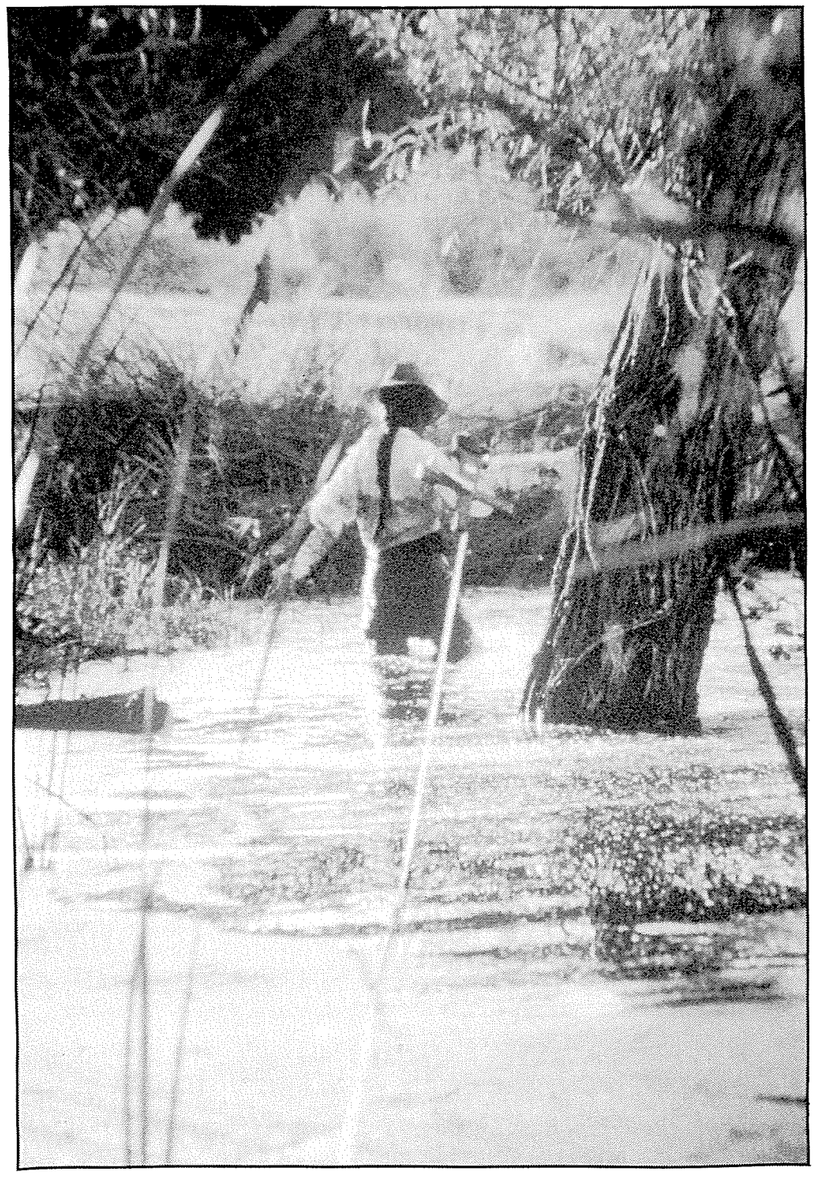


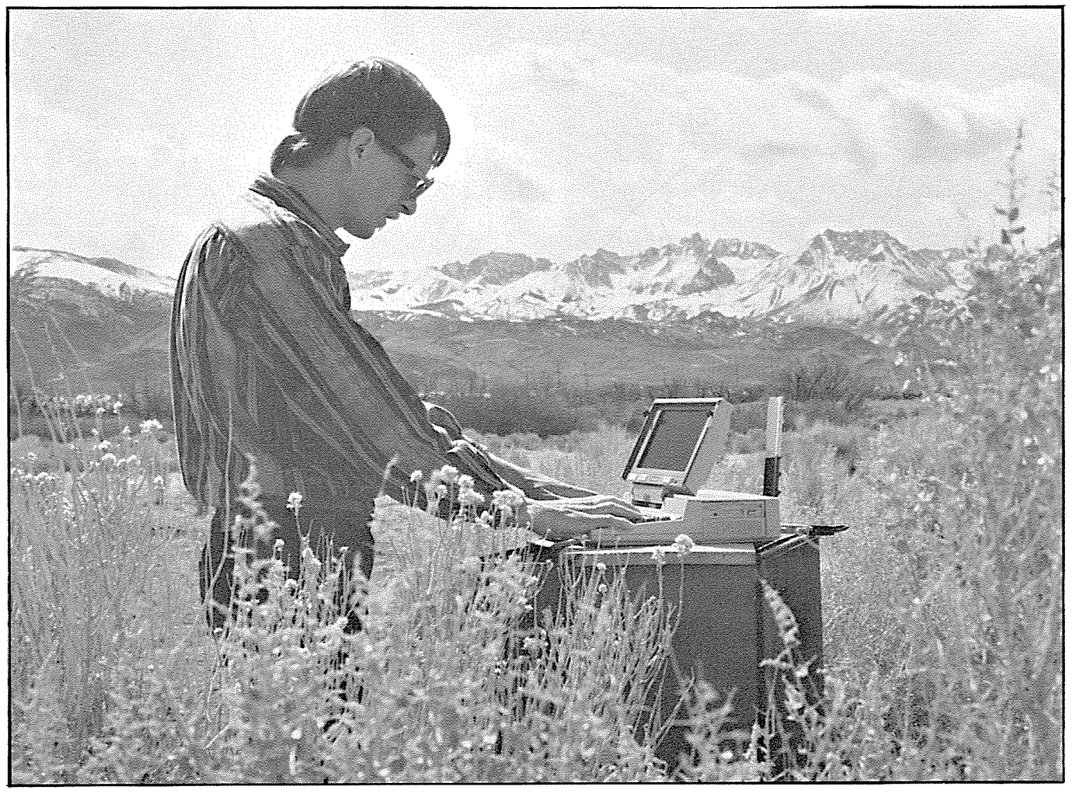
River work — *Irene Yamashita stretches tape measure across lower Owens River in a 1988 study.*

Brian Cashore photo

Inyo County Water Department
163 May Street
Bishop, California 93514

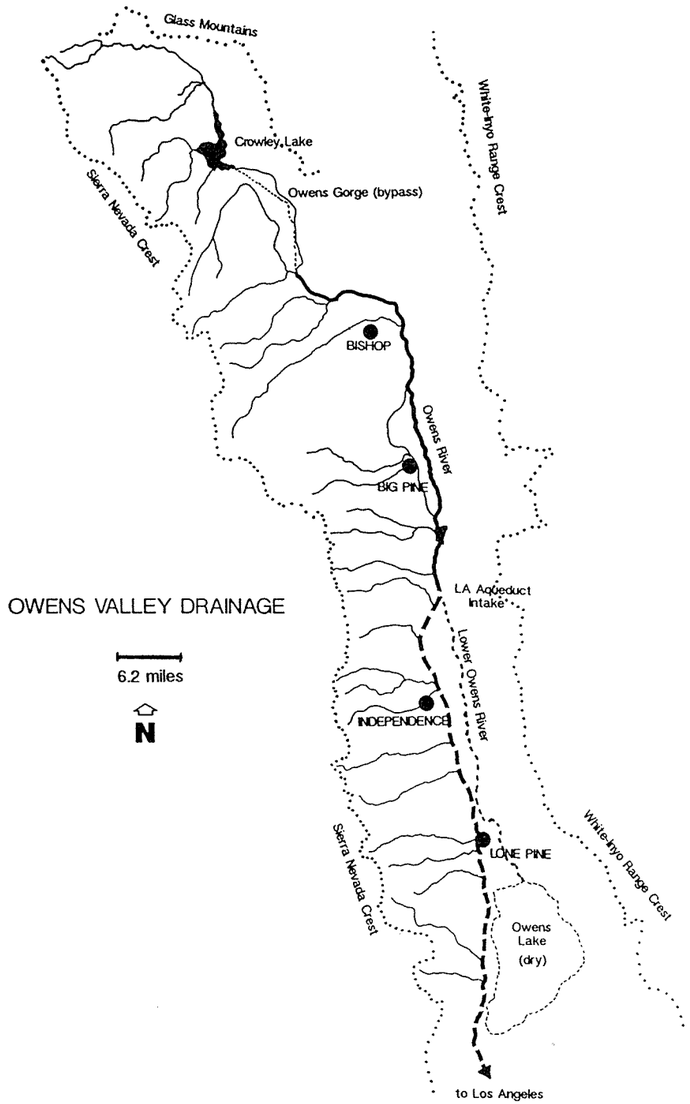
The Owens Valley

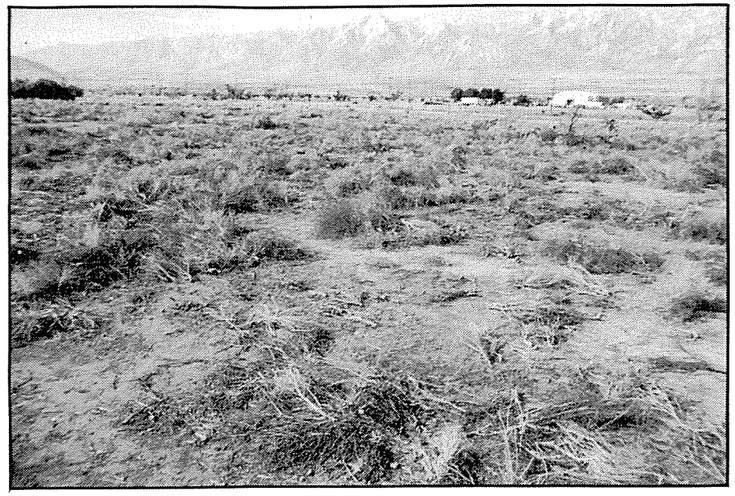
Monitor

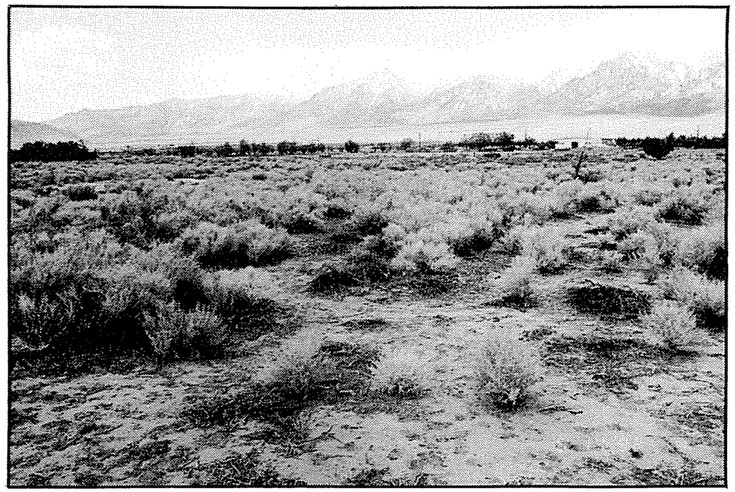


Inyo County Water Department's First Annual Report On Events, Activities and Conditions in the Owens Valley

Runoff Year April 1991 through March 1992







Photographs taken from the same vantage point, 11 years apart

These photographs, taken in the Symmes-Shepherd well field, illustrate the difficulty of scientifically evaluating the long-term significance of vegetation change.

The upper photograph was taken July 15, 1981. Groundwater pumping and drought during the 1970s contributed to the death of virtually all the vegetation in this view.

The lower photograph was taken June 14, 1992. It shows that the vegetation at this site re-established during the relatively wet years prior to 1987. However, since the vegetation conditions which serve as the baseline for management were inventoried at this site in 1985, groundwater pumping and drought led to a reduction in the cover of this vegetation by 58 percent as of 1992.

Once the drought ends, water tables have risen, and the vegetation has had an opportunity to recover, vegetation conditions will be compared to baseline conditions, and the effectiveness of the current groundwater management provisions in preventing significant changes and declines in vegetation from baseline conditions will be evaluated and modified if necessary. Photos by David Groeneveld.

Reports

Our staff and consultants prepared the following reports last year:

Hydrology

Inyo County Water Department hydrologic reports are numbered by the year written followed by the order (91-1 means the first report written in 1991, for example). The title of the report follows the number, then the author(s), and then the status of the report: released to the public, or still in draft and being reviewed.

- ☐ **91-1** *Analysis of Groundwater Levels Near Indian Reservations*. By Randy Jackson and Andy Zdon. Released to the public as Appendix A-2 in Volume III, Response to Comments, of the final environmental impact report titled Water from the Owens Valley to Supply the Second Los Angeles Aqueduct, 1970 to 1990, and 1990 Onward Pursuant to a Long-Term Groundwater Management Plan.
- ☐ **91-2** *Laws Impact Area Hydrologic Attributability*. By Jackson. Draft, being reviewed by Los Angeles Department of Water and Power.
- ☐ **91-3** *Shallow Groundwater Levels in the Owens Valley, 1985-1991: A General Overview*. By Zdon and Jackson. Released to the public.
- ☐ **91-4** *Hydrologic Analysis of Selected Operational Scenarios for Enhancement/Mitigation Wells 385 and 386 at the Nikolaus and Nikolaus Gravel Operation, Inyo County, Calif*. By Jackson and Sally Manning. Released to the public.
- ☐ **91-5** *Analyses of Well and Aquifer Tests for Replacement Wells 398, 399, 400, 401, 402 and 403*. By Jackson. Draft, being reviewed by LADWP.
- ☐ **(E/M Project Report — no number)** *Deep Test Hole Study*. By Tom Griepentrog, Bill Hutchison, Jackson and LADWP's Gene Coufal. Transmitted to Inyo/Los Angeles Standing Committee May 1991.
- ☐ **92-1** *Analyses of Slug Tests Performed on Shallow Test Holes 434T, 492T and 670T*. By Jackson. Draft, being reviewed by LADWP.
- ☐ **92-2** *Shallow Groundwater Levels in the Owens Valley — 1992 Update*. By Zdon. Draft, being reviewed by LADWP.
- ☐ **(FERC-related Analysis — no number)** *Hydrology of the Hall- Indian Ditch System, Inyo County, Calif*. By Zdon. Transmitted to FERC.

Vegetation, Soils

These reports are not numbered and thus are listed by date (if given) and then alphabetically by title.

- ☐ **September 1991** *Vegetation and Soil-Water Monitoring System for the Owens Valley, Calif*. By David Groeneveld. Presented at the White Mountain Research Station Symposium IV, "The History of Water: Eastern Sierra, Owens Valley, White-Inyo Range." Accepted for publication in University of California symposium volume.
- ☐ **September 1991** *Water Requirements of Owens Valley Vegetation*. By Sally Manning. Presented at the White Mountain Research Station Symposium IV, "The History of Water: Eastern Sierra, Owens Valley, White-Inyo Range." Accepted for publication in the University of California symposium volume.
- ☐ **October 1991** *Analysis of Vegetation Change in the Laws Area, 1987-1991*. By Manning. Final report being prepared.
- ☐ **November 1991** *Owens Valley Riparian Vegetation: Its Ecology and Alteration by Man*. Groeneveld. Presented at the California Riparian Systems Conference III, Sacramento, Calif.
- ☐ **February 1992** *1991 Leaf Area Trend (results of monthly transects)*. By Manning. Released.
- ☐ **February 1992** *Measuring Vegetation Change: Preliminary Report (results of line-point transects)*. By Manning. Final report being reviewed.
- ☐ **1991** *Detection of Trace Quantities of Green Vegetation in AVIRIS Data*. By C. Elvidge, Z. Chen, F. Portigal and Groeneveld. Proceedings of the Third Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) Workshop. Jet Propulsion Labratory Publication 91-28.
- ☐ **1991** *Detection of Trace Quantities of Green Vegetation in 1990 AVIRIS Data*. By Elvidge, Chen and Groeneveld. Submitted to "Remote Sensing of Environment."
- ☐ **1991** *Plant Transpiration Estimate from Hand-Held Porometer Measurements, presented in "Evapotranspiration Measurements of Native Vegetation, Owens Valley, Calif., June 1986."* By Groeneveld. To be published as a chapter in United States Geological Survey Water Resources Investigation.

Introduction

The Inyo County Water Department was formed in 1980 to protect the Owens Valley environment from the effects of groundwater pumping by the Los Angeles Department of Water and Power (LADWP).

An agreement on a water management plan was signed last year by Inyo County and Los Angeles. The agreement and an accompanying environmental impact report have yet to be approved by the courts but many of the documents' provisions are being followed.

ICWD monitors water activities in the valley and their impacts on vegetation and water levels, and performs studies in the process of improving the water management plan.

ICWD will produce an annual report detailing monitoring and other activities during each past runoff year, April through March. This, *The Owens Valley Monitor*, is our first annual report, covering runoff year 1991-1992 and the program for groundwater pumping during 1992-1993.

We'd enjoy hearing your comments on the *Monitor* and welcome any suggestions for future coverage.

To the point — *Denise Waterbury and Irene Yamashita run a point-frame transect at a site in Thibaut-Sawmill well field.* Heidi Walters photo

The Owens Valley
Monitor

This annual report was produced by the Inyo County Water Department in Bishop, California.

Greg James, Water Director
Heidi Walters, Editor

The ICWD also produces a newsletter called the **Owens Valley Water Reporter**. This newsletter covers water issues in the Owens Valley and the Eastern Sierra. If you would like to be added to the mailing list to receive the newsletter and the annual report, please call **619-872-1168**, or send your name and address to:

Inyo County Water Department
163 May Street
Bishop, California 93514
Attn: Heidi Walters

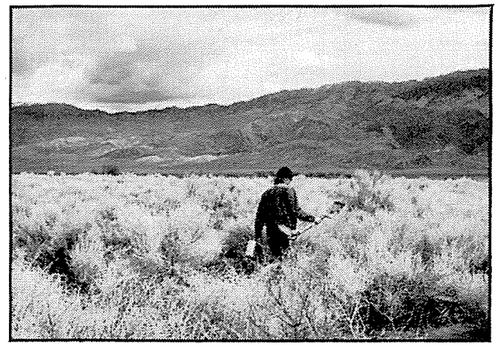
Cover photograph:

Rick Puskar, hydrology research assistant, measures groundwater levels at Laws with a computerized, continuously recording water level indicator. Photo by Heidi Walters.

CONTENTS

Free copies of this report are available at the Inyo County Water Department in Bishop and at Inyo County libraries. If you would like a free copy mailed to you, call: 619-872-1168, or write: Inyo County Water Department, 163 May Street, Bishop, Calif. 93514, Attn. Heidi Walters.

Out in the Owens Valley



Off to work — *Inyo County's Brian Cashore carries psychrometer equipment to monitor soil water at monitoring site near Independence.* Heidi Walters photo

When Inyo County and Los Angeles signed a long-term water management agreement last year, they essentially agreed to make protection of the Owens Valley vegetation and environment the primary goal of water management. Los Angeles' water needs from the Owens Valley were not left out, but Inyo and Los Angeles agreed that no longer would those needs be met at the expense of the environment.

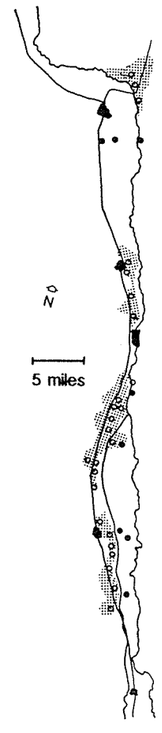
The main goal of water management is to avoid significant decreases or composition changes in vegetation.

Another goal is to ensure that LADWP's water practices have no significant adverse effect on the Owens Valley environment.

A third major goal is to avoid groundwater mining, or the depletion of water in the aquifer that exceeds replenishment from recharge over a 20-year period.

To ensure the goals of protection, Inyo and Los Angeles agreed upon a management and monitoring program developed over the past several years. And, they agreed on the need to continuously test and improve management methods and to update the program as needed.

The program for managing Los Angeles' groundwater pumping was developed in 1988 following a series of cooperative studies conducted by Inyo, Los Angeles and the United States Geological Survey. The program was implemented in 1989, in the third year of what is now a six-year drought and following two years of high groundwater pumping.



Monitoring sites *in the Owens Valley. Shading shows drawdown areas in well fields. Open circles are monitoring sites. Closed circles are control sites.*

Thus the newly developed program for managing groundwater pumping is being tested against the backdrop of an actual worst-case scenario: prolonged drought combined with two years of high groundwater pumping at the onset of the drought.

Monitoring techniques for carrying out the management program and the hydrologic and vegetation monitoring conducted by Inyo and Los Angeles in 1991 are described below. Results of the 1991 monitoring program are described later in this report in the section titled "Conditions."

The Program

A document called the Green Book, developed by Inyo County and Los Angeles, provides technical guidelines for carrying out the monitoring and management provisions of the long-term agreement.

Vegetation in the Owens Valley has been classified according to its water uses and needs. For example, some plants, such as shadscale, can survive solely on precipitation. Other plants, such as rabbitbrush and Nevada saltbush, require more water than precipitation can supply and so use groundwater also. Plants such as those in meadow areas or riparian/marshland communities rely heavily upon groundwater or nearby surface water. And still other plants, such as alfalfa and native pasture grasses, rely on irrigation.

For purposes of management, monitoring sites representing vegetation that could

The Inyo County Water Department began expanding last year, bringing on more scientists to help monitor the Owens Valley environment.

First, Sally Manning, who was a vegetation researcher, was promoted to fill a new position as our plant monitoring specialist.

Then we added some new faces. We hired Randy Jackson as our hydrologist, Andy Zdon as our assistant hydrologist, and Rick Puskar as a research and field assistant to the hydrologists. Denise Waterbury was hired as a vegetation research assistant.

Paula Villa, our fiscal operations supervisor, moved to Susanville. She was replaced by Dorothy Reynard.

Irene McLean has become our receptionist.

We hope to hire a full-time soils scientist.

Finally, we have retained two temporary vegetation research assistants to help with the summer field work.

One assistant, Bishop High graduate Brian Stange, begins his third summer with the water department this June. Stange is a fisheries major at Humboldt State University.

Greg James — *director*
Dorothy Reynard — *fiscal operations supervisor*
Irene McLean — *receptionist*
Marie Traulsen — *secretary*
Leah Kirk — *environmental assistant*
Heidi Walters — *editor*

Vegetation staff

Sally Manning — *vegetation monitoring specialist*
Brian Cashore — *supervising research assistant*
Irene Yamashita — *supervising research assistant*
Derik Olson — *research assistant II*
Denise Waterbury — *research assistant I*

Water staff

Randy Jackson — *hydrologist*
Andy Zdon — *assistant hydrologist*
Rick Puskar — *research assistant I*

Consultants

David Groeneveld — *plant ecologist*
Bill Hutchison — *hydrologist*
Tom Griepentrog — *hydrologist*
Tony Rossmann — *legal counsel*

What else did we do last year?

Field work and negotiating may have consumed most of the work time last year, but we found time for other water-related projects, conferences and research trips.

OTHER WATER ISSUES:

Rancho Riata hydroelectric project (proposed) — Andy Zdon provided technical assistance to the county's fight against this project proposed to be constructed on a creek that is part of the Bishop Creek system.

Nevada water issues — Zdon and **Randy Jackson** attended several conferences dealing with Nevada water issues, especially the Las Vegas Valley Water District's proposal to pump groundwater from numerous basins in Nevada counties and import it to Vegas. The plan could affect Inyo County near the Nevada/Inyo border.

Another Nevada issue, which **Jackson** has been reviewing for the county, is the proposed nuclear waste repository at Yucca Mountain, also near the border. Jackson went on a tour of the proposed repository site.

Owens Lake — Some staff members attended Great Basin Air Pollution Control District meetings, which focus on mitigation plans for the dry lake.

Tri-Valley Groundwater Management District — Jackson was technical advisor to this new district.

CONFERENCES, ETC.

Sally Manning, David Groeneveld and **Jackson** presented papers at the White Mountain Research Station's "History of Water" symposium in Bishop. Other staff attended many of the talks.

Groeneveld presented a paper on Owens Valley riparian vegetation at the California Riparian Systems Conference in Sacramento. **Brian Cashore** attended the conference.

Manning attended the American Institute of Biological Sciences meeting in San Antonio, Texas.

Our vegetation and hydrology staff demonstrated monitoring to high school students participating in the first two sessions (spring and fall) of the new RIMS science camp (students came from Riverside, Inyo, Mono, San Bernardino and Los Angeles counties).

Cashore, Manning and **Irene Yamashita** toured the revegetation program at Joshua Tree National Monument. Work at Joshua is applicable to revegetation work here.

Zdon and **Manning** became Inyo County Water Department's representatives on the Eastern Sierra Interagency Geographic Information Systems (GIS) User Group.

Events in Review

April 1991

Public Surveyed — Results were released from a public opinion survey commissioned by the county to gather the public's views on the water agreement between Inyo County and Los Angeles. The survey revealed a strong desire for more information about the agreement and a general distrust of Los Angeles. The survey also found that, after receiving more information on the agreement, more people were likely to find it favorable to Inyo County than they were when they knew fewer details. Inyo County has been using the results from the survey as a guide for providing more information.

May

Expanded Monitoring — Inyo County began the summer field season with an intensified monitoring program and more field employees to carry out the extra work. Regular monitoring was expanded and several new studies were begun to verify old methods and to test new ones.

August

Drought Recovery Policy Strengthened — Inyo County and Los Angeles agreed to strengthen the drought recovery policy. The policy, designed to protect the environment during droughts, requires that groundwater pumping be conducted in an environmentally conservative manner until soil moisture and water table levels substantially recover in areas affected by pumping.

Final EIR Released — On Aug. 14, Inyo and Los Angeles released the final environmental impact report concerning Los Angeles' groundwater pumping in the Owens Valley. The report covers the years 1970 to 1991 and from 1991 into the future. The long-term water management agreement, tentatively agreed upon in August 1989, is discussed in the 1991-onward portion of the final EIR. The final EIR contains the draft EIR plus three volumes of public comments on the draft, responses to comments, and additional information.

September

Inyo officials hold EIR meetings — The Inyo County Board of Supervisors and the Inyo County Water Commissioners conducted four public meetings in late September and early October to hear people's views on the final EIR. Many people expressed dissatisfaction with the EIR but supported the water agreement. Those expressing major problems with the EIR included the Sierra Club, the Owens Valley Committee, the Owens Valley Indian Water Commission, the State Lands Commission, the California Department of Fish and Game, and individual citizens.

Video released — The Inyo County Board of Supervisors provided a 15-minute videotape explaining the long-term water agreement. "A Search for Justice" was shown on local television and is still available at video stores (free rental) and county libraries.

October

Inyo County and Los Angeles Approve Agreement — On Oct. 15, the Inyo County Board of Supervisors approved the agreement and certified the portion of the EIR pertaining to the agreement. Los Angeles also approved the agreement on Oct. 15, and certified the EIR. The documents were then delivered to the Third District Court of Appeal.

Accord — *Los Angeles Mayor Tom Bradley, left, Inyo County Supervisor Keith Bright, and Inyo County Water Director Greg James at the agreement signing ceremony in Los Angeles.* File photo

A ceremonial signing of the agreement took place on Oct. 18 in Los Angeles. Los Angeles Mayor Tom Bradley, Inyo County Water Director Greg James, Inyo County Supervisors Keith Bright and Bob Campbell, and LADWP commissioners Rick Caruso and Mike Gage were among the signers.

Because of ongoing litigation, the EIR must be approved by the Third District Court of Appeal before the agreement can be fully effective.

November — March 1992

Negotiations Over EIR Issues — Inyo County, Los Angeles, the Sierra Club, the Owens Valley Committee, the state Attorney General (for DFG and SLC), Stan Matlick, and the Owens Valley Indian Water Commission have met numerous times in attempts to resolve EIR issues that concern each of them. So far, Inyo and Los Angeles have reached a settlement with the Indian water commission over its concerns about water rights on Indian lands. Los Angeles has agreed to work with the commission, separately from the Inyo/Los Angeles agreement, on its concerns which center on an agreement between Los Angeles and the U.S. Government that established the Indian reservations.

Negotiations continue with DFG, the State Lands Commission, the Owens Valley Committee, the Sierra Club and Stan Matlick. The DFG is particularly concerned with the lower Owens River.

If no settlement is achieved, briefs will be filed with the Appellate Court, and that court will determine the adequacy of the EIR and the fate of the water agreement.

Monitoring and Management

potentially be impacted by groundwater pumping have been established throughout the Owens Valley. There are 33 monitoring sites. All but eight monitoring sites are within the area of drawdown of well fields. These eight sites are control sites, which are monitored in the same way as the well field sites to compare pumping affected areas to non-pumping affected areas.

Sixty of LADWP's 96 pump-equipped production wells are linked to monitoring sites.

Under the management provisions of the long-term agreement, soil water and vegetation conditions at monitoring sites are closely watched. If soil water at a monitoring site is less than the estimated water needs of the vegetation at the site, LADWP wells linked to that site are turned off. Inyo and Los Angeles may also agree to reduce or discontinue groundwater pumping in an area for other reasons in order to achieve the goals of the agreement.

Wells may be turned back on once soil water recovers sufficiently to meet the needs of the vegetation at the time the wells were turned off.

Of the unlinked wells, 25 are exempt from the provisions of the agreement requiring wells to be turned off because they are the sole source of supply for either town water systems, fish hatcheries or irrigation, or because they are located away from areas of groundwater-dependent vegetation. The remaining 11 unlinked wells are in Bishop, where pumping is under the restrictions of a 1940 court order known as the Hillside Decree.

In addition to the agreement's provisions for managing groundwater pumping, in 1990 Inyo and Los Angeles adopted a Drought Recovery Policy. As modified in 1991, the policy requires groundwater pumping to be managed in an environmentally conservative manner during and following the drought, until there is a substantial recovery in soil water and water table conditions in well field areas.

Monitoring in 1991

Monitoring is a key management tool in the overall scheme for protecting the Owens Valley vegetation and water resources from Los Angeles' water gathering activities.

Hydrologic monitoring

Our hydrologic monitoring program was boosted last year when we hired a full-time hydrologist, assistant hydrologist, and hydrology research assistant. Before that, we relied primarily on a hydrology consultant.

The new staff analyzed the hydrologic resources in the Owens Valley, examined the data already available from sources such as LADWP hydrographers, and set up a number of monitoring methods. These include:

- ☐ Once-a-week status checks on the 96 pump-equipped wells to make sure wells that are supposed to be off are off, according to the provisions of the water management agreement;
- ☐ weekly confirmation of LADWP's depth-to-water measurements;
- ☐ monthly water level measurements in 18 indicator wells;
- ☐ weekly measurements with ultrasonic flow meter to determine well discharge;
- ☐ setting up and reading continuous recording devices on selected wells to monitor water levels;

New studies hold promise of improving methods

Inyo County plant ecologist David Groeneveld initiated three new studies last year in an effort to better the monitoring program. These studies examine the use of three techniques: riparian/remote sensing, time domain reflectometry, and soil spatial variability.

Riparian/Remote Sensing, conducted with the Desert Research Institute of Reno:

Purpose: To determine whether water stress in riparian vegetation can be detected using remote sensing techniques.

Groeneveld said remote sensing (using hand-held spectroradiometers) might reveal stresses to riparian vegetation before they can actually be detected by on-the-ground observation. If stresses to vegetation can be discovered before actual injury occurs to the plants, further stress can be prevented by irrigation. Groeneveld said rapid detection is important because riparian vegetation is much more sensitive than the species being monitored and managed within the well fields (mainly shrubs and perennial grasses). Riparian species studied were Fremont cottonwood, coyote willow and black willow.

Time Domain Reflectometry (TDR), conducted with the Desert Research Institute of Las Vegas:

Purpose: To monitor soil water and soil salinity with TDR probes placed at different depths in the ground. TDR probes are longer-lived and can measure a greater volume of soil than the current soil water measuring instruments being used, psychrometers.

Soil Spatial Variability, conducted with Yoram Rubin and Dani Or of the U.C. Berkeley Civil Engineering Department:

Purpose: To develop methods that will increase the accuracy in measuring soil water and calculating plant-available water.

What's a point-frame transect? A psychrometer?

monitoring site — Typically a small fenced area containing psychrometers, a 100-meter vegetation transect, and other monitoring equipment. There are 33 monitoring sites. Twenty five of these are located within the drawdown range of a well. The other eight are control sites and lie outside the range of drawdown by the wells.

transect — A straight line through vegetation. If permanent, it is marked from point to point by fence stakes.

point-frame transect — A point frame is a two-legged metal frame with a row of long metal pins set vertically at 30-centimeter intervals.

To take readings, two researchers stretch a 100-meter measuring tape between fence posts marking the transect. They align the point frame along the tape and one of them lowers the long pins through the canopy of whatever plants might lie along the transect. The other records the number of times a pin contacts a live leaf and the species contacted.

line-point transect — A team of two researchers stretches a meter tape along a randomly located transect. Then, while one researcher records results the other walks along the tape and, stopping at regular intervals, looks straight down from the point on the tape to the ground and determines if there is live plant cover within the line of sight. If so, the species is recorded.

psychrometer — An instrument used to measure soil humidity. The psychrometer is permanently buried at a specific depth while connected wires remain at the ground surface.

A reading is taken by running a small electric current through the wires causing soil moisture to condense on the tip of the psychrometer.

By knowing soil characteristics and limitations for plant water extraction, the monitoring specialists then can derive the amount of soil water available for plant use.

- ☐ updating the hydrography data of the valley floor by taking measurements in 300 monitoring test wells;
- ☐ using test-well measurements to develop groundwater level contour maps, showing depth-to-water levels and change in depth-to-water levels;
- ☐ installing and reading seven rain gauges;
- ☐ using groundwater basin models to predict water levels in 10 of the 18 indicator wells;
- ☐ monitoring Reinhackle Spring;
- ☐ drafting a program for monitoring the Bishop Cone (an area from north of Bishop south almost to Big Pine);
- ☐ monitoring wells on Indian lands.

Vegetation monitoring

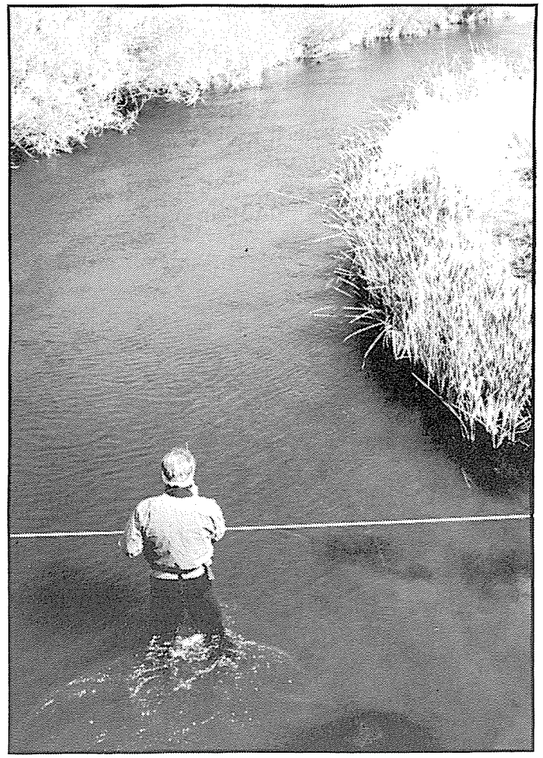
Our vegetation staff gained a new field researcher, and a former field researcher was promoted to vegetation monitoring specialist. With these changes, the staff moved into another field season in April 1991 ready to expand the regular monitoring with more transects and new techniques.

Monitoring included existing methods:

- ☐ 100-meter point-frame transects and recruitment (new plants) analysis;
- ☐ neutron probe readings; and
- ☐ psychrometer readings.

And new methods:

- ☐ Monthly point-frame transects;
- ☐ random line-point transects to document vegetation change; and
- ☐ groundwater level contour maps analysis with vegetation map overlays.



How Fast? — *Inyo County hydrologist Randy Jackson measures the flow of the Owens River near the Laws Bridge.* Heidi Walters photo

Environmental mitigation is a concept that was incorporated in the five-year agreement between Inyo County and Los Angeles in 1985. Under that agreement, LADWP mitigated some of the past impacts of its activities and undertook certain environmental enhancement activities.

Several projects, collectively called enhancement/mitigation projects, were planned. Many have been implemented, others are in progress or yet to be begun.

Here is the status of these projects:

Completed projects:

- ☐ Eastern California Museum grounds
- ☐ Independence ditch system
- ☐ Independence pasture lands
- ☐ Independence roadside rest area
- ☐ Independence wood lot
- ☐ Klondike Lake
- ☐ Lone Pine regreening — west side
- ☐ Lone Pine riparian park
- ☐ Lone Pine Sports Complex
- ☐ Lone Pine wood lot
- ☐ Lower Owens River rewatering project
- ☐ Manzanar tree pruning
- ☐ McNally ponds native pasture (irrigation of about 30 percent of project complete)
- ☐ Millpond
- ☐ North Lone Pine cleanup
- ☐ Richards and Van Norman fields
- ☐ Shepherd Creek alfalfa
- ☐ Tree planting along public roadways

Projects in progress:

- ☐ Big Pine tree planting — in progress
- ☐ Independence spring field — 95 percent complete
- ☐ Laws Museum — in progress
- ☐ Laws/Poleta native pasture — 70 percent complete

Projects pending:

- ☐ Independence regreening
- ☐ Regreening northeast of Big Pine

Klondike Lake Heidi Walters photo

Lone Pine Sports Complex

The Lone Pine Sports Complex was dedicated in April this year after months of preparation and construction and almost six years of planning.

The complex includes 12.5 acres of grass with two soccer fields (one regulation size), and regulation baseball, softball and Little League fields.

The complex is one of the enhancement/mitigation projects.

It has been in the works for years, according to Lone Pine Schools Superintendent Bill Schmidt.

"Six years ago, some of us talked about the need in our community for our children to have a Little League diamond, a soccer field and so on," Schmidt said.

They turned to LADWP with the idea. Last spring, construction finally began on LADWP-leased land adjacent to the Lo-Inyo Elementary School playground.

LADWP crews graded the site and prepared the soil, and Lone Pine volunteers installed the irrigation system which LADWP provided. The volunteers also built a snack bar, restroom and storage room. And 207 trees and shrubs were planted.

Besides doing much of the preparation, LADWP also contributed $35,000 worth of materials to the project. Volunteer work, Schmidt said, amounted to about $100,000 worth of materials and labor.

Children and adults alike will be able to use the fields for softball and other games.

Replanting barren lands with native species

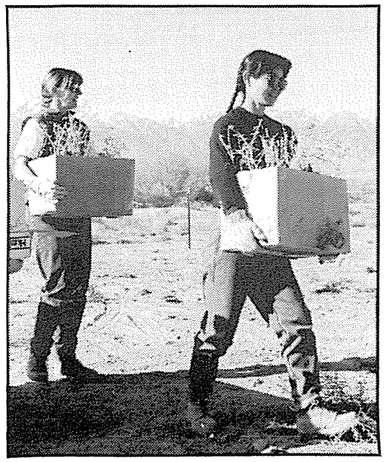
Last year, Inyo County and the Los Angeles Department of Water and Power began an experimental project to test revegetation techniques on a barren impacted site in Laws, north of Bishop.

The environmental impact report covering Los Angeles' groundwater pumping in the Owens Valley requires that areas impacted by pumping and/or surface water practices be mitigated. The EIR identifies about 1,000 acres of barren land that will be subject to revegetation.

Irene Yamashita, a research assistant for the Inyo County Water Department, is primarily responsible for developing the revegetation program and leading the pilot project at Laws.

"The EIR acknowledges a current lack of understanding about active revegetation of native shrub species in the West and commits Los Angeles and Inyo County to conduct necessary studies to use native plant revegetation as mitigation," Yamashita writes in the pilot mitigation study proposal for Laws.

The study site is within a 139-acre abandoned agriculture area. The land was irrigated to grow alfalfa up until the late 1920s, when Los Angeles bought the land and retired it from production. Since then, except for one year when a rancher cleared and farmed the area, the land has been barren except for non-native weedy species. Native perennials have failed to re-establish from surrounding seed sources, Yamashita said.



New life — *Denise Waterbury and Irene Yamashita carry saltbush plants to revegetation site.* Heidi Walters photo

So last fall, LADWP fenced a 172-by 173-foot portion of the site. Within this plot, Yamashita and other water department employees planted 400 juvenile four-wing saltbush plants. The plants, which were leftovers from a revegetation project at the Nevada Test Site, had been kept for two years in a greenhouse in Chalfant Valley.

The study uses three variables on the plants, put together in eight different combinations, to determine what works best for revegetating similar impacted lands. The variables are supplemental irrigation, a low dose of fertilizer, and planting densities (how far apart the plants are placed from each other).

It has been more than half a year since the project began. During that time, Yamashita has measured the plants twice for height and diameter. But she said that because the measurements took place before the growing season there has been no change in plant size. She will continue to take measurements during and after the growing seasons.

Several of the plants died, either because they were weakened before planting by spending two years in tight containers, or because of being damaged during planting. Eleven of the dead plants were replaced.

Weeds continue to invade the site. Yamashita said there was a flush of *Salsola* (Russian thistle) this spring, probably caused by the soil being churned by truck tires during its preparation last year, and by the following winter and spring rains.

In response, another treatment has been added to the test: removal of weeds from half of each of the eight treatment plots.

Continued from page 10

terbrush, a main staple for deer, twice a year. Last year's fall transects showed an increase in bitterbrush growth. The deer seem to have benefited, said DFG biologist Denyse Racine. She said there were more deer on the winter range in 1992 than there were in 1991. The Round Valley herd, for example, had 954 deer in January 1991. In January 1992, DFG counted 1,200 deer.

Racine said the dove population seems to have declined since 1987. She and other biologists monitor the dove population along the same route every year. The route was set up to show nationwide trends.

She said there were no doves along the route when she performed her last count, although that does not mean there are no doves in the Owens Valley. It merely represents a decline along that route, and therefore is an indication of the overall health of the dove population. Racine said that before the drought, she usually counted numerous doves along the route.

Raptors such as bald eagles and various hawks seem to be doing well. Racine said she has seen many raptors north of Bishop.

Inyo County does not have a wildlife biologist. We rely on information from agencies such as the DFG, the federal Bureau of Land Management, Los Angeles Department of Water and Power, and the United States Forest Service.

Billy Lake Heidi Walters photo

Under the annual pumping program for the 1992-1993 runoff year, the Los Angeles Department of Water and Power will again pump a total of 87,000 acre-feet of groundwater from April 1, 1992 to March 31, 1993.

This pumping amount is the same as last year, and is based on criteria considered by the Inyo/Los Angeles Technical Group each year before it recommends a program to the Inyo/Los Angeles Standing Committee.

The Technical Group, comprised of representatives from both agencies, is an advisory group to the Standing Committee, which makes many of the final policy decisions between Inyo and Los Angeles.

The criteria upon which the pumping program is based include:

- ☐ monitoring results of vegetation conditions, water tables, soil water available to the vegetation and vegetation water requirements;
- ☐ the goals of the long-term agreement, the Green Book and the drought recovery policy; and
- ☐ the forecast of water conditions for the year, which this year means a forecast for a sixth consecutive year of substantially below normal precipitation and runoff in the Owens River Basin.

Most of the 87,000 acre-feet LADWP may pump this year will directly supply in-valley uses. Some, however, will be used by LADWP to replace surface water supplied for in-valley uses and to supply water to the Los Angeles Aqueduct during the winter to prevent its freezing. But pumping (87,000 acre-feet of groundwater) will equal in-valley uses (87,000 acre-feet of groundwater and surface water combined), the same as last year.

It is expected that up to 45 of the 96 pump-equipped wells will be operated between April 1992 and September 1993.

In-valley uses will be reduced the same as in 1991-1992 because of the continuing drought. LADWP leases will receive 90 percent of the water supplied to them in the 1986-1987 runoff year (first year of the drought).

One in-valley use, Klondike Lake, will receive the same amount of water as last year. McNally ponds will receive no water for the second year in a row. Lakes that are part of the lower Owens River rewatering project will still be supplied water.

Flows will be released into the lower Owens itself, beginning at Billy Lake, east of Independence. About 12,000 acre-feet will be supplied to the project — 6,000 acre-feet less than that released in a normal runoff year.

More Monitoring

This year, the Inyo County/Los Angeles joint monitoring program will continue the expansion begun last year. This includes:

— Selected areas will be inventoried to quantify vegetation conditions, compare these conditions with conditions that were documented in the 1984-1987 vegetation inventory, and to determine the extent to which vegetation changes in the valley are measurable and quantifiable.

— Areas of trees, riparian vegetation and sensitive plant populations are being mapped on overlays to the 1984-1987 vegetation inventory maps. Identified sites of significant environmental value will be given special management considerations.

— Known populations of rare plants will be monitored and their status documented.

— Groundwater contour maps were prepared for each 7.5 minute USGS quadrangle, beginning in April of the year the vegetation inventory was conducted in each quadrangle and for each April of each succeeding year up to 1992. The maps will help track water tables during the drought.

Runoff remains low as drought persists

Last year, despite a deluge of rain in March just before the 1991 runoff year began, the drought that began in 1987 continued.

Below normal snowpack in the mountains meant reduced recharge to the Owens Valley groundwater basin as less snowmelt ran into the creeks and the Owens River.

In 1992, the drought has persisted into its sixth year, and its impact on the valley's vegetation, water and wildlife is evident both in scientific data and in informal observations.

In 1990, because of the continuing dry spell, the Los Angeles Department of Water and Power agreed with Inyo County to manage pumping in an environmentally conservative manner during the drought and during a period of recovery after the drought. Thus, in a major departure from Los Angeles' past practices, pumping from the valley in dry years has been substantially reduced. As a result, groundwater levels, which fell precipitously during the first three years of the drought in the valley's well field areas, stopped declining and have either stabilized or begun a slight recovery.

A summary of Owens Valley environmental conditions from April 1991 to date follows:

WATER

Precipitation

April 1991 through March 1992 precipitation was still below normal for most areas of the Owens Valley. Bishop's precipitation was 76 percent of normal with 4.83 inches. Big Pine was also 76 percent of normal with 6.95 inches. And Independence was 68 percent of normal with 3.47 inches.

The south end of the valley fared better, with 6.46 inches of precipitation measured at Cottonwood Gates, south of Lone Pine, which is 102 percent of normal.

Snowpack

According to the April 1, 1992 snow survey performed by Los Angeles Department of Water and Power, water content of the snowpack at Mammoth Pass is 74 percent of normal. In April 1991, the snowpack's water content was 70 percent of normal at Mammoth Pass.

Runoff

In April 1991, runoff was projected to be 74 percent of normal. It is projected to be 67 percent of normal in 1992.

Surface water

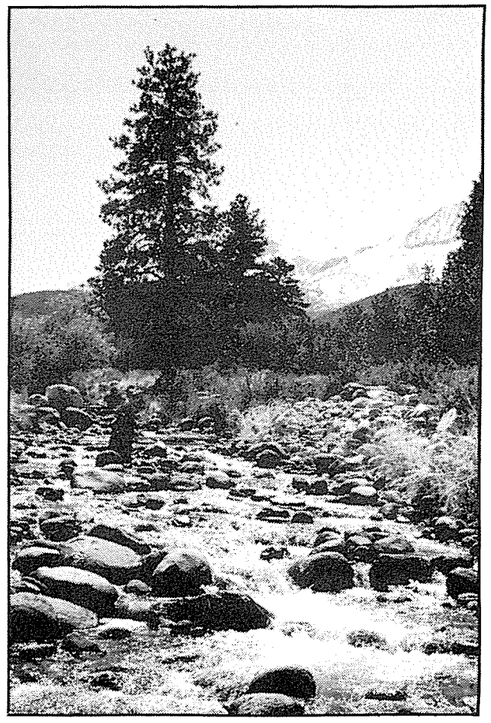
Drought caused low flows in the Owens River and in the more than 20 creeks flowing into the Owens Valley from the Sierra Nevada and White Mountains last year. Low flows continue this year.

Los Angeles, which operates three hydroelectric power plants in the Owens River Gorge above Pleasant Valley Reservoir, controls to some extent the amount of water flowing from the reservoir and is required to keep at least 100 cfs in the river.

The Owens River outflow at Pleasant Valley Reservoir last year was down to an average flow of less than 200 cubic feet per second (cfs). Normal average flow would be about 500 cfs. At the lowest, the river was down to 115 cfs last year. It was as high as 400 cfs during one period when LADWP was sending more water down the river as part of a fish flow study. A normal high is 700 cfs.

Recharge

Recharge is the amount of water percolating into the aquifer, and is measured for a water year (October through September).



Big Pine Creek — *Low runoff* Heidi Walters photo

Recharge is projected to drop almost 8,000 acre-feet this year in the Owens Valley.

Based on the projected runoff, the 1991 water year's estimated total recharge into the Owens Valley was 138,955 acre feet. Total recharge into the valley during the 1992 water year, based on the 67 percent projected runoff, is expected to be 131,510 acre feet.

The drop in recharge, attributed to continued low snowpacks and declining runoff, is valleywide.

Groundwater

Inyo County hydrology staff last year were able to determine the depth to groundwater in areas throughout the Owens Valley, and the changes in depth to water that have taken place over the past seven years, by using

Based on our comparisons of vegetation conditions and groundwater conditions between the pre-drought period of 1984 to 1987 and the current period after six years of drought, there is little doubt that the drought has caused a general vegetation decline and pumping has caused an even greater decline in the well fields than outside these areas. Under these circumstances it is reasonable to ask: "What have you done and what are you going to do about it?"

The answer is simple: "Plenty."

What we have done

The first step was to develop the Drought Recovery Policy and to get the Standing Committee to adopt it in 1990. The next step was to get the Standing Committee to strengthen it in 1991.

Under the policy, groundwater pumping will be managed in an environmentally conservative manner during this drought and during a period following the drought until there is a substantial recovery in soil moisture and water table conditions in the well field areas.

This policy, in effect, temporarily replaces the groundwater management program in the Inyo/Los Angeles water agreement which is based on soil water availability to plants.

'Groundwater pumping will be managed in an environmentally conservative manner'

While pumping is being conservatively managed, we will be conducting a thorough evaluation of the effectiveness of the existing management program in achieving the vegetation protection goals of the agreement.

To assist in this evaluation, we have expanded our vegetation monitoring program and, in particular, our efforts to identify and measure changes in vegetation caused by the drought or pumping or both.

What we will do

Once soil water and water tables have recovered, and after giving the vegetation time to recover, a determination will be made as to whether or not groundwater pumping has caused greater harm to the vegetation than that caused by the drought alone. To do this, vegetation conditions in areas where water tables have been affected by pumping will be compared to vegetation in non-affected areas. Conditions in both areas also will be compared to those which existed in 1984-1987 and to conditions at present to see whether after the recovery period vegetation in areas affected by pumping has or has not recovered to the same extent as vegetation affected only by drought.

Since the groundwater management provisions of the agreement were not in effect six years ago when the drought began, there is a question of whether the decline in water tables that occurred in the absence of such management (and which has contributed to the current vegetation decline in the well field areas) would have occurred if the agreement's management had been in effect. To answer this question, we will be modifying existing mathematical groundwater models and conducting certain research so we can predict what would have happened to water tables and soil water available to vegetation if the agreement's management provisions had been in effect throughout the current drought.

If we find that vegetation in areas affected by pumping has declined and has not recovered to the same extent as vegetation in non-affected areas, and if we find that this would have happened even if the agreement's management provisions had been in effect throughout the drought, then we will seek to tighten the management provisions of the agreement so that such a situation will not recur in the future.

If we find that even though vegetation in well field areas declined to a greater degree during the drought than in areas not affected by pumping, but that after a period of recovery it recovers to the same extent as non-affected vegetation, then we can conclude that the management provisions of the agreement are achieving the environmental protection goals of the agreement.

Owens Valley Checker Mallow — *These flowers are endemic to the Owens Valley.* Brian Cashore photo

available to the plants was predicted to be less than the amount of water required by the vegetation cover measured at the same site in 1991.

Wells associated with all 15 sites-in-deficit were off and remain off to allow water tables to recover so that the soil water is replenished.

Most of the other monitoring site wells were also off at the end of the runoff year, whether they showed a soil moisture deficit or not, because of the pumping limit agreed upon by Inyo County and Los Angeles. Most of the pumping in the valley was being done from wells exempt from turn-off provisions because they supply the fish hatcheries and towns, supply irrigation water, or are surrounded by non-groundwater dependent vegetation.

Rains during the 1991-1992 winter caused soil water to increase slightly near the soil surface but did not substantially contribute to soil water available to plants.

The above vegetation information was provided by Inyo County plant monitoring specialist Sally Manning.

Cool oasis — *Riparian area along Baker Creek.* Brian Cashore photo

Riparian areas

According to Inyo's consulting plant ecologist, David Groeneveld, decreases in surface water flow, groundwater pumping and the drought have played a role in killing trees and other riparian vegetation. These are some of the places that have been impacted over the past several years:

- ☐ **Millpond, northwest of Bishop:** A large area of riparian vegetation between U.S. 395 and Millpond declined because of drought, local pumping to supply the pond, and reduction in recharge to the aquifer because of diversions from Birch Creek by Southern California Edison. In extremely dry years, there is not enough water in Birch Creek to supply Millpond and so water is pumped to fill it. To halt the impact, water is being released from Millpond to flow through the affected stretch. The riparian vegetation, primarily black willow, is making a comeback.
- ☐ **North of Bishop:** A riparian area next to the Laws well field has suffered severe impacts during the drought. Vegetation along old meanders on the north side of the Owens River has died. Possible causes are low river flows, groundwater pumping, and scant rainfall over the past six years.
- ☐ **South of Tinemaha Reservoir:** Black willows have declined or died near old river meanders because of lower flows and downcutting in the Owens River. Compared to elsewhere on the Owens River, the greatest amount of downcutting has occurred here. Below Tinemaha Reservoir the river has incised more than six feet since the reservoir was constructed.
- ☐ **Near Thibaut Creek north of Fort Independence:** About one acre of willows adjacent to U.S. 395 have died back. The cause is thought to be a reduction in groundwater recharge to the area during the drought.
- ☐ **South end of Fort Independence:** Twenty to 50 acres of willows and cottonwoods have died. Possible causes are reduced irrigation because of the drought, and groundwater pumping in the nearby Independence-Oak well field. This is one of the first areas where groundwater pumping was curtailed because of impacts. Also, black locust trees along ditches died when irrigation was discontinued because of low runoff.

Riparian information was provided by consulting plant ecologist David Groeneveld.

WILDLIFE

New plant growth stimulated by last March's rains may have helped animal populations, suffering from years of drought, in the Owens Valley.

The California Department of Fish and Game monitors growth of bit-

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newly produced groundwater contour maps. Inyo staff developed the maps using water level data collected by LADWP in years prior to 1991 and by Inyo County in 1991 and 1992.

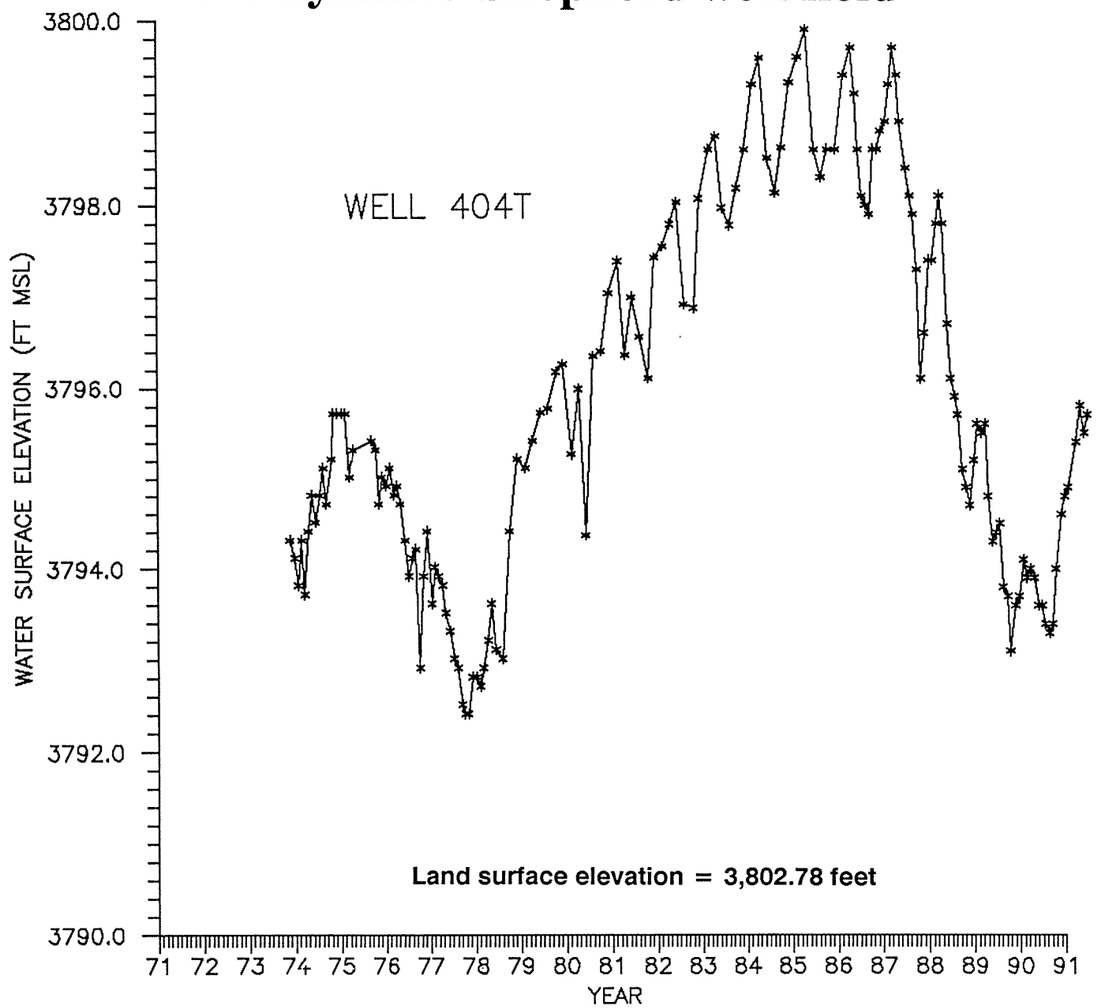
The maps begin with data from 1984, so that they can be used to compare with data on vegetation conditions recorded in a 1984-1987 vegetation inventory and again in a 1991 vegetation inventory.

By looking at these maps, hydrologists can tell how water levels have changed since the 1984-1987 inventory and also since the drought began in 1987 — and see the effects of pumping during a drought: have water levels remained unchanged, or have they dropped or risen and by how much?

Results

They found that groundwater levels in the well field areas of the Owens Valley began to drop in 1987 because of pumping. Between 1987 and 1991, water levels dropped as much as 30 feet in a few well field areas. In 1990,

Hydrograph of water levels measured in a well in the Symmes-Shepherd well field



water levels in some well fields reached their lowest point since the drought began.

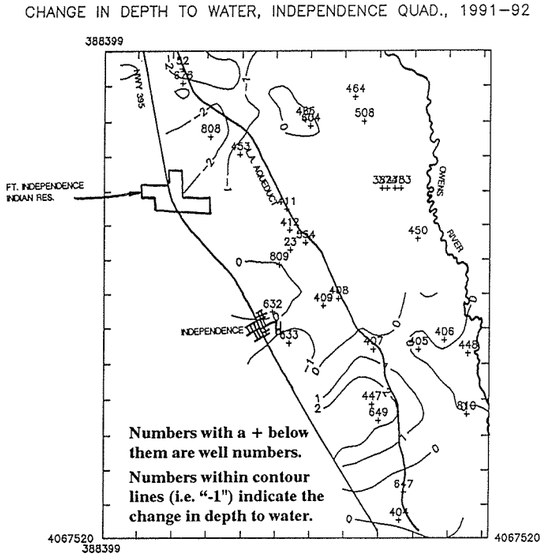
However, pumping was reduced in 1989 when the soil water monitoring program was implemented. Pumping was further reduced in 1990 and 1991 in response to the continuing drought.

Last year, according to measurements taken from 18 indicator wells in eight well fields throughout the valley, water tables were beginning to stabilize throughout the valley with several areas such as Laws and Bairs-Georges well fields showing marked recovery. A few small areas, such as around the Blackrock Fish Hatchery, showed minor water level declines over the past year. But overall, water levels throughout the valley still are lower than when the vegetation was mapped in 1984-1987.

Recovery – although far from complete – was most notable in the Laws well field area, north of Bishop, which has suffered severely from pumping and the drought. On average, water levels recovered six feet last year because wells were turned off for four months. In the immediate vicinity of wells that were turned off along upper McNally canal north of Laws, water levels recovered as much as 35 feet. When the Laws wells were turned off, pumping for in-valley use was redistributed to other areas of the valley, which caused a maximum decline in these areas of three-tenths of a foot.

While the six-foot recovery in the Laws indicator wells was a dramatic response to the wells being turned off, the water table in that area is still below the root zone of the plants. Along the canals north of Laws the water table is 10 to 28 feet lower than it was in 1987.

Groundwater contour map



West of the Owens River in the Laws area, water levels are down as much as eight feet from 1987 levels.

Conditions in some of the other areas are:

North of Bishop, including the Five Bridges area

Last year: Water levels remained stable, less than one foot of rise and/or decline in depth to water.

Change in depth to water since 1987: Zero to eight feet lower than 1987 levels.

Bishop area

Last year: No change

Since 1987: Little change since 1987, except near one well where a four-foot decline has occurred.

The Bishop area – roughly 45 square miles – exhibits stable water table conditions because of the pumping restrictions of the Hillside Decree.

South of Laws to Collins Road

Last year and since 1987: Water levels have remained relatively stable throughout this area because there are no groundwater production wells. This area is a good representation of an area affected primarily by drought.

Big Pine east to the Owens River

Past two years: Water levels remained stable, although six feet of recovery occurred at the extreme southeast corner of the area.

Since 1986: In the Klondike Lake area, water levels are zero to two feet lower than in 1986 because of the drought. East of the town of Big Pine near the Owens River, water levels are down about zero to four feet since 1986.

In the vicinity of Fish Springs Fish Hatchery

Past two years: Water levels remained stable, except for up to eight feet of recovery north of the hatchery.

Since 1986: Water levels have dropped six feet near the hatchery.

Independence area

Last year: Water levels remained stable, except for a two-foot decline north of the Fort Independence Indian Reservation. About 10 feet of recovery has occurred since water levels reached their lowest point in 1990 southeast of Independence.

Since 1985: Water levels remain between 12 and 24 feet lower than 1985 levels east and southeast of Independence. West of the Owens River, water levels are down four to 10 feet from 1985 levels.

Shepherd Creek to Georges Creek

Last year: Up to six feet of recovery took place in the Bairs-Georges well field. North of Bairs Creek and South of Shepherd Creek, water levels have declined about one foot.

Since 1985: Water levels in the extreme northeast corner of the area (for which the only water level data was recorded in 1985) are four feet lower. Since 1990, levels have remained stable.

Lone Pine area

Last year: Water levels declined less than a foot in the Lone Pine area.

Since 1986: Water levels throughout the area have been relatively stable.

Hydrology information in this article was obtained from the Inyo County hydrology staff and from LADWP hydrographer reports.

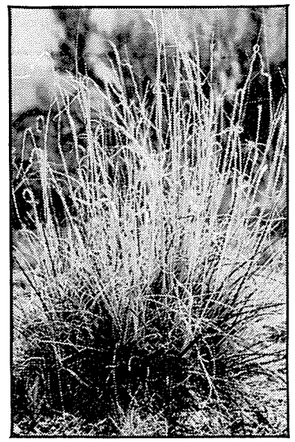
PLANTS

Vegetation throughout the Eastern Sierra has been declining since the drought began six years ago. On the floor of the Owens Valley, Inyo County and Los Angeles have been monitoring the health of the vegetation at permanent well field monitoring sites since 1987 to determine the effects of groundwater pumping in addition to those of the drought.

Although vegetation has declined dramatically in many locations within well fields, this decline does not necessarily mean long-term vegetation die-off. The significance of this decline in well fields will be evaluated after the drought has abated and water tables have recovered.

Live cover

Monitoring data from point-frame transects and line-point transects run at monitoring and control sites have revealed a general downward trend in the percentage of live plant cover during the drought, according to Inyo County's plant monitoring specialist Sally Manning. Plant cover reached its lowest point at most of the sites in 1990.



Alkali sacaton Heidi Walters photo

However, the downward trend was temporarily halted in March 1991 with the heavy rains. By summer 1991 most sites showed an increase in cover, including more annuals. The exception was the Laws area, where sites remained at low 1990 levels of vegetation cover.

But the drought continues and for the most part plants have not been able to recover to pre-drought conditions.

Vegetation change

In 1991, transects were run to inventory vegetation in selected vegetation parcels on the valley floor. The purpose of the inventory was to determine whether new data could be compared with information gathered during 1984-1987 and to compare vegetation conditions between parcels located inside and outside of well fields.

Results indicate that vegetation has declined more within well fields than outside of well fields since the vegetation was inventoried in 1984-1987. However, Manning cautions that until additional ongoing monitoring is completed, it cannot be scientifically concluded that there has been more decline within well fields than outside. That is because not enough parcels were sampled in 1991 and because there were problems with the earlier vegetation data. Thus the data do not yet permit thorough comparisons between well field and non-well field areas.

Background

It is a large area to sample. During the 1984-1987 vegetation inventory, LADWP sampled, or inventoried, 2,132 parcels amounting to a total area of 227,160 acres – practically the entire Owens Valley. The inventory included not only the valley floor vegetation but also non-groundwater dependent vegetation on the fans, bodies of water (lakes, ponds), urban areas and irrigated agriculture. Subtracting those areas, the actual area of the valley floor with groundwater-dependent vegetation, which Inyo County is especially concerned with monitoring, amounts to about 160,000 acres.

In 1991, 40 of the 2,132 parcels were re-inventoried and the transect data compared to data for those same 40 parcels from the 1984-1987 inventory. Manning chose these 40 because most of them were in areas that encompass permanent monitoring sites.

However, only 25 parcels ended up providing full results because transect data from the 1984-1987 inventory could not be found for the other 15 parcels. These 25 parcels amount to a total area of 3,619 acres, or just 2.3 percent of the 160,000 acres of groundwater-dependent valley floor vegetation.

Future plans include inventorying more parcels and sampling more evenly over the Owens Valley.

The 1991 results

A report in final preparation by Manning on the 1991 inventory quantifies changes in valley vegetation between the time of the 1984-1987 inventory and 1991. Here is a summary of her findings:

General – Results from transects run during 1991 showed that vegetation in parcels sampled inside the well fields declined about 55 percent since the mid-1980s.

In control parcels, away from the effects of pumping, results from transects varied: In the Bishop area, control parcels experienced an increase in vegetation. But in control parcels in the southern end of the valley, vegetation decreased.

Well fields – Overall, parcels inventoried in well fields in the Laws area experienced the most extensive decrease in perennial live cover with an average decline of more than 65 percent. Parcels inventoried in other well fields also showed declines: Big Pine, 40 percent decline; Taboose/Aberdeen, 35 percent decline; Thibaut/Sawmill, 30 percent decline; Symmes/Shepherd, 60 percent decline.

Controls – Control parcels in the Bishop area showed more than 50 percent increases in percent live perennial cover on average. Control parcels to the south, however, showed declines in cover, with a 30 percent decline in control parcels in the Independence area.

Soil water

As of March 1992, 15 of the 25 well field monitoring sites were in soil water deficit. This means that at the beginning of the 1992 growing season the estimated amount of water in the soil