WATER OPERATION AND MAINTENANCE

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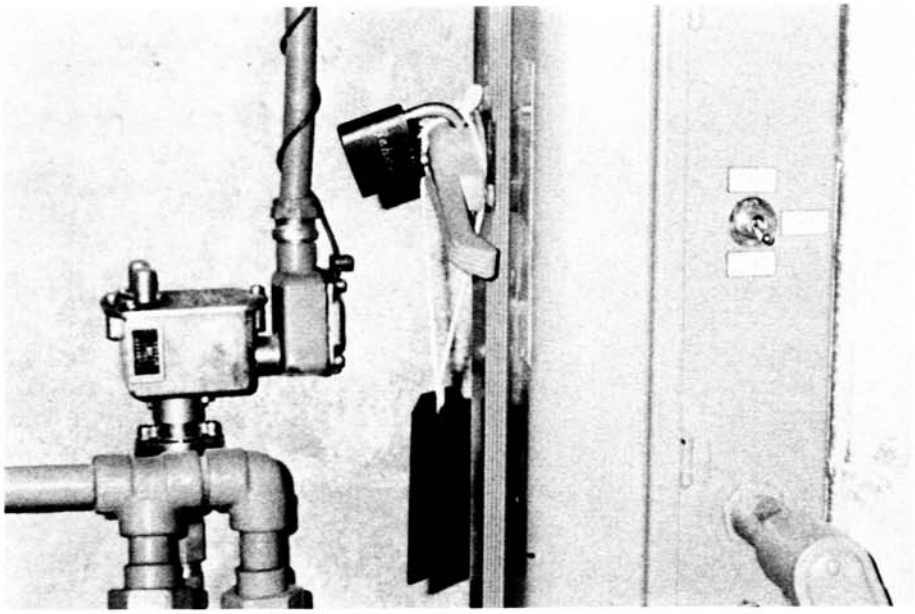

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Manual Collection of Digital Data

UNITED STATES DEPARTMENT OF THE INTERIOR

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 information for use by Bureau personnel and water user groups for operating and maintaining project facilities.

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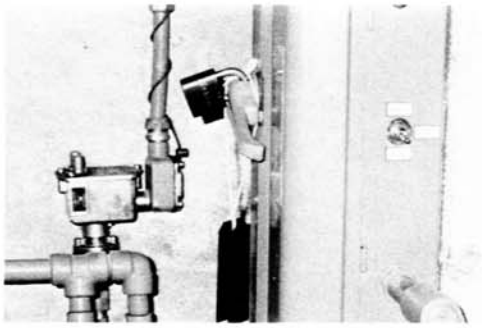
Jerry Fischer, Managing Editor
Bill Bouley, Technical Editor
Operation and Maintenance Engineering Branch
General Sciences Division
Denver Office, Code D-5850
PO Box 25007, Denver CO 80225
Telephone: (303) 236-7798

Cover photograph:



Electric disconnect switch under lockout and tagged for maintenance.

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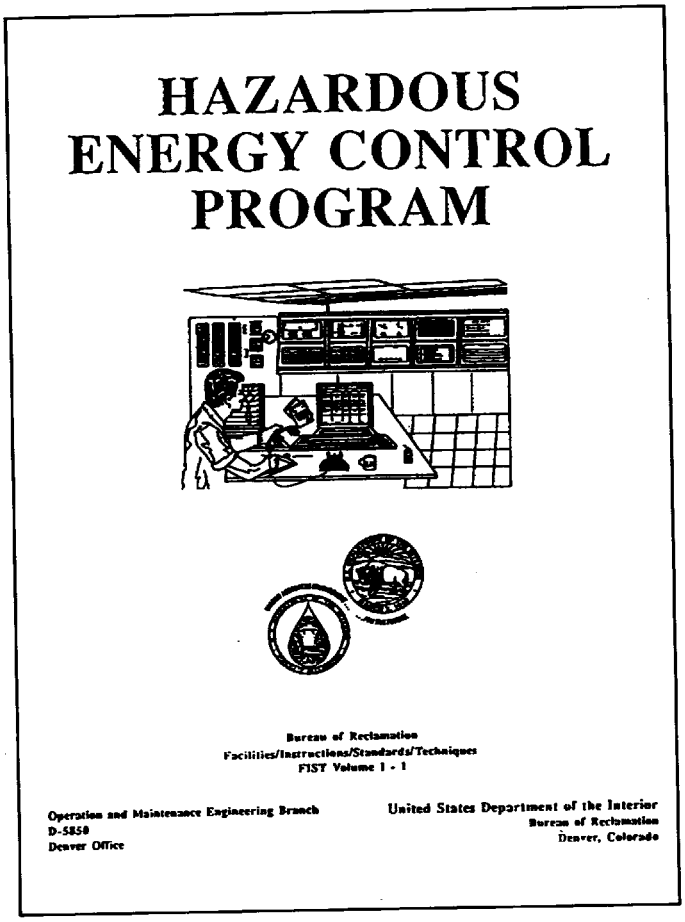
HAZARDOUS ENERGY CONTROL PROGRAM

by Larry Mooneyham[1]


HAZARDOUS ENERGY CONTROL PROGRAM

Bureau of Reclamation
Facilities/Instructions/Standards/Techniques
FIST Volume 1 - 1

Operation and Maintenance Engineering Branch
D-5850
Denver Office

United States Department of the Interior
Bureau of Reclamation
Denver, Colorado

The evolution of Facilities, Instructions, Standards, and Techniques, Volume 1-1 (FIST VOL 1-1) into a Hazardous Energy Control Program is complete. The new document (still FIST VOL 1-1) has been compiled, reviewed, edited, and is now published. The new publication incorporates the requirements set forth by OSHA relating to the safety of personnel working in power plants, pumping plants, waterways, and other electrical facilities. These new requirements will dictate several changes in the way Reclamation facilities perform switching operations. The Hazardous Energy Control Program sets forth the guidelines for all Reclamation facilities to follow in the development of their individual programs and procedures.

This program goes well beyond our current procedures for the application of safety tags and locks. The program calls for energy isolating devices to be locked whenever possible where work is being performed on any equipment served by an energy source. An energy source may be pneumatic, electrical, mechanical, hydraulic, etc,. When the physical characteristics of the energy source prohibit its isolation by locking, a tagout device will be utilized. There are now specific requirements for the construction of this device (tag). They must be impervious to the environment, substantial enough to prevent their inadvertent removal, and attached by a non-reusable means that has a breaking strength of not less than 50 pounds.

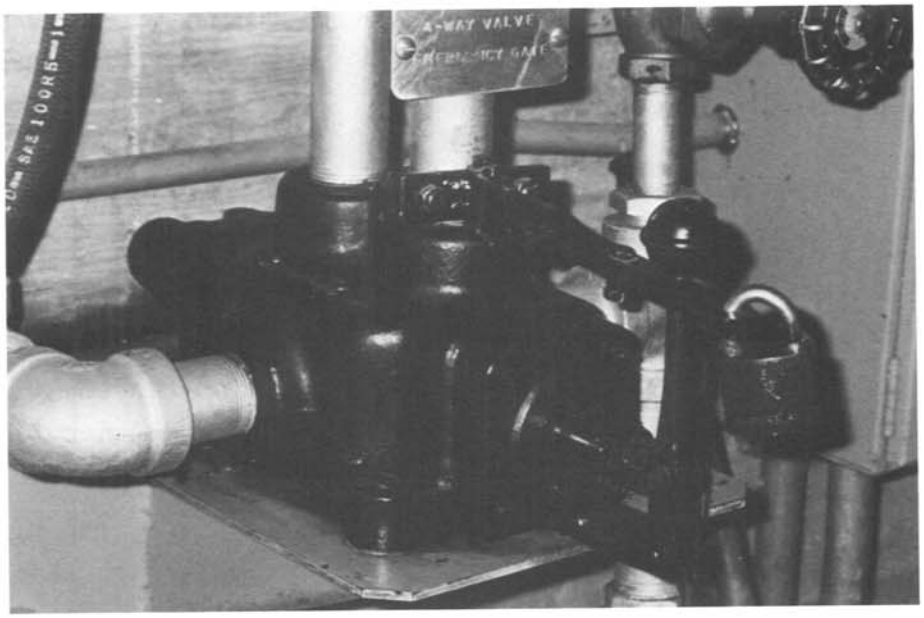
When maintenance is to be performed on any equipment where there is potential for start-up, energizing, or the release of stored energy, there shall be a Hazardous Energy Control Procedure in place. This procedure will define the steps necessary for the isolation of this particular piece of equipment and the control of its energy sources. Individual(s) working on a piece of equipment shall not be considered protected until the Hazardous Energy Control Procedure has been implemented.

Training must be provided to all affected employees on the Hazardous Energy Control Program. Authorized employees (those working with the facility procedures) must be trained to recognize hazardous

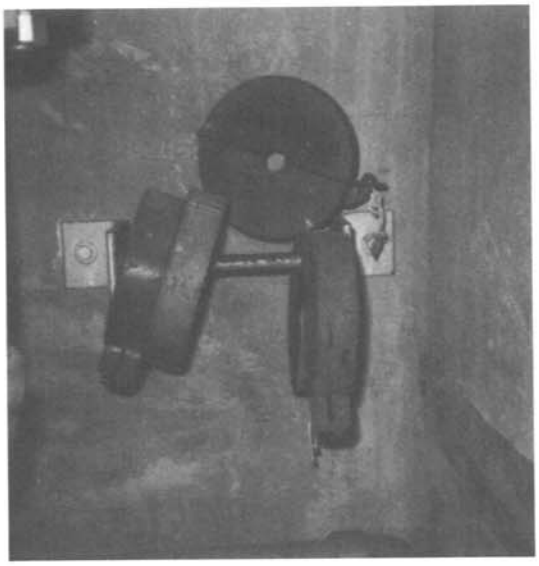
[1] Mr. Mooneyham is a Power Operations Specialist in Reclamation's Policy Analysis Office, Denver, Colorado.

energy sources, the type and magnitude of energy available in their work place, and the means and methods for isolation and control.

This program does not replace current switching practices or current procedures for the application of clearances. It does add to these practices and procedures and in a lot of cases, makes them more stringent. The purpose of the program is increased safety for Reclamation personnel and with the proper application of the program we can see that the purpose is achieved.



Locking device for a 4-way valve used to operate high-pressure gates.

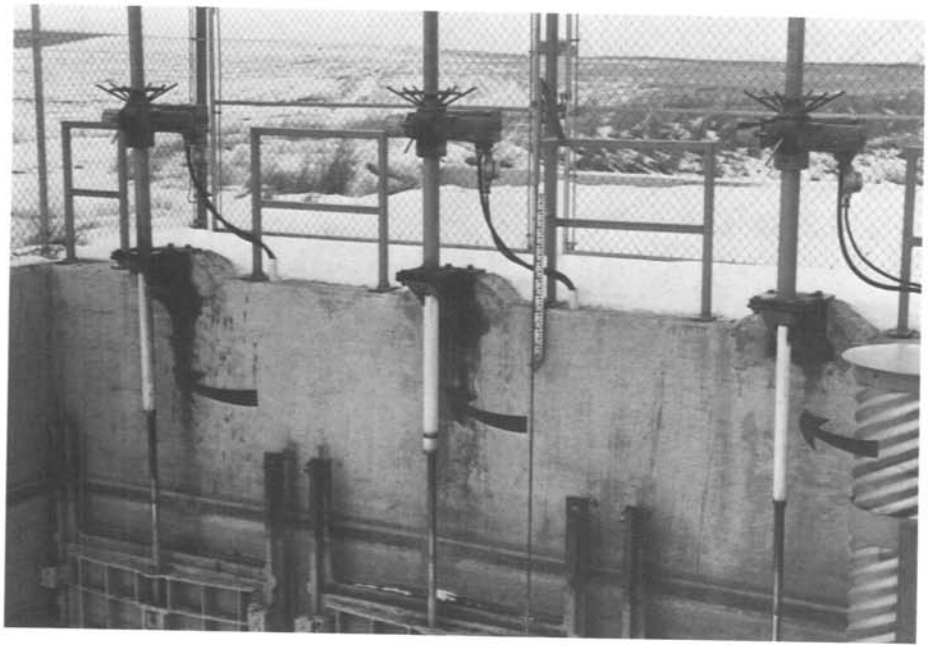


Gate valve lock covers.

GATE STEM COVERS[1]

One major element on any threaded gate stem is a good uncontaminated lubricant. The lubricant protects the stem from corrosion and provides for smooth operation. One day of blowing dirt can ruin the best lubricant and cause the Rotork operators to bind, says Ralph Oldenburger, watermaster, Lethbridge Northern Irrigation District. In our windy area, a gate stem cleaned and oiled in the morning can be severely contaminated by blowing dust before evening. Removing the contaminated lubricant with a diesel fuel soaked brush from all the grooves between the threads isn't easy and takes time, especially if it has to be done after dark.

The problem becomes very serious if the Rotork operator mechanism becomes heavily fouled and compacted with oily dirt. When this happens, says Oldenburger, the mechanism must be removed and sent in for factory trained service. The gate remains closed for a number of days.



Arrows point to in-place gate stem covers.

For Oldenburger there had to be something better. That something better was a gate stem protector made out of a piece of surplus PVC pipe and couple of shop-made metal brackets. Once the measurements are obtained -- diameter of stem, length of thread to be protected, and the angle of the brackets, it's time to go to work. A thin-walled PVC pipe 12 mm (inside diameter) larger than the diameter of stem is cut 12 mm longer than the threaded part. To allow the pipe to be opened up and slipped around the stem, a single saw cut is made for the entire length of the pipe. When asked about a cost, Oldenburger grins

[1] Reprinted with permission from the Editor. The Water Hauler's Bulletin, Volume 53, 1994.

and replies "almost nothing if you have a surplus piece of the right diameter PVC pipe and a welder to make a couple of brackets."

It didn't take long to see that the gate stem protectors worked. After our first big blow, says Oldenburger, the lubricated stems remained clean and free of contaminants. His district installed the covers on five of their major control gates. Based on the first year's positive test results and low cost, it won't be long before others are calling and wanting to know how to make and install the gate stem protectors.

Ralph Oldenburger lifts gate stem cover from hand wheel gate.

For more information, please contact Ralph Oldenburger, Watermaster, Lethbridge Northern Irrigation District, 334 - 13 Street North, Lethbridge, Alberta, Canada T1H 2R8; telephone (403) 327-3302.

LEAKING JOINT PROBLEM SOLVED WITH INTERNAL SEAL[1]

By Henry E. Topf, Jr.[2]

Irrigation systems are a piece of the public infrastructure that have not received much attention. These vital water-carrying networks; however, are crucial to agriculture in many parts of the country where adequate moisture is at a premium. To these users, water is a valuable commodity that should not and cannot be wasted. Additionally, many of these systems cross large stretches of natural desert environments that can be impacted by leakage problems.

A major irrigation user is the Navajo Indian Reservation, a 25,000-square-mile area, most of it situated in the northwest corner of New Mexico. Thanks to these modern water supply systems, the Navajo people have been able to grow a variety of farm products.

These farming activities include the Navajo Indian Irrigation Project (NIIP) and the Navajo Agricultural Products Industry (NAPI). The NIIP is the irrigation project's infrastructure, including the water storage and delivery system, land, roads, utility installations, and other facilities. Created in 1970, NAPI is a tribal business entity that develops, farms, operates, and manages the NIIP lands. It also operates and maintains the NIIP water delivery system.

Big Area to Cover

There are 216,842 acres of NIIP lands. The first water for irrigation was delivered through NIIP's system in 1976. Construction of the system has progressed to a point where water can now be distributed to over 57,000 acres.

The system's water storage facilities include the Navajo Dam and Reservoir, part of the upper Colorado River storage projects. Water is transported over 22 miles to the farms through a delivery system of canals, tunnels, and siphons. Using siphons allows water to be moved through the canyons without pumping stations.

It was at one of these siphons that a leakage problem developed over several years. The Largo Siphon, located near Farmington, New Mexico, is approximately 5,000 feet long and made up of pipe that is 210 inches in diameter. Leaks developed in three of the siphon's expansion-contraction joints. This leakage causes sink holes, water loss, and damage to the surrounding environment.

The mammoth siphon barrel is constructed of 210-inch diameter, 1/4-inch steelplate on the interior, along with 19 inches of concrete containing rebar in the form of circular hoops and segmental bars on the exterior. The steelplate, rolled to the 210-inch diameter and welded as a continuous cylinder, was used as the inside form for the poured concrete and rebar. The pipe's entire interior surface is coated with coal tar epoxy.

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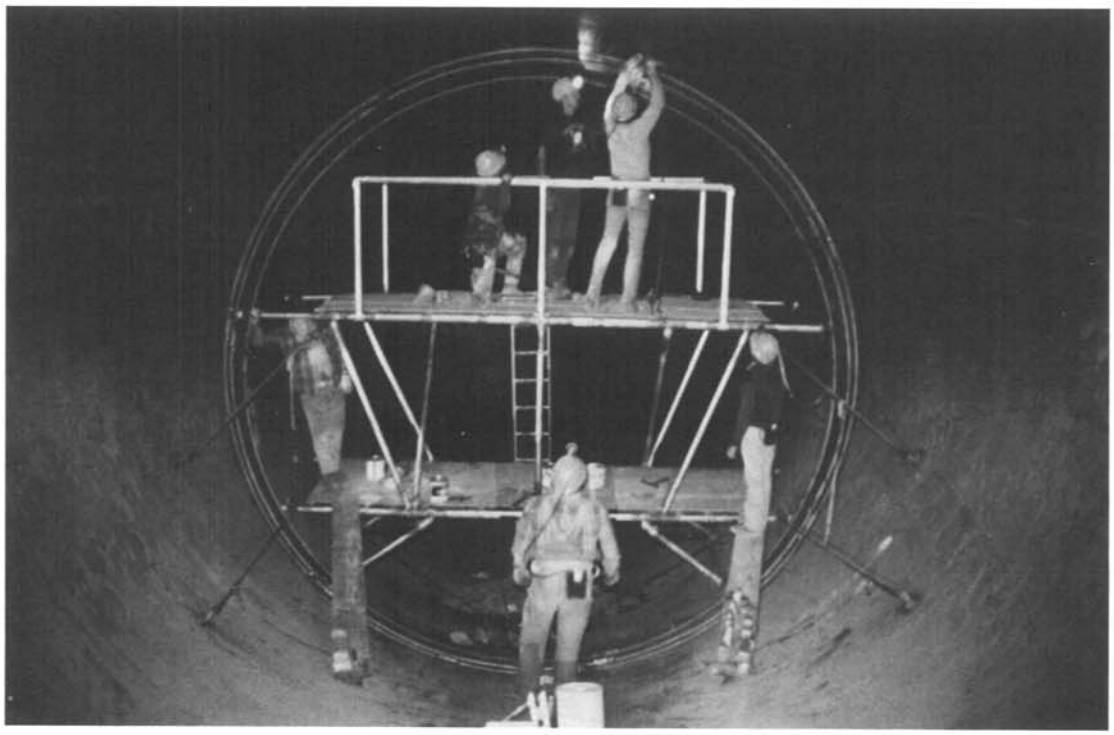
[1] Reprinted with permission from the Editor, Public Works, January 1994 issue.

[2] Mr. Topf is the Vice President of Operations, Miller Pipeline Corporation, Products and Services Division, Indianapolis, Indiana.

Expansion-contraction joints were constructed in the siphon at intervals of approximately 500 feet. These joints contain a 9-inch rubber water stop and are designed to place some flexibility in the system. The leakage problems had occurred at three of these joints. The Largo Siphon, installed in 1968, performed well up to the time the leaks became a problem.

Attempts to repair the joints had been undertaken by NAPI personnel but with no success. NAPI then turned to the U.S. Bureau of Reclamation (BurRec), which had designed and constructed the water delivery facility and was still performing a large part of the engineering work for NIIP. BurRec personnel suggested the possibility of using an internal joint repair system to solve the leakage problem.

This involved the Miller Pipeline Corporation, which had introduced its internal repair method, the AMEX-10 Seal, to BurRec in the early 1980's. Since that time, the seal has been used on BurRec projects using flexible pipe joint couplings (mostly located in the western part of the country). Personnel from BurRec and NAPI felt the Largo Siphon's leakage problems could be solved with this method.



Specially designed scaffold enabled workmen to reach entire inner circumference of the 210-inch pipe.

Tight, Flexible Seal

The seal itself is a flexible leak clamp creating a bottle-tight seal around the full inside circumference of the pipe joint area. With over 100,000 of these internal seals installed, ranging in size from 16 inches to 210 inches in diameter, there is a sufficient record as to their durability. They are in service in potable water, distribution lines, sanitary sewer lines, storm sewers, natural gas piping, industrial piping, and nuclear powerplant piping.

Following an inspection of the siphon in November 1992, a proposal was submitted to permanently repair the leaks using the AMEX-10 double-wide seal. In March, Miller entered into a contract to repair the three joints. The project's timing was critical, since the first spring water delivery was scheduled for the end of March.

Because of the siphon's extremely large diameter and the locations of the repair sites, the project posed various challenges for our engineering staff. To safely complete the installation, it was first necessary to design and build a scaffolding that provided fail-safe stability for the installers. Secondly, there was a requirement for the structure to be lightweight and easy to assemble. The locations of the three joints were spread out over a distance of 2,500 feet. Access was via two separate 22-inch-diameter manholes through which all equipment and materials had to fit. The scaffolding also had to be designed so that it could be set up perpendicular to true horizontal for the two relatively "level" joints and then on the 18° slope where the third joint repair was required.

The final scaffolding design provided a working platform at about 5 feet above the invert plus a second platform at about 11 feet above the invert. This assured the installers of three safe and secure working elevations (including the pipe bottom) while allowing full access to the entire 55 linear feet of internal pipe circumference.

According to OSHA...

The finished scaffolding, seals, and other component parts were delivered to the jobsite where installation was to be handled by Miller's seven-worker crew of confined-space entry trained, internal sealing technicians. Since the Largo Siphon is located about 10 miles from the nearest paved road, access to the site was by dirt and gravel roads through the canyon. The atmosphere within the manholes and pipe was first tested with confined-space air monitors to determine the internal atmosphere and what other precautions might be required. The crew then entered the pipe through the 22-inch manholes and assembled the scaffolding for the first joint seal installation.

These seal installations were conducted in full compliance with OSHA's 29 CFR 1910.146 Permit-Required Confined Spaces regulations. Past work done by the company in confined spaces was essentially in compliance with confined-space standards long before they were made mandatory. Rescue and retrieval equipment was on the jobsite at all times. In addition to being trained in using this equipment, the crew is also schooled in first-aid, CPR, and SCBA emergency procedures.

Before the seal could be installed, it was necessary to remove the 3/16- to 3/8-inch-thick coal tar epoxy coating from an area 2 inches wider than the seal width. The seal could then be applied directly to the steelplate. Any weld seams found in the sealing area were ground smooth using a pneumatic powered abrasive grinder. A thin layer of bitumastic coating was then applied to protect any exposed areas of steel remaining after the seal was positioned. Because this was a water application, these 25-inch-wide seals were manufactured from ethylene propylene diene monomer (EPDM) rubber.

Installing the Seal

The next step was placing stainless steel retaining bands. These bands compress the seal against the pipe's internal circumference using a special hydraulic expanding device that applies an equal radial load. This pushes the proprietary design sealing lips of the AMEX-10 firmly against the inside of the pipe.

Because of the pipe's size and entry restrictions on this project, the Type 304 stainless steel retaining bands were manufactured in seven segments. All were rolled to match the radius of the 210-inch pipe and used slotted overlaps to interlock each segment to another. Fabricating the retaining bands in segments also permitted them to be easily carried by one person from the entry point to the repair site.

Once a seal had been installed and the retaining bands expanded and locked, a pressure test was conducted to ensure a "bottle-tight" bond. The first two installations were completed and tested in 3 days, including assembly and take-down of the scaffolding. The following 2 days were spent on the more difficult installation of the third seal, which was on an 18° slope requiring entry through a separate manhole. To prevent tipping or sliding of the scaffolding on this angle, it was necessary to secure the structure with bracing straps anchored at a higher level in the pipe. The third seal was safely installed and tested, after which the scaffolding was removed. The entire project was completed in only 5 working days, leaving the system ready for NAPI to receive their first delivery of water.

Now, that the repaired joints on the Largo Siphon have been in operation for several months, NAPI personnel observed that the ground around the expansion-contraction joints was dry for the first time in several years thanks to the repairs.

This project demonstrates the value, cost-effectiveness, and efficiency gained from planned maintenance as opposed to emergency shutdown and repair. Not only was the joint leakage problem solved, there were also the added benefits of improved construction safety and no effect on other utilities since excavation was not required, as well as a proven maintenance-free finished product.

A 'WHOLE' LOT OF PLANNING GOING ON'[1]

by Debra K. Rubin, Mary B. Powers, Housley Carr, and David B. Rosenbaum

Two decades into America's water quality crusade, practitioners are realizing that the whole is greater than the sum of its parts. Cleanup strategies that targeted separate pollution dischargers and bowed to political boundaries are giving way to a more "holistic" approach -- watershed management. The philosophy is nothing new to many water quality, experts, but it's gaining renewed acceptance in states and in Washington.

"We're seeing new life in an old idea," says Ann Powers, general counsel of the Chesapeake Bay Foundation. "There is an interconnectedness at the watershed level." Even so, making that link is proving no easy task for the diverse array of watershed stakeholders.

Managing water quality by ecosystem is as old as the 1972 Clean Water Act itself, which authorized "area-wide" efforts. Multistate programs to protect high-profile, high-risk waters such as the Great Lakes, the Chesapeake Bay, and the Gulf of Mexico are much touted.

But for the most part, water quality managers and regulators targeted pollution problems that were easiest to see, to fix, and to fund. With federal monies then abundant and "end-of-pipe" problems persistent, the national strategy targeted individual municipal and industrial "point" sources of pollution.

The approach has fixed the worst pollution nightmares, but critics say it has neglected the less obvious but potentially more egregious impact of "nonpoint" pollution such as farm and stormwater runoffs and air emissions. "Unfortunately, efforts under these programs have been largely fragmented and piecemeal," said Tudor T. Davies, EPA's acting deputy assistant water administrator, in congressional testimony last month. "As a result, there are significant gaps in our efforts to protect ecosystems from the cumulative impacts of a multitude of activities that stress our waterbodies."

Value

With time, experience, and new sophistication, water quality managers have come to appreciate the value of a watershed-wide approach. It is the cornerstone of the much-praised *Water Quality 2000* report, a blueprint for 21st Century water quality management issued last year by a coalition of 75 industry groups. "We believe the nation is now ready, and indeed must, embrace this approach," says Paul Woodruff, coalition chairman and president of Environmental Resources Management Inc., an Exton, Pennsylvania, consultant.

Already, local governments and their citizens are taking watershed matters into their own hands. "Our experience repeatedly shows that people are most likely to protect what they know," says EPA's Davies. "The watershed provides a logical area within which to build on this local commitment."

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[1] Reprinted from Engineering New-Record (ENR, September 20, 1993, copyright McGraw Hill, Inc., All Rights Reserved. (Pictures not available.)

Cleanup of the nutrient-loaded Chesapeake Bay is a sterling example of a watershed approach that has successfully crossed state lines and linked point and nonpoint dischargers. With a goal of reducing bay nutrients by 40 percent by 2000 under a 1987 agreement, Maryland has already cut nitrogen levels by 13 percent and phosphorus 18 percent, says Cecily Majerus, Gov. William Donald Schaefer's Chesapeake Bay coordinator.

A key part of that effort now is implementing a "nesting" approach that targets smaller, localized watersheds that feed into the bay. Under a 1992 pact, bay area states agreed to place nutrient caps on the Chesapeake's 10 main tributaries. "We've struggled a lot to bring the broader message to states like Pennsylvania that don't even have bay frontage," says Powers. The state, nevertheless, accounts for 70 percent of bay water. This past June, Pennsylvania enacted a law mandating new controls on farm-generated nutrient loadings and discharge planning.

Meanwhile, Majerus says Maryland is using a watershed approach even within its own boundaries in crafting plans to reduce nutrients in 10 state tributaries to the bay. Drafts will be sent by month's end to affected jurisdictions to thrash out whether steps are equitable and cost effective. "We're doing this by watershed, not by county," she notes.

Other states are following suit. North Carolina has adopted what many consider the most far-reaching approach, dividing the entire state into 17 watersheds. The effort has allowed officials to synchronize discharge permits in each basin simultaneously, boosting management efficiency, says Steve Tedder, state water quality chief. "It's a way of doing business," he says.

Likewise, Oregon formally adopted a new watershed management strategy last year, which includes statewide assessment of conditions and voluntary "councils" to develop specific goals and action plans, says Lorna Sticker, chairwoman of the Oregon Water Resources Commission. She notes that state members of the Western Governors Association and the Western States Water Council will meet for the first time in November (1993) to share watershed management strategies.

And in another precedent-setting union, 23 representatives of state and federal agencies, environmental groups, developers, and agribusiness met last week to begin charting a new environmental approach for the floodplain of the 100-mile-long Santa Clara River in southern California. "They're trying to make some multi-million-dollar decisions that are going to affect the river and all the stakeholders," says Michael T. Savage, senior water resources engineer for CH2M Hill Inc., the effort's engineering consultant. "Very seldom have we brought them together in a systems approach. But there's a growing understanding that you can't treat just one piece of it."

Woodstock

The watershed ground-swell was apparent when EPA's first big watershed management conference in Washington last spring drew a standing room only crowd. "It's being called the Woodstock of water quality protection," says Robert H. Wayland III, director of the agency's new office of wetlands, oceans, and watersheds, formed in 1991.

That was a watershed event for EPA itself. "There's an institutional change going on," says Wayland. Regional EPA water officials are meeting this week on watershed issues, "the largest block of time we will have spent on this," he notes. An EPA source says the agency will seek dedicated funds for watershed management efforts in its fiscal 1995 budget request. In past years, it has had to crib from

other water program areas because budget overseers couldn't understand what watershed management was, says one agency source.

The agency's Seattle-based region, which includes the Pacific Northwest and Alaska, has already adjusted to management by watershed. In a restructuring begun last year, the region divided its domain into 22 key watersheds and assigned a staff member to each "to understand everything going on there," says Tom Wilson, senior policy advisor in its water division, "Before we were running programs. Now we're targeting those programs to solve problems, and we're getting the states to do likewise."

Wilson says this has worked in handling, eutrophication problems in Idaho's Snake River basin. "We found the problem was caused by a multitude of small sources, so we changed our priorities and the state's to put needed resources there," he notes. "Before, we would not have recognized this."

Wilson says the regional refocus will come in handy as EPA and other federal agencies tackle the Clinton Administration's mandate for change in government management of Pacific Northwest forests. The effort, expected to set national precedent, will be based on a watershed approach, he notes.

Transfixed

But nothing has created more of a stir in watershed management circles than pending legislation that references the approach for the first time. In particular, all eyes are on the Water Pollution Prevention and Control Act of 1993, introduced in the Senate last June by Max Baucus (D-Mont.) and John H. Chafee (R-R.I.), ranking members of the Committee on Environment and Public Works, as the vehicle for Clean Water Act reauthorization. What's important about the approach "is the integration," says Baucus. "Otherwise you address one part of the problem in a watershed, and neglect another."

The bill, S.1114, authorizes single or multiple states to voluntarily designate "watershed management units" and to identify impaired waters within them. It requires EPA to approve such designations and requires states to manage the units. The bill also asks states to submit watershed management plans for EPA approval; authorizes more attention to nonpoint source pollutant reductions in a watershed; and allows incentives such as state revolving fund (SRF) use and longer-term discharge permits in approved watersheds.

The bill's watershed approach is generally applauded in water quality management circles, but interest groups voice concern over certain provisions and are furiously lobbying to get their agendas addressed.

States in particular fear that their traditional primacy in water quality management could be undercut by federal watershed mandates. "The whole virtue of watershed management is that it bubbles up," says Robert J. Zimmerman, administrator of the surface water management section in Delaware's Department of Natural Resources and Environmental Control. "But this legislation is top down and will impair this."

State officials say the provisions would force states to adopt uniform solutions for very unique problems. "We don't want a one-size-fits-all process," says North Carolina's Tedder, a particularly outspoken critic for the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA). "If they all start looking alike, we've defeated the concept." States hope for a sympathetic ear from EPA's newly named assistant water administrator, Robert Perciasepe, who formerly headed Maryland's Department of the Environment. "Having him is a reality check for the feds," says ASIWPCA Executive Director Roberta Savage.

States also worry about having to contend with too many outside interests in drafting and managing plans, particularly where watershed efforts are still very premature. Even Baucus admits that one pitfall of the approach is "you get too many cooks in the kitchen."

ASIWPCA is particularly unhappy with a proposal by the Association of Metropolitan Sewerage Districts (AMSA) to create formal "commissions" that would make watershed management decisions. AMSA contends such entities, staffed by relevant local stakeholders, would act as "bureaucracy busters," forcing agencies to coordinate efforts.

Meanwhile, AMSA and environmental groups make unlikely bedfellows in both calling for S.1114's provisions to be mandatory, not voluntary. "Making the program voluntary means that it is likely to fail," said Charles F. Gauvin, president of Trout Unlimited, a Virginia-based conservation group, in Senate testimony in July. Environmentalists also insist on strong EPA oversight of watershed programs, and are suspicious that the approach will allow states to ease up on point source dischargers. "The watershed planning provisions in S.1114 may represent an irresistible temptation to local governments to delay upgrading sewage treatment plants," testified Curt Spalding, executive director of Save the Bay, a Providence, Rhode Island, group.

And, advocates for farmers and other landowners worry about their liability for curbing nonpoint pollution in a watershed scenario. Farmers are adopting practices such as reduced tillage and contour planting to curb runoff, "but these changes are not without cost," says Gerald Talbert, director of policy for the National Association of Conservation Districts. While some industry spokesmen say farmers could benefit from a watershed approach, others want no part of it. "They see watershed planning as the first step toward a permit program for agriculture," says John H. Thorne, director of water quality programs for the National Agricultural Chemicals Association.

Senate Environment and Public Works Committee staff decline to elaborate on possible changes to S.1114, but a spokeswoman says these will be made when the bill heads for markup, possibly early next month.

Meanwhile, the House is targeting to introduce companion legislation within the next 2 months. Rep. James Oberstar (D-Minn.) introduced a bill several months ago that would tighten nonpoint source restrictions and pushes a watershed approach, but it has seen little activity lately, sources say. Most Washington observers don't expect a reauthorized Clean Water Act to come out this year.

In the meantime, practitioners wonder whether Congress will provide more financial and regulatory incentives to make watershed programs more politically palatable in economically hard-hit states. Confusion still reigns over how existing protocols for using SRF and federal grant monies will work in a watershed structure.

In particular, the bill is silent on the issue of trading water pollutant "credits," either between point sources in a particular area or between point sources and nonpoint sources. "As of now, [S.1114] doesn't include anything at all about trading or any other market-based approaches," says Mark Luttner, director of policy and resources management in EPA's water office. Environmental groups have been fighting such strategies "tooth and nail," he notes.

But government and private-sector experts say trading still has great potential. Trading consultant Kenneth I. Rubin, president of Apogee Research Inc., Bethesda, Maryland, says that several conditions appear necessary for trading to work. They include the presence of a definable watershed; a combination of point

sources and controllable nonpoint sources that each contribute a significant portion of the total pollutant load; and a water-quality goal for the watershed that forces action.

Also, he says, point sources must be facing the need to either upgrade their facilities or trade for nonpoint reductions to meet water-quality goals; and significant nonpoint reductions must be possible at a lower marginal cost than reductions from point-source improvements. All told, there are more than 900 U.S. watersheds with water-quality problems that could potentially benefit from trading, says Rubin, and that number will grow. Among those eyeing trading are New York and Connecticut jurisdictions near Long Island Sound, the Tampa Bay region in Florida, the Chehalis River watershed in Washington State, and the Neuse Fiver basin in North Carolina.

Perhaps the first actual water-pollutant trade already is underway in North Carolina's Tar and Pamlico river basin. There, a state-administered fund has contributed $900,000 to help about 20 farmers and livestock managers on Chicod Creek institute best-management practices to reduce nutrient runoff.

This entitles them to credits of 15,000 kg per year of nutrients, about equal to the amount released by a 1-million-gallon-per-day wastewater treatment plant.

Malcolm Green, general manager of the Greenville, North Carolina, Utilities Commission and chairman of the Tar-Pamlico Basin Association, a group of wastewater treatment plant owners, says it will use credits for those reductions to help members meet new, stricter limits on area-wide nutrient releases (ENR 12/21/92, p. 33).

Mark Tedesco, director of EPA's Long Island Sound office in Stamford, Connecticut, says 11 local management zones that have been established in New York and Connecticut to reduce nutrient release into the sound. "What we'd like to do is allow trading for nutrient reduction within the zones and possibly between the zones," he says.

Meanwhile, farther out on the horizon are calls for the watershed approach to reach beyond the Clean Water Act and to synchronize other environmental laws. *Water Quality 2000* has recommended a new national water policy that should be implemented through watershed planning and management.

Others want more attention to watershed management as a profession. "There are no watershed professionals, per se," says Harvey Olem, executive director of The Center for Watershed Protection, a nonprofit group based in Herndon, Virginia, which was formed last year to promote the approach. It soon plans to issue a quarterly newsletter and a variety of other technical guidance documents.

Even as water quality experts struggle to understand and implement watershed management, it is clear the philosophy is here to stay. EPA's Davies cites a 1911 quote by the famous naturalist John Muir that Davies says remains the essence of watershed management 82 years later: "When we try to pick anything out by itself, we find it hitched to everything else in the universe."

MANUAL COLLECTION OF DIGITAL DATA[1]

Data, data everywhere. . . and ne'er a way to collect it! Without a doubt, field operational data collection will be increasing in emphases for water managers and researchers, now and in the years to come." So says Wally Chinn, head of the irrigation development section of Alberta Agriculture, Food and Rural Development.

"This is becoming more essential now for irrigation operators as water availability becomes more critical and they must also rationalize their operations under much more public and environmental scrutiny." This was emphasized quite explicitly in the summary of the recent Alberta Irrigation Projects Association Annual Conference by C. Doug Radke, deputy minister of Alberta Agriculture, Food and Rural Development.

As the saying goes, "You cannot manage what you cannot measure!" The need for a variety of measuring systems is being recognized by the stewards of the water resource. But although one can and does measure, what happens to all that information? The world of computers has aided in assembling, collating, and correlating all this potential data in countless ways. But how can one actually collect the vast amount of data demanded these days in an effective and efficient manner? Certainly, automatic data recording stations are a great asset and are currently assisting extensively in this regard. However, when tying-in interfaces between irrigation district operations and individual on-farm systems, the number and cost of fixed data recorders required to keep track of some 12,000 plus serviced parcels would be prohibitive to say the least.

Recognizing the need for this data collection at the on-farm irrigation level and its interface with district works, the irrigation branch has carried out some preliminary evaluations of one type and make of portable data recorder that could become a standard tool for water supervisors in the irrigation districts.

The picture shows a "Polycorder 600" in field use. This type of unit is simply a battery-operated, manual-entry, portable electronic notebook that can be custom programmed to accept, store, and download data in and from a spreadsheet format. Such a rugged unit with its large entry and scrolling keypad, can be used by a water supervisor on a daily basis to "inventory" the operations within his or her block, right down to information about the associated on-farm situations. There are many manufacturers of similar equipment which could quite likely equally serve this purpose.

The intent within this evaluation was not to test a particular product but only to evaluate the concept.

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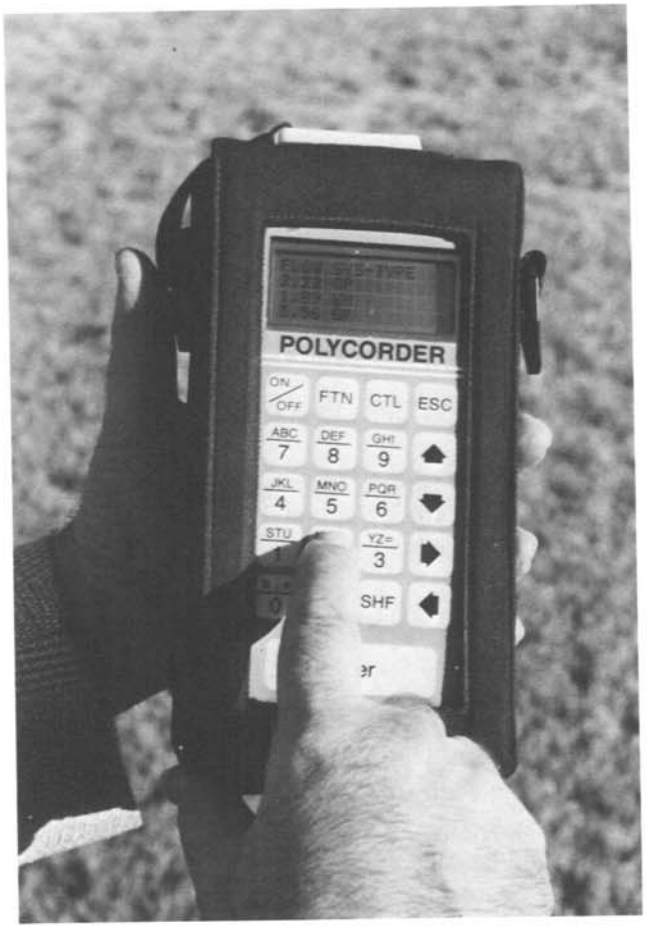

"Polycorder 600" being used in the field.

Depending upon the size of memory installed within the unit, the "Polycorder" can hold up to five different spreadsheet applications, with any one application supporting up to 99 different data fields and 9,999 records per field.

A sample operational records spreadsheet was set up for evaluation. A portion of the input data and field labels (Flow & System Type) is displayed within the LCD readout as shown in the picture. By scrolling across or up and down the display, more fields and input data can be recorded or viewed. Figure 1 shows the full-width portion of the printout of the evaluation spreadsheet. Within this example, three different sets of records are shown for the 10 fields programmed into the unit. These fields represent:

1) Land location
2) Parcel No.
3) Turnout No.
4) Water "On" time
5) Water "Off" time
6) Deliv. flow rate
7) On-farm system type
8) Acres irrigated
9) Pumping energy
10) Crop type

IRRIGATION DISTRICT FIELD/SYSTEM DATA - 1993

LAND LOCATION	PARC. NO.	T/O NO.	TIME ON	TIME OFF	FLOW	SYS. TYPE	AC	NRG	CROP
NW 321018	1	C3	6272100	3018000	2.22	CP	132	EL	SWSW
NE 321018	2	C4	6220840	7051630	1.89	WM	116	NG	BEET
NE 321018	1	D5	6221045	6261230	3.56	GR	72	GR	ALF

Figure 1. - "Polycorder" output spreadsheet.

There are some obvious benefits from these units says Chinn.

The unit can be set up and programmed during the off-season. The operational season data can be recorded from the cab of the supervisor's truck and quickly downloaded on a daily or weekly basis to a larger computer storage and handling system for various analyses.

The list price for a unit such as the one shown in the evaluation test is about US$1,400 depending upon quantity ordering.

Of course there are many applications that these units could be used for but the objective remains the same. . . to collect as much relevant information, without the in-field paper work, and with a minimum of transfer or downloading and analyses time afterward. Jack Ganesh, P.Eng. of the irrigation branch, who has been searching for an electronic recording device for water supervisors, will be evaluating this model along with others. The device should be capable of storing water requests, turn-off times and using these data to compute daily demands. By storing rating curves in the recorder, the ditchrider makes gate adjustments to meet flow demands and minimize return flow. In addition, the electronic recorder should be capable of keeping records of other relevant data. Some of these devices will be tested as part of the overall water management strategy of the Block Study currently underway in Bow River Irrigation District. With cooperative efforts between agencies, tools such as this offer tremendous potential for necessary database development and ongoing maintenance as well as data sharing.

The irrigation branch welcomes the opportunity to work with any irrigation district interested in pursuing this type of venture. For more information, contact Wally Chinn (403) 381-5864, or Jack Ganesh (403) 381-5869 -- Irrigation Branch, Alberta Agriculture, Food and Rural Development, Agriculture Center, Lethbridge, Alberta, Canada T1J 4C7.

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Evan Rasmussen, Pacific Northwest Region, Attn: PN-3224, 1150 North Curtis Road, Boise ID 83706-1234, (208) 378-5334, fax (208) 378-5305.

Dena Koyama, Mid-Pacific Region, Attn: MP-430, 2800 Cottage Way, Sacramento CA 95825-1898, (916) 978-5078, fax (916) 978-5284.

Ron Smith, Lower Colorado Region, Attn: LC-436, PO Box 61470, Boulder City NV 89006-1470, (702) 293-8436, fax (702) 293-8042.

Don Wintch, Upper Colorado Region, Attn: UC-434, PO Box 11568, Salt Lake City UT 84147-0568, (801) 524-3307, fax (801) 524-3034.

Tim Flanagan, Great Plains Region, Attn: GP-433, PO Box 36900, Billings MT 59107-6900, (406) 657-6243, fax (406) 657-6418.