WATER OPERATION AND MAINTENANCE

BULLETIN NO. 110

DECEMBER 1979

IN THIS ISSUE

UNDERWATER PATCHING SYSTEM STOPS IRRIGATION CANAL LEAKS
HANDLING OF EPOXY RESIN MATERIALS
TRAINING FOR DAM OPERATORS
DITCHBANK WEED CONTROL GETS NEW EMPHASIS ON ARIZONA FARMS
EYE PROTECTION NECESSARY
TCA (TURNOUT CONTROL ASSEMBLIES), A NEW INSTALLATION AT CUSTOMER WATER DELIVERY SITES IN THE SAN JOAQUIN FIELD DIVISION

UNITED STATES DEPARTMENT OF THE INTERIOR
Water and Power Resources Service

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for 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 Service offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

Any information contained in this bulletin regarding commercial products may not be used for advertisement or promotional purposes and is not to be construed as an endorsement of any product by the Water and Power Resources Service.

* * * * *

Division of Operation
and Maintenance Technical Services
Engineering and Research Center
Denver, Colorado 80225

The Putah South Canal of the Water and Power Resources Service's Solano Project near Fairfield, California. The project irrigates approximately 29 000 ha (72,000 acres) of land and provides a supplemental water supply for about 9700 ha (24,000 acres). It also provides municipal and industrial water for the urban and military portions of Solano County on the northern shore of San Pablo and Suisun Bays. Monticello Dam, creating Lake Berryessa, provides the water for the canal.

On November 6, 1979, the Bureau of Reclamation was renamed the Water and Power Resources Service in the U.S. Department of the Interior. The new name more closely identifies the agency with its principal functions–supplying water and power.

SI METRIC

Please insert the attached supplemental sheets in your copy of Water Operation and Maintenance Bulletin No. 110, December 1979. These sheets clarify the current permitted uses of the chemicals listed on page 11 in the article entitled "Ditchbank Weed Control Gets New Emphasis on Arizona Farms."

For reference purposes, please add the following footnote to page 11:

_/ Current permitted uses of the chemicals are discussed on pages 20 and 21. These permitted uses have been clarified by Gary W. Hansen, Pest Control Specialist, Water and Power Resources Service, Engineering and Research Center, Denver, CO.

WATER OPERATION AND MAINTENANCE
BULLETIN NO. 110

December 1979

INTRODUCTION

New epoxy paints and patching gels applied to underwater cracks in canal liners have proven to be very successful. See the article starting on page 1.

Safety precautions for handling epoxy resin materials are described on page 5.

A short writeup on the objectives of a training program for dam operators begins on page 6.

A revolt! Arizonans have started a revolution on ditchbank weeds by establishing permanent weed control programs. See page 10.

Use it, don't let it sit. Yes, as described on page 16, those safety glasses will save your most precious possession.

The San Joaquin Field Division's installation of improved electronic control equipment at customer delivery sites has cleared up many an operational problem as described on page 17.

UNDERWATER PATCHING SYSTEM STOPS IRRIGATION CANAL LEAKS[1]

by

James L. Birdsall

Leak repair in concrete liners of irrigation canals is being done successfully in California–without dewatering. The key to the repair method, which has been in use for over a year, is the use of new epoxy paints and patching gels which can be applied underwater where they dry hard, durable, and waterproof. These underwater epoxies combined with a unique and inexpensive two-component continuous pumping and mixing apparatus developed by Dredgemasters Company, Suisun City, California, make it easy and cost effective to repair canals while they are full of water.

The Solano Irrigation District (SID) which pioneered this new method of repair is located in northern California about 97 km (60 mi) north of San Francisco. SID provides and administers the drinking water and irrigation water for the surrounding area, including the cities of Vallejo, Fairfield, Suisun City, and Vacaville.

The SID receives its water from Lake Berryessa located about 32 km (20 mi) northwest of Vacaville. From Lake Berryessa the water flows down Putah Creek for 53 km (33 mi) through Lake Solano and into the Putah Canal, the main waterway into the SID. Putah Canal is a combination earth-lined and concrete-lined waterway. Upon entering the SID, Putah Canal divides into many small concrete-lined lateral canals or tributaries which carry irrigation water to the many farms located throughout the district. Water in the canals averages 3 m (10 ft) in depth. One particular canal near Dixon, California, was cracked, allowing water to flow through the liner. This caused flooding in a nearby cornfield. The farmer was unable to cultivate about 1.6 ha (4 acres) of his field properly due to the excess water and the flooding ultimately caused serious crop damage.

The Dredgemasters Company was contracted to repair the cracks. The canal could not effectively be dewatered for fear of further damaging the concrete liner. This is the case in many areas where the water table is high and emptying the canal could allow the pressure underneath to rupture the liner. In fact, during the California drought of 1974-1976, the California Aqueduct, which carries water to southern California, was severely damaged in this way.

The cracks in the Dixon Canal were, for the most part, underwater, although some continued vertically to the above-water portion. The cracks had occurred both at the vertical break

---

[1] Reprinted by special permission of the Editor, Public Works, from September 1979 issue. James L. Birdsall is Operations Manager, American Chemical Corporation, Palo Alto, Calif.

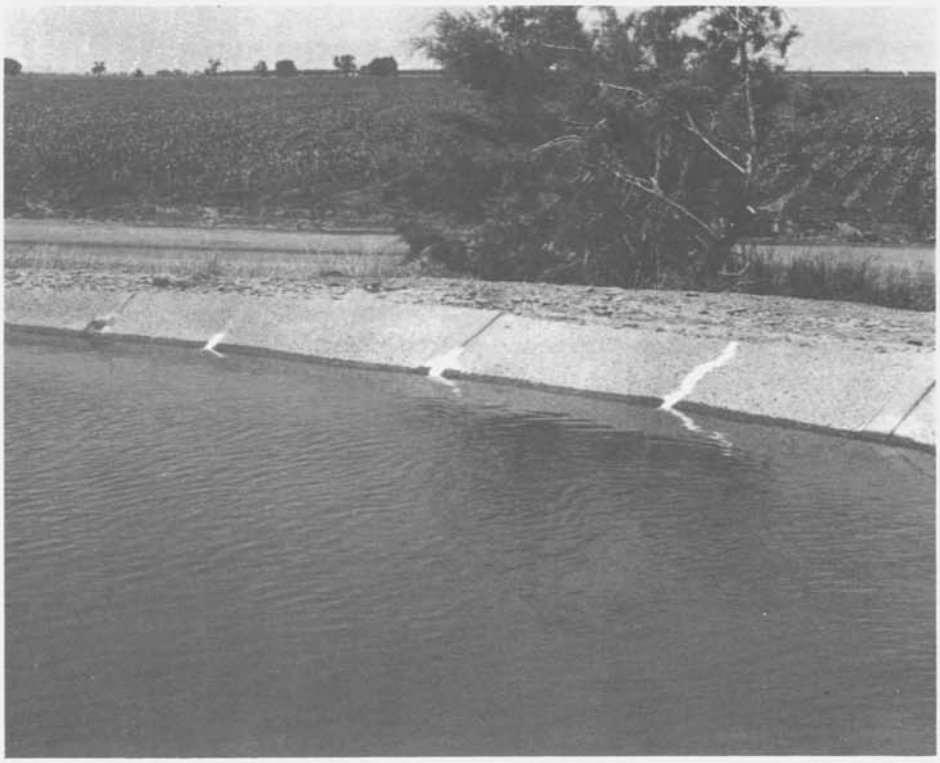

Figure 1.–Cornfield flooding ceased when patching material was applied above and below water level.

points of the poured liner and also in other sections of the liner running vertically and laterally along the wall of the canal.

According to Lonnie Lundsford, President of Dredgemasters, "The only way to seal this type of leak effectively is to use an epoxy sealer which will adhere underwater. Hydraulic cement may be used in some cases effectively, but it is difficult to work into very narrow cracks and does not give an absolutely watertight seal." The contractor uses Aquatapoxy from American Chemical Corporation in this type of repair. This material is a two-part epoxy/polyamine coating and patching system developed especially for underwater application.

When choosing an underwater epoxy system, it must form a tight waterproof bond with the concrete liner and be insoluble in water. If the material is water soluble, even to a limited extent, it will tend to cloud the water. In addition, since SID canals often carry potable water, the district specified that any repair material must be nontoxic and nonpolluting. The patching material was accepted by the California Department of Health and met all the SID requirements.

In many cases, it is better if the patch is the same color as the material being patched, so the epoxy should be capable of being tinted on the job. In this application, the patch was mixed in buckets above the surface of the water. The cracks were cleaned with a high-speed

pneumatic rotary steel wire brush. This also served to widen the crack and provide a good surface for proper adhesion of the epoxy. The mixed epoxy was applied to the crack underwater using a wide putty knife. The epoxy was spread over the crack, forced into the opening and then smoothed over about 100 mm (4 in) on either side. This stopped the water flow through the cracks immediately, and in 1 day the patch had dried hard and permanent. Within 12 hours, it was evident that the flooding in the field had stopped. The SID repair was made in the early spring of 1978 and as of this date, there is no evidence of failure.

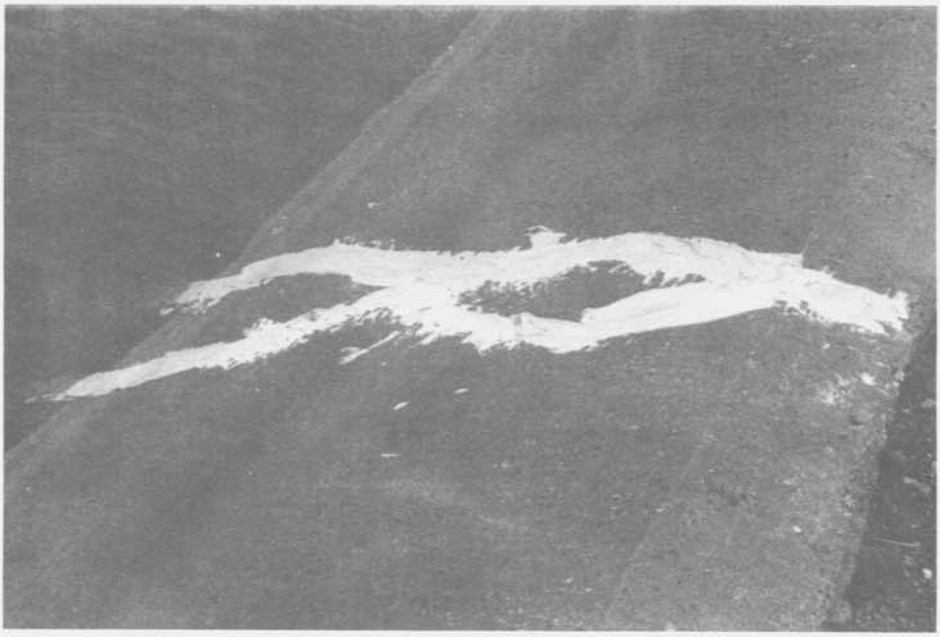

Figure 2.–Epoxy material applied to canal cracks underwater and above water.

For underwater continuous application where there are many long cracks, a compact high pressure pump and inline mixing apparatus is used. The epoxy material is held in drums, one containing resin and the other containing the hardener. The material is pumped through separate lines and then through accurate air control valves which proportion and limit the flow of material. The epoxy passes from the control valves into a mixing chamber which continuously mixes the material. One component of the system is pigmented red so that it can easily be determined if a thorough mix is being attained. An even pink color tells the operator that the mix is proper. Then the material passes out through the application head and is applied to the crack much the same way a caulking gun is used. The pump assembly remains above the water as do both epoxy drums. Using this method, a diver can apply material at a rate greater than 3 m (10 ft) per minute.

The problem of water leakage from irrigation canals is a serious one in many areas and repairs need to be made quickly. Not only does the leaking water cause considerable damage to

nearby land and crops, it can also flood into residential areas and cause leaky basements, mosquito problems, and serious erosion. The cost of water in the western states has risen drastically in the last few years and the loss of water through these leaks can be substantial. Agricultural water users and city and county officials in California have become understandably sensitive to any water loss after experiencing the severe drought of 1974-76. Water that is available must be conserved.

In some circumstances, it is more practical to repair concrete-lined waterways when they are dry. Maintenance crews can easily handle the job during routine maintenance tours using traditional materials. But, as has been illustrated above, this is not always economical or feasible. In this latter case, the patching method incorporating new durable underwater epoxies available today seems to be very practical and efficient.

* * * * *

HANDLING OF EPOXY RESIN MATERIALS[2]

Certain safety precautions are necessary when handling or using epoxy resin materials. Epoxies and especially their activators are chemical irritants which can cause severe skin irritations or other disorders. Protective creams, gloves, goggles, and clothing which is disposable or can be laundered before reuse, should be provided in all cases.

Safety equipment for handling epoxies should include:

Supply of polyethylene or rubber gloves
Goggles
Good supply of paper towels and disposal container
Bar of soap for hand washing (not a detergent)
Bucket or tub of wash water
Protective cream
Complete rain suit (rubber or plastic) for protection of epoxy handlers on extensive jobs
Respirators–if work is in a confined or poorly ventilated area

Every care should be taken to avoid contact of epoxy compounds with human skin; if skin contact does occur, the contamination should be immediately wiped off with a disposable wipe (paper towel) followed by immediate, thorough washing with soap and water. All personnel should be alerted to the potential hazard of using epoxies and carefully instructed to take all precautions necessary to avoid contamination which could result in discomfort or injury to the individual.

---

[2] Excerpted from Bureau of Reclamation Water Systems Management Workshop Notes, 1979, session on "Concrete Repair and Maintenance."

TRAINING FOR DAM OPERATORS[3]

It has long been recognized that operations personnel who operate dams and reservoirs play an integral role in providing maximum benefits and a safe operating environment at these facilities. Although training has been provided in the past in the Service, it has usually been infrequent and on an individual basis, rather than an organized effort involving all concerned personnel. Recognizing the responsibilities and the potential problems which could result from an improper operation or lack of proper maintenance, it was decided to set up a program for periodic training of Service dam operations personnel.

The main objectives of this training are:

- To acquaint dam operators with all facets of dam operation, both from a general viewpoint and specifically for the dams which they operate.
- To discuss and emphasize duties and responsibilities.
- To provide an awareness and familiarity with all operating documents and recordkeeping procedures needed to properly operate Service dams–Standing Operating Procedures, Designers Operating Criteria, reservoir allocations, etc.
- To provide adequate information to dam operators so proper and prompt decisions are made to best protect the dam and life and property downstream.

---

[3] Written especially for this publication by the Water O&M Branch, Division of O&M Technical Services, E&R Center, Denver, Colorado.

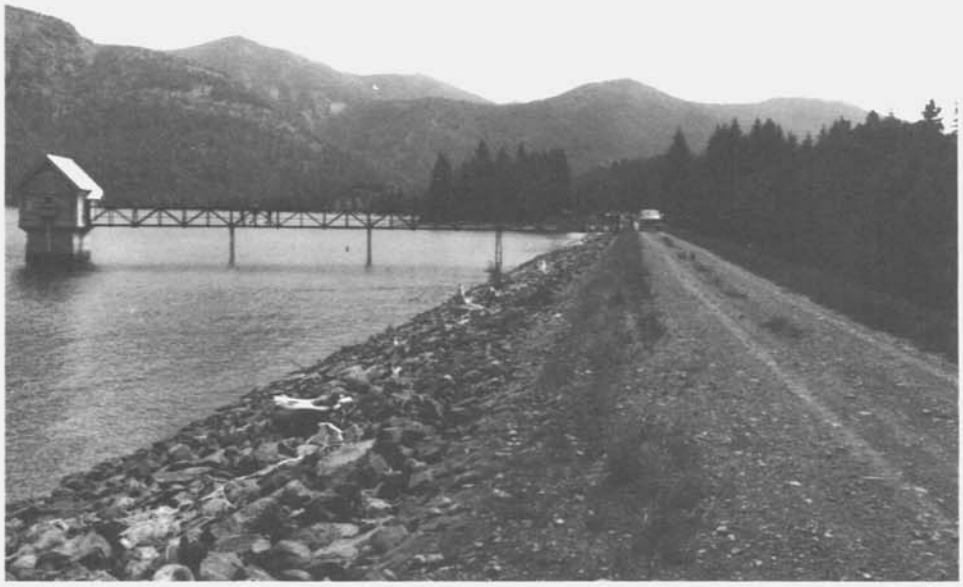

Figure 3.–Part of the dam operator's job is to provide frequent surveillance on dams such as this to detect problems and/or potential problems and initiate action to correct them.

Dam operators were involved in developing the training program to assure that problems encountered in the field would be included as part of the training. The final program consists basically of two parts. The first part includes discussion sessions on general matters related to safe and proper operation and maintenance procedures for dams and reservoirs. The second part is specific on-site training and includes discussions and operation of facilities and Standing Operating Procedures review by personnel who are responsible for operating and maintaining the facilities.

The following are the main items covered during the training:

General session (part 1)

Objectives
History of dam incidents
Hydrology and reservoir regulations
Instrumentation and structure behavior
Periodic and routine examinations
Operation and maintenance and safety procedures
Unusual occurrences and emergency procedures
Recreation management
Designers Operating Criteria (DOC)
Standing Operating Procedures (SOP)

O&M reference data
Operating agreements

On-site session (part 2)

Review of Standing Operating Procedures (SOP)
Connection of SOP deficiencies
Actual operation of facilities
Emergency procedures

Emphasis during the training is placed on documentation of or potential problems. In this respect, the requirement was established for an operating log at each dam in which all significant incidents and actions would be recorded. Regular surveillance and noting of changing conditions by comparing past conditions with the present were also emphasized. The ability to recognize unusual occurrences and the proper actions to take under various conditions are very important aspects of this training. O&M problems which could eventually lead to dam safety problems are also of primary importance.

Figure 4.–Measuring devices, such as shown above, are a simple and economical means of monitoring seepage at the dam. Records should be kept of all significant activities, such as this, at the dam and entered into the operating log as a permanent record.

As a minimum, attendance at this training should include operators who are directly responsible for operating and maintaining the dam and reservoir. It is also highly desirable for first-time supervisory personnel and/or those who may need to operate the facility on

an intermittent or emergency basis to attend this training. It is required that operations personnel must have completed this training before becoming the primary operator of a dam. After having received the initial training, a refresher course will be necessary every 3 years to continue as the primary operator.

Each region in the Service is primarily responsible for conducting and assuring that proper operations personnel have received this training and that it is being utilized. A manual will be written which will provide direction in conducting these training classes for Service dam operators.

* * * * *

DITCHBANK WEED CONTROL GETS NEW EMPHASIS ON ARIZONA FARMS[4]

There's a revolution going on in the forgotten art of ditchbank weed control in Arizona.

Being phased out is the time-honored custom of postponing noncrop weed control until the last minute, then rounding up a couple of hired hands to apply a contact herbicide with a jerry-built handsprayer.

Being phased in is a totally new approach in which a grower makes a deliberate effort to establish a weed control program utilizing existing chemicals and newly-developed spray equipment.

Accelerating the programmed approach to ditchbank weed control has been recent spring and winter rains which, while filling up reservoirs with badly needed irrigation water, turned ditchbanks, turnrows, cropped areas, sumps, and wastewater ditches into weedy nightmares.

There have already been indications that the rainy weather of the last 2 years has nudged some Arizona food and fiber producers into better field weed control, but most of those growers have so far failed to drop the other shoe and tackle noncrop areas.

One recent convert to better weed control puts the problem into perspective with his statement that:

> "I just don't think it makes sense to go to the time, expense, and trouble to get your field immaculate while allowing weeds from ditchbanks and other noncrop areas to either blow in by the wind or be carried in by irrigation water.
>
> "I doubt that any of us would deliberately dump a sack full of weed seeds into our ditches, but that's what we do when we fail to realize that proper weed control encompasses all weed control—not just that under crops.
>
> "So, maybe it's high time all of us placed noncrop weed control on the same pedestal as field weed control and get on with our business of producing weed-free food and fiber."

According to experts, there are four main reasons why many growers have stopped paying lip service and have begun doing something about weeds in noncrop areas.

---

[4] Reprinted by special permission of the Editor, Arizona Farmer-Ranchman, from September 1979 issue.

The first, as was previously stated, was the unusually heavy amounts of rainfall experienced during the winter of 1978 and the spring of 1979. This moisture was tailor-made for thirsty weed seeds, and many growers found themselves struggling to catch up with their annual, biennial, and perennial weed pests.

The second is the acknowledged impact of weeds on irrigation efficiency, movement of water through ditches, and final payments for harvested crops.

Reason three has to do with newly-developed weed control spraying equipment that makes possible custom noncrop weed control services and grower-owned equipment that greatly simplifies weed removal.

And the final reason? Growers now have available to them the services of those custom weed control agents whose sole purpose is not only to remove weeds from noncrop areas but to help the grower establish permanent weed control programs so he can finally get a handle on his plant pests.

It is the contention of one of these custom operators that typically, Arizona growers pay little heed to noncrop weed control until spring brings a new crop of perennials. At that time growers panic, and must settle for a labor-intensive approach which necessitates the use of hired men to walk ditchbanks applying contact chemicals.

The custom operator argues that it's much better to adopt a program (for not less than 3 years) in which rain-activated residual chemicals are applied in November while some "touchups" by foliar-applied contact chemicals are applied in the spring to catch the perennials some of the residuals fail to get.

Residual chemicals currently available include DuPont's Karmex, Krovar 1, and Hyvar X. Ciba-Geigy's Princep and AAtrex.

Contact chemicals, of course, include Monsanto's Roundup, Paraquat, Dow's Dowpon, and common weed oil.

One of the proponents of an organized month-to-month weed control program is Arlington's Stan Gable. Gable, head of Desert Weed Control, a custom operation doing herbicide applications for ditchbanks, lots, and fence lines, feels that the recent rains have awakened the need for noncrop weed control among farmers and that his personally-developed weed control tank truck will go far toward meeting that need.

> "Already," he said, "my tank truck has been contracted for about 6437 km (4,000 mi) of ditchbank this year. Some of my clients are realizing the need for good ditchbank weed control and they know that with my operation, I'll take that worry off their hands and put them on a year-long weed control program. And keep in mind that a good program means

much more than just ditchbanks; it means turnrows, sumps, roadsides, and tailwater ditches."

Gable admits that his service–while one of a kind–is a logical extension of the new weed control philosophy first espoused by Marvin John, an independent PCA with Desert Chemical Company. "It was John," Gable added, "who taught me that we don't live in a world anymore where you can get the job done by turning a man lose with a handsprayer with almost no calibration control and expect to do a good job of getting rid of plant pests. We must have consistent control and we can't get it with just a 'once a year and forget it' approach."

Gable's tank truck costs around $45,000 to build and it's essentially a modification of a California-designed spray boom coupled with two large water tanks.

With it, he can do about 80 km (50 mi) of ditch per day and spray both turnrows and ditchbanks at the same time simply by turning nozzles off and on.

Figure 5.–A feature of the Gable tank truck is the closed system used to transfer chemical from 19 L (5 gal) cans into the water-filled tanks. The closed system will not only open cans but will triple rinse them as well.

Gable feels that with his tank truck, he can do a good job of applying residual chemicals in November (just in time for winter rains) to combat pigweed, tumbleweeds, Canadian rocket, and other annuals and then come back in the spring with contact chemicals to tackle Johnsongrass, bindweed, burmuda, and other perennials that residuals may fail to get.

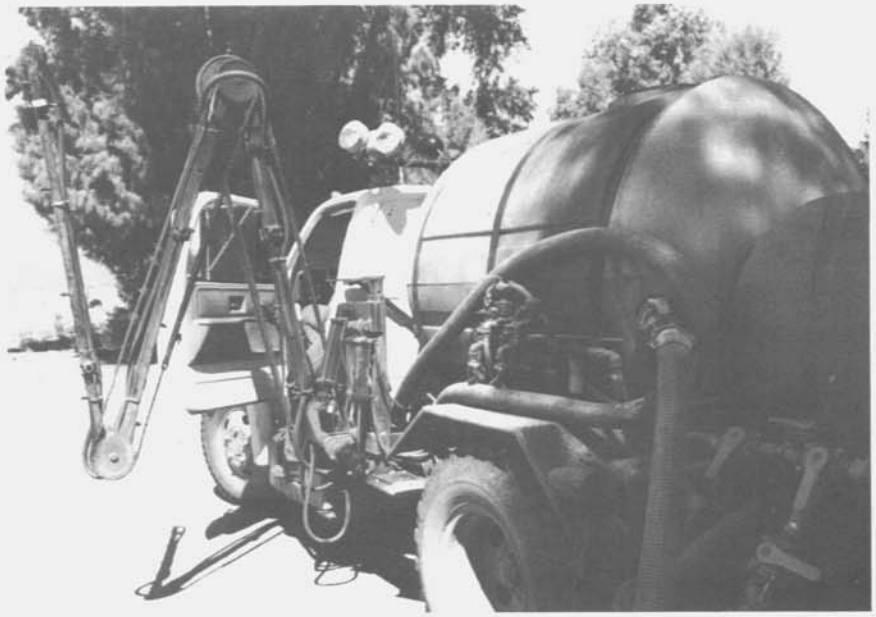

Figure 6.–View of the Gable spray boom showing partial extension.

Figure 7.–View of the Gable spray boom showing full extension.

He admits that growers and applicators must realize that caution must be taken when applying the residuals. As an example, if you have concrete-lined ditches and residual chemicals are for some reason sprayed on the water, that water must be flushed into the desert to prevent contamination with present or future crops.

If you have unlined ditches, you have the option of spraying residuals into ditchwater and then flushing or spraying with ditches dry and then (if no rainfall) filling the ditches and allowing it to either soak in, evaporate, or run into the desert.

"But regardless of the process used," Gable said, "residuals must make contact with water to work. No rain means no results."

Growers who are convinced that noncrop weed control programs are essential but who are not yet willing to go the custom applicator route, may prefer to own and operate a newly-developed spray boom designed, fabricated, and sold locally by A. D. Williams of Buckeye.

Williams, who operates both a custom application and spray equipment repair service near Buckeye, recently put together a herbicide spray boom that can be fed by a 1500-L (400-gal) tank mounted on a small tank trailer.

Like Gable's boom, the Williams' ditch sprayer features one-man operation and four-way control of spray nozzles so that both ditchbanks and turnrows can be covered at the same time.

But what separates the Williams' sprayer from the many other small sprayers now rusting from disuse in bone-yards is the fact that Williams has refused to power his sprayer with a gasoline engine, preferring instead what he calls a hydrohydraulic centrifugal pump. That pump provides all the agitation needed and when reversed, the pump will refill itself with ditch water in 5 to 10 minutes.

Williams said, "Through the years, there have been many ditch sprayers developed that featured gas engines. And I don't have to tell a farmer what happens when hired help is turned loose on a gas engine. Oil is forgotten and the engine burns up. Or, heavy use causes the entire engine to break down. Or, of course, the hired man runs out of gas. As a result, there has been general dissatisfaction with gas-powered ditch sprayers and that's why you won't find one on one of my sprayers."

Other features of the sprayer include:

1. A folding, breakaway boom of adjustable height.

2. Ability to handle up to 24 km (15 mi) of ditch per day.

3. A 6.3 L/s (100 gpm) hydraulic pump.

4. A $300 cost for just the breakaway boom; an entire system of boom, tank trailer, spray nozzles, plumbing and a 4-way valve will cost $2,150.

"I like to think that the Williams' boom is about as simple as possible," Williams said. "When I developed it, I reckon I sprayed 12 950 ha (32,000 acres) of ditches, modifying here and simplifying there. As a result, any grower with a mind to do something about his ditchbank weeds can mount one of these behind a tractor, put a hired man on the tractor and be in the weed control business."

Figure 8.–Williams' ditch sprayer allows the operator to either spray ditchbanks and turnrows separately or together.

* * * * *

EYE PROTECTION NECESSARY [5]

A foreman was removing old urethane foam from a roof by scraping and chopping with a straight spade. A large nail had been left on the roof by workmen when installing the handrail on the roof perimeter. The foreman's spade caught this nail and propelled it into his unprotected eye, scratching the cornea. The foreman had failed to wear proper eye protection which was provided. Number of calendar days lost: 47.

The above incident demonstrates the need for proper eye protection and the need for enforcement of wearing provided eye protection. In addition, all eye protection must meet stringent requirements for lens and frame strength. Lenses, made of either tempered glass or plastic, absorb a far greater impact before reaching the breaking point than lenses of the same thickness in conventional streetwear glasses. An object striking a conventional lens could shatter the lens and send pointed shards of glass into the eye. The lenses of safety glasses, when they do break, break into chunks. Because the frames of safety glasses are designed to hold the lenses under impact, the chunks often remain in the frames. If they should be pushed out, they invariably do little or no eye damage.

Do not confuse safety glasses with streetwear glasses that have impact-resistant lenses made to meet Food and Drug Administration standards. FDA regulations do not cover eyeglass frames and are not as strict as the American National Standards Institute requirements used for industrial safety glasses. Safety glasses can give better eye protection for working in the yard, puttering around the home workshop, tuning up the car, scraping old paint off the house, and many other chores. For jobs where dust and grit enter the eye from above or below the glasses, a pair of full-coverage safety goggles provide better protection.

* * * * *

[5] Reprinted from Reclamation Safety News, Third Quarter 1978.

TCA (TURNOUT CONTROL ASSEMBLIES), A NEW INSTALLATION AT CUSTOMER WATER DELIVERY SITES IN THE SAN JOAQUIN FIELD DIVISION [6]

There are approximately 43 turnout sites for water delivery to customers in the San Joaquin Field Division, California Department of Water Resources. Several different types of turnout arrangements are used, as well as different kinds of equipment used to control and measure the amount of water delivered to contractors. The different sites can be classified as: flow tube, gravity, parshall flume, pump, or a combinatin of these in some cases. Within the sites there may be a variety of types and sizes of equipment installed. All of these sites were strictly local control when first installed. A few had limited remote monitoring by the customer. This situation often presented operational problems to the Department, and to the customer. If the water contractor wanted a change in flow, it meant that a DWR (Department of Water Resources) operator had to travel to the site to make the gate change or dial in the new flow rate set point. For the furthest site, this could mean up to 4 hours travel time for a round trip. An equipment malfunction at one of the sites has caused, on occasion, field flooding and/or damage to the turnout canal. To overcome these problems, and to reduce operating costs, Department personnel have installed new site control equipment (TCA's) at each turnout. Views of typical customer turnout sites are shown as figures 9 and 10. The small buildings house the delivery control equipment.

Figure 9.–Typical customer turnout site.

Figure 10.–Typical customer turnout site.

A wall-mounted, metal box 0.6 by 1.2 m (2 by 4 ft), contains a microcomputer assembled from commercially available parts, and the necessary interface elements. This, along with the associated control console, measuring devices, gates, and channel, makes up the

[6] Reprinted by special permission of the editor, from Technical Bulletin No. 41, California Department of Water Resources.

complete site. Several modifications had to be made to the TCA and the associated items to accommodate the variety of site equipment originally installed. D&C (Design and Construction) contracted to purchase the TCA. Actual installation at the sites was done by Field Division personnel with D&C assistance. Control Systems Engineering did the program modification required to accommodate the various operating conditions. Bruce Reese coordinated activities of construction engineering, the TCA manufacturers, Field Division engineering and operations groups, design and construction support, and the various water customers. Each TCA is a link, via telephone, between the turnout equipment (TCA), the nearest aqueduct checksite, and the ACC (Area Control Center).

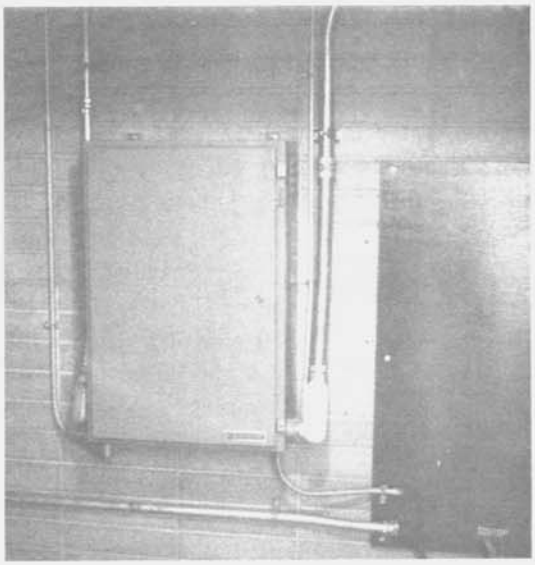

Figure 11.–TCA cabinet mounted.

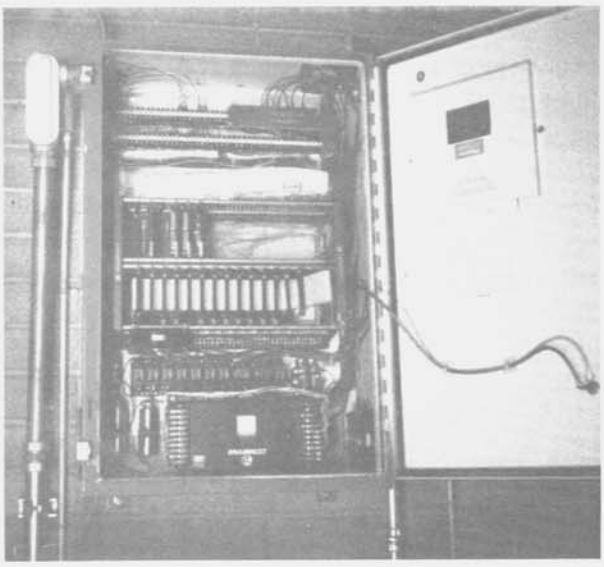

Figure 12.–Cabinet opened for inspection.

Each turnout is interrogated automatically by the ACC control system. Gate position, flow rate, water level, setpoint, operating mode (manual or automatic), status, and alarm information are updated continuously at the ACC and are available to the operator on the CRT page. The operator at the ACC can also command a change in flow rate setpoint, gate position, or operating mode, and restart after power failure or a pump emergency. All of this is possible through the TCA. Also, the ACC can monitor continually certain site conditions such as excess flow, high gate position, and incorrect response to command. Each condition will annunciate an alarm at the ACC. The sites which display these conditions assure that the operator has greater flexibility in site operation. For instance, if the flow-rate data do not appear to be correct, the operator can determine whether the reading is in error or not by displaying the gate position and water level information. If the data displays are in error, operators can switch the site to manual mode and control flow rate by commanding the gates to the appropriate position.

Although the workload for the maintenance control technicians has increased by installing TCA systems, this will be reduced by modifying turnouts controlled by UES, an analog device

which controls water flow automatically. TCA's great advantage is the positive control and monitoring capability it provides. This will prevent, or certainly limit, possible accidental releases and flooding.

For any additional information, contact Richard Flippen, Control Systems Unit, San Joaquin Field Division, California Department of Water Resources.

* * * * *

WATER OPERATION AND MAINTENANCE BULLETIN NO. 110
December 1979

SUPPLEMENTAL SHEET

The use of the listed residual chemicals Karmex, Krovar 1, Hyvar X, Princep, and AAtrex, and of the contact chemicals Roundup, Paraquat, Dowpon, and weed oil for control of ditchbank weeds is regulated by the FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and its regulations and corresponding state laws and regulations. The following information describes the current restrictions on the use of these chemicals:

Karmex (diuron) is registered for dry (dewatered) ditch application in the fall. Following fall application, if rainfall or snowfall has not totaled at least 4 inches of water, the treated ditch should be filled with water the following spring and the water should be allowed to stand in the ditch for 72 hours. The fill water should then be drained off and wasted where it will not contaminate irrigation water or croplands. This practice is not necessary if 4 inches or more of water results from rain or snowfall after dry ditch application. Karmex (diuron) must be fixed in the soil both to provide adequate broad spectrum weed control and to avoid the contamination of irrigation water that may result if the active ingredient is not thoroughly fixed in the soil. Four inches or more of water is sufficient to adequately fix the active ingredient in the soil.

Krovar 1 (bromacil), Hyvar X (bromacil), Princep (simazine), and AAtrex (atrazine) are not registered for either dry or wet ditch application to the inside banks or bottoms of irrigation ditches and should not be used for that purpose.

Roundup (glyphosate) is registered for broad spectrum weed and brush control on the inside banks and bottoms of dry (dewatered) ditches. Monsanto has petitioned EPA for a potable water tolerance to allow use of Roundup on the inside banks of watered irrigation canals and ditches. If or when EPA accepts the tolerance proposal, the registration of Roundup will be extended to permit wet ditch application. Until such time, Roundup is not registered for application to the inside banks of wet ditches.

Paraquat is not registered for application to the inside banks or bottoms of wet or dry ditches and should not be used for that purpose.

Dowpon (dalapon) use on the inside banks of irrigation ditches should also be clarified. Only Dow's Dowpon M brand of dalapon is now registered for application to the inside banks or bottoms of dry and wet irrigation ditches. All other dalapon products are not registered for such use and should not be used for that purpose.

Weed oil is registered for application to the inside banks of dry or wet irrigation ditches. The heaviest use of weed oil is in the southwest in irrigated areas where Weedar 64 (2,4-D) cannot be used to control broadleaf weeds on the inside banks of dry or wet irrigation ditches due to proximity of cotton, tomatoes, or grapes.

Amchem's Weedar 64 dimethylamine salt, 4 lb a.e. 2,4-D, is the only 2,4-D in the United States that is registered for application to the inside banks of dry or wet irrigation ditches. It has a potable water tolerance allowing such use. No other 2,4-D product in the United States has a potable water tolerance which permits application to the inside banks of irrigation ditches.