2009 Extraordinary Agricultural Water Conservation Plan

Prepared for

Coachella Valley Water District

March 19, 2009

By

JMLord, Inc.

INTRODUCTION

The purpose of this report is to document the Coachella Valley Water District's (CVWD's) plan to identify, verify, evaluate, and quantify extraordinary agricultural water conservation for payback of Colorado River water under the Quantification Settlement Agreement (QSA) and the Bureau of Reclamation's (USBR) Inadvertent Overrun Payback Policy (IOPP). The 2009 program is a continuation of the program which was initiated in 2004. The extraordinary agricultural water conservation program will terminate in June of 2009 as all Inadvertent Overrun obligations will be paid back by that time.

BACKGROUND

Through QSA negotiations, CVWD agreed to "payback" water through reduced diversions. CVWD has formally initiated an extraordinary agricultural water conservation program in order to achieve the required water savings.

According to the payback schedule developed by USBR, "Each district may, at its own discretion, elect to accelerate paybacks to retire its payback obligation before the end of the eight-year period ending in calendar year 2011." Based on the ability to achieve extraordinary agricultural water conservation in advance of the existing schedule and in anticipation of possible shortage in the Lower Colorado River Basin, CVWD has opted to accelerate payback. The original and actual accelerated payback schedule is depicted in Table 1.

Table 1. CVWD Payback Schedule.

	Original QSA	Accelerated Payback
Year	Amount (Ac-ft)	Amount (Ac-ft)[1]
2004	9,100	19,957
2005	9,100	18,491
2006	9,100	16,608
2007	9,100	7,404
2008	9,200	6,989
2009	9,200	3,751
2010	9,200	
2011	9,200	
TOTAL	73,200	73,200

[1] Value for 2004 thru 2008 represent actual payback amount.

As shown in Table 1, CVWD's payback schedule has been shortened by two years with total payback of 73,200 ac-ft to be completed in 2009.

Payback is occurring as a result of extraordinary agricultural water conservation measures that improve farm water management practices. In 2008, the following practices were approved as eligible for credit as extraordinary agricultural water conservation practices for CVWD; (1) Scientific Irrigation Scheduling And (2) Scientific Salinity Management.

Payback as of January 1, 2009 is 69,449 acre-feet. The projected payback amount for 2009 is 3,751 acre-feet and will be accomplished during the first 6 months of 2009.

EXTRAORDINARY CONSERVATION ACTIVITIES

CVWD extraordinary agricultural water conservation activities for 2009 consist of Scientific Irrigation Scheduling and Scientific Salinity Management. The services are provided through contract services of JMLord, Inc., an agronomic and engineering consultant with experience in water and crop management in the Coachella Valley. Services are paid by the District and provided to the water users. The expenditure of funds to provide scientific water management services to water users results in advances in irrigation water management that would otherwise not occur, making the program an extraordinary effort.

The following pages contain a description of the extraordinary conservation practices to be implemented in CVWD during 2009.

Scientific Irrigation Scheduling

Scientific irrigation scheduling is the practice of determining, through the best available methods, the optimum timing and amount of irrigation. Scientific irrigation scheduling results in improved crop quality and yield, optimum water and energy consumption, and prevention of fertilizer overuse and non-point source pollution.

Using the California Irrigation Management Information System's (CIMIS) network of weather stations, we are able to determine the weekly reference Evapo-Transpiration (ETo), which is the amount of water consumptively used by a plant or evaporated from the soil surface. In the case of CIMIS, the reference crop is grass and, therefore, a factor must be applied in order to determine the specific crop ET or ETc. This factor is known as the crop coefficient and it varies by crop and also by growth stage. Plants such as vegetables use much less water as seedlings than as fully grown plants. In the case of permanent crops there may be different water requirements based on the stage of fruit growth.

Taking into account the weather forecast as well as historical weather data, JMLord Inc. can then estimate the amount of water to meet the ETc requirement for the coming week. JM Lord Inc. has developed a model for predicting ET based on historic weather conditions and current weather forecasts from the National Weather Service (NWS). The factors included in this model are the historic, and forecast, average daily temperature, relative humidity and solar radiation. Since solar radiation is not directly forecast by the NWS it is estimated based on the forecasted cloud cover. Each factor influences the ET differently and, therefore, is given a different weight in the model.

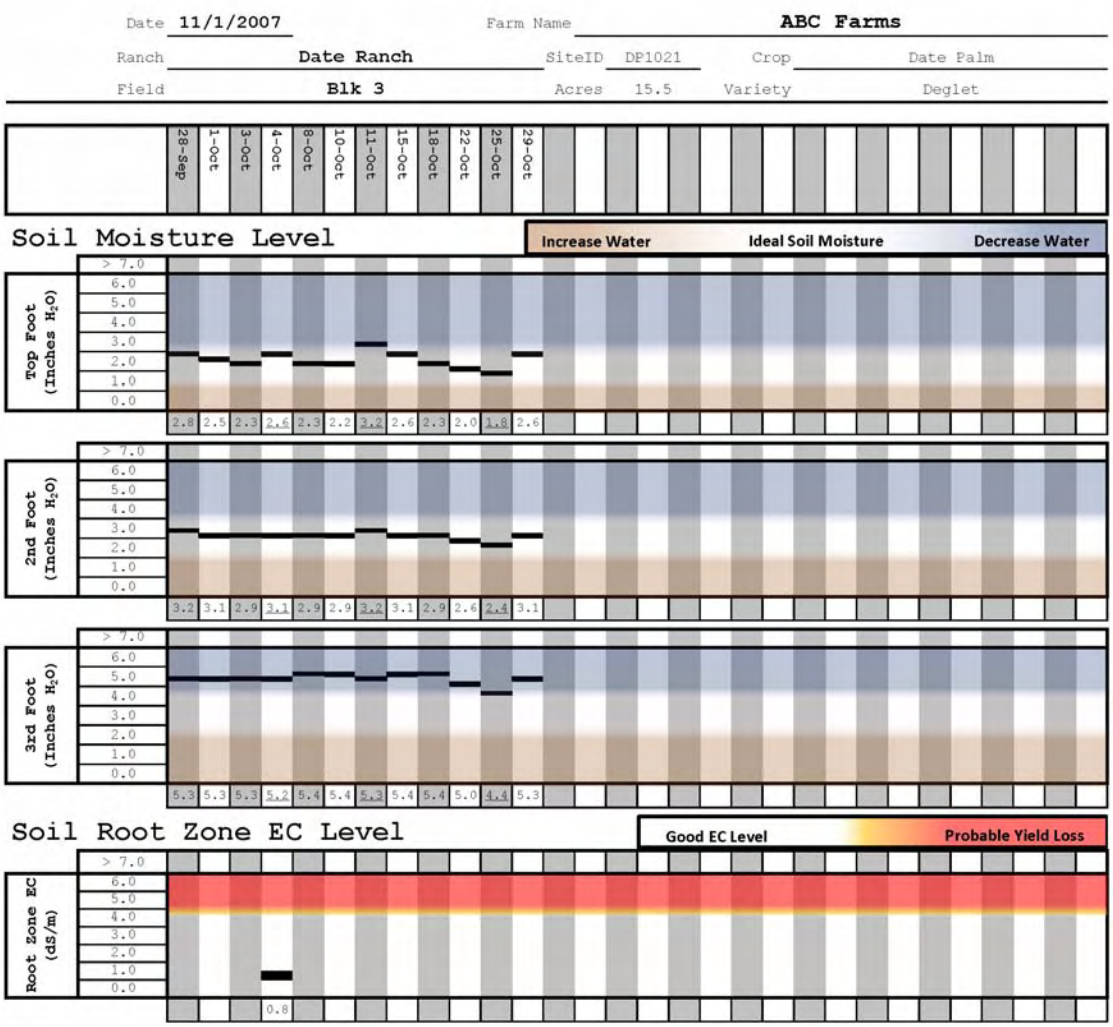
Measurement of soil moisture content is also a key part to effective irrigation scheduling. The amount of water in the soil can be estimated either by feeling the soil or by using some sort of moisture sensor.

Ty Mull, Abbas Amir-Teymoori, Steve Jones and Alan Jackson.

In this extraordinary agricultural water conservation effort, JMLord Inc. uses a combination of both methods to determine the current soil moisture levels. We use the Delta-T PR2 profile probe which measures the volumetric moisture content of the soil down to 3 feet deep. The device consists of a 1 meter rod with 6 sensors placed along it at 4, 8, 12, 16, 24, and 39 inches. The rod is then placed into an access tube which is permanently buried in the field. These measurements are averaged for the first, second and third foot of soil, the first foot being the nearest to the surface. The measured volumetric moisture content represents the total amount of water held in the soil, however not all of this water is available for plant use. The amount of water available to the plant is determined by the soil type, soil structure and the amount of organic matter in the soil.

Figure 1 illustrates a typical soil moisture graph where the moisture level is graphed at each foot. The brown area indicates too little water, blue indicates too much water and white indicates the ideal moisture content.

Figure 1 – Typical Soil Moisture and Salinity Monitoring Graph



The soil moisture sensor provides valuable data for use in scheduling agricultural water irrigation. However, it is limited to a very small sampling of the entire field and placing many sensors in a field becomes impractical. It is important, therefore, to verify that this small sampling is indeed representative of the entire field. This is accomplished by manually probing and feeling the soil at random locations throughout the field. In the event that the soil moisture is considerably different where the soil moisture sensor is located than in the majority of the field then the sensor would be moved to a more representative location.

Other factors used in irrigation scheduling are the application rate and uniformity of the irrigation system. No irrigation system is 100% uniform meaning that some areas of the field will receive more than the designed application rate and others less. Therefore, a uniformity coefficient is

applied to the irrigation requirement in order to ensure that all areas of the field receive at least the required amount of water. Better system uniformity will therefore obviously lead to conserved water.

If more water is applied to the soil than it has the ability to hold, then the excess water goes to deep percolation. In some cases deep percolation is a beneficial use of water. In highly saline soils, such as those in the Coachella Valley, some deep percolation is necessary to ensure that salinity levels do not exceed tolerance levels within the root zone of the plant. This will be discussed further in the Scientific Soil Salinity Management section of this report.

Providing conscientious growers with the information they need to make good irrigation management decisions is key to effective water conservation.

The following process will be used to implement scientific irrigation scheduling:

1. Enroll water users willing to implement scientific irrigation scheduling.
2. Identify historic water use, crop performance and management practices.
3. Select fields to be Demonstration fields and fields to be Associated fields.
4. Implement scientific irrigation scheduling on Demonstration fields.
5. Periodic soil salinity analysis.
6. Monitor soil moisture levels to optimize irrigation application.

Scientific irrigation scheduling will conserve water by raising water user awareness of crop water requirements and by providing technical assistance required to optimize irrigation applications.

Scientific Soil Salinity Management

Scientific soil salinity management is the practice of monitoring soil salinity levels through soil sampling and lab analysis and then using this analysis to properly maintain soil salinity at target levels through leaching and proper irrigation practices.

Major leaching is done every few years by either basin flooding or sprinkler application of water over an entire field to flush salts below the crop root zone. By sampling previous to leaching, the grower can determine the proper amount of water to apply in order to reach target soil salinity levels. This is accomplished by sampling the soil at a representative location in the field at 1, 2 and 3 foot depths and analyzing the electrical conductivity (EC) which is the standard indicator for salinity levels. Knowing the EC at multiple levels helps to determine the proper amount of leaching

water to apply and gives an indication as to whether the soil is properly drained. Once the soil is analyzed then the results are used to calculate the recommended amount of water for leaching. The calculations involved are derived from the modified Hoffmann equation. After leaching is done another sample is taken in order to verify that salinity levels have dropped to the desired levels.

Soil salinity can also be maintained through proper irrigation management. Sampling periodically throughout the irrigation season will allow the grower to adjust the irrigation leaching ratio, or the amount of water in each irrigation dedicated to carrying salts below the root zone. By following this practice the frequency of major leaching can be reduced thereby conserving water. As shown in Figure 1, periodic root zone salinity testing can be done in conjunction with soil moisture monitoring in order to verify that the proper amount of water is being applied for both irrigation and leaching.

The following process will be used to implement scientific salinity management:

1. Enroll water users willing to implement scientific salinity management.
2. Identify fields to be leached during the current year.
3. Evaluate historic leaching practices.
4. Determine field and crop characteristics impacting leaching requirement.
5. Determine leaching requirement.
6. Track leaching water use.
7. Analyze the effectiveness of the recommended leaching on selected fields

Scientific salinity leaching will conserve water by raising water user awareness of salinity levels and leaching requirements and by providing technical assistance required to optimize leaching applications.

Increasing Services for Active Participants

To those who actively participate and interact with us regularly, we will offer more frequent soil moisture readings using the latest technology in soil moisture sensors. These growers will also be provided with the access tubes required for the soil moisture sensor at no cost to the grower. Due to budget constraints, this increased level of soil moisture monitoring cannot be offered at large but it can be made available to those participants who will use it to the greatest benefit.

MEASUREMENT OF EXTRAORDINARY CONSERVATION

Entity Scale Water Balance

Water savings will be measured by quantifying applied water for each participating entity in order to determine extraordinary agricultural water conservation. An entity is the smallest unit of land for which the total amount of Colorado River water delivered may be determined from available data. Coachella Canal water deliveries will be calculated using CVWD monthly delivery records for individual metered turnouts.

Calculation of Extraordinary Conservation: Entity Scale

Extraordinary agricultural water conservation will be calculated by comparing 2009 Colorado River water use to 1999 baseline use, adjusted for differences in reference crop evapotranspiration (ETo). The difference in water use between 1999 (adjusted) and 2009 represents the amount of water saved through extraordinary agricultural water conservation practices.

Katherine Zander, Steve Jones,
Alan Jackson, and Balraj Tammali

Calculation of Extraordinary Conservation: Program and District Scales

The total extraordinary agricultural water conservation occurring for all participating entities will be calculated by summing individual savings. The expected decrease in Coachella Canal diversions at Drop One will be confirmed by examining total CVWD water orders for the period (January through June, 2009). A final report will be provided at the end of the period.

2009 PROJECTED EXTRAORDINARY AGRICULTURAL WATER CONSERVATION

Projected water savings for 2009 were calculated from baseline water use in 1999 and from calculated water requirements for crops grown in the Coachella Valley. An estimated 92% irrigation efficiency level was applied to the difference between baseline applied water and calculated water requirements.

VERIFICATION OF EXTRAORDINARY CONSERVATION

Participant Enrollment

Participating water users are enrolled in the extraordinary conservation program by completing an Authorization for Professional Services (APS) form. This form is signed by the participating water user, and by JMLord, Inc. A copy of the standard APS form is included as Attachment A to this report.

Third Party Field Visits

Third party field visits will be carried out as deemed appropriate by the committee.

Abbas Amir-Teymoori, Alan Jackson, and Katherine Zander

Front cover: Alan Jackson, and Steve Jones

ATTACHMENT A: AUTHORIZATION FOR PROFESSIONAL SERVICES FORM

AUTHORIZATION
FOR
PROFESSIONAL SERVICES

DATE: _____ PROJECT NO: A031162

PROJECT NAME: CVWD Extraordinary Agricultural Water Conservation

CLIENT: Coachella Valley Water District – Attn: Robert Robinson
ADDRESS: P.O. Box 1058
Coachella, California 92236

PARTICIPANT: _____
ADDRESS: _____
_____
_____

Participant hereby requests and authorizes JM Lord, Inc. (hereinafter referred to as Consultant) to perform the following services:

SCOPE OF WORK: Consultant will provide irrigation scheduling services on selected agricultural fields. Irrigation scheduling includes one or more of the following specific activities: soil moisture monitoring, crop evapotranspiration calculation, irrigation system performance evaluations, salinity monitoring, drainage performance evaluations, feasibility studies, documentation of water use and preparation of irrigation and leaching recommendations. Services provided will be commensurate with verified water savings and/or degree of participation. Reports and recommendations will be provided to the Participant for review prior to submittal to the Client. The Consultant will not share operational practices observed of the Participant.

COMPENSATION: Compensation will be paid in full by the Client on a time and expense basis. The Participant will not compensate the Consultant Directly.

TERM: This Authorization shall be valid for the term of the Consulting Agreement between Client and Consultant, unless earlier terminated as provided in Number 8 of the Provisions For JM Lord Inc. Authorization for Professional Services on the back hereof.

Services covered by this Authorization shall be performed in accordance with the provisions stated on the back of this form.

Participant:	_____	Consultant:	JM Lord, Inc.
By:	_____	By:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____
Address:	_____	Address:	267 N. Fulton St
	_____		Fresno, CA 93701
	_____		_____
Date:	_____	Date:	_____

PROVISIONS FOR JMLORD, INC., AUTHORIZATION FOR PROFESSIONAL SERVICES

1. AUTHORIZATION TO PROCEED

Signing this form shall be construed as authorization by PARTICIPANT and CLIENT for JMLORD INC (JML) to proceed with the work, unless otherwise provided for in the Authorization.

2. HOURLY RATES

JML hourly charge shall be the billing rate of JML employees for work performed on CLIENT'S Project as shown on current fee schedule.

3. PROJECT PRICING

JML pricing on a project basis shall be considered as the maximum charge for a specific project. If the project scope changes and, therefore, project pricing, written notice and consent will be given by both parties.

4. DIRECT EXPENSES

JML's direct expenses shall be those costs incurred on or directly for the CLIENT's Project, including but not limited to necessary transportation costs including mileage at JML's current rate (when JML automobiles are used), meals and lodging, laboratory tests and analysis, computer services, printing and binding charges. Reimbursement for these expenses shall be on the basis of actual charges when furnished by commercial sources and on the basis of usual commercial charges when furnished by JML.

5. OUTSTANDING SERVICES

When technical or professional services are furnished by an outside source, when approved by CLIENT, no additional charge will be added to the cost of these services for JML's administrative costs.

6. COST ESTIMATES

Any cost estimates provided by JML will be on a basis of experience and judgment, but since it has no control over market conditions or bidding procedures, JML cannot warrant that bids or ultimate construction costs will not vary from these cost estimates.

7. PROFESSIONAL STANDARDS

JML shall be responsible, to the level of competency presently maintained by other practicing professional engineers and scientists in the same type of work in PARTICIPANT's and CLIENT'S community, for the professional and technical soundness, accuracy and adequacy of all designs, drawings, specifications and other work and materials furnished under this Authorization. JML makes no other warranty, express or implied.

8. TERMINATION

The PARTICIPANT, CLIENT or JML may terminate this Authorization by giving 30 days written notice to the other party. In such event, CLIENT shall pay JML in full for all work previously authorized and performed prior to effective date of termination. If no notice of termination is given, relationships and obligations created by this Authorization shall be terminated upon completion of all applicable requirements of this Authorization.

9. ARBITRATION

All claims, disputes and other matters in question arising our of, or relating to, this Authorization or the breach thereof may be decided by arbitration in accordance with the rules of the American Arbitration Association then obtaining. The PARTICIPANT, CLIENT, or JML may initiate a request for such arbitration, but consent of the other parties to such procedure shall be mandatory. No arbitration arising out of, or relating to this Authorization may include, by consolidation, joinder, or in any other manner, any additional party not a party to this Authorization.

10. LEGAL EXPENSES

If any action is brought to enforce or interpret the provisions of this Agreement, the prevailing party shall be entitled to recover reimbursement for reasonable attorneys' fees, court costs, cost of investigation and other related expenses incurred in connection therewith.

11. PAYMENT TO JML

Monthly invoices will be issued by JML for all work performed under the terms of this agreement or on timing specified by this contract. Invoices are due and payable within 30 days of receipt.

12. LIMITATION OF LIABILITY

Consultant and Client will not be liable to Participant, or to anyone who may claim any right due to a relationship with Participant, for any acts or omissions in the performance of services under the terms of this agreement or on the part on employees or agents of Consultant unless those acts or omissions are due to willful misconduct. Participant will indemnify and hold Consultant and Client free and harmless from any obligations, costs, claims, judgments, attorney's fees and attachments arising from, growing out of, or in any way connected to the services rendered to Participant under the terms of this agreement, unless Consultant or Client is adjudged by a court of competent jurisdictions to be guilty of willful misconduct.

13. ENGINEER'S DRAWINGS AND PLANS

All documents developed in performance of this work by JML or considered instruments of professional service and are intended only for the use of this project. JML will be held harmless and indemnified against losses, damages, and costs arising from use of reuse of these documents not authorized by JML in writing.

14. COPYRIGHTS

All original papers, documents, drawings and other work product of Consultant produced by Consultant pursuant to this Agreement, except documents which are required to be filed with public agencies, shall be deemed solely the property of Client.