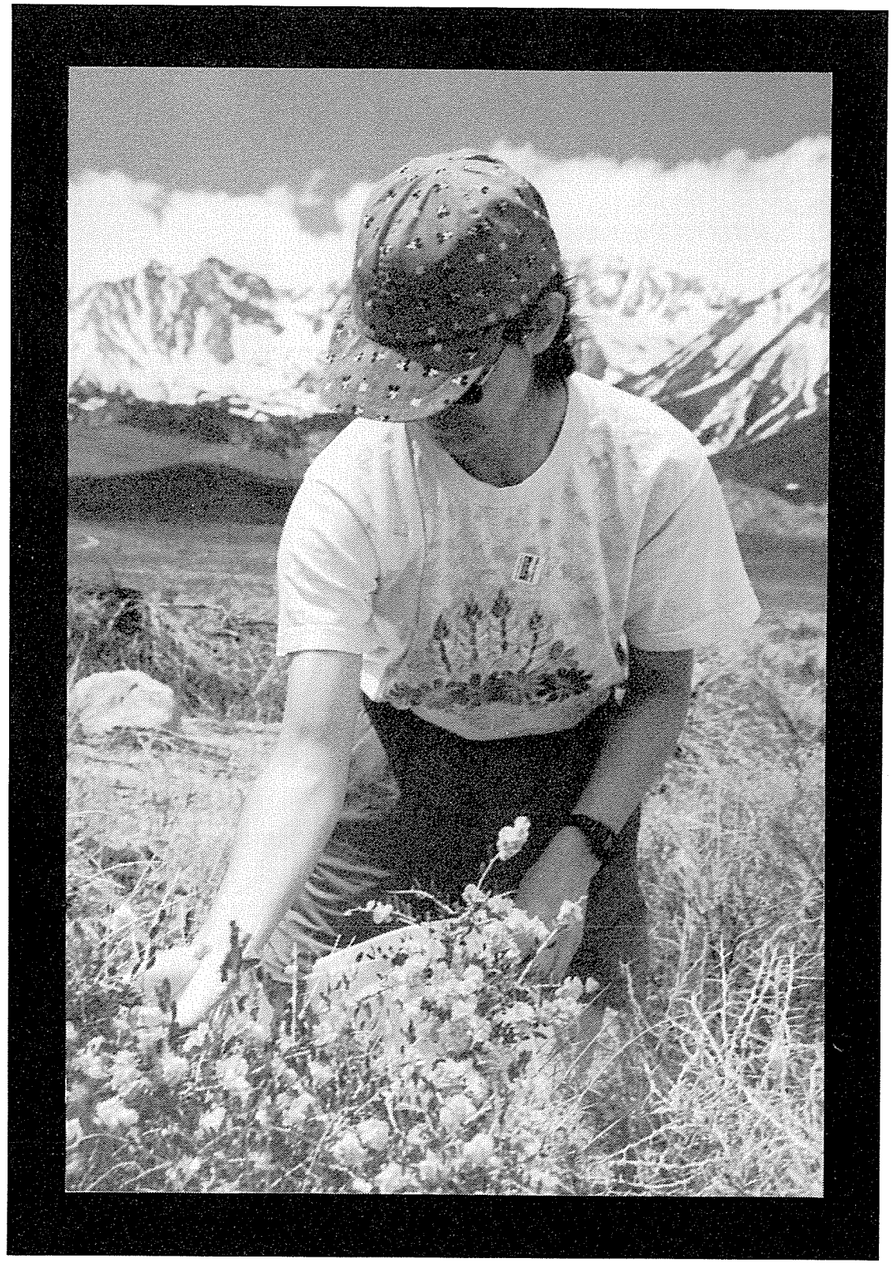
A snowy Owens Valley, early 1993

Photo by Heidi Walters

Inyo County Water Department
163 May Street
Bishop, California 93514



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

1 9 9 3

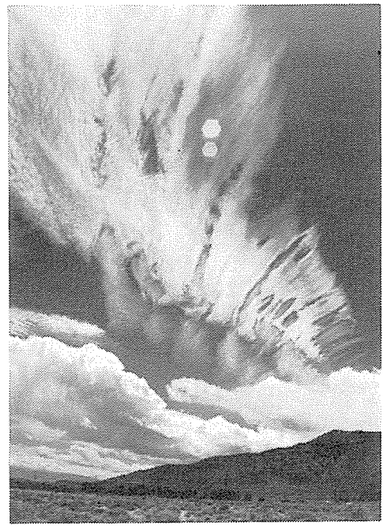
Introduction

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.

Operating under a water management agreement with Los Angeles, the ICWD monitors water activities in the valley and their impacts on water levels and vegetation, and conducts scientific research on methods of improving water management.

ICWD produces this annual report to describe legal and political events, conditions of the vegetation and water levels, and to detail monitoring, research and other work of the past year.

This is the second annual report — it covers the time period of April 1992 through March 1993, plus certain events from March 1993 to date.



The Owens Valley

Monitor

This annual report was produced by the Inyo County Water Department (ICWD) in Bishop, California. Its purpose is to explain the ICWD's yearly monitoring and management activities in the Owens Valley.

Greg James, Water Director
Heidi Walters, Editor

The ICWD also produces a newsletter called the **Owens Valley Water Reporter.** This newsletter covers the activities of the ICWD and water issues in general in the Owens Valley and the Eastern Sierra. If you would like to receive the newsletter and the annual report, please call **619-872-1168**, or write to:

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

Cover photograph:

ICWD's Irene Yamashita collects hopsage seeds near Red Hill west of Bishop. Photo by Heidi Walters.

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This report is printed on recycled paper. Free copies 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 CA 93514, Attn. Heidi Walters.

Reports and Papers

Staff and consultants wrote the following documents last year and early this year:

Hydrology

Inyo County Water Department hydrologic reports are numbered by the year written followed by the order (92-3 means the third report written in 1992, for example. Hydrology reports listed here start with 92-3 because the first two reports of 1992 were already listed in the first annual report). 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.

- ☐ **92-3** *Water Level Predicting Multiple Linear Regression Models Developed for the Eighteen Indicator Shallow Test Wells in Owens Valley, California*. By Randy Jackson. Draft, being reviewed by LADWP.
- ☐ **92-4** *Analysis of Slug Tests Performed On Shallow Test Holes 456T, 457T, 462T and 466T Adjacent to the Lower Owens River Reach from the Los Angeles Aqueduct Intake to East of Goose Lake, Owens Valley, California*. By Randy Jackson. Draft, being reviewd by LADWP.
- ☐ **93-1 (Technical Note)** *Discharge Data from Cottonwood Springs, Owens Lake Basin, Owens Valley, California, 1979-1992*. By Randy Jackson. Released to the public.
- ☐ **93-2 (Technical Note)** *Reconnaissance Hydrology of Diaz Lake, Owens Lake Basin, Inyo County, California*. By Randy Jackson. Draft, under ICWD internal review.
- ☐ **93-3 (Technical Note)** *Reconnaissance Estimate of Natural Groundwater Recharge to the California Section of the Tri-Valley region, Mono County, California*. By Randy Jackson. Draft, ICWD internal review.

Vegetation, Soils

These reports are not numbered and are listed by date.

- ☐ **1992** *Owens Valley California Plant Ecology: Effects from Export Groundwater Pumping and Measures to Conserve the Local Environment*. By David P. Groeneveld. Paper published in University of California White Mountain Symposium 1992 volume.
- ☐ **April 1992** *Water-Table Induced Shrub-Herbaceous Ecotone in Owens Valley, California*. By David P. Groeneveld and Dani Or. Paper submitted to "Ecological Applications." In review.
- ☐ **November 1992** *Report on Enhancement/Mitigation Vegetation*. By Sara J. Manning. Draft, under ICWD internal review.
- ☐ **February 1993** *Revegetation on Arid Lands: The Effects of Adverse Impacts and Techniques for Revegetation*. By Irene S. Yamashita. Prepared for the Inyo/Los Angeles Technical Group.
- ☐ **March 1993** *Laws Revegetation Project — 1992 Progress Report*. By Irene S. Yamashita and Sara J. Manning. Prepared for the Inyo/Los Angeles Technical Group.
- ☐ **May 1993** *Changes in Owens Valley Vegetation Due to Groundwater Pumping and Six Years of Drought*. By Sara J. Manning. Paper submitted to "Crossosoma." In review.

The Water Department

We have a new fiscal operations supervisor, Douglas Daniels, who began work this May. Daniels, who previously worked for the Bishop Indian Tribe, replaces Dorothy Reynard, who left this April to work for the Inyo County Parks Department.

Andy Zdon, our former assistant hydrologist, and Marie Traulsen, our former secretary, have also left.

Zdon married last summer and moved to southern California where his wife is employed. Zdon now works for Woodward-Clyde Consultants in Santa Ana. Traulsen also moved to southern California, where her husband is employed.

Irene McLean, who was our receptionist, is now our secretary.

Kelli Lanshaw, who was the Clerk for the Inyo County Board of Supervisors for most of the 15 years she has worked for the county, joined our department in December as a part-time receptionist.

Finally, Aaron Steinwand, our new soils scientist, began working for us this August 1. He will be in charge of soil water monitoring and related data analysis. Steinwand completed post-doctoral work this year at Iowa State University in Ames, Iowa.

General

Greg James — *director*
Douglas Daniels — *fiscal operations supervisor*
Irene McLean — *secretary, receptionist*
Kelli Lanshaw — *receptionist*
Leah Kirk — *environmental assistant*
Heidi Walters — *editor*

Vegetation

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*
Brian Stange — *research assistant*

Hydrology

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

Consultants

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

1992-1993 Adopted Budget

The Inyo County Water Department operates under two budgets. One,the larger budget, is for general operation such as ongoing monitoring and management in the valley and office administration. The other budget is for cooperative studies, which are studies administered by ICWD and often involve hiring outside consultants to perform specialized work in the valley.

The general budget for 1992-1993 was $905,874. Of this amount, $860,496 was provided by the Los Angeles Department of Water and Power. The remainder, $45,378, came from the county's geothermal trust fund.

The cooperative studies budget for 1992-1993 was $149,650. This budget was supplied totally by LADWP.

Manning receives botany Ph.D. from U.C. Davis

Last August, ICWD's plant monitoring specialist Sara J. (Sally) Manning received her doctorate degree in botany from the University of California at Davis.

Her dissertation title is "Competition for water between two desert shrubs, *Haplopappus cooperi* and *Chrysothamnus teretifolius*, in the Owens Valley, Calif."

Manning has worked for the ICWD since 1985. In 1991, she was promoted from field technician to her current position.

Besides her monitoring work for the county, Manning also is the county's representative to the Eastern Sierra Land Information System Network, also known as the Interagency Geographical Information System (GIS) group.

She also serves as the county's representative to the Owens Valley Endangered Species Recovery Task Force, formed as a result of the U.S. Fish and Wildlife Service's requirement to develop recovery plans for federally listed endangered species.

Manning said the group so far has developed a draft "Request for Proposals" which will be used to hire a consultant to write the recovery plan.

Manning is involved in other projects in the county and in the state.

Since 1991, she has been the secretary of the Bristlecone Chapter of the California Native Plant Society (CNPS). And, since December 1990, she has been a member of the CNPS Plant Community Committee.

This committee, established in 1990, is composed of academic, governmental, CNPS, and private consulting representatives.

Its purpose is to adopt a vegetation classification system applicable to the entire state, and to adopt a standard vegetation sampling technique by which vegetation may be quantitatively described and documented in an unbiased way by CNPS members.

Perspective

by Greg James, Water Director

It doesn't seem possible that even after the passage of almost two years since Inyo County and the City of Los Angeles formally approved the long-term Owens Valley water management agreement, uncertainty still persists as to the fate of the agreement and its full implementation.

However, despite the uncertainty, there have been some positive developments during the past two years — and some very frustrating events.

Background

Although officially approved by Inyo County and Los Angeles, the long-term water agreement cannot become a final court judgment until an environmental impact report (EIR) has been approved by a three-judge appellate court panel in Sacramento. The EIR addresses the effects of the agreement as well as the impacts in the Owens Valley of Los Angeles' water gathering activities since 1970.

The requirement to prepare an EIR was first imposed on Los Angeles in 1973 by the appellate court. The order arose from litigation commenced by Inyo County over the environmental effects of supplying Owens Valley water to Los Angeles' second aqueduct, which was completed in 1970.

Los Angeles subsequently wrote two EIRs, in 1976 and 1979, both of which were found inadequate by the appellate court.

In 1984, after more than a decade of water battles, Inyo and Los Angeles sought permission from the appellate court to resolve their disputes through the development of a joint long-term groundwater management plan.

The appellate court granted this request but said that any agreed upon management plan must be addressed in a third EIR, together with the impacts of Los Angeles' activities since 1970.

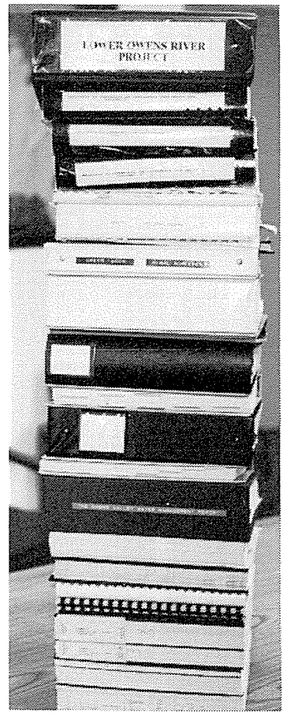
Following approval of the long-term management plan in October 1991, Los Angeles submitted a third EIR to the appellate court.

Litigation over the EIR

Los Angeles' EIR submittal was accompanied by a request that the appellate court dismiss its order requiring an EIR. Inyo County joined in Los Angeles' dismissal request.

After submittal of the EIR, several groups and one individual sought permission from the appellate court to challenge the adequacy of the EIR as amicus curiae, or "friends of the court."

The groups seeking to challenge the EIR were the California Department of Fish and Game (DFG), the California State Lands Commission, the Sierra Club, the Owens Valley Committee and the Owens Valley Indian Water Commission. The individual was Stan Matlick.



A few of the documents produced since the 1970s concerning LA's groundwater pumping in the Owens Valley, including LA's three EIRs and the Inyo/LA water agreement

Photo by Heidi Walters

At the request of Inyo County, discussions over the settlement of the EIR issues were commenced in December 1991.

As a result of the settlement talks, in February 1992 the Owens Valley Indian Water Commission notified the appellate court that it had reached a settlement and withdrew from the litigation.

Although a conceptual agreement on most of the EIR issues was reached among all concerned soon after the settlement talks commenced, an issue of great importance to the state agencies — the rewatering of the lower Owens River — remained unresolved despite months of negotiations.

In January 1993, the appellate court issued an opinion denying Los Angeles' request to discharge its EIR order and stating that the court would judge the adequacy of the EIR with the assistance of amicus curiae. Shortly after the issuance of the court's opinion, the EIR settlement talks came to an unsuccessful conclusion.

Since the termination of the settlement talks four amicus curiae briefs have been submitted to the appellate court.

The brief filed by the DFG and the State Lands Commission expresses these agencies' concern with the EIR's discussion and analysis of the mitigation of impacts caused by Los Angeles' water gathering since 1970, with particular focus on the lower Owens River mitigation measure.

In separate briefs, the Sierra Club and the Owens Valley Committee (with Carla Scheidlinger) each challenge the EIR's description of pre-project conditions, the adequacy of the EIR's description of impacts from 1970 to 1990, and the EIR's discussion and analysis of mitigation, including the lower Owens River. The Sierra Club raises an additional issue concerning the EIR's lack of a cumulative impact analysis of cattle grazing.

Stan Matlick's brief challenges the adequacy of the EIR's discussion and analysis of the impacts of groundwater

pumping and irrigation practices on the Bishop Cone.

It is expected that the appellate court now will review each brief to determine compliance with administrative requirements set by the court.

Once the court has made the required determinations, it is expected that it will invite Los Angeles and Inyo County to submit briefs addressing certain issues identified by the court. After all required briefs have been submitted, the court may or may not set the matter for oral argument.

Following review of all the briefs and consideration of any oral argument, the appellate court will issue an opinion on the adequacy of the EIR. The process of deciding the adequacy of the EIR may take from several months to more than a year.

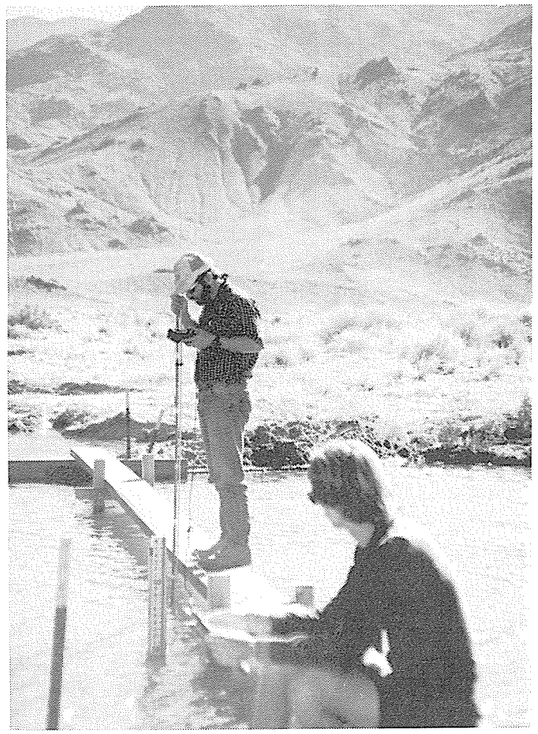
Water Management

Following the unsuccessful conclusion of the EIR settlement talks, the county commenced discussions with Los Angeles aimed at insuring that the environmental protection provisions of the long-term agreement and the drought recovery policy would continue to govern water management in the valley at least until the court's decision on the EIR.

These discussions concluded with the adoption of a "statement of intent" by the Inyo/Los Angeles Standing Committee at its June meeting.

The statement of intent provides that Inyo County and Los Angeles will to the extent allowed by law:

- ☐ manage the water resources in the Owens Valley in accordance with the provisions of the long-term agreement and with the provisions of a drought recovery policy adopted by the Standing Committee on May 26, 1992;
- ☐ continue existing enhancement/mitigation projects and implement new projects as may be agreed upon by the committee;
- ☐ continue, as provided in the long-term agreement, to provide Inyo County with financial assistance for operation of the water department and for providing services to its citizens;
- ☐ undertake, as may be agreed upon by the Standing Committee, other activities, programs, cooperative studies, and financial assistance as provided in the long-term agreement; and
- ☐ act in accordance with the general provisions of the long-term agreement concerning legislative coordination, exchange of information, lease charges, and hold harmless.



Randy Jackson measures flow in lower Owens River at the LA Aqueduct intake Photo by Heidi Walters

Lower Owens River

While the statement of intent secures an agreement to abide by the environmental protection provisions of the long-term agreement, other programs and activities contained in the long-term agreement only will be implemented if agreed upon by the Standing Committee.

Among the other activities subject to agreement is the Lower Owens River Project. During the more than a year of EIR settlement discussions, disagreements over the flow rates to be implemented in the approximately 60 miles of the lower Owens River were the major impediment to a settlement agreement.

Moreover, three of the four amicus curiae briefs raise issues concerning the adequacy of the river as mitigation for impacts that have occurred since 1970.

Given the importance of the Lower Owens River Project, the differing views as to what the river flows should be, and the virtual lack of data and analysis concerning the flow issues, early this year Inyo County began to push for river flow study tests to be conducted this summer.

The studies would analyze the amount and quality of fishery, riparian and wildlife habitat that would be created at various flow rates.

The study results would be used in seeking agreement on permanent river flows and in developing a management plan for the Lower Owens River Project.

Earlier this summer Inyo County and Los Angeles agreed that the study flows would be released

Conferences, classes and other mind expansions

Last year, ICWD staff again participated in the **RIMS high school science program** organized by the Inyo County Environmental Education program. Students from Riverside, Inyo, Mono, San Bernardino and Los Angeles counties spent a week in the Eastern Sierra learning about the environment.

In July 1992, David Groeneveld gave a presentation at the **Ideas Festival** in Colorado, called "The History of Water Use in Eastern San Miguel County, Colo."

In October 1992, Sally Manning attended the first **California Exotic Pest Plant Council** (CalEPPC) meeting and became a charter member of this non-profit organization.

Burned saltcedar in Afton Canyon Photo by Brian Cashore

Manning says the goals of CalEPPC are: to provide a focus for issues regarding exotic pest plants (introduced weeds) in California; to facilitate communication and information exchange on these issues; to promote public understanding of pest plant problems; to advise on research, management and control schemes dealing with these plants; and to monitor the problems. Saltcedar, *Tamarix ramosissima*, which is proliferating in the Owens Valley, is recognized as a serious pest plant in California.

Also in October 1992, Manning was invited to give a presentation at the **Southern California Botanists' annual symposium** at Cal State Fullerton. The theme of the symposium was the effect of drought on California native plants. The title of Manning's talk was, "Changes in Owens Valley Vegetation Due to Groundwater Pumping and Six Years of Drought."

Feb. 2, 1993, Brian Cashore attended the **Saltcedar Control/Afton Canyon ACEC Meeting** in Barstow. The Bureau of Land Management has initiated a habitat improvement project in the Afton Canyon Area of Critical Environmental Concern. The project involves eradicating saltcedar by different combinations of burning, cutting with chain saws and treating with herbicides.

Feb. 26 and 27, 1993, Irene Yamashita attended the fifth annual meeting of the **Desert Restoration Interest Group** in Tucson, Ariz., at the Tucson Plant Materials Center.

This year the group, which meets annually in different locations, focused on abandoned agricultural lands and plant genetics. The group took field trips to look at revegetated sites and equipment used in revegetation.

Also this February, Randy Jackson attended the **Nevada Water Resources Association** meeting in Reno.

In March, Jackson took a **HEC-2 class** at the University of California, Davis. HEC stands for the "Hydrologic Engineering Center" of the U.S. Army Corps of Engineers. HEC-2 is a river water surface profile model.

In April, Jackson took a **HEC-6 class** at U.C. Davis. HEC-6 is a model for scour and deposition in rivers and reservoirs. HEC-2 and HEC-6 are techniques that are applicable to lower Owens River studies.

April 30, 1993, Leah Kirk and **Greg James** took a class at U.C Davis titled **"Endangered Species: Practical Approaches To Resolving Conflicts."** The class focused on state and federal laws concerning endangered and threatened species.

This spring, Groeneveld took an **"Applied Fluvial Geomorphology"** class in Pagosa Springs, Colorado.

Others make use of Inyo hydrology staff's expertise

Our hydrology staff participated in several interdepartmental and ecologically oriented projects around Inyo County last year, including:

– Measuring depth-to-groundwater for a Mustang Mesa groundwater conditions study. Mustang Mesa is a residential community north of Bishop;

– Providing depth-to-groundwater, flow direction and velocity estimates to the Big Pine Tribe to facilitate design of their wastewater treatment facility;

– Using the Inyo County Water Department's ultrasonic flowmeter to help fine-tune water feed rates to air pollution control equipment at the Nikolaus and Nikolaus gravel operation north of Bishop;

– Helping Inyo County solid waste personnel take water quality samples at monitoring wells at the Bishop solid waste disposal site;

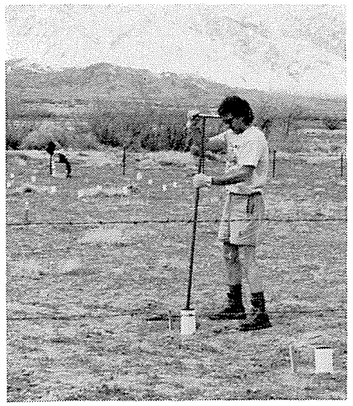
– Rating staff gauges at selected locations along the Owens River for the Owens Valley Mosquito Abatement District.

The use of fertilizer might only be beneficial for high density plantings.

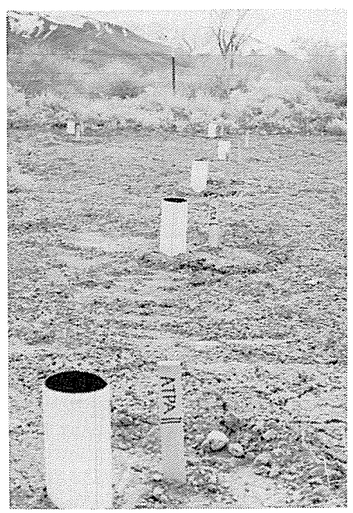
Monitoring growth and survival will continue for four years.

In addition, a study of seed germination and seedling survival on the study plot began this year, with several species of native Owens Valley seeds being planted at the site.

In a separate study, laboratory tests on germination of native seeds are being conducted (see story, this page).



Derik Olson augers holes for seed plantings at Laws site



Seed plots at Laws site

Photos by Heidi Walters

Local Owens Valley shrub seeds subject of study

This spring Inyo County tested germination rates of locally collected seeds of Owens Valley shrub species to determine viability and the amount of live seed within a bulk seed collection.

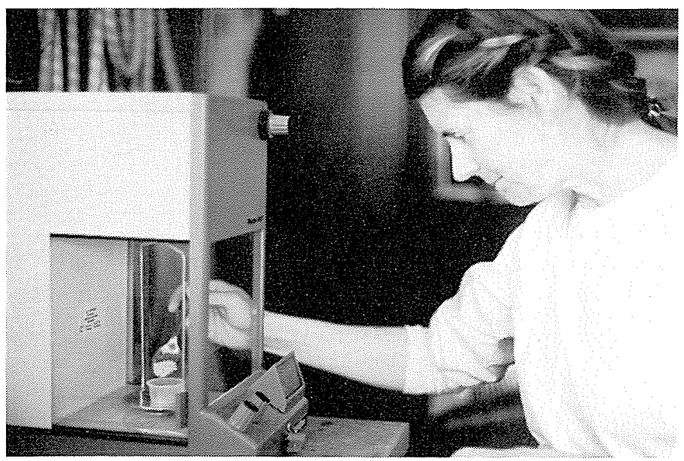
Species tested were: *Atriplex canescens, A. confertifolia, A. parryi, A. polycarpa, A. torreyi, Artemisia tridentata, Chrysothamnus nauseosus, C. albidus.*

Tests ran from February through May and involved varying methods based on a literature review of successful seed treatment techniques performed on the different species.

First, an attempt was made to germinate seeds without pre-treatment. Species of seeds that showed less than 20 percent germination without treatment were then treated and placed in a growth chamber in the laboratory at the White Mountain Research Station in Bishop. The growth chamber regulates light and temperature. Pre-treatment included removing surrounding fruit or other appendages on the seed, and/or subjecting seeds to scarification (abrading), leaching, and varying the periods of cold temperature.

So far, results show that local seeds are viable and can be germinated in the laboratory, although some species are more difficult to germinate. Tests will continue on the more difficult species.

Eventually, the information gained in this study will be used in field tests to determine the use of native seeds on impacted valley lands slated for revegetation in LADWP's environmental impact report.



Denise Waterbury weighs seeds

and that Don Chapman Consultants, Inc., of Boise, Idaho, would conduct the two-phase study. The DFG assisted in designing the study and agreed upon the protocols.

The first phase of the study began in early July and concluded in early August.

Although the water released to the river was of very good quality, at the highest study flows the water quality degraded as the water flowed down the river channel. The level of dissolved oxygen in the river dropped and many fish died.

Water quality in the river began to improve as the river was returned to pre-study conditions. An inspection of the river by personnel from Inyo County, Los Angeles and the DFG after the fish loss revealed that fish are still present in the river.

Los Angeles and DFG have said they will consider restocking the river.

It is expected the study consultant will provide copies of all data collected to Los Angeles, DFG and Inyo this fall. The consultant says an analysis of the data, including the amount and quality of habitat at various flow rates, will be available next spring.

Also, it is expected that discussions concerning the flow rates to be permanently implemented will take place through next summer.

Additionally, a financial grant for water quality planning is being sought from the State Water Resources Control Board. The grant would assist in planning the channel preparatory work that is necessary to reduce the risk of another fish kill once permanent flows in the river are implemented.

The Coming Year

Even with the uncertainties of the EIR litigation, the provisions of the Standing Committee's statement of intent provide an excellent opportunity for Inyo County and Los Angeles to determine priorities under the long-term agreement and to begin to establish policies and procedures for carrying out those priorities and for implementing the agreement.

Inyo/Los Angeles Technical Group – Implements the monitoring program and studies under the Inyo/LA water agreement. Reviews information from studies in the Owens Valley and serves as an advisory group to the Standing Committee.

Members are selected internally by Inyo County and the Los Angeles Department of Water and Power.

Inyo/Los Angeles Standing Committee – A decision-making body that reviews reports and recommendations from the Technical Group and attempts to resolve differences between the parties. Members also make recommendations to appropriate governing bodies.

The Inyo County Board of Supervisors and Inyo County Water Commission appoint members to represent Inyo County. The Los Angeles City Council and Los Angeles Board of Water and Power Commissioners select Los Angeles' representatives.

Staff at the Inyo County Water Department has begun developing recommendations for priorities for activities and programs contained in the long-term agreement as well as for monitoring, studies and management.

Moreover, staff has begun developing recommendations and ideas for a mission statement for the water department and for the Inyo County Water Commission.

Also under review are the future roles, compositions and operating procedures for the water commission, the Inyo/Los Angeles Technical Group and the Standing Committee under the long-term agreement.

In early fall, the recommendations and ideas will be presented to the water commission for discussion. Following public meetings, it is anticipated that the water commission's views will be presented for consideration to the Inyo County Board of Supervisors.

As these activities and programs are evaluated, administrative decisions will have to be made as to which county departments, commissions, and so on should be responsible for each activity or program,

For instance, should the water department, water commission and the board of supervisors be responsible for selecting the lands to be released by Los Angeles under the agreement, or should that decision be made by the planning department, planning commission and the board, or by others? At present, there are no procedures in place.

It is hoped that by the first of the year, the board of supervisors will have set the county's priorities, established the administrative procedures for carrying them out, determined the water commission's future role and composition, and will have adopted statements of purpose for both the water department and the water commission.

> Disagreements over the flow rates to be implemented in 60 miles of the lower Owens River were a major impediment

Once this work has been accomplished, implementation of those activities, programs, studies and financial provisions with high priority can be presented to the Standing Committee for consideration of approval.

By undertaking this work in the near future, there is a good possibility that key activities, programs, studies and financial assistance contained in the long-term agreement will be implemented even before there is a resolution of the EIR litigation.

Further, regardless of the final decision of the appellate court on the adequacy of the EIR, by having done this work, the county will be in a stronger position to continue to work to protect the environment of the Owens Valley.

Goal

Throughout the year we monitor the native vegetation, groundwater and surface water in the Owens Valley.

One of our primary goals is to protect the valley's environment from groundwater pumping and other water activities primarily performed by the Los Angeles Department of Water and Power.

To achieve this goal, we use the results from our monitoring to make management decisions that will avoid significant decreases or composition changes in vegetation, and that will avoid groundwater mining – the depletion of water in the aquifer that exceeds replenishment from recharge over a 20-year period.

Background

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. It is reinforced by a long-term water management plan agreed upon by LADWP and Inyo County in 1989.

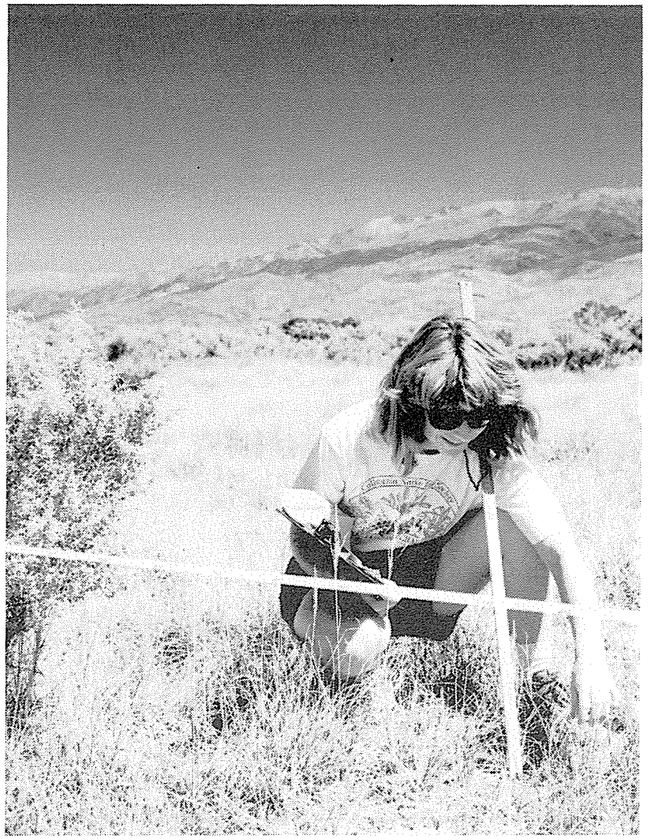
The program was implemented in 1989, in the third year of a six-year drought and following two years of high groundwater pumping.

For the past six years, this program for managing groundwater pumping was 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.

This year, the program is being tested in the first above-normal precipitation year after the long drought, and after several years of lessened pumping by LADWP.

Management

The Green Book, a document developed by Inyo County and Los Angeles, provides the scientific methods for carrying out the monitoring and management provisions of the long-term agreement.



Sally Manning looks for new plants along transect in Laws

Photo by Heidi Walters

In the Green Book, Owens Valley vegetation is 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 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.

Vegetation classified as requiring groundwater could potentially be impacted by groundwater pumping. For purposes of management, monitoring sites representing such vegetation 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

Revegetation study continues at Laws impact site

Inyo County and the Los Angeles Department of Water and Power are continuing an experimental revegetation project begun in 1991. It is on part of a 139-acre stretch of land that has been mostly barren of vegetation since it was abandoned as farmland in the 1920s.

The site, near Laws north of Bishop, is among 1,000 acres of barren land identified in an environmental impact report as candidates for revegetation. The EIR, covering Los Angeles' groundwater pumping in the Owens Valley, requires that areas impacted by pumping and/or surface water practices be mitigated.

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

Before the revegetation project began at the Laws site, the only vegetation growing there were non-native weedy species. Native perennials have failed to reestablish from surrounding seed sources, Yamashita said.

In November 1991, LADWP fenced a 172-by 173-foot portion of the site. In December 1991, Yamashita and other water department employees planted 400 juvenile four-wing saltbush plants in this plot.

Irene Yamashita plants seeds at Laws revegetation site

Photo by Heidi Walters

The plants were subjected to four treatments, applied in different combinations: irrigation, fertilizer, density (how far the plants are spaced apart), and weed control. An uncontrollable factor is precipitation. (During the first growing season (1992) of the study, precipitation was below average.)

Study results from 1992 showed that:

- ☐ Survival was greater for irrigated shrubs (96 percent survived) than for unirrigated shrubs (54 percent survived).
- ☐ Shrubs with weed control showed a higher survival rate (84 percent) than unweeded shrubs (67 percent), especially among unirrigated shrubs.
- ☐ Survival differences between high and low density shrubs and between fertilized and unfertilized shrubs were small, both with only a six percent difference in survival (high density shrubs showed 72 percent survival, low density shrubs showed 78 percent survival; fertilized shrubs, 72 percent, unfertilized shrubs, 78 percent).
- ☐ Measurements in growth revealed that as individual treatments, supplemental water and weed removal significantly increased growth. Density and fertilizer treatments did not show significant effects on growth.
- ☐ There were significant interactions between irrigation and density and between density and fertilizer. Low and high density shrubs benefited from irrigation but the low density shrubs showed a larger increase in growth than the high density shrubs. High density shrubs increased growth with the addition of fertilizer while low density plants showed a negative effect. A surprising result was a higher growth in unirrigated high density plants compared to unirrigated low density plants.

For the first growing season, it was apparent that both irrigation and weed control positively affected growth and survival during a dry year.

homogeneous the soils are. At one of the two sites, near Laws north of Bishop, the soils are heterogeneous (a mix of soil types). At the other site, four miles south of Bishop, the soils are homogeneous (the same). Soil spatial variability directly influences the amount of data that need to be collected to accurately project the water available to the vegetation. For example, if soils are homogeneous at a monitoring site, fewer data collection points might be needed than at a site where the soil varies across the site.

- ☐ Testing a preliminary model that uses vegetation spacing (space between plants) to estimate soil spatial variability. Additional testing of vegetation spacing as an indicator of soil variability continues, including using low-altitude air photos and computerized image processing techniques. If the vegetation spacing model successfully indicates soil spatial variability, it can be used to more effectively place soil water monitoring devices at the monitoring sites.
- ☐ Developing a soil water and plant canopy mathematical model that will enable simulation of conditions at the monitoring sites in well fields through cycles of drought and recharge. This model could be used to test whether the monitoring and related water management decisions will protect the vegetation, and could tell LADWP in advance how much groundwater can be extracted from a well field without damaging the vegetation. The model is being tested.
- ☐ Testing the use of geophysical techniques for estimating soil hydraulic properties at two sites (near Laws, and south of Bishop). It was thought that geophysical techniques could be non-invasive (no disturbance of the land), though expensive, ways to measure soil spatial variability at the monitoring site. Two techniques, one involving electrical resistivity and the other ground penetrating radar (GPR), were tested. Neither of the two techniques provided sufficient sensitivity at the level of detail desired, and the models were rejected.

Future work will include:

- ☐ Testing the soil water and plant canopy model at monitoring sites.
- ☐ Designing the final soil water equipment and the techniques for its application at the study sites.
- ☐ Writing the procedures in the Green Book (technical manual to the Inyo/Los Angeles agreement) for determining the soil water equipment to be used at each monitoring site, and for sensor installation, monitoring and interpretation of the data.

Brian Cashore conducts soil particle size analysis
Photo by Heidi Walters

Determining leaf area index using airborne or satellite scanners

The intent of this study is to determine whether remote sensing can be used to monitor Owens Valley vegetation and, if so, which techniques would be applicable. The most promising scanner, AVIRIS (Airborne Video and Infrared Imaging System), is carried on an aircraft. It is scheduled to be part of a satellite sensor package in the late 1990s. If AVIRIS can accurately identify living leaf cover, then we can reduce emphasis on field monitoring. The data will cover the entire valley, which can enhance our ability to monitor and manage the valley vegetation.

Last year, Groeneveld and other consultants determined that AVIRIS can detect even very small amounts of green vegetation. This study was performed on a tree farm at Stanford University.

This year, the consultants are measuring leaf cover during AVIRIS overpasses in homogeneous shrub cover in the Mono Basin. The Mono Basin was chosen because the AVIRIS sensor was scheduled to make several flights for other ecological studies.

Future work will include examining existing scanner data taken over the Owens Valley floor and comparing it with vegetation leaf area data collected from the same period at the monitoring sites.

The purpose is to determine whether scanner data is accurate enough for well field monitoring.

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 the monitoring sites.

At these sites, soil water and vegetation conditions are closely watched. If soil water at a monitoring site is less than the estimated water needs of the vegetation there – that is, if there is a soil water deficit – 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.

Twenty-five of LADWP's unlinked production wells are exempt from the provisions of the agreement requiring wells to be turned off. Reasons for exemption are: (1) they are the sole source of supply for either town water systems, fish hatcheries or irrigation, or (2) they are located away from areas of groundwater-dependent vegetation.

The remaining 11 unlinked production 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, there is the Drought Recovery Policy adopted in 1990 by Inyo and Los Angeles. The policy, with 1991 modifications, requires groundwater pumping to be managed in an environmentally conservative manner during and following a drought, until there is a substantial recovery in soil water and water table conditions in well field areas.

Monitoring

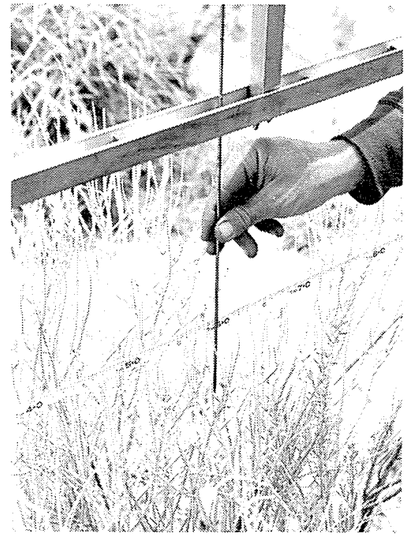
Monitoring is our key management tool. From year to year, we follow a consistent monitoring program which is essentially two-fold: Our hydrology

Terms and definitions

monitoring site – Typically a small fenced area containing a 100-meter vegetation transect (line), buried psychrometers and other monitoring equipment.

There are 33 monitoring sites. Twenty-five of these are located within the drawdown range of a well (in a well field, in other words). The other eight are control sites and lie outside the range of drawdown by the wells.

Data collected at these 33 sites are used to represent vegetation conditions over a large area, and to compare conditions at well field sites to those at control sites.



Point frame Photo by Heidi Walters

transect – A straight line along which data are collected. 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 along a permanent transect. They align the point frame along the tape and one of them lowers the 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 metric 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 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 moisture. A reading is taken by running a small electric current through wires causing soil moisture to condense on the tip of the psychrometer.

By knowing soil characteristics and the ability of the plants to extract water, the monitoring specialists then can derive the amount of soil water available for plant use.

neutron probe – This instrument also is used to measure moisture content of soil. It contains a gauge that works on the principal of neutron thermalization. Fast neutrons emitted by a radioactive source are slowed when they encounter hydrogen, a component of water, in the soil. The slowed neutrons are detected by the gauge and then converted to represent the proportion of water in the soil.

Monitoring and Management

staff monitors the surface water and ground water of the Owens Valley, and our vegetation staff monitors the plants and soil water.

Hydrologic monitoring

- ☐ Randomly checking the status of LADWP's pump-equipped wells to make sure wells that are supposed to be off are off, according to the provisions of the water management agreement.
- ☐ Regularly reading three continuously recording groundwater level transducers on selected wells. These devices can be moved around the valley by Inyo County on an as needed basis.
- ☐ Measuring water levels in 300 monitoring test wells in April to update the hydrography data of the valley floor; test well measurements are used to develop groundwater level contour maps, showing depth-to-water levels and change in depth-to-water levels.
- ☐ Reading rain gauges. December 1992 marked the first full year of operation of seven rain gauges. They are located from Laws in the north to the Union Wash area in the south and are designed to fill data gaps in the LADWP rain gauge network.
- ☐ Using multiple linear regression models to predict water levels in 18 indicator wells.
- ☐ Monitoring Reinhackle Spring.
- ☐ Monitoring wells on Indian lands.

Vegetation monitoring

- ☐ Collecting and analyzing data from 100-meter point-frame transects, twice a year.
- ☐ Counting recruitment (new plants), once a year.
- ☐ Reading neutron probes and psychrometers to measure soil moisture.
- ☐ Running monthly point-frame transects.
- ☐ Running random line-point transects to document vegetation change. Vegetation in more than 100 parcels was re-inventoried in 1992 and compared to vegetation conditions as mapped in 1984-1987 (the baseline conditions according to the Inyo/Los Angeles agreement). A report of results is being prepared.
- ☐ Analyzing groundwater level contour maps with vegetation map overlays.
- ☐ Improving the 1984-1987 vegetation map base in regards to "other" vegetation. The maps were examined in conjunction with aerial photos and field visits in order to identify riparian, wetland, tree stand, rare plant populations or other distinguishable areas that should be differentiated but were not recognized when the maps were produced. We located about 950 acres of such areas. A report on results is being prepared and LADWP is reviewing the proposed "other" vegetation areas.
- ☐ Beginning a preliminary map to update the extent of the infestation and spreading of saltcedar in the Owens Valley.

Conditions

Hydrology

Precipitation

From Los Angeles Department of Water and Power and Inyo County Water Department rain gauge stations, total rainfall in inches between Oct.1, 1992 and April 1, 1993:

Laws (north): 5.93

Laws Museum: 6.23

Bishop (north): 11.14 (226 percent of normal)

Bishop (south): 7.12

Big Pine (west): 14.67 (190 percent of normal)

Big Pine (east): 8.32

Independence: 7.41 (175 percent of normal)

Goose Lake: 6.78

Thib-Sawmill: 8.75

South Haiwee: 9.35 (192 percent of normal)

Union Wash: 4.90

Snowpack

The April 1, 1993 snow survey conducted by the Los Angeles Department of Water and Power found water content in the snowpack to be 168 percent of normal. LADWP said this was the fifth highest April 1 snowpack in the last 25 years. It is more than twice the amount recorded in the April 1, 1992 snow survey, which was 74 percent.

Surface water

More than 20 creeks flow into the Owens Valley from the Sierra Nevada and the White Mountains. All of them were running low again in 1992, as in the past years of the drought.

The Owens River also had low flows last year. LADWP, which operates three power plants in the Owens Gorge above Pleasant Valley

Annual Pumping Program — 1993-1994

On June 16, the Inyo/Los Angeles Standing Committee set a limit for Owens Valley groundwater pumping of 75,000 acre-feet for the 1993-94 runoff year (April 1 to March 31).

Now the Inyo/Los Angeles Technical Group is preparing the 1993-94 pumping program document, which will include a breakdown of the amount of pumping that will occur in each well field, and the expected recovery of the water table in each well field. It should be available in the near future.

Discussions by the Technical Group concerning this year's pumping program began last February. However, the Technical Group had not reached agreement on the amount of groundwater pumping prior to the Standing Committee meeting.

Prior to the Standing Committee decision, LADWP had sought to pump up to 105,000 acre-feet – the estimated amount of water that will be required to supply water uses this year on Los Angeles-owned lands in the valley.

On the other hand, to achieve maximum water table recovery under the drought recovery policy, Inyo County wanted to limit pumping to 55,000 to 60,000 acre-feet – the base amount of groundwater that must be pumped in any year to supply irrigation uses, enhancement/mitigation projects, town water systems and fish hatcheries that cannot physically be supplied with surface water.

Following a lengthy discussion, the Standing Committee agreed to a compromise pumping amount of 75,000 acre-feet.

This level of pumping is approximately equal to the required base pumping amount plus the amount of additional water that will be supplied to enhancement/mitigation projects during the year.

Last year, the sixth consecutive year of drought with a runoff of only 67 percent of normal, pumping was set at 87,000 acre-feet.

This year, with a projected runoff of 135 percent of normal, pumping will be decreased by 12,000 acre-feet.

The combination of high runoff and high groundwater recharge, together with the lower pumping, will result in greater water table recovery than in past years.

Randy Jackson, Inyo County hydrologist, says groundwater levels could rise dramatically in many areas of the Owens Valley this year. Groundwater levels have stabilized or have been slowly recovering from mid-drought lows under conservative pumping programs approved for the past three years.

Jackson notes, however, that the projected water table recovery within each well field area will not be available until the pumping has been allocated by well field in the annual pumping program document being prepared by the Technical Group.

Cooperative Studies

Occasionally, Inyo County and LADWP try new methods. If the new methods improve monitoring, they are added to the monitoring program. Many of these methods are tested in "cooperative studies," which are mostly paid for by LADWP and managed by Inyo County Water Department staff and consultants.

Inyo County's consulting plant ecologist David Groeneveld conducted several cooperative studies in 1992 with other consultants.

GPR study Photo by Heidi Walters

Time Domain Reflectometry

Time domain reflectometry (TDR) is used to measure soil moisture. TDR probes were installed in 1992 at two sites, and the county is attempting to verify the accuracy of their readings and to evaluate the applicability of TDR to our monitoring program.

Soil spatial variability

This study is designed to build statistical reliability into estimates of soil water measured at monitoring sites in the Owens Valley.

Better statistics will lend credence to our monitoring and management decisions.

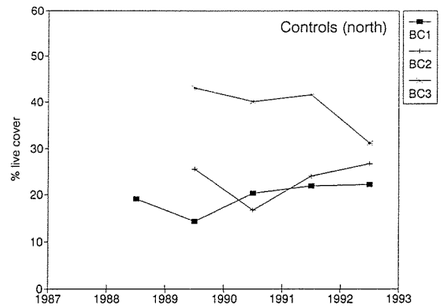
Under the provisions of the Inyo/Los Angeles agreement, estimates of plant-available soil water are compared to plant water requirements.

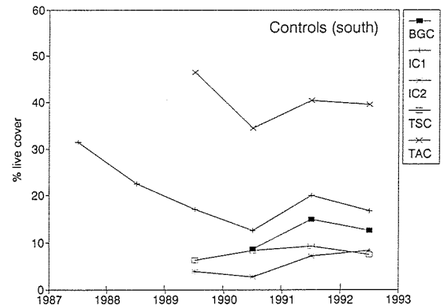
Groundwater pumping within a well field can occur when the associated monitoring site documents that sufficient soil water exists to meet the needs of the vegetation. This is contingent upon the Drought Recovery Policy, which requires that pumping be conservative until vegetation has recovered to 1984-1987 (pre-drought) conditions.

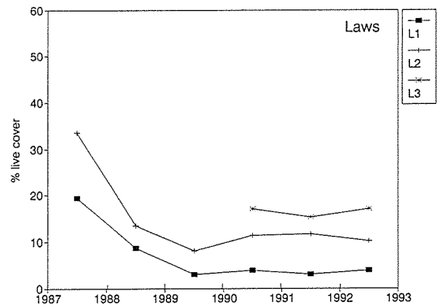
As part of the study, this year a number of tests were performed. They included:

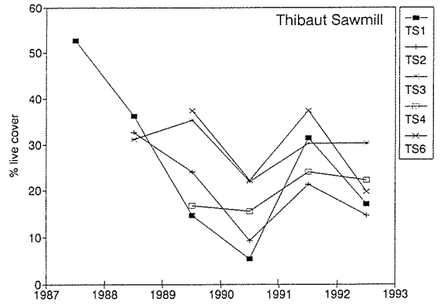
- ☐ Testing the current statistical technique used to evaluate water availability to vegetation within well fields, with the goal of refining this technique.
- ☐ Determining the spatial variability of soils at two monitoring sites. Soil spatial variability refers to how heterogeneous or how

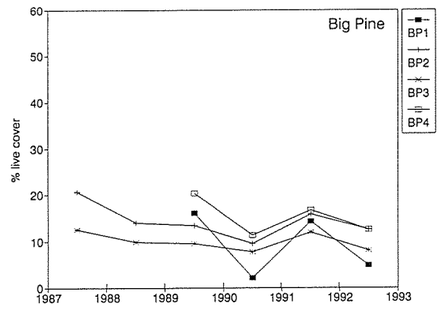
Plant cover at permanent monitoring sites, 1987-1992

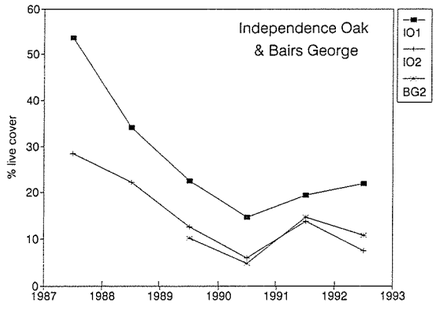


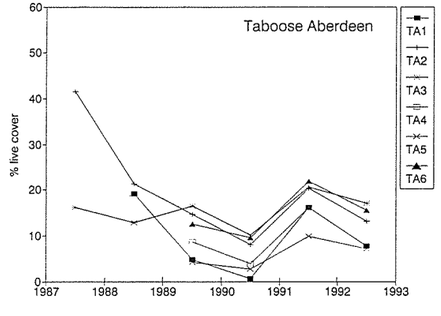


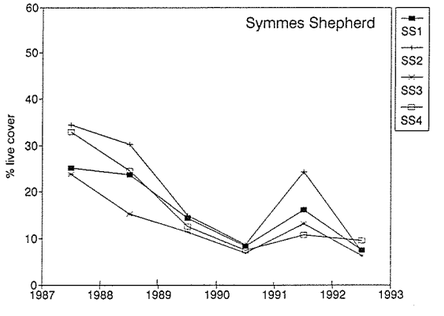












Reservoir, controls to a great extent the amount of water flowing into the reservoir and is required to keep a minimum of 100 cubic feet per second (cfs) flowing into the Owens River below the reservoir.

Last year (and through March 31 of this year), average outflow into the Owens River from Pleasant Valley Reservoir was 174 cfs. The river reached a low flow of 96 cfs, and a high of 553 cfs. (Normal average flow is 500 cfs, which wasn't experienced in the past six drought years. The normal high flow for the river is 700 cfs during spring runoff.)

Because of the big snowpack this winter, there is already more water available to the river and, as of May, LADWP was releasing 600 cfs from Pleasant Valley Reservoir.

Runoff

In April 1992, runoff was 67 percent of normal.

Runoff projected for 1993 is 135 percent of normal.

Groundwater recharge

Recharge, the amount of water percolating into the aquifer, is estimated for a water year, October through September, and is based on projected runoff.

ICWD's hydrologist, Randy Jackson said estimated total recharge into the Owens Valley for 1992, based on 67 percent projected runoff, was 131,510 acre-feet, 8,000 acre-feet less recharge than in 1991.

Recharge for the 1993-1994 water year is expected to be more than in the past two years. Jackson said the estimated total recharge for the Owens Valley this year, based on the projected 530,900 acre-feet of total runoff, is 195,610 acre-feet.

Estimated recharge by well fields for 1993, in acre-feet:

Laws: 16,346

Bishop: 47,895

Big Pine: 32,654

Taboose-Thibaut: 40,110

Independence-Symmes-Bairs: 42,684

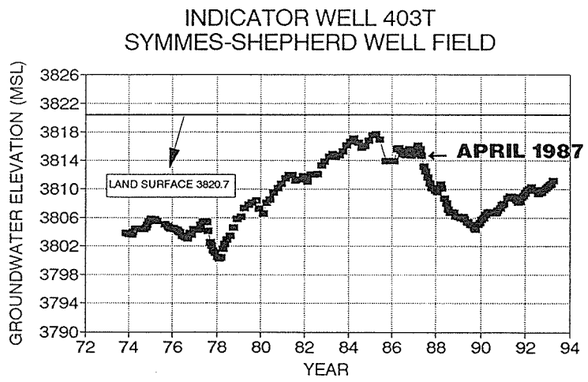
Lone Pine: 15,921

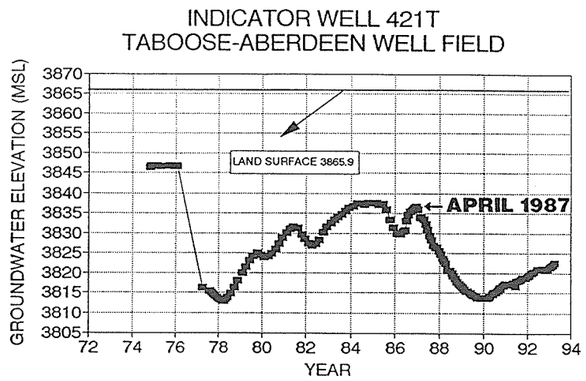
Shallow aquifer water level recovery in 18 indicator wells:

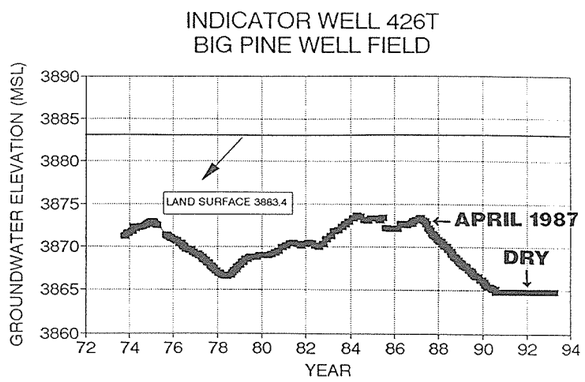
		Depth to groundwater (in feet)			*Recovery (ft)*	*Recovery needed to reach April 1987*	*Predicted recovery (ft)*
	Well #	*1987*	*1992*	*1993*	*April 1992 to April 1993*	*water levels (ft)*	*in 1993-94**
Well field							
Laws	436T	-7.8	-19 **dry**	-18.53	0.47 minimum	11.35	4.01
	492T	-32.34	-51.31	-50.48	0.83	18.14	9.02
Big Pine	425T	-14.25	-26.63	-26.24	0.39	11.99	0.78
	426T	-11.4	-19.7 **dry**	-19.7**dry**	**remains dry**	8.3 minimum	1.01
Tab-Ab	418T	-8.3	-17.8	-16.75	1.05	8.45	1.54
	419T	-6.49	-21.81	-18.75	3.06	12.26	4.22
	421T	-34.25	-47.46	-45.24	2.22	10.99	3.98
	502T	-7.64	-16 **dry**	-15.71	0.29 minimum	8.07	4.27
Thib-Saw	415T	-18.5	-33.1	-32.38	0.72	13.88	4.24
Ind-Oak	407T	-7.21	-16.93	-15.38	1.55	8.17	1.60
	408T	-3.02	-9.34	-8.34	1.00	5.32	1.01
	409T	-17.4	-19.4	-17.39	2.01	recovered	4.70
Sym-Shep	401T	-17.53	-24.96	-24.37	0.59	6.84	2.66
	403T	-6.07	-11.36	-10.45	0.91	4.38	1.72
	404T	-3.81	-7.44	-6.31	1.13	2.5	0.65
	447T	-22.97	-47.49	-46.36	1.13	23.39	4.74
Bairs-Geo	398T	-5.64	-7.45	-5.44	2.01	recovered	1.55
	400T	-6.6	-6.78	-6.3	0.48	recovered	0.14

* Predicted recovery is based on a scenario of 75,000 acre-feet of pumping for the 1993-1994 runoff year, with pumping allocated to well fields thusly: Laws, 10,400 acre-feet; Big Pine, 24,440 af; Taboose-Aberdeen, 8,785 af; Thibaut-Sawmill, 13,775 af; Independence-Oak, 3,784 af; Symmes-Shepherd, 2,400 af; Bairs-Georges, 0 af.

Sample of hydrographs showing groundwater elevations through April 1993







Vegetation

General conditions at permanent vegetation transects:

LAST YEAR: The valley entered a sixth year of drought in 1992. Total rainfall was less than normal and runoff also was low. More rain did fall on the Owens Valley prior to the 1992 growing season than fell prior to the 1991 growing season. However, the 1992 storms were spread out and there was no single big rainfall, and so not much of the water soaked into the ground, said Sally Manning, Inyo County's plant monitoring specialist.

Exacerbating the dry conditions, warm weather came early with higher temperatures than normal in April. Manning said this caused the vegetation to leaf out and reach its peak growth earlier than normal.

Warm, dry weather continued and adversely affected the vegetation. Manning said the 22 monitoring sites generally showed a decline in vegetation cover from 1991 conditions.

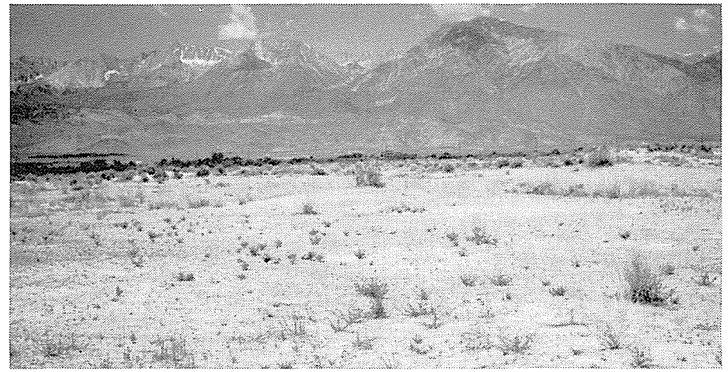
"In fact, 1992 vegetation conditions more closely resembled conditions in 1990, when cover was the lowest since monitoring began in 1987," she said.

THIS YEAR: Snow in the Sierra and Whites and rain and snow in the Owens Valley exceeded normal this past winter, breaking the six-year drought.

The moisture has caused a flush of growth on the valley floor, Manning said. Results from monthly point-frame transects at selected monitoring sites and from the usual transects during June and August will allow the water department to assess the growth.

Soil water

LAST YEAR: At monitoring sites: Soil water showed little or no increase in response to 1992 winter precipitation. As of July 1, 14 of the 22 well field sites were in soil water deficit. By Oct. 1, 15 sites were in deficit.



Site impacted by groundwater pumping and drought Photo by Sally Manning

At control sites: Despite the drought, soil water at the eight control sites continued to be ample enough to support the vegetation. None of the control sites have ever been in deficit.

THIS YEAR: Winter precipitation resulted in an increase in water table levels and soil water content at most of the monitoring sites, Manning said. Precipitation has percolated to at least 0.5 meter, according to psychrometer data gathered at this depth. At a few sites, water has penetrated to 1.5 meters or more.

Vegetation change

Staff re-inventoried vegetation in more than 100 parcels in 1992 and compared results to vegetation conditions mapped in a 1984-1987 survey (which serves as the baseline for the Inyo/Los Angeles water management agreement).

About half of the parcels re-inventoried were in well fields. The other half were in control areas, away from the direct influence of pumping.

The results? While in control areas there was no measurable decline in cover, the 1992 results of the re-inventory show a 42 percent decline from 1984-1987 conditions in cover of perennial plants in the well fields, Manning said. Just as in 1991, dry conditions in the Laws, Symmes-Shepherd and Taboose-Aberdeen well fields inhibited the plants' ability to produce as many leaves as they might under more normal conditions.

"Another troublesome trend shows an increase in annual weedy species, especially Russian thistle and bassia, in the northern part of the Owens Valley," Manning said. "Apparently, these species were already abundant in the southern part of the valley, so they did not show an increase during the dry year of 1992. But, they did increase as a percentage of parcel flora in many parcels in the northern part of the valley, in spite of it being a dry year."

The parcel re-inventory was done to further test our ability to measure vegetation change and to assess drought conditions in and out of the well fields.

"Through the process, I am confident that our techniques can yield data that can be statistically analyzed to show changes," Manning said. "That is, change is generally measurable.

"While we have seen a decline in well field vegetation cover, we do not yet know if this change is permanent. Continued re-inventory in 1993 and in subsequent above-normal rainfall years will help us further understand the resiliency of the well field plants."