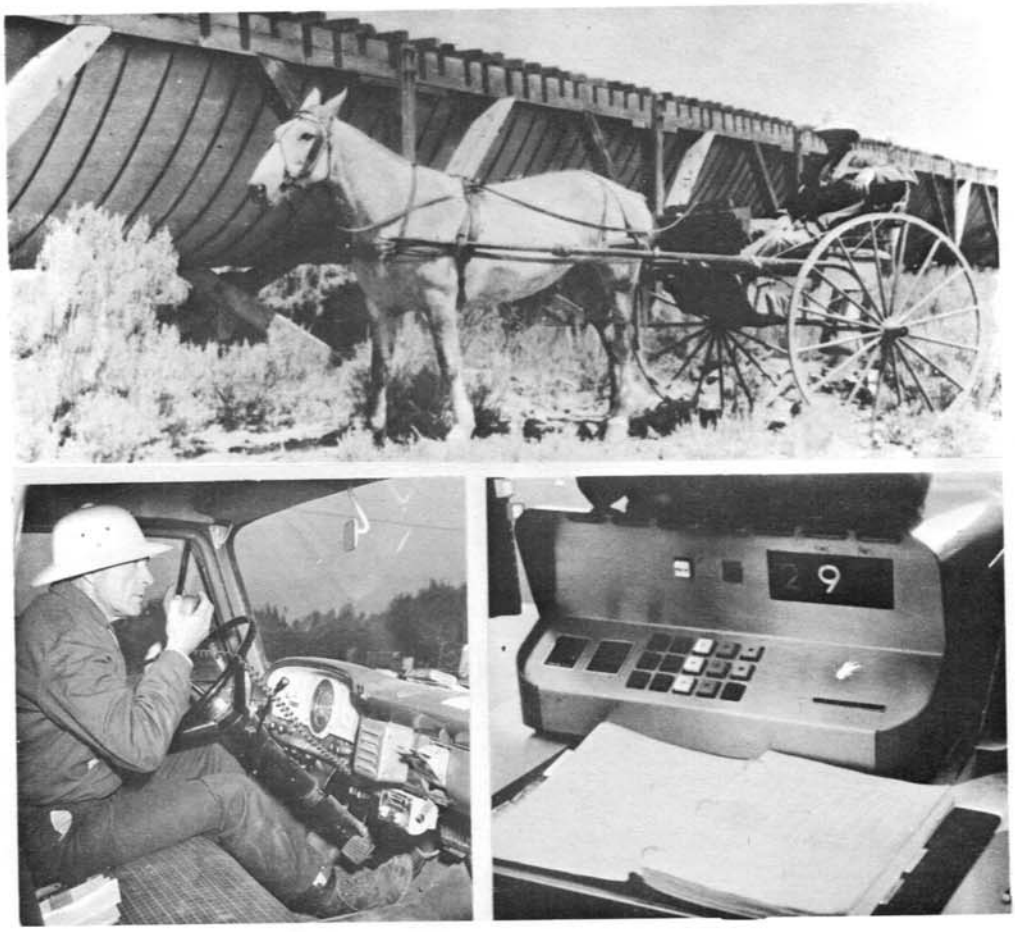
Department of the Interior, Bureau of Reclamation

IRRIGATION OPERATION AND MAINTENANCE

BULLETIN NO. 50

October, November, December, 1964



In This Issue:

Ditchrider Trainee Program

The Irrigation Operation and Maintenance bulletin is published quarterly, for the benefit of irrigation project people. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning labor-saving devices and less costly equipment and procedures, developed by resourceful project people, will result in improved efficiency and reduced costs on the systems of those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

* * * * *

Division of Irrigation Operations
Office of Chief Engineer
Denver, Colorado

The cover depicts the history of the work of ditchriders. The horse-drawn cart was used in 1916 on the Twin Falls North Side Project, Idaho. PX-D-45751. The second panel shows modern ditchriders communicating with headquarters from a radio-equipped vehicle. PX-D-45750. The third panel shows the console of a remote control system which raises and lowers the gates, and reports elevations of the gates and water surface at the headworks of a canal on the Salt River Project, Arizona. CTP25-D-36931-D.

IRRIGATION SAFETY OPERATIONS PROCEDURES FOR PUMPING PLANTS

With the approach of another irrigation season, it again becomes necessary to emphasize safe operations practice in regard to all pumping plants and relift stations. This applies to plant mechanics, helpers, ditchriders, electricians, and any others who may undertake to operate these plants.

The plant mechanics have been issued danger tags which are to be attached to the operating switchgear prior to irrigation season. When one of these tags is displayed, all personnel are required to secure clearance from the plant mechanic in charge or be accompanied by him before attempting to start any unit. These tags shall be dated and signed by the plant mechanic when attached and when removed, and shall be recorded. The smaller plants may be tagged "OK", signed and dated by the plant mechanic where time will not permit him to be there personally.

The procedures listed below will be followed:

1. Operating instructions for all major pumping plants will be prepared or updated. These will stress safety cautions and procedures and will be mounted in permanent form in a prominent place on the control panels.

2. Instructions and training on safe operating procedures will be reviewed with plant mechanics by their supervisor.

3. The plant mechanic will inspect, clean and adjust all control operating mechanisms each year prior to the start of the irrigation season. Should an unsafe condition be noted during the operating season, arrangements for its correction shall be made between personnel of the field branch and the Technical Services Branch.

4. At least once each year the operating ditchrider and his watermaster will review operating procedures with the plant mechanic at each plant. When a different ditchrider is assigned a ditchride during the operating season, he shall be instructed as to the proper operating procedures for each pumping plant by the plant mechanic and watermaster prior to assuming responsibility for the ditchride.

5. If something goes wrong or is not working properly, the ditchrider is to notify the plant mechanic or watermaster immediately, giving complete information concerning the malfunction.

6. An operator shall report any mistakes which he may have made.

7. Do not block contactors in place with a piece of wood.

8. Shut off motors with pushbutton switches.

9. When burning weeds and rubbish, exercise caution not to burn the galvanizing off fences, rubber cover on flexible conduit canvas motor covers and any other combustible property around the plants.

* * * * *

March 19, 1964

To: Irrigation Managers - 440, 450, 460, 470

From: Acting Irrigation Supervisor - 400

Subject: Flooded measuring devices - revised procedures for operating irrigation system

During the past winter, letters were sent to many water users asking that deficiencies to measuring devices be rectified where the trouble originated in his system.

Response to the recent reminder sent to the same water users indicates that the majority have either taken care of the trouble or are making arrangements to do so. Some have not responded, either by action or card.

The following instructions apply for handling the delivery of water:

1. Ditchriders shall not permit the flooding of any measuring device unless they have written approval regardless of whether the water user received a letter about his flooding measuring device or not.

2. Those who received letters and still have their problem but intend to take care of it may receive their full water delivery order after the irrigation manager has cleared such action and after the water user's irrigation district director has concurred in a limited extension of time for the rectification work to be done.

3. Those water users who received letters and have not responded by action or mail shall have their water limited to the extent stated in the original letter until such time as they have made arrangements to take care of the deficiency. If

the water user did not receive a letter as to his deficiency he must correct the problem or have the flooding of the measuring device cleared by the watermaster.

It is expected that in handling items 2 and 3, there may be modifications to the system at the water users expense and in some cases concessions on the part of the project. All such actions, however, will be controlled by and be at the discretion of the irrigation manager and in some cases with the collaboration of the irrigation district director or directors.

J D Humes

* * * * *

Ditchrider Mileage Allowance

During 1964 you will be paid $0.10 a mile for actual speedometer mileage for the use of your privately-owned vehicle on your ditchride from the beginning of the irrigation season through April 25. From April 25 through August 29 you will be paid a beat allowance covering only the regular scheduled ditchride beat. If you are called out or have to go out, outside your regular working hours, to remove weeds, restart pumps, etc., you will be paid actual speedometer mileage.

From August 29 through the end of the irrigation season you will be paid actual speedometer mileage.

Mileage other than the regular beat ride must be reported on Form 115A (Statement of Travel-Mileage Claim).

Be sure that you and your watermaster sign the Form 115A. In filling out the Form 115A, it is not necessary to fill in the arrival and departure time columns.

58

* * * * *

GPO 844-644

CONTENTS

Ditchrider Trainee Program

CONTENTS--Continued

Our Fiftieth Issue

This is Issue No. 50 of a publication intended solely to provide a means of exchanging operation and maintenance ideas between irrigation project personnel and to serve as an outlet for general information that is deemed of value to project operators. In the past our publication was known as Operation and Maintenance Equipment and Procedures. For some reason it became known and was usually referred to as a "bulletin." Therefore, beginning with this, our "Golden" issue, we are officially calling the publication a "bulletin," and at the same time changing the name for brevity to Irrigation Operation and Maintenance.

In a large sense, we are only the editors of the "bulletin," publishing material prepared by people in the field who encounter an operation or maintenance problem and solve it through their own initiative and practical approach. It is surprising to find how many problems encountered on a project are common to other projects, and how often the means of solving the problems of one project can be adapted to local conditions on another project. We also have been pleasantly surprised to have so many of you share your ideas. We have never lacked material for the "bulletin," since we began publication in 1952. We wish to express our appreciation to all who have contributed to the success and usefulness of the "bulletin" which started with the first issue of 300 copies distributed primarily to Bureau of Reclamation constructed projects in the western portion of the United States. Requests for the "bulletin," worldwide now, require that we print 800 copies. Our readers are apparently interested in your means of solving irrigation problems, and we will continue to publish them in our renamed, but otherwise, unchanged publication.

Copies of all releases of the Operation and Maintenance Equipment and Procedures series except Releases No. 1, 3, 8 and 16 are available in the office of Chief Engineer, Attention: Code D-400, Building 53, Denver Federal Center, Denver, Colorado 80225. Release No. 1 is out of print and will not be reprinted; Releases No. 3, 8 and 16 were incorporated into Release No. 37 which was devoted to the subject of "Equipment for the Prevention, Control and Disposal of Weeds on Irrigation Projects."

* * * * *

IRRIGATION OPERATION AND MAINTENANCE
Bulletin No. 50

OCTOBER, NOVEMBER, AND DECEMBER 1964

Ditchriders and zanjeros, the latter a Spanish term used in the Southwest, designate the men who control the water deliveries and patrol waterways on irrigation projects in the United States. They are important to the successful operation of an irrigation project, and, undoubtedly have been since the practice of irrigation began. In addition to distributing the projects' water, and seeing that conveyance systems for handling this principal project commodity are in satisfactory condition, the ditchrider is an important public relations man, and a well-qualified responsible ditchrider or zanjero is an asset, in fact a necessity, in the satisfactory operation and administration of an irrigation project. It is fitting, then, that this our fiftieth issue of the bulletin be devoted to these men and their training.

As depicted on the front cover, time changes most everything. The first ditchriders must have made their rounds on foot, gradually utilizing other means of locomotion as it became available. In the United States the record shows that saddle horses; horse-drawn carts, buggies, and wagons; motorcycles; and other motor-driven vehicles have been used in making the project "rides," that the ditchrider must make in covering his "beat." The modern radio-equipped automobile is in contrast to the horse-drawn cart shown on the cover. If the past is an indication of the future, additional changes will occur, such as the automatic and remote control equipment depicted also on the cover that is now in use on the Salt River Project in Arizona. Such automation provides for greater efficiency, more rapid changes in distribution of water, and increased safety in project operation during emergencies. Nevertheless, the services of competent and well-trained men to maintain vigil in project operation and maintenance and in the maintenance of personal relationships between administrators and water users will continue to be necessary. It is suspected that these men will be "ditchriders."

A good competent ditchrider becomes such only after experience and training. Where large numbers are needed to staff new projects, this becomes a problem. On such projects, time generally does not permit inexperienced personnel to become sufficiently trained through practical field experience to assume the necessary responsibilities, therefore, supplementary training has become important in several instances. This supplementary training is the subject of this issue of the bulletin dedicated to the conscientious men who control the day-by-day distribution of irrigation water so vital to the economic life of a project.

* * * * *

DITCHRIDER TRAINEE PROGRAM

Introduction

One of the more difficult but recurring jobs on any irrigation project, particularly on the larger ones, is the proper training of ditchriders prior to their assuming full responsibility for their respective rides. Through a period of several years, the Columbia Basin Project, in central Washington State, with the approval of the Civil Service Commission, has developed a good system of training through which they put their new ditchriders each year, including a training school, just prior to the beginning of the irrigation season. The principles comprising the Columbia Basin training system and school are set forth in some detail herein with the thought that operators of other projects may wish to adapt some of these ideas to fit the needs of their own training programs.

The training program developed is designed to halve the time required to qualify a person to perform the work required. The training period is 26 weeks and the Watermaster is directly responsible for all trainees assigned to his section. This includes the classroom training, individual coaching, on-the-job training, and evaluation of the individual periodically during and at the end of the training period. For this latter purpose, a special form prepared for use on the Columbia Basin Project "Report of Ditchrider Trainee" will be found at the end of this article. Also, at the end of the narrative statement is an outline of the Columbia Basin training program which presents an idea as to how it is organized. It will be noted that 3 days are devoted annually to the intensive field demonstrations and special instruction. The "training school" curriculum includes 1 day of instruction and discussion of water measurement and measuring devices, with the morning of the first day spent in the field demonstrations. The second day is devoted to a discussion of ditchrider responsibilities and water records and the third day to relations with irrigation districts and farmers, preventive maintenance work in connection with daily water regulation and a field demonstration of preventative maintenance activities. This schedule may be revised or altered each year.

Water Regulation

The morning session devoted to field demonstrations, during which the trainees actually make dry-run regulations of water, covers the use of such regulating and measuring devices as checks, weirs, constant head orifices (CHO), meter gates and Parshall flumes. Making liberal use of the Bureau's Water Measurement Manual during the demonstrations and in the afternoon session of water measurement and measuring devices, the principles of measurement methods are discussed. Also discussed is lateral regulation as it affects deliveries, downstream conditions and other lateral systems.

Ditchrider Responsibilities

The duties of ditchriders are discussed in relation to progressive responsibility and reduced supervision as trainees receive additional training and experience. It is pointed out that the more experience and knowledge an employee has and the sooner it is applied, the better prepared he will be to meet the qualifications for a promotion. Working conditions, such as tour of duty, period of employment and working hours are explained and in some instances, actual public relation problems are cited. During the training sessions the ditchrider handbook is thoroughly covered. Much of the material presented to the trainees during their training period is summarized in brief form in the "Ditchrider Handbook." Supplements and corrections to this booklet are issued as necessary as conditions warrant or are deemed desirable. One present supplement is concerned with weed control; another with safety in equipment operation, another with safety in operating pumping plants, etc. The handbook is reprinted as an attachment to this issue of the bulletin.

Employment, Leave and General Duties

On the Columbia Basin Project, ditchriders are generally hired on a 12-month-duty basis. They must be generally available 24 hours a day during the irrigation season to meet operational emergencies, to perform emergency services and to assure efficient operation and adequate protection of the irrigation system. During the nonirrigation season, the ditchriders are utilized as canal maintenance men, equipment operators, truck drivers, etc., in the maintenance of the system facilities.

The ditchrider is, of course, responsible for the safety and proper operation of channels and structures in his area and prior arrangements are required for any absence from the regular beat during the irrigation season. Accordingly, leave of any type, annual or sick, must be arranged for in advance as early as possible, since scheduling for relief or substitute ditchriders can often be a complicated problem. Whenever possible, particularly if the regular ditchrider is to be absent for several days, it is better to allow the substitute rider to spend several days with the regular ditchrider and become gradually acquainted with the ditchrider beat prior to taking over his beat.

Hours of Work

The regular workweek for ditchriders on the Columbia Basin Project is Monday through Friday from 7:30 a.m. to 4:00 p.m. each day with a half-hour lunch period. A tour of duty of 8 hours on Saturday or Sunday of overtime is required during the irrigation season each week.

Water User Relations

The general relations with water users and the importance of treating all alike is stressed in the training school. Further, the employee is instructed to be very careful about giving advice to water users concerning their farm operation. Information on farming operations is available from the Soil Conservation Service and County Agents, and farmers should be courteously referred to these agencies when farming questions arise. The acceptance of gifts of any type by employees is called to the attention of new personnel, explaining that the practice must be avoided since it can jeopardize a ditchrider's position and result in questions concerning his ability to perform his duties impartially.

On the Columbia Basin Project the law requires that water be paid for in advance of deliveries. The ditchrider is instructed to deliver water only to those farm units which his watermaster or branch office has informed him are eligible. When a water user has used up the amount of water he has paid for, it is his duty to shut off the water until notified by the watermaster or branch office that he has purchased additional water. Good public relations require that the water user be given advance notice before shutting the water off.

Agreements made between the farmers and the Government which constitute general operating policy may be revised or changed from time to time by mutual consent. The prospective ditchrider is informed concerning these agreements and also informed that it is his responsibility to understand these agreements and try to explain them to the farmer. In this way, better understanding is imparted to the ditchrider of project work and responsibilities and, consequently, a better working relationship is created between the ditchrider and his supervisor. In this same area of discussion, the project supervisors want the ditchriders to handle everything possible in the field and on the job, because they are closer to the detail operations; however, ditchriders are instructed to contact their supervisors (watermasters) if in doubt on particular cases. In the more difficult situations, even though corrective action has been taken, the supervisor should be acquainted with the circumstances. The ability of the ditchrider to handle complaints and problems without the assistance of the supervisor increases as experience is gained.

The ditchrider can help public relations by being familiar with the reasons for pertinent project regulations, as water users may sometimes be inclined to think that the project's regulations are arbitrary and feel the project administrators are being uncomprising and stern in enforcement of the regulations. When this occurs, a brief on-the-spot explanation by the ditchrider can go a long way to improving project water user relations. The difference between a good ditchrider and a poor ditchrider is often that a good ditchrider knows what he is doing and why he is doing it. The poor ditchrider is doing things from day to day without fully knowing why.

Ditchrider Beats

All of the ditchrides on the Columbia Basin Project are relatively similar in length, acreage and number of turnouts. However, one of the main things a ditchrider is instructed to keep in mind on any ditchride is the establishment of a regular schedule that will bring him to the same general area and turnout at the same time every day. When the water users can depend on such a schedule they will be able to have their water delivery request cards there and, if they so desire, may be able to be on the spot when water is turned on or off. Also, a regular schedule personally allows the watermaster or other supervisors to more easily make necessary field contacts with the ditchrider.

Water Orders

Before making any changes in water deliveries, the ditchrider will receive a water request card from the water user authorizing him to do so.

The project emphasizes the necessity of these water request cards as it is the ditchriders only authority to adjust a water delivery or to turn it on or off, unless the water user has used his water or definite word is received from the office that the water is supposed to be turned off.

The ditchrider can request water changes on 48 hours notice. Sometimes water can be delivered on 24 hours notice, and since water can be dispatched and moved within a 24-hour limitation, the Columbia Basin Project is not requiring 48-hour advance notice at this time. Undoubtedly, there may be cases in the future, as the number of users increases and a larger percentage of the lateral capacity is being used, that it will be necessary to have requests on a 48-hour basis; however, here again the water user should be served to the best of the project's ability.

The ditchrider should always remember that only as much water as has been ordered should be delivered, otherwise there is going to be some operational waste. When not needed, excess water should be ordered back into the system.

Locking Gates

Not only why gates are locked, but some of the benefits that are received from all gates being locked should be discussed with the prospective ditchriders.

Unlocked gates are a temptation to some people. There is always that certain someone who does not realize the total impact but only his own farm problems. Perhaps the turnout gate is on a bend in the lateral and all the weeds seem to jam into the gate, the farmer may want that

gate left open so he can clean out the weeds and save the ditchrider some trouble. The offer is commendable but the farmer will get into trouble some night and shut off the water. Having closed the gate, a couple of adjustable weirs on the end of the lateral may receive extra water. In the morning the ditchrider will find someone waiting for him with more trouble.

There have been cases of people cutting the chains and changing the gates in an emergency, and in other ways changing the rate of deliveries. Here again is a case of informing the farmers of the whole problem. His turnout is there to deliver his water; the rest of that lateral is there to serve other people. The ditchrider soon learns that any change made may necessitate changes to all deliveries on the lateral.

Another good reason for locking the gates is to avoid tampering by unauthorized persons such as fishermen, hunters, etc.

Pump Operations

The ditchrider not only must know the water users, but also must know their irrigation system and how they are using the water. The farmer whose water is supplied by pumps or who irrigates with sprinklers creates an entirely different situation than one with a gravity irrigated unit.

Some water users are served by project relift pumps so when the power goes off, the ditch is dry. However, delay restart devices are being placed on some of the project pumps and in case of a brief power outage, as soon as the power service is resumed, the pumps are automatically restarted.

People with sprinklers are one of the biggest offenders in not providing disposal or big enough ponds to store a 12- to 18-hour supply of water, another reason why the ditchrider must know his particular distribution system so that he may be able to plan ahead for emergencies.

Ditchrider Checks

Periodically, each established ride will be checked by the supervisor responsible. He will spot check measuring devices and record time of day and flow. As a followup to these checks, the supervisor will usually spend a day with a particular ditchrider on his ride and discuss the findings of his spot check. This type of check has several different purposes; it is of benefit to the project, to the watermaster and to the ditchrider himself in correcting deficiencies and helping to teach him more efficient methods of operation.

If a farmer is complaining about his water, the ditchrider should always investigate to see whether there is cause for complaint. He

should try to find out what the complaint is about, and if it cannot be resolved and if the farmer keeps complaining after the problem is explained to him, the matter should be reported to the watermaster.

Request for Repairs

Forms are available to the ditchrider to record not only repairs needed on the delivery system, but other situations that should be brought to the supervisor's attention, including seepage, erosion, etc.

Claims Against the Government

If a water user believes he has a complaint against the Government, the ditchrider should not agree, disagree, suggest, guess or suppose. The water user should be told to write the project manager and the ditchrider should make a report to his immediate supervisor.

Filling Pipelines

Ditchriders are instructed to use extreme care in filling pipelines. All available valves, turnouts, etc., should be opened and the pipe should be filled very slowly. Air trapped in a pipeline is compressible and with the tremendous weight of water pounding on it, high pressures can build up.

CHO vent pipes should also be kept clean as the effect of trapped air in this case reduces pipe area and thereby reduces the flow.

Weeds

Where noxious weeds, such as thistle, etc., are growing on rights-of-way, ditchriders are expected to treat or mark them for treatment. Portable spray cans are made available to ditchriders on the Columbia Basin Project. A good weed control program can only be maintained by ditchrider assistance in the investigation of any patches of weed on rights-of-way that are reported by farmers.

Rodents

Rodents can weaken canal banks and can be particularly disastrous around structures. The ditchriders should report all rodent activity and encourage rodent control by water users.

Encroachments

Because of problems that can be created during O&M operations, ditchriders may have to explain to the farmers the need to refrain from encroaching on rights-of-way. Common encroachments are: parking on ditchbanks, hauling produce on operating roads, using gates when cattle guards should be used, placing head ditches and other structures on rights-of-way where the space may be needed

to deposit spoil, stacking hay on rights-of-way, etc. In connection with encroachments, the ditchrider should not give advice which he is not sure about, but should report the encroachment if necessary after contacting the responsible farmer and explaining the problem.

Daily Reports

The water report is the ditchrider's report of accomplishment for the day and his order for what is needed tomorrow. On the Columbia Basin Project the report must be in by 4 p. m. to facilitate the work of others.

Record Keeping

All projects must have forms for record keeping. On the Columbia Basin Project, forms have been provided to facilitate uniformity of records on different colored paper stock for easy identification, as follows:

1. Diversion from canal - yellow
2. Wasteways - blue
3. Unit daily deliveries - white

A diversion is water ordered and for which responsibility is assumed by the ditchrider. Any changes in daily delivery are reported using the algebraic plus (+) and minus (-) signs. Wasteway flows recorded are those expected during the next 24-hour period. Unit daily deliveries are the quantities of water delivered to a unit during the preceding 24 hours.

As a part of the "trainee course" the turnout numbering system and map symbols for the different types of turnouts, pumps, checks, etc., are explained. Also a part of the course is a "ditchride problem" in which it is assumed that each trainee has to take over a ditchride without previous experience in record keeping, assuming that methods of regulation are known. Printed copies of a small lateral and farm unit map are distributed to the trainee which show the ride to be covered, and ditchride books containing diversion, delivery and wasteway sheets are passed out to each trainee to record each day's activity. Turnout discharge tables also are distributed for each of the different types of turnouts on the ride.

The "ditchride problem" starts with a "dry-run" over the lateral map noting and explaining all turnouts and getting a general idea of what is ahead. Each man individually assumes that he is the rider taking over and fills in his ditchride book as the group proceeds together down the lateral. Aside from recording the proper water delivery, the special circumstances that might be encountered, such as those given below, can be explained:

1. Diverting water into the head of the lateral to fill new orders taking into account the amount of waste at the end that can be used and also adding ditch losses that may require a greater diversion than the actual new orders.

2. Single unit delivery laterals with measuring device at the head and the application of a considered ditch loss allowance.

3. Diversion to a sublateral with four deliveries without a wasteway.

4. Units having two turnouts, and therefore two delivery sheets, but one water balance from which both deliveries must be subtracted.

5. How to handle water charges on relift pumps when power outages shut the pump off and curtail the delivery for several hours. Charging only for the hours run, divided by 24 times the discharge at the previous visit.

Example: Ran 8 hours at 2.00 cubic feet per second

$$\text{charge } \frac{8 \times 2.00}{24} = 0.67$$

6. Checking each turnout delivering water to determine previous 24-hour charge prior to making any changes or checking gates for weeds, etc.

7. Evening report of diversions, deliveries and waste which summarize what was done for the day with the water and whether or not more water is needed tomorrow (plus) or whether water is to be put back into the main lateral (minus).

8. Water request cards for turn on, turn off or changes must be handled and recorded in the ditchride book in the space provided and on the proper day.

9. The policy on the Columbia Basin Project is to never charge the farmer for more water than he orders. If he receives less than his order, charge him with what he receives.

10. How to charge if a weed is in a headgate and there has been a reduced flow for an unknown time. Policy on the Columbia Basin Project is to assume the headgate has been plugged for the previous 24 hours.

11. Constant head orifice corrections when gage differential is other than 0.20 foot should be applied to get a corrected discharge. Correction factors are available on the CHO tables and should be used. For example:

CHO set for 2.00 cubic feet per second, gages differential is only 0.15 foot. To get the proper charge select the correction factor for a head of 0.15 which is 0.87 x 2.00 = 1.74 charge.

12. Water purchase sheets sent to the ditchrider are the formal notice that water may be delivered to a unit. Verbal notice is often given from the office so that the ditchrider will know of new purchases in case the mail delivery is delayed.

13. Enter the amounts of supplemental purchases in the ditchride book and update the proper balance.

14. Limit the entries on any one order card to a single turnout. Units with more than one turnout should use a different card for each turnout to avoid confusion.

It is most important that a new employee understand that the ditchride book should be a complete record of everything that transpired each day on the ditchride. Nothing should be left to the imagination or memory.

Units of Water Measurement

The units of water measurement are covered in detail in the Columbia Basin Project training course and are presented as a part of the discussions so that questions may be encouraged. A few of the problems that might elicit other questions are given after explaining some of the more commonly used terms. The problems are then worked by the trainee and later discussed. Some of the typical problems are being included herein.

Cubic-foot-per-second

The basic unit of water measurement used on the Columbia Basin Project is the cubic-foot. This is a volume of water. Water deliveries and measurements are made and recorded in cubic-feet-per-second (cfs), a rate of flow of 1 cubic-foot of water passing a given point every second, not to be confused with a volume measurement.

In practice it works out like this, if a cubic-foot of water per second is delivered for 60 seconds, the total volume of water delivered will be 60 cubic-feet.

Second-foot-day

The two most common volume units of water measurement used on the project are the second-foot-day (sfd) and the acre-foot. One second-foot-day (sfd) is the amount or volume of water that has been delivered when 1 cubic-foot-per-second has been running for 24 hours or 1 day. Thus, 1 second-foot-day.

Problem No. 1

If a second-foot-day is the amount or volume of water delivered when 1 cubic-foot-per-second has been running for 24 hours, what is the amount or volume of water in cubic-feet that has been delivered in that 24 hours?

Ans.: $\frac{1 \text{ cu ft}}{\text{sec}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times 24 \text{ hours} = 86,400 \text{ cu ft}$

Problem No. 2

Two cubic-feet of water per second delivered for 24 hours would be 2 sfd. If 1 cubic-foot-per-second was delivered for 72 hours, how much water would that be in sfd?

Ans.: $1 \text{ cfs} \times \frac{72 \text{ hr}}{24 \text{ hr}} = 3 \text{ sfd}$

Acre-feet

The second volume measurement in use is the acre-foot. This is the amount of water necessary to cover 1 acre 1 foot deep. There are 43, 560 square feet in an acre.

Problem No. 3

How many cubic-feet are there in an acre-foot of water?

Ans.: $43,560 \frac{\text{sq ft}}{\text{acre}} \times 1 \text{ foot} = 43,560 \frac{\text{cu ft}}{\text{acre-feet}}$

Problem No. 4

If there are 43, 560 cubic-feet per acre-foot and 86, 400 cubic-feet per sfd, how many acre-feet are there in 1 sfd?

Ans.: $\frac{86,400 \text{ cu ft/sfd}}{43,560 \text{ cu ft/acre-feet}} = 1.9835 \text{ acre-ft/sfd}$

Problem No. 5

How many acre-feet in 2 cfs running for 24 hours?

Ans.: Two cfs running for 24 hours = 2 sfd = 2 x 1.9835 acre-ft = 3.9670 acre-feet or approximately 4 acre-feet.

Measuring Devices

Other matters covered in general discussions includes an explanation of the Constant Head Orifice and the effect of gate opening, variable head and/or tailwater; an explanation of weirs, including rectangular suppressed, rectangular contracted and Cipolletti types and weir boxes. Covered thoroughly are the effects of all types of approach channels, the velocity distribution going through the weir structure and also velocity of approach. Use of weir tables for estimating discharge at rectangular checks, etc., is demonstrated and a comparison of suppressed vs. contracted rectangular weirs is discussed as well as the reasons leading to the Cipolletti design and principles.

The streamlines of contraction in flow over weirs and their reduction in discharge, maintenance of the depth of pool below a weir crest to a minimum of 1 foot, as well as keeping side clearance above minimum, and measuring the flow over the weir by turning of the weir gage at a 45° angle when measuring with gage numbers turned upstream, are discussed in relation to proper measurement methods and procedures. It is also pointed out that there are correction factors available in handbooks for measuring water through submerged weirs, but that this practice is discouraged and farmers should be informed of irregular delivery under submerged conditions.

The ditchriders are instructed that inspections should be made by all riders on every CHO, by checking gate opening, comparing stem measurement with actual gate opening and always setting gates on the upturn so that tension is kept on the threads; by checking gages, closing back gate and open front gate, read gages to see if one of two conditions exist: (a) the gages are level or (b) there is 0.20-foot differential; and to be sure there are no rocks or other foreign objects or materials in vicinity of a gate opening to reduce the area and discharge.

Some of the advantages and disadvantages of various measuring devices are covered. For instance, meter gate turnouts are relatively inexpensive to build but are undesirable for the type of operation involving frequent changes. Adjustable Cipolletti weirs on a common distribution box must be regulated one in relation to the other, not set independently. When these weirs are preset with the proper relation between the weirs, the water will distribute proportionately.

Control Structures

Lateral regulation with control structures to minimize ups and downs and their resulting effect on all types of measuring devices are demonstrated and discussed. Preference for carrying all checks 0.05 to 0.20 foot over overflow portions of structures as a maximum are explained as permitting both slight ups and downs

of the water level with a minimum effect on upstream turnouts. By carrying and maintaining this overflow, an overflow ratio of 3:1 results, i. e., on a check and pipe inlet. At such a control there is a 3-foot check opening but with water flowing over all three sides there is a 9-foot overflow width.

Storage Between Checks

Another operating problem called to the attention of the trainees includes water storage between checks and the fact that such storage can be appreciable and, consequently, can greatly delay the movement of changes through a lateral system. Also, if performed regularly, check regulation is simpler than changing or correcting each turnout.

Field Observations

A further general discussion on regulation, especially setting checks and understanding water movement, was carried on during a field trip with some of the points covered specifically being:

Cipolletti weir - examination of weir pool, use of gage on weir crest and checking submergence.

CHO - setting opening and gages, further explanation of normal operating criteria and what to look for to explain possible changes in flow.

Check regulation - time-saving arrangement of check boards.

Weir box - checking baffle and weir gage.

Adjustable weir regulation - detailed methods of regulation.

General Operation and Maintenance Policy

All dealings with the water users should be on a businesslike basis. They are members of organized irrigation districts conforming to state law, and also contract with the United States for repayment of the reimbursable costs of project construction. The ditchriders should understand that the general project business operation as well as its operation and maintenance policies and this subject is included in the "trainee" curriculum. For instance, it is explained that the Columbia Basin Project is organized into three irrigation districts - Quincy, East and South; that each has a board of directors selected from the farms within their district and set up to take over the operation and maintenance at some future date; that each irrigation district has full-time secretaries to whom the farmers pay their water charges and through whom many problems are passed on to the Bureau; and that a joint board composed of members from each of the three district boards also exists.

Changing cfs to sfd or acre-feet is changing rate of flow into a volume.

1 cfs for 60 sec = 60 cu ft

1 cfs for 1 hour = 3, 600 cu ft

1 cfs for 24 hours = 86, 400 cu ft

$$\frac{86,400 \text{ cu ft/day}}{43,560 \text{ cu ft/acre-feet}} = 1.9835 \text{ acre-ft/day}$$

As a matter of general information, 1 sfd can cover approximately the following per day:

2 acres - 1 foot deep

4 acres - 6 inches deep

8 acres - 3 inches deep

Also 1 cfs running for 10 days would cover 80 acres 3 inches deep, assuming, of course, there is no loss due to evaporation, seepage, etc.

Miner's Inches

The miner's inch will vary with the states. In the State of Washington 50 miner's inches - 1cfs or in 24 hours = 1 sfd. This unit of measurement, however, is not used on the Columbia Basin Project.

Gallons-per-minute

Gallons-per-minute is a term that is used occasionally and must be understood in relation to other volume terms, 1 cfs - 448 gpm. Gallons-per-minute (gpm) conversion to cfs is explained in the following problem.

Problem No. 6

Irrigation with 100 sprinklers where each head puts out 6 gpm will require how much water?

Ans.: 100 x 6 = 600 gpm, but to convert to cfs we must divide 600 gpm by 448 gpm = 1.34 cfs required.

Variations in sprinkler systems due to pressure changes resulting from moving the laterals or wear in the sprinkler nozzles often occurs. This must be considered in system design along with the ever-present need for waste disposal and/or storage capacity.

General Flow Equation

The general flow equation for water is:

$Q = AV$ (Quantity = Area x Velocity)

In this form the equation relates to open flow channels, turnouts, all measuring devices and pipelines. Adding a coefficient for type of opening, the equation becomes: $Q = CAV$. Velocity can be shown by the equation: $V = \sqrt{2gh}$, (Velocity = the square root of 2 x gravity x the head difference). Now writing the general flow equation: $Q = CA\sqrt{2gh}$.

The general flow equation is illustrated in the following example. Lets say A is the size of chute a band of sheep is going to run through. Velocity is the speed the sheep move and requires energy to be changed. If the sheep are prodded they move faster, energy is added. Velocity being a function of the head, theoretically, head is added to the sheep to speed them up. The coefficient "C" is the slowing down of the sheep as they near the opening which retards the average speed a little so the sheep won't get stuck. In other words, the coefficient is applied to account for the confusion that occurs entering the chute. The rate "Q" is the actual number of sheep that get through the chute in a given time expressed as x number of sheep per minute. Reference material cited for study by the trainees includes simple hydraulics and the Bureau's Water Measurement Manual.

Factors Affecting Measurements and Waterflows

Pressure

Pressure and its relation to head and waterflow and also its effect on different areas is also discussed with the trainees as these terms may be encountered in daily operations. For instance, 50 pounds of force spread over 1 square foot equals only 0.35 pounds per square inch. A head of water 10 feet high creates a pressure of only about 5 pounds per square inch (psi). Suppose this is in a pipeline with a manhole that has 5 psi pressure on it. If the manhole is 15 inches square it has an area of 255 square inches. Five psi sounds like a very small pressure and would lead one to believe that it would be a simple matter to remove the cover, but 5 psi x 255 square inches = 1,275 pounds.

Erosion

The relationship of area to velocity involving erosion can be explained by water trying to get around a weed in the ditch. The reduced area due to the space occupied by the weed causes increased velocity around the weed and results in erosion.

Other points that require explanation are that the Irrigation Division of the Bureau of Reclamation on the Columbia Basin Project operates and maintains the works; determines the dollars to be provided annually in advance by the Irrigation Districts; and collects the entire sum of the operation and maintenance costs from the districts. The districts make their collections directly from the water users.

Maintaining the System

It should be stressed that water charges are estimated in advance and are set at a level to cover, without any surplus, the year's O&M expenditures. Some years there may be a surplus and in others there may be a deficit. One may offset the other. If funds are consistently accumulated in excess of costs, reductions will be made in the water charges.

Each district adds a percentage to the Bureau's charge to cover their cost of operation and to build up a reserve. The fund is necessary because the Bureau must be paid in full each year by May 1. Also, the reserve will be required when the districts take over the operation and maintenance of the irrigation system some time in the future.

Construction Repayment

Construction repayment is not a part of any of the foregoing charges. Each block after the test year goes into the 10 development years still paying only O&M charges. During the development years every unit must pay the yearly minimum charge for water whether they use it or not. Charges are graduated during those 10 development years beginning at 70 percent of the average and ending in the 10th year at 135 percent of the average. In the 11th year the construction charge is added, but the cost of water drops back to the average of 100 percent on top of which is added the construction charge.

Charges are based, for equality, on land classification. Minimum purchase of water is for one-half acre-foot less than the allotment. Supplemental and excess water make up the remainder of water available to any unit.

Preventive Maintenance

Preventive maintenance is given emphasis in the ditchrider training, pointing out that it should be done a bit every day to prevent the necessity of major emergency repairs, including:

1. Keeping weed racks clean so the water passage is not restricted or can cause erosion, washed-out structures and overtopped banks.

2. Encouraging grass growth to stabilize banks. A good sod limits weed growth but streambank grasses growing in the waters edge trap silt and later will require berming.

3. Prevention of wind erosion of soil if the land is bare. Weeds or other vegetation may be of help in holding soil. Possibly the weeds are temporarily doing some good but seeding grass in the weeds should be tried.

4. Removal of rocks in laterals that catch weeds.

5. Repairing operation roads which may consist of hauling a few loads of gravel and dirt for sinkholes, etc.

6. Making temporary repairs on small washouts. If the washout is too big when found, the water should be shut off first and a call made for help. The ditchrider must consider what can happen and weigh the values resulting if the water is shut off. Possibly the water can be taken in another lateral. The ditchrider must be careful about arbitrarily shutting off water, and in any event the watermaster should be notified of action taken as soon as possible.

Procedures in handling and repairing canal breaks are discussed. The fact that all breaks are different and present varied possibilities of control is stressed. The new employees are instructed that sacks or canvas should be carried to assist in stopping imminent ditch breaks and that baled hay and straw also are good tools for this purpose. They are informed, however, that at best, these procedures are only temporary, and accordingly, all possible regulations and diversions should be utilized to lower water levels in the vicinity of ditch breaks and that it may be possible to lower water levels enough to keep the water from going out through the break and still maintain deliveries to others on the lateral. The easiest way out, of course, is to turn the water off at the head of the lateral but with a little thought, the flow or a reduced flow might be maintained for deliveries.

One of the most important preventive maintenance jobs will be to develop a plan, even a very loose flexible plan, of attack when confronted with an emergency. A good ditchrider should be thinking all the time and take very little for granted.

Rodent control, covered very briefly previously, is becoming more important every year as stands of grass mature and spread on a new project such as the Columbia Basin. Gophers, squirrels, badgers and mice are of direct concern. Ditchriders will be expected to do a certain amount of trapping and poisoning.

Repairs should be made to damaged structures regardless of who caused the damage. Bent gate frames or broken gate wheels should be reported in the proper manner.

In pump operation, some of the things a ditchrider will need to watch are:

1. Lubrication, grease fitting or oil reservoirs for the main bearing will be filled by the pump maintenance man, more commonly called the plant mechanic.

2. Vibration, their causes and control, i. e., throttling a pump down too low or imminent bearing failure, etc.

The ditchriders were instructed concerning the data on relift pump operation that must be reported.

Pump motors must be kept clean and free from such accumulation as spider webs, dirt and occasional bird nests. Overheating for a particular motor should be checked, but it should be remembered that some motors are designed to run hotter than others. Loose connections can cause excessive heating or complete failure. Normal vibration will cause connections to loosen and the ditchrider should be alert to such possibilities. Motor and pump controls, the maze of relays, etc., all have important functions mainly of concern to the plant mechanic. Any malfunction that may be encountered in starting or stopping a pump should be reported immediately.

Float switches activated by the water can shut a pump off if the water level drops below a safe depth. It should be checked for freedom of operation to insure that it will move up and down with changes in water level.

Weed Control

Weed identification is also an important function and if the ditchrider finds a patch of weeds, he should identify the species, treat it properly and/or report its existence to the watermaster or weed control specialist for the area. The weed control program consists of three factors: (1) prevention, (2) control as a means of prevention, and (3) removal. Prevention is the process of seeding grasses to inhibit weed growth. Control is usually a chemical process of stunting the weed growth and planting grass with the weeds as protection. Removal is the bailing out from the laterals of windblown weeds that were not prevented or controlled. Using photographs the trainees were drilled in weed identification and it was emphasized that the common procedure to be followed by a ditchrider who locates a weed patch is: Locate, identify, mark, notify, kill and check back to assure kill.

The training sessions were brought to an end with a field trip for observance of weed control and preventive practices, both good and bad.

Summary

Summarizing the series of training sessions the major responsibilities of a ditchrider position were pointed out. It was emphasized that the

structures and equipment used daily by the ditchrider are valued at thousands of dollars and misuse or mistakes can cost additional thousands.

The training program is intended to acquaint the trainee ditchriders with as many facets of his job as possible in the hopes that through subsequent supervision, training and experience he can assume the full responsibility of a ditchride and become an important member of an important business venture - that of delivering and selling water.

APPENDIX

Outline

Ditchrider Training Program

Part 1 - Training School

Place:

Dates: Three days annually

Time: All day meetings, beginning at 8:30 a.m.

First day

Instructor:

Reference: Water Measurement Manual

I. Morning Session - Field Demonstrations with Trainees Making Dry-run Regulations

A. Weirs
1. Inspection of weir pool and farm weir
2. Delivery elevation instructions
3. Dry-run delivery and measurement
4. Submerged weir measurement
5. Weir box - discussion of characteristics and dry-run delivery and measurement along with checking 0 setting of gage
6. Adjustable weirs two or three in one location and dry-run water change on one delivery
7. Actual setting of a portable weir for single delivery lateral allowance determination

B. CHO (Constant Head Orifice)
1. Determination of size
2. Set 0 opening on orifice gate
3. Checking gage settings
4. Go through procedure for water delivery and change in diversion of delivery
5. Discussion of farm operations on delivery. Delivery elevation, etc.

C. Meter gate
1. Checking 0 gate opening
2. Head measurement
3. Check on meter well operation
4. Go through procedure for making delivery or change in diversion or delivery

D. Parshall flumes
   1. Visit to one of these if possible
   2. Go through measurement procedures

E. Lateral regulations
   1. Dry-run lateral diversion check regulation
   2. Downstream delivery change from lateral and check regulations continuing downstream making regulations as time permits

II. Afternoon Session - Water Measurement and Measuring Devices

A. General flow equation
   1. $Q = AV = A \times C\sqrt{2gh}$
   2. Determinations of A
   3. Determinations of H
   4. Determinations of C
   5. Tolerances or limits of accuracy

B. Weirs
   1. Cipolletti, rectangular, rectangular suppressed (weir boxes) sharp and broad crest
   2. Proper installation and maintenance of proper physical features for accurate weir measurement. Explanation of effects of each (page 9 of Water Measurement Manual).
   3. Approved method of measuring head over weir with weir gages and explanation of reasons for using this method
   4. Importance of clean weir pool and weir crest and opening being free of weeds, grass, etc.
   5. Submergence of weirs, submerged weir graphs and tables, quick calculation of flow over submerged weirs (upstream measurement in cfs one-half downstream measurement in cfs = discharge)
   6. Adjustable weirs - methods of regulating two or three located in the same weir pool or pipe division box
   7. Use of portable weirs for determination of lateral loss allowances for single delivery laterals

C. Constant head orifices
   1. Size of orifice determinations
   2. Checking or setting of 0 - gate openings
   3. Checking gage settings
   4. Explanation of advantages and disadvantages of this measuring device, proper procedure for making regulations, the functional purpose of each gate, influence farm operations have on flow variations, etc.
   5. Proper procedure for making water changes or water regulation

D. Meter gates
   1. Relationship to CHO or other orifice-type measuring devices
   2. Setting of zero gate opening
   3. Function of check facilities in caboose similar to that of backgate of CHO
   4. Method of measuring head
   5. Checking meter wells to see if they are functioning properly

E. Parshall flumes
   1. Characteristics of Parshall flumes
   2. Method of water measurement

F. Principles of other water measurement methods
   1. Use of current meters and recorders
   2. Measurement over check boards for waste measurements, checks on lateral losses, etc.

G. Units of measurement and terminology
   1. Gpm, miner's inches, cfs, sfd, acre-ft

H. Lateral regulation as it affects deliveries, downstream conditions, or other lateral systems

Second day

Instructor:

Reference: Ditchrider's Handbook

III. Morning Session - Discussion of Ditchrider Responsibilities

A. Personal conduct
   Hours of work

B. Operating a ditchrider beat
   1. Establishing a regular beat
   2. Payment in advance
   3. Water orders
   4. Water request cards
   5. Locking gates
   6. Filling pipelines

C. Inspection and maintenance of a beat
   1. Weeds
   2. Rodents
   3. Encroachments
   4. Farm structures affecting delivery
   5. Claims

D. Daily reports

E. Contacts with water users
Inquiries and complaints

IV. Afternoon Session - Water Records

Instruction and actual practice in interpreting and maintaining the following water records:

A. Canal diversion record

B. Daily deliveries

C. Wasteway records

D. Water request cards

E. Water purchase notice

Third Day - Morning Session

Instructor:

V. Relations with Irrigation Districts and Farmers - E. H. Neal

VI. Preventive Maintenance Work in Connection with Daily Water Regulation

A. General maintenance, Marvin Sektnan, Assistant Irrigation Manager, East Low Field Branch

Suggested items for discussion:
1. Effects of tumbleweeds, cattail growth, etc., on erosion control in laterals
2. Use of weeds, etc., to control bank erosion
3. Proper procedure for cleaning weeds from a lateral that is full of weeds (work from end upstream)
4. Checking turnout gates for weeds
5. Methods of available means of checking or temporary repair of incipient washouts - bags of sand, canvas, baled straw, etc.

B. Relift pumps - G. R. Burrows, Chief, Maintenance Engineering Branch, and Warren Heldenbrand, Pump Maintenance, Franklin Field Branch

C. Weed control - Delbert Suggs, Weed Specialist
Weed identification, hand spraying weeds, soil sterilants, etc.

Third Day - Afternoon Session

VII. Field Trip to Demonstrate Preventive Maintenance Work

Delbert Suggs

1. Grass plantings and identification
2. Erosion control by grass growth
3. Possibly some weed identification

Bill Gray

1. Bank erosion by wind
2. Water erosion of banks in sandy laterals
3. Weed racks (purpose and maintenance)

Personnel
Watermaster
Branch
Division

REPORT OF DITCHRIDER TRAINEE

For Month of _____

Name _____ Date Entered Program _____

Item	Assignment	Length	Follow-up by Assistant Irrigation Manager
1.	Accompany experienced Ditchrider (preferably an Assistant Watermaster candidate) when he performs the following duties.	1 day	Date and Comments:
	a. Checking with Watermaster Headquarters for changes in water orders or special instructions.		Completed
	b. Diverting water from canals to laterals, or from laterals to sublaterals in amounts required to fill day's orders.		
	c. Regulating water velocity and depth in laterals.		
	d. Reading measuring devices at farm turnouts, computing quantities delivered, and making adjustments to accomplish increases or decreases requested by water users.		
	e. Recording water measurements.		
	f. Operating and servicing pumps.		
	g. Inspecting channels and structures for proper functioning, and performing minor maintenance such as weed removal.		
	h. Assisting water users with problems referred them.		
	i. Advising Watermaster Headquarters of water requirements for the following day.		
	The instructor will explain the method and purpose of the tasks described; also, special problems ofhis ride such as estimating loss allowances for long channels, handling water in laterals lacking wasteways, etc. He will answer questions concerning the work, particularly regulation and measurement of water.		
2.	Accompany another experienced Ditchrider or the Watermaster over a different ride. Instructor will perform duties described in Item 1. The following day the Trainee will perform these duties assisted by the instructor. Since results of water regulation in channels and to individual farm units are not immediately apparent, the Trainee will make regulations on the third day in order to observe the results of his regulations the previous day. Instructor will explain the purpose and method of each step, have the trainee perform the work to insure that he comprehends the instructions, check closely to prevent erroneous water deliveries, and answer questions.	3 days	Dates and Comments: Completed
3.	Assume ditchride under direction of the Watermaster or Relief Rider. Trainee will receive specific instructions regarding changes to be made in water deliveries and assistance in calculating water orders; and his water measurements and regulations will be checked for accuracy by instructor.	6 days	Dates and Comments: Completed

Monthly Report of Ditchrider Trainee (Continued)

Items 4, 5, 6 and 7 must total 24 weeks with minimums and maximums as shown below:

Item	Assignment	Length	Follow-up by Assistant Irrigation Manager
4.	Take over ditchride under close supervision of the Watermaster or Relief Rider. Supervisor will consult with Trainee before during and after the day's ride to answer questions; he will also review daily water orders and assist trainee to determine required system changes and water orders.	6 - 12 weeks	Dates and Comments: Completed
5.	Patrol the more critical areas of the main canals during night hours. Trainee accompanies an experienced ditchrider for several days; then is assigned to job with frequent follow-up by instructor to check on work practices and answer questions.	0 - 10 weeks (Not applicable in all Branches)	Dates and Comments: Not required
6.	Under close supervision of a person skilled in irrigation maintenance work, perform several of the following jobs, or similar duties:		
	a. Clearing weeds from channels.		
	b. Planting grass.	Nov. 18 - on East Low Canal - 1 day	
	c. Identifying weeds and using appropriate eradication measures.		
	d. Repairing concrete pipelines.	Nov. 1, 4,5,6,7,14,15,27 - 9 days	
	e. Building forms for concrete for uses in repair and modification of irrigation structures.		
	f. Cleaning sandblasting, and painting metalwork.	Nov. 19, clean off cables and metal work at checks on East Low Canal - 1 day	
	g. Helping Plant Mechanics to remove, dismantle, and repair irrigation pumps.	Nov 8, 12, 13 - 3 days	
	h. Removing and repairing irrigation structure gates and regulating devices.		
7.	Heavy equipment: Assist qualified operator in capacity of oiler, or helper. Performance of the following type duties will orient Trainee to the machine:	Individual coaching 1 - 3 weeks and on-the-job training.	Dates and Comments:
	a. Greasing machine.	Nov 22. Assist mechanic - 1 day	
	b. Removal of grease and dirt from machine including inside cab.	1 - week (not required for all Trainees)	
	c. Preparation of daily usage and maintenance records.		
	d. Advising operator regarding fences, power lines and other obstructions and hazards.		
	e. Stepping off footage.	Survey sand dune area fence line Nov 20-21 2 days	
	f. Inspecting cables for wear.		
	g. Checking machine while operating or idle for indications of maintenance or repair needs.		
	h. Assisting operator during breakdowns.	Total - 17 days	

Recommendation: Promotion _____ Further on-the-job training Yes Dismissal _____

Comments: Performed pipe leak repair under supervision of GS-5; Survey work - under supervision; Grass seeding and rodent control work performed under supervision.

R. W. Bolitho Nov. 1963
Watermaster

S/ Harvey Williams Branch Engineer
Assistant Irrigation Manager