]
	2	4 264	3.82	2 27	3970.0	3186.4	1125 5
	3	4.196	3.63	2 20	3845.0	2877 5	1056 7
	4	4 198	3.60	2.18	3848.0	2829 6	1037 9
	5	3.979	3.60	2 18	3459 0	2829.7	1037.9
	6	3.892	3.26	2.11	3309 0	2320.9	972.2
	7	4.049	3.28	2.05	3581 0	2349.3	927.0
	8	4.044	3 30	2.00	3572.0	2377.7	873.3
	9	3.816	3.18	1.96	3180.0	2208.3	839.3
	10	3.436	3.16	1 95	2575.0	2180.8	830.7
	11	3.288	3.04	1 87	2360.0	2018.6	763 9
	12	3.187	2 98	1.79	2118.0	1939.3	699.7
	13	3 249	2.94	1.77	2305.0	1887.7	684.5
	14	3.355	2.86	1.71	2458 0	1784 4	638.6
	15	2.977	2.78	1.67	1933.0	1687.7	609.4
	16	2.832	2.80	1 66	1753.0	1711.8	602 2
	17	2.836	2 84	1.67	1755.0	1761.5	609 4
	18	2.726	2.77	1.78	1622.0	1675.7	692.1
	19	2.640	2 75	1 80	1522 0	1651.7	707.4
	20	2 556	2 67	1,75	1428.0	1556 9	669.2
	21	2 508	2.64	1.87	1462.0	1522 3	763.9
	22	2.342	2 60	1,61	1198.0	1475 9	566.1
	23	2.337	2.43	1 59	1193.5	1398 0	552 2
	24	2 289	2.40	1.58	1145.0	1257 6	545.4
	25	2.267	2 32	1.64	1123.0	1175.5	587.7
	26	2.120	2.35	1.57	982.0	1206 3	538.6
	27	2.091	2.32	1.46	955.0	1175.5	465.9
	28	2.033	2.22	1 42	903.2	1076 4	440.6
	29	1.987	2.30	1 37	862.0	1155.0	410.2
	30	2,1680	2.29	1.36	1026.0	1145.2	404.3
	31	2 206	2.22	1 34	1063.0	1076.4	392 6

Monthly mean height, 1884, 3 041
Monthly mean height, 1885, 2.87
Monthly mean height, 1886, 1.79.
Monthly mean rate of discharge, cubic feet per second, 1884, [illegible]
Monthly mean rate of discharge, cubic feet per second, 1885, 1,756 6.
Monthly mean rate of discharge, cubic feet per second, 1886, 716 0

GAUGING STATION NO. 1—CONTINUED.

DATE.	Daily mean height.			Daily rate, cubic feet per second.		
	1884	1885.	1886.	1884.	1885.	1886.
August 1	2.211	2.20	1.30	1068.0	1056.7	369.0
2	2.163	2.17	1.19	1022.0	1028.6	309.3
3	2.264	2.11	1.17	1120.0	972.2	299.3
4	2.374	2.05	1.15	1231.0	918.1	289.2
5	1.988	2.08	1.13	863.0	936.9	279.2
6	1.971	2.26	1.10	849.0	1116.3	264.2
7	1.937	2.16	1.08	820.0	1019.2	255.0
8	1.880	1.98	1.08	772.0	856.3	255.0
9	1.984	1.90	1.08	859.7	788.2	255.0
10	2.067	1.88	1.07	933.5	772.0	250.4
11	1.985	1.84	1.05	860.0	739.7	241.2
12	1.918	1.77	1.04	804.0	684.5	236.7
13	1.889	1.69	1.03	780.1	623.8	232.0
14	1.908	1.65	1.03	795.9	594.9	232.0
15	1.899	1.59	1.04	787.5	552.2	236.6
16	1.947	1.54	1.04	827.0	518.3	236.6
17	1.953	1.48	1.15	833.0	478.6	289.2
18	2.048	1.40	2.60	916.3	465.9	1475.9
19	2.057	1.45	1.48	925.0	459.6	478.6
20	2.021	1.42	1.38	921.7	440.6	416.1
21	1.913	1.60	1.27	800.0	558.9	342.6
22	1.768	1.61	1.20	683.0	566.1	314.3
23	1.643	1.60	1.15	590.0	558.9	294.2
24	1.691	1.58	1.12	624.7	545.4	274.2
25	1.729	1.54	1.38	652.7	518.3	416.2
26	1.662	1.50	1.33	603.0	491.2	386.7
27	1.691	1.46	1.25	624.6	465.9	341.6
28	1.649	1.42	1.26	594.0	440.6	347.1
29	1.529	1.38	1.22	510.7	416.1	325.2
30	1.425	1.35	1.13	443.0	398.4	279.2
31	1.392	1.30	1.10	423.2	369.0	264.1

Monthly mean height, 1884, 1.829.
Monthly mean height, 1885, 1.71
Monthly mean height, 1886, 1.21.
Monthly mean rate of discharge, cubic feet per second, 1884, 791.5.
Monthly mean rate of discharge, cubic feet per second, 1885, 656.5.
Monthly mean rate of discharge, cubic feet per second, 1886, 338.2.

GAUGING STATION NO. 1—CONTINUED.

DATE.	Daily mean height.			Daily rate, cubic feet per second.		
	1884	1886	1886.	1884.	1885.	1886.
September 1	1.428	1 26	1 10	446 1	347.1	264.1
2	1.337	1 22	1 12	390.0	325.2	274.2
3	1.296	1.19	1 12	369 0	309 3	274.2
4	1.267	1 17	1.14	350.0	299.3	284.2
5	1.286	1 16	1.08	361 2	294.2	255.0
6	1.294	1.17	1.03	364.1	299.3	232.0
7	1.350	1.24	1.01	397.4	336.6	222.9
8	1.371	1.33	0.99	409.9	386.6	214 6
9	1.281	1.33	0.99	360.0	386 6	214.6
10	1.207	1 28	0.99	318,0	358.0	214.6
11	1.176	1,25	0.98	302.0	341.6	210 0
12	1.20	1.22	0.98	314,3	325.2	210.0
13	1.161	1.20	0.95	294.0	314 3	197.5
14	1.113	1.12	0.90	270.5	274.2	176.8
15	1 196	1.08	0 88	312.5	255.0	169 4
16	1.310	1.06	0.86	375.0	245 8	162.0
17	1.209	1.05	0.85	319.3	241.2	158.2
18	1.132	1.03	0.86	280.0	232.0	162.0
19	1.081	1.01	0.90	255 0	222.9	176.8
20	1,048	1,00	0.81	239.3	218.3	143.4
21	1.035	1.00	0 79	233.4	218.3	136.4
22	1.030	1.00	0.75	231.2	218.3	122 2
23	1.042	1.00	0.73	236.7	218.3	115.4
24	1.11	1.00	0.75	268 9	218.3	122.2
25	1.093	1.00	0.77	260 3	218 3	129 9
26	1,062	0.98	0.79	245 9	210.0	136 4
27	1.061	0.98	0.82	245.0	210 0	147.1
28	1.050	1.00	0.81	240.2	218.3	143.4
29	1.039	1,00	0.80	235.2	218.3	139 7
30	1.028	0.99	0.79	230.3	214.6	136 4

Monthly mean height, 1884, 1.176.
Monthly mean height, 1885, 1.11.
Monthly mean height, 1886, 0.91.
Monthly mean rate of discharge, cubic feet per second, 1884, 305.1.
Monthly mean rate of discharge, cubic feet per second, 1885, 272.5
Monthly mean rate of discharge, cubic feet per second, 1886, 184 8.

GAUGING STATION NO. 1—CONCLUDED.

DATE	Daily mean height.			Daily rate, cubic feet per second.		
	1884.	1885.	1886.	1884.	1885.	1886.
October 1	1.015	0.98	0.78	224.6	210.0	133.1
2	0.985	0.97	0 78	211.5	205 8	133.1
3	0.966	0.96	0.80	203.4	201 7	139.7
4	0.956	0.96	0.77	197.3	201.7	129.9
5	0 966	0.96	0.78	203.4	201.7	133.1
6	0.956	0 96	0.78	199.3	201.7	133.1
7	0.955	0.96	0.77	199.3	201.7	129.9
8	0.985	0.96	0.78	211.8	201.7	133.1
9	0.979	0.96	0.78	209.1	201.7	133.1
10	0.992	0.97	0.77	214.7	205.8	129.9
11	0.961	.....	0.76	202.3	.....	126.6
12	0.961	.....	0.75	202.3	.....	122.2
13	0.952	.....	0.74	197.3	.....	120.0
14	0.958	.....	0.74	199.9	.....	120 0
15	0.958	.....	0.74	199.9	.....	120.0
16	0.948	.....	0.75	195.7	.....	122.2
17	.....	.....	0.77	.....	.....	129.9
18	.....	.....	.....	.....	.....	.....

Monthly mean height, 1884, 0.968
Monthly mean height, 1885, 0.96.
Monthly mean height, 1886, 0.76.
Monthly mean rate of discharge, cubic feet per second, 1884, 205 1.
Monthly mean rate of discharge, cubic feet per second, 1885, 203.3.
Monthly mean rate of discharge, cubic feet per second, 1886, 128 7.

THE JOSH AMES DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made June 24, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second
0.0	0.0	0.8	8.2	1.6	27.4
0.1	0.6	0.9	9.8	1.7	31.2
0.2	1.4	1.0	11.6	1.8	35.5
0.3	2.3	1.1	13.6	1.9	40.1
0.4	3.3	1.2	15.8	2.0	.....
0.5	4.4	1.3	18.2	.....	.....
0.6	5.5	1.4	21.0	.....	.....
0.7	6.8	1.5	24.0	.....	.....

Record of appropriations for the Josh Ames Ditch, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity
Original construction.....	25	1867	35.92	35.92	1.81

THE LAKE CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made June 25, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0.9	40 7	1.8	150.6
0.1	2.2	1.0	50.1	1.9	164.7
0.2	4.8	1.1	60.0	....	....
0 3	7.8	1.2	71.2	....	.. ..
0.4	10.9	1.3	83 9	....	....
0.5	14 8	1.4	97 0	.....	.....
0.6	19 7	1 5	110.1	.....	.....
0 7	25.5	1.6	123.6	....	....
0.8	32.5	1 7	137.1	.....	.....

NOTE.—The measuring flume of this canal is too narrow, and the wings at the upper end should have been set at an angle of 45° instead of at right angles to the current.

Record of appropriations by the Lake Canal, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	53	1872	158.33	158.33	1.85

DRY CREEK DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made June 26, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0 0	0.8	5.5	1.6	18.2	2.4	44.8
0 1	0.0	0.9	6.6	1.7	20.6	2 5	50.6
0.2	0 0	0.1	7 8	1.8	23.1	2.6	57.0
0.3	0 8	1.1	9.2	1 9	25.9	.....	.....
0.4	1.6	1.2	10.7	2.0	28.9	.....	.....
0.5	2 5	1.3	12.3	2 1	32.2	.....	.....
0.6	3 4	1.4	14.1	2.2	36.0	.....	.....
0.7	4.4	1.5	16.0	2.3	40.0	.....	.....

Record of appropriation by the Dry Creek Ditch, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	No. of cubic feet per sec. in all of the appropriat'ns	Depth of water in measuring flume to give corresponding quantity.
Original construction	3	1861	11.66	11.66	1.26
First enlargement.....	36	1870	14.42	26.08	1.91
Second enlargement.....	64	1873	12.13	38.21	2.26
Third enlargement.....	82	1882	12 70	50.91	2.51

THE LARIMER COUNTY NO. 2 CANAL.

Table giving discharge through the measuring flumes, as computed from gaugings made June 28, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	1.0	19.6	2.0	64.2	3.0	129.6
0.1	1.6	1.1	22.6	2.1	70.7	3.1	136.0
0.2	3.0	1.2	26.2	2.2	77.2	3.2	142.5
0.3	4.5	1.3	30.3	2.3	83.8	3.3	148.9
0.4	6.2	1.4	34.8	2.4	90.4	3.4	155.4
0.5	7.9	1.5	39.5	2.5	97.0	3.5	161.9
0.6	9.9	1.6	44.1	2.6	103.7	3.6	168.4
0.7	12.0	1.7	48.8	2.7	110.4	3.7	174.8
0.8	14.3	1.8	53.7	2.8	117.1	3.8	181.2
0.9	16.8	1.9	58.8	2.9	123.4	.....	.....

Record of appropriations by the Larimer County No. 2 Canal, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second	Depth of water in measuring flume to give corresponding quantity.
Original construction..	56	1873	175.00	175.00	3.72

CACHE LA POUDRE IRRIGATION COMPANY'S DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made June 26 and 27, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.8	16.4	1.6	36.5	2.4	71 8
0.1	2.1	0.9	18.5	1.7	40.0	2.5	77.3
0.2	4 2	1 0	20.6	1.8	43.9	2.59	82.5
0 3	6.3	1.1	22.8	1.9	48.2	.....	.....
0.4	8.4	1.2	25.2	2.0	52.5	.....	.....
0.5	10.4	1.3	27.6	2.1	56.9	.....	.....
0.6	12.4	1.4	30.4	2.2	61.5	.....	.....
0.7	14.4	1.5	33.2	2.3	66.5	.....	.....

NOTE—The measuring flume to this ditch is about three feet wider than the bottom of the ditch. This produced eddies and cross-currents which interfered with the accuracy of the gauging. The table given above can only be regarded as a close approximation.

Record of appropriations by the Cache la Poudre Irrigation Company's Ditch, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	31	1869	62.08	62.08	2.21
First enlargement.....	57	1873	20.42	82.50	2.59

NEW MERCER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made June 30, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.8	19.9	1.6	62.4	2.4	124.4
0.1	1.1	0.9	23.8	1.7	69.8	2.5	132 8
0.2	2,6	1.0	28.0	1.8	77.1	2 6	142.0
0.3	4 6	1.1	32.4	1.9	84.8	2 7	152.0
0.4	7.0	1.2	37.8	2 0	92 0	2.8	162.0
0 5	9 7	1 3	43.3	2.1	99.6	2.87	170.0
0 6	12.7	1 4	48 9	2 2	107 0	.....	.....
0.7	16.0	1 5	55 5	2 3	116.0	.....	.....

Record of appropriations by the New Mercer Ditch, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	33	1869	4.16	4.16	0.27
First enlargement	46	1871	8.33	12.49	0.59
Second enlargement	28	1872	15.00	27.49	0.99
Third enlargement	88	1880	136 00	163 49	1.61

LARIMER AND WELD IRRIGATION CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made July 2, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	Still water...	1.3	38.5	2.6	178.0	3.9	413.0
0.1	Still water...	1.4	45.6	2.7	194.0	4.0	434.0
0.2	Still water...	1.5	53.2	2.8	210.0	4.1	457.0
0.3	Still water...	1.6	61.0	2.9	226.5	4.2	480.0
0.4	Still water...	1.7	69.0	3.0	243.0	4.3	504.0
0.5	Still water...	1.8	78.0	3.1	261.0	4.4	526.0
0.6	3.5	1.9	88.0	3.2	279.0	4.5	551.0
0.7	7.5	2.0	99.0	3.3	296.0	4.6	578.0
0.8	12.0	2.1	110.0	4.4	314.0	4.7	605.0
0.9	16.0	2.2	122.0	3 5	334.0	4.8	634.0
1.0	20.5	2.3	135.0	3.6	355.5	4.9	664.0
1.1	26.0	2.4	148.5	3.7	373.0	5.0	696.0
1.2	32.0	2.5	163.0	3.8	393.0	5.1	729.0

NOTE.—This measuring flume has a line of posts in the middle of the water way, and is three feet too far towards the left bank of canal. The wings at the upper end should be flush with the sides of the flume, and the walk-over should be on the lower end, instead of the upper end. On account of cross currents, caused by posts in the middle and wings butting against posts, could not make an exact measurement.

Record of appropriations by the Larimer and Weld Irrigation Canal, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity
Original construction	10	1864	3.00	3.00	.....
First enlargement	21	1867	16.66	19.66	0.97
Second enlargement	44	1871	75.00	94.66	1.96
Third enlargement	69	1874	54.33	148.99	2.405
Fourth enlargement	79	1878	571.00	719.99	5.073

THE CACHE LA POUDRE IRRIGATION COMPANY'S CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made July 4, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	1.1	29.0	2.2	136.0	3.3	290.5
0.1	0.0	1.2	36.8	2.3	147.2	3.4	307.5
0.2	0.0	1 3	45.7	2.4	159.2	3.5	334.6
0.3	0 0	1 4	54.6	2.5	171.2	3.6	342.2
0.4	0.0	1 5	64.6	2.6	184.2	3.7	360.2
						3.8	378.6
0.5	1.0	1 6	74.6	2.7	197.6	3.9	396.8
						4.0	415.4
0.6	3.0	1.7	84 6	2.8	211.2	4.1	433.8
						4.2	452.4
0.7	6.0	1.8	94 6	2.9	226.0	4.3	470.6
						4.4	488.8
0.8	10.6	1.9	104.6	3.0	241.6	4.5	507.0
						4.6	525.2
0.9	16.0	2.0	114.6	3.1	257.4	4.7	543.6
						4.8	561.6
1.0	22,2	2.1	125.0	3.2	273.6	4.9	579.8
						5.0	598.8

Record of appropriations by the Cache la Poudre Irrigation Company's Canal, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	37	1870	110.00	110.00	1.96
First enlargement	43	1871	170.00	280.00	3.24
Second enlargement	68	1874	184.00	464.00	4.26
Third enlargement	75	1877	121.00	585.00	4.93

JOHN G. COY DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the fourth and nineteeth days of July, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second
0.0	0.0	1.0	6.4	2.0	14.9	3 0	24.4
0.1	0.2	1.1	7.2	2.1	15.7	3.1	25.4
0.2	0.5	1.2	8.1	2.2	16.6	3.2	26.4
0.3	1.0	1.3	9.0	2.3	17.5	3.3	27.4
0.4	1.6	1.4	9.8	2.4	18.4	3.4	28.5
0.5	2.3	1.5	10.6	2.5	19.4	3.5	29.5
0.6	3 0	1.6	11.5	2.6	20.4	3.6	30.5
0.7	3.8	1.7	12.3	2.7	21.4	3.7	31.63
0.8	4.7	1.8	13.2	2.8	22.4	.....	.....
0.9	5.6	1.9	14.1	2.9	23.4	.....	.....

NOTE.—Ditch gauged to a depth of 2.1 feet; discharges beyond that depth are only close approximations.

Record of appropriations by the John G. Coy Ditch, as decreed by the court in the Second judicial district, approved April 11, 1882:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume, to give corresponding quantity.
Original construction.....	13	1865	31.63	31.63	3 7

THE LARIMER COUNTY DITCH.

Table giving discharge through the measuring flume, as computed from gaugings made July 5, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in and and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second
0 0	0.0	0.4	65.2	2.8	176.0	4.2	308.0
0.1	2.4	1.5	72.5	2.9	184.6	4.3	318.0
0 2	5.1	1.6	79.8	3.0	193.6	4.4	328.1
0.3	8 4	1 7	87.4	3.1	202.6	4.5	338.2
0.4	12.0	1.8	95.2	3.2	212.5	4.6	348.4
						4.7	358.6
0.5	16.0	1.9	103.0	3.3	221.8	4.8	368.8
						4.9	379.2
0.6	20.2	2.0	110.4	3.4	231.4	5.0	389.4
						5.1	399.4
0.7	24.6	2.1	118.4	3.5	241.0	5.2	409.6
						5.3	419.8
0 8	29.4	2.2	126.6	3.6	250.2	5.4	430.1
						5.5	440.4
0.9	34.4	2.3	134.8	3.7	259.8	5.6	451.0
						5.7	462.0
1.0	39.8	2.4	143.0	3.8	269.6	5.8	473.0
1.1	45.7	2 5	156.2	3.9	279.0	5.9	484.0
1.2	51.8	2.6	159.4	4.0	288.6	.....	.....
1.3	58.3	2.7	167 6	4.1	298.3	.....	.....

NOTE.—Gauged to 3.33 feet deep. Calculations for depth greater are close approximations.

Record of appropriations by the Larimer County Ditch, as decreed by the court in the Second judicial district, and approved ____, 188__:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic ft. per second.	Depth of water in measuring flume, to give corresponding quantity.
Original construction	89	1881	469.8	469.8	5.77

THE PLEASANT VALLEY AND LAKE CANAL COMPANY'S DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made August 1, 1883:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0.9	52.96	1.8	133.60
0.1	.....	1.0	61.92	1.9	142.56
0.2	6.00	1.1	70.80	.....	.....
0.3	9.82	1.2	79.76	.....	.....
0.4	14.01	1.3	88.80	.....	.....
0.5	19.40	1.4	99.84	.....	.....
0.6	22.45	1.5	106.72	.....	.....
0.7	34.13	1.6	115.68	.....	.....
0.8	44.00	1.7	124.64	.....	.....

Record of appropriations by the Pleasant Valley and Lake Canal Company's Ditch, as decreed by the court in the Second judicial district, and approved April 11, 1882:

	Appropriation priority—Number.	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	4	1861	10.72	10.72	0.322
First enlargement.....	11	1864	29.63	40.35	0.763
Second enlargement.....	49	1872	16.50	56.88	0.944
Third enlargement.....	83	1879	80.83	137.68	1.845
Fourth enlargement.....	91	1881	.....	.....	.....

UNION CANAL NO. 3.

Table giving the discharge through the measuring flume, as computed from gaugings made July 23, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.8	46.1	.....	.....	.....	.....
0.1	1.6	0.9	54.9	.....	.....	.....	.....
0.2	4.1	1.0	63.8	.....	.....	.....	.....
0.3	8.2	1.1	72.9	.....	.....	.....	.....
0.4	14.1	1.2	82.0	.....	.....	.....	.....
0.5	21.8	1.3	91.2	.....	.....	.....	.....
0.6	29.6	1.4	100.4	.....	.....	.....	.....
0.7	37.6	.....	.....	.....	.....	.....	.....

NOTE.—Not sufficient water to rate above 1.4 depth.

Record of appropriations by the Union Canal No. 3, as decreed by the court in the Second judicial district, and approved April 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per sec. in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	35	1870	52.00	52.00	0.87
First enlargement	45	1871	41.00	93.00	1.32
Second enlargement	50	1872	63.13	156.00	.....
Third enlargement.....	50	1873	16.67	172.80	.....

Water District No. 4.

Consists of all lands irrigated from ditches taking out water from the Big Thompson and its tributaries.

Water Commissioner, GEO. W. LITLE.

Appointed March 4, 1886. P. O. address, *Loveland*.

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 4.

LOVELAND, COLO., December 2, 1886.

HON. E. S. NETTLETON,

State Engineer,

Denver, Colorado:

DEAR SIR:

In compliance with your letter of October 4, 1886, I have the honor to report as follows:

The date of first notice to divide water was May 23, 1886. It came from the Little Thompson. The stage of water in the stream was not exceeding 300 inches. I first cut down the supply in ditches, having more than they needed, until I became satisfied that there would not be sufficient for irrigating purposes; then I distributed according to priority of right. I was employed fifty-two (52) days. My assistant was employed one day only; he was a deputy sheriff, employed by me to protect me in performing my official duties, as threats of violence had been made against me.

I found it necessary to adjust the head-gates frequently, on account of fluctuations of the stream—on account of showers in the foothills, and hot and cool weather.

All of the large ditches have measuring flumes. I consider it of great benefit to have measuring flumes rated. It would be a great help in adjusting the flow of water, to have a measuring flume in the main stream with an automatic registry. It would also be beneficial as a record in the future.

The capacity of ditches in this district is, ordinarily, equal to the discharge of the streams during three irrigating seasons, after June of each year. The construction of other ditches carrying water after August would be an evil, as there is not sufficient water in the streams for domestic purposes for the several ditches as already constructed.

I think there should be suitable authority granted water commissioners to arrest persons who violate the law in relation to head-gates, and instead of being compelled to obtain a warrant of arrest, he should be clothed with competent power to make such arrest, in cases where immediate action is necessary in the premises.

Respectfully, yours,

G. W. LITLE,

Water Commissioner District No. 4.

NOTE.—There was no report rendered for 1885, by reason of the resignation and removal of the Water Commissioner to another district, leaving no records to his successor.

Mr. Wm. Roper, the former Water Commissioner for this district, resigned his position in March, 1886, and failed to make a report for the year 1885.

The irrigators in this district have thus far been well supplied, although the water of the Big Thompson creek

was said to have been all appropriated some years ago. Still, each year, new and additional areas of land are brought under cultivation. Some of the largest storage reservoirs at present utilized in the State lie in this district, which, in part, accounts for the ability to extend the irrigation area.

The four years limitation, in which to bring suit or action to change or modify the decrees already tendered, will expire in this district on the twenty-eighth of May, 1887. So far as I am able to learn, the adjudication of the rights of prior appropriators is quite satisfactory.

It is the general opinion that the area of land susceptible of irrigation can be largely increased by utilizing numerous natural reservoir sites for storing the surplus waters of the Big Thompson.

There are twenty-eight canals in this district, whose average decreed capacity is 85.62 cubic feet per second, which shows a greater degree of economy in canal construction and distribution of water than exists in many of the other water districts of the State.

HANDY DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the fifteenth day of July, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.8	37 9	1 6	95 3	2 4	152 1
0.1	.....	0 9	44 7	1 7	102 4	2 5	159.5
0.2	.....	1.0	51 6	1.8	109.6	2.6	167.1
0.3	.....	1.1	58.8	1 9	116 8	2.7	174.8
0.4	.....	1,2	66.1	2.0	123.8	2.8	182.6
						2.87	188.0
0.5	.....	1.3	73.6	2.1	130 8	2.9	190.4
0.6	25.3	1.4	80 7	2 2	137.8	3.0	198.5
0.7	31 4	1 5	88.0	2.3	144 9	..	.....

NOTE.—Ditch run to a depth of 2.87 feet while being rated.

Record of appropriations by the Handy Ditch, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	39	1878	31.20	31.20	0.7
First enlargement.....	47½	1880	141.23	172.43	2.67

LOUDON DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made July 16, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0.8	11.5	1.6	48.4	2.4	96.6
0.1	.....	0.9	15.8	1.7	53.5	2.5	103.3
0.2	.....	1.0	20.0	1.8	58.8	2.6	110.0
0.3	.....	1.1	24.4	1.9	64.3	2.7	117.0
0.4	.....	1.2	29.1	2.0	70.4	2.8	124.5
0.5	.....	1.3	33.8	2.1	76.8	2.9	132.0
0.6	.....	1.4	38.5	2.2	83.3	3.0	139.7
0.7	7.5	1.5	43.4	2.3	90.0	.....	.....

NOTE.—Ditch gauged to a depth of 2.3 feet; could not be filled to greater depth at the time on account of dam in stream being partly carried away. The measuring flume is situated so near the head-gates that the pressure against them during high water is liable to effect the velocity.

Record of appropriation by the Loudon Ditch, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	18	1871	40.00	40.00	1.43
First enlargement.....	38	1877	154.30	191.67	.....

HOME SUPPLY DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made July 15 and 16, 1884:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.9	29.6	1.8	86.8	2.7	159.8
0.1	1.7	1.0	35.4	1.9	94.5	2.8	169.3
0.2	3.8	1.1	41.3	2.0	102.2	2.9	180.0
0.3	6.1	1.2	47.4	2.1	109.9	3.0	191.3
0.4	8.5	1.3	53.5	2.2	117.6	3.1	203.1
0.5	11.2	1.4	59.6	2.3	125.6	3.2	214.9
0.6	14.8	1.5	65.8	2.4	134.0	3.3	226.7
0.7	19.2	1.6	72.3	2.5	142.6	3.4	238.7
0.8	24.2	1.7	79.4	2.6	151.0	3.5	251.9

NOTE.—Ditch gauged to a depth of 2.8 feet; discharges at a greater depth are only approximately correct.

Record of appropriation by the Home Supply Ditch, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	50	1881	278.84	278.84	3.68

THE SOUTH SIDE DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the seventeenth day of July, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.6	0.8	6.9	1.6	27.0	.....	.....
0.1	.....	0.9	8.7	1.7	30.8	.....	.....
0.2	.....	1.0	10.7	1.8	34.7	.....	.....
0.3	0.6	1.1	12.8	1.9	38.7	.....	.....
0.4	1.3	1.2	15.0	2.0	42.7	.....	.....
0.5	2.4	1.3	17.6	2.1	46.6	.....	.....
0.6	3.7	1.4	20.4	2.2	50.8	.....	.....
0.7	5.2	1.5	23.6	.....	.....	.....	.....

NOTE.—Owing to a break in the ditch bank, the ditch could not be gauged to its full capacity. The greatest depth gauged was 1.6 feet; ditch has been run about one foot deeper.

Record of appropriations by the South Side Ditch, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	47	1880	50.30	50.30	2.19

LOVELAND AND GREELEY CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made on the eighteenth day of July, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.8	57.6	.....	.....	.....	.....
0.1	2.8	0.9	66.8	.....	.....	.....	.....
0.2	7.0	1.0	76.2	.....	.....	.....	.....
0.3	13.0	1.1	85.8	.....	.....	.....	.....
0.4	21.2	1.2	95.7	.....	.....	.....	.....
0.5	30.0	1.3	105.6	.....	.....	.....	.....
0.6	39.0	1.4	115.6	.....	.....	.....	.....
0.7	48.4	1.5	124.4	.....	.....	.....	.....

Record of appropriations by the Loveland and Greeley Canal, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	{ 6 7	1865	{ 18.56 8.36	{ 18.56 26.92	.....
First enlargement	13½	1867	12.06	38.98	.....
Second enlargement	17	1870	39.04	78.02	.....
Third enlargement	21½	1873	19.93	97.95	.....
Fourth enlargement	23	1873	35.50	133.45	.....
Fifth enlargement	42	1878	15.20	148.65	.....
Sixth enlargement	48	1881	297.44	446.09	.....

THE FARMERS' IRRIGATING CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made July 21, 1884:

Depth in feet and tenths	Discharge in cubic feet per secodd.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.7	4.5	1.4	20.0	2.1	44.4
0.1	1.0	0.8	5.9	1.5	23.2	2.2	48.0
0.2	0.3	0.9	7.5	1.6	26.6	2.3	51.7
0.3	0.6	1.0	9.6	1.7	30.0	2.4	55.4
0.4	1.2	1.1	11.7	1.8	33.7	2.5	59.3
0.5	2.1	1.2	14.2	1.9	37.2	2.58	62.4
0.6	3.2	1.3	17.0	2.0	40.8	.....	.....

NOTE.—Discharges above the depth of 1.4 are only approximately correct.

Record of appropriation by the Farmers' Irrigating Canal, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume, to give corresponding quantity.
Original construction	4	1864	5.72	5.72	0.78
First enlargem nt.....	14½	1868	2.60	8.32	0.94
Second enlargement	41	1878	54.08	62.40	1.58

HILLSBOROUGH DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-second day of July, 1884:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.8	21.3	1.6	60.7	2.4	106.4
0.1	1 0	0 9	26.1	1 7	66 0	2.5	112.90
0 2	2 2	1 0	30 9	1.8	71 5	2.6	118.7
0 3	4.1	1.1	35 5	1.9	77.0	2 7	125.1
0.4	6.6	1 2	40 2	2.0	82.6	2.8	131.6
0.5	9 5	1.3	45.0	2 1	88 3	2 9	138.4
0 6	12 9	1.4	50.2	2.2	94.0	3 0	145.2
0 7	16.8	1 5	55 4	2 3	100.0	3 1	151 8
						3.12	153.4

NOTE.—On account of low stage of water in the stream, was only able to gauge the ditch to a depth of 1.75 feet. The discharges given for greater depths are only approximate.

Record of appropriations by the Hillsborough Ditch, as decreed by the court in the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	25	1874	8.25	8.25	0 46
First enlargement	40	1878	99 46	107.71	2.42
Second enlargement	51	1881	45.69	153.40	3.12

THE BIG THOMPSON AND PLATTE RIVER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-third day of July, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0.5	6.3	1.0	18.7	1 5	31 4
0.1	0.5	0.6	8.8	1.1	21.2	1.6	33.9
0.2	1.3	0.7	11.2	1.2	23.7	1.65	35.0
0.3	2.5	0.8	13.7	1 3	26.2	.....	.....
0.4	4.2	0.9	10.2	1.4	28.8	.....	.....

NOTE.—Canal gauged to a depth of one foot; discharges for a greater depth are only approximately correct.

Record of appropriations by the Big Thompson and Platte River Ditch, as decreed by the court of the First judicial district, and approved May 28, 1883:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	8	1865	35.00	35.00	1.65
First enlargement.....	31	1876	86.18	121.18	.....

Water District No. 5.

Consists of all lands irrigated from ditches taking water from the St. Vrain Creek and its tributaries, except the Boulder, its tributaries and Coal Creek.

Water Commissioner, DICK RANSOM.

Appointed March 25, 1885. } P. O. address, *Longmont.*
Appointed Nov. 5, 1885. }

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 5.

LONGMONT, COLO., December 8, 1886.

To HON. E. S. NETTLETON,

State Engineer,

Denver, Colorado:

SIR—By your letter of October 5, 1886, you requested an official report from me for the years 1885 and 1886.

Certain topics were especially mentioned, upon which you asked information, and I was requested to embrace such others as in my experience might be timely and important.

Just below the foothills, the St. Vrain river divides, and forms forms an island of several hundred acres, the larger and main channel flowing to the north, and the smaller channel to the south of this island. Irrigating ditches are taken out from each channel, and a portion of the water of the south channel supplies the power, through a ditch, to a flouring

and grist mill. In seasons of very low water the south, or smaller channel, is naturally dry, while the entire remaining flow of water is in the north or main channel. During the extension of the Denver, Utah and Pacific railroad from Longmont to Lyons, in the summer of 1885, a dam, apparently intended as a permanent and tight one, was constructed in the main channel of the river, a short distance above the head of the island, where the stream naturally divided, and a new channel was cut in the south bank of the river, above the dam, whereby the whole stream was turned into the south channel, except such water as leaked through the dam before it settled and became tight. The apparent object of the dam was to facilitate the building of the railroad, and make a safe road-bed along the north side of the old natural north channel, and at the same time stop the washing away of the banks and consequent destruction of a small portion of the land through which the railroad company desired the right of way. It is not known that the dam was intended as an injury to any interest, but to permit it to remain and become perfectly tight, and the new channel to be cut out by the high water of the following spring, would have permanently cut off the supply of water from all ditches having their head-gates on the natural north channel. In September, 1885, when the foregoing situation became apparent, and no water could be had in the north or main channel, and the ditches therefrom being dry, there being no Water Commissioner, an appeal was made to you that the difficulty might be remedied by the removal of the unlawful dam. Upon your advice, the Governor was asked to appoint a Water Commissioner, which resulted in my appointment November 5, 1885, and on the ninth I duly qualified, and on the sixteenth I caused a tearing away of a portion of the dam, sufficient to permit the larger part of the water to flow in its natural channel, though the new south channel was not fully closed up, and is yet liable, with extreme high water, to so wash out as to naturally

diminish thereafter the former natural flow in the north channel.

Farther down the north channel, and yet above the head-gates of several ditches, there is a small natural chan nel by which, during high water, there is a flow in a southerly direction across the island to the south channel. At this point trouble arises whenever the water is low. The south channel ditches and the mill before mentioned then *want* more water than *naturally* goes their way, and dams of logs, boulders, etc., are placed in the stream to divert the water in their direction, by way of this cross channel, only to be removed by the people who obtain water through ditches from the north channel. From the almost daily building and removing of these temporary dams, it is strange that opposing parties have not oftener met, and serious trouble ensued.

The only calls made upon me to divide water previous to the irrigating season of 1886, resulted from the diverting of water from the north, or main channel, by the dams at these two points.

During June, 1886, at your request, I accompanied the Assistant State Engineer, Professor Elwood Mead, for several days, while gauging a part of the ditches of the district, and from him received much valuable information and advice regarding my duties.

On the twentieth of June, with a force of men and teams, I caused a partial removal of the remaining obstructions in the main channel of the St. Vrain, to more thoroughly prevent the cutting out of the new channel, which was made southward from above the railroad dam in the autumn of 1885.

The first complaints and notices in legal form to divide the water in the summer of 1886, were dated June 22, and

for several days succeeding, complaints were numerous, and all of them came from parties supplied by ditches taking water from the river below the head-gates of the Highland Ditch, which is the largest one in the district. From that time forward, notices and complaints regarding the division of water were frequent, mainly owing to the gradual diminishing of the flow, until after the season for irrigating grain, by which time the stage of the river was too low to permit of irrigating for fall plowing, except to a limited extent. On the fifth of October the supply of water was so reduced that a public meeting was called to consider a plan of entirely closing certain ditches for certain periods, to the end that all might alternately have sufficient water for "domestic use." No agreement was possible at the meeting, and on the twelfth of October, after obtaining the advice of, and learning more fully the plans followed by the commissioners of other water ditches, I began the system of "alternating," which is still in use, and which, as far as I am informed, has proven satisfactory.

On the twenty-fifth of last June the Highland Ditch Company caused a summons to be served on me, beginning an action for trespass in the Boulder county District court, claiming ten thousand dollars damages for partially shutting down their head-gates. On the third of July, demand was made for a copy of this complaint, which was furnished, and in due season an answer was prepared and filed in court, and a copy thereof furnished to plaintiff's attorneys. From that time until the opening of court, on the fourth of October, a large amount of testimony was looked up, preparatory to a trial of the case. Attorneys were present for each side when the case was reached, but on motion of plaintiff it was dismissed. Thus, in the absence of any provision by law for legal advice or assistance, or compen sation for time or money expended by a Water Commissioner in such a matter, I am compelled, without recourse

upon the Highland Ditch Company for the same, to "pocket the loss," which in this instance amounts to considerably over one hundred dollars in money alone, and all as the price paid by me for the privilege of doing my duty in defending the rights of ditches, the water for which I found it necessary, in strict order of priorities and appropriations, to shut off from the Highland Ditch.

My guide in dividing and adjusting the flow of water has been the tables furnisned me from your office, which have been disputed in but one instance—that of the Highland Ditch Company—wherein it is claimed by them that your figures do not allow them the quantity to which they are entitled. The variation possibly occurring through the uncertainty as to the meaning of their decree, and the reduction of any certain quantity, as expressed in "customary" inches on any (or no) certain grade, so as to give its equivalent, as contemplated by law, in cubic feet per second. In the case of this ditch, as of all others which have been gauged and ratings furnished, reliance has been placed upon these ratings. For the remainder of the district, where no gauging has been done, my rule has been to measure the width and depth, estimate the velocity as near as practicable, and, calculating 38 4-10 statutory inches as equal to one cubic foot per second, so set the gates as to *approximate* a fair division.

I have had no assistant Water Commissioner, having deemed it most prudent, on account of absence of measuring flumes in most cases, to see personally to the division of water. The time I have devoted to the work is fifty-five days, more than one-half of which time was during June and July last.

It was necessary to frequently visit and regulate headgates during the entire irrigating season, a small portion of the changes being required on account of the unlawful

opening of gates, during my absence, by unauthorized parties, but the larger portion of the visits being required by the gradual decrease of water after the middle of June.

By your printed report to the Governor, of November 30, 1884, I find there are seventy-three ditches in this district, while, so far as I can learn, not more than one-tenth of them have complied with the law requiring the building and maintaining of measuring flumes, notwithstanding all have been notified, the principal ones by special request and the rest by public notice. Were such flumes put in and gauged, the division of water would certainly be more satisfactorily accomplished; and then with a measuring flume in the main stream above the heads of all the ditches, to automatically register the daily flow of water, still further satisfaction would be found by all concerned. In fact, a measuring flume in the river is *absolutely necessary*, to avoid the present system of chasing back and forth between the various head-gates, situated miles apart, in the almost vain endeavor (on the carpenter's plan of "cut and try") to maintain a proper division. The first requisite in the division is *a knowledge of how much water there is to divide.*

In ordinary seasons, the ditches of this district already constructed require all the water of the streams to meet their appropriations. In dry seasons there is not enough. In seasons of great abundance of water probably some more additional land might be irrigated if ditches were built, but the general feeling seems to be that the limit has been reached in building "high" ditches in this district. During a good part of July, August and September of the current season, the St. Vrain for two or three miles west of Longmont has been almost a dry bed of sand, while four or five miles below there has been a continual good flow.

In your request for my report, you asked me to desig-

nate defects or omissions in the present law, which, in my judgment, should receive the attention of the next General Assembly. That many defects and omissions exist, is common remark, and although I feel that, in a crude manner, I might name some of them, I shall do so hesitatingly, owing to my lack of training as a lawmaker. Some of my suggestions for legislation may be impracticable, or even undesirable, but I trust some of them may be useful. They are as follows:

First—Measuring flumes, in streams.

Second—A method of enforcing by penalty, or otherwise, the present law requiring measuring flumes in ditches, or the construction of them by water commissioners, after some form of legal notice, and provision for collecting or taxing the cost thereof.

Third—Location of measuring flumes, by section, township, etc., to be reported to and recorded by the State Engineer.

Fourth—State Engineer's office to be the legal place of record of all decrees, priorities, appropriations, and every other kind of matter required for the information and guidance of Water Commissioners, and proper provision for carrying out the plan,and thereafter furnishing such information. All Water Commissioners to rely solely for their guidance upon such information and instructions as they receive from the State Engineer, possibly making the whole business a State matter, instead of the present system.

Fifth—A provision for locks on all head-gates and waste-gates which are to be regulated by Water Commissioners. Commissioner to have one key to each; all at expense of ditch company. Authority to Commissioner to supply, collect, etc., in case of neglect.

Sixth—Some sort of a "State Board," to include the State Engineer, to hear and decide certain questions of dispute between parties, without waiting for judicial action, such decision to stand until overruled by court.

Seventh—Some restriction as to building new ditches to take water from streams, until the "State Board," as suggested above, shall have considered an application therefor and shall have decided that there is sufficient water in ordinary seasons to permit, with safety, further appropriations. This, to the end that, in time of low water, the quantity required by evaporation and domestic use, does not so far diminish the supply as to become a danger to all prior rights, not only to water for irrigation, but for prior domestic use rights.

Eighth—In cases where appropriations are larger than ditches can carry, such appropriations to be reduced to present capacity of ditch.

Ninth—Water Commissioners to have police power to arrest, etc.

Tenth—A plan for the uniform construction of head-gates and waste-gates which Water Commissioners need to use, certain *levers* for opening and closing; such levers to be *attached*, and not removable. Authority for Commissioners to construct, alter or supply, after due notice, etc., and collect cost of same, in case of neglect.

Eleventh—In case of absence of gauging by State Engineer, Commissioner to be authorized to *estimate*, according to some definite rule to be fixed for that purpose, the quantity of water flowing, and regulate accordingly.

Twelfth—A regular legal form of notice to be provided, printed and furnished by the State Engineer, at State expense, to be filled out, dated, signed and posted by Water

Commissioner, on a suitable board provided by each ditch at the head-gate thereof, within plain view, that it may be readily seen and read by any person who may attempt to change such head-gate. Duty of Commissioner to renew and post such notice at each change made by him. Notice to be a caution to unauthorized persons regarding violation of law by changing head-gate, and stating the statutory penalty, etc. Also provide penalty for defacing or destroying such notices, and embody substance of same in the notice. Commissioner to be authorized to erect boards, collect, etc., after due notice, if neglected.

Thirteenth—Water Commissioners not to be liable to suits, as in case of the Highland Ditch Company against myself, or provision for their defense by the State, without expense to the Commissioner.

Fourteenth—"Domestic use" water to be defined, and confined to water for house, live stock, gardens, fruit trees and shrubbery, but not to extend to gardens after September 1, each season.

Fifteenth—In time of extreme scarcity of water, the Commissioner to have authority to decide, according to his best judgment, whether or not there is more than enough water for domestic use, and in case there is no excess, then to publish that fact in some legally prescribed manner, after which it shall be his duty to cause the arrest, prosecution, etc., of any person who uses water, except as required for domestic use, or allows it to run to waste. Penalty to be prescribed.

Sixteenth—Alternate use of water when supply is reduced below quantity required for domestic use by all at same time. Power to be vested in Water Commissioner to decide, according to his best judgment, such plan of alternate use as will best serve all interests, and to enforce same.

Seventeenth—Amend that portion of present law which provides for the measurement of water sold by the inch, so that all water taken from streams to supply canals, ditches or reservoirs shall be measured by the single standard of unit of one cubic foot per second. All existing decrees not stated in cubic feet per second to be reduced to that standard by the State Engineer, a certificate thereof to be issued by him to the various ditch companies interested, and also recorded in the district to which it belongs, as well as in the records of his office, and in the issuance of all decrees thereafter the same standard of measurement to be observed. In delivering, furnishing or selling water from any canal, ditch or reservoir, the same may be measured either by the standard unit of one cubic foot per second or by the inch; but if measured by the inch, every inch shall be of such quantity that thirty-eight and four-tenths (38.4) inches shall be equivalent to one cubic foot per second. Provide for the method by which a cubic foot per second shall be ascertained in its discharge from any canal, ditch or reservoir, if possible, by certain measuring device, readily constructed, without necessity of using a meter, having reference to size, shape, position, etc., of box or gate, and avoid the present impracticable provision for horizontal slides, etc.

Eighteenth—No individual or corporation to be permitted, under very severe penalty, to place or construct any permanent or temporary dam or other obstruction in any stream, by means of which the water thereof may be made to flow in or through any new cut or channel, or by which any natural channel may then or thereafter be liable to, by natural washing or cutting out, be changed, and the water of the stream in any quantity whatsoever, be diverted from its own free natural course, except in strict order of priority and appropriation as decreed by court. Water commissioners to have authority and be required to enforce this provision, arrest, prosecute, etc.

Nineteenth—The numbers at present assigned to certain appropriations in this district, being no reliable guide as to the order of priorities, should be corrected by legal means.

Twentieth—Duty of Water Commissioner to be extended to cover all requirements of enforcing the present, and whatever new laws are made, with provision for lengthening the time he may be employed each year to two hundred days, and that an assistant may be employed two hundred days; also, that two or more assistants may be employed at the same time if required, but in that event the whole aggregate time of assistants shall not exceed two hundred days. This seems necessary to cover the emergency of having to put in measuring flumes, head-gates, etc. That portion of present law providing that Commissioners shall not begin work until called upon, and not continue, etc., is not necessary and is not desirable, and should be repealed, leaving the Commissioner upon his honor in that regard.

It will occur to you that several of the foregoing suggestions are not original with me, and I know that some of them have come to me through yourself as well as Prof. Mead, your assistant, and yet that makes them *all the better*. I only add to them whatever I am capable of in the way of *emphasis*. Among the whole lot of twenty I trust something may be found by you that you have not had before. And with such as are *new* may you not deal harshly, but "pass my imperfections by."

Very respectfully yours,

DICK RANSOM,

Water Commissioner, District No. 5.

It will be seen from the report of Mr. Ransom that the Water Commissioner from this district has had his full share of trouble.

Notwithstanding the fact that the full volume of water in the St. Vrain Creek was in short supply during the last season, and the impossibility of the Water Commissioner to increase it or extend its duty beyond a careful and intelligent distribution, I consider many of the troubles of the irrigators are not without a remedy, which lies within the power of the canal owners and managers to correct. Some of these difficulties, in my judgment, can be easily overcome in the following manner:

First—A good and efficient Water Commissioner should be continued in charge of the distribution of water from year to year, as the longer and better acquaintance with the work of dividing the water supply in seasons of scarcity, and his familiarity with the rules regulating and the laws governing his actions, are of an enormous advantage to a Water Commissioner, and cannot be gained in one season of service. It is an unwise policy to change this officer, except for good and sufficient cause, concurred in by a majority of the irrigators of the district.

Second—All canals or ditches having a legal appropriation of ten or more cubic feet per second, should comply with the law providing for proper measuring flumes, whereby the Commissioner will be able correctly to ascertain the amount of water each canal is drawing from the main stream, and to adjust with certainty the quantity belonging to each and every appropriator. The substitution of accurate measurements for guess work has much to do with satisfying parties interested and establishing confidence in the acts of the Commissioner.

Third—A readjustment of the decrees relating to the quantity of water appropriators are entitled to, seems to be

almost an absolute necessity. As they now stand, the quantity, as expressed in "customary" inches (or sectional area of the canal expressed in square inches), is very indefinite, changing as it does in canals possessing different grades, sinuosities, form of channel and accuracy of construction. To do away with this important obstacle to an intelligent and equitable distribution of the water among appropriators, the legal and uniform unit of cubic feet per second should be established.

When these few suggestions are adopted, and confidence in the acts of the Commissioners established, I predict that nearly all the trouble in this district will disappear.

PELLA DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the _____day of July, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0 0	0.4	10.9	0.7	24.7	1.1	46.8
0.1	2 0	0.5	14 9	0.8	30 3	1 18	51 32
0.2	4.6	0.6	19 50	0.9	35.9	.....	.....
0.3	7 4	0.68	23.45	1.0	41.5	.....	.....

NOTE.—Beyond the depth of 0.8 the discharges are only approximately correct.

Record of appropriations by the Pella Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	10	1862	16.85	16.85	0.58
First enlargement.....	35	1867	6.60	23 45	0.68
Second enlargement.....	56	1873	27.87	51.32	1 18

JAMES DITCH.

Table giving discharge through the measuring flumes, as computed from gaugings made on the _____ day of July, 1884:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0 0	0 0	0 8	6.2	1 0	25.6	.....	.....
0 1	1 4	0.9	7 9	1.7	28.8	.....	.....
0 2	0 7	1 0	9 8	1.8	32 2	.....	.....
0 3	1 2	1 1	12 0	1 9	35 5	.....	.....
		1 13	12 48				
0.4	1 8	1.2	14.2	2 0	38 7	.....	.....
0.5	2.6	1 3	16.7	.....	.....	.....	.....
0 6	3 6	1 4	19 5	.....	.....	.....	.....
0.7	4 8	1 5	22.4	.....	.....	.....	.....

NOTE.—The discharges of the above table are only approximately correct, only two gaugings of the ditch having been made

Record of appropriations by the James Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction..	37	1868	12.48	12.48	1.13
First enlargement.....	47	1871	9.36	21.84	1.48
Second enlargement	70	1877	16.85	38.69	2.00

OLIGARCHY DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twelfth day of June, 1886:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0 8	15.8	1 6	72.2	.....	.....
0.1	1.1	0 9	20.0	1.7	79.2	.....	.....
0 2	2.5	1.0	24 7	1.8	86 0	.....	.....
0 3	3.9	1.1	30.1	.....	.....	.....	.....
0 4	5.4	1 2	36.0	.....	.....	.....	.....
0.5	7.3	1 3	43.0	.....	.....	.....	.....
0.6	9 4	1.4	53 0	.....	.....	.....	.....
0.7	12.1	1.5	63 8	.....	.....	.....	.....

NOTES.—This ditch was gauged in the flume of the lower head-gates, there being no proper measuring flume. Gauging was made at the upper cross-beam above the gates.

Current uneven and affected by the center post between the gates and six feet below where the gauging was made. Should have a proper measuring flume and be re-rated.

Record of appropriations by the Oligarchy Ditch, as decreed in the First judicial district, and approved:

	Appropriation priority Number.	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second	Depth of water in measuring flume to give corresponding quantity
Original construction	32	1866	26.00	26.00	1.03
First enlargement.....	42	1870	48.88	74.88	1.64
Second enlargement.....	48	1872	22.62	97.50	.....
Third enlargement.....	59	1874	32.50	130.00	.....

ROUGH AND READY DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the fourteenth day of June, 1886:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0.4	8.0	0.8	22.8	1.2	52 5
0.1	2 0	0.5	10.7	0.9	29.0	1.3	64.1
0.2	4.0	0 6	13 6	1.0	36 0	1.4	74 0
0.3	6 0	0 7	19 5	1 1	43.0	1.44	78 0

NOTE.—Gauging made in the flume passing under the railroad track. The down stream end of this flume is fully one foot above the grade of the ditch. In consequence of the free discharge, the velocity of the water in the flume was greatly accelerated, rendering its correct gauging a matter of considerable difficulty. The ditch should have a proper measuring flume and be re-rated

Record of appropriations by the Rough and Ready Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity
Original construction	38	1869	39.00	39.00	1.04
First enlargement	55½	1873	39.00	78.00	1.44

SUPPLY DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the fourteenth day of June, 1886:

Depth in feet and tenths.	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0.8	18.8	1.6	57.2
0.1	1 5	0 9	23.5	1.7	63.9
0.2	3.0	1.0	27.4	1.8	70.6
0.3	4.9	1.1	31.5	1.9	77.2
0.4	6.8	1 2	36.0	2 0	84.0
0.5	9.5	1.3	41.4	2.1	91.0
0.6	12.8	1 4	45.9	2 2	98.0
0.7	16.1	1 5	51.4	2.3	105.0

NOTE.—Gauged at sixth cross-beam from upper end of long standard flume.

Record of appropriations by the Supply Ditch, as decreed by the court in the Second judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity
Original construction.....	75	1878	104.0	104.0	2.29

HIGHLAND DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-first day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second
0.0	.....	0.9	14.9	1.8	73.9	2.7	180.2
0.1	.....	1.0	19.0	1.9	86.7	2.8	191.8
0.2	.....	1.1	24.0	2.0	98.5	2.9	203.4
0.3	.....	1.2	28.2	2.1	110.0	3.0	215.0
0.4	.....	1.3	37.0	2.2	121.5	3.1	226.5
0.5	1.3	1.4	40.8	2.3	133.0	3.2	238.0
0.6	2.0	1.5	48.9	2.4	144.9	3.3	250.0
0.7	6.7	1.6	57.0	2.5	156.8	3.4	262.0
0.8	10.8	1.7	66.0	2.6	168.4	3.5	278.0
...	.....	...	.....	...	.....	3.6	293.2
...	.....	...	.....	...	.....	3.7	311.2
...	.....	...	.....	...	.....	3.8	355.0

NOTE—Gauging made at the lowest cross-beam of flume, at the second set of headgates. A row of posts through the center of this flume produced cross-currents that interferred with the correct rating. Canal should be re-rated.

Record of appropriations by the Highland Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	46	1871	5,500 in.	.....	.....
First enlargement.....	60	1878	980 in.	6,480 in.	.....

SWEDE DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-second day of June, 1886:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0 0	0.4	5.2	0.8	15.3	1.2	32.4
0 1	1 0	0.5	7 4	0.9	18.5	.....	.....
0.2	2.3	0 6	9.2	1.0	22.1	.....	.....
0.3	3 8	0.7	12.2	1.1	27.0	.....	.....

NOTE.—Gauging made in flume at lower head-gate, there being no proper measuring in the ditch. Current very uneven, and discharge given in table only approximately correct. Ditch should have a proper measuring flume, placed below the waste gate, and be re-rated.

Record of appropriations by the Swede Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	44	1871	14 98	14.98	0.79
First enlargement	53	1873	13.10	28.08	1.12

Water District No. 6.

Water Commissioner, HIRAM PRINCE.

Appointed June 4, 1884. P. O. address, *Canfield.*

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 6.

CANFIELD, March 5, 1887.

MR. E. S. NETTLETON,

State Engineer,

Denver, Colorado:

RESPECTED SIR:

Your favor of March 2 is at hand, asking me if possible to give a more extended report of my official acts as Water Commissioner in District No. 6.

I am so much improved in health as to be able to do what I intended to some months ago—give a full report. Although it may be too late for publication, it may assist you in making recommendations to the present General Assembly.

The experiences and observations of each Water Commissioner should be given to the State Engineer—and a careful abstract and compilation of the facts and observations as reported by the Water Commissioners representing, as they do, the different portions of the State—should be made by him, which will help to develop and perfect his knowledge of irrigation matters in general, which will

enable him to recommend proper subjects for legislation requisite to a just distribution of water. With a few slight changes and additions to our present laws, we will have an admirable system. The general principles of our laws should be let alone. As the country is being developed and the duty and requirements of water are extended, we may from time to time see where to better some of the details.

Priority of appropriation of water for beneficial uses gives the better right under the constitutional provision, and if enforced and protected by our administrative officers and courts, we shall have but little to complain of. Any departure from these general provisions will bring confusion and destroy the present excellent system of irrigation laws.

Rights have been given by the State and taken by the people. Enact laws that treat ditches as common carriers; then it follows that they must prorate to all needing or asking for water, and have no choice, no priority, as do railroads, hacks and other common carriers.

Each person, receiving water from or through a ditch, gains a priority from date of use, no matter if it be a purchased right to a perpetual use, a share of stock in the ditch, or a purchase from year to year by the inch. Call it bonus, royalty, or by any other name you please, the fact remains the same. The cost of the construction must be taken into account by the county commissioners when called upon to fix the price for delivering the water from time to time. The time may come when the price so fixed will only need to be sufficient to cover the annual expenses of superintendence and other incidentals.

In 1886 my services were required twenty-four days, to distribute the water. I required no assistant. The ditches were all fairly supplied with water during the season of irrigation.

More than one-half of the twenty-four days was required in taking dams out of the stream of the South Boulder and regulating the supply for domestic use, as many of the farmers would make tight dams across the entire channel of the stream, for the purpose of obtaining water for irrigating lands, that they might more easily plow, while others, below, were suffering for water for domestic use. This state of affairs developed the fact that the Water Commissioner should be given the power to regulate for domestic use as well as for irrigation. I take it for granted that you see the need of giving police power to Water Commissioners for control of water for irrigation, and that they should have assistants when necessary; they should not be limited to time they serve, and should give bonds for the faithful performance of their duties.

I desire again to call your attention to the need of a more stringent law regarding head-gates, so Water Commissioners can control the water running in ditches. Often he has no means of regulating them except by removing dams. There are a few good head-gates in District No. 6. Can you conceive anything more annoying than after working two hours to regulate the water by removing dams, and within a half hour after the Commissioner has gone, some one to slip up unseen and turn the water back into the ditch as before it was adjusted. You can see the amount of work the Commissioner may do, and how little he can accomplish in the equitable distribution of water.

On the twenty-second day of June, 1886, I was called out by applications of several persons in writing, to divide the waters of the South Boulder. I examined the ditches on the lower part of the stream; found some running about half full and others entirely dry, although having the oldest right to water, according to priority.

I proceeded up the stream, found the latest ditches that have been taken out, which are higher up the stream, run-

ning full, and some of them running over their banks, except the Community Ditch, which was about one-half full, and was carrying about fifteen hundred cross-section inches of water. At this time the stream was a little below its average stage at this time of year. Some of the late made ditches have been very greatly enlarged; some of their decrees are two to eight times their carrying capacity of one year ago, and the owners are trying to get them enlarged up to their decrees. I shut out one-half of the water in the Community Ditch, believing I could shut off a small amount from these enlarged ditches, some of which were running water to waste, that I might get water down to the lower ditches, and not have to resort to extreme measures of dividing according to priority of right, but make the water do the greatest good to the greatest number. This was done on June 22, some of these ditches having poor head-gates, and the water entering them could be easily interfered with; also, having to travel about fifteen miles to adjust several ditches. I found at daylight the next morning I had no more water for the lower ditches than before I made the attempt to regulate the stream. I immediately started back on the twenty-third of June and closed down the Community Ditch, except to allow sufficient water to flow in it to keep the flumes from drying up, as I deemed this only justice to the owners of this ditch. I also shut off part of the water from the Rock Creek, Davidson and Marshallville ditches. These latter ditches are the enlarged ditches since obtaining their decrees, and these ditches can be enlarged very much more, and yet will not carry the amount of water decreed to them. These ditches were partially shut down to supply those having older rights.

Then came a howl, and watching other ditches, and a demand that I had no right to shut down their ditches, excepting the Community Ditch, which has a reservoir about one and one-half miles below the head-gate. At this

time there was three and one-half to four feet of water in the reservoir, so that the amount of water in the ditch below the reservoir was about the same, even after the ditch was shut down. Then a howl was set up that I was partial to this ditch. I was published in one of the Denver papers. I was bulldozed and my authority was denied *in toto*. They said, while the sheriff might shut their ditch down, I had no right to do so. They bullied me, threatened me with bodily harm, and with law suits. Then, for the first time since I have acted as Water Commissioner, or for a period of seven years, I enforced more stringently the priority of the decrees, although I knew many of them were unjust, as to date and carrying capacity. I made it plain that I should do so if it took the sheriff and fifty men to enforce and carry out the law, even at the sacrifice of my life and every dollar I possessed.

I at once employed an assistant, and gave him the ditches belonging to these turbulent men, to patrol and keep the water in them at a depth I should deem right under the law. I gave notice that I should arrest anyone who dared interfere with my adjustments.

Then they resorted to opening their gates at night by stealth. I stopped this as far as was possible to do with poor head-gates; my work was laborious. I often spent most of the night on the stream. If I could have had another assistant, when most needed, I could have controlled the water much better. Thus, to properly control the water in this district, will require good head-gates and two assistants when necessary. Assistants are not so much required many times to measure the water as to patrol and keep the head-gates in position as adjusted by the Commissioner. It sometimes requires one assistant after the irrigating season to regulate for domestic purposes. It is of vital importance that the use of water for domestic purposes be defined either by legislative enactment or by the

Supreme court. The Water Commissioner scarcely knows where his duty begins or where it ends respecting the division of water for domestic uses. The claim of water for domestic uses is reducing the duty of water for irrigating purposes in many instances. The great length of some of our ditches and the loss in them from evaporation and seepage require in some instances nearly one-third of the capacity of the stream during low water.

I wish to call your attention to the statute of limitation of four years. It arouses much feeling when, by law and decrees rendered, some ditches are shut off from water, while others, constructed two to eight years later, are having ample water for irrigation, owing to fraudulent statements to the referee when making claim to water rights. I think the words "four years" erased and "twenty years" inserted, or some mode by which justice might prevail and these fraudulent decrees corrected by the courts.

When the General Assembly provided for the adjudication of water rights, they might have provided that a competent engineer should take the capacity of the ditch and the land lying under and being irrigated therefrom. Much trouble, fraud and injustice might have been avoided and the four years limitation would be of less importance.

The majority of the ditches in this district were given to the referee without any measurement, other than guess; and you will readily perceive what will occur when ditches of nearly the same grade—say one-fourth of an inch to the rod—some would state that the grade was one-half and some as high as two and one-half inches per rod; and some ditches were given in as being constructed two to eight years before they really were, and from three to eight times the original size.

The State Engineer should have ample means to enable him as quickly as possible to rate the ditches and esti-

mate the carrying capacity. I take it that no ditch should have a decree greater than its carrying capacity, and this grave state of affairs could in this way be corrected. Nothing is so important to the farmer at this time as that the State Engineer should have ample means to rate the streams and ditches and perfect his admirable plans, which enable the Water Commissioner to make easy work in the equitable distribution of the water.

The North Boulder kept up its usual volume of water better than the South Boulder.

I adjusted the head-gates of this stream in accordance with priority. Every one seemed to be satisfied with the acts of the Commissioners, and we worked in harmony in this part of the district.

On Coal Creek there is but little water to divide, and the people are entirely satisfied with the distribution made by the Water Commissioner.

Respectfully submitted,

HIRAM PRINCE,

Water Commissioner District No. 6.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk in Boulder county since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNERS.	STREAMS FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth in feet.	Grade per mile in feet.	Length in miles.	Capacity in cubic feet per second.	Date of Appropriati'n		
			Bottom in feet	Top in feet.					Day.	Month.	Year.
Haight	Eliza H. Haight	Four Mile Creek	4.	.....	1.	...	...	15.16	11	Nov.	1884
Dry Creek Valley Ditch	Dry Creek Valley Ditch Co	Ralston Cr'k & Church ditch, Golden City	.....	.....	.....	..	...	26.32	25	May	1885
South Boulder and Rock Creek Ditch	South Boulder & Rock Cr'k Ditch Co	South & Boulder Cr'k	As enlarged		3.5	...	...	19.5	...	.....	.....
Llewellyn	John Llewellyn and John H. Myer	Redstone Creek	2 5	.....	2.	4.0	...	6 0	25	Mar.	1886
.....	Wesley Brainard	South Fork St Vrain	For drainage and ditch purposes						30	Aug.	1886
.....	David M. and Edw. H. Reedy	Left Hand Creek	For drainage and ditch purposes						31	Aug.	1886

LOWER BOULDER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the nineteenth day of June, 1886:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.2	0.8	0.6	13.8	1.0	36.6	1.4	59.6
0.3	1.6	0.7	19.5	1.1	42.3	.....	.....
0.4	5.2	0.8	24.2	1.2	48.0	.....	.....
0 5	8.8	0.9	30.7	1.3	53.7	.....	.....

NOTES.—This flume has been lifted by the water, a small portion passing under at the time it was gauged.

Measured discharge at second cross-beam from down stream end of flume. *This is important*, as the down stream end of the flume is higher than the up stream end, and water shallower. Flume should be repaired.

Record of appropriations by the Lower Boulder Ditch, as decreed by the court in the First judicial district, and approved.

	Appropriation priority—Number.	Year	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	1	1859	25.00	25 00	0 81
First enlargement	32	1870	97 00	122 00	.....

SOUTH BOULDER AND COAL CREEK DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-third day of July, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0 4	3.5	0.8	13.8	1.2	27 7
0.1	0.4	0.5	5.3	0.9	17.3	1.3	31.2
0.2	1.1	0.6	7.5	1 0	20.8	.....	.....
0.3	2.1	0.7	10.3	1.1	24 3	.....	.....

Record of appropriations by the South Boulder and Coal Creek Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second	Depth of water in measuring flume to give corresponding quantity
Original construction	28	1872	53.55	53.55	.....

DAVIDSON DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-third day of July, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second
0.0	0.0	0.4	2.6	0.8	11.2	1.2	26.0
0.1	0.25	0.5	4.1	0.9	14.2	1.3	31.0
0.2	0.8	0.6	6.0	1.0	17.5	.....	.....
0.3	1.55	0.7	8.5	1.1	21.3	.....	.....

NOTE.—Ditch gauged to a depth of 1.08 feet could not get more water through the head-gates

Record of appropriations by the Davidson Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	26	1872	116 30	116.30	.....
First enlargement	32	1875	125.50	241.80	.....

SOUTH BOULDER AND BEAR CREEK DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fourth day of July, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second
0.0	0.0	0.2	2 80	0.4	7 07	0 6	16 70
0.1	1 15	0 3	5.04	0 5	11.70	.....	.....

NOTE.—Not sufficient water to fill ditch.

Record of appropriations by the South Boulder and Bear Creek Ditch, as decreed by the court in the First judicial district, and approved.

	Appropriation priority—Number	Year.	No. of cubic feet per second in each appropriation	No of cubic feet per second in all of the appropriations.	Depth of water in measuring flume to give corresponding quantity
Original construction	5	1862	16.60	16 60	.....
First enlargement	8	1865	26 41	43.01	.....
Second enlargement	20	1868	54.69	97.70	.....
Third enlargement	23	1871	129.10	226.80	.....

HOWARD DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made July 24, 1885:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.2	1.1	0.4	5.4	.....	.....
0.1	0.4	0.3	2.8	0.5	9.7	.....	.....

NOTE.—Ditch gauged to a depth of 0.44 feet. It could not be filled on account of low water in the stream.

Record of appropriations by the Howard Ditch, as decreed by the court in the First judicial district, and approved.

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	3	1860	36.00	36.00	.....

MARSHALLVILLE DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on July 24, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0.2	2.2	0.4	10.9	0.6	22.3
0.1	0.9	0.3	5.1	0.5	16.5	.....	.....

NOTE.—Low water in the stream prevented filling the ditch above the depth of 0.47 feet. As only two gaugings were made, could not extend the table to a greater depth.

Record of appropriations by the Marshallville Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year	No. of cubic feet per second in each appropriation.	No. of cubic feet per second in all of the appropriations.	Depth of water in measuring flume to give corresponding quantity.
Original construction..	14	1865	14.76	14.76	0.47
First enlargement...	33	1878	31.92	46.68	.....

THE SOUTH BOULDER CANON DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fourth and twenty-seventh days of July, 1885:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0.6	8 1	1.2	17.5	1 8	26.8
0.1	0.8	0.7	9 6	1 3	19.0	1.9	28 4
0.2	2 0	0.8	11	1 4	20.5	2.0	29.9
0.3	3.4	0.9	12.8	1.5	22.1	.....	.....
0 4	5.0	1.0	14 3	1.6	23.7	.....	.....
0.5	6.5	1 1	15 9	1.7	25 2	....	.....

NOTE.—Ditch gauged to a depth of 1.5 feet. Banks of ditch near flume badly overgrown with willows.

Record of appropriation by the South Boulder Cañon Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	21	1870	26.37	26.37	.....
First enlargement.....	24	1871	192.00	218.37	.....

THE COTTONWOOD DITCH NO. 1.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fifth day of July, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and inches.	Discharge in cubic feet per second.	Depth in feet and inches.	Discharge in cubic feet per second
0.0	.....	0.2	1.8	0.4	5 5	0.6	11.6
0.1	0.8	0.3	3 4	0.3	8.1	0.7	15.8

NOTE.—Low water in the stream prevented the ditch being filled above the depth of 0.53 feet.

Record of appropriations by the Cottonwood Ditch No. 1, as decreed by the court in the First judicial district, and approved.

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	17	1866	15.58	15.58	0.69
First enlargement	22	1870	36 72	52.30	.....

BOULDER AND WHITE ROCK DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fifth day of July, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	0.0	0.4	35.0	0.8	101.5	1.2	172.5
0.1	6.4	0.5	50.5	0.9	121.5	1.3	.....
0.2	14.5	0.6	65.5	1.0	141.0	1.4	.....
0.3	23.5	0.7	81.5	1.1	156.8	1.5	.....

NOTE.—Table of discharges not extended beyond the measurements.

Record of appropriation by the Boulder and White Rock Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second	Depth of water in measuring flume to give corresponding quantity
Original construction..	35	1873	747.38	747.38	.....

THE FARMERS' DITCH.

Table giving the discharge through the measuring flume, as compiled from gaugings made on the twenty-first day of July, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.6	12.3	1.2	32.1	1.8	55.9
0.1	1.3	0.7	15.1	1.3	35.9	1.9	58.8
0.2	3.0	0.8	18.1	1.4	39.8	2.0	62.6
0.3	5.0	0.9	21.2	1.5	43.6	2.1	64.4
0.4	7.2	1.0	24.4	1.6	47.4	2.2	70.2
0.5	9.7	1.1	28.3	1.7	51.2	2.3	74.0

NOTE.—The discharges for depths greater than 1.7 feet are only approximate.

Record of appropriations by the Farmers' Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	14	1862	73.29	73.29	2.28

THE COTTONWOOD DITCH NO. 2.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fifth day of July, 1885:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.4	4.5	0.8	11.7	1.2	18.9
0.1	0.5	0.5	6.3	0.9	13.5	1.3	20.7
0.2	1.4	0.6	8.1	1.0	15.3	1.4	22.5
0.3	2.7	0.7	10.0	1.1	17.1	1.5	24.3

NOTE.—Ditch was gauged to a depth of one foot; discharges for greater depths are only approximately correct.

Record of appropriations by the Cottonwood Ditch No. 2, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	6	1863	33.70	33.70	.....

LEYNER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-seventh day of July, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0.4	3.8	0.8	8.5	1.2	15.6
0.1	0.9	0.5	4.8	0.9	10.1	1.3	17.7
0.2	1.8	0.6	5.9	1.0	11.7	1.4	19.8
0.3	2.8	0.7	7.1	1.1	13.6	.....	.....

NOTE.—Discharges for depths greater than one foot are only approximately correct.

Record of appropriations by the Leyner Ditch, as decreed by the court in the First judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume, to give corresponding quantity.
Original construction.....	13	1865	164.00	164.00	.....

Water District No. 7.

Consists of all lands irrigated from ditches taking water from Clear Creek and its tributaries.

Water Commissioner, JOSEPH W. T. MCKAY.

Appointed May 4, 1882. P. O. Address, *Denver*.

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 7, FOR THE YEAR 1885.

E. S. NETTLETON, ESQ.,

State Engineer,

Denver, Colo.:

DEAR SIR:

In obedience to the request contained in your letter of October 5, 1886, requesting me to make a report of matters connected with my position as Water Commissioner of District No. 7, of the State of Colorado, for the years 1885 and 1886, I most respectfully submit the following statement:

The water in Clear Creek, which supplies the ditches under my control, was in a good stage, sufficient to supply all demands, without any special interference on my part, until August 17, 1885, when I was notified by the officers of the Clear Creek and Platte River Ditch Company, requesting me to furnish them with a larger supply, such as they were entitled to under the law. I immediately went to the cañon, where the largest ditches are taken out of

said creek, and proceeded to regulate and distribute the water, making a proper adjustment according to the priority of rights and the various appropriations made to the various ditches supplied from the creek. The water continued at a low stage during the remainder of the irrigating season, with some exceptions. In this year there was but one ditch, to-wit, the Golden Canal, that complied with the law in establishing a *measuring flume;* and in the distribution of water I had to depend entirely on my own judgment, which proved entirely satisfactory to the patrons of the various ditches. During the year the state of water in the creek was such that I attended to all the duties of my position myself, and had no assistant; the time I occupied in so doing was thirty-two days. It was not necessary to adjust the head-gates in the spring, as the supply was greater than the demand. The adjustment is only required in the fall, when the water is in a low stage, owing to the fluctuations of the stream, and sometimes by being disturbed by persons without authority.

Report for the Year 1886.

The water in Clear Creek, which supplies all the ditches under my control, kept in a pretty good stage until July 12, 1886, when I was notified by the officers of Clear Creek and Platte River and Colorado Agricultural Ditch Companies (the two lowest ditches on the creek), to furnish a greater supply of water. I immediately went to Golden, near where all the large ditches start from said creek, and proceeded to adjust the supply in as satisfactory a manner as possible. As the creek gradually became lower, I deemed it necessary, on August 10, to appoint an assistant in the person of A. O. Patterson, of Golden, to take special charge of the first seven ditches, which all start in Golden and vicinity, and, owing to their capacity, are capable and were absorbing all the water in the creek, so that at its mouth it was dry. The assistant, by the daily adjustment of the

ditches, kept an adequate supply in the creek, so that there was no complaint on account of scarcity from the numerous ditches below. As the creek gradually got lower, at the expiration of the assistant's time, I deemed it necessary to have a person take charge of the aforesaid ditches, and give his whole time and attention to them, so I appointed him to act in my stead, and he has so done, giving entire satisfaction up to the present date. I will here state, at the low stage of water in the creek, from the tenth of August to the present date, without the constant attention of some person to take charge of the aforesaid ditches and adjust the gates at least once, and often twice, during the day, the various ditches below would have been without a drop of water. I might add that the fluctuations in the creek have been during that time usually caused by the running and stopping of the several mills in Golden, and it has required the closest scr utiny to make a proper adjustment of a low stage of water, owing to this cause. The time I have been employed, up to this date, consists of thirty-six days.

The course pursued in adjusting the flow of water was by measuring the depth of water in the flume, established by the Assistant State Engineer, when such flumes were established; and when they were not, then, according to my best judgment. I might here add that of the whole number of ditches on the creek, only ten have complied with the law and established measuring flumes, to-wit: Golden Ditch, Agricultural, Golden City and Ralston Creek, Golden Canal, Rocky Mountain, Wannemaker, Brown & Baugh, Fisher, Colorado Agricultural, Clear Creek and Platte River. I do most earnestly advocate the establishment of measuring flumes, as they afford positive facilities to the Water Commissioner in adjusting the water, and frequently are the means of satisfying many refractory persons who are continually contending for what they deem their rights, when they really have none. I am of the

opinion measuring flumes in the ditches are more satisfactory than any measuring flume that could be placed in the creek, owing to its fluctuations, and am of the opinion no improvement could be made on that, and that no legislation could be made to afford greater relief to the agricultural interests of the community. My opinion in reference to the supply of water in the creek is, that when the season affords an average supply, there is now a sufficient area of land already under ditch to exhaust the supply; when a dry season intervenes, such as the present one, the supply would not be sufficient to cover any more land; indeed during the present season many crops of various kinds have suffered for the want of water. I might further add that, owing to the high water in the spring, it is not necessary to adjust the gates. That is only necessary at a low stage in the fall. Especially was it the case this present fall, when the water in Clear Creek has been lower than was ever known before.

Very Respectfully submitted,

J. W. T. McKay,

Water Commissioner of the Seventh District.

The division of water in this district, under the court decrees, has been made to the satisfaction of the canal owners, as far as I have been informed, with possibly one or two exceptions.

Owing to the peculiar location of the heads of some of the larger canals, the Water Commissioner has found it necessary to employ an assistant constantly, to regulate the water at the head of these canals at Golden City.

A better method of distributing the water from some of the canals in this district seems desirable; and the same

may be said of many other canals in the State. I have often been asked to take some active part in the division of water along the line of a canal; but I fail to find anything in the law permitting or giving me any authority in such cases, except it may be by inference, to prevent waste and to secure a more economical use of water alloted to the canal.

FISHER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made July 16, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0.4	3.8	0.8	9.5	1.2	15.5
0.1	0.5	0.5	5.2	0.9	11.0	.....	.....
0.2	1.5	0.6	6.6	1.0	12.5	.....	.....
0.3	2.6	0.7	8.0	1.1	14.0	.....	.....

NOTE.—This ditch has an excellent measuring flume, but its location is faulty, being in a bend in the ditch. Rating interfered with by sand settling on bottom of the flume. Could not fill the ditch on account of gravel lodged in front of the gates.

Record of appropriations by the Fisher Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number.	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second	Depth of water in measuring flume to give corresponding quantity.
Original construction	16	1861	35.00	35.00	.....

THE COLORADO AGRICULTURAL DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the sixteenth and seventeenth days of July, 1886:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0.8	6.8	1.6	26.0	.....	.....
0.1	.....	0.9	8.8	1.7	28.5	.....	.....
0.2	.....	1.0	11.0	1.8	31.0	.....	.....
0.3	.....	1.1	13.5	1.9	33.5	.....	.....
0.4	.....	1.2	16.0	2.0	36.0	.....	.....
0.5	2.0	1.3	18 5	2.1	38 6	.....	.....
0.6	3.4	1.4	21.0	2.2	.....	.....	.....
0.7	5.0	1.5	23.5	2 3	.....	.....	.....

NOTE —Ditch has a proper measuring flume, but owing to the head-gates being out of order, could not give it a complete rating.

Record of appropriations by the Colorado Agricultural Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity
Original construction.....	49	1867	30,20	30,20	1.77
First enlargement	59	1874	31,80	62,00	.....

THE AGRICULTURAL DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fourth day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.1		1.0	3.9	1.9	53.9	2.8	111.4
0.2		1.1	7.8	2.0	60.0	2.9	118.4
0.3		1.2	11.9	2.1	66.4	3.0	125.2
0.4	Still water.	1.3	17.4	2.2	72.6	3.1	132.3
0.5		1.4	23.5	2.3	79.0	3.2	139.3
0.6		1.5	29.5	2.4	85.5	3.3	146.3
0.7		1.6	35.5	2.5	91.9	3.4	153.3
0.8		1.7	41.5	2.6	98.5	3.5	160.3
0.9	1.0	1.8	47.6	2.7	105.0	.....	.....

Record of appropriations by the Agricultural Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	61	1874	101.54	101 54	2 65
First enlargement.....	67	1883	48.46	150.00	3.35

GOLDEN CITY AND RALSTON CREEK DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fourth day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0 4	10.7	0.8	30.8	1 2	59 7
0.1	1.4	0 5	15.0	0.9	37.2	1.3	68.7
0.2	3.9	0.6	20.0	1.0	44 0	1.4	77.7
0.3	7.0	0.7	25.0	1.1	51.7	1.5	87.8

NOTE.—This ditch rated in upper flume at Golden, on second cross-beam above waste gate. Measurements of depth taken on left side. Bottom very uneven; ditch needs a proper measuring flume.

Record of appropriation by the Golden City and Ralston Creek Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	40	1865	41.43	41.43	0.96
First enlargement	62	1877	18.26	59.69	1.20
Second enlargement	65	1878	18.85	78.54	1.41
Third enlargement	66	1881	32.34	110.88	.....

THE GOLDEN DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fifth day of June, 1886:

Depth in feet and inches	Discharge in cubic feet per second.	Depth in feet and inches	Discharge in cubic feet per second	Depth in feet and inches	Discharge in cubic feet per second.	Depth in feet and inches	Discharge in cubic feet per second.
0.0	.....	0.5	4.3	1.0	15.8	1.5	30.2
0.1	.....	0.6	6.3	1.1	18.5	1.6	33.4
0.2	1 4	0.7	8.4	1.2	21.3	1.7	36.7
0.3	2.0	0.8	10.8	1.3	24.1	.....	.....
0.4	3.0	0.9	13.3	1.4	27.0	.....	.....

NOTE—Gauging made in second standard flume above Golden, 27 feet from lower end.

Record of appropriation by the Golden Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1886:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	55	1871	26.00	26.00	1.37

GOLDEN CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-fifth day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0.	0.0	0.6	21.2	1.2	67.4	1.8	129.5
0.1	1.5	0.7	28.5	1.3	76.2	1.9	141.5
0.2	4.2	0.8	35.7	1.4	86.0	2.0	153.2
0.3	7.8	0.9	42.7	1.5	96.0	.....	.....
0.4	12.1	1.0	50.5	1.6	106.7	.....	.....
0.5	16.9	1.1	58.6	1.7	117.8	.....	.....

Record of appropriations by the Golden Canal, as decreed by the court in the Second judicial district, and approved:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	9	1860	39.80	39.80	0.86
First enlargement.....	57	1872	154.00	193.80	.....

ROCKY MOUNTAIN DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-sixth day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in and and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0.7	11.5	1.4	33.9	2.1	60.2
0.1	.....	0.8	14.2	1.5	37.5	2.2	64.4
0.2	2.3	0.9	17.4	1.6	40.9	2.3	68.4
0.3	4.0	1.0	20.5	1.7	44.4	2.4	72.6
0.4	5.8	1.1	23.9	1.8	48.5	2.5	77.2
0.5	7.4	1.2	27.0	1.9	52.4	.....	.....
0.6	9.4	1.3	30.4	2.0	56.2	.....	.....

NOTE.—Ditch gauged in the flume at the waste gate, about half a mile below the head of the canal. Current uneven and rating interfered with somewhat by sand settling in the flume (caused by shutting the waste gates). Ditch should have a proper measuring flume below the waste gate.

Record of appropriations by the Rocky Mountain Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	19	1862	9.21	9.21	0.59
First enlargement.....	37	1864	7.30	16.51	0.87
Second enlargement.....	41	1865	47.13	63.64	2.18
Third enlargement.....	58	1873	113.66	177.30	.....
Fourth enlargement.....	64	1878	12.70	190.00	.....

BROWN AND BAUGH DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the thirtieth day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	.....	0.3	0.45	0.6	2.7	.....	.....
0.1	.....	0.4	1.0	0 7	3.56	.....	.....
0.2	0.2	0.5	1.9	0.8	4.4	.....	.....

Record of appropriations by the Brown and Baugh Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	45	1862	10.00	10.00	.....

WANNEMAKER DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the thirtieth day of June, 1886:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.4	2.7	0.8	7.7	1 2	14.8
0.1	0.5	0.5	3.7	0.9	9.28	1.3	17.0
0 2	1.2	0.6	4.9	1.0	11.0	1 4	19.4
0.3	1.9	0.7	6.2	1.1	12.8	1.5	22.0

Record of appropriations by the Wannemaker Ditch, as decreed by the court in the Second judicial district, and approved October 4, 1884:

	Appropriation priority—Number	Year	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	6	1860	8 00	8.00	0.82
First enlargement.....	52	1863	13.00	21.00	1.46

Water District No. 8.

Consists of all lands irrigated from ditches taking water from Cherry Creek, Plum Creek and Platte River, and their tributaries, except Bear Creek above District No. 2, and below the forks of the North and South branches of the South Platte River.

Water Commissioner, JOHN B. MYERS.

Appointed May 9, 1885. Postoffice address, *Littleton*

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 8.

LITTLETON, COLO., December 20, 1886.

E. S. NETTLETON,

State Engineer,

Denver, Colorado:

DEAR SIR:

Your letter of October 11, requesting certain information regarding my course as Water Commissioner, has been received, and in reply I beg leave to report as follows:

For the year 1885, I was only employed two days, under a call made June 17, from Plum Creek, to divide the water. On examination of affairs, I found nine ditches interested. Having established their rights under the priority they possessed, there was no further call for action.

During the year 1886, I was employed for sixteen days, at various times during the irrigation season. The first call was on June 2, coming from Cherry Creek. The second

call was June 23, coming from Indian Creek and its tributaries. The third call was July 5, from Plum Creek. In all these cases I examined into the matter, and regulated the supply of each ditch according to its priority of right.

On July 15, there was a general demand from some ditches lying below Platte cañon for an equitable distribution of the water. These ditches were the Last Chance, Platte Cañon, Nevada and Riley. After dividing the water according to priority, I still found trouble arising from some canals appropriating more than I had accorded them, and I was compelled to appoint assistants to watch the head-gates of the Last Chance and the Riley ditches, and see that they were not disturbed. One man was employed two days on the first and another six days on the last named canal, for this purpose.

In my opinion, the water is all appropriated from the streams in my district, as far as applies to the irrigating season; but there is a large quantity which could be held by storage reservoirs, and there are many favorable locations where such reservoirs could be constructed to advantage.

I find that there is a tendency among the farmers of my district to set underground flumes in the different dry sand creeks late in the season, through which they obtain a large supply of water. It has occurred to me that there might be a question as to the legality of such action, as affecting prior rights.

There are but two ditches in my district that possess measuring flumes. They are the High Line and the Nevada. It think it very important that such flumes should be in every ditch, and some provision should be made by Legislature to compel ditch owners to construct them. In the event of their not doing so within a period of time, to be fixed, the Water Commissioner should have the power to enforce their construction. He should also be clothed with

the power to arrest any person found disturbing measuring flumes or head-gates, or interfering in any way in the discharge of his duties.

I believe it would be a good plan to have a measuring weir in the South Platte river. It would greatly simplify the work of distributing the volume of water flowing in the stream and be the means of satisfying everyone interested that all rights are being respected in the matter of distribution.

I am of the opinion that, in the matter of the law as it now stands in regard to the time the Commissioners are employed, it should rest with the county commissioners, and be regulated according to the necessities which may arise.

Early in June, there was a complaint for water from the district below mine, and I was requested to divide the water between my own district, in which I was using all I had flowing, and had none to spare, with Water District No. 2. On applying to you for instructions as to my duty, you will remember that, after you had consulted the legal adviser of the State, you declined to advise in the matter, on the ground that you had, under the law, no authority to act. Under these circumstances, I felt that it was my duty to act only so far as my own district was concerned, and declined to deprive the canals under my charge of what they had prior claims upon. It seems to me that this is a subject upon which legislation is imperatively demanded, and that there should be some board of control created, with power to regulate all questions arising out of the variable flow of water in our streams, whether in seasons of drouth or at times when the regular supply is low, late in the season.

Yours, respectfully,

JOHN B. MYERS,

Commissioner District No. 8.

AN ABSTRACT FROM PAPERS RELATING TO THE PRIORITY AND APPROPRIATIONS

Of Ditches and Canals, filed in the County Clerk's office of Douglas county.

NAME OF DITCH.	NAME OF OWNER.	Name of stream from which the ditch takes its water	Width on bottom, middle or top, feet.	Depth in feet and inches.	Grade per mile	Length in miles	Capacity in cubic feet or in statute inches per second.	DATE OF FILING.			DATE OF APPROPRIATION		
								Day.	M'nth	Year	Day.	M'nth	Year
Gregg	W. H. Wallace...	Cherry creek..	4 ... 6	1.3	.....	About 3	14 feet	7	Mch	1885	27	Feb	1885
Wallace	W. H. Wallace...	Cherry creek..	4 ... 6	1.3	.....	About 1½	9.75 feet	7	Mch	1885	25	Feb	1885
Parker	G. A. Lord	Cherry creek..	3 ... 4	1 0	5 2-10 feet	2¾	3 feet	9	Mch	1885	1	Jan	1885
John Kinner No. 2	John Kinner	West Plum c'k	2 ... 3	1 0	⅛ in to rod	1	3.52 feet	23	Apr	1885	15	Apr	1883
Sellars' Gulch.....	W. Seidendicker.. J. Seidendicker...	Sellars' creek	... 2 ...	1.0	½ in to rod	About 2	2½ feet	15	June	1885	24	Mch	1885
Ratcliff & Dillon..	Ratcliff & Dillon	Spring creek...	... 3 ...	1 0	¼ in to rod	About 1¼	.....	1	Aug	1885	....	Mch	1883
Glen Gr've Feeder	J. Cantrill ..... B. Quick.....	W. Plum cr'k	3 ... 4	1.6	¼ in. to rod	About 1⅛	7 feet	9	Dec	1885	10	Sept	1885
Keystone	P. F. Legere..... A. S. Babcock..... W. V. Marey.....	Plum creek...	4 ... 6	2.6	.....	About 2	25 feet	8	Apr	1886	.....	.....	1863
Latham	Alex. Latham.....	Marcy gulch...	2½	1 0	10 in mile	60 rods	3 feet	29	May	1886	27	May	1886
Legere	P. F. Legere	Marcy gulch...	... 3 ...	1 6	.....	About 1	17 feet	1	June	1886	30	May	1886

Barnes & Allison	Wm. Barnes..... F. H. Allison.....	Cherry creek	... 3 ...	1.0	1/8 in. to rod	About 3	4½ feet	1	June	1886	20	Oct.	1884
Big Bayou.....	W. H. Price..... J. S. Perky ..... C. B. Whitford...	Big Bayou crk	3 ... 4	1.3	.....	About 1½	7 feet	3	June	1886	1	June	1886
Rowley.....	W. Rowley.....	Cherry creek...	... 3 ...	1.0	.....	About 2	4 feet	19	June	1886	25	Mch	1886
Parker No. 2.....	J. S. Parker, ...	Cherry creek...	3 ... 4	1.0	5 1/5 ft mile	About 2¾	3 feet	2	July	1886	15	June	1884
Mat Seigenfuhr.....	M. Seigenfuhr.....	Cherry creek ...	2½... 3½	1.0	¼ in. to rod	About ¾	6 feet	20	July	1886	22	May	1886
Extension of Dakan Ditch.....	G. Ratcliff ..... W. Dillon.....	Dry crk tributary W. P. crk	... 3 ...	1.0	¼ in. to rod	About ½	5 feet	1	Aug.	1885	...	Mch	1884

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk of Arapahoe county, since October 1, 1884:

NAME OF DITCH OR CANAL.	NAME OF OWNERS.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet	Grade per mile, in feet	Length, in miles	Capacity, in cubic feet, per second.	DATE OF FILING.		
			Bottom, in feet.	Top, in feet.					Day	Month.	Year
Republican Ditch	Republican Cattle Co.	Republican River	3.5		1 5		1.15	20.	1	April	1885
Dry Creek Ditch	Joseph M. Brown	Big Dry Creek	3.		1.5			16.	16	Nov.	1885
Lula A. Talcott's Irrigating Ditch	Lula A. Talcott	Little Dry Creek	2.5		1.			2.64	2	Dec.	1885
Burlingt'n Ditch, Reserv'r & Land Co	Burlington Ditch, Res'v'r & Land Co	Platte River	30.	37	3.5			450.	30	Nov.	1885
First Chance Ditch	Samuel W. Brown	Big Dry Creek	4.		4.		2.75	20.	15	Dec.	1885
J. D. Brown Ditch	S. W. Brown and Joseph D. Brown	Big Dry Creek	3.		2.		0.50	12.	15	Dec.	1885
Berry Gulch Ditch	S. W. Brown and Joseph D. Brown	Berry Gulch Creek	3.		3.		1.	16.	15	Dec.	1885
Spring Creek Ditch	Jacob C. Jones	Spring Creek	2 5	3 5	1.	5.	0 50	6.	18	Dec.	1885
Ireland Ditch	Republican Cattle Co.	Republican River	8.	12	1.5			56.86	24	Dec.	1885
Scherrer Ditch	Republican Cattle Co.	S.F'k Republic'n River	4.	8.	1.5			34.40	24	Dec.	1885
Rosenkrans Ditch	Rosenkrans	Dry Willow Creek	2.	8.	1.5			17.20	13	Jan.	1886
C. G. Richardson Ditch No. 1, and four Reservoirs	Cyrus G. Richardson	Coal Creek	6.	10.	3.			90.	19	Jan	1886
C. G. Richardson Ditches, Nos. 2 to 12; Reservoirs, 5 to 11	Cyrus G. Richardson	North Fork Greenwood Creek, Ditch No. 2	4.		1.5			16.	28	Jan	1886

Ditch No. 3	Cyrus G. Richardson	N. F. Greenwood Creek	4.	...	1 5	...	...	16.	28	Jan	1886
Ditch No. 4	Cyrus G. Richardson	N. F. Greenwood Creek	3.	...	1.	...	...	9.	28	Jan	1886
Ditch No. 5	Cyrus G. Richardson	N. F. Greenwood Creek	3.	...	1.	...	...	9.	28	Jan	1886
Ditch No. 6	Cyrus G. Richardson	N. F. Greenwood Creek	2.	...	1.	...	...	5.	28	Jan	1886
Ditch No. 7	Cyrus G. Richardson	N. F. Greenwood Creek	2.	...	1.	...	...	5.	28	Jan	1886
Ditch No. 8	Cyrus G. Richardson	Res. on Greenwood Cr.	4.	...	1.5	...	...	16.	28	Jan	1886
Ditch No. 9	Cyrus G. Richardson	Res. on Greenwood Cr.	4.	...	1.5	...	...	16.	28	Jan	1886
Ditch No 10	Cyrus G. Richardson	Res. on Greenwood Cr.	4.	...	1.5	...	...	16.	28	Jan	1886
Ditch No. 11	Cyrus G. Richardson	Res. on Greenwood Cr.	3.	...	1.5	...	...	12.	28	Jan	1886
Ditch No. 12	Cyrus G. Richardson	Res on Greenwood Cr.	3.	...	1.5	...	...	12.	28	Jan	1886
Burlington Ditch	Burlington Ditch, Res. & Land Co	Platte River	30.	36.	3.	...	...	520.	28	Jan	1886
Lateral Ditch, Agricultural Ditch Co	Agricultural Ditch Co	Clear Creek	4.	5.	1.5	25.	...	38.	16	Feb	1886
C. G. Richardson Ditch, No. 13	C. G. Richardson	Toll Gate Creek	8.	12.	4.	...	...	100.	25	Feb	1886
Cactus Hill Ditch	Cactus Hill Ditch & Reservoir Co	Sec'd Crk Long Branch	6.	...	2.	...	...	7.88	5	Mch	1886
Little's Gulch Ditch	Richard S. Little	Little's Gulch	2.	4.	1.	5	1.	4.	5	Mch	1886
Little's Farm Ditch	Richard S Little		2.	4.	1.	5.	1.25	4.	5	Mch	1886
The German Ditch and Reservoir	H. Hoting & Co	Big Dry Creek	5.	...	1.25	...	...	85.	15	Mch	1886
Lee Gulch Ditch	Henry R. Curtis	Lee Gulch	3	...	0.67	...	...	6.60	31	Mch	1886
Keystone Ditch	Peter F. Legere	Plum Creek	4	6.	2.5	...	...	25.	8	Apr	1886
Beeson Ditch, No. 1	Richard Beeson		3.	...	1.5	...	...	5.	21	Apr	1886
Beeson Ditch, No. 2	Richard Beeson	‡									
H Jones' Ditch	Hugh Jones	Greenwood Creek	4.	...	2.5	...	...	26.43	24	Apr	1886

DITCH AND CANAL APPROPRIATIONS—CONCLUDED.

NAME OF DITCH OR CANAL.	NAME OF OWNERS.	STREAMS FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade, per mile, in feet.	Length, in miles.	Capacity, in cubic feet, per second.	DATE OF FILING.		
			Bottom, in feet	Top, in feet.					Day.	Month.	Year.
Welsh Ditch	George S. Welsh	Cherry Creek	2.5	...	1 7	3.3	....	14.28	29	April	1886
Tucks' Extension Ditch Co	Alfred Tuck	Far. H. L., Clear Creek	.....	...	...	...	.....	.....	1	May	1886
Farmer' Mutual Ditch Co	Patrick Rowe, et al	Far. H. L., Clear Creek	3.3	...	1 7	...	....	*550.	4	May	1886
Linhart Ditch Co	Eliza Linhart	Dod Clark Gulch	3.	5.	1.	5.	1.25	3.	8	May	1886
Cherry Creek Ditch Co	William R. Campbell	Cherry Creek	20.	28.	2.	.....	.....	44.	12	May	1886
Underhill Ditch Co	Eugenie P. Underhill	Lake in Sec 6, T. 3, R. 68	3.	...	1.5	...	.....	1.	18	May	1886
Kiowa Ditch Co	W. J. Asken	Kiowa Creek	3.	4.	1.	...	.....	13.21	14	May	1886
Dumme Ditch Co	Samuel C. Dumme	Kiowa Creek	.....	...	...	.....	....	15.	19	May	1886
Roeschlaub Irrigating Ditches	H. F. Roeschlaub	Sand Creek	2.	4.	1.	...	.....	10.53	28	May	1886
J. H. Payne's Ditch, No. 1	James H. Payne	Little Dry Creek	4.	6.	2.	.....	.....	27.	29	May	1886
Legere Ditch	Peter F. Legere	Mavey Gulch	3.	...	1.5	.....	.....	17.	1	June	1886
Gibson Ditch	John W. Gibson	Kiowa Creek	2.	...	0 8	.....	...	1.	7	July	1886
Linhart Ditch, No. 2	Eliza Linhart	Dod Clark Gulch	1.5	3.5	1.	.....	0.50	2.	10	July	1886

Campbell Ditch	William L. Campbell	Cherry Creek	25.	...	6.	..	...	300.	16	July	1886
Lee Gulch	Eliza Linhart	Lee Gulch	2.5	...	1.	10.	...	3.	24	July	1886
Cann Wright and Granger Dit ch.		Terrapin Creek	6.	12	3.	..	...	150.	...	.....	....

* Probably means inches. ‡ Continuation of Ditch No. 1.

THE NORTHERN COLORADO IRRIGATING CO.'S CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made on the third and fourth days of August, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.9	27.5	1.8	120.5	2.7	254.8
0.1	1.0	1.0	34.0	1.9	133.5	2.8	271.8
0.2	2.1	1.1	41.6	2.0	147.3	2.9	290.5
0.3	4.0	1.2	50.2	2.1	160.5	3.0	310.2
0.4	6.4	1.3	61.0	2.2	174.2	3.1	330.2
0.5	9.4	1.4	71.6	2.3	188.8	3.2	350.4
0.6	12.8	1.5	82.5	2.4	203.3	3.3	375.0
0.7	17.0	1.6	94.6	2.5	219.4	3.4	403.0
0.8	21.8	1.7	107.5	2.6	235.5	...	.....

NOTE.—Gauging made in first standard flume below the head-gate.

Record of appropriations by the Northern Colorado Irrigation Company's Canal, as decreed by the court in the Fourth judicial district, and approved.

	Appropriation priority Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	111	1879	1,184.00	1,184.00	.....

PLATTE CANON CANAL.

Table giving the discharge through the measuring flume, as computed from gaugings made on the fifth day of August, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0.0	0.6	6.6	1.2	21.0	1.8	36.8
0.1	0.6	0.7	8.7	1.3	23.4	1.9	40.2
0.2	1.3	0.8	11.0	1.4	25.9	2.0	44.4
0.3	2.2	0.9	13.6	1.5	28.5	2.1	49.4
0.4	3.4	1.0	16.0	1.6	31.0	2.2	56.9
0.5	4.9	1.1	18.5	1.7	33.8	.....	.....

Record of appropriations by the Platte Cañon Canal, as decreed by the court in the Fourth judicial district, and approved.

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second	Depth of water in measuring flume to give corresponding quantity.
Original construction	5	1861	4.70	4.70	0.49
First enlargement	14	1863	34.00	38.70	1.86
Second enlargement	18	1864	17.30	56.00	2.20

This district includes, among other streams, that portion of the South Platte River lying between the city of Denver and the mouth of the north branch.

It is altogether probable that another district will be formed above this one, as there are a few ditches already in operation and others intended, which will take water from

the South Platte or its tributaries. There will then be no less than four separate and distinct water districts on this river.

Under existing laws, each district is as independent of the others as though it were an entirely separate stream; and the court decrees in each district establish the prior rights and amount of appropriation for that district without any reference to the claims or rights of others. Hence the possibility of a conflict between prior right owners and between Water Districts, as was the case in the summer of 1886, when there was not water enough to supply all the canals.

The Commissioner of this district was called out to divide the waters of the South Platte River, in July, 1886, because the whole stream was not sufficient to supply the demand made upon it by the canals in District No. 8, leaving practically no water for District No. 2, lying below, which contained some of the oldest canals in the State, antedating in some cases those in District No. 8 by twenty years or more.

From the fifth of July to the eighteenth, there was very little water in the South Platte at Denver. At one time only 35 cubic feet per second flowed into District No. 2. On the fifteenth of July a delegation of farmers from this district came up to the capital to confer with the Governor, State Engineer and Water Commissioner of District No. 8, in relation to dividing the water supply between the two districts. It was found that there was nothing in the irrigation law permitting such division, and that the only remedy was to suspend the decrees of the courts regarding priority of use of water for irrigation, and declare the water of the stream subject only to domestic use. On the sixteenth the Governor made such declaration, and directed the State Engineer to close down all canals and ditches in District No. 8 for this purpose.

Shortly afterward, by reason of frequent rains having fallen, succeeded by a rise in the river, the Governor, on the twenty-first of the same month, rescinded the order restricting the water for domestic uses only. But, had this condition of affairs occurred two weeks earlier, the loss of crops would have been very great, showing the necessity for legislation to regulate matters when such contingencies arise. It may not always happen at such an opportune time—at the close of summer irrigation.

Water District No. 9.

Consists of all lands irrigated from ditches taking water from Bear Creek and its tributaries.

Water Commissioner, FRANK EWERS.

Appointed June 16, 1886. P. O. address, *Morrison*.

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 9.

LITTLETON, COLO., January 31, 1886.

E. S. NETTLETON, ESQ.,

State Engineer,

Denver, Colorado:

DEAR SIR:

I have the honor to submit the following report for the year 1885:

I was appointed as Water Commissioner for District No. 9, April 13, 1885. I qualified on the twentieth, and immediately entered on my duties. I was called to regulate the

water supply of Turkey Creek, where I found reservoir owners in possession of all the waters of the creek.

On the twenty-second of April we had a heavy snow storm which gave such a large quantity of water as to supply all hands until the middle of June.

From the seventeenth of June until the thirteenth of August, I was employed on Turkey Creek alone. From the thirteenth of August until the end of the season, my work was confined to Bear Creek. I was employed regulating water this season eighteen days. Owing to the heavy snow storm in April, the water supply of Bear Creek was larger and more uniform than has been known for a great number of years. I am glad to state that the owners of ditches, as a general thing, abide by the rulings of the Commissioner.

I wish to call your attention to the unsatisfactory condition of the ditches in this district. But few of them have been rated, and as no two ditches have the same grade, it is necessary that they should be rated as soon as possible, so as to establish a uniform system of measurements. With many thanks for your kindness and assistance in solving difficult points, I remain,

Your obedient servant,

C. H. MONTGOMERY,

Water Commissioner, District No. 9.

REPORT OF WATER COMMISSIONER OF DISTRICT NO. 9.

No. 2.

BEAR CREEK, COLO., NOV. 12, 1886.

E. S. NETTLETON, ESQ.,

State Engineer,

Denver, Colo:

DEAR SIR:

In accordance with your request I hereby tender you my official report as Water Commissioner of District No. 9.

Date of first and second call for water occurred the thirtieth and thirty-first of May, 1886, complaint coming from Turkey Creek in both instances. On examination I found the stage of water rather low for the time of year. Water was appropriated by the Morgan and French canal. I closed their gates and supplied prior appropriations.

The actual time I have been employed to date is forty and a half days. No assistant was required.

It was necessary to frequently adjust gates, partly on account of dishonesty of a few people, the greater portion of labor being performed during June, July and August.

There are only three regular measuring flumes in the district, and only a portion of ditches have head-gates. I consider all ditches should have measuring flumes and have them rated. I think it would assist materially in dividing water to have the main stream rated.

There is not near enough water in both creeks to supply canals already on the stream.

In my judgment the law is unjust in allowing the first ditches taken out the privilege of claiming more water than they ever appropriated, holding for their own land

a sufficient amount of water, and having as much more to sell to other parties, to be conveyed in a higher line of ditch, and by appropriating it on new land, thereby depriving older rights of their just due.

Respectfully,

FRANK EWERS,

Water Commissioner, District No. 9.

Bear and Turkey Creeks, which furnish water for this district, reach their maximum flow much earlier in the irrigating season than streams heading in higher altitudes, and thus having the benefit of the later melting of the snow in the higher mountains. To preserve the water which generally runs away in early spring, a number of reservoirs have been constructed in this district, which are filled in the order of their priority. The Water Commissioner is generally called out before the irrigating season begins, to divide this water between reservoir claimants.

The season of 1886 was characterized by a much smaller flow of water in the two creeks than usual; all of the reservoirs were not filled, and some loss of crop occurred on this account.

A larger area of land is irrigated in this district, in proportion to annual flow of water in the streams, than in any in the State. This fact is due to its system of reservoirs.

THE ROBERT LEWIS DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the first day of July, 1885:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0.5	2.2	1.0	7.3	1.5	14.0
0.1	.....	0.6	3.1	1.1	8.5	1.6	15.6
0.2	0.2	0.7	4.1	1.2	9.7	1.7	17.3
0.3	0.65	0.8	5.1	1.3	11.1	.....	.....
0.4	1.4	0.9	6.1	1.4	12.4	.....	.....

NOTE.—Ditch gauged to a depth of one foot. Discharges from greater depths are only approximately correct.

Record of appropriations by the Robert Lewis Ditch, as decreed by the court in the Second judicial district, and approved February 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	21	1868	17.00	17.00	1.68

THE HODGSON DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the nineteenth day of June, 1884:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and inches	Discharge in cubic feet per second.	Depth in feet and inches	Discharge in cubic feet per second.
0.0	0.0	0.5	1.5	1.0	5.0	1.5	10.1
0.1	0.1	0.6	2.0	1.1	5.9	1.52	10.32
0.2	0.3	0.7	2.7	1.2	6.9	.....	.....
0.3	0.7	0.8	3.4	1.3	7.9	.....	.....
0.4	1.1	0.9	4.2	1.4	9.0	.....	.....

NOTE.—Discharges must be regarded as only approximately correct until another gauging is made.

Record of appropriations by the Hodgson Ditch, as decreed by the court in the Second judicial district, and approved February 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	3	1861	8.25	8.25	1.33
First enlargement.....	9	1862	2.07	10.32	1.52

WARRIOR DITCH.

Giving the discharge through the measuring flume, as as compnted from gaugings made on the nineteenth day of June, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0 0	.....	0 5	3.20	1.0	12.80	1.5	28.40
0.1	0.22	0.6	4.55	1.1	15.51	1 6	31.90
0.2	0.53	0 7	6.35	1.2	18.55	1.7	35.40
0.3	1.20	0.8	8.40	1.3	21.75	1.8	39.00
0 4	2.05	0.9	10.45	1.4	25.05	1.9	42.70

Record of appropriation by the Warrior Ditch, as decreed by the court in the Second judicial district, and approved February 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction .... Arnette & Lewis branch.....	4	1861	12.33	12.33	0.98
First enlargement .... Turkey Creek appropriation	8	1862	2.86	15.19	1.09
Second enlargement..... ..... Fairbank, Horner & Rist branch	14	1864	25.47	40.66	1.86
Construction of Barnes' branch	16	1865	11.49	49.29	.....

THE PIONEER UNION DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twentieth day of June, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	0 0	0.5	8.4	1 0	20.7	1.5	38 5
0.1	1 4	0 6	10.5	1.1	24,0	1.6	42.7
0.2	3.0	0.7	12.8	1.2	27 3	1.7	47.0
0.3	4.7	0 8	15 4	1 3	30.8	1 8	51.4
0.4	6.5	0 9	18 0	1.4	35.6	1.9	55.67

NOTE.—These discharges must be regarded as only approximately correct, until another gauging can be made.

Record of appropriations by The Pioneer Union Ditch, as decreed in the Second judicial district, and approved February 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	5	1861	12.41	12.41	0.68
Hodgson & McPheeters' original construction of Pioneer Union	11	1862	18.13	30.54	1.29
First enlargement	15	1865	25.13	55.67	1.89

McBroom Ditch.

Table giving the discharge through the measuring flume, as computed from gaugings made on the twenty-seventh day of June, 1884:

Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths.	Discharge in cubic feet per second.
0.0	.....	0 5	0.1	1.0	2.0	1.5	8.5
0.1	.....	0.6	0.3	1.1	3.0	1.6	10.3
0.2	.....	0.7	0.5	1.2	4 1	1.66	11.58
0.3	.....	0.8	0.9	1.3	5.5	.....	.....
0 4	.....	0.9	1.4	1.4	6.9	.....	.....

NOTE.—There was four-tenths (0 4) of still water in the measuring flume, hence no discharge up to that depth. These quantities must be regarded as approximate.

Record of appropriations by the McBroom Ditch, as decreed by the court in the Second judicial district, and approved February 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction.....	1	1859	11 58	11.58	1.66

THE ARNETT DITCH.

Table giving the discharge through the measuring flume, as computed from gaugings made on the thirtieth day of June, 1885:

Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.	Depth in feet and tenths	Discharge in cubic feet per second.
0.0	Still water	0.8	.....	1.6	16.1	.....	.....
0.1		0.9	.....	1.7	19.5	.....	.....
0.2		1.0	.....	1.8	23.0	.....	.....
0.3		1.1	1.4	1.9	26.8	.....	.....
0.4		1.2	3.3	2.0	31.0	.....	.....
0.5		1.3	5.9	2.1	35.9	.....	.....
0.6		1.4	9.3	2.2	41.0	.....	.....
0.7		1.5	12.9	2.3	46.1	.....	.....

NOTE.—Ditch measured in a flume about one-half mile below the head-gate. Owing to sand accumulating in the ditch at the end of the flume there was nearly one foot of dead water at the point where the gauging was made. This is liable to change and materially affect the correctness of the gauging. Ditch should have a proper measuring flume.

Record of appropriations by the Arnett Ditch, as decreed by the court in the First judicial district, and approved February 4, 1884:

	Appropriation priority—Number.	Year.	No. of cubic feet per second in each appropriation.	Total appropriation in cubic feet per second.	Depth of water in measuring flume to give corresponding quantity.
Original construction	23	1869	7.94	7.94	2.36
First enlargement.....	25	1871	25.54	33.48	3.06
Second enlargement.....	30	1882	12.87	46.35	3.32

Water District No. 10.

Consists of all canals irrigated from ditches taking water from the Fountain and its tributaries; *Provided*, That said district shall not extend beyond the limits of El Paso county.

Water Commissioner, H. I. REED.

Appointed April 9, 1885. P. O. address, *Colorado Springs*.

No report.

Water District No. 11.

Consists of all lands irrigated from ditches or canals taking water from that part of the Arkansas River lying in Chaffee county; also, all lands irrigated from ditches and canals taking water from the tributaries to the said portion of the Arkansas River.

Water Commissioner, _____

Appointed_____ P. O. address, _____

No report.

Water District No. 12.

Consists of all lands irrigated from ditches or canals taking water from that part of the Arkansas River lying in Fremont county; also, all lands irrigated from ditches or canals taking water from the tributaries of said portion of the Arkansas River, except Grape Creek and its tributaries.

Water Commissioner, _____

No report.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk in Fremont county:

NAME OF DITCH OR CANAL	NAME OF OWNERS	STREAM FROM WHICH WATER IS TAKEN	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet.	Length, in miles	Capacity in cubic feet per second.	Date of Appropriati'n		
			Bottom, in feet	Top, in feet.					Day	Month	Year.
Lester & Attebery Ditch	J. W. Lester and B. F. Attebery.	Arkansas River	3 0	.....	2.0	...	...	....		Spring of	1875
Hamilton and Getchell Ditch	.....	Arkansas River	.....	.....	.....	..	...	(200 in)	12	Feb.	1882
Silvernail Ditch	C. P. Silvernail	Texas Creek	2.0	.....	1.5	...	300 ft	2.5	6	Jan.	1882
Eldorado Ditch	A. J. Ashler	Currant Creek	2.0	2.5	1.5	26. 7	0 75	5.78	6	Jan.	1882
Eldorado Ditch, No. 2	A J Ashler	Currant Creek	2.0	2.5	1.5	26 7	0. 19	5.77	1	Jan.	1885
Arthur Ditch	John Arthur	Oak Creek	2.0	2.5	1.0	...	1.0	.....	26	May	1885
The Blair Ditch	Thomas Blair	Newland Creek	1.5	.....	1.0	...	...	7.82	8	July	1885
Brown Ditch	F. M. Brown	Beaver Creek	10 00	18.0	4.0	10. 5	...	303 86	17	July	1885
The Peggy Ditch	John F. Sullivan	Beaver Creek	4.0	.....	1.5	...	...	10.00	24	July	1885
Tallahassie Ditch	J. O. Brandish	Tallahassie Creek	1 25	.....	1.25	...	...	3 5	...	.....	1871
The Third Ditch	J. O. Brandish	Currant Creek	2.0	....	1.0	...	...	4.0	1	April	1875
The Pioneer Ditch	J. O. Brandish	Currant Creek	1.25	.....	0.9	...	...	3.75	...	.....	1861
The Connelly Ditch	J. C Palmer	Beaver Creek	3.0	3.0	1.0	24. 0	1.3	4.96	8	Dec.	1885
The Batliff Ditch	J. C. Palmer	Beaver Creek	2.5	3.0	1.0	13. 6	0.5	4.16	8	Dec.	1885
Toof Ditch No. 1.	G. H. and J. A. Toof	Beaver Creek	3.0	4.0	1.0	80. 0	0.8	4.13	8	Dec.	1885

Burdick Ditch	G. H. and J. A. Toof	Beaver Creek	3 0	3.5	1.0	80. 0	..	4.13	8	Dec...	1885
Banta & Meritt Ditch	T. E Meritt & W. A. & C. W. Banta	Beaver Creek	3.5	.....	1.5	36. 0	..	9.6	31	Dec...	1885
The Park Ditch	S. J. Murlock and J. W. Gribble	Beaver Creek	2.0	.....	1.0	12. 0	...	10.5	25	Nov...	1882
The Kelley Ditch	L. T. Kelley	Beaver Creek	2.0	2.5	1.5	12. 0	0.5	5.2	30	Dec...	1885
The Alkali Ditch	Ira A. Potter	Spring Creek	1 0	1.5	1.0	...	...	.....	17	June ..	1884
The Island Ditch	L. S. Perry	Beaver Creek	1.5	.....	1.3	...	...	37.52	...	April..	1885
Patton Ditch, No. 1	Thomas Patton	Beaver Creek	3.0	4.0	0.8	20. 8	0.8	4.99	26	Dec...	1886
Patton Ditch, No. 2	Thomas Patton	Beaver Creek	2.0	3.0	1.0	12. 0	0 4	3.75	26	Dec...	1886
Patton Ditch, No. 3	Thomas Patton	Beaver Creek	2.0	3.0	.....	16. 0	0 4	4.10	26	Dec...	1886
Roberts Ditch	J. L. Roberts	Oak Creek	1 3	.....	1 8	...	...	1.90	11	June ..	1885
Gate City Ditch	Gate City Land & Water Supply Co.	Beaver Creek	.....	.....	.....	...	...	.....	14	Aug...	1885
Danforth Ditch	A. H. Danforth	Arkansas River	.....	.....	.....	...	...	115.74	8	May...	1884
Reliable Ditch	A. Milner	Hardscrabble Creek	1.5	.....	.....	...	...	0.16	15	Nov...	1883
.....	Denver & Rio Grande R'y Co.	Sand Creek	.....	.....	.....	...	...	0.26	20	May ..	1884
Orange White Ditch	O. White	Arkansas River	3.0	.....	1.0	...	..	.....	9	Aug...	1883
Ross Carp Ditch	Ross Carp	Springs	.....	.....	.....	...	...	0.16	10	Sept...	1883
Fancher Ditch	J. M. Fancher	Beaver Creek	1.5	.....	1.0	13. 3	...	3.24	10	Mch...	1886
East Hughes Ditch	H. Hughes	Beaver Creek	1.5	.....	1.0	13. 3	0. 45	3.24	...	May ..	1882
John S. Logan Ditch	J. S. Logan	.....	3-inch	pipe.	.....	...	1. 48	1.00	17	June ..	1886
Fremont Water Supply Co.'s Ditch	Fremont Water Supply Co	Beaver Creek	10.00	.....	..	10.50	...	500 00	14	Jan ...	1886

NOTE.—Some of the largest and oldest ditches in the county are owned by incorporated companies, who have never filed any papers, except articles of incorporation Under this head are the South Cañon, Cañon City and Four Mile, and Cañon City and Oil Creek Ditches.

Water District No. 13.

Consists of all lands irrigated from ditches or canals taking water from Grape Creek or its tributaries.

Water Commissioner, _____

No report.

Water District No. 14.

Consists of all lands irrigated from ditches or canals taking water from the Arkansas River in Pueblo county; also, all lands irrigated by ditches or canals, taking water from the tributaries of said Arkansas River, in said county, the St. Charles and its tributaries, and the Huerfano and its tributaries.

Water Commissioner, _____

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk in Pueblo, Pueblo county, since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNERS.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet.	Length, in miles.	Capacity, in cubic feet, per second	Date of Appropriat'n		
			Bottom, in feet.	Top, in feet.					Day.	Month	Year.
Pueblo Land and Canal Company. Irrigating canal of	Pueblo Land and Canal Co.	Arkansas River	100.	.....	7.	.....	...	2500.	25	Jan	1885
Fountain Canal	Henry R. Holbrook	Fountain Creek	20.	.....	4.	...	...	384.	25	June	1885
Field Ditch	J. N. and L. F. Carlisle, S. W. Aldred, T. W. Lottridge	Huerfano River	* 6.	.....	2.	.....	..	21	18	Aug	1885
Turkey Creek Ditch and Reservoir System	Teller, Fullerton & Orahood	Turkey Creek	6.	.....	3.	.....	...	100.	15	Oct	1885
Excelsior Ditch	G. M. Chilcott, *et al*	Arkansas River	9	.....	5.	2.	...	240.	15	Dec	1861
Rosalie Ditch and Reservoir	P. T. Dotson	St. Charles River	.....	.....		...	...	.....	3	June	1886
Hobson Ditch	Charles J. Hobson	Arkansas River	† 6.	.....	2.5	...	...	48.	...	March	1871
Allen Ditch	Wm. R. Allen	Arkansas River	6	...	...	.....	.	40	19	April	1886

* Enlarged and extended † Enlarged.

GAUGING ARKANSAS RIVER.

An attempt has been made to measure the flow of water in the Arkansas River during the irrigating season. The most favorable point to be chosen, where the shape of the channel of the river and the current of the stream would give the best results, was the first thing to be established. Two favorable locations were found between Cañon City and Pueblo; but owing to their being so far from where any resident assistants could be obtained, it was decided to make a trial at a point less favorable, but more convenient; and a temporary gauging station was established at the crossing of the river by the Sixth street bridge in Pueblo. Here the river, in ordinary stages of water, passes between the abutments of the bridge, which are 113 feet in the clear. One of the State registering machines was placed at one end of the bridge to record the height and hourly change of the river. Measurements and soundings were made to obtain a correct profile of the bottom of the river. Velocity measurements were made of the currents at differing stages of the water by the use of the current meter and surface floats.

Upon taking soundings at different times, it was found that the bed of the river was changing, so much that the area of the water way was increased or diminished by the scouring of the bottom during high water and its refilling as the water receded. This, of course, introduced an element of uncertainty into the work which is difficult to eliminate; and to institute accurate methods for obtaining the exact velocity of the current or precise depth of water in view of the uncertainty of the sectional area, seemed to be a waste of time. Still, the results as given in the tables which follow, are, I believe, quite close approximations, and will be found to answer the purpose for which it was intended.

The record for 1885 is incomplete, the work of registering having been checked by an accident to the registering apparatus, caused by a sudden, and exceedingly high rise of water in the river on the twenty-third of June.

TABLE SHOWING THE HEIGHT AND DISCHARGE

Of the Arkansas River, at gauging station No. 2, for part of the year 1885, and the season of 1886, as computed from the records of the automanic registering machine, in operation during the irrigating season.

DATE.	Daily mean heights		Daily rate, cubic feet per second.	
	1885.	1886.	1885.	1886.
May 3	.....	2.18	.....	1,255.0
4	.....	2.30	.....	1,358.0
5	.....	2.44	.....	1,481.8
6	.....	2.50	.....	1,540.0
7	.....	2.62	.....	1,649.6
8	.....	2.79	.....	1,819.8
9	.....	2.89	.....	1,924.5
10	.....	2.92	.....	1,956.6
11	.....	2.92	.....	1,956.6
12	.....	2.90	.....	1,935.0
13	.....	2.91	.....	1,945.8
14	.....	2.89	.....	1,924.5
15	.....	2.54	.....	1,576.0
16	1.76	2.36	946.2	1,409.0
17	2.20	2.30	1,270.0	1,358.0
18	2.06	2.42	1,172.0	1,462.4
19	2.04	2.74	1,146.0	1,768.8
20	2.03	3.17	1,139.0	2,287.5
21	2.00	3.63	1,120.0	2,827.0
22	1.86	4.12	1,015.3	3,523.0
23	1.82	4.60	985.5	4,330.0
24	1.70	4.98	910.0	5,023.0
25	1.71	5.40	916.0	5,790.0
26	1.78	5.82	958.0	6,654.0
27	1.91	6.06	1,052.5	7,190.0
28	1.97	6.17	1,097.5	7,437.5
29	1.95	6.27	1,082.5	7,659.0
30	2.00	6.01	1,120.0	7,077.5
31	2.08	5.68	1,172.0	6,346.0

Monthly mean height for 1885, 1.93.
Monthly mean height for 1886, 3.67.
Monthly mean rate of discharge, cubic feet per second for 1885, 1,068.9.
Monthly mean rate of discharge, cubic feet per second for 1886, 3,045.6.

GAUGING STATION NO. 2—CONTINUED.

DATE.	Mean daily heights.		Daily rate, cubic feet per second.	
	1885.	1886.	1885.	1886.
June 1	2.62	5.53	1,649.6	6,044.0
2	3.01	5.96	2,053.7	6,965.0
3	3 55	5.67	2,720.0	6,324.0
4	4 18	5.74	3,622.0	6,478.0
5	4 71	5.57	4,529.0	6,116.0
6	3.85	5 42	3,122.5	5,830 0
7	4.15	5.35	3,572.5	5,695 0
8	3.65	5 45	2,855.0	5,890 0
9	3.32	5.49	2,417.0	5.970.0
10	3.15	5.54	2,212.5	6,062.0
11	3.27	5.61	2,355.5	6,192.0
12	3.65	5.62	2,855.0	6,214.0
13	4.17	5 70	3,605.5	6,390.0
14	3.94	5.72	3,250.0	6,434.0
15	3.96	5.45	3,280.0	5,890.0
16	3.78	5.17	3,029.0	5.357.8
17	3.66	4 83	2,869.0	4,752 5
18	3.90	4.61	3,190.0	4,348 0
19	4.01	4.50	3,355.0	4.160.0
20	4.21	4 44	3,672 0	4,058.0
21	4 48	*	4,126.0	*
22	4.70	.....	4.510.0	.....
23	4.66	.....	4,438.0	.....
24	.....	.....	.....	.....
25	.....	.....	.....	.....
26	.....	.....	.....	.....
27	.....	.....	.....	.....
28	.....	.....	.....	.....
29	.....	.....	.....	.....
30	.....	3.04	.....	2,085 9

*Not in working order.
Monthly mean height for 1885, 3 85
Monthly mean height for 1886, 5.62
Monthly mean rate of discharge, cubic feet per second, for 1885, 3,186 5.
Monthly mean rate of discharge, cubic feet per second, for 1886, 5,569 3.

GAUGING STATION NO. 2—CONTINUED.

DATE.	Daily mean heights.		Daily rate, cubic feet per second.	
	1885.	1886.	1885.	1886.
July 1	.....	2.94	.....	1,978 2
2	.....	2.81	.....	1,840 5
3	.....	2.66	.....	1,688.8
4	.....	2.71	.....	1,738.2
5	.....	2 76	.....	1,789.2
6	.....	2.78	.....	1,809.6
7	.....	2.82	.....	1,851.0
8	.....	2.74	.....	1,768.8
9	.....	2 58	.....	1,612.0
10	.....	2.41	.....	1,452.7
11	.....	2.39	.....	1,435.5
12	.....	2.28	.....	1,340.4
13	.....	2.33	.....	1,383 5
14	.....	2 28	.....	1,340.4
15	.....	2.23	.....	1,296.4
16	.....	2.21	.....	1,278.8
17	.....	2 31	.....	1,366.5
18	.....	2 33	.....	1,383.5
19	.....	2 94	.....	1,978 2
20	.....	2 90	.....	1,935 0
21	.....	3.82	.....	3,082.0
22	.....	3 61	.....	2,799.0
23	.....	3.12	.....	2,175.0
24	.....	2.91	.....	1,945.8
25	.....	2 77	.....	1,799.4
26	.....	2.67	.....	1,698.6
27	.....	2.60	.....	1,630.0
28	.....	2 54	.....	1,576.0
29	.....	2 50	.....	1,540.0
30	.....	2.44	.....	1,491.5
31	.....	2.41	.....	1,452.7

Monthly mean height for 1886, 2.67.
Monthly mean rate of discharge, cubic feet per second, for 1886, 1,724 4.

GAUGING STATION NO. 2—CONTINUED.

DATE.	Daily mean height.		Daily rate, cubic feet per second.	
	1885.	1886.	1885.	1886.
August 1	.....	2.37	.....	1,417.5
2	.....	2.30	.....	1,358.0
3	.....	2.29	.....	1,349.2
4	.....	2 28	.....	1,340 4
5	.....	2 28	.....	1,340.4
6	.....	2.25	.....	1,314 0
7	.....	2,22	.....	1,287.6
8	.....	2 15	.....	1,232.5
9	.....	3.33	.....	2,430.5
10	.....	2.24	.....	1,305.2
11	.....	2.13	.....	1,217.5
12	.....	2.06	.....	1,159 0
13	.....	4.36	.....	3,924.0
14	.....	3.01	.....	2,053.7
15	.....	2.51	.....	1,549.0
16	.....	2.27	.....	1,331.6
17	.....	2.24	.....	1,305.2
18	.....	2.59	.....	1,621.0
19	.....	2.57	.....	1,603.0
20	.....	2.49	.....	1,530.0
21	.....	2.43	.....	1,472.1
22	.....	2.39	.....	1,434.5
23	.....	2.34	.....	1,392 0
24	.....	2.27	.....	1,331.6
25	.....	2.21	.....	1,278 8
26	.....	2.17	.....	1,247.5
27	.....	2.15	.....	1.232.5
28	.....	2.14	.....	1,225.0
29	.....	2.12	.....	1,210.0
30	.....	2 12	.....	1,210.0
31	.....	2.13	.....	1,217.5

Monthly mean height for 1886, 2.40.
Monthly mean rate of discharge, cubic feet per second, for 1886, 1,481.3.

GAUGING STATION NO. 2—CONCLUDED.

DATE.	Daily mean height.		Daily rate, cubic feet per second.	
	1885.	1886.	1885.	1886.
Sept. 1	.....	2.11	.....	1,202.5
2	.....	2.11	.....	1,202.5
3	.....	2.12	.....	1,210.0
4	.....	2.15	.....	1,232.5
5	.....	2.15	.....	1,232.5
6	.....	2.10	.....	1,195.0
7	.....	2.90	.....	1,935.0
8	.....	2.70	.....	1,728.0
9	.....	2.48	.....	1,520.6
10	.....	2.35	.....	1,400.5
11	.....	2.24	.....	1,308.5
12	.....	2.23	.....	1,296.4

Monthly mean height for 1886, 2.30
Monthly mean rate of discharge, cubic feet per second, for 1886, 1,371.7.

Water District No. 15.

Consists of all lands irrigated from ditches, or canals, taking water from the St. Charles and its tributaries.

No report.

Water District No. 16.

Consists of all lands irrigated from ditches, and canals taking water from the Huerfano and its tributaries.

No report.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk of Huerfano county, since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet	Length in miles.	Capacity in cubic feet per second.	DATE OF APPRIATION.		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
Greaser Creek	Henry F. Drake	Greaser creek	.....	.....	...	.....	0.25	.....	1	Jan.	1882
Bradford and Swire	George Bradford *et al.*	Muddy creek	abo't3	.....	1.8	20.	...	.....	..	May	1871
Patton	J S. Patton	Pass creek	.....	.....	...	.....	...	.....	8	Mar.	1883
.....	A. J. Vallejos *et al*	Cucharas creek..	.....	.....	...	... ..	...	.....	18	Mar.	1869
Glade	Charles E. Price	Muddy creek	2.5	.....	1.5	20.	1.5	7.89	..	Mar.	1879
Road No. Two	Charles E. Price	Muddy creek	2.5	.....	1.5	10.	...	6.58	..	Mar.	1883
Lake Miriam	T. F. Martin & Co	Cucharas creek..	10.	.....	3.	3.5	10.	45.	..	Dec.	1883
Spanish Peak	Jasper Bruce *et al*	Cucharas creek	.....	.....	...	.....	...	.....	9	Feb.	1880
Oso	Ignacio Pacheco *et al.*	Cucharas creek	.....	.....	...	40.	2.	.....	..	Nov.	1886

Water District No. 17.

Consists of all lands irrigated from ditches or canals, taking water from that part of the Arkansas River lying in Bent county; also, all lands irrigated from ditches or canals, taking water from the tributaries of said portion of the Arkansas River, except the Apishapa and its tributaries, and the Purgatoire and its tributaries.

No report.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS,

Which have been filed in the office of the County Clerk in Bent county, since October 1, 1884:

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet	Length, in miles.	Capacity, in cubic feet, per second.	DATE OF APPROPRIATION.		
			Bottom, in feet.	Top, in feet					Day.	Month.	Year.
Arkansas R. L. T. & C. Co	O. L. Haskell	Arkansas River	60	.....	7	2.11	.....	.....	25	Dec.	1883
Rocky Ford Ditch Co	J. Denny, et. al	Arkansas River	.....	.....	...	.....	.....	.....	25	July	1882
Arkansas Valley Land and Canal Co	G. W. Swink, O. L. Haskell, H. D. Perky	Arkansas River	60	.....	7	2.11	.....	.....	7	Mar.	1884
Arkansas River and Fort Reynolds Ditch Co		Arkansas River	60	.....	...	.....	.....	.....	17	Mar.	1884
River Bend Land, Town and Canal Co	O. L. Haskell, H. D. Perky, J. W. Gaynor	Arkansas River	20	.....	...	2.11	.....	.....	17	Mar.	1884
Bent County Irrigation Co	Thomas Dunbar, W. Thomoson, R. C. Bloomfield	Arkansas River	.....	.....	...	.....	.....	.....	25	Mar.	1884
Bob Creek Canal	G. W. Swink, J. L. Martell, A. Swink	Arkansas River	60	.....	7	2.00	.....	.....	5	April	1884
La Junta Canal, Land and Stock Co	G. W. Swink, H. D. Perky, O. G. Patterson	Arkansas River	60	.....	...	.....	.....	.....	9	May	1884
Meadows Canal, Land and Stock Co	M. P. Dooley, O. G. Batterson, J. S. Perky	Arkansas River	60	.....	7	.....	.....	.....	17	May	1884
St. Charles, Huerfano and Nepesta C. L. & T. Co	J. F Minnis, J. W. Gaynor, N. S. Ballou	Arkansas River	60	.....	81	.....	.....	.....	4	June	1884

BENT COUNTY APPROPRIATIONS.—CONCLUDED.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet	Grade per mile in feet.	Length, in miles.	Capacity, in cubic feet, per second	DATE OF APPROPRIATION		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
Belmont Land and Canal Co.....	O. G. Patterson, M. P. Dooly, W. H. Brandenburg.....	Arkansas River..... ...	40	.....	7	.....	...	.....	25	Sept.	1884
Colony Canal, Land and Stock Co...	J. M. Wallace J W. McCreery, A. Moore, J. S. Perky.....	Arkansas River	60	.....	7	. ....	...	.. ..	25	Oct.	1884
Catlin Land and Canal Co.....	J. C. Vroman, J. W. Beaty, R O. McClain	Apishapa River.....	20	.....	6	2.11	...	.....	1	Nov.	1884
Pueblo Land and Canal Co.....	John M. Wallace, G. H West, J. W McCreery	Arkansas River	100	.....	7	2.00	...	.....	21	Nov.	1884
Bent County Ditch Co.....	J C. Jones, G M. Dameron, A. R Black	Arkansas River.....	.....	.....	...	.....	...	.....	...	.....	.....
Buffalo Creek Irrigation Co.....	....	Arkansas River.....	.....	.....	...	.....	...	.....	3	Jan.	1885
Colorado Kansas C., L. & S. Co.....	D. C. Roberts, J. S. Perky, A. Moore	Arkansas River.....	60	.....	7	.....	...	.....	26	Jan.	1885
Pueblo Land and Canal Co.....	George H West	Arkansas River..... ...	100	.. ..	7	.....	...	.....	24	April	1885
Bent County Canal.....	H. R. Holbrook.....	Arkansas River..... ...	40	.....	...	.....	...	11.00	28	July	1885
Colorado and Kansas L. & I. Co.....	F. B. Kohen, Amos N. Paust, W. H. Holmes, et al.....	Arkansas River.....	.....	.....	...	.....	...	.....	7	Aug.	1885
New Era C. & R. Co.....	F. B. Kohen, E. L. Kohen, et al.....	Arkansas River.....	.....	..	...	.....	...	.....	15	Dec.	1886

* At head

Water District No. 18.

Consists of all lands irrigated from ditches or canals taking water from the Apishapa and its tributaries.

No report.

Water District No. 19.

Consists of all lands irrigated from ditches or canals taking water from the Purgatoire and its tributaries.

Water Commissioner, S. W. DeBusk.

Appointed February 23, 1884. P. O. address, *Trinidad*.

Report of Water Commissioner of District No. 19.

Trinidad, Colo., October 20, 1886.

Hon. E. S. Nettleton,

State Engineer,

Denver, Colorado:

No call was made upon the Water Commissioner of this district to distribute water during the year 1885.

During the year 1886, one urgent demand came from Frijoles Creek, but the parties in interest had never made proof as to their prior rights, so no attention was paid to

this request. I have rendered no official services, beyond endeavoring to prevent waste by serving some printed notices, calling attention to the requirements of the law concerning head-gates, ditch borders, waste of water, etc.

Only ten ditches have made proofs of prior water rights. Many others have commenced to do so, and proofs are now pending. No ditches have constructed measuring flumes. The combined capacity of the canals already operated is universally conceded to exceed the capacity of the streams at ordinary stages. About fifty miles of new canals are now in process of construction. The builders of these say that they propose using some of the large supply of water which years of plenty afford, by making reservoirs wherever practicable. They say, further, that they expect little in years of scarcity.

The Purgatoire River is subject to many and great floods, resulting from summer rains. During the brief periods of high tide, enough water passes out of Las Animas county to irrigate a vast area, if this surplus could be caught in reservoirs and saved. Without means of storing surplus water, the construction of additional canals would be of doubtful utility.

If the average monthly flow of water in the river were determined, such measurement would undoubtedly prove of benefit to all concerned.

All our ditches waste much water. It seems to me that Water Commissioners ought to be specifically required by law to prosecute all wasters of the precious fluid during the irrigating season.

So far, the board of county commissioners of Las Animas county have been opposed to lending any aid to a proper and legal supervision of the irrigation interests. They have been accustomed to show no favor to the referee

appointed by the District court; have declared that they see no use for a Water Commissioner, and, when the present incumbent desired to resign, declined to recommend anyone to succeed him. This unaccountable hostility to the agricultural interest has been unfavorable to any proper control of the irrigation system. But, as all of our leading live-stock owners, as well as others, are becoming owners of farms, and vitally interested in the growth of crops for feed, it is likely that resort will be had to the requirements of law at an early day. Order and system will undoubtedly succeed the present confusion.

Very respectfully,

S. W. DeBusk,

Water Commissioner, District No. 19.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in District No. 19, and placed upon record since the year 1882.

NAME OF DITCH OR CANAL.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet.	Length, in miles.	Capacity, in cubic feet, per second.	DATE OF APPROPRIATION.			REMARKS.
		Bottom, in feet.	Top, in feet.					Day.	Month.	Year.	
Riley Dunton Ditch	Purgatoire	4.	.....	2.	8 8	2.	5.28	...	May	1863	
McCormick Ditch	Purgatoire	5.	.....	2.	8.	2.5	23.10	...	April	1864	235 acres under ditch.
Levelling Ditch	Purgatoire.	5.	.....	1.5	8.	4.0	15.90	...	Sp'ng	1865	375 acres under ditch.
Hoehne Ditch	Purgatoire	8.	.....	1.5	2.5	4.25	15.36	12	Mch	1886	1,100 acres under ditch.
Phelps Ditch	Purgatoire	4.	.....	1 1	3.4	...	.....	..	.....	.....	Abandoned.
Burns & Duncan Ditch	Purgatoire.	4.	.....	...	3 4	2.5	.....	8	April	1886	Waters 320 acres.
Ben McGalliard Ditch	Purgatoire	3.	.....	1.6	3.4	2.	6.43	...	.....	.....	Waters 200 acres.
Arimanta Ditch	Purgatoire	2.5	.....	1.6	3.	2.	4.14	...	.....	.....	Waters 200 acres.
South Side Ditch	Purgatoire	5.5	.....	2.	6.	7.	.....	7	Feb	1876	Waters 3,000 acres.
First Enlargement	Purgatoire	7.5	.....	2.	6.	7.	35.25	...	.....	.....	

San Luis Park System.

DISTRICT NO. 20.

Consists of all lands irrigated from ditches or canals taking water from that part of the Rio Grande River lying in Rio Grande county; also, all lands irrigated from ditches or canals taking water from the tributaries of said portion of the Rio Grande River, which shall include the Piedra, Spring and Gato Creeks.

DISTRICT NO. 21.

Consists of all lands irrigated from ditches or canals taking water from the Alamosa and La Jara Creeks and their tributaries.

DISTRICT NO. 22.

Consists of all lands irrigated from ditches or canals taking water from Conejos Creek and its tributaries, in the State of Colorado.

DISTRICT NO. 23.

Consists of all lands irrigated from ditches or canals taking water from that portion of the Rio Grande River which forms the western boundary of Costilla county; also, all lands watered by ditches or canals taking water from the tributaries to said portion of the Rio Grande River, excepting the Culebra and Costilla Creeks and their tributaries.

District No. 24.

Shall consist of all lands irrigated from ditches or canals taking water from the Culebra Creek and its tributaries, and as much of the lands as lie in the State of Colorado as are irrigated from ditches or canals taking water from the Costilla Creek and its tributaries.

District No. 25.

Consists of all lands irrigated from ditches or canals taking water from the San Luis Creek and its tributaries.

District No. 26.

Consists of all lands irrigated from ditches or canals taking water from Saguache Creek and its tributaries.

District No. 27.

Consists of all lands irrigated from ditches or canals taking water from Tuttle, Carnero, La Garita, and all other creeks and their tributaries, which have their sources of water supply in the La Garita Mountains, and flow eastward into the San Luis Valley.

San Luis Park, containing the largest connected body of arable land, lying under a more extensive and costly system of irrigating canals than in any other section of the State, has no papers of record, of any nature whatever, in this office. It comprises eight water districts; the principal rivers being the Rio Grande del Norte and the San Luis, each with numerous and important tributaries.

In these districts there has been, apparently, no need, as yet, for the services of Water Commissioners. This satisfactory state of affairs is doubtless in consequence of the unlimited supply of water in the main streams coursing through the park, which is about ninety miles long, and from sixty to eighty miles wide.

It is only within the last few years that this vast and fertile area has attracted the attention of settlers or projectors of irrigating canals. In the year 1870 there were less than 5,000 people in the four counties of Saguache, Rio Grande, Conejos and Costilla, comprising the San Luis Park system. In the year 1885, the number had increased to 16,000; while during the year 1886, the increase has been even more rapid, consequent upon the completion and successful operation of several extensive canals, built by corporations which have invested a large amount of capital in them. These canals, in addition to Government lands, cover many thousands of acres of State lands, in which the people have a direct and important interest.

District No. 28.

Consists of all lands irrigated from ditches or canals taking water from the Tomichi and its tributaries.

District No. 29.

Consists of all the lands lying in the State of Colorado irrigated from ditches or canals taking water from that part of the San Juan River and its tributaries, which lie above the junction of the San Juan and the Rio Piedra, and including the Rio Piedra.

DISTRICT NO. 30.

Consists of all lands lying in the State of Colorado irrigated from ditches or canals taking water from that part of the Rio Las Animas River and its tributaries, which lie in Colorado.

DISTRICT NO. 31.

Consists of all lands in the State of Colorado irrigated from ditches or canals taking water from that part of the Los Piños River and its tributaries, which lie in Colorado.

DISTRICT NO. 32.

Consists of all lands in the State of Colorado irrigated from ditches or canals taking water from that part of the Rio Las Animas River and its tributaries which lie in Colorado.

DISTRICT NO. 33.

Consists of all lands lying in the State of Colorado irrigated from ditches or canals taking water from the La Plata River and its tributaries, which lie in Colorado.

DISTRICT NO. 34.

Consists of all lands lying in the State of Colorado irrigated from ditches or canals taking water from the Rio Mancos and its tributaries.

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk of Garfield County, since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet.	Length, in miles.	Capacity in cubic feet, per second.	DATE OF APPROPRIAT'N		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
The Little Ditch	Thomas J. Little	White River	1.	2.	1.5	3	1.75	.....	1	May	1886
Highland Ditch	Highland Ditch Co.	White River	6.	7.	1 5	3.	7.50	.....	1	June	1886
Piceance Ditch	Charles T. Limberg	Piceance Creek	1.	3.	1.	10.	2.50	.....	30	Aug	1886
Larson Ditch	Henry C. Larson	Piceance Creek	1.	2.	0. 75	6.	1.50	3.06	18	Sept	1886
Morgan Ditch No. 1 and Extension	Frank H. Morgan	Piceance Creek	1.	2.	1.	5.28	.88	1.69	20	Sept	1886
Morgan Ditch No. 2	Frank H. Morgan	Piceance Creek	1.	2.	1.	5.28	.75	1.69	22	Sept	1886
Rooney Ditch	John E. Rooney	Flag Creek	2.	2 5	0. 75	5 28	1.25	3.207	28	Sept	1886
Howard Ditch	George M. Howard	Dry Piceance Creek	1.	2.	1.	3.168	1.	1.51	25	Aug	1886
Gale Ditch	George A. Gale	Dry Piceance Creek	...	2	1.	3.168	.50	1.51	24	Aug	1886

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk in San Miguel county, since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH		Depth, in feet.	Grade per mile, in feet.	Length in miles.	Capacity in cubic feet per second.	DATE OF APPROPRIAT'N		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
Lone Cone Ditch and Water Right...	T. D. Matties and F. E. Leland	Naturita Creek.....	2.5	...	1.8	4.59	3.2	12.	7	May	1885
Ditch and Water Right.	C. S. Watson, S. B. Gifford, G. P. Costigan, H. H. C. Kay..	Elk Creek.....	...	...	...	...	...	26.43	28	July	1885
Columbia Saw and Planing Mill Water Right.....	C. Cromer	Bear Creek.....	Flume 3x10 ft		.17	...	0.17	47.40	15	Aug.	1885
Columbia Water Right	Town of Columbia..	Cornett Creek	...	...	...	...	...	.....	17	Aug.	1885
Ditch and Water Right.....	Lafayette Seaman, H. A. W. Tabor..	Bilk Creek.....	...	...	..	...	...	52.86	1	Sept.	1885
Wire Gold Ditch and Water Right...	Charles W. Ward, M. A. Wood.....	Alder Creek	...	...	...	...	...	52.86	4	June	1886
Tenderfoot Ditch and Water Right....	Albert F. Wyley.....	Cornett Creek.....	...	...	..	...	...	26.43	21	May	1886

TABLE GIVING LIST OF DITCH AND CANAL APPROPRIATIONS

Which have been filed in the office of the County Clerk in Delta county, since October 1, 1884.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile, in feet	Length, in miles.	Capacity, in cubic feet, per second.	DATE OF APPROPRIATION		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
Rock Springs Ditch	B. F. Woodring and E. W Wiley	Rock Springs	1.2	...	1.	...	1.5	1.25	10	April	1883
Shepherd Ditch	S. G. Shuffield, James Zaninetti Collet, H. Gresham and Cæsar Zanola.	Surface Creek	7	...	2.	...	2.	56.	9	Dec	1881
Hall and Yoder Ditch	Geo. G. Hall and John Yoder	Leroux Creek	2.5	...	1.	...	1 r	8.	5	Jan	1884
Cedar Ditch	John B. Hart, Spencer S. Baldwin, Mrs. Corinna Hart, Alfred C Botsford and Jesse Hart.	Alfalfa Ditch	10.	...	3.	...	8.	106	15	Jan.	1883
Alfalfa Ditch	Mrs. Corinna Hart, John B. Hart, Spencer S. Baldwin, Alfred C. Botsford and Jesse Hart.	Surface Creek	10.	...	3.	...	9.2	106.	17	Dec.	1881
Anway Ditch	Charles H. Anway	Angevine Creek	1 5	...	1.	v 2	4	.....	10	Nov.	1884
The Lucas Ditch	Fred Lucas	Angevine Creek	.9	...	.5	v 1 5	0 6	2.27	30	April	1884

DELTA COUNTY APPROPRIATIONS—CONTINUED

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade, per mile, in feet.	Length, in miles.	Capacity, in cubic feet, per second.	DATE OF APPROPRIAT'N		
			Bottom, in feet.	Top, in feet.					Day	Month.	Year.
Stillwater Ditch	A. A. Smith, Twiney Neal, Mrs. Eugenia D. Kennicott, Clarence M. Kennicott, Harold E. Kennicott, and Rose Kennicott	Surface Creek	2.	.....	1.5	.....	1.5	12.	20	Sep.	1882
Howard Ditch	Clarence M Kennicott	Surface Creek	2.	.....	1.	.....	0 4	6.	4	Feb.	1882
Big Fall Ditch	Mrs. Eugenia D. Kennicott and Clarence M. Kennicott	Surface Creek	2.	.....	1.5	.....	1.2	12.	14	Sep.	1882
Dough Spoon Ditch	Harold E. Kennicott	Dough Spoon Creek	2.	.....	1.	.....	0.4	6.	20	June	1882
Currant Creek Ditch, No. 1	James A. Kane	Currant Creek	2.5	.....	...	*53.3	3.	.....	N	otice	.....
Minnesota Creek Irrigating Ditch	A. Clough, W. Ault, F. Hightower, J. Turner, J. Lane, C. H. Anway, R. J. Decker, J. Fluallen, J. H. Short and E. B Quackenbush.	Minnesota Creek	6.5	7.5	2	.....	...	44.78	19	Feb.	1885
The Gelwicks Ditch	Luther C. Gelwicks	McDonald Creek	1.7	.....	1.	v 2.	...	2.64	11	Mch.	1885
The Lamburn Ditch	John W. Lane and Geo. W. Wade	Orth Creek	1.7	.....	1.	v 2.	...	.....	18	Jan	1885
The Fogg Ditch	G. F. Fogg, Jas. Stell, George Hider, G.W. Brower, and Mrs. H. Kimball.	Surface Creek	5.	.....	1.5	.....	...	15.	26	Feb.	1885

The Forrest Ditch	Richard Forrest, Mrs. H. Forrest, Jonathan Weir, and Robert Trickle.	Surface Creek	4.	6.	1.5	.....	...	12.	4	Dec.	1884
The Estes Ditch	R. A. Estes	Estes Gulch	.....	.....	...	.....	...	4 22	...	.. ...	.....
Wheel and Ditch Location	Wm. F. Johnson, C. D. Johnson, Albert Wilson, Joseph Rollins, and John C. Gale.	Gunnison River	.....	.....	...	.....	...	131.60	...	.....	.. ...
Crawford Clipper Ditch	Olof Olson, Peter Olson, S. J. Allen, Harry Bopp, and Henry Grant.	Smith's Fork..	8.	10.	2.	.....	...	83.52	10	April	1884
The Buttes Ditch	Erick Johnson, H. A. Castle, N. H. Castle, Jas. W. Snelson, and John R. Hall	Surface Creek	3.	.....	2.	.....	...	26.	...	Mch.	1882
The Crown Ditch	D. E. Yarnell, Oliver F. Cox, Don F. Crown, and James R. Foster.	Smith's Fork.....	10.	.....	2.	v 1.	...	20.	11	Oct.	1885
Eric Johnson's Ditch	Erick Johnson	Surface Creek .	4.	.....	1.	.....	...	6.	4	Nov.	1884
The Terror Ditch	H. L. Marot, G. H. Merchant, G. W. Fry, Zed Watson, D. W. Mckee, and A. R. Bruce.	Terror Creek	4.	.....	2.	v 1.5	...	12.	11	Dec.	1884
The Childs Ditch, No. 1	Frank W. Childs, and John W. Childs.	Tongue Creek, east branch.	4.	.....	2.	.....	...	27.	28	Nov.	1884
The Childs Ditch, No. 2	Frank W. Childs	Tongue Creek, east branch.	3.	.....	1.	.....	...	10.	9	Mch.	1883
Gunnison Cañon Ditch	D. W. Field, John C. Dowling, Charles H. Field, and Bruce B. Griggs.	Gunnison River	10.	.....	3.	.....	...	105.	2	Dec.	1885
The High Line Ditch	I. W. Davis, Eli Truesdale, J. W. Truesdale, and J. W. Green.	Le Roux Creek	3.	4.	1.5	.....	...	4.	1	Dec.	1885
The Fogg Ditch Extension	George W. Brower, and J. R. Hall..	Extension of the Fogg Ditch.	4.	.....	1.5	.....	...	15.	26	Feb.	1885

* Probable error.

DELTA COUNTY APPROPRIATIONS—CONTINUED.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade, per mile, in feet.	Length, in miles	Capacity in cubic feet, per second.	DATE OF APPROPRIATION.		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
The Hartland Ditch	J. C. Howard, J. T. Rollins, A. J. Sparr, W. F. Johnson, C. A. States, Joseph Bond, Geo. Diamond, Frank Koppe, Geo. Stanton, T. O. Bruce, Nathaniel Wales and J. C. Gunn.	Gunnison River	11.	.....	*2.5	.....	...	100.	8	Jan	1882
The Dillon Ditch	Robert F. Dillon	Uncompahgre River	2.	.....	2.5	.....	...	8.	1	Dec	1884
The Trial Ditch	S. E. Snyder, J. F. Cole and R. C. Hutchinson.	Gunnison River	14.	.....	10.	.....	...	*11.	...	Jan	1882
The Big Riffle Ditch	J. W. Barry, Martin Winfield, L. S. Coleman, R. R. Thomas, J. Q. Adams, A. P. Brown, Thomas A. Griffiths, Leaper Gill, Henry Fadely, Joel Griffith and James Rhodes.	Gunnison River	8.	.....	2.	.....	...	24.	8	Dec	1882
The Oak Valley Ditch	Adele Teachout and A. T. Blachley.	Blue Nose, or Oak Creek.	4.	.....	2.	.....	...	13.	...	.....	.....
The Broncho Ditch	F. E. Boyd, William Young and F. W. Child.	Tongue Creek, east branch.	3.	.....	1.	.....	...	12.	16	Apr	1883
The North Lateral Ditch	J. H. Adams, E. B. Masters, W. H. Jones, John McCarthy, Daniel McCarthy, E. M. Brown, Clarence Brown, C. A. Bear, E. L. Kellogg, R. Bigelow & Co., J. P. Pennington, A. H. Swan and P. K. Berlin.	Ironstone Ditch ex. in Montrose Co.	6.	....	1.5	.....	...	50.	24	Mch	1886

The Pilot Rock Ditch	M. Ford, Mrs. M J. Hefley, B. F. Woodring and R. R. Woodring.	Coal Creek	5.	6.	2.	.....	...	18.	14	Apr 1886
The Gove Ditch	Alva M. Gove and W D Gove	Coal Creek	3.	.....	1.	.....	...	5.5	14	Apr 1886
Big Fall Ditch Enlargement	John Young	Surface Creek	2.5	.....	2.	.....	...	4.25	12	Apr 1886
Buttes Ditch Enlargement No. 1	George P. Child, George W. Snelson, Isaac N. Fleenor and Peter Shark.	Surface C'k Before enlargement.	3.	.....	2.	.....	.	15.	...	....
		Surface C'k After enlargement.	4.	6.	2.	.....	...	27.	8	Feb 1886
The Chipeta Ditch	E. H. Capron, F. B. Beaudry, W. G. Pritchard, D. G. Salisbury and J. C. Lewis.	Uncompahgre River	8.	.....	1.5	.....	...	35.	20	Feb 1882
Fogg Ditch Enlargement	Geo. H Bell, Wm. M. Spaulding, Geo. W. Brower and James W. Stell.	Surface Creek	6.	10.	4.	.....	...	25.	20	Mch 1886
The McNeil Ditch	Horace McNeil	McNeil Creek	1.5	2.5	1.	.....	...	1.6	9	June 1886
The Kizer Ditch	Wm. Kizer, J. W. Gardner and Lester York.	Roseberry, or Kizer Creek.	3.	.....	1.5	.....	...	9.33	...	 1884
The Red Bluff Ditch	Joseph Barker, Edward Corly, Thomas Cully, Wm Donnelly and Slaughter Bros.	Tongue Creek, east branch.	3.	4	2.	.....	...	16.	...	 1884
Kennicott & Mower Ditch	Harold E. Kennicott, Thomas H. Mower and Charles Mundry.	Forked Tongue Creek.	2.	.....	1.5	.....	...	9.	15	Aug 1883
A A. Smith Ditch	A. A. Smith	Quackenbush Creek	.....	.....	...	.....	...	2.64	...	....
Carbonate Camp Ditch	Otto A. Peterson	Milk Creek	4.	.....	2.	.....	...	20.	26	May 1886
The Perkins Ditch	George Fogg, H. E. Perkins and D. S. Baldwin.	Forked Tongue Creek	4	.....	2.	.....	...	12.	20	Apr 1886
Forked Tongue Ditch	Chas. Mundry, D. S. Baldwin and T. H Mower.	Tongue Creek	4	.....	2.5	.....	...	10.	15	April 1882

* Probable error.

DELTA COUNTY APPROPRIATIONS.—CONCLUDED.

NAME OF DITCH OR CANAL.	NAME OF OWNER.	STREAM FROM WHICH WATER IS TAKEN.	WIDTH OF DITCH.		Depth, in feet.	Grade per mile in feet.	Length, in miles.	Capacity, in cubic feet, per second.	DATE OF APPROPRIATION		
			Bottom, in feet.	Top, in feet.					Day.	Month.	Year.
Sandstone Bluff Ditch	N. M. Pifer, D. L. King and J. C. Pollock.	Ward's Creek { Original Constr'c	2.	.....	1.	.....	..	3.	...	.....	1883
		Ward's Creek { Enlargement.	2.	.....	1.5	.....	...	12.	1	Sep.	1886
Surface Creek Ditch	The Surface Ditch and Reservoir Co.	Ward's Creek	10.	.....	2.	.....	...	127.	11	Aug.	1886
Roseberry Ditch	Wm. Donnelly	Keyser Creek (Kiser)..	3.	5.	1.	.....	...	10.78	20	Aug	1886
The Lake Fork Ditch	Joseph Barker, Edward Cody, Lyman Sessions, Henry Bull, W. H. S. Owen and L. J. Bryant.	35 feet from Lake Fork of Forked Tongue Creek, 15 feet from Kizer Creek (Kizer).	5.	6.	2.	.....	...	50.	26	July	1886
Surface Creek Ditch (amended)	The Surface Creek Ditch and Reservoir Co.	100 feet from Ward's Creek and the Reservoirs at the head, 5 feet from Camp Creek, 5 feet from Beaver Creek, 5 feet from Cottonwood Creek, 10 feet from Kiser Creek and 2 feet from Lick Creek.	10.	.....	2.	.....	...	127.	11	Aug.	1886
A. A. Smith Ditch	A. A. Smith.....	Quackenbush, or Bell Creek.	1	2.	1.	.....	...	2 6	29	Oct.	1886

Delta county shows no large canals, either belonging to individuals or corporations. The numerous small creeks, the comparatively limited area irrigated by each, the ease of construction and maintenance have made it possible for each farmer to control his own irrigation system to a greater extent here than elsewhere. Although there are fifty-six canals and ditches thus far a matter of record in the county, there seems to have been no collision of interests and no necessity for the creation of water districts. One or more individuals occupying lands on running streams, have constructed canals and regulate the use of them by mutual agreement, without the aid of the authorities. If this state of affairs existed everywhere, there would be no need of legislation or of officials charged with the duty of the equitable distribution of water. It is only possible in such favorably situated valleys as are possessed by Delta county.

Forming and Organizing

Water Districts.

Thirty-four (34) water districts have already been laid out in this State, but in few of them, except those in the northeastern part of the State, has anything been done to take advantage of the provisions of the law. Section 1751 of the General Statutes of 1883 provides that water districts, in addition to those formed by the Legislature, "may be formed from time to time by the Governor, on petition of parties interested." This law has been held unconstitutional by one of our District court judges, and probably with right, as an unauthorized delegation of legislative powers. In such districts, however, as have been created by law, and in which there is no qualified Water Commis-

sioner, one may be appointed by the Governor, to be selected by him from persons recommended to him by the several boards of county commissioners of the counties into which the water district in question extends. Vacancies in the office may be similarly filled. Within ten days after his appointment, the appointee must take the oath of office prescribed by Article XII., section 8 of the State Constitution, and is then fully qualified to begin the duties of his office.

Water Commissioners.

THEIR POWERS AND DUTIES.

SEC. 1754, General Statutes, State of Colorado. It shall be the duty of said Water Commissiners to divide the water in the natural stream or streams of their districts among the several ditches taking water from the same, according to the prior rights of each, respectively; in whole or in part, to shut and fasten, or cause to be shut and fastened, by order given to any sworn assistant, sheriff or constable of the county in which the head of such ditch is situated, the head-gates of any ditch or ditches heading in the natural streams of the district which, in a time of scarcity of water, shall not be entitled to water by reason of the priority of the rights of others below them on the same stream.

SEC. 1756. The Water Commissioners herein provided shall be each entitled to pay at the rate of five dollars per day for each day he shall be actually employed in the duties of his office, not to exceed eighty days in any one year, to be paid by the county or counties in which his irrigation districts may lie. Each Water Commissioner

shall keep a just and true account of the time spent by him in the duties of his office, and shall present a true copy thereof, verified by oath, to the board of commissioners of the county in which his district may lie, and said board of commissioners shall allow the same; and, if said irrigation district shall extend into two or more counties, then such Water Commissioner shall present his account for his said services, verified as aforesaid, to the board of county commissioners of each county into which such district extends, and each board of county commissioners shall allow an equal part thereof.

SEC. 1757. Said Water Commissioner shall have power, in case of emergency, to employ a suitable assistant to aid him in the discharge of his duties. Such assistant shall take the same oath as the Water Commissioner, and shall obey his instructions, and shall be entitled to three dollars per day for every day he is so employed, not to exceed twenty-five days, to be paid upon the certificate of the Water Commissioner, in the same manner as provided for paying Water Commissioners.

SEC. 1758. Said Water Commissioners shall not begin their work until they shall be called on by two or more owners or managers, or persons controlling ditches in their several districts, by application in writing, stating that there is necessity for their action; and they shall not continue performing services after the necessity therefor shall cease.

It is also provided (G. S. 1807) that the State Engineer shall have general supervision over the Water Commissioners of the different water districts in the State.

The important question for the Water Commissioner is, to settle in his own mind what are "the prior rights" of the respective ditches in his district. How is he to ascertain this? We think that a fair construction of the statutes warrants the statement that, as regards priority for irrigation,

he is bound to regard only such claims as (1) have been placed on record in the county clerk's office of the District court within his water district (G. S. 1763), or which (2) have been adjudicated and a certificate of the decreed amount and priority exhibited to him (G. S. 1766, 1767), or of which (3) a statement has been filed in the office of the county clerk of each county into which the water district extends, as required by section 1720, General Statutes. This information is, however, promptly procured by the State Engineer and books procured by him and loaned to each Water Commissioner, in which are plainly shown, in tabular form, the various ditches and reservoirs which have complied with the law; which books are kept posted to date, so that the Commissioner has only to follow its plain instructions. In the exercise of these duties, as may be seen from section 1754, he is fully aided and protected, if need be, by the arm of the law.

Adjudication of Water Rights.

The object of the proceedings for adjudication of priorities is stated in the statutes to be "that all parties may be protected in their lawful rights to the use of water for irrigation," and thus to provide *pro tanto* for the ascertainment of those rights. As, under the statutes, absolute power is given the Water Commissioners to control the flow of water into the ditches of their respective districts "according to the prior rights of each respectively," it is of the utmost importance that these rights be ascertained. Besides making these decrees *prima facie* evidence of the right generally, the Water Commissioners are bound to follow them, when brought to their notice by the respective ditch

and reservoir owners. In view of this fact, it is a little strange that decrees of this nature have been made in only nine of the water districts; and we have given the following outline of procedure and forms, with a view of facilitating action in this matter, as it can hardly be expected otherwise that a Water Commissioner can know of his "inner consciousness" what the rights of the various ditch owners in his district are.

The method of proceeding, in order to secure a decree in any water district adjudging priorities therein, is for some one or more ditch owners in such water district to present a petition to the District court, or the judge thereof if in vacation, praying such an adjudication. The county in the District court of which the petition shall be filed, is that county in the water district in question in which the first regular term of the District court shall occur after December 1. The following is the usual

FORM OF PETITION.

STATE OF COLORADO, }
_____COUNTY. } ss.

In the matter of the application of_____and_____ for the adjudication of the priorities of right to the use of water for irrigation in Water District No. ____, in said State. — *In the District Court.*

To the Honorable District Court of the_____Judicial District of the State of Colorado, within and for the County of_____and to the Honorable_____Judge of said Court:

Your petitioners respectfully represent that they are the owners, respectively, of the_____ _____and_____ ditches (or reservoirs), located in said water district, taking

and using water from (name of stream), and the tributaries thereof, in said water district, for irrigation purposes, in the cultivation of lands adjacent to and under said ditches along the line thereof; that the petitioners herein are interested, as such owners aforesaid, in the settlement and adjudication of the priorities of right to the use of the waters of said stream, and the tributaries thereof, for irrigation purposes, between the several ditches, canals and reservoirs and owners of water rights in said district number___ .

Wherefore, your petitioners pray that your Honor will proceed to an adjudication of the priorities of rights to the use of water for irrigation between the several ditches, canals, reservoirs and owners of water rights in said District Number _____, in said State, under the provisions of the Constitution and laws of the State of Colorado in that behalf.

(Signed) _____

[Verification.]

This petition is presented to the court, or judge, whereupon he orders it filed, and either appoints a day when he will hear and consider the evidence, or he appoints a referee to take the evidence, abstract the same, make his findings thereon, and draft a decree. As the latter is, owing to its convenience, the invariable practice, we will consider it only. The following is the usual form of order for adjudication, and appointment of referee:

Style of Court and Proceeding.

On this _____ day of _____, A. D. _____, the same being one of the judicial days of the _____ A. D. _____ term of said District court [*or*, before the Hon. _____, judge of said court, in vacation, at his chambers in the city of_____, in _____ county, State of Colorado], come the above-named petitioners, and present their petition, praying for an adjudication of the rights of petitioners, and all other owners of or interested in ditches, canals, reservoirs, or water rights therein, taking water from the natural streams known as _____,

and the tributaries thereof, in water district No. _____, in said State of Colorado, and the said petition, having been read and considered by the court [or said judge], it is hereby ordered that the same be filed in the office of the clerk of the District court, in and for said county of _____, in the State of Colorado. And it being deemed by the [judge of] said court impracticable to hear the evidence touching the rights of petitioners and others in this behalf, in open court, it is further ordered that _____, Esq., of the county of _____, and State of Colorado, he being, in the opinion of the court [or judge], a discreet and qualified person, be, and he hereby is, appointed referee of said court in said matter, to whom is referred the said petition and all statements of claim to the use of water for irrigation from the natural streams of said water district, heretofore filed, or which may hereafter be filed in said court or in this proceeding; and that said referee shall take all evidence in the matter of the said petition and the several priorities of right to the use of water for irrigation in said water district, offered by parties who have filed, or shall file; their statements of claims as required by law, and shall consider the same, and also any other evidence and testimony, if any there be heretofore taken in said water district in any like proceeding, and shall make an abstract of said evidence and his findings upon the same, and draft a decree thereon, and report the same to this court. And, generally, said referee shall have all the powers and perform all the duties required of a referee of said court by the laws of the State of Colorado regulating the matter of the adjudication and determination of water rights, and defining the duties and powers of referees appointed by courts of record. That before entering upon his duties as referee, and within ten days from the date of this order, the said referee shall file in the office of the clerk of the District court, for the county of _____, his written acceptance of this appointment, and his oath of office as such referee.

_____,

Judge.

The referee, after filing his acceptance of appointment and oath of office, prepares the following:

FORM OF NOTICE BY REFEREE.

In the matter of adjudication of the priorities of water rights in Water District No. _____

WHEREAS, By an order of the judge of the District court of the_____judicial district of the State of Colorado, in and for_____county, the undersigned was appointed referee in the above matter, of which order the following is a copy:

[Here comes copy of order.]

Therefore, I do hereby give notice to all persons, associations and corporations interested as owners or consumers of water in said Water District No._____, that I will, at the places and on the days hereinafter designated, attend for the purpose of hearing and taking evidence touching the priority of rights of the several ditches, canals and reservoirs in said district, and will continue such hearing from day to day until all such evidence shall be taken, to-wit:

At_____, at the office of_____, on the_____day of_____, A. D. 188__, at___o'clock a. m.

At_____, at the house of_____, on the_____day of_____, A. D. 188__, at___o'clock a. m., etc.

And I do hereby notify all persons, corporations and associations interested, as owners or consumers of water in said district, to attend, by themselves, their agents or attorneys, at the times and places appointed herein, and then and therein file a statement of claim, under oath (in case no statement has been before filed with the clerk of the District court of_____county aforesaid, by him, her or them), showing the ditch, reservoir or canal, or two or more such, in which he, she or they claim an interest, together with the names of all owners thereof, which statement may be made by any one of the owners of such ditch, canal or reservoir, for and in behalf of all; and all persons interested, as owners or consumers aforesaid, may then and there present his, her or their proofs for or against any priority or right of water by appropriation sought to be shown

by any party, by or through any such ditch, canal or reservoir, either as owner or consumer of water drawn therefrom.

_____,
Referee.

(Date.)

This notice shall be published, weekly, in one public newspaper in each county into which the water district extends, for four consecutive weeks, the last publication to be prior to the day appointed for the taking of testimony. Ten or more printed copies of the notice must also be posted in ten or more public places in the district, at least twenty days before the day for taking testimony.

For the statements of claims required to be prepared and presented, is suggested the following:

FORM OF STATEMENT OF CLAIM.

STATE OF COLORADO, }
_____ COUNTY, } ss.

In the matter of the adjudication of the priorities of water rights in District No. _____ } *In the District Court.*

The undersigned, _____, owner of the _____ ditch (or reservoir), herewith makes statement of claim, for use in the above entitled matter, as required by section No. 1763, of the General Statutes of the State of Colorado, and for the purpose of securing the benefits of the act of which said action is a part.

1. The name of this ditch (or reservoir) is the_____

2. The name of the owner (or owners) of said ditch (or reservoir) is (or are)_____, whose post office address is (or are)_____

3. The head-gate of the said ditch (or the feeder of said reservoir) is at a point in the county of_____

State of Colorado, on the_____bank of the_____ creek (or river), from which said ditch (or reservoir) draws its supply of water, at a point (locating the same by courses and distance from some well-defined monument).

The general course of said ditch (or feeder) is as follows: Beginning at the point above designated as the location of the head-gate thereof, and running thence (here state the courses and distances generally, and the government subdivisions crossed).

The length of said ditch (or feeder) is_____
The width of said ditch (or feeder) is_____
The depth of said ditch (or feeder) is_____
The grade of said ditch (or feeder) is_____

The date of appropriation of water by the original construction of said ditch (or reservoir) is the____day of_____ A. D. 18____, and the amount of water claimed by and under said construction is_____cubic feet per second of time.

The date of appropriation of water by the enlargement (or extension) of said ditch (or feeder) is the____day of _____A. D. 18____, and the amount of water claimed by and under said enlargement is_____cubic feet per second of time.

The present capacity of said ditch (or feeder for said reservoir) is_____cubic feet of water per second of time.

The number of acres of land lying under and irrigated (or proposed to be irrigated) by water from said ditch (or reservoir) is_____acres.

(Signed)_____

STATE OF COLORADO, }
_____COUNTY. } SS.

_____, being first duly sworn, on oath says, that he is one of the persons named as owners (or _____of the corporation named as owner) in the above statement; that he has read the foregoing state-

ment, and is conversant with the facts, and that the matters therein stated are true of his own knowledge.

Subscribed and sworn to before me this.----------day of ----------A. D. 18--.

Unless such statement has been filed with the clerk of the proper District court on or before June 1, 1881, it must be filed with the referee at the time when the taking of proofs begins.

On the day appointed the referee begins taking testimony. The proceedings are conducted in the same manner as the taking of depositions when the parties appear by attorney; but the referee is also directed to examine the witnesses himself on all points necessary to settle the questions of priority. After the taking of all testimony offered, the referee abstracts it, and also any testimony theretofore taken in like proceedings in the district, and makes up his findings and decree accordingly.

Upon the filing of the referee's report, the court appoints an early day of some regular or special term, for consideration thereof, at which any and all interested may attend, and have objections, if any, thereto considered; and after all matters have been finally settled, the decree is entered of record. (1783.)

On petition of any party to the proceeding, the court may, at any time within two years after the entry of the decree, order a reargument, or review (1788); and parties who failed to come in, or refused to offer testimony, may afterwards come in, on due notice and proper showing, and the payment of all costs. (1784.)

Due provision is made for appeal to the Supreme court,

from any decree so entered, by any party or parties to the proceeding. (1789-1794.)

The referee is allowed for his services $6 per day and his necessary expenses, and mileage. (1798.)

After the lapse of four years from the rendering of the final decree, all parties whose interests are thereby affected shall be deemed to have acquiesced in the same, except in case of suits brought before them as hereinafter mentioned, and thereafter all persons shall be forever barred from setting up any claim contrary to such decree; but this act does not take away the Common Law right of any party, in a water district where a decree has been entered according to its provisions, from bringing action in the usual form to determine any claim of priority; *Provided*, The same be brought within four years after the decree is entered; but no injunction may issue to prevent the use or distribution of water according to such decree.

Seepage.

Seepage is a subject which is beginning to assume definite importance in connection with the economic use of water for irrigation; but it is only within the last year or two that any observations have been taken to accurately determine the volume in the stream at a point above where canals are taken out and at a given point below. The amount returned to the stream by seepage through the soil was merely a matter of conjecture.

It is a well established fact that, before irrigation became so universal in Colorado, the water in the streams was greatly decreased in volume, as it found its way out upon

the plains. This was more particularly observed in the time of low water during the spring and fall season. Those who came up the South Platte valley a few years ago will remember crossing the river, in the eastern part of Weld county, on the dry sand. Within the last ten years, at Platteville, the river has vanished utterly at times, so that people could cross and recross dry shod.

But there has come a change in this respect, and it has evidently been caused by the building of irrigating canals and the distribution and suspension, for a time, of the water upon and in the uplands adjacent to the streams. Observation and experience prove conclusively that seepage water is an important factor, and adds largely to the volume of water flowing in the channel. The increase in the lower valley of the South Platte has been a matter of notice, and becomes so distinct and certain that new canals have been constructed to take advantage of this interesting and important condition of affairs. It is well known that the bed of Cherry creek, once utilized as a thoroughfare for business in the city of Denver, has now a constant stream of water coursing through it, which is unquestionably the result of seepage from what is commonly known as the High Line canal of the English company.

In October, 1885, I instituted a series of measurements of seepage water in the Cache la Poudre, in order to obtain some accurate information upon this subject. Five points of observation were selected, the uppermost being at the measuring flume in the cañon, and the lowest at a point east of the town of Greeley. A request was issued to canal owners to close down the head-gates of all the canals, and so exclude all water; but in consequence of head-gates leaking, this was found to be impracticable. So the quantity which found its way into each canal was added to the amount found flowing in the river in order to obtain the total discharge.

The following is a copy of the notice issued:

NOTICE TO CANAL OWNERS IN DISTRICT NO. 3.

The State Engineer will make measurements of the Cache la Poudre for the purpose of determining the amount of seepage water that flows into it between the Cañon and Greeley; providing the ditches and canals between these points can be shut down three or four days, for the purpose of allowing the water to run through undisturbed; Mr. Nettleton has set October 12 as the day to begin this work, and has requested the water commissioners to close the head-gates of all the ditches and canals on the tenth. Therefore, all owners of ditches and canals taking water from the river below are respectfully invited to assist in this important work, and to close and make water-tight their head-gates on the tenth proximo, and allow them to remain so until the Wednesday evening following.

NOTE.—This notice was published in the Greeley and Fort Collins papers.

The following table of measurements was the result;

MEASUREMENTS OF SEEPAGE WATER IN THE CACHE LA POUDRE.

PLACES WHERE MEASUREMENTS WERE TAKEN.	Amount of water in river.	Amount of water diverted from river by canals	Amount of water in the river at the points measured, plus that diverted by canals between those points.	Am't of increase in volume of the river between points measured	Am't of increase in river from the cañon to point where measured
	Cubic feet per sec.	Cubic feet per sec.	Cubic feet per second.	Cubic feet per sec.	Cubic feet per sec.
First river measurement	127.609	.....	.....	.....	.....
Pleasant Valley and Lake canal	.....	1.75	.....	.....	.....
Larimer County canal	.....	0.58	.....	.....	.....
Jackson ditch	.....	0.266	.....	.....	.....
Cache la Poudre ditch.....	.....	1.00	.....	.....	.....
Larimer No. 2 canal	.....	0.534	.....	.....	.....
New Mercer canal.....	.....	0.228	.....	.....	.....
Fort Collins canal	.....	1.14	.....	.....	.....
Second river measurement	133.973	.....	139.471	11.862	11.862
Larimer and Weld canal	.....	1.731	.....	.....	.....
Judge Howe's ditch	.....	2.60	.....	.....	.....
Josh Ames' ditch	.....	0.69	.....	.....	.....
The Lake canal	.....	1.248	.....	.....	.....
Cache la Poudre No. 2.....	.....	3.216	.....	.....	.....
Third river measurement	149.985	.....	159.470	25.497	37.359
The Whitney ditch.....	.....	1.583	.....	.....	.....
Cache la Poudre No. 3	.....	5.870	.....	.....	.....
Fourth river measurement	161.863	.....	169.316	19.331	56.690
Ogilvy ditch	.....	38.955	.....	.....	.....
Fifth river measurement	153.117	.....	192.072	30.209	86.899

NOTE.—The first measurement of the river was made in the flume in the cañon, above all irrigation canals. The second about two and one-half miles above Fort Collins. The third at the dam at the head of the Cache la Poudre No. 2. The fourth about one-fourth of a mile below the head of the Cache la Poudre No. 3. The fifth one-third of a mile below the head of the Ogilvy ditch.

Some interesting data is secured by a study of the above table. It will be seen that, starting with a flow of

127.609 cubic feet per second in the cañon before any water is drawn into canals, the volume at the lower point, after supplying fifteen canals, had increased to 214.508 cubic feet per second; showing an addition of more than two-thirds of the original amount, to supply canals further down the valley.

The knowledge of an increase of water, both before and after the summer rise in the stream is important to the irrigator, since, in the majority of cases, the river's capacity is limited to the supply it affords for early and late irrigation, and anything tending to equalize the flow through the season adds to the irrigation area. For instance, on the Cache la Poudre, more water passes through the cañon during one day in the height of flood season than there does during a month in the fall; but if enough water becomes stored in the soil during the flood time to augment the flow later in the season to twice the original volume at a low stage of water, it is evident we have practically doubled its capacity.

All lines of study tending to develop the economic use of water are of great importance to the State. The facts above obtained are of value, and, if extended to other streams, would aid Water Commissioners in discharging their duties to the satisfaction of all concerned.

Canal Building.

Diversified Farming, Farming Without Irrigation.

A proper estimate of the advancement made in irrigation and agriculture, since the publication of my last report, comprises much more than the number of miles of

canal built and the number of acres brought under cultivation, during that period, although in both those particulars the progress has been most gratifying. We have, however, passed through the era of rapid canal construction, for a time, at least, which has hitherto crowded from notice the less material, but not less important, matters connected with our agricultural progress, and which may now properly claim our attention.

Owing to there being no provision in the law for statistics for canal construction to be forwarded to this office, I am unable to give official statistics of the number of miles of ditches and canals built in the past two years. The work, however, has gone on rapidly, several canals of large size having been completed in the San Luis Valley and the valley of the Grand River. One of these, the Del Norte Canal, is the largest in the United States. Other canals of considerable magnitude and importance have been projected in the southeastern part of the State, and are being constructed on the Arkansas and in the southwestern part of the State, in the Montezuma Valley.

It will be observed on examination that this report does not include statistics of those counties where canal building has been carried on with the greatest activity, which is greatly to be regretted. The law which provides for making a record of the size and location of ditches in the office of the county clerk, makes no provision for their transmission to this office. I am largely indebted, therefore, to the gratuitous co-operation of the county and district clerks for the data on this subject in the report.

A large number of canals built in the older ditches of the State, have their head-gates in what were formerly dry channels, carrying water only in exceptional storms. Some of these are intended to be made feeders to reservoirs, and in this way store up the water of the spring rains; others,

and the larger number, are designed to utilize the seepage from ditches and canals, or from cultivated fields situated above. Some idea of the amount lost by this action can be gained from the number and size of the ditches being built, whose whole water supply is dependent upon it. In Arapahoe county alone, ditches of this character, with an aggregate capacity of over 500 cubic feet per second, have been projected in the past two years.

In consequence of the rapid progress in canal building in widely separated localities in the State, irrigation has ceased to be considered a local interest. While the northeastern part of the State still maintains its supremacy as the largest and most populous irrigation district, the San Luis Valley and the valley of the Arkansas are making rapid progress, and it is only a question of a few years' time when the Montezuma Valley in the southwest, and the Grand in the west, will each be the center of thriving and important agricultural communities.

The rapid progress of canal building in the past two years is largely due to the system under which canals are now constructed. A large percentage of the earlier canals were built on the co-operative plan, in which a large number of farmers united, and through their joint credit and labor, built the canals to water their farms. This method was not suited to large enterprises, and capital was not slow to perceive that ditch enterprises offered a safe and lucrative field for investment, and, as a result, the majority of the canals constructed during the past two years, or now being projected, are owned by corporations merely as speculative enterprises. This change in our methods of canal construction opens up some grave questions for consideration, in order that we may rightly estimate its influence on the progress and prosperity of our agricultural interests.

The canals built under the last mentioned system com-

prise the largest and most important ones in the State. They have probably been built in a more substantial, and at the same time more economical, manner than would have been possible under the old system. Under the old system, however, the interest of the canal owner and farmer were usually identical, because united in the same person. But in canals built by individual or corporate capital, the interests of the ditch owner and farmer are not always considered identical. It therefore becomes a matter of permanent importance that our legislation should be such as to protect the interests of both parties, and, as far as possible, prevent the working of any hardship or injustice. In view of the increasing magnitude of this interest, and the greater need of legislative regulation and control, I have watched with no small degree of gratification the growth of a spirit of adherence and respect for the laws now in force, and an appreciation of the absolute necessity of additional and more effective legislation. This, I think, is due to two causes, the first and most important of which is, that the laws now in force have, as a whole, been of undoubted service. While in California the irrigation interest is harrassed and menaced by expensive and vexatious litigation, and its further development practically abandoned, the administration of our own system has each year been more efficient and harmonious. The second cause I would mention is that the management and ownership of so many canals by others than the farmers who are supplied from them has made it necessary that the rights and responsibilities of each party should be defined and enforced. At the outset of our irrigation legislation there was a deep-seated prejudice against any restriction of the will or interest of the individual, but this has been slowly disappearing. Two years ago a commission was sent by the government of Australia to visit this country and report on our irrigation system and works. In their report, speaking of the laws of this State and California, they referred to the prejudice against legislation in

these words: "In fact, Lesislative interference is only desired by the people of the States to untie the knots which the Legislature has either tied or neglected to untie. The utmost political aspiration of the American irrigator is that the government will let him severely alone."

However well this may have applied to us two years ago, it is certainly wide of the truth at the present time. Nearly everywhere there is a spirit of loyal support of the laws now in force, and an earnest desire that other and more efficient ones be enacted. This fact alone I regard as among the most significant and promising of any in the progress of the past two years.

While our agricultural development has not kept pace with our progress in canal building, it has been rapid and prosperous, being far greater than in any two previous years of the State's history. Some idea of our progress can be gained from the transaction of the United States land offices in this State for the years 1885 and 1886, a table of which is given in this connection, together with a table covering the entire period since the establishment of land offices in the State. For all except the office at Denver the record is for the fiscal years of 1885 and 1886. The Denver records are for the years beginning January 1, 1885, and January 1, 1886. The fourth quarter of 1886 not being complete at the date of writing this report, the transactions were assumed as being equal to those of the third quarter.

TABLE GIVING THE NUMBER OF ACRES

Of land entered under the laws of the United States for the years 1885 and 1886, in the different land offices in Colorado:

1885.

NAME OF OFFICE.	Total No. acres entered under the pre emption laws	Total No. acres entered under the timber culture laws.	Total No acres entered under the homestead laws.	Pre-emption cash entries.	FINAL HOMESTEAD.	
					Entries.	Total Entries.
Central City	.....	2,562 04	9,188.63	5,685.72	.....	17,449 39
Denver	397,280.	362,562 82	105,883.45	50,843.80	22,560.	948,140 07
Glenwood Springs	9,396.50	4,835 27	5,364.17	.....	.....	19,595.94
Gunnison	29,164.31	719.52	2,439.47	.....	.....	32,323.30
Durango	17,560.	640.00	9,175.	4,942.	1,468.	33,785.
Lake City	Not given.	Not given.	826 44	2,838.42	480.	4,144 86
Pueblo	29,599.73	29,136.99	54,201.45	.....	.....	111,938.17
Del Norte	76,480.	13,039.54	11,378.	8,941.89	11,378.	6,596 18

1886.

Central City	.....	1,840 39	10,136.94	4,966.72	.....	16,944.05
Denver	647,200.	654,233.82	209,864 47	64,476.67	17,895 85	1,593,769 81
Glenwood Springs	13,131.27	11,268.21	14,461.70	.....	.....	38,861 18
Gunnison	36,693.12	432.00	1,431 99	.....	.....	38,557.11
Durango	27,040 00	6,490.	11,542	4,495.	3,209.	52,776.
Lake City	Not given.	322.56	2,508.65	3,659.46	623.50	7,114.87
Pueblo	23,508 05	132,222 59	61,135.97	.....	.....	216,566.61
Del Norte	41,440.	17,721.37	15,009.90	9,102,89	8,490.83	.....

TABLE EXHIBITING THE DEMAND FOR LAND IN COLORADO

Since the establishment of the first United States land office at Golden, in 1864, and showing the progress of construction of irrigating canals in the State, as per priorities granted in decrees of courts, and claims filed in the offices of the various County clerks:

YEAR.	UNITED STATES LAND OFFICE.				Railway land sales. Acres.	STATE LAND BUSINESS.		Total demand for public land in the State. Acres.	Canals constructed, in total capacity of cubic feet per second.
	Sales. Acres.	Pre-emption Filings.	Homestead and timber entries Acres.	Total demand in U.S. land office Acres.		Sales. Acres.	Leases. Acres.		
1864	6,747.54	.....	45,224.80	51,972 34	.....	.....	.....	51,972 34	747 32
1865	22,828.90	.....	24,197.99	47,026.89	.....	.....	.....	47,026.89	1,230 94
1866	17,038.28	.....	31,265.14	48,303 42	.....	.....	.....	48,303 42	718.52
1867	11,840.68	.....	18,315.86	30,156.54	.....	.....	.....	36,156.54	625.56
1868	10,579.32	.....	6,754 70	17,334.02	.....	.....	.....	17,334.02	485.51
1869	13,310.44	.....	6,609.49	19,919 93	.....	.....	.....	19,919.93	216.50
1870	130,436.78	.....	69,986.59	200,423.37	32,613.00	.....	.....	233,036.37	1,073 46
1871	83,519 58	.....	93,301.39	176,820.97	32,818.71	.....	.....	209,639 18	1,873.73
1872	113,029 41	.....	46,579.39	159,608.80	20,403.80	.....	.....	180,012.60	1,090 58
1873	158,128 93	.....	65,641.07	223,770.00	15,734.80	.....	.....	239,504.80	1,646.83
1874	56,794.90	.....	39,874.93	96,669.83	8,878.75	.....	.....	105,548.58	1,053.29
1875	56,010.09	.....	67,955.35	123,965.44	5,155 24	.....	.....	129,120.68	1,417.09

1876	50,431.02		63,351.05	113,782.07	1,840.40			115,622.47	661.95
1877	32,493.94		37,686.52	70,179.56	26,129.84			96,309.40	702.04
1878	38,787.75		85,469.92	124,257.67	32,729.15			156,986.86	1,948.07
1879	29,646.16		81,324.45	110,970.61	10,021.13	* 6,000.00	‡ 78,800.00	205,791.74	2,140.61
1880	59,074.65		127,127.49	186,202.14	25,419.02	* 6,000.00	‡ 78,804.00	296,425.16	966.23
1881	57,452.28		167,226.49	224,673.77	39,555.16	† 35,656.00	‡ 57,131.00	357,020.93	*a* 4,340.79
1882	85,573.04		183,844.93	269,417.97	18,658.39	† 35,657.00	‡ 57,131.00	380,763.36	*b* 5,049.74
1883	119,251.78		269,485.45	388,737.23	48,945.15	¶ 95,440.38	° 152,745.00	685,867.78	*c* 2,276.92
1884	213,351.46		339,951.89	553,303.35	60,000.00	¶ 95,440.38	° 152,746.00	861,489.73	*d* 3,528.51
1885	*e* 103,359.01	559,480.54	611,962.79	1,274,802.34	*h* 50,000.00			1,324,802.34	
1886	*f* 117,009.92	789,012.44	1,153,621.56	2,059,643.92	*h* 5,500.00	*g* 12,986.81	*g* 788,253.00	2,915,883.73	

* 12,000 acres of State land sold in the two years ending Nov. 30, 1880.
† 71,313 acres of State land sold in the two years ending Nov. 30, 1882.
¶ 190,880.76 acres of State land sold in the two years ending Nov. 30, 1884.
a Including Del Norte Land and Canal Company's canal, not filed.
b Including State Land No. 2 canal, & Citizens D. & L. Co. canal, not filed.
‡ 157,604 acres of State land leased prior to Nov. 30, 1880.
‡ 114,262 acres of State land leased in the two years ending Nov. 30, 1882.
° 305,491 acres of State land leased in the two years ending Nov 30, 1884.
c Including Uncompahgre canal, not filed.
d Including Grand River ditch, not filed.
e Incomplete.
f Incomplete.
g For the years 1885 and 1886.
h Estimated.

Up to within a period of three or four years, our agriculture could almost be said to be compassed by one word —wheat—as that important cereal occupied the greater part of the cultivated area of the State. The reasons for this were not hard to find. Owing to the favoring influences of soil and climate, its yield was certain and abundant. There was a ready market for the product, and, until recently, a fair price. So long as the price obtained rendered its production exceptionally lucrative, its supremacy was undoubted, but with the advent of low prices it became evident to all thoughtful minds that the permanent prosperity of our agriculture required the adoption of different methods.

The efforts to bring about a change and the adoption of a system of mixed husbandry in place of the old method of special crops, was greatly facilitated by the success met with in cultivating alfalfa and its enormous yields. Once established that there was something which would pay better than small grain, the other arguments in favor of a change of methods had an interested hearing, and so rapidly has the change gone on in the past two years, that in many districts it almost amounts to a revolution, which has transformed the appearance of these agricultural districts.

As to the beneficial effects of the change, there can only be one opinion. Mixed husbandry means that the fertility of the soil is to be kept up, more of the agricultural products required in the State will be produced at home, and the danger of glutting the market with a few correspondingly diminished.

Without attempting a discussion of this phase of the subject, I will further say that the change in our methods of farming has had an important influence on the "duty of water," as well as on the method of its distribution, and to these matters I wish to call attention.

Under the earlier methods of "wheat" farming, the demands made on our irrigating canals in the earlier part of the season were very heavy. Nearly the whole of the cultivated lands under our ditches being given up to one crop, which required a large amount of water in a short time; ditch companies adjusted the size of their water rights to meet the requirements of that crop, while farmers in purchasing water bought the quantity required during the period of greatest need rather than the average amount required for the season. As a consequence, water rights were established on a basis above the actual amount used, and the estimate of the duty of water placed correspondingly low. The method of flooding practiced with this crop demanded a large volume of water to make rapid progress, and this was nearly always an important consideration, more water was frequently employed than could be handled properly, and a large proportion wasted in consequence. The season of the irrigation of wheat is a short one, being usually ended by the first of July, the period of active irrigation only lasting about forty-five days. In estimating the duty for the season this should be taken into account, but frequently has not been. Two things, therefore, contributed to make the early estimates of the duty of water low.

First—Wasteful methods made necessary in part, and in part due to inexperience.

Second—Estimating the duty for the whole season as being proportional to the first half.

It may also be proper to add a third cause for the low duty of water not connected with the crop, which is, that the amount of water required during the first two or three years that land is cultivated, is greater than that needed afterwards.

Under the system of mixed farming which now so gen-

erally prevails, many important crops are grown with but little or no water. Corn, when grown on land which has been irrigated for several years, requires but little water; hence, with the increase of the area devoted to its growth, the average duty of water is proportionally enhanced. Furthermore, some crops not requiring to be irrigated until small grains are out of the way, the demand made on canals in the early part of the year has been correspondingly diminished, and has made it possible for farmers to use their water supply with more care and economy. The beneficial effects of this are seen in the decrease of swamped lands in some of the older districts during the past two years.

The growth of alfalfa and the increase of gardens and orchards around farmers' homes, have greatly augmented the demand for water for early and late irrigation. This is likely to cause serious loss and trouble, unless energetic measures are taken soon, either to restrict the further extension of our irrigated area, or to construct reservoirs for the storage of water to be used at these seasons.

The change from special crops to mixed farming seems to have produced the following results:

First—To have largely increased the duty of water.

Second—Extended the period of irrigation; increasing the demand at a time when the streams are low and threatening a scarcity of water for late irrigation.

The past season has been especially marked by the large immigration to the eastern part of the State and the, so far, notably successful attempt to farm without irrigation. For several years farming has been pursued with success on what is generally known as the Divide country, being the elevated lands between Denver and Colorado Springs. Thinking a description of this country and its products

would be of interest at this time, I made an effort to gather some statistics on this subject. A letter from J. C. Plumb, Esq., who lives in this section, gives so complete a summary that it leaves nothing for me to add. I print it, therefore, in full:

The growing of crops without irrigation in this divide country dates back twenty years or more; at first in a small way, mere garden patches, but few lived here at that time, and they were stockmen or lumbermen. It would be hard to give the name of the first person to try the experiment, for such it surely was at that time, but along in the sixties John Russell used to raise potatoes on Cherry creek and market them in Denver at 25 cents per pound. D. M. Holden has farmed his home ranch for twenty-five years or more in Bijou Basin; and other names might be given as being among the first. Yet, not much was done until the Leadville boom, which gave us a home market for potatoes and oats at 3 cents per pound, and big prices for anything a farm would produce. This led the ranchman to become more of a farmer, until now it is not an experiment. We plant most of the cereals with as much assurance of a crop as does the farmer of Iowa and Illinois. This assertion is backed by yields of the following: Twenty acres of oats that gave a yield of seventy-five bushels per acre; barley, fifty bushels; rye, thirty bushels, and potatoes one hundred and twenty-five bushels. These are not isolated cases, but there are many. I would say the average yield, one year with another, was: Oats, thirty-five bushels; barley, twenty-five bushels; rye, fifteen bushels, and potatoes seventy bushels. Wheat is but little grown, owing to the distance to mills for grinding and the cheapness of good flour. The yield, when grown, is about fifteen bushels, of a good quality. Early varieties of corn are grown, which sometimes yield twenty-five and thirty bushels, but the altitude is too great to make it one of the staple crops. Buckwheat and flax yield well; as yet there are no mills for grinding, and they are only grown for stock feed. Roots of all kinds grow prolific.

For the stockman, rye is without doubt the most valuable crop now raised. Sown in August, it makes green pastures for the fall, winter and early spring, and a sure

crop of hay; and if cut early, often the second crop of hay; if left for the grain, it can be cut while the straw is still green, which makes a far better feed than many of the grasses; for instance, I wintered last winter sixty head of grown stock on the straw grown on thirty acres, and threshed 450 bushels of rye from the same; my stock so wintered were in good flesh in the spring. I believe a greater portion of the plains will grow rye, if sown early enough to get the benefit of the late summer rains. The spring showers give it such a start that before the dry weather of June it so completely covers the ground that it will hold enough moisture to make a good crop of hay. For the farmer, potatoes are considered the most profitable crop at present.

This farm belt is at present twenty miles wide and forty long, from Palmer Lake east to Bijou Basin. Each year it extends further down the sides of the Divide; also, creeps out more on to the plains to the east. This spreading out is going on quite rapidly, and with it the rain belt keeps pace, just as it has done in Kansas and Nebraska, and without doubt will join hands across the line of those States, and with the irrigated districts to the north and south of us, and that in but a few more years.

In the year of 1885 this unirrigated district produced, as near as I can learn from reliable statistics, the following:

	Bushels.
Oats	110,860
Barley	9,790
Rye	35,444
Potatoes	239,844

Timothy hay is grown with good results. Alfalfa has been experimented with but little; in a small way some have succeeded. Small fruits are grown without trouble. Apples, but few orchards, and they are young.

The poorest crop grown here is the mortgage. I have it from good authority that there is less debt here than in any irrigated district of Colorado.

Agriculture without irrigation has been practiced with considerable success in several other parts of the State,

notably in the southwest, near Durango, where small grains have been grown on the elevated lands without irrigation. The results obtained thus far in this region have been only experimental, no general attempt having been made to settle these lands. The uncertainty of having moisture enough in the soil to germinate fall-sown grain and the lack of moisture during the winter and in the spring have thus far rendered the attempt too precarious to warrant an extended trial. The settlements in the eastern portion of the State are, however, of a different character. More than a thousand people have settled there in the past year on lands above ditches; they have brought their families, built houses, planted trees and gardens, and have raised sufficient crops to sustain them another year. So favorable has been the experience of the first year that nothing short of an absolute failure will check the tide of emigration now setting in this direction. The progress of this experiment will be watched with the deepest interest, not only because of its importance to to the growth and prosperity of the State, but also because the enterprise, energy and courage shown by these pioneers has inspired everyone with a sincere desire for their continued success.

While upon this subject of farming without irrigation, it may not be without general interest to us in Colorado to know that something of the kind is in progress in California, and I append extracts from a letter written by a former resident of Colorado, bearing upon this topic: * * "It is true, as you have heard, that considerable farming is carried on in California without irrigation, even in the more arid sections, and that good crops are often produced. But, you may add to this information the fact, as an axiom, that no crops of grain are raised anywhere in the State with a less rainfall than ten inches, and that *good crops* are only the result of 12 to 14 inches rainfall and upward. We have not yet discovered the secret of making vegetation grow in

dry land, without irrigation; but for several years past Southern Califarnia has been blessed with phenominally large rainfall, and excellent crops have been produced, even upon the Mojave desert. There a number of venturesome settlers have been daring Nature in her wildest mood. Since these heavy rainfalls have made grain growing possible almost anywhere in the arid region, the impression has been spread abroad that irrigation is unnecessary; but a few normal seasons will speedily correct this impression."

Wanted---More Farmers.

I estimate that the canals already constructed and those projected, if utilized to their full capacity, would be capable of furnishing water for nearly double the amount of land now under cultivation in the State; but at present, the facilities for the supply of water is greater than the demand for land, and will be for some time to come, judging from the settlement going on. That there is an urgent demand for a greater supply of agricultural products, than are now grown in the State, cannot be disputed. I refer you to the statistics which were carefully compiled and published in the report of the State Engineer for the years 1884-85, which give the value of products imported into Colorado, such as can be raised in our own State by the aid of irrigation. Take the two articles of cut meats and butter, and it will be seen there was shipped into Colorado during the year ending November, 30, 1884, an amonnt to the value of $2,347,978. The value of either one of the articles mentioned was more than the value of the total wheat crop sold during the same year. In addition to importing into our State the above amount of such products as I have

named, which we should and could raise here with profit, the people pay nearly $2,000,000 for imported oats, corn, lard and green fruit, all commanding prices that will pay well to raise. Admitting that we cannot make it pay to engage in raising agricultural products to export, (which is not true in every case), yet we have a home demand for all that we can, but do not yet raise, the value of which amounts to over six million dollars annually.

It will be seen that we have a market for at least three times the value of what is now grown in the State, at fair prices. We have the land, of most excellent quality, in abundance; and there are canals already built and projected and would be constructed were there a demand for water, capable of furnishing an ample supply. But the State needs the class of people that will settle upon and cultivate such lands, and steps should be taken to secure them. A Board of Immigration could do effective work in this way, building up the State, increasing its population and wealth to an extent not now dreamed of; the farmers finding good markets and fair profits, enabling them to build up good homes, and thus secure the advantage of a rapidly increasing value of landed property, which, of itself is a silent but sure income.

Fruit Growing in Colorado.

Fruit culture in the United States generally is making rapid progress. Recent statistics show that over 5,000,000 acres are devoted to it. Of apples, there are 120,000,000 trees; of pears, 30,000,000; of peaches, 115,000,000; of grapes, 150,000,000; of other fruits, 100,000,000. The total value is set down at about $150,000,000, an amount

equal to one-half the wheat crop of the country. This shows what rapid strides have been made within the past fifty years in this industry. But the lesson of fruit growing has been a succession of efforts and failures, efforts and occasional successes, efforts and final success, throughout the Western States; so that only through the gateway of experience will we pass onward to the orchard lands of the future. But this is true also of soil culture in all its branches, or there would be no need for the growing demand for experiment stations in every State of the Union, under the fostering care of agricultural colleges; no need for the establishment of a district department of agriculture represented in the cabinet; no need of farmers' clubs, county or State societies. The education of the people must move forward. The teachings of the past are not always the text for present progress. The future outlook requires constant study to adapt grains, grasses, vegetables, fruits, to local climatic influences, and bring within the range of certainties all the promises held out by enthusiastic believers in the possibilities of the soil.

The possibilities of fruit culture in Colorado seem to require some reference to it in this report, subject, as all soil culture in Colorado is, to the systematic application of water by irrigation.

In the early days of settlement it was said that this was not an agricultural country, and it naturally followed, if this were true, that it was not a fruit-growing State. But time has demonstrated that no foot of soil, from the lowest altitude within its borders up to timber line, but is capable of producing fruits, vegetables, grains, and, at the last resort, grasses; so that the growth of this industry is one worthy the careful attention of the State. The variety of soil, the difference in climate, the water supply—all these enter into the proper consideration of the subject; and no

rules can be laid down for safe following in every part of the State.

We are but learning here the same lesson other settlers have learned in other States. The belief that fruit could not be raised in Wisconsin, Minnesota, Iowa and other Western States, was as firm in the minds of the first settlers there as it was in the minds of the great majority of people who settled along the creeks and streams of Colorado in its early days, which belief still prevails in the minds of many to-day. This is not to be wondered at. Even in so old a State as Vermont, as late as the year 1866, it was the popular belief that apples, aside from the Siberian crabs, could not be grown there; but Dr. T. H. Hoskins and others began experimenting with other than native seedlings, and the result is that such apples as the Duchess of Oldenburg, Tetofsky, Peach of Montreal, St. Lawrence, Plumb's Cider, Wealthy and others, are profitably grown; and experimenting is still going on among the more advanced horticulturists of the State.

Once in Wisconsin it was said that apples could not be raised, unless it was the toughest kind of crabs. It took years of patient toil and experience to overcome the severity of the hard winters. Repeated failures of attempts, based on well-founded theories which had proven true elsewhere, led the fruit growers of Wisconsin's early days to believe that it was the "confounded climate," as one discouraged grower expressed himself, and not—as it was found to be later—their own blundering; and to-day there are many who do not believe in the future of fruit-growing in that State.

In Iowa, fruit growers labor under the disadvantage that failures are the rule and success the exception in their experience. Nature here, as elsewhere, seems determined to contest the field with mankind. But discouragements

only make the tree horticulturist the more earnest in his efforts to combat climatic influences, even when they descend to 35° below zero, and insect enemies, which seem to have found a peculiarly favored place of abode in the orchards of Iowa.

The early settlers of Kansas, coming from the Middle and Eastern States, brought with them the varieties they were familiar with there. Experience soon taught them their unfitness. They became discouraged; but there were those whose faith in the future kept them up, and in a few years it began to be believed that the State was yet to be a fruit growing one. In 1860 the value of its orchard products was $656. Ten years later the growth had been so very rapid that the value had increased to $158,046, and in 1871, the succeeding year, the Great Gold Medal of the Pennsylvania Society was awarded Kansas for a display of fruits unsurpassed for beauty and excellence by any other State in the Union. In 1880 over six million trees were growing. But even in Kansas to-day the knowledge is limited, and its best authorities are cautious as to placing opinions on record. The disastrous results of certain methods of pruning and cultivating, the worthlessness of varieties of standard value in States further east, the general unsuitableness of Eastern trees here, all had to be contended with. As the Secretary of the State Horticultural Society well said in his report for the year 1881: "The problem had to be solved on Kansas soil, under Kansas climate, and the environments peculiar to Kansas conditions." To a great extent the problem has been solved, but at an enormous expense. But its value, present and future, who can calculate?

Other States might be mentioned, in which the same line of experience has been met. Few States are so fortunate as Michigan, for instance, where fruit culture has been a success from its first beginning. And yet at least one

lesson can be learned from there. In the early days but little attention was paid to varieties at first, and to-day more than half the orchards bear fruit experienced pomologists find it hard to name. The lesson this teaches us here in Colorado, at the beginning of our work in this line, is clear. Keep track of varieties. Know the names of your trees. It is not enough to say this is an apple, this a pear, this a peach tree, planted in such a year. Be sure to be able to give its name.

In Colorado it is said the first attempt at fruit culture was made in the year 1864, twenty-two years ago. Shortly afterwards trees were planted in Jefferson and Arapahoe counties, in the bottom lands along Clear Creek. Of course, little was known of the climatic conditions of the country, the adaptability of the soil, or the varieties suited to the peculiar method of cultivation required. For many years it was, as it still may be said to be, a system of experimenting, but it is beginning to be the general belief that whatever is grown in the Middle and Western States may be grown here, and that the soil that will grow soap weed, sage brush or buffalo grass, will grow trees, with proper tillage and suitable water supply.

An experienced horticulturist, of Larimer county, tersely summed up the experience of fruit growers when he said, in an address before the Northern Horticultural Society, in 1884: "Nearly all of us have commenced experimenting in a small way, and have found the road a hard one to travel. It takes brains as well as patience, labor and capital, to grow fruit successfully in Northern Colorado. Not knowing the varieties suited to her soil and climate, nor the treatment necessary to insure success, we have gone blundering along, each one for himself, expending about all the money we could become possessed of, and receiving almost no returns for his labor. It is estimated that over $3,000,000 go out of the State each year

for green and dried fruits. And this sum is yearly increasing. The question thus becomes an important one. Can we not stop this fearful drain upon our capital and turn it into a channel by which our own people are to be benefited, and not those of other commonwealths?"

The time has already gone by when the assertion, "You cannot raise fruit in this State," was accepted as a fact by the people. The apple exhibit, made from Colorado at the New Orleans Exposition, and the display at the Manufacturers' Exposition of last fall, has effectually closed the mouths of the doubters, and the fact that it has taken a shorter time to demonstrate this than it did in Minnesota, Iowa and other States, speaks volumes, both as to the enterprise of those whose earnest efforts have brought about this happy result, and to the peculiar advantages of soil and climate possessed by us. It took over a quarter of a century to demonstrate, in Wisconsin, that fruit growing was an industry profitable to those who engaged in it. It has not taken more than half that time to prove the same fact here. Thirteen years ago, at the Territorial Fair held in Denver, Colorado, fruit was shown to such an extent and in such variety as surprised all who witnessed it. Since then each year has shown marked progress.

If then, since that time, almost every valley county in Colorado, below an altitude of 6,500 feet, has shown that most standard fruit can be grown, what may we not expect in the years to come? As a recent writer has aptly said, "Much of the progress made in the past is the outgrowth of experiments and trials and failures which were necessary to determine the methods best adapted to the climatic conditions. These experiments and failures need not be repeated, and progress in the future should be more rapid than in the past."

A brief glance at the present status of fruit growing in some of the counties of the State and of those who are

actively engaged in it may not be out of place, to show that from the eastern line of the State to an altitude of 7,000 feet above the sea level the conditions are favorable for all or some of our standard fruits, now brought in by hundreds of carloads from the Pacific coast, and from the States east of us, to supply the demands of the people.

Ten years ago wheat had to be brought into the State to supply the home demand for flour. Now we have a surplus. Can we hope that in ten, or even twenty, years from now we shall have our own supply of home-grown fruits to enrich its growers? Or shall we still be sending out millions of dollars to benefit other people? Let us hope that our intelligent farming and fruit growing classes are preparing to answer this question in the affirmative, and that the State will do its share to aid in such a result.

In Weld county, Mr. N. C. Meeker, for the Union colony, shipped in a carload of fruit trees in 1870; these were sold to the settlers at Greeley and in the vicinity, but the newness of the soil, lack of water supply, unsettled condition of people, and other causes, had a disastrous effect. It was not until 1875 that any extensive fruit tree planting was engaged in. Then Mr. J. W. Parker set out a crab apple orchard of 1,200 trees. Since then Mr. A. E. Gipson and others have engaged largely in the industry; the average altitude of the county is 5,000 feet.

In Larimer county, Mr. W. F. Watrous, present Secretary of the State Agricultural college, was the first man to set out a fruit tree. This was in 1871. Since then many others have planted large orchards, which yearly yield heavily and bring in a large revenue to their owners. The principal fruit here, as in Weld county, and it may be said in all the counties of the State, is the apple. Mr. J. S. McClelland has an orchard of 2,500 bearing trees.

Boulder county may be said to be the pioneer fruit

county since as early as 1859, when Mr. James Ackerman began planting trees. He met with the usual discouragements, failures, losses, that follow untried soils and unfamiliar climates; but he was not discouraged, and now he has a fine orchard containing nearly all standard fruits and all small fruits. Many of his apple trees bear five barrels annually. Mr. G. W. Webster may also be mentioned as a pioneer in the work, and he is doing experimenting in the way of seedlings, which will prove of great benefit to the State at large; having shown at the Denver Exposition a number of choice seedlings of his own growing far superior to the parent from which they sprung. A few peaches have been raised in this county.

In Jefferson county, along the line of Wheat Ridge, between Denver and Golden, David Brothers and others have orchards from six to fifteen years old. The late Mr. J. W. Cook, on Ralston creek, planted largely, though he made the grape more of a speclalty. In 1884 he had over 2,000 grape vines in bearing, from which, it is said, he had forty tons of fruit, thirteen varieties. He estimated forty pounds to the vine as the yield.

In Southern Colorado, Fremont county takes the lead in this line. It is estimated that there are over 750 acres in trees and vines. Jesse Frazier is the pioneer, having now twenty acres in apples alone. He began in 1870, carting his first trees 600 miles across the plains with ox teams. In 1885 his apple crop sold for $9,000. In addition, he grows pears, peaches and plums. His orchard is at Florence. About Cañon City, Beaver Creek, Hardscrabble and Sand Creek there are over 600 fruit growers, having from two to twenty-acre tracts. It will not be long before the Arkansas Valley, from the Grand Cañon east to Pueblo, will be a continuous orchard.

El Paso, Pueblo and Huerfano counties are other counties in which interest is taken in fruit culture by enthusias-

tic believers in Colorado as a fruit State, whose efforts in this direction deserve hearty commendation.

In Western Colorado, in the country lately known as the Ute Reservation, opened up to white settlement within the last five or six years, a greater advance is to be noticed, considering the period of time, than elsewhere in the State. Delta and Mesa counties, in the valleys of the Gunnison and Grand, lying on the western slope of the Rocky mountains, with an altitude ranging from 6,000 down to 4,500 feet, seem to possess soil and climate similar to that of the Utah valleys, where fruit-growing has been a source of profit for many years. In this section, particular attention is being paid to the peach, apricot and California varieties of grapes. Peach trees three years old have borne heavy crops, and vines of the Muscat type grow vigorously and yield abundantly, needing only winter protection by covering, such as is pursued in Eastern Colorado with native varieties. An exhibit of peaches from Mesa county attracted great attention at the Denver Exposition of 1886. These were grown at Whitewater, on the Gunnison, ten miles south of Grand Junction, by W. H. Coffman, and at Fruita, eleven miles west of Grand Junction, on the Grand, by W. E. Pabor. Others in Mesa county will plant largely of peaches, in the belief that they are to be as sure a crop as apples. In Delta county, Hon. S. Wade, Jr., an active worker and earnest believer in fruit culture in Colorado, and others, have fruited apples, pears, peaches, plums and apricots from trees set out four and five years ago. The outlook, therefore, seems to be favorable in Western Colorado for a class of fruit which has failed in the eastern part of the State.

It is to be noticed that experiments at an altitude of 8,000 feet show that the apple can be grown successfully. In Chaffee county, by Otis White, at about 7,000 feet; B. N. Whitman and A. N. Sharp, in Huerfano county, the one

at an elevation of 6,500, the other 8,000 feet; Mr. John H. Shaw, in Del Norte county, elevation 7,750, has over sixty crabs and standard apples in bearing; Mr. W. A. McAfee, in La Plata county, altitude 6,500 feet, has bearing pear, plum, cherry, crab and apple trees. Many others might be mentioned, but these are sufficient to show the wide range of altitude at which fruits will grow.

A few words may be added as to the profit in the business. In California, an acre of peach or apricot trees, 100 in number, after the fifth year, will produce 200 pounds of fruit per tree; value, at 3 cents per pound, $6, or $600 per acre. An acre of plums, 200 in number, at the end of the same time, will produce at least 50 pounds per tree; value, at 5 cents per pound, $2.50 per tree, $500 per acre. Cherries, pears, prunes, about the same amount in yield and return. An acre vineyard yields, on an average, five tons of grapes, worth, at the low figure of 2 cents per pound, $200. In all these instances, after first cost of planting, the expense of cultivation and marketing will not exceed 25 per cent. of the amount, leaving a handsome remuneration to the grower. It is not to be wondered at that California is attracting so many settlers, and yet our own State can offer equal advantages, and as certain a good return for labor; while it possesses a more healthy climate. Colorado only needs to have her advantages fully set forth to the world, and the result would be the doubling of its population within the next five years.

Many growers of small fruits in Colorado have taken $500 from a single acre, season after season. Mr. J. Wilcox, of Boulder county, from two acres, has gathered $1,500 worth of strawberries. Mr. A. N. Hoag, of Larimer county, from half an acre picked 1,548 quarts of raspberries, valued at 15 cents per quart, about $465 per acre. Instances like these can be multiplied, but why enlarge upon the subject? It may be said in confidence, in a gen-

eral way, that ten acres of small fruits will yield, second year, $500 worth of fruit; third year, $2,000; fourth year, $3,500; fifth year, $4,000; or an average of $200 per acre for each year, including the first non-bearing year.

Standard fruits show the same large margin of profits. Take a ten acre orchard of apples, peaches, pears, plums and cherries, from which no income will be derived until the third year after planting, and conservative horticulturists set down the returns as follows: Fourth year, $1,000; fifth year, $3,000; sixth year, $4,000; seventh year, $5,000; eighth year, $6,000; ninth year, $7,000; tenth year, $10,000. This makes an average of $340 per acre for each year, including the first three non-bearing years. During these first three years at least, farm crops of corn, potatoes, or other vegetables, can be grown, from which can be realized more than the interest on the cost of planting the orchard.

These estimates are under rather than above the mark. Allowing one-third of the amount for expense of cultivating and gathering the crop, and even then the profit is large.

But these profits are not the result of sticking trees into the ground, and leaving them there without attention. Nothing suffers so much from neglect as a tree. Like a child, nurture it and it will expand and grow and flourish. Hence, there enters into the work of the pomologist and horticulturalist patience, skill, labor. In fruit culture we are almost as much at sea as was Columbus when he set sail to discover America. He felt sure there was a new world somewhere, but the currents leading to it were unknown. So with us. We are sure that fruit growing will be a successful and profitable industry; but intelligence and thrift must teach the way to the deserved success. Such questions as soil and subsoil, the effect of exposure, of altitude, of shelter belts, of high or low-topped trees,

of systems of cultivation, of amount of irrigation, of pruning, mulching, manuring, cropping orchard lands, varieties, insect pests, blight, phylloxera—all these and many others confront the fruit grower. The old adage that "the many fail, the few succeed," will apply here. "The race is not always to the swift, nor the battle to the strong." Earnest effort, patient study, conservative progress, careful experimentation in the end will surely reward the laborer in the orchards, vineyards and fruit gardens of Colorado.

Reservoirs.

The small appropriation granted this department has not made it possible for me to give this subject the consideration that it deserves. No personal examinations have been made during the past two years to discover sites on the headwaters of the streams in the mountains, and the information gathered on this subject has come mainly from those who live or travel frequently among the little parks high up on the mountain side.

Information gathered from these sources leads me to believe that there are a large number of very favorable sites —such as extensive level tracts of flat or marshy land surrounded by mountains, with narrow outlets, forming favorable locations for dams of moderate dimensions, which will impound large areas of water, and which could be filled and discharged twice each year, thus reinforcing our streams, for both early and late irrigation. There are many opportunities to turn the waters that run off some of the higher mountains into the rivers on the western slope, into the head of the streams flowing down the eastern slope. I have seen quite large streams of water coming down from

the mountains in the direction of a low pass, that finally turn and find their way into the waters of the streams making for the Pacific ocean. A few days' work with pick and shovel would turn into some streams on the eastern slope sufficient water to irrigate hundreds of acres; and there is no doubt that, with an outlay not exceeding the cost of many of our irrigation ditches on the plains, an amount of water equal to their capacity could be diverted and carried over these low passes and put to a beneficial use, rendering hundreds of thousands of acres of land, now without the element that renders them of utility to man, in a condition favorable for settlement and cultivation. The extending of the capacity of some, if not all of the streams in northeastern Colorado, to irrigate the large areas of almost desert land that is practically worthless, by the construction of a system of storage reservoirs and canals diverting the waters of westward-flowing streams, is, in my opinion, a subject which should receive the attention, not only of our State Legislature, but that of the Congress of the United States. I am confident that the storage of water, and other methods of increasing the water supply for early and late irrigation, can be made a safe and profitable investment for capitalists, and the State should encourage such enterprises by proper legislation; and the General Government could well afford to grant subsidies of land to those who are willing to provide means to develop and render habitable an otherwise barren country.

With the more diversified methods of farming now coming into vogue, the requirements of early and late irrigation are increasing from year to year, till now the capacity of an irrigating stream is limited by the amount of water it furnishes in the spring and fall months; and any effort to increase the flow during these months is of the utmost importance.

The building of reservoirs for storing water for irriga-

tion purposes has not kept pace with canal building, even in districts where the waters of the public streams have been considered as all appropriated. With one or two exceptions, all those constructed within the past two years have been by private or individual enterprise, and the general verdict is that their cost is small in comparison with the benefit derived. So far, the sites chosen have nearly all been in the immediate vicinity of the land to be irrigated, and those which could be improved most readily and with the smallest outlay of labor and money. Thus the progress of reservoir building has, up to the present time, followed the plan of building ditches in early days.

When encouraged by some Government or State action and protection, we can look for an era in reservoir building on as grand a scale as our canal building has been of late, when compared with the small ditches of twenty years ago.

The Conservation of Water.

BY STATE CONTROL.

The year of 1886 was one of exceptionally low water in nearly all the streams in the State; yet the loss of crops from this cause was very slight. Probably in no year in the history of Colorado was there ever so many tons of the products of the soil brought to maturity with the same amount of water per ton as was done in the season which has just passed.

By an examination of the tables of discharge of the Cache la Poudre river for the three years of 1884, 1885 and 1886, it will be seen that the total volume discharged

during the months of May, June, July, August and September, of 1886, was less than that of the single month of June, 1884.

We may quite safely make the same statement regarding the other irrigating streams in the South Platte division. If the same low stage of water had occurred five years ago, I am confident the loss of crops would have been many times greater, with a much less acreage under cultivation.

In accounting for this increased duty of water, I attribute the encouraging state of affairs mainly to two causes: *First*—To a better knowledge from year to year of how and when to apply the water. *Second*—To the control the State has taken in the distribution of the waters of the streams among the legal appropriators, and to the authority the Water Commissioners have exercised in requiring its beneficial use for irrigating purposes.

It is encourageing to know that the old idea that "I am entitled to all the water my ditch will carry;" or "I have bought and paid for this water, and have a right to do what I please with it," is fast giving way to a better and more equitable as well as economical policy of puting more labor in the preparation of the soil, and in the final distribution of the water as well, thus leaving the large amount saved by this method to remain in the canals and main streams for the use of later appropriators.

This method of extending the irrigating capacity of our streams is, in my judgment, the first one to be encouraged and adopted, and should be supported (and required, if necessary) by proper legislation. If the State authority can be extended beyond the diversion of the public waters by the canals (which it now assumes under the existing irrigation laws) to a thorough and intelligent administration of a law requiring all parties entitled to the use of the

public waters to use their supply economically and only for a beneficial purpose, I am confident the time is in the far distant future when the building of reservoirs in some portions of the State will become an absolute necessity. Such legislation, I am led to believe, will meet the approval of the greater portion of the people interested in irrigation and in extending its usefulness.

Recommendations.

I respectfully renew some of the recommendations made in my last report, and offer a few others which the experience gained during the last two years suggests as important and should command the attention of the General Assembly.

I. Water Commissioners—(1). That the law be amended so that the time these officers and their assistants serve, and the salary that they be allowed, be fixed by the commissioners of the county, or counties, in which the water district may lie. (2). That the law be amended so that the Water Commissioners be protected in the exercise of the discretionary power conferred on them. (3). That police power be conferred on the Water Commissioners and their assistants to enable them to arrest persons violating sections 1734, 1754, 1755 and 1759 of the General Statutes of 1883. (4). That Water Commissioners be placed under bonds to faithfully perform the duties of their office.

II. That *all* appropriators of the public waters be required to build measuring flumes when required to do so by the State Engineer, and in case of neglect or refusal, the State Engineer may direct the Water Commissioner to build such measuring flume, and collect the cost in the same manner as the cost of public bridges or irrigating canals are at present collected by law.

III. That *all* appropriators of the public waters, who have not yet done so, be required to "prove-up," or establish their claims, under the existing laws, within a reasonable time.

IV. That the office of State Engineer be made the office of record of all appropriations of the public waters of the State, and provisions be made for the forwarding thereto, and filing therein, certified copies of all the decrees of courts awarding priority within the various water districts; and that it be made incumbent on all officers with whom filings are made under sections 1720 and 1763 of the General Statutes of 1883, to forward certified copies of such filings to the State Engineer.

V. That the present drainage act be amended so that procedure under it may be simpler and less expensive.

VI. That the law establishing the "inch" as the legal unit of measure of water be repealed, and the "cubic foot per second" be made the legal unit of measure of water used for irrigation purposes; and that the relation between the statutory "inch" and the "cubic foot per second" be established, in order that the term "inch" in existing contracts may be defined and expressed in an equivalent quantity of the proposed legal unit.

VII. That a board of commissioners for water divisions be established by law.

The necessity for such a board is apparent to all who have had practical acquaintance with the working of the present law. This board, composed of two or three commissioners from each water division of the State, and the State Engineer *ex officio*, should have the power to make rules and regulations, in conformity to law, for the guidance of Water Commissioners and appropriators in the various water districts.

There are many questions connected with the diversion, division and the use of water, and the subject of irrigation generally, that are not, as yet, covered by statute or court

ruling, and it would be a very great advantage to settle such questions promptly, as they arise; such settlement being subsequently open to review by the proper court.

VIII. Some legislation or court decisions should be had regarding the appropriation of water for domestic use; whether or not its use is subject to priority of appropriation; also, if the use of it for domestic purposes can be claimed only in its natural channel.

IX. In case of conflict between water districts in time of scarcity of water, the State Engineer, or some one authorized by law, should have the authority and be required to divide the water of the entire length of a stream, according to the order of the dates of priority of appropriation, as established by the courts or court having, by existing laws, jurisdiction over the adjudication of claims to water from the entire water shed.

X. The department of the State Engineer should be provided with a secretary, whose salary should not be less than $1,200 per annum; and be appointed by the Governor, on recommendation of the State Engineer. His duties should be similar to those of the secretary of the land board, or as far as such duties are applicable to the two departments.

APPENDIX.

Report on State Bridge

AT GRAND JUNCTION.

DENVER, COLO., Jan. 1, 1887.

To His Excellency,

BENJAMIN H. EATON,

Governor of Colorado:

SIR:

I have the pleasure of complying with your request for a report regarding the expenses, etc., of the State bridge across the Grand River, at Grand Junction.

The total cost of the bridge is as follows:

Masonry in north abutment	255.3	cubic yards.
Masonry in south abutment	165.22	"
Masonry in pier No. 1,	99.1	"
Masonry in pier No. 2,	97.2	"
Masonry in pier No. 3,	154.0	"
Masonry in pier No. 4,	205.3	"

Total	976.0 cubic yards, at $16.06	$15,674 56
Extra work on pier No. 1, $23 00		
Extra work on pier No. 2, 53 00		76 00
740′ .9″ iron superstructure, at $34,00 per foot		25,185 50
Excavation, south approach, 3,229 cub. yards, at $0.75		2,421 75
Embankment, south approach, 214 cub. yards, at $0.25		53 50
Embankment, north approach, 386 cub. yards, at $0.25		96 50
Square timbers to carry up supports for floor, as a substitute for masonry, 2,000 feet B. M., at $30 per M		60 00
Engineering and incidental expenses		1,367 05
Total cost		$44,930 96

Paid by Mesa county	$15,000 00	
Paid by State	20,000 00	
Due from State	5,000 00	
	$40,000 00	
Excess of appropriation		$4,930 96

On the twenty-first of December I received notice that the bridge was finished, and on the twenty-fourth proceeded to inspect and test the structure.

I found the bridge completed according to the contract and specifications. Both the masonry and the superstructure are first class in quality of material and workmanship.

I was not able to test the bridge to its full capacity. the load put on the longest span (157′9″) was as follows:

100 men, estimated at 155 lbs. each	15,500 lbs	
24 horses, estimated at 1,000 lbs. each	24,000 lbs	
8 wagons, estimated at 700 lbs. each	5,600 lbs	
1 load of stone, estimated at	6,000 lbs	
Total	51,100 lbs.	25.55 tons

One-half of this load was placed on the center of the span, the remainder was distributed between the center and the end of the span. The deflection of the span at the center when the load was upon it was 29-1000 of a foot, or about ⅓ of an inch. Upon being released of the load, the span came back to its original position, within 2-1000 of a foot. Considering the fact that this was the first load put upon the bridge, the test shows that the workmanship is not only excellently good, but almost perfect.

As you are already advised, it was thought best to change the original location to a point a short distance down the stream, in order to secure better foundations and enable us to take advantage of a less expensive approach to the south end, and to substitute an iron bridge throughout, on stone piers; for the one span which was to be sup-

ported on piling, as contemplated in the original plan. While this change increased the cost of the bridge somewhat, it is without question a wise one, as now the whole bridge rests on stone piers and abutments, all of which are sunk into the solid bed-rock.

I have examined the bills paid by Mr. Brink, the chairman of the board of county commissioners of Mesa county, and find that Mesa county has paid the sum required by law.

Respectfully submitted,

E. S. NETTLETON,

State Engineer.