Section 3. Best Management Practices for Agricultural Contractors

In this Section, describe the water management program the Contractor determines will best accomplish each BMP. The success of some of the practices will depend on cooperative work with other entities. Monitoring and updating will allow the Contractor to modify planned programs that do not accomplish the practice as designed.

For each BMP, describe how the plan will be carried out, including actions and timelines, budgets, staff, and projected results (e.g. changes in water and energy use, chemical inputs; improved yields; increased habitat) for at least the initial 3 years of the Plan. Identify how each practice will be monitored to see if it is achieving the projected results.

Note, if the requested information is not available, describe how that information will be obtained for the next Plan revision or state that the information is historical and cannot be reconstructed.

A. Critical Best Management Practices for Agricultural Contractors

Critical BMPs are those that every USBR agricultural Contractor is expected to implement. These BMPs are considered to be the basic elements of good water management. Select a program design for each BMP that will provide maximum benefit to the Contractor and its customers.

1. Water Measurement

Measure the volume of water delivered by the Contractor to each customer with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent. Three categories of measurement devices that may meet this criterion are: devices with totalizers, standard flow measurement devices, and non-standard but calibrated devices.

The first category includes devices with totalizers that measure volume: propeller meters, Venturi meters, magnetic meters, and acoustic meters. These have a high level of accuracy with proper installation and periodic maintenance and calibration.

The second category includes standard flow measurement devices that measure flow rate and also require accurate measurements of delivery time to determine volumes: Replogle and Parshall flumes; rectangular, trapezoidal (Cipolletti) and V-Notch weirs; and canal meter gates. These devices require proper installation; regular recording of flow rates and delivery times; adjustments for approach velocity in some cases; and regular maintenance and calibration for good accuracy.

The third category includes non-standard, calibrated flow measurement devices. This category includes special measurement devices developed by a Contractor. Typically, there are no published standard dimensions or flow tables for such devices. Consistent dimensions and installations; accurate determination of delivery time; local calibration and a verification of accuracy, based on a representative sample number of devices measured over time; and a proposed schedule for maintenance and calibration would be necessary for acceptability.

Refer to Appendix B for examples of installation, calibration and maintenance of measurement devices that are described here.

Rough estimates of flow rate or volume, such as

*flow rate estimates at check structures or the sum of siphon tubes (or other methods of measurement not specified here), are **NOT** acceptable since they do not provide a documented reasonable degree of accuracy.*

total # of customer turnouts that are unmeasured or do not meet the standards listed above _____

number of measurement devices installed last year _____

number of measurement devices installed this year _____

number of measurement devices to be installed next year _____

Water measurement of each turnout has many benefits. When customers know how much water they use for incremental time periods (monthly, per irrigation, etc.) they are able to make informed economic decisions. The distribution system can be correctly sized and operated to provide the water quantities and timing that customers need. Contractor costs for pumping, canal maintenance, and drainage can be controlled. Measurement devices (meters, flumes, weirs, sonic, etc.) should be selected based on the characteristics of the Contractor's distribution system, water quality and delivery requirements. It is important to implement a maintenance and/or replacement program in conjunction with the installation program because measurement devices become less accurate over time.

Contractors that measure deliveries can provide customers with their historic water delivery records. Customers can then determine what quantities of water were applied to crops in previous years and evaluate their irrigation systems and operations.

An example of a measurement program is the one implemented by the Laguna Irrigation District (ID). Laguna ID delivers water to 32,000 acres of agricultural land. In 1988, the Contractor began a project to install propeller meters on all Contractor delivery turnouts. The goal of the project was to ensure that all growers in the district received an equitable share of the available water. There was no method of measuring water deliveries prior to this program.

At the time Laguna ID implemented the metering program it had over 500 turnouts. To reduce cost, the Contractor purchased 180 portable propeller meters of various sizes. Contractor personnel install these meters at delivery turnouts when a grower receives water. Contractor personnel read the meters daily during a water delivery.

This program allowed the Contractor to change from a rigid delivery schedule to an arranged demand system, which features flexible flow rates and shut off times. The new system ensures the equal distribution of available water.

Laguna ID reports that flexible deliveries allow growers to irrigate crops according to crop need, increasing irrigation efficiency and reducing deep percolation. It also helps growers to more closely monitor water application and identify high-use fields. A comparison of deliveries in 1987 (before metering) and 1991 (after metering) indicates that 8 percent less water was used in 1991. Laguna ID purchased 180 meters, a computer and software database to compile the meter readings, a rack to store the meters, repair parts for the meters, and training for their personnel. They also hired a consulting agency to administer the program. Project cost was approximately $260,000. The Contractor customers are pleased with the metering system.

2. Designate a water conservation

coordinator

Provide the name, phone number, e-mail address and mailing address of Contractor staff person responsible for Plan development and implementation. For small districts, this could be a part-time responsibility. For larger districts, this may be a full-time responsibility with additional staff as appropriate.

If a consultant is hired to write this Plan, the Contractor should designate a conservation coordinator to manage the work and communicate with the USBR.

USBR offers workshops to assist with Plan development and will provide technical assistance to the Contractor during plan preparation and implementation. When necessary, USBR area office staff will meet with a Contractor's conservation coordinator to assist with the preparation, implementation, and evaluation of the Plan.

3. Provide or support the availability of water management services to water users

Develop and conduct individual programs or cooperative programs with other Contractors in regional programs. Some Contractors may want to contract or arrange program delivery through consulting firms, Cooperative Extension, or others. The services include, but are not limited to:

a. On-farm evaluations

1) On farm irrigation and Drainage system evaluations using a mobile lab type assessment

The USBR has developed guidelines for evaluating the adequacy of the on-farm irrigation system evaluation to assist Contractors in the planning of this BMP. The Criteria states that Contractors shall provide or support on-farm irrigation system evaluations for their customers. The BMP is intended to provide the water users with access to irrigation system performance information that will help them to improve the management of their irrigation.

Water users may or may not take advantage of this service. The Contractors are not required to offer these services free of charge. The following is considered an adequate program:

i) Offer to Contractor water users a rebate/discount of 25% off the fair market price of an evaluation.
ii) Annually, provide this service to at least the first 5% of the Contractor water users requesting this service.
iii) Actively advertise this service to Contractor water users.

This can be accomplished by providing financial support to mobile lab programs, consultants, university students, or others who can perform the evaluations. The Contractor shall also make all Contractor water users aware of the service through newsletters, bill stuffers, or other Contractor publications. If the Contractor can demonstrate that at least 5% of Contractor customers currently have their systems evaluations annually, the Contractor does not have to provide the service. The Contractor will still be expected to maintain support for this service by providing information to Contractor customers.

On-farm irrigation system evaluations provide information that growers need to make efficiency improvements to existing irrigation systems. Irrigation evaluations, such as those being provided by mobile labs and other consulting services, identify correctable problems such as worn nozzles, insufficient filtration, incorrect or irregular nozzle sizes, excessive run time, etc. Also, evaluations often identify when and where over- or under-irrigation are occurring.

In the Plan provide information on the number

of farms and acres that are projected to receive irrigation system evaluations each of the next three years. Include:
Total number of irrigated acres:
Number of irrigated acres to be surveyed per year by on-farm irrigation evaluations:
Total number of farms:
Number of farms to be surveyed per year by on-farm irrigation & drainage evaluations:

For those Contractors with irrigation specialists on staff, on-farm evaluations could be part of the Contractor's overall program, thus supplementing the efforts of other services or mobile labs. The California mobile lab program, with more than 20 Contractors participating, has evaluated more than 2,000 fields since 1981 (about 1% of the total). Agricultural consultants may also be able to perform this service for Contractor customers. Information on existing mobile labs can be obtained from DWR. If a mobile lab is not located in the local area, DWR can provide information on starting one.

2) Timely field and crop specific water use information to the water user

There are several substantial benefits of accounting for water deliveries by crop and field. A water user having knowledge of the deliveries has real-time information on their individual irrigation events and the total of all irrigation on each field throughout the season. Comparison of per acre water usage of each crop by field within the district provides very meaningful water use information both to the water user and the Contractor. Crop-specific and field-specific data allows development of a tiered water pricing system which is sensitive to crop type. It also provides accurate data for measuring the results of BMPs.

So that water users can compare their crops' specific water use with others within the district, the Contractor can prepare an annual report that summarizes water use by crop and by field, computes the unit water use per acre, and sorts these data in several ways - by water user, field number, crop type, and unit water use. At the end of each year, these reports can either be mailed to Contractor customers or posted at the Contractor office.

These reports will also be the best source of information to identify anomalies in water use which are indicators of possible sources of excessive tailwater and deep percolation or inaccurate metering.

b. Normal year and real-time irrigation scheduling and crop ET information (i.e., CIMIS)

Describe the Contractor's irrigation scheduling assistance program, including methods of data dissemination, and list any cooperating agencies.

To assist growers to develop crop irrigation schedules, Contractors can establish programs to: (1) measure and collect the necessary climatological parameters (temperature, relative humidity, wind velocities, solar radiation, and precipitation) to make proper ET rate calculations (in both real-time or current and normal situations), (2) disseminate the data to interested Contractor customers, and (3) provide technical assistance and instruction on scheduling techniques.

Climatological data for crop ET calculations and irrigation scheduling can be collected through various means. DWR has utilized the following types of climate stations to accomplish this task: (1) an evaporation pan station modeled after standard U. S. Weather Bureau stations and (2) computerized stations of California Irrigation Management Information System (CIMIS).

For an evaporation pan station, detailed discussions on the minimum standards for installation and application of the data in

determining crop ET can be found in the CA DWR Bulletins 113-3 and 113-4. Contractors will have to establish a program to disseminate the data collected at these stations (newspapers, television, radio, telephone, e-mail, newsletter etc.).

The CIMIS project uses computer and telecommunication technologies to collect and disseminate climatological data to Contractors, growers, irrigators, and others on a daily basis. Climatological data is measured and collected constantly by a network of computerized climate stations. The data is transmitted to and stored in a centralized computer, and is accessible to all interested parties within 24 hours. Hardware and software requirements to receive this data includes a personal computer and a telephone modem and communications software.

Historical climatological data can be used to develop normal year crop ET rates which can assist: (1) Contractors to determine approximate quantities of water that may be requested during any particular growing season, and (2) Growers to estimate the growing season ET requirements of crops.
DWR Bulletin 113-3 also provides normal year ET rates, adjusted for effective precipitation, for selected crops.

For assistance in developing training workshops and seminars in irrigation scheduling, Contractors may wish to contact local offices of the University of California Cooperative Extension Farm Advisors (see Appendix C) or NRCS. Consultants are also available to assist in the development of training courses or to provide direct technical assistance.

c. Surface, ground, and drainage water quantity and quality data

Describe the Contractor's surface, ground, and drainage water quality monitoring program; including methods of data dissemination, and list any cooperating agencies.

If the Contractor has water sources with a range of qualities that affects how much water is needed for leaching, providing water quality information when sources change can assist customers to use an appropriate amount of water. When the quality of delivered water changes, Contractors should inform customers so that they can make appropriate irrigation adjustments (for leaching, etc.). Workshops can be designed to assist growers to make the best use of this information.

d. Agricultural water management educational programs and materials for farmers, staff, and public (soil moisture and salinity monitoring; in-school awareness programs; Agwater software; efficient irrigation techniques, crop water budget and other approaches; program delivery via workshops, seminars, newsletters, field days and demonstrations, etc.)

Describe the Contractor proposed or supported educational programs and their goals. Attach the materials used in these programs.

The Contractor should either sponsor or conduct educational seminars/workshops for Contractor farmers and staff. Examples of workshop topics include: information on weather, crop ET, soil moisture holding capacity, crop characteristics, irrigation scheduling, and water use planning. Input from customers, consultants, irrigators and other technical experts will be important when determining the content of these seminars/workshops.

Educational seminars/workshops can serve Contractors in several ways. They can be used to: (1) communicate the importance of implementing conservation programs; (2) describe conservation procedures that can be utilized by customers; and (3) provide a forum

for growers, industrial users, and others to exchange ideas and experiences. These meetings also provide Contractors an opportunity to exchange ideas.

Information included in the Plan should include:
Program
Co-funders (if any)
Yearly targets

Various local, state and federal agencies such as the Agricultural Research Service, U.C. Cooperative Extension and Resource Conservation Districts offer technical assistance and will work with the Contractor to provide educational seminars and workshops to water users.

4. Pricing structure

Adopt a water pricing structure for Contractor water users based at least in part on quantity delivered.

Describe the proposed quantity-based water pricing structure and when it will become effective.

Financial variables influence the way customers use water. For example, when agricultural customers pay for each acre-foot of water received, they are more likely to order an amount closer to the actual crop water need. Ordering only what is needed can improve distribution system capacity, reduce tailwater, and increase supply reliability. Experience shows that urban customers reduce water use by 20 percent or more when charges are based on quantity used. This can result in substantial cost savings for potable and waste water treatment costs.

5. Evaluate the need, if any, for changes in policies of the institutions to which the Contractor is subject

Identify changes to the rules and regulations of the Contractors water suppliers that would allow for more efficient water use and operations.

Water Projects (CVP, SWP, etc.) and wholesale water agencies provide water based on policies that sometimes make retail water management more difficult. For instance, policies that require payment for unused entitlement or that restrict carry-over of unused water, can encourage unnecessary water use. Identify any policies that reduce the Contractor's ability to improve water management and provide suggestions for improvements.

As an example, Westlands WD, through negotiations with USBR, was able to change their water year so that the end of the water year could coincide with the end of the rainy season. Now Westlands' customers are better able to manage their water supplies to take advantage of effective precipitation.

6. Evaluate and improve efficiencies of Contractor's pumps

Describe the pump efficiency evaluation program and the role of the Contractor and participating local utilities in the program.

Many Contractors operate booster pumps or ground water pumps as part of their delivery facilities. A program to evaluate and improve the efficiencies of such pumps may result in energy savings, peak load reductions, or reveal capacity limitations due to inefficient facilities. Over the long term, the Contractor may be able to reduce operational costs and improve operational efficiency.

Provide information in the Plan on the Contractor's pump testing program. Both PG&E and Southern-California Edison (SCE) have pump-testing programs that can assist Contractors to minimize power costs.

B. Exemptible Best Management Practices for Agricultural Contractors

Agricultural Contractors should implement the following BMPs unless the Contractor demonstrates that the practice is not appropriate. Some Contractors may spend time studying the most effective way to implement a BMP or conduct a pilot study to determine if a BMP is appropriate for that Contractor. For appropriate BMPs, provide a description of the implementation plan and include time schedules, budgets and monitoring plans. If a BMP is to be studied, or a pilot study conducted, provide details and schedules of the study. These studies must be completed expeditiously and before the next Plan revision. The Contractor should follow the exemption criteria (see Section Six) to justify exemptions and document the exemption in this Section. Some Exemptible BMPs may not apply to the Contractor. See Attachment B for examples of circumstances under which Exemptible BMPs are not applicable.

1. Facilitate alternative land use

Facilitate alternative uses (voluntary, compensated) for lands with exceptionally high water duties, or whose irrigation contributes to significant problems such as drainage.

This BMP applies only to Contractors that have irrigated lands with the following characteristics: High water table (<5 feet) Poor drainage GW Se Concentration > 50 ppb Poor productivity

If a Contractor does provide water to lands that have the above characteristics, describe the Contractor's program that will promote a voluntary, compensated change of use for those lands.

The decision to retire land usually includes other factors, such as alternative land use demand. Also, it may not preclude the option of re-establishing irrigated agriculture if circumstances should change.

In Arizona, recreation-oriented uses have been proposed for agricultural lands retired due to salinity problems. In other areas, golf courses and shooting ranges have been proposed. The USBR and DWR are interested in working with Contractors to design such a program.

2. Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils.

The use of recycled urban waste water for agricultural irrigation provides an opportunity for reuse of an available water supply. Reuse of urban waste water can be an important element in overall water management.

Identify the source of recycled water and the yearly quantity that is available. Provide the cost of the recycled water and describe its quality in relation to the crops the water will irrigate. Describe the program that will promote the use of the recycled water by agricultural customers and identify the Contractor s role in the program.

3. Facilitate the financing of capital improvements for on-farm irrigation systems

Financial aid to farmers may include cataloging available funding sources and procedures and/or obtaining funding, administering the program, and providing low-interest loans.

Identify Contractor programs to facilitate and/or provide financial incentives for improved on-farm water management. Include information on the estimated amount of yearly loans. Attach funding source information

provided to water-users.

Often a grower can greatly improve water management techniques if financing is available. For some growers, the ability to implement efficient management practices and install modern irrigation system is hampered by the lack of capital. These individuals are willing to improve efficiency if long-term affordable financing is available.

Two examples of Contractor assisted customer financial assistance programs follow.

In 1992, the Broadview WD established a low-interest loan program for their customers. It is a lease-to-own program where the customer takes out a loan to purchase equipment and supplies, and owns the equipment after the loan is paid off. The customer approaches the Contractor with a on-farm water conservation proposal (e.g. the installation of a new irrigation system). If the Contractor approves the proposal, the customer selects the retail outlet that offers the lowest bid to provide the necessary supplies and equipment. If all aspects of the proposal are met, the Contractor issues the loan to grower.

The Contractor pays 3.0% interest on the loan to a state agency and charges customer 3.2%, which covers administrative costs. For a tax advantage, the Contractor considers these transaction as a lease program rather than a straight low interest loan.

The program is scheduled to run for 12 years, however the Contractor estimates that the program will be paid off within five years. During 1992, $900,000 was used by customers to improve their irrigation equipment. The Contractor requires that the customer and Contractor names be stamped on the equipment purchased under this program. Also, the grower must have insurance on the equipment.

In 1989 the Central California ID implemented a conservation loan program for its customers. The kinds of projects financed by the program includes pipeline installations, concreting ditches, sprinklers and drip irrigation system installations. land leveling, tailwater return systems and constructing community ditches. The Contractor's Board of Directors encourages customers to participate in the program.

Customers have up to five years to repay the loans. The Contractor adds an annual interest rate of 3 percent to cover its administrative costs associated with processing the loans. The maximum dollar amount for any individual farming entity or project is $50,000. All loans are repaid with single annual payments which are then reissued as new loans.

The funding for the program is surplus fees generated by the Contractor’s tiered water pricing schedule. begun in 1989. Tiered pricing was implemented to encourage water conservation. However, several customers went into the second tier of pricing during that first year. Extra funds were generated and the Contractor's Board of Directors decided to make $635,000 available for the conservation loan program. Total funding for the loan program presently stands at $1 million. When customers no longer wish to participate in the program, the funds will be used for other Contractor conservation projects.

4. Incentive pricing

Implement a pricing structure that promotes one or more of the following goals: a) encouraging more efficient water use at the farm level, b) supporting planned conjunctive use of ground water, c) appropriate increasing of ground water recharge, d) reducing problem drainage, and e) improving management of environmental resources.

Describe the incentive pricing structures that were considered, which was selected for

implementation and when it will become effective.

Incentive pricing, such as increasing block rates, are those which encourages appropriate water use. Incentive rates encourage customers to accurately determine and apply only the water a crop needs, thus reducing over-irrigation and the resulting drainage.

Examples and explanations of Agricultural rate schedules can be found in *USBR's Incentive Pricing Handbook for Agricultural Water Districts*, available from your USBR Area Office.

Several Contractors have implemented incentive pricing structures for irrigation water and drainage water disposal. Because of area specific management needs (such as leaching requirements, potential supply shortages, crop types, soil and climatological conditions), Contractors' incentive rate designs will vary.

Broadview WD implemented an increasing block-rate pricing structure for agricultural in 1989. The purpose of the program was to motivate growers to improving their on-farm irrigation operations and reduce the quantity of drain water collected in the subsurface drainage system installed beneath two-thirds of the district.

Broadview WD's block-rate pricing structure is comprised of two components: crop-specific tier levels (percolation depths which determine the price of water) and field-level accounting of water deliveries. The crop-specific levels are required because the volume of drain water generated from the applied water varies by crop according to the rate of crop ET. Crops with higher ET requirements are permitted to receive additional irrigation water applications before higher prices become effective. Without these concessions, growers could be limited in the kinds of crops to plant. Field-level accounting of water deliveries encourages the growers to carefully monitor and apply their irrigation supplies.

The pricing structures for the 1989 growing season were established at 90 percent of the district-wide average irrigation depths for 1986 through 1988 for all crops. This approach incorporates locally relevant crop water requirements, soil characteristics, and irrigation practices. The 10 percent reduction in applied water was previously determined to result in a 15 percent reduction in drain water volume. Other incentive pricing structures can be as effective as this example.

5a) Line or pipe ditches and canals

Line or pipe distribution systems to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage.

Seepage and evaporation losses in earthen ditches and canals can be minimized by replacement with pipelines or lining with bentonite clay, concrete or pour-in-place plastics/textile membranes. To reduce on-farm seepage losses, Contractors may wish to consider helping growers to line their ditches or install pipelines.

An example of a Contractor that utilizes a pipeline distribution system is Westlands WD, whose permanent distribution system consists of a buried pipeline network which conveys irrigation water from the main supply canals to 160- or 320-acre land units totaling more than 550,000 acres. The distribution system was built between 1965 and 1979 and serves approximately 90 percent of the irrigable land in the district. Most of the remaining district lands are served by farmer-constructed temporary diversions, which are maintained by the farmers.

The Contractor's water supply is distributed through 1,034 miles of buried pipe, varying in diameter from 10 to 96 inches. Gravity and

pumps feed 71 lateral pipelines.

In 1969 the Shasta View ID, located in the Klamath Falls area, in 1969 converted from an unlined canal system to a piped water delivery system. A 65-year Rehabilitation and Betterment Act loan from the USBR funded the $3.2 million project.

Seventeen miles of buried pressure pipe replaced 21 miles of unlined canal, which eliminated eight small regulating reservoirs and 110 farm pumping stations. With the canal system, the district had lost approximately 30 percent of its water through seepage from the unlined ditches and reservoirs. District losses are now less than 5 percent.

An additional benefit of the pipe system is the ability to deliver water to growers for frost protection. The elevation of the Klamath Basin is such that frost is a threat to the potatoes grown in the region. To protect against the affects of frost, growers sprinkle the potato fields to control air temperature. The open canal system could not deliver enough water to meet the demands for frost protection but the new pipe system was designed to operate at full pressure during frost periods, assuring growers of sufficient water to protect the potato fields.

Describe the program to line or pipe the distribution system reaches with the greatest loss per foot or those, which have the greatest negative impact on delivery flexibility and capacity.

As water cost or demands increase it will become cost effective to line / pipe more sections of the distribution system. Lining or piping canals and laterals is an expensive program, therefore consider lining or piping canals with the greatest seepage rates.

5b) Regulatory reservoirs

Construct regulatory reservoirs to improve distribution system delivery flexibility.

The construction and/or lining of regulatory reservoirs can provide improved distribution flexibility, improved system operation, additional supply storage, reduced operational losses, and increased flexibility in the reception of surface and/or aqueduct supplies.

The Imperial ID constructed six regulatory reservoirs as part of its program to improve the operation efficiency of its distribution system. Although the combined storage capacity of these reservoirs is only about 2,300 acre-feet, some of the more significant benefits of the reservoirs include: (1) storing water normally held with less efficiency in the Contractor's canals and laterals or released to the Salton Sea (when growers are unable to use ordered water due to unexpected rainfall), (2) the ability to meet customer water delivery requests, and (3) increased distribution system operational efficiency.

6. Increase flexibility (within operational limits in water ordering by, and delivery to, water users

Modify distribution facilities and controls to increase the reliability, consistency and flexibility of water deliveries.

Describe measures you plan to implement to: change from a rotation to on-demand delivery system, improve delivery flexibility, and improve delivery system capacity.

Many factors affect the effectiveness of irrigation. Among these are soil texture and uniformity, surface gradient, length of irrigation run, weed growth, debris from previous plant growth, irrigation water quality, root zone soil chemistry, depth of the unsaturated zone, wind velocity, humidity, air temperature, grower's expertise, and the design, condition and operation of the irrigation system.

If all of the above factors are optimum, but the irrigation water is not available at the necessary time or in the appropriate quantities, irrigation effectiveness will be adversely affected. Weather unpredictability often does not allow a grower sufficient lead time to order water. Unlike urban water systems, agricultural districts often do not have systems that can provide water on demand.

Broadview WD at one time required a 48-hour notice for water orders and a 24-hour notice to end a water delivery. This was modified in 1990 to 2-hour notice in most cases to provide growers with more flexibility. Many growers now apply frequent, shallow irrigations instead of the deep, infrequent irrigations used prior to 1990. Growers have the ability to begin and end irrigations on short notice, often in the same day.

Increased flexibility allows growers to irrigate only when necessary, but growers must be sure that the water will be there when needed.

7. Construct and operate Contractor spill and tailwater recovery systems

Construct facilities to capture and reuse district operational spills.

The design and operation of a Contractor's conveyance system has a significant role in the quantity of annual operational spills.

A Contractor should measure the annual spill from each canal and determine the percentage that could be captured for beneficial use. This data is essential to correctly site and size spill and tailwater recovery systems.

Interceptor systems can be designed to capture and transport operational spills throughout a conveyance system. One design adds lateral-connector canals. In this design, a secondary canal is constructed at the terminus point of a series of laterals to capture operational spill. The system is designed to either pump spills back into the laterals or transport them to a reservoir for storage.

The Imperial ID has a lateral interceptor, five miles in length, that captures operation spills from the terminus points of eight lateral canals and delivers the water to more than 22,000 acres of cultivated land. The interceptor has more than 90 automated drop leaf gates in addition to a 240 acre-foot reservoir for storage of spill water. The interceptor annually conserves approximately 8,300 acre-feet of water.

8. Optimize conjunctive use of surface and ground water

Increase planned conjunctive use of surface and ground water within the district.

Describe the potential for increased conjunctive use and identify programs to achieve this potential.

If feasible, Contractors should prepare and implement long-range plans to conjunctively use surface water and ground water to meet current and future demands. Conjunctive use programs store surplus imported and local surface water in groundwater basins. When surface water is inadequate to meet demand, groundwater is pumped and distributed.

The Arvin-Edison Water Storage District (WSD) has an active conjunctive use program. The Contractor utilizes two major spreading basins and a total of 55 recovery wells. During wet years, agricultural demand is adequately met with imported surface water. Surplus surface water is transported to the spreading basins and percolated into the groundwater basin. During years when the Contractor's imported surface water supply will not meet demand, the Contractor pumps the stored groundwater. This conjunctive use program

began in 1966. As of 1991, the Contractor had stored approximately one million acre-feet of water in the groundwater basin.

The costs to develop, implement, and maintain a conjunctive use program include funds to construct and maintain the spreading basins and to install and maintain the groundwater extraction wells. Where feasible, Contractors may wish to develop programs with neighboring districts.

9. Automate canal structures

Automation of canal structures may increase flexibility in water deliveries and increase the Contractor's control over its water supplies; thereby, providing the opportunity to improve the efficiency of water use.

Estimate annual operation spills by reach. Identify locations for automated canal structures and other distribution system improvements. Estimate annual water savings (AFY) resulting from the evaluated projects. Describe program to automate distribution system.

10. Facilitate or promote water user pump testing and evaluation.

Describe the program to facilitate or promote water user pump testing and evaluation.

A Contractor and the local utility can develop a cooperative pump testing service program for their customers. The program will benefit all involved parties by cutting down on energy demand, while providing ground water at the lowest possible price.

Several utilities companies currently offer a free pump testing service to their customers. A pump test report discusses the condition of a pump and well and provides improvement recommendations.