BULLETIN 160-98 ■ CDEC-A BETTER WAY ■ THE PALISADES PROJECT ■ AND MORE!

DEPARTMENT OF WATER RESOURCES

News

SPRING ISSUE 1998

The Project Operations Center:

Command Central

mission statement

"To manage

the water resources of California,

in cooperation with other agencies,

to benefit the State's people and protect,

restore, and enhance the natural

and human environments."

features

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Once occupying a snug spot on the 16th floor at headquarters, the POC has not only had a makeover in space and looks, its control system has undergone a metamorphosis which will bring SWP operations into the future.

Old Equipment, New Tools

First installed in the late 1960s, the POC's old control system had outlived its usefulness. "It was obsolete and difficult to keep online or even find parts for," says Ed Trevino, Chief of the Control Systems Branch. "Data update rates were 3 to 5 minutes, meaning if there was a power failure or a unit tripped (stopped operating), the POC staff was unaware during that delay."

Different computers drove the control systems for the main center and the five Area Control Centers located in each field division. Field staff normally control Project facilities within their jurisdictions, with the POC acting as backup if any ACC failed. But the dissimilar systems tested the capabilities of the old controls. If two or more ACCs failed simultaneously, the POC computer was severely overstressed.

Another problem arose in data calculations. With each system analyzing numbers for reservoir storage, water flows and levels differently, data values used for operational decisions varied. As time passed and with the databases managed by separate staff, the values grew even more disparate.

The biggest stumbling block, however, was the old system's inability to change as modifications were needed, particularly where new concepts for operation were envisioned.

So the search began for a new control system—and a new center. The original site for the new POC was at Jibboom Street near Sacramento's Old Town. When toxic waste was found on the grounds and the site was rezoned within the 100-year floodplain, another site was selected on El Camino Boulevard. Since the existing building had to be stripped and rebuilt, Supervising Engineer Al Cosper (now retired), working with the architectural firm of Dreyfuss & Blackford, coordinated construction of the POC to fit the specifications of its users. Officially opened in 1995, the new building now houses and integrates SWP operations with DWR's Division of Flood Management, the U.S. Bureau of Reclamation's Central Valley Project, the National Weather Service, and the California-Nevada River Forecast Center.

Around the same time, the project to replace the old control systems began. "Various headquarters and field division staff met to discuss design concepts and list system requirements," says Ed Trevino, then an associate control engineer working on his first DWR assignment.

Water and power dispatchers (see "A Different Breed," page 12) who staff the POC and the hydroelectric plant operators and senior operators who monitor the ACCs, needed more detailed information on equipment status at the remote facilities, faster data updates of changes as they occurred, and a more fault-tolerant, reliable system. Control engineers required a software system that could be easily modified as operational needs changed. All agreed that with a database expected to reach 70,000 monitor-and-control points, a fast and easy-to-

To fill a dispatcher's seat requires a person who knows the SWP system through experience and can now visualize what's happening in the field from numbers on a computer screen.

"We wanted visitors to clearly see and understand what is happening and where it's happening."

– Ron McAfee

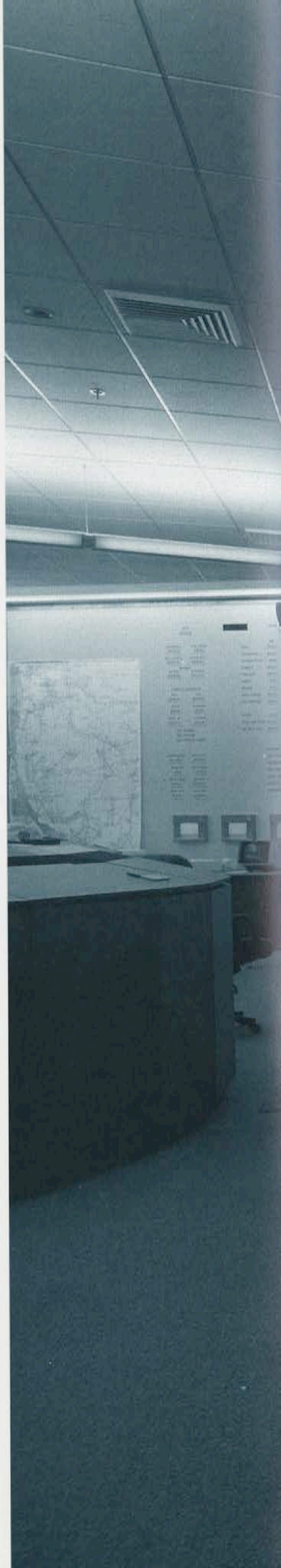
navigate display system was essential.

"The system chosen meets all those requirements, as well as takes advantage of recent technological advances such as wide area networking and relational database design," says Jain Fong, head of the POC Engineering section, which provides application development and engineering support for the POC. "These advances give us tools to face future needs with confidence."

State-of-Art Equipment, Great Improvements

Replacing the old with the new system was a massive undertaking consisting of two major phases—installing and programming of (1) many new Remote Terminal Units used to monitor and control equipment (see "Role of an RTU," page 6) and (2) control computer systems for each of the 10 largest pumping and power plants, the Area Control Centers, and the POC.

For the latter phase, the JC-6000 SCADA (Supervisory Control And Data Acquisition) was selected. Each SCADA system incorporates a redundant backup computer for increased reliability. The POC's system can control the entire SWP, as well as allow ACC operators and POC dispatchers to perform their respective duties.



Standing 12 feet high and spanning an arched surface 54 feet across, the map board displays data and colored lights which show the status of major SWP facilities and check sites.

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UPSTREAM WL
DOWNSTREAM WL
CFS

The Role of an RTU

RTUs, Remote Terminal Units, are microprocessor-based equipment, which serve as a system's local input-output devices. These units are connected to all pumps, generators, aqueduct checks, turnouts, and other SWP facilities, which require frequent monitoring and remote control by POC dispatchers and ACC operators. Each of the system's approximately 250 RTUs is programmed to automatically perform equipment functions such as start-up or shutdown of units, as well as to send updated data on their operations.

The RTUs within a pumping or power plant are part of a local SCADA system, operated from the plant's control room. These units, together with the RTUs along the aqueduct, are controlled by the SCADA control centers serving the POC dispatchers and ACC operators ■

"Now there is enough power to handle the entire statewide system and then some," explains Trevino. "Both POC and ACC staff will be looking at the same database and see the same values. SCADA will also coordinate whether the POC or the ACC is in control of Project facilities."

The new SCADA system brings improvements that will radically alter how data is presented and how fast. Data transmission is down to 4 seconds along the aqueduct and 8 seconds from major plants. Displays will present data in tables, charts and graphs unlike the earlier displays with their lines of numbers, which often lacked sufficient detail.

The new hierarchical database provides another pragmatic refinement by providing the speed needed for rapid display updates, control calculations, and alarm functions. Plus the technology is easier to use and maintain than the older system. Data can be located by a name or ID, instead of remembering its specific location in the database as was required in the old system.

"This modification will make a big difference in our ability to program changes in the system," explains Jain Fong.

An added feature especially welcomed by the dispatchers is alarm priority. "Alarms are set off by changing conditions such as a water level drop in the aqueduct or pumping or power units shutting down. Because the system can now bring in more data, all kinds of alarms may go off at once," says Ron McAfee, the POC's Chief Water and Power Dispatcher with 30 years' DWR experience in his field.

"There is no way a dispatcher can look or even deal with a 1,000 alarms, so the system is programmed to prioritize the alarms and

display only those that need immediate attention."

But the improvement that most excites the engineers and users alike is the Information Storage and Retrieval System, which will allow more users to view ongoing SWP operations.

"Previously, the only way to access the database was to directly connect to the control system," says Fong. However, because of security constraints, only operators and dispatchers were allowed connections.

"Through ISR, users can have access to a near real-time, mirror image of the data. This means they can see the numbers but can't change them. With this new security, anyone in the Department who is interested (and obtains permission) can view Project operations as they're happening."

Big Map Board, More Displays

Standing 12 feet high and spanning 54 feet across the front of the POC, the map board displays data from specific facilities such as pumping and power plants, electrical interties, reservoirs, and check sites—the 66 radial gate sites that control water flows along SWP aqueducts. The display panels correspond to the locations of the facilities along the board's plan view of the Project's alignment set against a topographical background of California.

Lights on the board also alert dispatchers to alarms that may indicate a plant exceeding operational limits, the failure of a unit in a pumping or power plant, or an unexpected change in water level in an aqueduct pool. (The pool is the body of water between gates.)

"We also wanted visitors to the POC to be able to clearly see and understand what is happening and where it's happening," says Ron McAfee. "It's not just impressive to look at but provides a more complete picture of SWP operations, as well as that of USBR reservoirs affecting Project releases."

The board however is not yet complete. Plans are to add data showing earthquakes as they occur in the state and water quality conditions in the Delta.

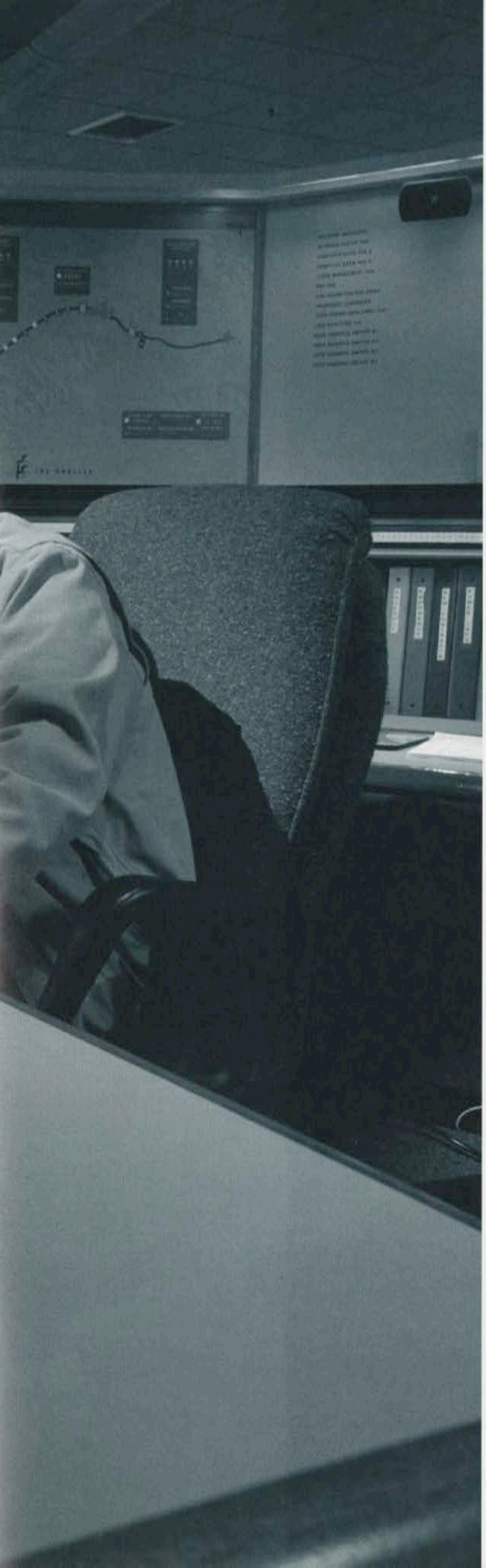
Fresh Challenges, Outstanding Team Work

To replace the old with the new was a "massive" undertaking for all involved. Initially the POC's and ACCs' systems were scheduled to be completed in 1995, with the plant SCADA systems to follow later. But plans aren't always foolproof, and challenges along the way sometimes seriously delay deadlines. Such was the case with the system's software.

"This modification will make a big difference in our ability to program changes in the system,"

– Jain Fong.

"Our operations are very complex to simulate for factory tests with the vendor," says Ed Trevino. "There were errors in the system and it took a long time to debug the software,



which went back to the vendor many times for fixes. That was the main reason for the slip in completion dates."

But the effort was well worth the time. "Because all the ACCs, the POC, and the major plants will use the same software, it's crucial that the software be right and reliable," Trevino explains. "Once the software is right, the rest is easy."

Even more critical to the success of the program was the team effort between headquarters and field division staff.

"The field divisions' input into the system's development was essential. Plus their staff did all of the installation at each ACC—including the wiring and physical mounting of equipment. Without their cooperation and hard work, it wouldn't have been possible to achieve what we did."

The feelings are mutual, says Jeff Said, Chief Operator at Delta Field Division. "They gave us outstanding service," he explains. "The control systems technicians and operators here also did an excellent job. Working together made all the difference. Because our division was the first to operate the aqueduct on the new SCADA system, we helped them get most of the 'bugs' out before the system was expanded to other field divisions."

Headquarters' staff also took their concerns seriously. "If we wanted to see certain displays or change the way we entered data, they tried to accommodate our needs," Said adds. "Of course, not everything could be done but whatever they could do, they did."

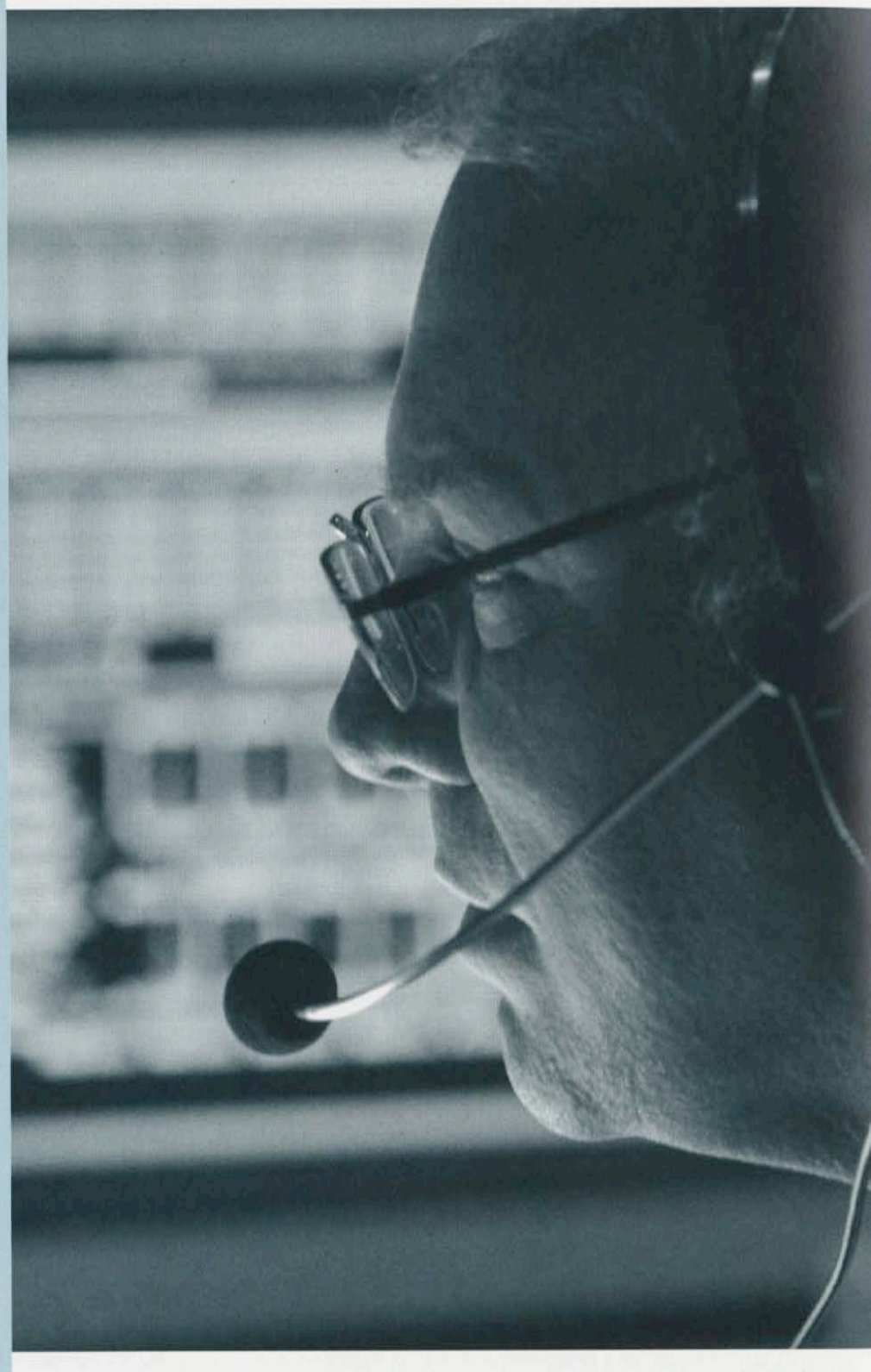
As for the new system itself, Said says basically his operators love it. "It's fast, easy, and pleasing to look at—that's important when

Each station contains four computer monitors displaying data which gives the dispatcher instant access to information on any major SWP facility, anywhere along the system, at any time.

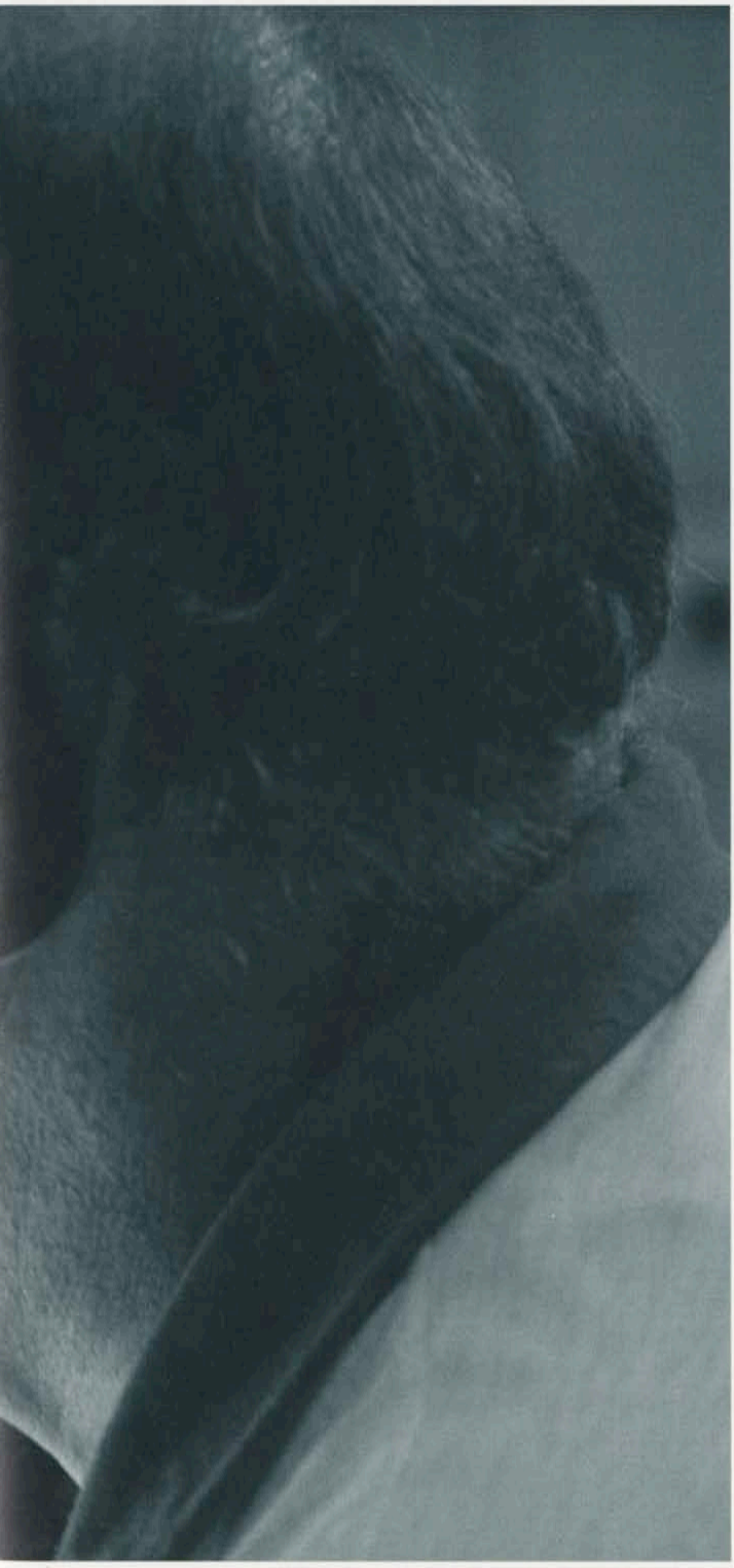
A Different Breed of People

It takes a different breed of people to work as dispatchers in the POC. The 24-hour workday is divided into three shifts—day, swing, and graveyard. They rotate shifts, constantly juggling work hours and sleep schedules. The consoles must be continually staffed, even through meal times. While the activity is constant, it's not always exciting. But these hardy souls already know the routine, having paid their dues in the field divisions' Area Control Centers where the duties are much the same.

Of the three dispatchers, one monitors water operations. Another deals with power generation, loads, and transactions. The third is the senior who oversees all of it and makes decisions in emergencies. Each must be able to perform the other's duties, a feat which can take up to two years to master comfortably. ■



Three shifts, 24 hours a day, seven days a week, and a lot of responsibilities - These are just a few requirements of a POC dispatcher.



you consider the long hours we work, the amount of water that is moved, and the many sites we have to monitor. But adjusting to it hasn't been easy. We still have work to do."

Chief Operator at San Joaquin Field Division April Petok and her staff are experiencing a similar learning curve. "Change is hard; it's difficult to let go what you were comfortable with. Plus there are still some 'bugs' to work out in the new system.

"But when it's functioning well, the operators are discovering what the new SCADA can do," she adds. "It is much faster. There is a lot more operators can do and do it easier. At the same time, the system is much more complicated to use. But it's like anything brand new; you have bumps here and there until you master it."

The Work Continues

Even with the new system now online (since spring 1998), the project remains a work in progress.

"We can't sit back and take a deep breath that it's over. By having the ability to make changes, we find we are asked to make changes. We will continue to implement modifications and upgrades, and try to support what's needed in the field," says Trevino.

Jain Fong adds, "It's always an evolutionary process. We have to try to grow with changes in technology, and we will experience growing pains while getting accustomed to these changes. But this system will take us into the future and leave us ample room to improve and expand." ■

OUT *of* HARM'S WAY

A MODERN-DAY DEVICE –

the fish screen – is helping the chinook salmon live out its ancient propagation cycle in California rivers and streams.

by **Ted Thomas**

It is a cycle that many have witnessed: a chinook's climactic run from the Pacific Ocean to spawn, and inevitably die, in the stream or fish hatchery where it began life years before. Experts fear too few survive and that at least one race of chinook faces extinction.

Fish hatcheries assist survival odds by artificially spawning thousands of fish, but it is the wild salmon whose dwindling populations most concern scientists and water users.

Risks to the chinook are many, including agricultural diversion pumps that suck fish into irrigated fields.

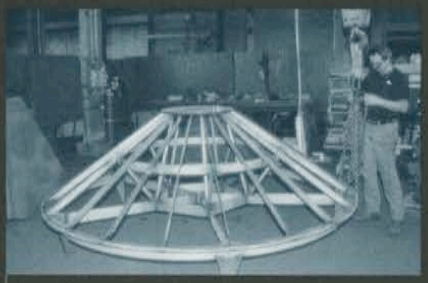
Private engineering firms and government agencies, including the Department of Water Resources, are developing new technologies and utilizing new funding sources to help water users install fish screens to keep salmon, and other fish, out of harm's way.

MORE FUNDS FOR FISH

Fish screens are usually physical barriers, although screens of sound, light, and electricity have also been tried. Fish screens are not new, but computer modeling and other technologies now make it possible to fine-tune their design to specific and often tricky hydrologic conditions.

Increased funding, largely stemming from the federal Central Valley Project Improvement Act of 1992 and the 1994 Bay-Delta Accord between state and federal agencies, has spurred the pace of screening projects.

Parties to the Bay-Delta Accord pledged to provide $180 million toward fish screening and other ecosystem restoration projects as part of the accord's Category III program. In 1996 California voters provided $60 million of that amount by passing Proposition 204, the source of more than $33 million for 36 projects that were announced by Governor Wilson in December 1997. Under the accord, urban water agencies are also providing funding.



The framework supports a conically shaped fish screen well suited to tidal marsh area diversions.

A metal fabricator is used to place the perforated plate material over the stainless steel frame.

A diversion site in the Suisun Marsh is modified to accommodate the installation of the fish screen.

Bottom three photos courtesy of Metropolitan Water District of Southern California

The federal share of Category III funds will be provided by appropriations in 1998, 1999, and 2000. Section 3406 of the CVPIA established the Anadromous Fish Screen Program under which the federal government pays up to half the costs of some screening projects. Water diverters and the State of California typically split the remaining cost.

Older sources of screening funds include agreements under which DWR and the federal Bureau of Reclamation mitigate for fish lost at their Delta pumping plants near Tracy. DWR signed the Delta Pumping Plant Fish Protection Agreement, or "Four Pumps Agreement" with the Department of Fish and Game in 1986, and the Bureau signed a similar agreement, referred to as the "Tracy Fund," in 1992.

The total number of dollars available for fish screening has not been determined, largely because individual project funding is contained in a variety of programs running over different periods of time whose specific expenditures are subject to modification. But funding has increased markedly.

PROGRESS UNDER WAY

"We were idling along on the Four Pumps and the federal pump mitigation funds," said Dan B. Odenweller, Fish Screen and Fish Passage Coordinator for the DFG. "The CVPIA is what kicked things loose."

Screening progress has been dramatic and millions of dollars are being spent on numerous fish screening projects in the Sacramento Valley, the Delta, and elsewhere in California.

"Three years ago, no major water users on the Sacramento River other than the Glenn-Colusa Irrigation District, the Tehama-Colusa Canal Authority, and the Anderson-Cottonwood Irrigation District were screened," said Jeff Jaraczeski, a Sacramento water issues attorney with the firm of Downey Brand Seymour & Rohwer, who until recently was Director of Member and Government Relations for the Northern California Water Association.

"Today," Jaraczeski said, "at least 12 major water users who divert between 70 and 80 percent of the total developed (controlled and managed) agricultural water on the river are in some stage of fish screen development."

Top photo: A brackish water wetlands, Suisun Marsh serves as a vital resting stop for migrating waterfowl.

Among Sacramento River diverters in addition to the GCID, Tehama-Colusa Canal Authority and Anderson-Cottonwood Irrigation District that have completed, are constructing or studying large fish screen projects are the Princeton-Cordova-Glenn Irrigation District, Provident Irrigation District, M&T Chico Ranch, Pelger Mutual Water Company, Maxwell Irrigation District, Reclamation District 108, and Reclamation District 1004.

Jaraczeski said that government's determination to restore California's fisheries is shared by Sacramento Valley farmers, many of whom are taking the lead in screening agricultural diversions.

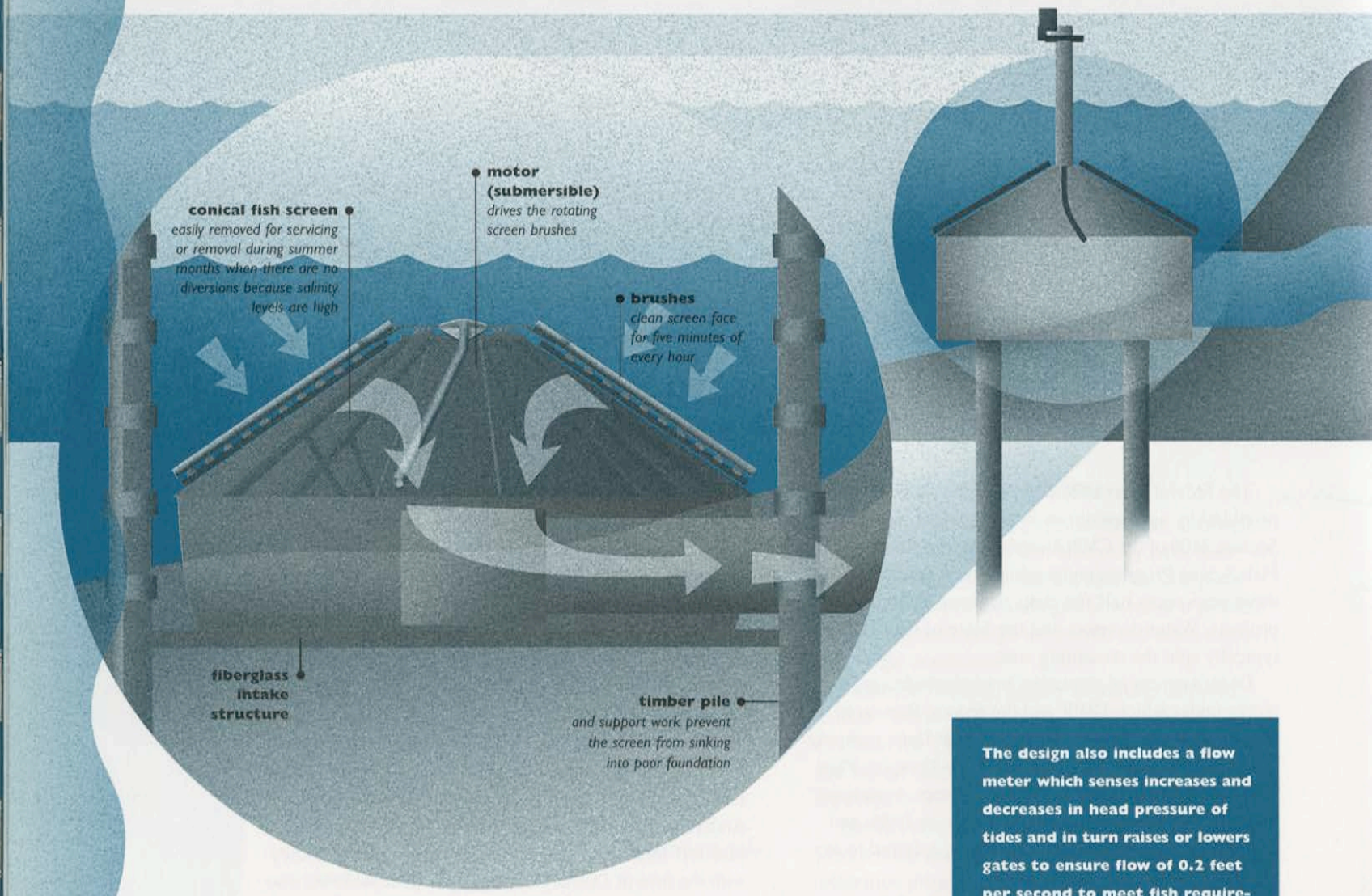
"The message here is that everybody is getting serious about fish screens," said Dick Daniel, Assistant Director for Habitat Restoration at CALFED, the state-federal agency implementing the Bay-Delta Accord.

GCID LESSONS

More than 70 years of fish screening history has been logged by the Glenn-Colusa Irrigation District at its Hamilton City Pumping Plant on an oxbow of the Sacramento River west of Chico. That history includes costly lessons in the tricks a stream can play to frustrate engineering efforts.

A flood washed out GCID's first fish screen shortly after it was installed in 1920, and another flood in 1935 reduced the efficiency of the district's second screen.

A massive complex of 40 rotating drum screens designed by the Department of Fish and Game was installed at the GCID pumps in 1972 at a cost of $2.6 million. Each of the 40 screens was 17 feet in diameter and weighed 7.5 tons, but their design performance was

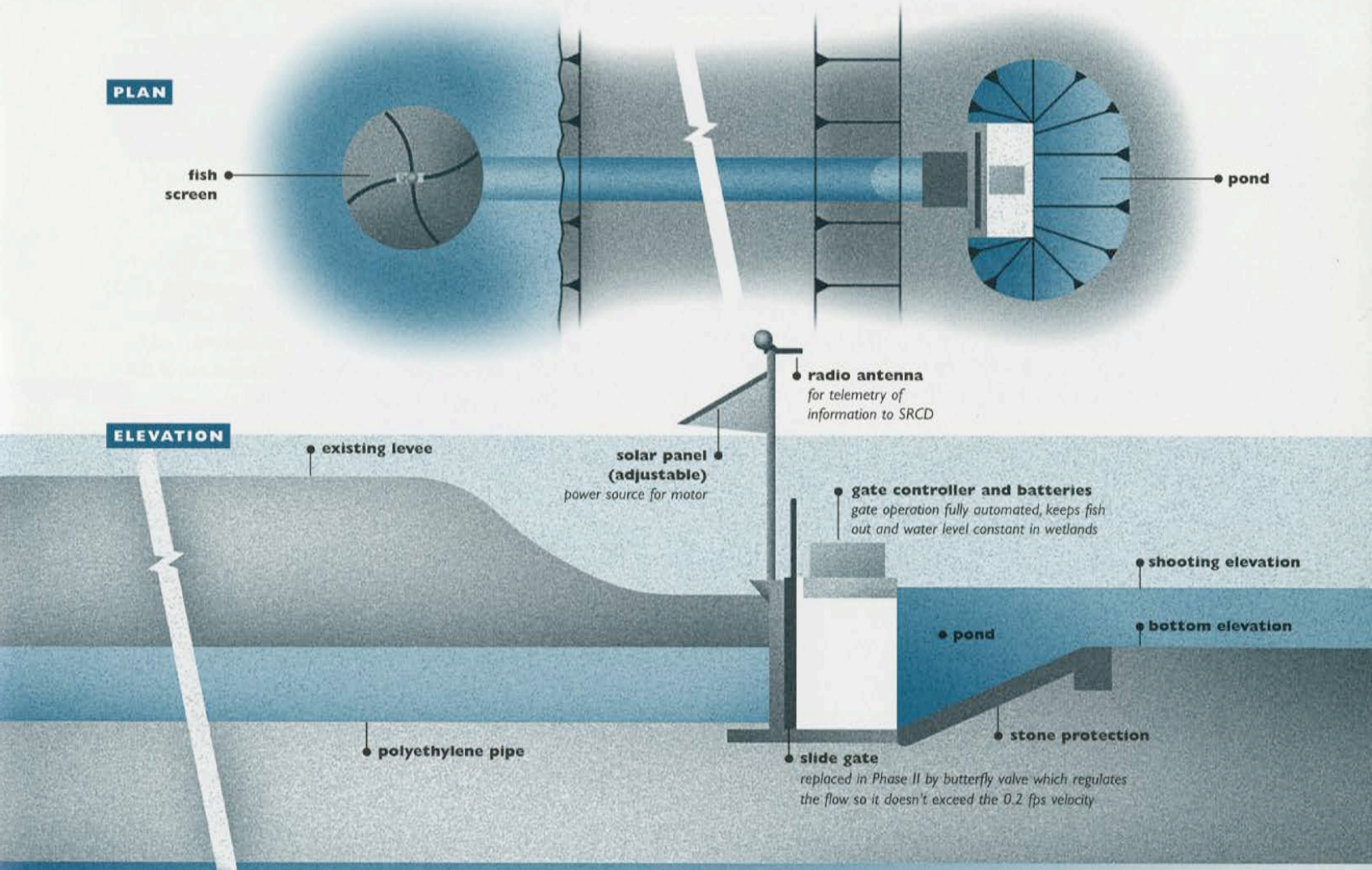


DETAIL OF FISH SCREEN

The design also includes a flow meter which senses increases and decreases in head pressure of tides and in turn raises or lowers gates to ensure flow of 0.2 feet per second to meet fish requirements. And a float sensor which signals the gate to shut down and stop diverting water.

SUISUN RESOURCE CONSERVATION DISTRICT FISH SCREEN IMPLEMENTATION PROGRAM

FISH SCREEN LAYOUT



SUISUN MARSH FISH SCREEN PROGRAM

Purpose:
To protect fish (especially listed species such as winter-run chinook salmon, steelhead trout, and delta smelt) from entrainment as water is diverted into seasonal wetlands from marsh sloughs.

Benefits:
Recovery of listed species, avoidance of future listings, creation of productive habitat of seasonal wetlands used by diverse species

Priority 1:
Diversions directly off of Montezuma Slough (without intervening vegetated berms)

Diversions larger than 36 inches in diameter

Challenge:
Tidal action in the marsh creates changing head pressures at diversions. Sensors read head pressure and regulates the gate to ensure a flow of 0.2 feet per second to meet fish requirements.

Design Team:
Suisun Resource Conservation District; Pacific Engineering; Borcalli & Associates, Inc.; Intake Screens Inc.; EETS, Inc., & Wetland Construction

Number of Screens:
13 of this design, 2 of another design (SCRD is seeking funding for 17 more screens.)

Funding:
Category III (CALFED), 4-Pumps mitigation (SWP), Tracy mitigation (CVP)

never realized because changing river conditions lowered the water-surface elevation at the pumping plant. Flat-plate screens were installed in 1993 and the rotating drum screens were removed as the district and government agencies continued to seek a permanent solution to fish loss problems.

Today, computer and modeling technologies that were not available in 1920, 1935, 1972, or even 1993 are being tapped by GCID, consultants, and state and federal experts to fence chinook salmon and other fish out of the approach waters to GCID's pumps.

"We have more tools and experience now to predict hydraulic behavior of a large fish facility and really are a lot more confident in what we can expect," said DWR Senior Engineer Darryl Hayes, who serves on the Technical Advisory Committee for the GCID project.

It became apparent that the Sacramento River's hydraulic behavior had to be altered to prevent stream level changes from again reducing fish screen efficiency. The U.S. Army Corps of Engineers will stabilize the water level at the GCID site by constructing a gradient facility similar to a man-made riffle in the main stem of the river.

The new GCID flat plate screen (approximately 1,100 feet long) is expected to be the biggest of its type in the world, as was the district's complex of rotating drums when dedicated in 1972. Construction of the new facility will begin in the summer of 1998.

As part of the CVPIA, Congress authorized the Bureau of Reclamation to pay 75 percent of the cost of the GCID screening project, estimated at $32 million including the screen and river gradient facility. GCID and the State of California each will pay 12.5 percent of the cost. The project is expected to be completed in the year 2000.

A TREADMILL FOR FISH

Size, history, and cost have focused attention on the Hamilton City Pumping Plant, but innovative fish screening projects dot the Central Valley and new ideas are being sought in the laboratory.

"We're trying to figure out where the gaps are in our understanding," said Hayes, who is also chief of the Fish Facilities Section in DWR's Environmental Services Office.

One gap was dramatized when the state and federal governments listed the Delta smelt as threatened in 1993.

"We don't have good criteria for the Delta smelt, as to what will and will not work with fish screens," said the DFG's Odenweller. "Studies are being done at the University of California at Davis to find out."

FISH "TREADMILL" RESEARCH

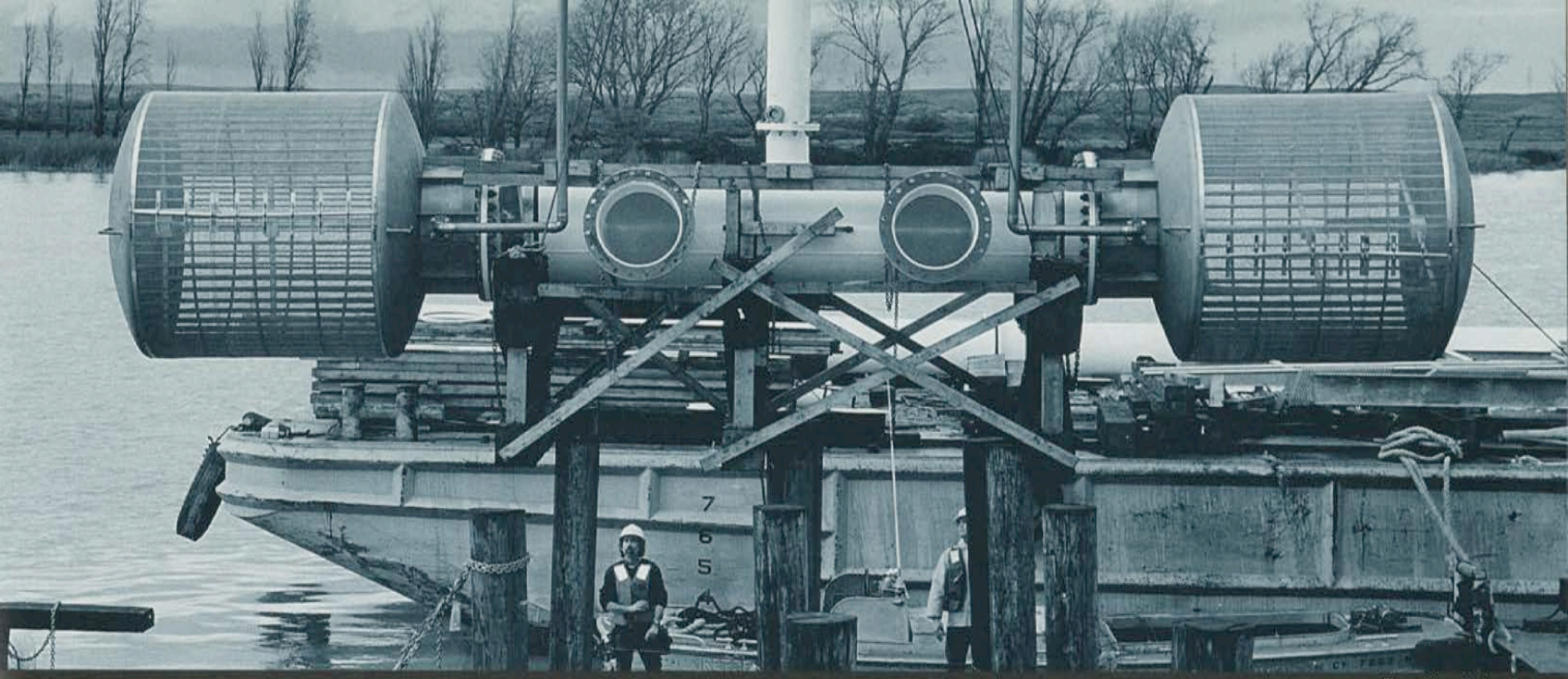
will help determine the hydraulic conditions under which fish of different species and in different stages of physical development will be abe to safely bypass screens avoiding fatigue, impingement and entrainment.

DWR's Hayes is heading the UC Davis studies, using a circular flume dubbed the "Fish Treadmill" in which fish encounter realistic screen conditions that can readily be changed for experimental purposes.

Fish "treadmill" research will help determine the hydraulic conditions under which fish of different species and in different stages of physical development will be able to safely bypass screens, avoiding fatigue, impingement, and entrainment.

"Much of the existing research has focused on salmonid species instead of the increasing numbers of fish which are in need of protection in California's Central Valley," Hayes wrote in a scientific paper. "With this need identified, a program is under way to address the screening needs for a number of California's native fishes."

The three-year treadmill study that began in the summer of 1997 is a joint enterprise of the Department of Water Resources, the University of California at Davis, the Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Bureau of Reclamation. The research project is paid for by the 29 agencies that receive water from the State Water Project under long-term contracts with DWR.



Photos: Norm Hughes

In the treadmill study, fish are subjected to various hydraulic conditions they may encounter in the Delta.

The velocity in the fish treadmill is precisely measured.

The study was cooperatively developed by state and federal agencies. Its results will be useful to CALFED's investigations.

REBOUND HOPES

Rebounding to healthy numbers will be an upstream struggle for some races of salmon and some other California fish, but they are getting human help.

Is the increased help arriving in time?

Paul Jensen, a fisheries biologist and former Deputy Director of the California Department of Fish and Game, is optimistic. Speaking of the winter-run chinook salmon, which has been listed by state and federal agencies as endangered, Jensen said:

"Anyone who has watched salmon populations in California or elsewhere along the Pacific Coast can vouch for the fact that the animals are amazingly resilient."

"Given that built-in resilience," Jensen added, "it's not too late to bring those fish populations back to acceptable population levels. All we have to do is to commit ourselves to the job. And all of us seem increasingly willing to do that.

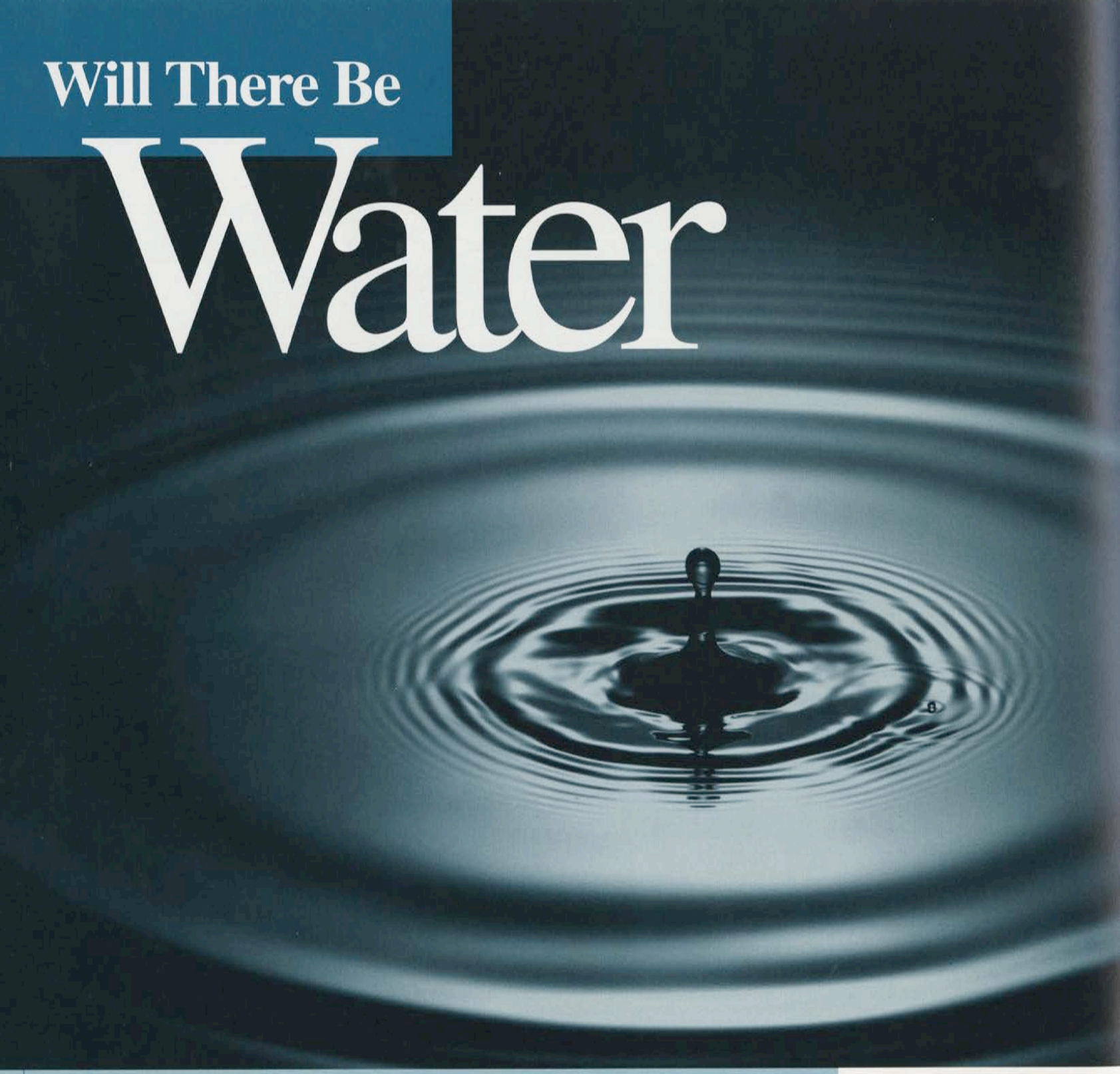
"Of course, all the fish screens in the world are going to accomplish nothing unless there's water left in the system in which the fish can exist. So along with fish screens must come some reasonable effort to assure that adequate flows for migration and spawning remain."

DWR and the Bureau of Reclamation — complying with fishery restoration goals of the CVPIA and the Bay-Delta Accord — have increased fresh water flows from upstream reservoirs through the Delta with apparently positive results.

The estimated spawning run of winter-run salmon — one of four races of chinook on the Sacramento River and its tributaries — was down to 186 adults in 1994 but increased to 940 in 1996, according to the Department of Fish and Game. Officials of the federally sponsored San Francisco Estuary Project credited the population upswing to several years of heavy rains and runoff, increased releases of fresh water by DWR and the Bureau of Reclamation and an increase in funds for environmental programs.

Top photo: In February, two large cylindrical fish screens were installed in one of the largest Delta diversions located on Sherman Island.

Will There Be Water



Bulletin 160-98 hints at a possibly bleak future for Californians

Article by Joyce Tokita

To

The year is 2020.

California is in the third year of a statewide drought. Mandatory rationing is commonplace. Rock gardens have replaced lawns; plants and trees are rare. Swimming pools are banned, and sprinklers sit idle. Water is now a priceless commodity.

So costly that houses are priced beyond the pocketbook of the average resident. Businesses are charging more for their products and services. And apples are selling for a $1 each...on sale.

This may seem too bleak an outlook for California's future, but it may not be too far off the mark, if the Department's forecasts are accurate in predicting shortages that await the public within the next two decades.

omorrow?

"The magnitude of potential shortages... demonstrates the urgency of taking action."

-- Bulletin 160-98

The Latest Water Update

In January 1998, DWR released a public review draft of Bulletin 160-98, part of a series of updates published every five years. A legislatively mandated report, the Bulletin 160 series evaluate California's urban, agricultural, and environmental water needs; assesses water supplies available to meet those needs; and recommends options that may counter future shortages. This report looks at the state's water prospects for the years 1995 and 2020.

To evaluate water supplies versus water needs in the selected years, Bulletin 160-98 examines each year's level of development. For example, the report evaluates how 1995's water supply (including surface, groundwater, recycled, and desalted) will meet or fall short of that year's demands under average and drought water years. Conditions and events that would reduce or increase supply or demand are assessed, then the amount of predicted shortages are estimated.

The same goes for the year 2020. Using population, irrigated acreage, and other forecasts together with the anticipated outcome of water management programs and events, approximations are made of average and drought year shortages, as well as recommendations to meet those future needs.

Out of two thick volumes of research and calculations come these stark conclusions:

• If no action is taken to improve the reliability of the state's water supply, by 2020 Californians will be short 7 maf during a drought and 2.9 maf in an average year.

• If currently planned facilities and water management actions are put into place, under drought year conditions, the state's 1995 shortage would be 5.2 million acre-feet, while an average water year shortage would be 1.6 maf (the annual overdraft of groundwater in recent years).

However, there is hope that these shortages can be reduced — if water purveyors throughout the state can implement ways to improve their water supplies.

Shortages and Solutions

By 2020, the Department of Finance forecasts that California's present population of over 32 million people will grow to 47.5 million. This future population roughly equals the state's present population plus the total number of people living in Arizona, Nevada, Oregon, Idaho, Wyoming, Colorado, and Utah.

"The magnitude of potential shortages, especially drought year shortages, demonstrates the urgency of taking action," Bulletin 160-98 states. "The do-nothing alternative is not an alternative that will meet the needs of 47.5 million Californians in 2020."

At a 1995 level of development, urban water use accounts for 11 percent of the state's total water use, with agricultural and environmental water use at 43 percent and 46 percent, respectively. By 2020, these percentage will change slightly. Urban use will rise to 15 percent and agricultural use decline to 39 percent.

The solutions to reduce the shortages require action by the state's water purveyors, including the local agencies that provide about 70 percent of California's developed water.

"If water purveyors statewide—at all levels of government—implement actions likely to be taken by 2020, forecasted water shortages would be reduced, but not eliminated," the bulletin reports.

With improvements made by 2020, water shortages could diminish to 3.9 maf during droughts to 1.4 maf in average years.

However, such measures will be costly and require many and varied water management approaches.

"There is not one magic bullet" that will solve the water dilemma, according to the 1998 update. All options must be considered. Among them, Bulletin 160-98 includes CALFED's efforts to fix the Delta, development of new surface and groundwater supplies, urban and agricultural water conservation, the implementation of California's 4.4 Plan to reduce its use of the Colorado river water, increased use of water transfers and exchanges, and DWR's drought water bank.

A New Spirit of Cooperation

All of these potential actions will amount to nothing without cooperation among the water agencies, planners, and users. Planning for future water demands on a regional basis and increased stakeholder participation will play key roles in whether actions taken succeed.

To face the future with productive results, all of the state's water-using sectors must work together and respect the needs of others as legitimate. The bulletin calls for those involved to continue the "new spirit" created by the Bay-Delta Accord "of fostering cooperation and consensus rather than competition and conflict.

"Such an approach will be increasingly necessary, given the magnitude of the water shortages facing California. Mutual accommodation of each others' needs is especially important in drought years, when water purveyors face the greatest water supply challenges."

Ending on a positive note, Bulletin 160-98 concludes, "With continued efforts to prepare for the future, California can have safe and reliable water supplies for urban areas, adequate long-term water supplies to maintain the state's agricultural economy, and restoration and protection of fish and wildlife habitat."

Public review of Bulletin 160-98 was conducted during February and March. A final version is expected in late 1998.

The draft Bulletin 160-80 can be accessed via the Internet at <http://wwwdwr.water.ca.gov/dir-dwr_publicationsR2/DWR_PublicationsR2.html>. ■

A Bond For The Future

On January 5, the Governor proposed a $1.3 billion Water Management general obligation bond to improve and protect California's water supply, protect lives and property, and upgrade the Bay-Delta watershed and ecosystem. The water bond addresses major water supply shortages identified in DWR's Bulletin 160 and flood control improvements recommended by the Flood Emergency Action Team report. It includes funding for an array of key purposes such as flood control, watershed management, non-structural storage,water conservation and recycling, and future Delta planning. This bond proposal differs from Proposition 204, the $995 million water bond approved by California voters in 1996. While Proposition 204 primarily funded environmental programs, this new bond will support California's need for a reliable water infrastructure.

- from Director Kennedy's Report to the California Water Commission

PEACE

BY PETE WEISSER

Photos by Paul Hames

WHEN TRESPASSERS AND POACHERS *began plaguing DWR property on two Delta islands in the early 1990s, the Department copied a tactic from the Old West — inviting some good "hired guns" to restore peace to the range.*

DWR turned to a sister agency, the Department of Fish and Game, and enrolled the property (eventually about 1,000 acres each on Twitchell and Sherman Islands) in a sanctioned game bird hunt program.

on the RANGE

THE RESULT?

Legal hunting by family groups and youngsters, along with monitoring by wardens, improved security for the property and brought a halt to the trespassing and poaching. In fact, the hunts have proven so successful that the Fish and Game Commission presented a prestigious new award to DWR and two DWR officials who initiated the hunting effort — Chief Deputy Director Bob Potter and Right-of-Way Agent Ron Boeck.

Boeck proposed the idea and Potter obtained approval for its implementation.

"This is really a 'win-win' situation for both DWR and DFG," said Bob Potter, DWR's Chief Deputy Director. "The public gained hunting access to some of the best

PEACE on the RANGE

"It encourages family-oriented outdoor recreational activities," said Connelly. "It rekindles interest in traditional outdoor recreation."

pheasant habitat in the Delta. And DWR, as a prudent landlord, benefits by having controlled, official hunting programs in place, with DFG wardens to monitor activities."

DWR owns extensive acreage on the two islands as part of its efforts to protect and restore the Delta. Both islands are critical to the region's water quality because they lie adjacent to major channels where the fresh water from the east mixes with the salt water from the west. If either island floods, the rate and area of that mix would increase and saline water would intrude farther upstream. More saline water means poorer water quality, a condition that could require increases in water releases from upstream reservoirs like Oroville. This in turn impacts the reliability of the State Water Project's water supply.

Working with the State Water Contractors, the agencies that receive water from the State Water Project, the Department developed plans for managing the islands to protect water quality and the reliability of SWP supply, as well as to provide habitat and mitigation.

Plans for the two islands also include development of permanent and seasonal wetlands and wildlife habitat, and opportunities to conduct programs to test fish screens and investigate land use practices to reduce subsidence. Already under way are levee improvement projects and other special flood control projects.

When problems with trespassers and poachers on Twitchell and Sherman islands started in 1992, DWR decided prosecution was not the solution; a less time-consuming and expensive approach than prosecution was needed. The officials looked to the islands themselves for the answer. Sparsely populated and heavily agricultural, both offer excellent game bird hunting habitat, especially in their grain and corn fields.

"I felt we needed a better way to police this trespass problem and the poaching problem," recalled Boeck, property manager (see *DWR's Landlords*, page 29) for both Sherman and Twitchell islands, "rather than trying to 'bust' all these people that were coming onto our property for illegal hunting."

A hunter and expert pistol shooter, Boeck proposed cooperating with DFG on a limited number of controlled, legal hunts.

"The word would get out that this was a sanctioned hunt," he explained. "There would be Fish and Game officials there. It would keep the poachers out, basically, and keep the trespassers down to a minimum."

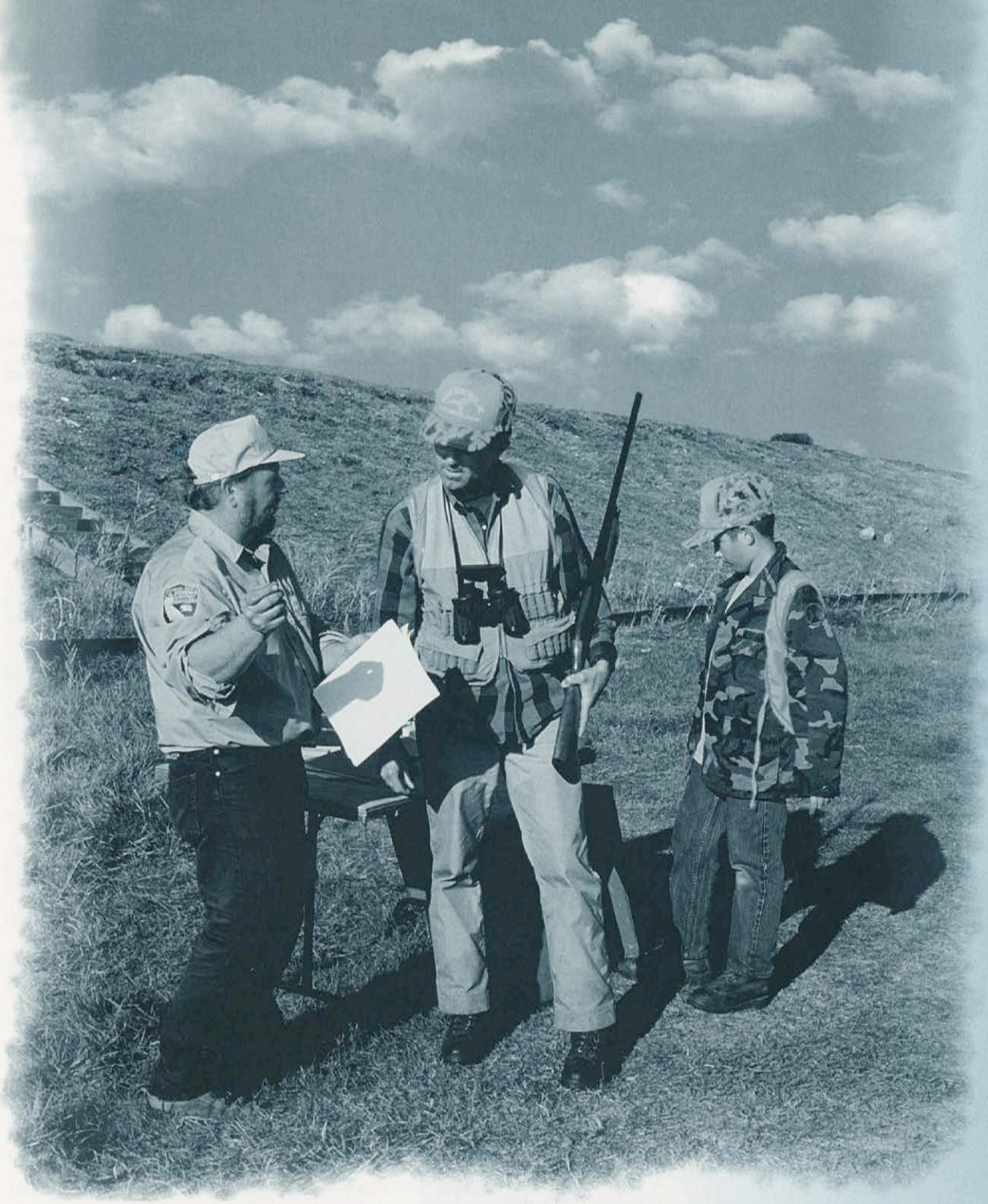
With Potter championing the proposal, the hunts started in 1993. The hunts began that fall on a few selected fields. They expanded in numbers and geographic scope in subsequent years.

"We haven't had a poaching problem since on either island," said Boeck. "So far, it's worked. It's worked real well."

Fish and Game officials appreciate gaining hunting access to productive pheasant hunting land in the Delta as part of its Game Bird Heritage Program.

DFG Biologist Dan Connelly said the program, begun in 1992, seeks to expand hunting choices in California and offer high quality hunting opportunities.

"It encourages family-oriented outdoor recreational activities, " said Connelly. "It rekindles interest in traditional outdoor recreation."



"This is really a **'WIN-WIN' SITUATION** *for both DWR and DFG," said Bob Potter, DWR's Chief Deputy Director. "The public gained* **HUNTING ACCESS** *to some of the* **BEST PHEASANT HABITAT** *in the Delta. And DWR secured wardens to* **PROTECT ITS PROPERTY** *from trespassers and poachers."*

PEACE *on the* RANGE

THE TWITCHELL AND SHERMAN ISLAND HUNTS *occur on Wednesdays and Saturdays during the hunting season,* **FROM MID-NOVEMBER THROUGH DECEMBER.** *Typically, these include some hunts limited to teenagers or women.*

The Twitchell and Sherman Island hunts occur on Wednesdays and Saturdays during the hunting season, from mid-November through December. Typically, these include some hunts limited to teenagers or women, demographic groups DFG wants to attract to the sport of hunting.

Persons wishing to participate send in a postcard to DFG. Successful applicants are drawn in a lottery and assigned a hunting date.

Wildlife officials are so pleased with the DWR-DFG cooperative effort that the Fish and Game Commission gave some of the first "Taucher Awards" to DWR, and to Potter and Boeck at a ceremony last August. DWR's award was the first given to a public agency.

In recommending the honor, DFG officials noted that DWR's cooperation "has created more than 2,000 public hunter opportunities" during a four-year period, adding: "These public hunts have provided some of the highest quality wild pheasant hunts in the State."

The Taucher awards recognize agencies and individuals who have made a significant contribution to promoting hunting opportunity in California. The awards are named in honor of Albert C. Taucher, a Long Beach sporting goods dealer, hunter and longtime member of the California Fish and Game Commission. Taucher served as a member of the Commission from 1983 until his death in 1994.

Persons wishing more information about the Game Bird Heritage Program hunts, either in the Delta or elsewhere, may contact Karen Fothergill, a DFG biologist in Sacramento at 916-654-7429.

DWR'S LANDLORDS

The Division of Land and Right of Way

Ron Boeck is a DWR landlord. That is, he manages the Department's property as a land agent with the Division of Land and Right of Way. Functioning as the real estate arm of the Department, the Division and its staff prepare property descriptions, maps, exhibits, and deeds needed to acquire, manage, lease, transfer, exchange, or sell lands for the State Water Project or Reclamation Board.

DWR owns more than 4,000 parcels totaling about 94,000 acres — including Sherman and Twitchell islands. Such property is used to build or expand projects such as SWP facilities, provide mitigation areas to offset impacts by DWR projects, gain rights-of-way for DWR projects to cross private property, and acquire access to a project site through adjacent properties.

They also survey DWR lands to help engineers design facilities. Others do market research, write appraisals, issue encroachment permits needed to enter DWR or Reclamation Board properties, help people or businesses move from purchased property, and arrange for relocating or replacing facilities such as roads, pipelines, and power and telephone lines.

More than 19,000 acres of SWP land and nearly 18,000 acres of Reclamation Board land are under lease, producing annual revenues of about $1 million. Leased land is predominantly used for farming, although such diverse groups as windsurfers and dog trainers also lease DWR properties.

photo: Willy Onarheim, Yreka, CA

Http://water.ca

Back Forward Home Netsite http://water.ca.gov/cdec_abetterway/

HOPE

A BETTER W

WAY

A news bulletin interrupts your favorite sitcom. The anchor announces the past days' heavy rains are raising river levels, and reservoirs are making flood releases. Levee patrols are out, and warnings to evacuate certain areas may come in a few hours.

The situation is critical—at least to you because flood waters nearly threatened your home the last time. You want to know where the rain is falling, which rivers are approaching warning stages, and how much water are reservoirs releasing. But who do you turn to?

The answer may be right at your fingertips.

Open to public access via the Internet since 1995, the California Data Exchange Center serves as a one-stop information center for almost everything you need to know about weather forecasts, temperatures, wind direction, precipitation amounts, river stages, reservoir releases, snowpack, water supply, water quality, Delta tides, and much more.

But the system serves a more crucial function than keeping the public informed. With the vital information it provides, CDEC fulfills its first and foremost mission — to forecast floods so residents can stay out of harm's way.

From the beginning

DWR programmers David Parker and Ray Welch know CDEC intimately. They witnessed its beginnings in 1984 as a small system with a limited database and a select group of users. Back then the computer room was a utility space with an air conditioning unit to cool off equipment, data was manually entered, and water-related data was maintained by separate agencies. Both program-

Article by JOYCE TOKITA Photography by DALE KOLKE

mers still remain with CDEC, working through the changes that have boosted the system's capabilities.

Today, CDEC is accessible through the Internet, served by four computer systems in new quarters in the Joint Operations Center building, fed real-time data automatically, and updated with information from 12 agencies. (During high water and floods, information from CDEC is available by calling 1-800-952-5530, the State-Federal Flood Operations Center.)

After the 1997 floods and before the onset of the coming rainy season, Parker, Welch, and staff were furiously making improvements to the system, once accessible only to users with passwords. While Internet access in 1995 was a giant step forward, it also proved to be CDEC's Achilles' heel.

As flood waters broke through levees and inundated homes, businesses, and farmland during January 1997, the web site received about 100,000 hits a day, a situation which caused some heartburn for the programmers."During peak periods, access was difficult and the time delay was impeding the flow of data to flood forecasters and interfering with data exchange between agencies," says Welch, who manages the transmission of data to and from CDEC.

"We had one computer system doing it all — web server, database control, data exchange, data collection," explains Parker, the lead programmer. "The main bottleneck was access to the database. The system could not handle the excess traffic."

Now with four computer systems, there's no worry about access, no matter how great the demand. Government agencies need not wait in line either because they in essence have private keys into the database, via intranet access, guaranteeing a clear data exchange highway.

The web page also sports a new look — not fancy but functional. "Our users were saying it's difficult to find information on the page," says Parker. He and his staff reviewed e-mail comments and input from DWR and other users to assess what improvements to make.

"The page was redesigned more like a reference tool with available information organized by type such as river conditions and weather forecasts," adds Parker. One of their largest tasks was the completion of a map interface to all the recording stations by hydrologic area. Accessible too are satellite images, much like those meteorologists display for local weather forecasts.

While they've accomplished their immediate goals, the CDEC staff is moving on to more ambitious plans which include added historical and real-time data, explanations of how different data relate, and more visuals including flood maps from FEMA.

The heart of CDEC

For Mark Heggli, senior meteorologist and head of CDEC, what matters most is the information. "This is the largest database maintained by the Department. Water and weather affect everyone, so there is a great deal of internal and external interest in this program."

The database in turn depends on the telemetry system, a network of recording stations constantly

feeding CDEC the latest measurements from DWR's own remote stations and those maintained by U.S. Geological Survey, U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and the California Department of Forestry and Fire Protection.

However, the 1997 floods revealed that a more complete assessment of water conditions was required, especially for the San Joaquin River basin. Many river recording stations in place were not able to automatically transmit real-time data. Information from these stations was manually collected and reported back to the State-Federal Flood Operations Center. To obtain real-time data, automatic transmitting equipment needed to be placed at key reservoir and river measurement points.

DWR spearheaded an effort to quickly equip existing manual measurement sites with radio transmitters. "The level of cooperation and support from various agencies exhibited a great deal of trust in DWR," says Heggli. The U.S. Army Corps of Engineers provided 25 new satellite transmitters. More satellite transmitters came from the U.S. Geological Survey, which also supplied the labor to quickly install them in the hard-stricken San Joaquin River basin. DWR staff from Northern, Central and San Joaquin Districts assisted with the installation. To expedite the project, Heggli and Water Resources Technician John Deam had to travel to many stations to either install the equipment, or train others and oversee the installation.

Since the 1997 floods, 50 new satellite transmitters recording water conditions have been added along the Sacramento and San Joaquin rivers and

CDEC and Flood Forecasting

There's no doubt in Gary Hester's mind about the value of CDEC. In his 15 years as a DWR flood forecaster, he has watched the system grow in importance to the flood forecasts issued jointly by DWR and the National Weather Service's California-Nevada River Forecast Center. Hester and other DWR forecasters — Fadhil Al-Kazily, Edward Diamond, Herb Hereth, Matt Winston, as well as meteorologist Bill Mork — work with 11 CNRFC hydrologists and meteorologists to translate CDEC's real-time hydrologic data into projections of downstream river levels.

"CDEC is the backbone of flood forecasting and has an important role in forecast dissemination via the Flood Center," he says. "From this one source we can study all of the conditions that can add up to a flood, such as weather forecasts, the condition of different watersheds (how wet or dry), runoff from precipitation, reservoir levels, operational decisions that determine releases from different reservoirs into a river system, and river stages.

"And because the data and forecasts are available to all of the agencies involved—local, state and federal—they can coordinate operations to minimize any impacts downstream. "

Hester adds that improved techniques of data collection and recently developed forecast models have in turn improved flood forecasting. "But like weather forecasts, predicting where storm systems will move and how rivers respond is still filled with a tremendous amount of uncertainty. There remains pieces of the puzzle that we don't have real-time information on."

For state and federal forecasters, river forecasting is a blend of science and past experience. "Forecast models are only as good as the information that was available at the time they were developed," Hester explains. "So even though you make your decisions based on the best data available, you're not always going to be right, particularly when you're experiencing flows that have never occurred before."

Still he believes in the value of flood forecasting and the exchange of hydrologic data between agencies. "It allows those who manage reservoirs and emergency response to get a headstart in preparing for a major flood event before it's under way. And that can save a lot of lives and property."

Instruments of Data

Along a river bank, a small metal structure stands, with a grated walkway leading to its secured door. A sign and barbed wire reinforce the message to stay out. Antennae stick out of its roof. Its coat of gray starkly stands out against a background of earthy tones.

What seems an odd and unnatural object amidst the scenic mix of water, vegetation and wildlife houses the equipment which gives CDEC its life and worth.

Once you get past the lock, resistant to bolt cutters, what is inside surprises with its simplicity. On a plain wooden shelf lie a battery for power, a data logger to record information on river levels, a satellite radio to transmit the signals, and a shaft encoder to measure the water's rising and falling levels. Beneath the floor, hidden by a metal cover, is the stilling well with a ladder leading down to the water. The measuring tape from the shaft encoder extends down the well which "stills" waves so they can be gaged and allows access for maintenance.

These stations are inspected regularly by CDEC and DWR's district office staff. John Deam is one of those technicians. "It's a fun job," he says of the position that interrupted his schooling for a civil engineering degree. "I knew it was a job that would come along only once in a lifetime."

With a special ruggedly built computer to check equipment status, Deam's mission can take him to wilderness areas where only snowshoes, skis, or horses can go. Other sites may call for a snowcat or a helicopter; while some call for a short drive down to the river.

Deam inspects 60 sites (sometimes more) regularly between June and September. These include rain and snow gages located in various watersheds from near the Oregon border to those entering Southern California. That doesn't include the emergency calls to stations malfunctioning during floods, situations that he says present more of an obstacle (due to closed roads) than a hazard.

their tributaries. "We were able to install some systems within a week or two after the floods. We wanted to prepare ourselves for more flooding as happened after the January 1995 floods, when it flooded again in March, " says Heggli.

"Last year, when the reservoirs were at capacity and the many levee breaks had compromised property and public safety, we knew we needed a much clearer picture of where the water was flowing. This would greatly benefit the forecasters in providing forecasts and decision makers in making decisions that could impact thousands of people."

As important as the transmitted data is the method of transmission. The state is now taking advantage of satellite technology. Before, remote stations sent their information through mountaintop radio systems, a communication mode vulnerable to the very phenomena being monitored, severe weather events. "In January 1995, a power outage took out one of our mountaintop radio repeater systems, and we lost 20 plus stations...right in the midst of a flood," he says of the data lost from stations along the Russian and Napa rivers.

The incident spurred Heggli's determination to find a better way — to forge arrangements with the federal government for use of a satellite system expressly designed for weather and water measurements. (It also is used to collect satellite weather pictures).

"The satellite technology is a common communication medium and not proprietary like many conventional radio-based systems. If you have a dish and receiver, you can collect the information. This allows agencies from across the U.S. to monitor conditions in California," he explains.

"And because it is in space, out of the earth's weather, we feel that we have a more fault-tolerant system, as well as one more in tune with the future."

A Twist of Fate

The floods that devastated the lives and economy of residents in Arboga, Modesto, and Wilton ironically provided the impetus to upgrade the CDEC system. Legislation passed in 1997 appropriated thousands of dollars to aid flood forecasting and add recording stations. Previously the staff did what they could with the funding they had.

"Such a vital function requires adequate funding to do the job right—regardless of whether there is an emergency or not," says David Parker about their new budget from which they've purchased new hardware and telemetry equipment...and hired new staff.

"It's like insurance—you may not use it for a long time, but when you do, you just have to have it." □

THE UNFULFILLED *Promise*

IT WAS A well-intended experiment To Save a Park but instead illustrated the sometimes tragic consequences of challenging nature. Its final lesson however showed what can happen when agencies work together.

The careful observer might notice a few steel piles clustered along the river bank upstream from Woodson Bridge State Recreation Area. The piles (hollow metal pipes) are monuments to a bank protection project that generated hope, disappointment, controversy, and tragedy in its 11-year life span.

Conceived and built to control the river and direct its erosive currents, the Palisades never fully met the expectations promised. Though the river somewhat relented at first, it eventually prevailed, adding mishap and misfortune to disappointment in the project's failure.

Story by ***Bill Draper*** *Photography by* ***Norm Hughes***

The Experiment Begins

Twelve years ago, state officials gathered to celebrate the Palisades groundbreaking. The project promised to save the Woodson Bridge State Recreation Area, which was literally eroding away. Since the park opened in 1964, the river had devoured 800 feet of riverbank.

"It's a beautiful park," says Koll Buer, a Senior Engineering Geologist with DWR's Northern District. "It is one of the few areas with high-terrace-valley-oak woodland vegetation."

While it gnawed at the park's riverbank in its effort to change course, the river deposited sand and gravel on the opposing shoreline. But state officials judged it a poor tradeoff. The park with its paths, roads, picnic tables, and oak trees, was too valuable to sacrifice for the inaccessible wild riparian growth on the opposite shore. A decision was made to stop the erosion, if possible, and do so in a way that caused the least environmental damage to the park and riverbank.

Up stepped Ercon Corporation with an innovative approach that offered an environmentally friendly alternative to conventional rock riprap and claimed to be maintenance free. The alternative known as the Palisades could be installed by barge, without disturbing the riverbank or removing vegetation. The State Legislature directed DWR to field-test the system, and after scouting several sites, the Reclamation Board selected this one. The Palisades was intended to not only stop the park's bank erosion but also trap sediment and debris, thus allowing vegetation to take hold.

On July 28, 1986 the work began. The Reclamation Board and U.S. Army Corps of Engineers provided the funding, and the Division of Design and Construction (now the Division of Engineering) administered a construction contract to install a series of cargo-net panels anchored to 10-inch steel piles driven into the river bottom. In theory, the panels would slow the river current, allowing debris and sediment to build up between the panels and fortify the riverbank, thus stopping erosion of the riverbank.

Satisfied with the installation, officials prepared to monitor the progress. Their confidence, however, began waning during the next few years.

Disappointment & Tragedy

"It did slow the bank erosion process. In fact there was very little erosion during the first nine years, but very little sediment deposition occurred," says Buer.

Such results were not entirely unexpected since Ercon's previous Palisades projects had been used in rivers with slower flows and vastly greater amounts of sediment, in contrast to the Sacramento River's stronger flows carrying less sediment. Under these conditions, the netting design did not provide sufficient resistance to allow sediment to drop out.

The Palisades installation was moving the deepest part of the river away from the park, but seasonal floods were damaging the project, ripping out the netting and some of the piles. By 1994 half the nets and 10 to 20 percent of the piles were bent or missing. (Although maintenance of the project may have prolonged the structure's integrity and improved results, the Palisades was consciously being conducted as a "maintenance-free" experiment.)

"It did slow the bank erosion process. In fact there was very little erosion during the first nine years, but very little sediment deposition occurred,"

Reports of occasional boating mishaps suggested that the Palisades posed a navigation hazard. Upstream warning signs directed boaters away from the project, but the signs were vandalized or ignored. Boaters sometimes found themselves caught in the maze of piles and cargo nets, and the swift current caused an occasional craft to capsize. Fortunately, passengers avoided injury during these incidents, though they sometimes lost their craft.

Then disaster struck. In August 1995, a canoe carrying several teenage boys became entangled in the Palisades. The strong current crushed the canoe against one of the piles, trapping 15-year-old Jimmy Bashaw under water. His friends desperately tried to rescue him, but they could not overcome the strong currents. Rescue units pulled him out, but he did not survive.

Following this event, the boy's mother, Jeannette Bashaw, urged state officials to modify the project to make that portion of the river safer for recreational users. Her efforts, plus reevaluation of the system by DWR staff after the 1997 floods further damaged the structure, led Director David Kennedy to direct that the dangerous portions of the project be removed expeditiously.

Dismantling & Teamwork

The end of the Palisades was now a foregone conclusion, and Koll Buer was assigned in March 1997 to head the dismantling project. State and federal agencies (DWR, Fish and Game, Parks and Recreation, Reclamation Board, Corps of Engineers, Boating and Waterways, Caltrans, U.S. Fish and Wildlife, and environmental organizations) cut through red tape in record time as DWR sought contractor bids.

"We were limited in terms of time," recalls Buer. "We had the winter-run salmon fingerlings coming downstream, which meant there could be no in-stream activity, no turbidity after August 15."

Also, as with the installation, the dismantling had to be done from the river to limit environmental damage to the riverbank. DWR's Division of Engineering prepared the design and contract documents, solicited bids, and awarded the contract in near record time.

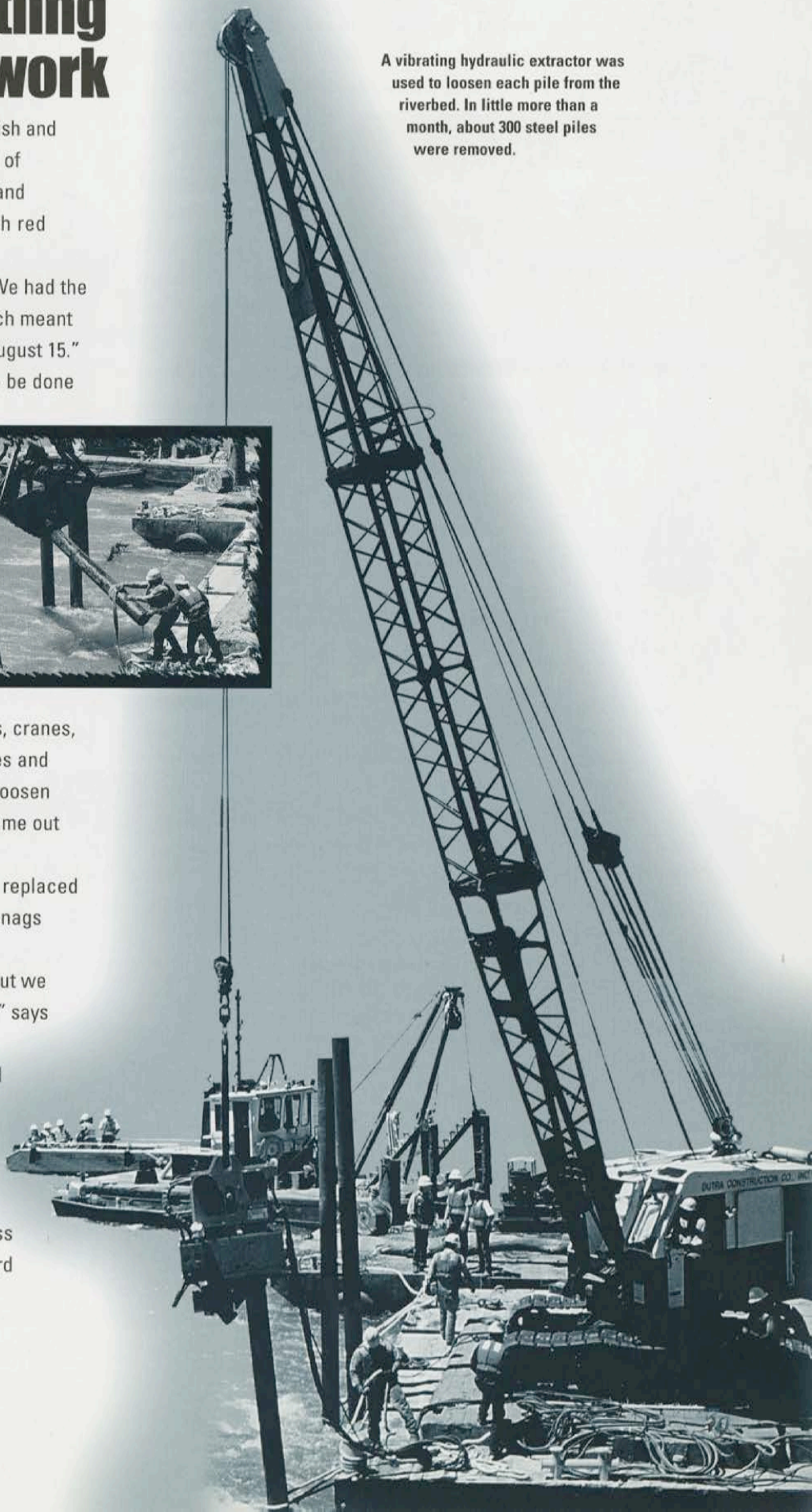
DOE awarded the contract to DD-M Crane and Rigging from Riverside, and the first equipment began arriving in July at a staging area next to the Woodson Bridge. By July 18, the contractor, under the direction of DOE's Sacramento Project Headquarters, had barges, cranes, and the tugboat in position and began removing the piles and debris. Workers used a vibrating hydraulic extractor to loosen each pile so that a crane could pull it out. Some piles came out quickly, others did not, and some broke off.

The first vibrating head did not work well and was replaced with a different more effective head. Also, submerged snags interfered with the project and had to be removed.

"We anticipated snags up to two feet in diameter, but we had full-sized trees four and a half to five feet in diameter," says then Chief Inspector Sonny Fong.

Meanwhile, DWR environmental specialists monitored the project, watching for water turbidity and oil and fuel spills.

During the project Jeanette Bashaw twice visited the project. DWR Division of Engineering Chief Les Harder first accompanied her and her family to witness construction progress. DOE's Program Manager Maynard Flohaug escorted during her second visit.



A vibrating hydraulic extractor was used to loosen each pile from the riverbed. In little more than a month, about 300 steel piles were removed.

"We were removing the piles where her son died, and she wanted to see those piles removed," Maynard recalls. "We took her out on the water. She got to see the piles removed, and she put flowers in the water. It was a pretty touching time."

Later in the project, the dangerous river current that contributed to her son's death caused another accident at the removal site. Just before completion, with three piles left to be removed, the tugboat capsized while trying to maneuver the barges into position. Trouble began when the river current wedged the tug against the three piles. DOE Environmental Specialist John Squires happened to be on the tug when it capsized.

"Things happened very quickly," recalls Squires. "He (the captain) put the tug in reverse and put full power to the engines, and the tug began to list to the port side. I'm up on the bow, hanging on.

"When it started to list, the captain jumped overboard with the tug still in reverse, the engines wide open. As soon as the water broke over the freeboard onto the deck, the tug just rolled on over. I couldn't jump because of the cables and rigging. So I chose to hang on to a suspended cable until the tug got up to about a 45-degree angle, and at that point I was able to dive off. Unfortunately I had to dive upstream of the tugboat. My concern was that the current would push me back and I would get lodged under the tug and drown."

Fortunately, the tug began to float downstream before sinking, and Squires was able to keep his distance. Shortly after, the work boat came over and pulled him in. Still drenched and shaken from the incident, Squires notified DOE Headquarters and requested the contractor contact their hazmat team. Then he left for a medical checkup. He was back on-site the next day, monitoring the water for leaking fuel and oil from the submerged tug.

"I was a little shaky for a day or so. It was a real close call," he says.

The contractor's workers and divers worked all night, raised the tug the next day and transported it to Rio Vista for repairs. The tug was back on the job a week and a half later.

The accident, and a decision to remove additional piles, extended the project completion past the August 15 deadline. Again, the agencies scrambled to review and approve new environmental permits, and the last pile was pulled on August 23.

"I never had an opportunity to work on a project as good as this one in terms of cooperation of all the agencies," he says. "Everybody just pitched in to get this project done."

"We pulled out about 300 piles," says Buer. "Originally there were 356, but we left some because they had worked."

Buer says the remaining piles pose little or no navigation hazard. He is disappointed that the Palisades failed to work as expected, but, excluding the tug incident, he feels good about the removal project.

"I never had an opportunity to work on a project as good as this one in terms of cooperation of all the agencies," he says. "Everybody just pitched in to get this project done."

Maynard Flohaug agrees.

"Two months is a short period of time to get it all done. You have to get environmental permits, and you have to get authority to advertise contracts. Then you have to develop the contract, advertise it, and then do the construction work. We had to work together to make it happen," he says.

With the Palisades now gone, state agencies are back where they were before the Palisades were built: searching for a solution to the original erosion problem. They hope to develop a plan this year. Meanwhile, the river continues to consume more of the valuable riverbank in its inexorable quest to change direction.

Down the Concrete Chute

Photography by Paul Hames

New Year's Day 1997 was not one of celebration at Lake Oroville. Its level was nearing the maximum capacity of 3.5 million acre-feet, with more than 300,000 cubic feet of water flowing into the lake from heavy rainstorms.

To lower the lake, the spillway's eight outlet bays were opened to release 160,000 cubic feet of water into the Feather River. As water rushed down the concrete chute's 3,050-foot length into the river, it made a spectular sight. Heavy mist hung in the air as the immense flows hit the chute blocks used to dissipate their force. While the heavy releases lasted only about three hours, the water's punishing power dug craters, blew out old patches, and exposed previously cracked areas in the structure's concrete surface.

To prepare for the next rainy season, repairs began in mid-October. Men and equipment were dwarfed as they labored along the spillway chute's 178-foot, 8-inch width. Under mostly sunny skies, they sandblasted the craters before filling them with concrete patches.

By November 18, the project, costing more than $300,000, was done. ■

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