CHOWCHILLA
WATER DISTRICT

SBx7-7 Supplement Report
2015 Update

Additional Documentation to Accompany
Chowchilla Water District's Water Management Plan
Prepared for the U.S. Bureau of Reclamation

Submitted to:
California Department of Water Resources
Division of Statewide Integrated Water Management
Water Use and Efficiency Branch

December 2015

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1 – INTRODUCTION

Background

The Chowchilla Water District (District) is a U.S. Bureau of Reclamation (USBR) water supply contractor that receives water from the Friant Division of the Central Valley Project (CVP). The District has a contract for up to 55,000 acre-feet/year (AF/yr) of Class 1 Friant water, up to 160,000 AF/yr of Class 2 (excess) Friant water, and up to 24,000 AF/yr of Buchanan Unit CVP water. The District also has some rights to local water supplies when available. The surface water supply available to the District is extremely variable, recently ranging from 233,060 acre-feet (AF) in 2011 to only 437 AF in 2014. The District does not pump any groundwater. Water users within the District must have a private groundwater well to supplement surface water available from the District to meet crop water needs.

The District is a conjunctive use district, and water users in the District conjunctively use both surface water from the District and private groundwater to supplement the surface water supply. The District delivery system is used to deliver water to the growers as well as recharge the groundwater. During wet years the District also delivers water to sloughs and other dedicated recharge areas to promote groundwater recharge. During dry years the water that was previously stored as groundwater is available to be pumped by growers for irrigation. The District's conjunctive use program is described in detail in the District's Groundwater Management Plan.

The USBR requires all contractors to prepare a water management plan in accordance with criteria established by USBR. The District most recently prepared a 5-year water management plan in 2009, with final acceptance by USBR in 2011. The District prepares annual updates each year in compliance with USBR criteria. The District is currently preparing a new 5-year updated water management plan that will be submitted to USBR for approval in 2016. A copy of the District's current 2011 USBR WMP is attached to this report (**Attachment 1**).

Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, mandated water conservation and measurement and reporting activities for certain agricultural water suppliers, including the preparation of water management plans in 2012, 2015 and every five years thereafter. The provisions of SBx7-7 were incorporated in the California Water Code, and Water Code §10828 allows agricultural water suppliers subject to the USBR CVPIA/RRA water management/conservation plan process to submit their USBR plan along with additional documentation to the California Department of Water Resources (DWR) to comply with the requirements of SBx7-7. The District prepared an SBx7-7 Supplement Report in December 2012 and submitted it to DWR, along with the District's current USBR water management plan, to satisfy the requirement to prepare

an agricultural water management plan in 2012. This report serves to document the District's compliance in meeting the 2015 requirements for additional documentation.

California Water Code §10828 states:

a) *Agricultural water suppliers that are required to submit water conservation plans to the United States Bureau of Reclamation pursuant to either the Central Valley Project Improvement Act (Public Law 102-575) or the Reclamation Act of 1982, or both, may submit those water conservation plans to satisfy the requirements of §10826* (requirement to prepare an agricultural water management plan), *if both of the following apply:*
    1) *The agricultural water supplier has adopted and submitted the water conservation plan to the United States Bureau of Reclamation within the previous four years.*
    2) *The United States Bureau of Reclamation has accepted the water conservation plan as adequate.*

b) *This part does not require agricultural water suppliers that are required to submit water conservation plans to the United States Bureau of Reclamation pursuant to either the Central Valley Project Improvement Act (Public Law 102-575) or the Reclamation Act of 1982, or both, to prepare and adopt water conservation plans according to a schedule that is different from that required by the United States Bureau of Reclamation.*

As noted in Water Code §10828(b), the requirements of SBx7-7 do not require an agricultural water supplier to prepare and adopt a water management plan according to a schedule that is different from their normal USBR schedule. Since the District's current water management plan was accepted by the USBR in 2011, the normal 5-year update for the District's USBR plan is due in 2016. As such, the District is preparing this SBx7-7 Supplement Report to serve as the additional documentation that the District must include with the USBR water management plan and submit to DWR to document compliance with specified requirements of the Agricultural Water Measurement Regulations of SBx7-7. This SBx7-7 Supplement Report is being prepared to comply with the requirement to have an update by December 2015 and will be incorporated into the District's USBR plan that will be adopted in 2016.

SBx7-7 Requirements

The SBx7-7 agricultural water measurement regulation is a part of the California Water Code §10106.48(b)(1), Article 2, §597. SBx7-7 requires agricultural water suppliers serving more than 25,000 acres to prepare agricultural water management plans and implement efficient water management practices (EWMP), including water delivery measurement and volumetric pricing for water that the water supplier delivers to its

customers. SBx7-7 describes sixteen EWMPs aimed at promoting efficient water management. Of these, two are considered "critical" or mandatory, and the remaining fourteen are considered "conditional". The EWMPs that are to be implemented to comply with SBx7-7 include:

- Measure the volume of water delivered to customers with sufficient accuracy to comply with California Water Code §531.1 for aggregated farm-gate delivery reporting, and
- Adopt a pricing structure for water customers based at least in part on the quantity of water delivered (collecting some revenue on a per AF basis), and
- Implement 14 additional efficient water management practices if technically feasible and locally cost effective.

The final water measurement regulation prepared by DWR (approved July 11, 2012) requires measurement at the location where the agricultural water supplier transfers control of delivered water to a customer or group of customers. In most cases, the transfer of control occurs at the farm-gate, but the regulation does allow for measurement upstream in a lateral under certain conditions. Regardless of where the measurement is made, the following numeric accuracy standards apply to the volume of delivered water:

- Existing measurement devices shall be certified to be accurate within 12%± by volume.
- New or replacement measurement devices shall be certified to be accurate within 5%± by volume in the laboratory if using a laboratory certified device (such as propeller meters) or 10%± by volume in the field if using a device that is non-laboratory certified (such as meter gates).

Note that the required accuracy is by volume. If the measurement device does not totalize the volume delivered, then the water supplier must incorporate flow rate, area and a time factor to calculate the volume delivered and certify the accuracy by volume.

The regulation requires a water supplier to measure water delivery volumes at the individual delivery point or farm-gate, unless measurement is not possible at the farm-gate and must be moved upstream on a lateral because, (a) the agricultural water supplier does not have legal access to the delivery points of individual customers (farm-gates) downstream of a point of measurement (such as the lateral head works), or (b) the measurement accuracy cannot be met, as approved by an engineer, due to small differentials in water level or large fluctuations in flow rate or velocity that occur during the delivery season at a single-farm gate. If measurement does not occur at the individual farm-gate and instead gets measured at the lateral headworks, the water supplier shall explain the reasoning and document the criteria used to apportion the volume of water delivered to individual downstream customers.

For existing measurement devices, the regulation provides two options for initial certification of existing accuracy (existing prior to adoption of regulation), and this certification must be submitted to DWR:

a) Field-testing that is completed on a random and statistically representative sample of the existing measurement device by individuals trained in the use of field-testing equipment, and documented in a report approved by an engineer, with field testing performed for a sample of devices following certain criteria. The sample size recommended by DWR is at least 10% of existing devices, with a minimum of 5, and not to exceed 100 individual devices for any particular device type.

b) Documentation by field-inspections and analysis completed for every measurement location to demonstrate that the design and installation standards used for the device installation meets the 12%± accuracy standard, and that operation and maintenance protocols meet "best professional practices". Field-inspections and analysis protocols shall be performed by trained individuals and documented in a report approved by an engineer.

If an existing water measurement device is determined to be out of compliance, the water supplier shall provide a schedule, budget and finance plan for taking corrective action to repair or replace the measurement device.

SBx7-7 required a water supplier to implement all required EWMPs, including initial certification of farm-gate volumetric delivery accuracy, by July 31, 2012, an unrealistic deadline considering the water measurement regulation was not finalized until July 11, 2012. The District submitted a Supplement Report in December 2012 that documented a strategy to obtain initial certification and confirm measurement accuracy by presenting a schedule, financing plan, and budget to comply with the requirements of SBx7-7 within a three year period. This 2015 SBx7-7 Supplement Report provides an update on the District's progress on obtaining initial certification and confirmation of measurement accuracy.

Water Measurement Methods

As a CVP contractor, the District already measures water at the individual grower turnout and collects a portion of its revenue based on the quantity of water delivered to its growers. The District currently has 746 active grower turnouts out of a total of 972 turnouts, all of which are currently either metered or measured. The District uses four different types of measurement devices at the farm-gate turnout level - propeller meters, magnetic inductive meters, meter gates, and weirs. District efforts in improving water measurement are discussed later in this document.

Below is a brief explanation of each type of measurement device used by the District:

Propeller Meter

This type of meter contains a propeller that protrudes into a pipe connected by a cable or shaft to a meter readout. As the water passes by the propeller, the propeller rotates. The number of revolutions is then calibrated for the pipe size to determine a flow rate, and most propeller meters indicate the flow rate as well as accumulate the volume of water delivered. Propeller meters can be saddle-type meters that attach directly to a pipeline, or an open-flow type meter that is typically installed in a standpipe at the end of a pipe section. Propeller meters are very common and extensively used. Propeller meters require a certain obstruction-free distance upstream and downstream of the meter to ensure accuracy, and a full pipe at the location of the meter is required. Trash in the water is one of the biggest concerns with propeller meters since any trash that accumulates on the propeller can cause the meter to read inaccurately and can cause significant head loss.

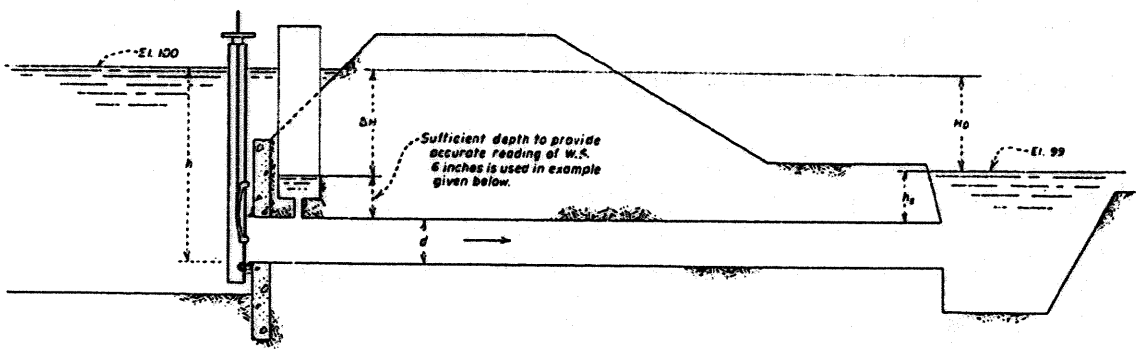
Magnetic Inductive Flowmeter

The District recently began installing Seametrics AG2000 Irrigation Magmeters in locations where there was not enough room to install a propeller meter having sufficient upstream and downstream pipe diameters. The AG2000 is a spool-type electromagnet flowmeter for use in irrigation applications. With no moving parts, these meters provide unobstructed flow and are resistant to wear from debris found in surface water. Little maintenance is required because there are no bearings to wear out or propellors to stop turning. Minimal straight pipe requirements allow AG2000 meters to be used in piping configurations where there is little space between the meter and an elbow.

Meter Gate

The meter gate (also known as rated gate or calibrated gate) is a measuring device that operates as a submerged variable area orifice. This device measures the flow rate, and a time factor must be included to convert to volume of water delivered. Some of the initial testing of this type of device was conducted in the 1920s and was later updated by USBR in the early 1950s and more recently by the Irrigation Training and Research Center (ITRC) at Cal Poly San Luis Obispo. This type of measurement device is based on a stilling well and tap hole placed a certain distance (usually 12") behind a turnout gate that measures the head at that location in the downstream pipe. A measurement is made of the head differential between the water level on the upstream side of the gate and the water level in the stilling well that reflects the head on the pipeline downstream of the gate. This head differential along with a known gate opening is then used with a rated table that relates to an instantaneous flow rate. Because the gate has a larger diameter than

the inside diameter of the pipe, the ratio of the two openings changes as the gate is opened and makes calculating the flow rate difficult with an equation since the coefficient of discharge changes as the gate is opened. As such, a table for the specific gate size is used that was developed through extensive testing to determine the instantaneous flow rate. This type of measurement device requires full pipe flow downstream of the turnout and the flow rate can vary if the upstream and downstream water levels, or at least the head differential, are not held constant. This type of device can provide accurate flow rate measurements as long as the device is installed properly and can provide accurate volumetric measurements with proper water level measurements and time factor conversion. Recent testing by the ITRC has confirmed that meter gates can be accurate measurement devices when properly installed and operated with a gate opening between 25% and 75% open. To properly measure the gate opening, the "dead stem" on each gate must be determined to obtain the "zero" point on the gate when water starts to trickle past the gate. A "*Practical Guide for Metergates*" prepared by the ITRC is attached to this report (**Attachment 2**).



Schematic of Typical Meter Gate

Weir

In a few locations the District has a weir that measures the amount of water delivered to the grower. A measurement is made of the head on the upstream side of the weir. This head measurement is used to determine the flow rate over the weir, and this flow rate is multiplied by the time period of irrigation to determine the quantity of water delivered for each irrigation.

Current Status of other EWMP Compliance

The District has already implemented the "conditional" EWMPs identified in Water Code §10608.48 that are cost effective and technically feasible. EWMPs already implemented

by the District or EWMPs that do not apply, as discussed in the District's 2011 USBR WMP, include:

- No. 1: Alternative land use *(USBR WMP Sec. 3B1)*
- No. 2: Recycled water use *(USBR WMP Sec. 3B2)*
- No. 3: On-farm irrigation system improvements *(USBR WMP Sec. 3B3)*
- No. 4: Incentive pricing structure *(USBR WMP Sec. 3B4)*
- No. 5: Distribution System improvements *(USBR WMP Sec. 3B5)*
- No. 6: Order/delivery flexibility *(USBR WMP Sec. 3B6)*
- No. 7: Supplier spill and tailwater systems *(USBR WMP Sec. 3B7)*
- No. 8: Conjunctive use *(USBR WMP Sec. 3B9)*
- No. 9: Automated canal controls *(USBR WMP Sec. 3B10)*
- No. 10: Facilitate customer pump test/evaluations *(USBR WMP Sec. 3B11)*
- No. 11: Designate a Water Conservation Coordinator *(USBR WMP Sec. 3A2)*
- No. 12: Water management services to customers *(USBR WMP Sec. 3A3)*
- No. 14: Supplier pump efficiency *(USBR WMP Sec. 3A6)*

The only "conditional" EWMP that was not directly addressed in the 2011 USBR WMP was No. 13 - *Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage*. The District is a USBR CVP contractor and as such, is subject to the water delivery rules and regulations imposed by the USBR. The District has very little ability to impact USBR policies and regulations. The District does stay engaged in issues that affect the District's water supply, such as the San Joaquin River Restoration Settlement, and fights to protect its water supply. See **Attachment 3** for a schedule outlining EWMP compliance with current budget amounts.

2 – COMPLIANCE WITH 2012 REQUIREMENTS

2012 Supplement Report

In response to the SBx7-7 requirement that all agricultural water suppliers delivering water to more than 25,000 acres must submit an agricultural water management plan, the District submitted its accepted USBR water management plan along with a 2012 SBx7-7 Supplement Report that provided additional documentation as required by SBx7-7.

As part of the 2012 SBx7-7 Supplement Report, the District proposed a schedule to field inspect the measurement device at every active turnout for initial certification and repair or replace non-compliant measurement devices within the 3-year period 2013-2015 with the underlying assumption that sufficient water would be available for normal District operations each year. Because of the extended drought, the District only delivered water for a 2-month period in 2013 and delivered virtually no water in 2014 and 2015, making it impossible to complete all tasks outlined within the timeline proposed in the 2012 SBx7-7 Supplement Report.

Although testing and certification of the measurement devices was unable to be completed because of the reduced (or non-existent) water deliveries during the past three years, the District was able to accomplish the following tasks that were identified in the 2012 SBx7-7 Supplement Report during the 2013- 2015 period:

- District staff field inspected every turnout in the District in 2013, taking photographs and noting such things as the "dead stem" value and distance to downstream measurement location on meter gates, upstream and downstream obstruction free pipe lengths on propeller meters, etc.
- 24 rated pumps were equipped with either propeller meters or magnetic (mag) meters.
- Existing meters were moved as required to achieve proper upstream and downstream clearances for improved accuracy at 63 locations. In some cases a remote meter head had to be installed if the relocated meter was in a position that was difficult to read.
- Straightening vanes were installed in 95 locations to improve accuracy where the proper upstream clearance was not available.
- The pipe discharge was reconfigured at 88 locations in order to achieve proper upstream and downstream clearances for improved accuracy.
- Installation of 187 meters, consisting of both propeller meters and mag meters.

- In 2014 and 2015, the District repaired or modified a total of 63 meter gates and 301 water meters (364 total turnout measurement devices) at a total cost for labor, material and equipment of over $390,000. These repairs or modifications generally included the following:
  - Gate repairs/modifications – gate maintenance or replacement, installation of measurement well, and cleaning entrance conditions.
  - Meter repairs/modifications – move existing meter to obtain proper upstream clearances, installation of straightening vanes, pump discharge reconfiguration, and new turnout with propeller meter.

When water deliveries return to normal, the District will complete the work required to allow certification of the measurement devices as outlined in Section 3 (Supporting Documentation) of this report.

After the corrective actions and improvements made in 2013-2015, the current breakdown of measurement devices within the District is as follows:

Measurement Type	Number	Percent
Propeller Meter	369	49.5%
Canal Meter Gate	293	39.3%
Mag Meter	67	9.0%
Other Flow Method (weir, combined)	17	2.3%
Total Turnouts in Service	**746**	**100%**
Out of Service (>10 years)	226	
Total Turnouts	**972**	

3 – SUPPORTING DOCUMENTATION

Agricultural Water Measurement Regulation Documentation (as applicable)

A. Legal Certification and Apportionment Required for Water Measurement - Lack of Legal Access to Farm-gate

Not applicable - the District has legal access to measure water at the farm-gate. There are a few instances where a private pipeline may serve more than one grower, but the District does not allow more than one grower to irrigate at a time so measurement can be made at the head of the lateral. The District obtains permission from the landowner when work on a pump discharge measurement device must be performed.

B. Engineer Certification and Apportionment Required for Water Measurement - Technically Infeasible

Not applicable – the District measures water at each farm-gate. There are no turnout locations that are technically infeasible to measure, although some locations have minimal head differential that make measurement challenging. There are also some locations that have very large head differentials that require additional infrastructure to obtain accurate measurements. The District has a policy requiring a landowner to install a propeller meter if measurement with a meter gate is difficult. The District will cost share 25% of the cost of the propeller meter, and will install and maintain the meter at no cost to the grower.

C. Description of Water Measurement Best Professional Practices

Description of District Operations

The District has a scheduled demand irrigation delivery system. Water users order water with the District before 1:00 pm for delivery on the following day for the period of time requested. The water user notifies the District of their desired shutoff time before 1:00 pm and shuts off at the requested time on the next day. District staff oversee all operations, but water users are allowed to open and close their own gates at the scheduled time. The water user has been trained by District staff of how far to open the gate for the desired flow rate. Flexibility in start time and shutoff times are explained in detail in Rule 6 of the District's Rules and Regulations. Violations of the operating rules and regulations may be cause to suspend water deliveries. A senior ditchtender is assigned each day that coordinates water deliveries.

The District has invested a tremendous amount of money in improving the distribution system to allow the District to operate on a scheduled demand system and maintain water levels. The District has installed a number of long-crested weirs, broad-crested weirs and ITRC Flap Gates to stabilize water levels in the canal system and measure flows in critical sections of the system. The District has invested in a SCADA system that allows the District to monitor key locations in the system on a real-time basis. The District has also constructed numerous regulating reservoirs and continues to investigate locations that would improve the efficiency of the District and provide more flexible and consistent deliveries.

Any new turnout that is installed consists of a standard meter gate design with a propeller meter downstream. Propeller meters are also installed on any non-active turnouts that are reactivated. The District has installed backup stands on meter gates where required to keep the vent pipe full. Replacement gates on existing turnouts are being installed with stainless steel stems to reduce corrosion and wear on the gate and associated "slop" in the measurement of the gate opening. In locations where the canal is significantly above the field level and the head conditions would cause the gate to barely be cracked to deliver the desired amount of water, a secondary stand (known as a "head breaking stand") has been added with an adjustable weir to reduce the head differential so the gate can be opened a minimum of several inches to improve the measurement accuracy.

Water use information is continuously posted on the District website so water users know how much water they have used. Surface water within the District is relatively expensive, so water users are very interested in tracking their water use. There is usually more demand for surface water than there is supply, so proper water management is critical. The District system can only supply approximately 65% of peak demand.

Since water is fairly expensive and often limited within the District, water users generally know how much water they are delivering to their land and occasionally may question the District about a measurement or the method used to determine the volume delivered. If a water user questions the District's measurement or volumetric charges and desires to install a propeller meter, the District will cost share 25% of the cost of the water meter, and will install and maintain the meter at no cost to the grower.

Collection of Water Measurement Data

The District has a redundant system for collection of water measurement data. IPOD's are used in the field as hand held data recorders, but information is also recorded by hand on paper. The data from the hand held data recorders is downloaded to the District computer system, and the paper copy serves as backup

in case there are any questions about the data that was downloaded into the system.

The District uses a computer program called STORM to manage the water measurement data, calculate the volume delivered, and prepare monthly invoices. STORM is a computer program that was specifically developed for use by agricultural districts, and is customizable for each district. The information collected in the field with the hand held data recorders is downloaded into STORM on a daily basis. The "dead stem" amount for each turnout gate (needed to obtain the "zero" point on the gate when water starts to trickle past the gate) is stored within the STORM program, allowing the ditchtender to just measure the total stem opening and STORM will automatically deduct the "dead stem" amount to get the gate opening.

In some locations where weirs are utilized, a water level recorder is used to record the water levels across the weir. In the remaining locations the water level information is recorded by hand.

Frequency of Measurements

The District measures the water levels at operating meter gates and measures the gate opening at least once a day, sometimes more often. A measurement is made each time a scheduled flow rate change is made. At locations where meter gates and weirs are used, District staff will measure the head differential and gate opening generally within 1 hour of the scheduled change in flow rate. At locations where propeller meters are used, the cumulative meter reading is recorded once a day, and the flow rate is verified when the meter reading is taken.

Method for Determining Irrigated Acres

The District has determined the potential irrigable acreage for each parcel by subtracting non-irrigable acres (home sites, storage yards, roads, etc.) from the parcel gross acreage. The District collects crop information from each landowner every year, and the landowner will indicate at that time if only a portion of the parcel will be irrigated that year.

Quality Control and Quality Assurance Procedures

As previously mentioned, the District has a redundant system for collecting water measurement data using both hand held data recorders and hand written paper records, with the paper copy being used as backup if there are any questions. This procedure is very helpful in quality control and quality assurance (QC/QA).

A range of expected flow rate has been established by the District for each individual turnout. The STORM program checks for exceptions if the recorded flow rate is

outside the expected range for that turnout and prepares an exception report that is reviewed by District staff for corrective action. STORM can also check for exceptions regarding propeller meter readings as noted below.

On meter gates a mark is painted on the gate stem to indicate the closed position, then a certain distance referred to as the "dead stem" (typically 1-inch) will be subtracted to obtain the "zero" point on the gate when water starts to trickle past the gate. This "dead stem" difference is to account for the gate movement required within the mechanism to get to the "zero" point and can vary slightly as the gate wears and more "slop" is encountered. The District has verified the "dead stem" value on each meter gate and will periodically have a senior ditchtender check the "slop" in a gate and make adjustments to the amount subtracted for the dead stem for that gate as necessary so an accurate gate opening is obtained, further improving the District's QC/QA.

Water measurement data is posted on the District website within 3 days of measurement, allowing the District water users to track their water use on a nearly real-time basis. Billing information is available by turnout on the website, as well as information from the previous year so growers can compare their water deliveries. This is one of the ultimate means of QC/QA, as the growers generally know how much water they are delivering and will raise any questions they have because the water is too expensive to waste.

D. Documentation of Water Measurement Conversion to Volume

The method of converting water measurement to volume utilized by the District depends on the type of water measurement device:

- Propeller Meters - The type of propeller meters used by the District automatically accumulate the volume of water delivered at that location. The District records the flow rate and the cumulative volume meter reading each time a propeller meter is read, generally on a daily basis. If a meter plugs and the accumulation of volume delivered stops in between readings, the recorded flow rate is utilized to estimate the volume delivered over the time frame between readings. The STORM program automatically calculates the expected volume that would have been delivered based on the flow rate and time duration and checks that against the difference in meter readings. Any significant variance is flagged for the District to review and override the meter reading difference if needed.
- Meter Gates – A measurement of the head differential across the device is taken generally within 1 hour of scheduled flow rate changes. The head differential and gate opening is entered into STORM, along with the scheduled on-off times. STORM uses the gate opening along with the rating

table for that size gate to calculate the flow rate. The flow rate reading from one day and the reading the following day is averaged to determine the average flow rate that is applied to the time interval between the scheduled start (or stop) and the measurement time or the time difference between readings (if continuous irrigation) to determine the volume delivered. District staff confirm in the field that on-off times are followed as scheduled.

Recent meter gate testing conducted by ITRC (*Improving Flow Measurement Accuracy at Farm Delivery Gates in California*) concluded that an error in the delivery duration estimate of 4% (1 hour in 24 hours) coupled with conservative expected errors of upstream and downstream water level measurements would still allow meter gates to measure the volume of water within the required ±12% accuracy as long as the instantaneous flow measurement uncertainty was within ±10.7%.

- Rated Pumps – the volume delivered by the rated pumps historically was determined by multiplying the standard flow rate for that pump by the time of scheduled delivery, with District staff confirming in the field that on-off times are followed as scheduled. All rated pumps have now been equipped with meters, either propeller meters or mag meters that accumulate the total volume of water delivered.
- Weirs – The flow rate measured by a weir is calculated by hand (rather than within STORM) using the appropriate weir equation and the water level information over a given time period. The flow rate reading from one day and the reading the following day is averaged to determine the average flow rate that is applied to the time difference between the scheduled start (or stop) and the measurement time or the time difference between readings (if continuous irrigation). District staff confirm in the field that on-off times are followed as scheduled.

E. Device Corrective Action Plan Required for Water Measurement

The District has already undertaken some significant corrective actions as noted in Section 2 of this report. At this time it is unknown what, if any, additional corrective action the District will need to take to certify each measurement device and comply with the accuracy requirements of SBx7-7. Additional testing and certification will not be possible until the District receives a near normal water supply for several years. The District has developed the following plan to complete the certification of measurement devices and to determine what corrective actions may be required:

- During the irrigation season each year for the next three years (assuming normal water deliveries), a selected number of locations that have a propeller meter installed downstream of a meter gate will be tracked during an irrigation set to develop a correlation for the meter gate. Measurements for the meter

gate will be collected in accordance with normal procedures, and the calculated volume delivered during a set period of time (day, week, etc.) will be compared to the volume of water recorded by the propeller meter. Locations will be selected in different areas of the District to compare different systems within the District. There are over 300 locations within the District where a propeller meter or mag meter is already installed downstream of a meter gate.

- Meter gates that are operating under similar conditions within the District will be identified, with the assumption that a meter gate correlated for accuracy with a propeller or mag meter in the manner identified above within a given reach of the system could be extrapolated to apply to other meter gates within the same reach of the system if conditions are similar.

- District procedures utilized for meter gate measurements will be refined and the data tables being utilized will be verified based on recent testing by ITRC. Additional testing by ITRC may be requested to address installations that are encountered within the District that do not match the typical vent measurement distance requirement.

Following the field review and analysis each year, a device corrective action plan will be developed for the following year that documents the repair or replacement of devices that require corrective action to meet the accuracy requirements of SBx7-7, and a budget will be developed for implementation by the District during the following winter maintenance season.

It is expected that the majority of the measurement devices currently in use will meet the 12%± accuracy requirement, although it is likely that some additional devices will be identified that will require corrective action to comply with the accuracy requirements.

The District services and maintains the propeller meters. As more and more propeller meters are installed within the District, the District will be evaluating the feasibility of constructing a test center to self-certify the accuracy of the propeller meters after repairs have been made. A test center, if constructed, would likely utilize a highly accurate meter such as a magnetic meter as the control.

4 – COMPLIANCE WITH EXECUTIVE ORDER B-29-15

Drought Management Plan

As a conjunctive use district with a highly variable surface water supply, the District and its water users are constantly juggling supply and demand. In most years, there is usually more demand for surface water than there is supply, so proper water management is critical. Water users in the District must have a private deep well in order to supplement surface water available from the District.

The water supply available to the District is extremely variable. In wet years as much as 131,000 AF (1.75 AF/acre) is available for delivery to the 75,000 acres of irrigated land in the District. In average years the water supply is about 95,000 AF (1.27 AF/acre). In critically dry years the water supply is less than 8,000 AF (0.11 AF/acre) and can be virtually non-existent as evidenced in 2014 and 2015. Even in above normal years the District conveyance system can only supply approximately 65% of peak demand, so water users must supplement the District supply with groundwater during peak periods.

The District's Drought Management Plan for allocating reduced water supplies consists of the following:

> Rule 4 of the District's Rules and Regulations provides for allocation of water during periods of time when water will not be available throughout the year. Water supply forecasts are reviewed to determine the date when District water deliveries begin. Determination of a beginning date takes into account estimated crop water demands and maximization of delivery efficiencies. If forecasts indicate water will be available throughout the year, deliveries are scheduled to begin on or about the first of March and continue until late fall. When forecasts indicate water will not be available throughout the year, the period of mid-June thru mid-August is given priority when scheduling water for delivery. When in the opinion of the District, water demands exceed the design or actual capacity of the distribution system or the supply of water, the district reserves the right to rotate the use of water by basic time and quantity method in order to deliver approximately equal amounts of water in acre-feet per acre to each water user requesting water deliveries.
>
> As a CVP contractor in the Friant Division, the District's annual water supply allocation is determined by the USBR, and the District has virtually no ability to change the available water supply for a given year other than to carryover some water from the previous year. The USBR typically makes an initial water supply allocation in late January, and will adjust the allocation as the water year progresses if warranted by the snow pack and projected water supply. The final

water supply allocation available to the District is often not known until July. Each time the water supply allocation is changed by the USBR, the District will notify all water users so they can plan accordingly.

The District will facilitate and encourages landowner to landowner transfers of water into the District if a water user requests to bring water into the District. The District coordinates with other local water agencies and the USBR as needed to facilitate requested transfers.

In below normal and drought years, the District will minimize expenditures as much as possible to reduce operating costs. The District collects revenue through both acreage based assessments and volumetric water charges based on the quantity of water delivered, measured in acre-feet. The volumetric water rate is established each year to cover projected expenditures that exceed the revenue collected through the acreage based assessments. The water rate is based on a melded rate of the various water supplies available to the District.

Quantification of Water Supply and Demands

In accordance with Executive Order B-29-15, quantification of water supplies and demand is to be reported for 2013, 2014 and 2015 to the extent data is available. Information on recent water supply and estimated demand for the District is as follows:

Water Budget Summary (AF)			
Water Accounting	2013	2014	2015
1 District Water Supplies	71,748	437	527
2 Water Uses / Demand	222,500	228,000	225,000

Note: 2015 demand estimated as final crop data is not yet available.
The shortage between supply and demand is met by private groundwater pumping.

5 – SCHEDULE, FINANCE PLAN, BUDGET

Schedule

The District has developed the following schedule for completing certification of measurement devices and developing a device corrective action plan to comply with SBx7-7. Work will be re-initiated in 2016 assuming the water supply is near normal, and will be substantially complete within three years assuming normal District operations.

Proposed Corrective Action Plan Timeline

Action	Proposed Date
Verify procedures and data tables for meter gate measurement	Jan-Mar 2016
Compare meter gates versus propeller meters (1/3±)	2016 irrig. season
Identify turnouts with similar operations, take corrective action	2016-17 off season
Compare meter gates versus propeller meters (1/3±)	2017 irrig. season
Identify turnouts with similar operations, take corrective action	2017-18 off season
Compare meter gates versus propeller meters (1/3±)	2018 irrig. season
Identify turnouts with similar operations, take corrective action	2018-19 off season
Prepare measurement device certification report	March 2019
Full compliance with SBx7-7	2019 irrig. season

As previously discussed, the District is already in compliance with the "Conditional" EWMPs, many of which are on-going.

Finance Plan

The District's water measurement program on-going operations and maintenance (O&M) costs are funded through the District's existing water assessments and volumetric toll rates. Compliance with the "conditional" EWMPs has already been incorporated into the District's operating budget as discussed in the 2011 WMP and current budgets are shown in Attachment 3. The District's water measurement improvement program and optimizing conjunctive use make up the bulk of the District's EWMP budget. The District has been implementing these EWMPs on an on-going basis and will continue to do so.

If it is determined that corrective action and installation of a propeller meter or other measurement device is required at a location, the District would cost share with the

water user 25% of the cost of the water meter, and will install and maintain the meter at no cost to the grower. The grower would be required to pay for the remaining 75% of the cost of the meter. If significant improvements in the measurement devices are determined to be required as a result of the field inspection and analysis, it is possible that the District would need to consider increasing assessments, which would require a Prop. 218 election and approval by a majority of the affected landowners.

Budget

The District budgeted $150,000 annually for 2014 and 2015 for water measurement improvements. The District has preliminarily budgeted $100,000 for water measurement in 2016 and $50,000 in both 2017 and 2018. At this time it is not known exactly how much additional capital is required to comply with SBx7-7. Each year when the field inspection and analysis is completed on that year's group of turnouts, a device corrective action plan will be developed that identifies what improvements are required at each turnout and what the estimated cost will be to both the District and the water user. Budgets will be adjusted each year as part of the device corrective action plan.

CHOWCHILLA WATER DISTRICT

SBx7-7 SUPPLEMENT REPORT

2015 UPDATE

ATTACHMENT 1

2011 USBR WATER MANAGEMENT PLAN

Chowchilla Water District
Water Management Plan
Five Year Update

2008 Criteria

Date of first draft – (12-15-2009)
Date of final – (3-31-2011)

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Attachment A	District Facilities Map
Attachment B	District Soils Map
Attachment C	District Rules and Regulations
Attachment D	District Sample Bills
Attachment E	District Water Shortage Plan
Attachment F	District Map of Groundwater Facilities
Attachment G	Groundwater Management Plan
Attachment H	Groundwater Banking Plan
Attachment I	Annual Potable Water Quality Report – Urban
Attachment J	Notices of District Education Programs and Services Available to Customers
Attachment K	District Agricultural Water Order form
Attachment L	Drainage Problem Area Report

Section 1: Description of the District

District Name: Chowchilla Water District

Contact Name: Douglas Welch

Title: General Manager

Telephone: 559-665-3747

E-mail: dwelch@cwdwater.com

Web Address cwdwater.com

A. History

1. Date district formed: February 7, 1949 *Date of first Reclamation contract:* 1939

Original size (acres): 63,254 *Current year (last complete calendar year):* 2009

2. Current size, population, and irrigated acres

	(2009)
Size (acres)	88,115
Population served	NA
Irrigated acres	65,000

3. Water supplies received in current year

Water Source	*AF*
Federal urban water (Tbl 1)	
Federal agricultural water (Tbl 1)	118,396
State water (Tbl 1)	
Other Wholesaler (define) (Tbl 1)	
Local surface water (Tbl 1)	
Upslope drain water (Tbl 1)	
District ground water (Tbl 2)	
Banked water (Tbl 1)	
Transferred water (Tbl 6)	1,868
Recycled water (Tbl 3)	
Other (define) (Tbl 1)	
Total	120,264

4. Annual entitlement under each right and/or contract

	AF	*Source*	*Contract #*	*Availability period(s)*
Reclamation Urban AF/Y				
Reclamation Agriculture AF/Y Class 1	55,000	USBR	175r-2358-LTR1	March 1 to February 28

Class 2	160,000	USBR		
Buchanan	24,000	USBR	14-06-200-3844A-LTR1-2	March 1 to February 28
Other AF/Y Appropriative	50,000	Ash Slough	L8577	November 1 to May 1
Other AF/Y	1,000	LeGrand-Athelon WD	Flood Flows	Surplus years only

5. Anticipated land-use changes

The district is anticipating a small amount of agricultural acreage to be developed for housing in the City of Chowchilla. Most of this acreage has already been taken out of production.

6. Cropping patterns (Agricultural only)

List of current crops (crops with 5% or less of total acreage) can be combined in the 'Other' category.

Original Plan (1993)		*Previous Plan (2002)*		*Current Plan*	
Crop Name	*Acres*	*Crop Name*	*Acres*	*Crop Name*	*Acres*
Alfalfa	11,900	Alfalfa	13,267	Alfalfa	13,306
Almonds	15,092	Almonds	14,620	Almonds	25,978
Cotton	16,520	Cotton	7,663	Cotton	522
Corn/silage	5,771	Corn/Silage	8,998	Corn	10,628
Grapes	6,789	Grapes	8,109	Grapes	6,029
Wheat	3,214	Sorghum	4,999	Wheat	4,360
				Figs	2,294
				Pistachios	2,129
Other (<5%)	6,602	*Other (<5%)*	7,769	*Other (<5%)*	8,707
Total	65,888	*Total*	65,506	*Total*	73,953

(See Planner, Chapter 2, Appendix A for list of crop names)

7. Major irrigation methods (by acreage) (Agricultural only)

Original Plan (1993)		*Previous Plan (2002)*		*Current Plan*	
Irrigation Method	*Acres*	*Irrigation Method*	*Acres*	*Irrigation Method*	*Acres*
Furrow	61,082	Furrow	57,982	Furrow	49,213
Low Volume	4,763	Low Volume	7,443	Low Volume	24,740
Other		*Other*		*Other*	
Total	65,888	*Total*	65,425	*Total*	73,953

(See Planner, Chapter 2, Appendix A for list of irrigation system types)

B. Location and Facilities

See Attachment A for points of delivery, turnouts (internal flow), and outflow (spill) points, measurement locations, conveyance system, storage facilities, operational loss recovery system, wells, and water quality monitoring locations

1. Incoming flow locations and measurement methods

Location Name	*Physical Location*	*Type of Measurement Device*	*Accuracy*
Madera Canal	Madera Canal Mile 33.6	Rated structure	+/- 2 percent
Buchanan Dam	Buchanan Dam weir	Rated structure	+/- 5 percent
LeGrand-Athelon	Serrano Check	Water Meter	+/- 2 percent

2. Current year Agricultural Conveyance System

Miles Unlined – Canal	*Miles Lined - Canal*	*Miles Piped*	*Miles – Other Natural Channels*
159.6	0.8	45.8	48

3 Current year Urban Distribution System

Miles AC Pipe	*Miles Steel Pipe*	*Miles Cast Iron Pipe*	*Miles – Other*

4. Storage facilities (tanks, reservoirs, regulating reservoirs)

Name	*Type*	*Capacity (AF)*	*Distribution or Spill*
Berenda Reservoir	Regulating Reservoir	1,400	Distribution
Califa Pond	Regulating Reservoir	510	Distribution
Dairyland Pond	Regulating Reservoir	300	Distribution
Central Pipeline Pond	Regulating Reservoir	40	Distribution
Berenda Pond	Regulating Reservoir	30	Distribution
Siphon 3 Pond	Regulating Reservoir	60	Distribution
Asken Pond	Regulating Reservoir	30	Distribution
Vera Pond	Regulating Reservoir	40	Distribution
Rutherford Pond	Regulating Reservoir	40	Distribution
Gregory Pond	Regulating Reservoir	40	Distribution
Haynes Pond	Regulating Reservoir	40	Distribution
Townsend Pond	Regulating Reservoir	50	Distribution
Lateral 3 Pond	Regulating Reservoir	80	Distribution
Lateral 4 Pond	Regulating Reservoir	80	Distribution

5. Outflow locations and measurement methods (Agricultural only)
Provide this information in Section 2 F.

6. Description of the agricultural spill recovery system

Spill from Califa Canal, Central Pipeline and Dairyland Pipeline is spilled into the Dairyland Pond and pumped back into the Califa Canal and Dairyland Pipeline.

7. Agricultural delivery system operation (check all that apply)

On-demand	*Scheduled*	*Rotation*	*Other (describe)*
	X		

8. Restrictions on water source(s)

Source	*Restriction*	*Cause of Restriction*	*Effect on Operations*
USBR	Limited water supply	San Joaquin River Settlement	Increase in groundwater overdraft

9. Proposed changes or additions to facilities and operations for the next 5 years

The District will continue to upgrade metered gates to propeller meters, construct groundwater recharge basins, construct regulating ponds, install ITRC Flap Gates, expand the SCADA system, construct long-crested weirs, construct broad-crested weirs.

C. Topography and Soils

1. Topography of the district and its impact on water operations and management

Land surfaces in the District are relatively flat and slope to the southwest at 8 feet per mile. Elevation is 150 to 325 feet above sea level. Topography does not negatively affect District water management.

2. District soil association map (Agricultural only)
See Attachment B, District Soils Map

Soil Association	Estimated Acres	Effect on Water Operations and Management
Pachappa-Grangevilla	56,100	none
San Joaquin-Madera	15,880	none
Fresno-Traver	5,900	none
Fresno-El Peco-Ponzo	1,120	none
Lewis-Landlow-Burchell	1,000	none

3. Agricultural limitations resulting from soil problems (Agricultural only)

Soil Problem	*Estimated Acres*	*Effect on Water Operations and Management*
Salinity	0	None
High-water table	0	None
High or low infiltration rates	0	None
Other (define)	0	None

D. Climate

1. General climate of the district service area

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
Avg Precip.	2.09	1.81	1.89	1.12	0.49	0.10	0.01	0.02	0.17	0.61	1.30	1.71	11.32
Avg Temp.	44.7	50.0	54.3	59.9	67.3	74.4	79.7	78.3	72.8	64.1	52.8	44.5	61.9
Max. Temp.	54	61.2	66.9	74.9	83.7	91.8	98.0	96.1	90.8	80.7	65.9	54.7	76.6
Min. Temp	36.0	38.9	41.9	45.6	51.6	57.2	61.8	60.2	55.8	47.9	40.0	35.4	47.7
ETo	0.73	2.12	4.01	5.58	7.32	7.58	7.98	6.76	5.39	3.47	1.05	0.99	52.96

Weather station ID Madera 045233 *Data period: Year* 1948 *to Year* 2005

Average wind velocity 7 *Average annual frost-free days:* 355

2. Impact of microclimates on water management within the service area None

E. Natural and Cultural Resources

1. Natural resource areas within the service area

Name	*Estimated Acres*	*Description*
None		

2. Description of district management of these resources in the past or present

3. Recreational and/or cultural resources areas within the service area

Name	*Estimated Acres*	*Description*
None		

F. Operating Rules and Regulations

1. Operating rules and regulations

See Attachment C, District Rules and Regulations (water related)

2. *Water allocation policy (Agricultural only)*
See Attachment C, Rule 4

Summary – The District's water allocation policy considers factors such as water supply, distribution system capacities, crop water demands and maximization of delivery efficiencies. The policy is described in Attachment C, Rule 4, Rules and Regulations Governing Water Delivery.

3. *Official and actual lead times necessary for water orders and shut-off (Agricultural only)*
See Attachment C, Rule 6

Summary - Official requests for water orders and shutoffs must be received by 1:00 pm, for the following day. Actual lead times may vary depending on when on requests and off requests are received, most can be accommodated when requested.

4. *Policies regarding return flows (surface and subsurface drainage from farms) and outflow (Agricultural only)*
See Attachment C, Rule 13

Summary – The District's distribution system is not used to collect surface and subsurface drainage from farms.

5. *Policies on water transfers by the district and its customers*

Summary – The District can exercise the option to transfer water to other CVP contractors pursuant to current contract provisions. In-district transfers among District water users are allowed.

G. Water Measurement, Pricing, and Billing

1. *Agricultural Customers*

a. *Number of farms* 304

b. *Number of delivery points (turnouts and connections)* 948

c. *Number of delivery points serving more than one farm* 5

d. *Number of measured delivery points (meters and measurement devices)* 948

e. *Percentage of delivered water that was measured at a delivery point* 100

f. *Delivery point measurement device table (Agricultural only)*

Measurement Type	*Number*	*Accuracy (+/- %)*	*Reading Frequency (Days)*	*Calibration Frequency (Months)*	*Maintenance Frequency (Months)*
Metered Gates	472	3-6%	Daily		As required**

Propeller meter	354	2%	Daily	As required**	Annual
Weirs	8	2%	Daily		
Flumes					
Rated Pumps	114	5%	daily	As required**	
Metered gates					
Acoustic doppler					
Other (define)					
Total	948				

** whenever problems arise, District operations personnel respond to either repair, replace or service meters. Calibrations are conducted as repairs or replacements are completed.

2. ***Urban Customers***

a. *Total number of connections* _____0_____

b. *Total number of metered connections*_____

c. *Total number of connections not billed by quantity* _____

d. *Percentage of water that was measured at delivery point* _____

e. *Percentage of delivered water that was billed by quantity* _____

f. *Measurement device table*

Meter Size and Type	*Number*	*Accuracy (+/-percentage)*	*Reading Frequency (Days)*	*Calibration Frequency (Months)*	*Maintenance Frequency (Months)*
5/8-3/4"					
1"					
1 ½"					
2"					
3"					
4"					
6"					
8"					
10"					
Compound					
Turbo					
Other (define)					
Total					

3. ***Agriculture and Urban Customers***

a. *Current year agriculture and /or urban water charges - including rate structures and billing frequency*

The current rate structure is $54 per acre-foot for agricultural water which is billed monthly.

b. See Attachment C for current year rate ordinance

c. Annual charges collected from customers (current year data)

Fixed Charges			
Charges ($ unit)	*Charge units ($/acre), ($/customer) etc.*	*Units billed during year (acres, customer) etc.*	*$ collected ($ times units)*
$1.50/$100	$ assessed value	$132,973,928	$1,994,609
$16	$/acre	75,495 acres	$1,207,920

Volumetric charges			
Charges ($ unit)	*Charge units ($/AF), ($/HCF), etc.*	*Units billed during year (AF, HCF) etc.*	*$ collected ($ times units)*
$54	$/AF	84,881 AF	$4,583,574

See Attachment D, District Sample Bills

d. Water-use data accounting procedures

The District uses STORM, a multifunction computer program for water and assessment billing. Water delivery data is entered into a hand held Palm device and downloaded to the District's server. Water billing is done on a monthly basis. Farmers can request detailed printouts of water delivery history on an individual turnout basis. Data is available for the past 10 years.

H. Water Shortage Allocation Policies

1. Current year water shortage policies or shortage response plan - specifying how reduced water supplies are allocated

Water supply forecasts are reviewed to determine the date when District water deliveries begin. Determination of a beginning date takes into account crop water demands and maximization of delivery efficiencies. If forecasts indicate water will be available throughout the year, deliveries are scheduled to begin on or about the first of March and continue until late fall. When forecasts indicate water will not be available throughout the year, the period of mid-June thru mid-August is given priority when scheduling water for delivery. When in the opinion of the District, water demands exceed the design or actual capacity of the distribution system or the supply of water, the district reserves the right to rotate the use of water by basic time and quantity method in order to deliver approximately equal amounts of water in acre-feet per acre. Waterusers rely on their private deep wells to irrigate crops when District water is not available.
See Attachment E, District Water Shortage Plan

2. Current year policies that address wasteful use of water and enforcement methods

See Attachment C, District Rules and Regulations, Rule 7 Waste of Water

Section 2: Inventory of Water Resources

A. Surface Water Supply

1. Acre-foot amounts of surface water delivered to the water purveyor by each of the purveyor's sources

See Water Inventory Tables, Table 1

2. Amount of water delivered to the district by each of the district sources for the last 10 years

See Water Inventory Tables, Table 8

B. Ground Water Supply

1. Acre-foot amounts of ground water pumped and delivered by the district

See Water Inventory Tables, Table 2

2. Ground water basin(s) that underlies the service area

Name	*Size (Square Miles)*	*Usable Capacity (AF)*	*Safe Yield (AF/Y)*
Chowchilla Groundwater Basin	250	NA	18,000

3. Map of district-operated wells and managed ground water recharge areas

See Attachment F, District Map of Ground Water Facilities
The District does not operate any deep wells.

4. Description of conjunctive use of surface and ground water

Water users in Chowchilla Water District utilize both surface water and groundwater conjunctively. The District's canal system is unlined and is a major means of groundwater recharge. The District's conjunctive use program is described in detail in the CWD Groundwater Management Plan.

5. Ground Water Management Plan

See Attachment G, Ground Water Management Plan

6. Ground Water Banking Plan

See Attachment H, Ground Water Banking Plan
The District does not have a groundwater banking program.

C. Other Water Supplies

1. "Other" water used as part of the water supply

See the Water Inventory Tables, Table 1

D. Source Water Quality Monitoring Practices

1. Potable Water Quality (Urban only)
See Attachment I – District Annual Water Quality Report

The District does not deliver water to urban customers.

2. *Agricultural water quality concerns:* *Yes* _____ *No* ___X___
(If yes, describe)

3. *Description of the agricultural water quality testing program and the role of each participant, including the district, in the program*

The District does not have an agricultural water quality testing program. There are no known problems associated with use of surface water or groundwater for irrigation of agricultural crops.

4. *Current water quality monitoring programs for surface water by source (Agricultural only)*

Analyses Performed	*Frequency*	*Concentration Range*	*Average*
None			

Current water quality monitoring programs for groundwater by source (Agricultural only)

Analyses Performed	*Frequency*	*Concentration Range*	*Average*
None			

E. Water Uses within the District

1. *Agricultural*
See Water Inventory Tables, Table 5 - Crop Water Needs

2. *Types of irrigation systems used for each crop in current year*

Crop name	*Total Acres*	*Level Basin - acres*	*Furrow - acres*	*Sprinkler - acres*	*Low Volume - acres*	*Multiple methods - acres*
Corn	10,628		10,628			
Oats	1,704		1,704			
Wheat	4,360		4,360			
Alfalfa Hay	13,306		13,306			
Figs	2,294				2,294	
Grapes	6,029		2,015		4,014	
Almonds	25,978		12,200		13,778	
Pistachios	2,129				2,129	
Walnuts	242				242	
Miscellaneous	7,283		5,000		2,283	

3. Urban use by customer type in current year

Customer Type	*Number of Connections*	*AF*
Single-family		
Multi-family		
Commercial		
Industrial		
Institutional		
Landscape irrigation		
Wholesale		
Recycled		
Other (specify)		
Other (specify)		
Other (specify)		
Unaccounted for		
Total		

4. Urban Wastewater Collection/Treatment Systems serving the service area – current year

Treatment Plant	*Treatment Level (1, 2, 3)*	*AF*	*Disposal to / uses*
	Total		
Total discharged to ocean and/or saline sink			

5. Ground water recharge/management in current year (Table 6)

Recharge Area	*Method of Recharge*	*AF*	*Method of Retrieval*
	Total		

6. Transfers and exchanges into or out of the service area in current year (Table 6)

From Whom	*To Whom*	*AF*	*Use*
Madera Irrigation District	Chowchilla Water District	1,808	Agriculture
Gravelly Ford Water District	Chowchilla Water District	60	Agriculture

7. Trades, wheeling, wet/dry year exchanges, banking or other transactions in current year (Table 6)

From Whom	*To Whom*	*AF*	*Use*

8. Other uses of water in current year

Other Uses	*AF*

F. Outflow from the District (Agricultural only)

Districts included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)," should also complete Water Inventory Table 7 and Appendix B (include in plan as Attachment L)

See Facilities Map, Attachment A, for the location of surface and subsurface outflow points, outflow measurement points, outflow water-quality testing locations

1. Surface and subsurface drain/outflow in current year

Outflow point	*Location description*	*AF*	*Type of measurement*	*Accuracy (%)*	*% of total outflow*	*Acres drained*
1	Lateral 3 Spill	4.0	weir	+/- 2	13.3	NA
2	Lateral 4 spill	26.0	weir	+/- 2	86.7	NA

Outflow point	*Where the outflow goes (drain, river or other location)*	*Type Reuse (if known)*
1	Merced Irrigation District Canal	Irrigation of agricultural crops
2	Merced Irrigation District Canal	Irrigation of agricultural crops

2. Description of the Outflow (surface and subsurface) water quality testing program and the role of each participant in the program

The District does not perform water quality testing on canal spills. There is no subsurface drainage from the District.

3. Outflow (surface drainage & spill) Quality Testing Program

Analyses Performed	*Frequency*	*Concentration Range*	*Average*	*Reuse limitation?*
None				

Outflow (subsurface drainage) Quality Testing Program

Analyses Performed	*Frequency*	*Concentration Range*	*Average*	*Reuse limitation?*
NA				

4. Provide a brief discussion of the District's involvement in Central Valley Regional Water Quality Control Board programs or requirements for remediating or monitoring any contaminants that would significantly degrade water quality in the receiving surface waters.

The District is tracking Central Valley Regional Water Quality Control Board programs. The District is a member of the East San Joaquin Water Quality Coalition.

G. Water Accounting (Inventory)

1. *Water Supplies Quantified*

   a. *Surface water supplies, imported and originating within the service area, by month (Table 1)*
   b. *Ground water extracted by the district, by month (Table 2)*
   c. *Effective precipitation by crop (Table 5)*
   d. *Estimated annual ground water extracted by non-district parties (Table 2)*
   e. *Recycled urban wastewater, by month (Table 3)*
   f. *Other supplies, by month (Table 1)*

2. *Water Used Quantified*

   a. *Agricultural conveyance losses, including seepage, evaporation, and operational spills in canal systems (Table 4) or*
      Urban leaks, breaks and flushing/fire uses in piped systems (Table 4)
   b. *Consumptive use by riparian vegetation or environmental use (Table 6)*
   c. *Applied irrigation water - crop ET, water used for leaching/cultural practices (e.g., frost protection, soil reclamation, etc.) (Table 5)*
   d. *Urban water use (Table 6)*
   e. *Ground water recharge (Table 6)*
   f. *Water exchanges and transfers and out-of-district banking (Table 6)*
   g. *Estimated deep percolation within the service area (Table 6)*
   h. *Flows to perched water table or saline sink (Table 7)*
   i. *Outflow water leaving the district (Table 6)*
   j. *Other*

3. *Overall Water Inventory*
   a. *Table 6*

H. Assess Quantifiable Objectives:

Identify the Quantifiable Objectives that apply to the District (Planner, chapter 10) and provide a short narrative describing past, present and future plans that address the CALFED Water Use Efficiency Program goals identified for the District.

All of the Quantifiable Objectives for the Chowchilla Water District relate to on-farm water use.

QO #	*QO Description*	*Past, Present & Future Plans*
147	Provide flow to improve ecosystem conditions	District lands are not hydrologically connected to Merced River
148	Provide flow to improve ecosystem conditions	District lands are only hydrologically connected to San Joaquin River during flood releases from Buchanan Dam
159	Provide long-term diversion flexibility to increase the water supply for beneficial uses	District lands are not hydrologically connected to Merced National Wildlife Reserve
161	Provide long-term diversion flexibility to increase the water supply for beneficial uses	District lands are not hydrologically connected to salt affected soils
149	Reduce group A pesticides to enhance and maintain beneficial uses of water	District lands are not hydrologically connected to Merced River
150	Reduce group A pesticides to enhance and maintain beneficial uses of water	District lands are only hydrologically connected to San Joaquin River during flood releases from Buchanan Dam
151	Reduce pesticides to enhance and maintain beneficial uses of water	District lands are not hydrologically connected to Merced River
152	Reduce pesticides to enhance and maintain beneficial uses of water	District lands are only hydrologically connected to San Joaquin River during flood releases from Buchanan Dam
154	Reduce salinity to enhance and maintain beneficial uses of water	District lands are only hydrologically connected to San Joaquin River during flood releases from Buchanan Dam
155	Reduce temperatures to enhance and maintain aquatic species populations	District lands are not hydrologically connected to Merced River

District is a member and encourages its landowners to be members of the East San Joaquin Water Quality Coalition.

Section 3: Best Management Practices (BMPs) for Agricultural Contractors

A. Critical Agricultural BMPs

1. *Measure the volume of water delivered by the district to each turnout with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6%*

Number of turnouts that are unmeasured or do not meet the standards listed above: 0

Number of measurement devices installed last year: 11

Number of measurement devices installed this year: 15

Number of measurement devices to be installed next year: 10

Types of Measurement Devices Being Installed	*Accuracy*	*Total Installed During Current Year*
Propeller meter	+/- 2%	15

2. *Designate a water conservation coordinator to develop and implement the Plan and develop progress reports*

Name: Douglas Welch *Title:* General Manager

Address: 327 S. Chowchilla Blvd. Chowchilla, CA 93610

Telephone: 559-665-3747 *E-mail:* dwelch@cwdwater.com

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

See Attachment J, Notices of District Education Programs and Services Available to Customers.

a. On-Farm Evaluations

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

	Total in district	*# surveyed last year*	*# surveyed in current year*	*# projected for next year*	*# projected 2nd yr in future*
Irrigated acres	65,000	160	133	160	160
Number of farms	304	3	2	3	3

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

Friant Waterline Newsletter is provided to all District customers. Local newspapers report daily ET use and crop irrigation data. Numerous County Ag department fliers and newsletters provide crop water use

data to all farming interests. All of the above are readily available to District waterusers and they are encouraged to use the sources at hand. District includes fliers on water conservation from County Ag Department, NRCS, CIT Fresno, ITRC with water billing. Monthly reports are mailed to waterusers with summaries of water delivered to each of their turnouts. See Attachment D, District Sample Bills

b. Real-time and normal irrigation scheduling and crop ET information

Friant Water Users website contains daily CIMIS data and irrigation information for locally grown crops. ITRC normal year irrigation scheduling guides are available to all water users. Waterusers are informed about CIMIS ETo data available online.

c. Surface, ground, and drainage water quantity and quality data provided to water users

USBR has surface water quality data. District provides no groundwater and does not allow drainage into District delivery system.

d. Agricultural water management educational programs and materials for farmers, staff, and the public

Program	*Co-Funders (If Any)*	*Yearly Targets*
Grower information meetings	County Ag Department	200 participants
ITRC evaluations reviews	USBR	3 to 6 farms
Irrigation Tech-Line	Friant Water Users Authority	Mailed to all waterusers
CIT Fresno Seminar Series		unknown

See Attachment J for samples of provided materials and notices

e. other

4. Pricing structure - based at least in part on quantity delivered
Describe the quantity-based water pricing structure, the cost per acre-foot, and when it became effective.

The District has charged waterusers for water on a per acre-foot of use basis since the creation of the District. The water rate is set based on the melded rate of the various water supplies to the District. The water rate for 2009 was $54 per acre-foot.

5. Evaluate and describe the need for changes in policies of the institutions to which the district is subject
NA

6. Evaluate and improve efficiencies of district pumps
Describe the program to evaluate and improve the efficiencies of the contractor's pumps.

District pump testing provided for District low-lift pumps when required.

B. Exemptible BMPs for Agricultural Contractors

(See Planner, Chapter 2, Appendix C for examples of exemptible conditions)

1. Facilitate alternative land use

Drainage Characteristic	*Acreage*	*Potential Alternate Uses*
High water table (<5 feet)		
Poor drainage		
Ground water Selenium concentration > 50 ppb		
Poor productivity		

Describe how the contractor encourages customers to participate in these programs.

NA – District has no irrigable lands that have exceptionally high water tables or whose irrigation contributes to significant problems.

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

The District is investigating the potential to use recycled urban wastewater. The City of Chowchilla currently discharges wastewater into city's groundwater recharge basins to offset city's groundwater use.

Sources of Recycled Urban Waste Water	*AF/Y Available*	*AF/Y Currently Used in District*
City of Chowchilla	1,000	0

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

Funding source Programs	*How provide assistance*
NRCS	District refers waterusers to Madera County NRCS office for design and cost-sharing on conservation practices.
District	The District cost shares 25% of the cost of a water meter, installs the meter at no cost and maintains the meter forever.

4. Incentive pricing

Structure of incentive pricing	*Related goal*
Free or reduced price in wet years during winter and spring	Encourage use of surface water which results in in-lieu recharge of groundwater

5. a) Line or pipe ditches and canals

NA – Water users in Chowchilla Water District utilize both surface water and groundwater conjunctively. The District's canal system is unlined and is a major means of groundwater recharge. The District's conjunctive use program is described in detail in the CWD Groundwater Management Plan.

Canal/Lateral (Reach)	*Type of Improvement*	*Number of Miles in Reach*	*Estimated Seepage (AF/Y)*	*Accomplished/ Planned Date*

b) Construct regulatory reservoirs

The District has constructed numerous regulating reservoirs and continues to investigate locations that would improve the efficiency of the District and provide more flexible and consistent deliveries. The reduction in spill that has resulted from the construction of the regulating reservoirs is not known. See listing of regulating reservoirs in Section B - Location and Facilities.

Reservoir Name	*Annual Spill in Section (AF/Y)*	*Estimated Spill Recovery (AF/Y)*	*Accomplished/ Planned Date*

6. Increase flexibility in water ordering by, and delivery to, water users
See Attachment - C District Rules and Regulations

The District has a scheduled demand irrigation delivery system. Waterusers order water before 1:00 pm and receives it on the following day for the period of time requested. Wateruser notifies District of shutoff time before 1:00 pm and shuts off at requested time on next day. Flexibility in start time and shutoff time are explained in detail in Rule 6 of Rules & Regulations During periods of high demand some customers may experience short delay (usually less than 6 hours) in receiving water. The SCADA system improvements installed in 2009 will allow increased flexibility in water ordering and deliveries while reducing canal spill.

7. Construct and operate district spill and tailwater recovery systems

Drainage of tailwater into District canal system is not permitted. All tailwater must be contained on farm. District spill has been reduced by conservation practices to less than 0.1 percent.

Distribution System Lateral	*Annual Spill (AF/Y)*	*Quantity Recovered and reused (AF/Y)*
Lateral 3	4	0
Lateral 4	26	0
Total		

Drainage System Lateral	*Annual Drainage*	*Quantity Recovered*

	Outflow (AF/Y)	*and reused (AF/Y)*
NA		
Total		

8. Plan to measure outflow.

Total # of outflow (surface) locations/points 2
Total # of outflow (subsurface) locations/points 0
Total # of measured outflow points 2
Percentage of total outflow (volume) measured during report year 100%

Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

Location & Priority	*Estimated cost (in $1,000s)*				
	2009	*2010*	*2011*	*2012*	*2013*

The District has water level recorders that are located at the last check structure at the end of the two canals that spill water out of the District. The water level recorder charts are changed weekly and the acre-feet of spill is then computed from the charts.

9. Optimize conjunctive use of surface and ground water

On-going. Depends on wet/dry cycle, flood releases. District is a conjunctive use district. Delivery system is used to recharge groundwater and deliver water to farms. During wet years water is also delivered to sloughs and other recharge areas to promote groundwater recharge. During dry years water previously stored as groundwater is pumped by farmers for irrigation.

10. Automate canal structures

District just completed $729,000 SCADA Improvement project where 13 deliveries were automated and 12 locations where water flow is now remotely monitored. District will continue investigating expansion of SCADA system.

11. Facilitate or promote water customer pump testing and evaluation
See Attachment J, Notices of District Education Programs and Services Available to Customers

12. Mapping

District will investigate the benefit and cost of GIS mapping.

GIS maps	*Estimated cost (in $1,000s)*				
	2009	*2010*	*2011*	*2012*	*2013*
Layer 1 – Distribution system				$1	
Layer 2 – Drainage system					
Suggested layers:					
Layer 3 – Ground water information					
Layer 4 – Soils map					
Layer 5 – Natural & cultural resources					
Layer 6 – Problem areas					

C. Provide a 3-Year Budget for Implementing BMPs

1. Amount actually spent during current year.

BMP #		*BMP Name*	*Actual Expenditure (not including staff time)*	*Staff Hours*
A	*1*	*Measurement*	*$16,000*	*120*
	2	*Conservation staff*	*$1,000*	*12*
	3	*On-farm evaluation /water delivery info*	*$1,000*	*8*
		Irrigation Scheduling	*$250*	*10*
		Water quality	*$100*	*1*
		Agricultural Education Program	*$100*	*10*
	4	*Quantity pricing*	*$100*	*1*
	5	*Policy changes*	*$0*	*0*
	6	*Contractor's pumps*	*$0*	*10*
B	*1*	*Alternative land use*	$0	0
	2	*Urban recycled water use*	$0	5
	3	*Financing of on-farm improvements*	$0	40
	4	*Incentive pricing*	$0	10
	5	*Line or pipe canals/install reservoirs*	$0	0
	6	*Increase delivery flexibility*	$0	0
	7	*District spill/tailwater recovery systems*	$1,000	0
	8	*Measure outflow*	*$500*	*10*
	9	*Optimize conjunctive use*	$900,000	10
	10	*Automate canal structures*	$525,000	300
	11	*Customer pump testing*	$1,000	24
	12	*Mapping*	$0	*0*
		Total	$1,447,050	562

2. *Projected budget summary for the next year.*

BMP #		BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A	1	Measurement	$15,000	100
	2	Conservation staff	$1,000	12
	3	On-farm evaluations/water delivery info	$1,000	80
		Irrigation Scheduling	$250	10
		Water quality	$100	1
		Agricultural Education Program	$100	10
	4	Quantity pricing	$100	1
	5	Policy changes	$0	0
	6	Contractor's pumps	$0	10
B	1	Alternative land use	$0	0
	2	Urban recycled water use	$0	5
	3	Financing of on-farm improvements	$0	40
	4	Incentive pricing	$0	10
	5	Line or pipe canals/install reservoirs	$0	0
	6	Increase delivery flexibility	$50,000	400
	7	District spill/tailwater recovery systems	$1,000	0
	8	Measure outflow	$500	10
	9	Optimize conjunctive use	$900,000	10
	10	Automate canal structures	$0	0
	11	Customer pump testing	$1,000	240
	12	Mapping	$0	0
		Total	$970,050	723

3. *Projected budget summary for 3rd year.*

BMP #		BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A	1	Measurement	$15,000	100
	2	Conservation staff	$1,000	12
	3	On-farm evaluations/water delivery info	$1,000	80
		Irrigation Scheduling	$250	10
		Water quality	$100	1
		Agricultural Education Program	$100	10
	4	Quantity pricing	$100	1
	5	Policy changes	$0	0
	6	Contractor's pumps	$0	10

(continued)

BMP #		BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
B	1	Alternative land use	$0	0
	2	Urban recycled water use	$0	5
	3	Financing of on-farm improvements	$0	40
	4	Incentive pricing	$0	10
	5	Line or pipe canals/install reservoirs	$0	0
	6	Increase delivery flexibility	$0	0
	7	District spill/tailwater recovery systems	$1,000	0
	8	Measure outflow	$500	10
	9	Optimize conjunctive use	$900,000	10
	10	Automate canal structures	$0	0
	11	Customer pump testing	$1,000	24
	12	Mapping	$0	0
		Total	$920,050	323

Section 5

District Water Inventory Tables

Year of Data: 2009 Enter data year here

Table 1

Surface Water Supply

2009 Month	Federal Ag Water (acre-feet)	Federal non-Ag Water. (acre-feet)	State Water (acre-feet)	Local Water (acre-feet)	Other Water (acre-feet)	Upslope Drain Water (acre-feet)	Total (acre-feet)
Method							
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	347	0	0	0	0	0	347
May	25735	0	0	0	0	0	25,735
June	23686	0	0	0	0	0	23,686
July	41761	0	0	0	0	0	41,761
August	19193	0	0	0	0	0	19,193
September	0	0	0	0	0	0	0
October	841	0	0	0	0	0	841
November	6833	0	0	0	0	0	6,833
December	0	0	0	0	0	0	0
TOTAL	118,396	0	0	0	0	0	118,396

Table 2

Ground Water Supply

2009 Month	District Groundwate (acre-feet)	Private Groundwate *(acre-feet)
Method		
January	0	0
February	0	0
March	0	17,000
April	0	21,000
May	0	28,000
June	0	28,000
July	0	32,000
August	0	26,000
September	0	20,000
October	0	3,000
November	0	0
December	0	0
TOTAL	0	175,000

*normally estimated

Table 3

Total Water Supply

2009 Month	Surface Water Total (acre-feet)	District Groundwate (acre-feet)	Recycled M&I (acre-feet)	Total District (acre-feet)
Method				
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	347	0	0	347
May	25,735	0	0	25,735
June	23,686	0	0	23,686
July	41,761	0	0	41,761
August	19,193	0	0	19,193
September	0	0	0	0
October	841	0	0	841
November	6,833	0	0	6,833
December	0	0	0	0
TOTAL	118,396	0	0	118,396

*Recycled M&I Wastewater is treated urban wastewater that is used for agriculture.

Table 4

Distribution System

2009 Canal, Pipeline, Lateral, Reservoir	Length (feet)	Width (feet)	Surface Area (square feet)	Precipitatio (acre-feet)	Evaporation (acre-feet)	Spillage (acre-feet)	Seepage (acre-feet)	Total (acre-feet)
Earth Canal	841,632	15	12,624,480	193	1,420	30	15,650	(16,907)
Conc. lined Canal	4,320	20	86,400	1	10	0	2	(11)
			0	0	0	0	0	0
Natural Channels	84,480	40	3,379,200	52	380	0	4,189	(4,517)
Berenda Reservoir	800	8,000	6,400,000	98	720	0	7,934	(8,556)
Ponds	466	4,660	2,171,560	33	244	0	2,692	(2,903)
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
TOTAL			24,661,640	378	2,774	30	30,468	28,102

Table 5

Crop Water Needs

2009 Crop Name	Area (crop acres)	Crop ET (AF/Ac)	Leaching Requiremen (AF/Ac)	Cultural Practices (AF/Ac)	Effective Precipitatio (AF/Ac)	Appl. Crop Water Use (acre-feet)
Corn	10,628	2.59	0.30	0.00	0.20	28,554
Oats	1,704	1.71	0.30	0.00	0.20	3,076
Wheat	4,360	1.71	0.30	0.00	0.20	7,870
Alfafa Hay	13,306	4.04	0.30	0.00	0.20	55,065
Figs	2,294	3.42	0.30	0.00	0.20	8,067
Grapes	6,029	2.92	0.30	0.00	0.20	18,187
Almonds	25,978	3.55	0.30	0.00	0.20	94,798
Pistachios	2,129	3.13	0.30	0.00	0.20	6,871
Walnuts	242	3.77	0.30	0.00	0.20	935
Miscellaneous	7,283	3.00	0.30	0.00	0.20	22,577
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
Crop Acres	73,953					246,001

Total Irrig. Acres 65,000 (If this number is larger than your known total, it may be due to double cropping)

Table 6

2009 District Water Inventory

Water Supply	Table 3		118,396
Riparian ET	(Distribution and Drain)	minus	2,000
Groundwater recharge	intentional - ponds, injection	minus	0
Seepage	Table 4	minus	30,468
Evaporation - Precipitation	Table 4	minus	2,396
Spillage	Table 4	minus	30
Transfers/exchanges/trades/wheel	(into or out of the district)	plus/minus	1,868
Non-Agri deliveries	delivered to non-ag customer	minus	0
Water Available for sale to agricultural customers			85,371
Compare the above line with the next line to help find data gaps			
2005 Actual Agricultural Water Sales	From District Sales Records		84,881
Private Groundwater	Table 2	plus	175,000
Crop Water Needs	Table 5	minus	246,001
Drainwater outflow	(tail and tile not recycled)	minus	0
Percolation from Agricultural Land	(calculated)		13,880

Table 7

Influence on Groundwater and Saline Sink

2009

Agric Land Deep Perc + Seepage + Recharge - Groundwater Pumping = District Influence	30,468
Estimated actual change in ground water storage, including natural recharge)	(20,000)
Irrigated Acres (from Table 5)	73,953
Irrigated acres over a perched water table	0
Irrigated acres draining to a saline sink	0
Portion of percolation from agri seeping to a perched water table	0
Portion of percolation from agri seeping to a saline sink	0
Portion of On-Farm Drain water flowing to a perched water table/saline sink	0
Portion of Dist. Sys. seep/leaks/spills to perched water table/saline sink	0
Total (AF) flowing to a perched water table and saline sink	0

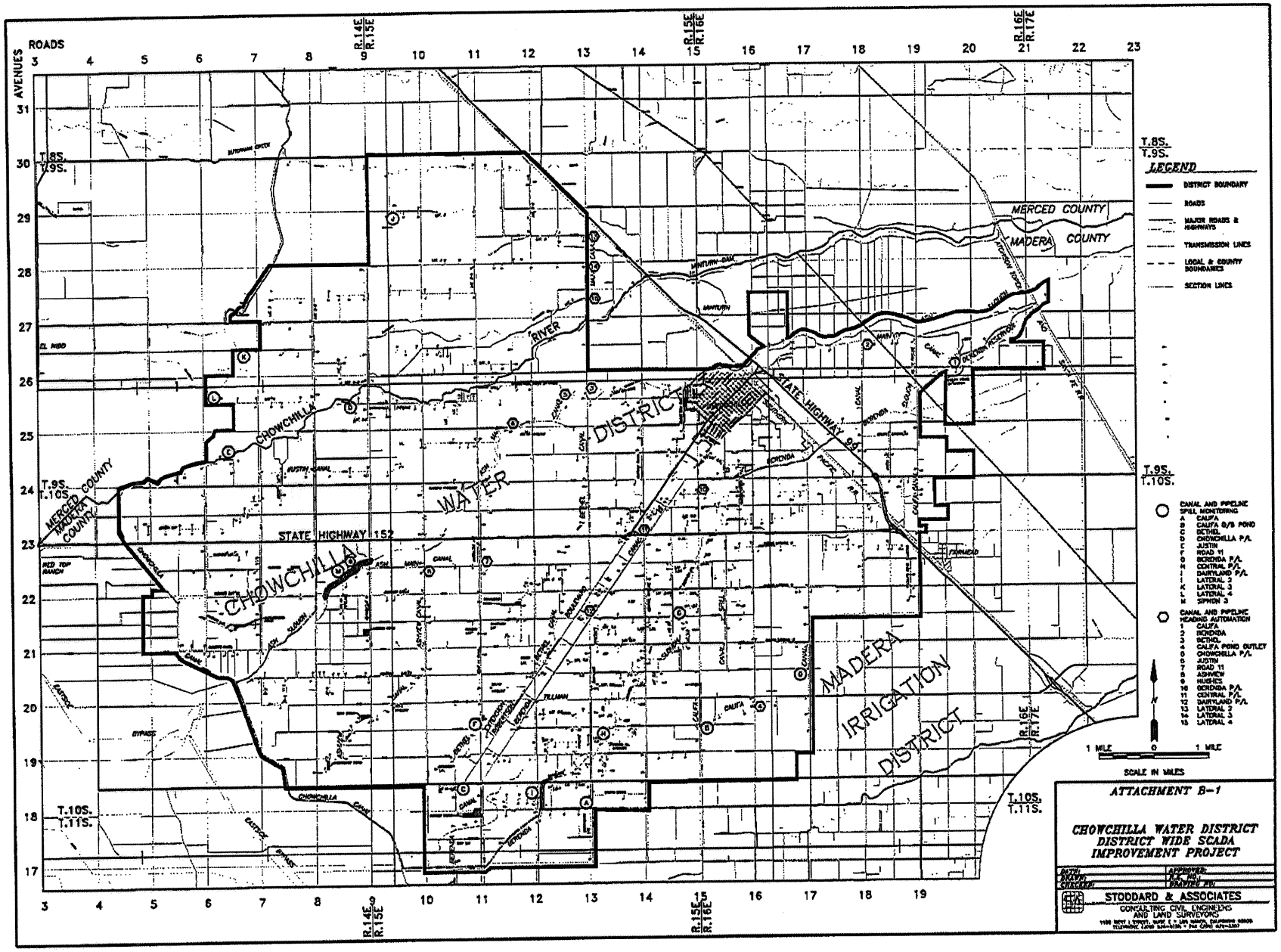
Table 8

Annual Water Quantities Delivered Under Each Right or Contract

Year	Federal Ag Water (acre-feet)	Federal non-Ag Water. (acre-feet)	State Water (acre-feet)	Local Water (acre-feet)	Other Water (acre-feet)	Upslope Drain Water (acre-feet)	Total (acre-feet)
2000	166,322	0	0	14,816	992	0	182,130
2001	126,652	0	0	12,884	1,877	0	141,413
2002	90,063	0	0	735	1,359	0	92,157
2003	101,390	0	0	508	10,815	0	112,713
2004	88,629	0	0	155	2,688	0	91,472
2005	161,115	0	0	15,255	72	0	176,442
2006	148,559	0	0	81,894	540	0	230,993
2007	107,917	0	0	173	855	0	108,945
2008	87,871	0	0	18	1,700	0	89,589
2009	118,396	0	0	0	0	0	118,396
Total	1,196,914	0	0	126,438	20,898	0	1,344,250
Average	119,691	0	0	12,644	2,090	0	134,425

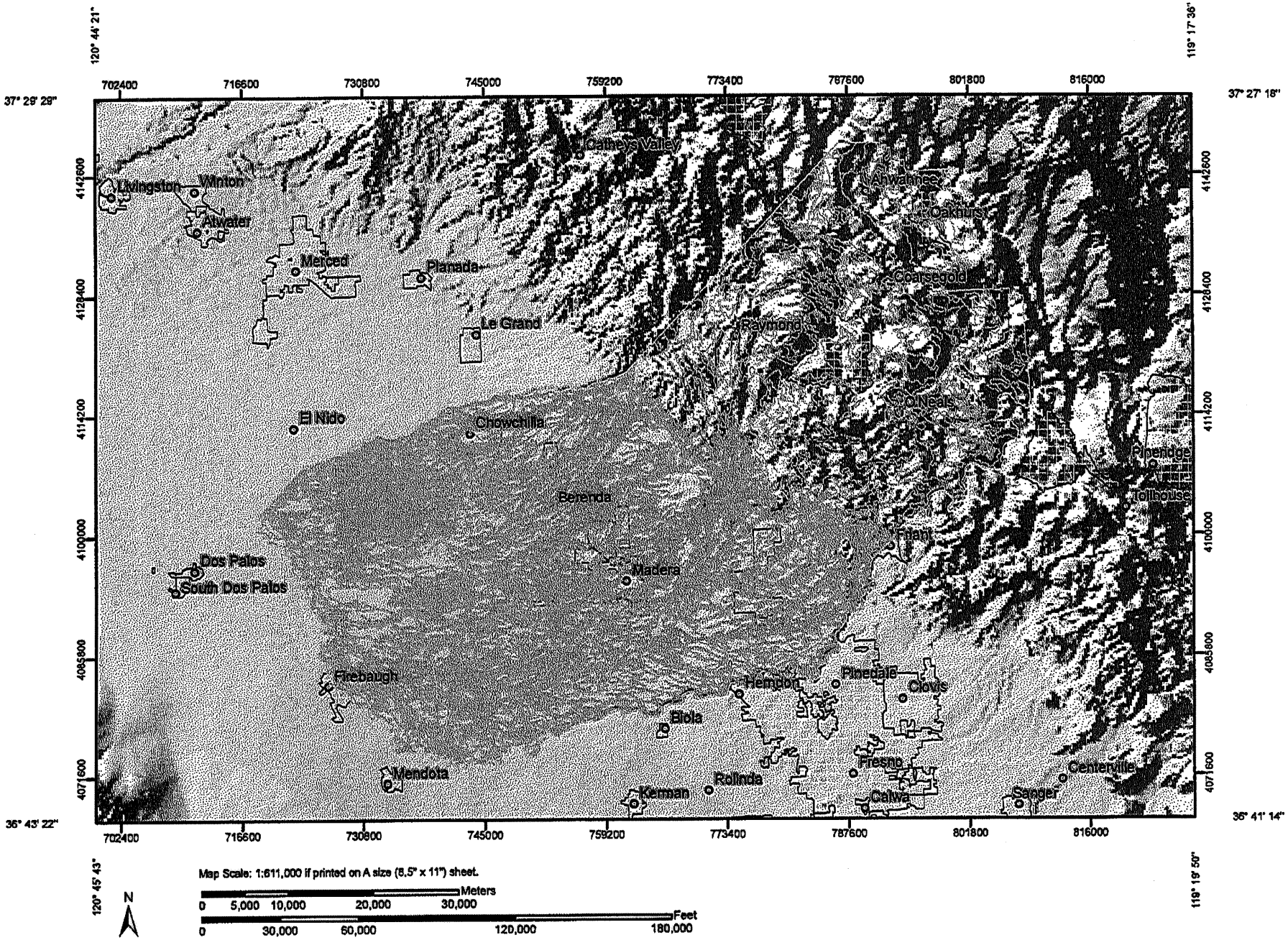
Attachment A

District Facilities Map


ROADS
AVENUES
R.14E
R.15E
R.16E
R.17E
T.8S.
T.9S.
T.10S.
T.11S.
MERCED COUNTY
MADERA COUNTY
CHOWCHILLA
RIVER
WATER
DISTRICT
STATE HIGHWAY 152
STATE HIGHWAY 99
MADERA
IRRIGATION
DISTRICT
LEGEND
DISTRICT BOUNDARY
ROADS
MAJOR ROADS & HIGHWAYS
TRANSMISSION LINES
LOCAL & COUNTY BOUNDARIES
SECTION LINES
CANAL AND PIPELINE SPILL MONITORING
A CAUFA
B CAUFA O/S POND
C BETHEL
D CHOWCHILLA P/L
E JUSTIN
F ROAD 11
G RICHONDA P/L
H CENTRAL P/L
I DAIRYLAND P/L
J LATERAL 2
K LATERAL 3
L LATERAL 4
M SIPHON 3
CANAL AND PIPELINE HEADING AUTOMATION
1 CAUFA
2 RICHONDA
3 BETHEL
4 CAUFA POND OUTLET
5 CHOWCHILLA P/L
6 JUSTIN
7 ROAD 11
8 ASHVIEW
9 HUGHES
10 RICHONDA P/L
11 CENTRAL P/L
12 DAIRYLAND P/L
13 LATERAL 2
14 LATERAL 3
15 LATERAL 4
1 MILE 0 1 MILE
SCALE IN MILES
ATTACHMENT B-1
CHOWCHILLA WATER DISTRICT
DISTRICT WIDE SCADA
IMPROVEMENT PROJECT
DATE:
DRAWN:
CHECKED:
APPROVED:
JOB NO.:
DRAWING NO.:
STODDARD & ASSOCIATES
CONSULTING CIVIL ENGINEERS
AND LAND SURVEYORS

Attachment B

District Soils Map


120° 44' 21"
119° 17' 36"
37° 29' 29"
37° 27' 18"
36° 43' 22"
36° 41' 14"
120° 45' 43"
119° 19' 50"
702400
716600
730800
745000
759200
773400
787600
801800
816000
4142600
4128400
4114200
4100000
4085800
4071600
Oakhurst
Ahwahnee
Coarsegold
Raymond
O'Neals
Piperidge
Tollhouse
Friant
Livingston
Winton
Atwater
Merced
Planada
Le Grand
El Nido
Chowchilla
Berenda
Madera
Dos Palos
South Dos Palos
Firebaugh
Mendota
Biola
Kerman
Rolinda
Hempton
Pinedale
Clovis
Fresno
Calwa
Sanger
Centerville
Map Scale: 1:611,000 if printed on A size (8.5" x 11") sheet.
Meters
0 5,000 10,000 20,000 30,000
Feet
0 30,000 60,000 120,000 180,000
N

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Gully
- Short Steep Slope
- Other

Political Features

- Urban Areas
- Cities

Water Features

- Oceans

Transportation

- Interstate Highways
- US Routes

MAP INFORMATION

Map Scale: 1:611,000 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Madera Area, California
Survey Area Data: Version 5, Jan 2, 2008

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AaC	Ahwahnee and Auberry coarse sandy loams, 8 to 15 percent slopes	3,494.8	0.4%
AaD	Ahwahnee and Auberry coarse sandy loams, 15 to 30 percent slope	12,238.1	1.4%
AbB	Ahwahnee and Auberry rocky coarse sandy loams, 3 to 8 percent slopes	59.3	0.0%
AbD	Ahwahnee and Auberry rocky coarse sandy loams, 8 to 30 percent slopes	16,953.8	2.0%
AbE	Ahwahnee and Auberry rocky coarse sandy loams, 30 to 45 percent slopes	12,671.3	1.5%
AcD	Ahwahnee and auberry very rocky coarse sandy loams, 15 to 30 percent slopes	1,209.2	0.1%
AcF	Ahwahnee and auberry very rocky coarse sandy loams, 30 to 75 percent slopes	3,875.4	0.4%
AdB	Ahwahnee and Vista coarse sandy loams, 3 to 8 percent slopes	112.1	0.0%
AdC	Ahwahnee and Vista coarse sandy loams, 8 to 15 percent slopes	8,101.7	0.9%
AdD	Ahwahnee and Vista coarse sandy loams, 15 to 30 percent slopes	28,005.6	3.3%
AeB	Ahwahnee and Vista rocky coarse sandy loams, 3 to 8 percent slopes	142.1	0.0%
AeD	Ahwahnee and Vista rocky coarse sandy loams, 8 to 30 percent slopes	97,558.8	11.3%
AeE	Ahwahnee and Vista rocky coarse sandy loams, 30 to 45 percent slopes	30,944.4	3.6%
ArD	Ahwahnee and Vista very rocky coarse sandy loams, 15 to 30 percent slopes	7,091.8	0.8%
ArF	Ahwahnee and Vista very rocky coarse sandy loams, 30 to 75 percent slopes	12,541.6	1.5%
AsA	Alamo clay, 0 to 1 percent slopes	1,980.6	0.2%
AtA	Atwater loamy sand, 0 to 3 percent slopes	3,297.1	0.4%
AtB	Atwater loamy sand, 3 to 8 percent slopes	2,552.9	0.3%
AwA	Atwater loamy sand, moderately deep and deep over hardpan, 0 to 3 percent slopes	4,404.1	0.5%
AwB	Atwater loamy sand, moderately deep and very deep over hardpan, 3 to 8 percent slopes	1,576.5	0.2%
BeA	Bear Creek loam, 0 to 3 percent slopes	575.2	0.1%
BfA	Borden fine sandy loam, 0 to 1 percent slopes	1,151.7	0.1%
BkA	Borden fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	1,262.7	0.1%
BmA	Borden loam, 0 to 1 percent slopes	288.4	0.0%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BoA	Borden loam, slightly saline-alkali, 0 to 1 percent slopes	357.0	0.0%
BuA	Buchenau fine sandy loam, 0 to 3 percent slopes	105.0	0.0%
BvA	Buchenau fine sandy loam, slightly saline-alkali, 0 to 3 percen slopes	73.4	0.0%
ByA	Buchenau fine sandy loam, strongly saline-alkali, 0 to 3 percen slopes	22.4	0.0%
BzA	Buchenau loam, 0 to 3 percent slopes	249.2	0.0%
CaA	Cajon loamy sand, 0 to 1 percent slopes	1,919.4	0.2%
CaaA	Cajon loamy sand, slightly saline-alkali, 0 to 1 percent slopes	2,674.6	0.3%
CabA	Cajon loamy sand, moderately saline-alkali, 0 to 1 percent slopes	197.5	0.0%
CacA	Cajon loamy sand, strongly saline-alkali, 0 to 1 percent slopes	490.9	0.1%
CbaB	Calhi loamy sand, slightly alkali, 0 to 8 percent slopes	938.5	0.1%
CbbB	Calhi loamy sand, moderately alkali, 0 to 8 percent slopes	1,046.0	0.1%
CcaA	Calhi loamy sand, moderately deep and deep over silt, slightly saline-alkali, 0 to 3 percent slopes	110.7	0.0%
CcaB	Calhi loamy sand, moderately deep and deep over silt, slightly saline-alkali, 3 to 8 percent slopes	104.5	0.0%
CcbA	Calhi loamy sand, moderately deep and deep over silt, moderatel saline-alkali, 0 to 3 percent slopes	239.1	0.0%
CcbB	Calhi loamy sand, moderately deep and deep over silt, moderatel saline-alkali, 3 to 8 percent slopes	158.3	0.0%
CccA	Calhi loamy sand, moderately deep and deep over silt, strongly saline-alkali, 0 to 3 percent slopes	130.8	0.0%
CdaA	Calhi loamy sand, shallow over hardpan variant, moderately saline-alkali, 0 to 1 percent slopes	622.1	0.1%
CeA	Chino clay loam, 0 to 1 percent slopes	338.7	0.0%
CeaA	Chino clay loam, slightly saline-alkali, 0 to 1 percent slopes	2,271.5	0.3%
CebA	Chino clay loam, moderately saline-alkali, 0 to 1 percent slope	407.3	0.0%
CfA	Chino fine sandy loam, 0 to 1 percent slopes	2,149.6	0.2%
CfaA	Chino fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	5,385.2	0.6%
CfbA	Chino fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	52.4	0.0%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CgA	Chino loam, 0 to 1 percent slopes	500.8	0.1%
CgaA	Chino loam, slightly saline-alkali, 0 to 1 percent slopes	5,142.4	0.6%
CgbA	Chino loam, moderately saline-alkali, 0 to 1 percent slopes	544.3	0.1%
CgcA	Chino loam, strongly saline-alkali, 0 to 1 percent slopes	47.9	0.0%
ChD	Coarsegold loam, 8 to 30 percent slopes	3,787.5	0.4%
ChF	Coarsegold loam, 45 to 75 percent slopes	28,135.1	3.3%
CkD	Coarsegold rocky loam, 15 to 30 percent slopes	1,432.3	0.2%
CkF	Coarsegold rocky loam, 30 to 75 percent slopes	2,611.1	0.3%
CmA	Columbia fine sandy loam, 0 to 1 percent slopes	1,007.6	0.1%
CmdA	Columbia fine sandy loam, moderately deep and deep over hardpan 0 to 1 percent slopes	492.8	0.1%
CmtA	Columbia fine sandy loam, moderately deep and deep over temple soils, 0 to 1 percent slopes	1,334.5	0.2%
CoA	Columbia loamy sand, 0 to 1 percent slopes	211.7	0.0%
CotA	Columbia loamy sand, over temple soils, 0 to 1 percent slopes	196.8	0.0%
CpA	Columbia sandy loam, 0 to 1 percent slopes	26.2	0.0%
CpdA	Columbia sandy loam, moderately deep over sand, 0 to 1 percent slopes	72.6	0.0%
CrB	Columbia soils, channeled, 0 to 8 percent slopes	153.9	0.0%
CsB	Cometa gravelly sandy loam, 3 to 8 percent slopes	1,675.4	0.2%
CtB	Cometa loam, 3 to 8 percent slopes	930.1	0.1%
CuA	Cometa sandy loams, 0 to 3 percent slopes	481.9	0.1%
CuB	Cometa sandy loams, 3 to 8 percent slopes	36,227.8	4.2%
CuC	Cometa sandy loams, 8 to 15 percent slopes	6,230.0	0.7%
CwB	Cometa-Whitney sandy loams, 3 to 8 percent slopes	2,075.3	0.2%
CwC	Cometa-Whitney sandy loams, 8 to 15 percent slopes	1,152.1	0.1%
CyA	Corning gravelly loam, 0 to 3 percent slopes	136.7	0.0%
CyB	Corning gravelly loam, 3 to 8 percent slopes	207.2	0.0%
DaB	Daulton fine sandy loam, 3 to 8 percent slopes	457.3	0.1%
DaD	Daulton fine sandy loam, 8 to 30 percent slopes	12,559.1	1.5%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaE	Daulton fine sandy loam, 30 to 45 percent slopes	1,020.6	0.1%
DAM	Dams	48.6	0.0%
DbD	Daulton loam, 8 to 30 percent slopes	10,698.8	1.2%
DcB	Daulton rocky fine sandy loam, 3 to 8 percent slopes	130.2	0.0%
DcE	Daulton rocky fine sandy loam, 30 to 45 percent slopes	4,340.1	0.5%
DeA	Delhi sand, 0 to 3 percent slopes	678.7	0.1%
DeB	Delhi sand, 3 to 8 percent slopes	426.7	0.0%
DfA	Delhi sand, moderately deep and deep over hardpan, 0 to 3 percent slopes	632.8	0.1%
DmA	Dinuba fine sandy loam, 0 to 1 percent slopes	1,806.9	0.2%
DoA	Dinuba loam, 0 to 1 percent slopes	98.9	0.0%
DpA	Dinuba-El Peco fine sandy loams, slightly saline alkali, 0 to 1 percent slopes	7,125.6	0.8%
DsA	Dinuba-El Peco fine sandy loams, moderately saline alkali, 0 to 1 percent slopes	3,379.8	0.4%
DtA	Dinuba-El Peco loams, slightly saline alkali, 0 to 1 percent slopes	168.5	0.0%
DuA	Dinuba-El Peco loams, moderately saline alkali, 0 to 1 percent slopes	127.3	0.0%
EdA	El Peco-Dinuba fine sandy loams, strongly saline alkali, 0 to 1 percent slopes	7,297.7	0.8%
FaA	Foster clay loam, 0 to 1 percent slopes	333.0	0.0%
FaaA	Foster clay loam, slightly saline-alkali, 0 to 1 percent slopes	923.8	0.1%
FabA	Foster clay loam, moderately saline-alkali, 0 to 1 percent slopes	318.6	0.0%
FacA	Foster clay loam, strongly saline-alkali, 0 to 1 percent slopes	150.3	0.0%
FbA	Foster loams, 0 to 1 percent slopes	1,747.1	0.2%
FbaA	Foster loams, slightly saline-Alkali, 0 to 1 percent slopes	328.9	0.0%
FbbA	Foster loams, moderately saline-Alkali, 0 to 1 percent slopes	470.2	0.1%
FbcA	Foster loams, strongly saline-Alkali, 0 to 1 percent slopes	336.0	0.0%
FbdA	Foster loams, sandy substratum, 0 to 1 percent slopes	20.1	0.0%
FbeA	Foster loams, moderately deep and deep over temple soils, 0 to percent slopes	299.5	0.0%
FcbA	Foster loams, moderately deep and deep over temple soils, moderately saline-Alkali, 0 to 1 percent slopes	38.4	0.0%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FdcA	Foster-Chino loams, strongly saline alkali, 0 to 1 percent slopes	642.4	0.1%
FeaA	Fresno and El Peco fine sandy loams, slightly saline-alkali, 0 to 1 percent slopes	4,516.0	0.5%
FebA	Fresno and El Peco fine sandy loams, moderately saline-alkali, to 1 percent slopes	5,636.8	0.7%
FecA	Fresno and El Peco fine sandy loams, strongly saline-alkali, 0 to 1 percent slopes	30,835.7	3.6%
FfaA	Fresno and El Peco loams, slightly saline-alkali, 0 to 1 percen slopes	3,786.2	0.4%
FfbA	Fresno and El Peco loams, moderately saline-alkali, 0 to 1 percent slopes	5,165.4	0.6%
FfcA	Fresno and El Peco loams, strongly saline-alkali, 0 to 1 percen slopes	6,765.1	0.8%
FgaA	Fresno, El Peco, and Chino soils, slightly saline-alkali, 0 to percent slopes	2,554.8	0.3%
FgbA	Fresno, El Peco, and Chino soils, moderately saline-alkali, 0 t 1 percent slopes	377.0	0.0%
FhbA	Fresno, El Peco, and Lewis soils, moderately saline-alkali, 0 t 1 percent slopes	5,003.9	0.6%
FhcA	Fresno, El Peco, and Lewis soils, strongly saline-alkali, 0 to 1 percent slopes	537.0	0.1%
FkaA	Fresno, El Peco, and Pozo soils, slightly saline-alkali, 0 to 1 percent slopes	692.6	0.1%
FkbA	Fresno, El Peco, and Pozo soils, moderately saline-alkali, 0 to 1 percent slopes	481.9	0.1%
GaA	Grangeville fine sandy loam, 0 to 1 percent slopes	12,300.5	1.4%
GbA	Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	4,540.7	0.5%
GcA	Grangeville fine sandy loam, over traver soils, 0 to 1 percent slopes	11,513.3	1.3%
GdA	Grangeville fine sandy loam, over traver soils, slightly saline alkali, 0 to 1 percent slopes	1,812.7	0.2%
GeA	Grangeville fine sandy loam, moderately deep and deep over temple soils, 0 to 1 percent slopes	500.9	0.1%
GfA	Grangeville fine sandy loam, deep over hardpan, 0 to 1 percent slopes	914.4	0.1%
GhA	Grangeville fine sandy loam, deep over alkali hardpan, 0 to 1 percent slopes	1,268.7	0.1%
GkA	Grangeville fine sandy loam, deep over alkali hardpan, slightly saline-alkali, 0 to 1 percent slopes	556.5	0.1%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GmA	Grangeville sandy loam, 0 to 1 percent slopes	1,048.4	0.1%
GnA	Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes	777.9	0.1%
Gp	Gravel pits	156.8	0.0%
GrA	Greenfield coarse sandy loam, 0 to 3 percent slopes	3,506.9	0.4%
GrB	Greenfield coarse sandy loam, 3 to 8 percent slopes	384.3	0.0%
GsA	Greenfield fine sandy loam, 0 to 3 percent slopes	3,169.8	0.4%
GsB	Greenfield fine sandy loam, 3 to 8 percent slopes	45.4	0.0%
GuA	Greenfield sandy loam, 0 to 3 percent slopes	735.1	0.1%
GuB	Greenfield sandy loam, 3 to 8 percent slopes	737.5	0.1%
GvA	Greenfield sandy loam, moderately deep and deep over hardpan, 0 to 3 percent slopes	1,225.8	0.1%
GvB	Greenfield sandy loam, moderately deep and deep over hardpan, 3 to 8 percent slopes	854.1	0.1%
HaA	Hanford fine sandy loam, 0 to 1 percent slopes	7,470.2	0.9%
HbA	Hanford fine sandy loam, moderately deep and deep over hardpan, 0 to 1 percent slopes	3,352.8	0.4%
HcA	Hanford (ripperdan) fine sandy loam, shallow varient, 0 to 3 percent slopes	143.9	0.0%
HdA	Hanford (ripperdan) fine sandy loam, moderately deep and deep over silt, 0 to 3 percent slopes	20,007.2	2.3%
HeB	Hanford gravelly sandy loam, 3 to 8 percent slopes	625.5	0.1%
HfA	Hanford sandy loam, 0 to 3 percent slopes	3,368.5	0.4%
HgA	Hanford sandy loam, moderately deep and deep over hardpan, 0 to 3 percent slopes	2,262.3	0.3%
HhA	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes	420.6	0.0%
HkB	Hideaway very stony loam, 0 to 8 percent slopes	1,136.2	0.1%
HkD	Hideaway very stony loam, 15 to 30 percent slopes	175.7	0.0%
HmA	Hildreth sandy clay, 0 to 3 percent slopes	1,691.9	0.2%
HnB	Hildreth-San Joaquin complex, 0 to 8 percent slopes	252.3	0.0%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HoD	Holland sandy loam, 15 to 30 percent slopes	6,149.2	0.7%
HoE	Holland sandy loam, 30 to 45 percent slopes	6,873.5	0.8%
HrE	Holland rocky sandy loam, 30 to 45 percent slopes	3,974.7	0.5%
HsB	Hornitos gravelly sandy loam, 3 to 8 percent slopes	509.2	0.1%
HsD	Hornitos gravelly sandy loam, 8 to 30 percent slopes	404.1	0.0%
HvD	Hornitos very rocky sandy loam, 8 to 30 percent slopes	1,691.5	0.2%
JeA	Jesbel clay, 0 to 3 percent slopes	80.8	0.0%
JgB	Jesbel gravelly clay, 3 to 8 percent slopes	26.2	0.0%
JyA	Jesbel gravelly clay loam, 0 to 3 percent slopes	176.0	0.0%
LeA	Lewis loam, slightly saline-alkali, 0 to 1 percent slopes	958.5	0.1%
LwA	Lewis loam, moderately saline-alkali, 0 to 1 percent slopes	796.5	0.1%
MaA	Madera fine sandy loam, 0 to 3 percent slopes	14,002.4	1.6%
MbA	Madera loam, 0 to 3 percent slopes	2,746.7	0.3%
McA	Madera-Alamo complex, 0 to 1 percent slopes	295.4	0.0%
MdA	Madera-Lewis complex, slightly saline alkali, 0 to 1 percent slopes	1,417.8	0.2%
MmA	Marguerite clay loam, 0 to 3 percent slopes	242.2	0.0%
MnA	Marguerite clay loam, moderately saline-alkali, 0 to 3 percent slopes	24.3	0.0%
MoA	Marguerita loam, 0 to 3 percent slopes	605.8	0.1%
MrA	Marguerite loam, slightly saline-alkali, 0 to 3 percent slopes	8.8	0.0%
MsA	Marguerite loam, moderately saline-alkali, 0 to 3 percent slope	78.4	0.0%
MtB	Montpellier coarse sandy loam, 3 to 8 percent slopes	572.0	0.1%
MtC	Montpellier coarse sandy loam, 8 to 15 percent slopes	1,487.4	0.2%
PaA	Pachappa fine sandy loam, 0 to 1 percent slopes	7,831.1	0.9%
PbA	Pachappa fine sandy loam, slightly saline-alkali, 0 to 1 percen slopes	8,503.6	1.0%
PcA	Pachappa sandy loam, 0 to 1 percent slopes	719.1	0.1%
PdA	Pachappa sandy loam, slightly saline-alkali, 0 to 1 percent slopes	4,185.1	0.5%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PeA	Pachappa sandy loam, moderately deep and deep over hardpan, slightly saline-alkali, 0 to 1 percent slopes	388.4	0.0%
PfA	Porterville clay, 0 to 3 percent slopes	321.0	0.0%
PfB	Porterville clay, 3 to 8 percent slopes	592.8	0.1%
PgB	Porterville rocky clay, 3 to 8 percent slopes	171.2	0.0%
PhA	Pozo clay loam, 0 to 1 percent slopes	968.1	0.1%
PkA	Pozo clay loam, slightly saline, 0 to 1 percent slopes	1,059.6	0.1%
PmA	Pozo clay loam, moderately saline, 0 to 1 percent slopes	206.0	0.0%
PnA	Pozo clay loam, strongly saline, 0 to 1 percent slopes	113.2	0.0%
PoA	Pozo loam, 0 to 1 percent slopes	2,511.2	0.3%
PsA	Pozo loam, slightly saline, 0 to 1 percent slopes	5,744.8	0.7%
PtA	Pozo loam, moderately saline, 0 to 1 percent slopes	2,975.8	0.3%
PvA	Pozo loam, strongly saline, 0 to 1 percent slopes	1,611.6	0.2%
RaA	Ramona sandy loam, 0 to 3 percent slopes	13,221.0	1.5%
RaB	Ramona sandy loam, 3 to 8 percent slopes	730.2	0.1%
RbA	Ramona sandy loam, deep over hardpan, 0 to 3 percent slopes	429.8	0.0%
RcA	Raynor clay, 0 to 3 percent slopes	207.6	0.0%
RcB	Raynor clay, 3 to 8 percent slopes	1,213.4	0.1%
RdA	Redding gravelly loam, 0 to 3 percent slopes	929.1	0.1%
RdC	Redding gravelly loam, 3 to 15 percent slopes	1,705.3	0.2%
RfC	Redding gravelly sandy loam, 3 to 15 percent slopes	1,006.9	0.1%
RgC	Redding-Raynor complex, 3 to 15 percent slopes	1,735.6	0.2%
Rh	Riverwash	3,762.5	0.4%
Rk	Rockland, hornitos soil material	236.4	0.0%
RmB	Rocklin rocky sandy loam, pumiceous variant, 3 to 8 percent slopes	38.0	0.0%
RmD	Rocklin rocky sandy loam, pumiceous varient, 8 to 30 percent slopes	574.8	0.1%
RoA	Rossi clay loam, slightly saline-alkali, 0 to 1 percent slopes	1,006.2	0.1%
RpA	Rossi clay loam, strongly saline-alkali, 0 to 1 percent slopes	193.4	0.0%
RrA	Rossi silt loam, slightly saline-alkali, 0 to 1 percent slopes	356.1	0.0%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
RsA	Rossi silt loam, moderately saline-alkali, 0 to 1 percent slope	571.2	0.1%
RtA	Rossi silt loam, strongly saline-alkali, 0 to 1 percent slopes	640.3	0.1%
SaA	San Joaquin sandy loams, 0 to 3 percent slopes	60,567.2	7.0%
SbA	San Joaquin-Alamo complex, 0 to 3 percent slopes	1,092.8	0.1%
ScB	San Joaquin-Whitney sandy loams, 0 to 8 percent slopes	393.8	0.0%
SeB	Sesame loam, 3 to 8 percent slopes	297.1	0.0%
SeC	Sesame loam, 8 to 15 percent slopes	69.9	0.0%
SkC	Sesame rocky loam, 8 to 15 percent slopes	101.5	0.0%
SnB	Sesame rocky sandy loam, 3 to 8 percent slopes	43.8	0.0%
SyB	Sesame sandy loam, 3 to 8 percent slopes	1,086.3	0.1%
TaA	Temple clay, 0 to 1 percent slopes	265.0	0.0%
TbA	Temple clay loam, 0 to 1 percent slopes	999.1	0.1%
TcA	Temple clay loam, slightly saline, 0 to 1 percent slopes	629.3	0.1%
TdA	Temple loam, 0 to 1 percent slopes	44.1	0.0%
TeA	Temple loam, slightly saline, 0 to 1 percent slopes	117.6	0.0%
Tf	Terrace escarpments	372.0	0.0%
TgF	Tollhouse rocky coarse sandy loam, 30 to 75 percent slopes	3,132.8	0.4%
ThE	Trabuco loam, 15 to 45 percent slopes	463.0	0.1%
TkC	Trabuco rocky loam, 8 to 15 percent slopes	176.6	0.0%
TkF	Trabuco rocky loam, 45 to 75 percent slopes	1,526.7	0.2%
TmA	Traver loam, slightly saline-alkali, 0 to 1 percent slopes	6,983.2	0.8%
TnA	Traver loam, moderately saline alkali, 0 to 1 percent slopes	8,229.4	1.0%
ToA	Traver loam, strongly saline-alkali, 0 to 1 percent slopes	7,267.0	0.8%
TpA	Traver-Chino complex, slightly saline alkali, 0 to 1 percent slopes	1,193.1	0.1%
TrA	Traver-Chino complex, moderately saline alkali, 0 to 1 percent slopes	2,211.7	0.3%
TsA	Traver, Fresno, and El Peco fine sandy loams, moderately saline alkali, 0 to 1 percent slopes	212.3	0.0%
TtA	Traver, fresno, el peco fine sandy loams, strongly saline-alkal , 0 to 1 percent slopes	178.5	0.0%

Madera Area, California (CA651)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
TuB	Trigo fine sandy loam, 3 to 8 percent slopes	1,716.0	0.2%
TuC	Trigo fine sandy loam, 8 to 15 percent slopes	552.9	0.1%
TvB	Trigo-Cometa sandy loams, 3 to 8 percent slopes	599.1	0.1%
TwA	Tujunga loamy sand, 0 to 3 percent slopes	20,631.9	2.4%
TwB	Tujunga loamy sand, 3 to 8 percent slopes	243.9	0.0%
TxA	Tujunga loamy sand, moderately deep and deep over hardpan, 0 to 3 percent slopes	639.8	0.1%
TyA	Tujunga loamy sand, moderately deep and deep over silt, 0 to 3 percent slopes	91.6	0.0%
TzB	Tujunga and Hanford soils, channeled, 0 to 8 percent slopes	2,660.9	0.3%
URB	Towns (not surveyed)	1,741.5	0.2%
VaA	Visalia fine sandy loam, 0 to 1 percent slopes	4,846.7	0.6%
VdA	Visalia sandy loam, 0 to 3 percent slopes	2,152.3	0.2%
VnA	Visalia sandy loam, moderately deep over sand, 0 to 3 percent slopes	316.9	0.0%
VsB	Vista-Sesame complex, 3 to 8 percent slopes	921.0	0.1%
W	Water	10,764.4	1.2%
WaB	Whiterock rocky fine sandy loam, 3 to 8 percent slopes	55.7	0.0%
WaE	Whiterock rocky fine sandy loam, 30 to 45 percent slopes	133.4	0.0%
WbD	Whiterock very rocky fine sandy loam, 8 to 30 percent slopes	460.7	0.1%
WfB	Whitney fine sandy loam, 3 to 8 percent slopes	7,093.0	0.8%
WfC	Whitney fine sandy loam, 8 to 15 percent slopes	1,030.5	0.1%
WmA	Whitney loam, 0 to 3 percent slopes	54.6	0.0%
WmB	Whitney loam, 3 to 8 percent slopes	86.7	0.0%
WmC	Whitney loam, 8 to 15 percent slopes	18.9	0.0%
WnD	Whitney sandy loam, 15 to 30 percent slopes, eroded	712.8	0.1%
WoC	Whitney and Rocklin gravelly sandy loams, 3 to 15 percent slope	462.8	0.1%
WrB	Whitney and Rocklin sandy loams, 3 to 8 percent slopes	6,131.1	0.7%
WrC	Whitney and Rocklin sandy loams, 8 to 15 percent slopes	5,286.6	0.6%
WtB	Whitney-Trigo fine sandy loams, 3 to 8 percent slopes	5,108.3	0.6%

Madera Area, California (CA651)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
WuA	Wunjey very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	555.2	0.1%
WvA	Wunjey very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	594.9	0.1%
WxA	Wunjey very fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	876.5	0.1%
WyB	Wunjey very fine sandy loam, strongly saline-alkali, channeled, 1 to 8 percent slopes	374.0	0.0%
ZaB	Zaca clay, 3 to 8 percent slopes	638.9	0.1%
Totals for Area of Interest		**861,651.4**	**100.0%**

Attachment C

District Rules and Regulations

CHOWCHILLA WATER DISTRICT
RULES AND REGULATIONS
GOVERNING WATER DELIVERY

RULE 1: CONTRACTS WITH THE UNITED STATES

1.01 All water distributed by the District pursuant to contracts between the United Stated and the District shall be subject to the restrictions, terms and conditions of said contracts and applicable Reclamation Law.

1.02 Copies of said contracts are on file and available for reference at the District Office and the provisions therein pertaining to use and distribution of, and payment for, water are incorporated as a part of these rules and regulations.

RULE 2: OPERATION AND CONTROL OF DISTRICT FACILITIES

2.01 All diversion works, canals, ditches, headgates and other facilities belonging to the District will be operated and maintained by the District. The control and operation will be conducted by only authorized agents of the District.

RULE 3: ACCESS TO LANDS

3.01 As provided by Section 35404 of the California Water Code, the "District may enter for the purposes of the District upon any land." Generally, this right of entry will be restricted to entry for the purpose of operation and maintenance of district facilities, determination of cropping patterns, control of District water deliveries and well measurements where authorized by a landowner.

3.02 If the District holds a right-of-way or easement across private land for the operation of a canal or other facility, the law provides that the District has, and the District shall exercise certain secondary rights and easements, such as the right-of-way or easement to make repairs and do such other things as are necessary for the full exercise of the easement rights.

RULE 4: ALLOCATION OF WATER AND SCHEDULING OF WATER YEAR:

4.01 The Directors of the District will evaluate available water forecasts and annually determine the date when District water deliveries will begin. Determination of a beginning date shall take into account crop water demands and maximization of delivery efficiencies. If forecasts indicate water will be available throughout the year, deliveries will be scheduled to begin on or about the first of March and continue till late fall. When forecasts indicate water will not

be available throughout the year, the period of mid-June thru mid-August will be given priority when scheduling water for delivery.

4.02 When in the opinion of the District, water demands exceed the design or actual capacity of the distribution system or the supply or water, the district reserves the right to rotate the use of water by basic time and quantity method.

RULE 5: APPLICATIONS FOR WATER SERVICE

5.01 Applications for crop water will not be accepted until all delinquent assessments, custom bills and crop water charges have been paid and Reclamation Law requirements have been satisfied.

5.02 All applications shall state the property description or parcel number, acreage to be served and acreage of crops to be grown thereupon.

5.03 Parcels of land consisting of less than five (5) acres may be billed on a Flat Rate Basis as determined by the District. In the event of excessive use by a Flat Rate User, the District reserves the right to levy an additional charge for such excessive use. Tenant growers falling under flat rate criteria shall be required to make payment in full prior to delivery of water. Landowners will be billed in one installment due and payable per District Credit Policy.

RULE 6: WATER DELIVERIES

6.01 Water orders will not be accepted for properties or growers with delinquent assessments or water charges.

6.02 All water orders shall be placed through the District Office, phone 665-3747 between the hours of 8:00 a.m. and 5:00 p.m.

6.03 Orders for water, change of quantity, or shutoff orders may be placed on any day of the week.

6.04 Orders received before 1:00 p.m. will be eligible to begin delivery the following day. Orders received after 1:00 p.m. will be considered as having been received the following day.

6.05 Preliminary notice of shutoff must be made before 1:00 p.m. on the preceding day. Waterusers should attempt to make their preliminary notice within two hours of the actual shutoff time. Orders for shutoff received after 1:00 p.m. may result in appropriate action by the Board of Directors to prevent unnecessary cost to the rest of the constituents of the District.

6.06 Following the preliminary notice, specific notice of shutoff must be made between 6:00 a.m. and 8:00 a.m. on the day of the shut off. If the water user has not notified the District of

the specific time that the delivery will be shutoff by 8:00 a.m., the preliminary notice time will serve as the specific notice time.

6.07 Water users will be notified between 3:00 p.m. and 5:00 p.m. if they will receive water on the following day. A preliminary notice of starting time will be given at that time. After several unsuccessful attempts to notify a wateruser are made, the water order listing will be consulted and the next wateruser on the list will be called.

6.08 Between 7:00 a.m. and 9:00 a.m., water users will be given specific notice of the time to start their delivery.

6.09 Orders will not be accepted for deliveries scheduled for more than three days in advance.

6.10 Orders must identify canal, turnout number, earliest time delivery can be taken, quantity desired and estimated shutoff time.

6.11 Unauthorized adjustment of a turnout or the check structure serving a turnout may result in appropriate action by the Board of Directors to prevent unnecessary cost to the rest of the constituents of the District. Unauthorized adjustment includes, but is not limited to, opening or closing a delivery gate without authorization or at an unauthorized time, starting or stopping a canal lift pump without authorization or at an unauthorized time.

6.12 Water users may request authorization to adjust the turnout from their ditchtender. Authorization will be granted on a case by case basis.

6.13 Water must be used continuously until the irrigation is completed.

6.14 Water users terminating deliveries on weekends and requesting water on the same parcel again on Monday will be charged on a continuous service basis as though water delivery had not been interrupted.

6.15 A minimum flow of one cfs (450 gpm) may be imposed at any delivery point when the District deems necessary.

6.16 All deliveries through head gate structures shall be controlled by the ditchtender, who may lock these gates open or closed. The ditchtender is to be notified to request any changes.

6.17 The District reserves the right to refuse service when an unreasonably large or small quantity of water is ordered.

RULE 7: WASTE OF WATER

7.01 The District reserves the right to refuse or terminate delivery of water to any lands when the proposed use, method of use or irrigation practice require such excessive quantities of water as will constitute waste.

7.02 Users wasting water, either willfully, carelessly or because or defective or inadequate on-farm facilities, or inadequate preparation of the land for irrigation shall be subject to immediate termination of service and refusal of future service until such conditions are remedied.

7.03 Waste pollution or other improper use of water shall be reported to the appropriate District authorities.

RULE 8: IRRIGATION OF EXCESSIVELY HIGH GROUND

8.01 The District shall not be required to raise water to an excessive height in canals or ditches to provide service to lands or ditches of excessive elevations. Such excessive elevation shall be determined by the particular conditions which could jeopardize District ditches and interfere with water user's service below or above said diversions.

RULE 9: PUMPING RULES

9.01 Users shall be responsible for keeping turnouts free of trash and debris to insure full flow of water to their lift pumps.

9.02 The District will not be held responsible for any debris which may accumulate in stream flow which may tend to decrease the full operative capacity of pumps or pipelines nor will the District be held responsible for any damage which may occur to pumping equipment from accumulated debris in District Canals.

RULE 10: OBSTRUCTIONS OF CANALS, USE OF CANALS AND RIGHTS-OF-WAY, AND TAMPERING WITH AND DAMAGE TO DISTRICT FACILITIES.

10.01 No fences shall be built, trees planted or structures placed on any right-of-way or other property of the District without a District encroachment permit.

10.02 Trash, rubbish, debris, fences and crops, including vines or trees, shall be deemed to be an obstruction and upon notification from the District, the user shall immediately remove said obstruction. If the obstruction is not removed within a reasonable time, as determined by the District, the District will remove the obstruction and bill the user for any costs incurred by the District.

10.03 The user shall be responsible for keeping turnouts free of trash and debris to insure adequate water delivery.

10.04 The District will not be responsible for any damage to machinery, equipment or motor vehicles which are either operated or stored on District rights-of-way. (See Rule 12 for Encroachment Permits.)

10.05 Any user or his authorized agent or employee who may use the right-of-way or other property of the District does so at his own risk and any person using any canal right-of-way for any purposes assumes all risk of doing so and by use accepts responsibility for any damage to District property resulting therefrom, and for any damage to private property caused by such damage to District property.

10.07 Under no circumstances shall any person modify any District facility. If such modifications are made, the District shall remove the installation and bill the responsible party for any cost incurred.

RULE 11: TAMPERING WITH WATER CONTROLS

11.01 No person who is not an employee of the District shall change, alter or disturb any valve, gate, weir boards, pump or other device used by the District to control the flow of the water. Violation of this rule is a criminal act punishable by fine or imprisonment, or both.

11.02 Section 592 of the Penal Code of the State of California provides as follows: Canals, ditches, flumes, or reservoirs. "Every person who shall without authority of the owner or managing agent, and with intent to defraud, take water from any canal, ditch, flume, or reservoir used for the purpose of holding or conveying water for manufacturing, agriculture, mining, irrigating, generation of power, or domestic uses is guilty of a misdemeanor."

RULE 12: ENCROACHMENTS ON DISTRICT'S RIGHTS-OF-WAY AND PROPERTY, EXCLUDING DRAINS:

12.01 A permit will be required before crossings, fences, structures, access use or other encroachments will be permitted to be used or installed upon the District's rights-of-way. Application for encroachment must be made at the District Office after payment of the applicable filing fee. Encroachment permits issued for the purpose of access shall be subject to the terms and conditions of the agreement under which the subject right-of-way was transferred to the District.

12.02 All encroachments must be approved by the General Manager and if works are required, they shall be constructed to the District's specifications at the sole expense of the applicant and maintained under the supervision and to the satisfaction of the District. No encroachments for trees will be approved.

12.03 If a permit is granted, the applicant shall be solely responsible for and shall indemnify and hold the District harmless from any and all liability for injuries to persons or damage to property caused or resulting in any manner from the applicant's exercise of the rights and privileges given in the Encroachment Permit.

12.04 All encroachment permits are subject to the conditions and specifications delineated on each individual permit.

12.05 Issuance of an Encroachment Permit in no way grants a permanent right, and if the District determines at a future date that said works do in fact interfere with its operation, the said works shall be removed, and the District's ditch or other right-of-way restored to its original state at the sole expense of the applicant.

12.06 Granting a permit does in no way and to no extent surrender or subordinate the District's control or supervision over the encroachment and rights-of-way involved.

12.07 Existing encroachments for which there are no written permits are subject to all of the above conditions. Failure to comply with District instructions shall constitute grounds for removal of said encroachment. Costs of required removal shall be billed to the owner thereof.

RULE 13: DRAINAGE ENCROACHMENTS

13.01 Encroachment Permits for drainage to District Canals shall be required for all discharges of water into the District's irrigation water distribution system.

13.02 Discharge of tailwater into the District's irrigation water distribution system will not be allowed when the District is delivering water to water users.

13.03 Discharge of backflush water containing fertilizer or pesticides into the District's irrigation water distribution system will not be allowed.

13.04

13.02 Existing drainage encroachments, except for those for which written contractual agreements exist, will be removed at the landowner's expense on or before March 1, 1993: however, the District reserves the right to require immediate removal of any drainage encroachments causing operational, maintenance or water quality problems to the District's distribution system.

13.04 Existing encroachments consisting of drains to District facilities shall have screens installed at the inlet of said drain so as prevent passage of material greater in size than one half inch in diameter. Screens shall be cleaned periodically to prevent buildup and introduction of foreign material into the District Facilities. Following notification of the requirement of installation of a screen, growers shall have fifteen days to install said screen. Failure to install within the fifteen day period shall result in removal of the drain by the District without further notice and the landowner will be billed for the expense thereof.

13.05 Existing drainage encroachments shall be under the control and supervision of the District and failure to comply with District instructions regarding operation of same shall constitute grounds for removal at the owner's expense.

RULE 14: LIABILITY FOR DAMAGES

14.01 Any claim for damages resulting from the District's acts or omissions of its employees requires that a verified claim giving full particulars on date, occurrence, at the District office. Claim forms are available at the District office.

14.02 No suit shall be brought against the District for monetary damages unless a claim is presented and acted upon.

RULE 15: WATER CHARGES AND DISTRICT CREDIT POLICY

15.01 Charge for water shall be payable at the District Office, mailing address P.O. Box 905, (327 South Chowchilla Boulevard), Chowchilla, 93610 in accordance with the current District Credit Policy as announced by the District prior to each water season.

15.02 Water charges shall be determined on an annual basis and announced prior to the water season.

15.03 Charges for water shall be payable at the District Office, mailing address P.O. Box 905, (327 South Chowchilla Boulevard), Chowchilla, California 93610 in accordance with the current Credit Policy:

RULE 16: DISCHARGE OF DAIRY WASTE

Discharge of dairy wastewater into the District's irrigation water distribution system is prohibited. Landowners are required to take appropriate action to install backflow prevention devices immediately downstream of District turnouts to eliminate the possibility of dairy wastewater back flowing into the District's irrigation water distribution system. This requirement applies to any farm irrigation system that transports dairy wastewater and is connected to a District turnout. The deadline for installing anti-backflow devices is March 1, 2002. If anti-backflow devices are not installed on effected irrigation systems by March 1, 2002, the District may take action to prevent dairy wastewater from back flowing into the District's canal and pipeline system. Landowners will be responsible for reimbursing the District for costs it incurs in doing so. Following are two possible configurations to prevent backflow:

1 Install lift pump with air gap between pump discharge and farm irrigation system.

2 Install line gate immediately downstream of District turnout.

Option (1) eliminates any possibility of backflow. Option (2) reduces the possibility of backflow but does not eliminate it. Landowners may install other configurations, but should consult with the District prior to their installation. If a landowner installs option (2) or another configuration and it is determined that backflow is still occurring the District will require that option (1) be installed.

RULE 16: PENALTY FOR NON-COMPLIANCE

16.01 Refusal to comply with the requirements hereof or transgression of any of the foregoing Rules and Regulations may be sufficient cause for termination of District services until full compliance has been made and reimbursement of any monetary loss to the District and/or private property owners has occurred.

16.02 All of these Rules and Regulations are subject to change as deemed by the Board of Directors.

Attachment D

District Sample Bills

CHOWCHILLA WATER DISTRICT

Post Office Box 905 -- 327 S. Chowchilla Blvd.
Chowchilla, CA 93610
(559) 665-3747

JULY WATER ACCOUNT STATEMENT

DATE	ACTIVITY	OUTLET	ACRE FEET	RATE	AMOUNT
07/02/2002	Previous Balance				3,120.00
07/12/2002	Payment				-3,120.00
08/01/2002	July 2002 Crop Water	Berenda Canal	19.29	40.00	771.60
08/01/2002	July 2002 Crop Water	Bethel Canal	29.43	40.00	1,177.20
08/01/2002	July 2002 Crop Water	Berenda Canal	40.18	40.00	1,607.20
08/01/2002	July 2002 Crop Water	Road Eleven Canal	55.27	40.00	2,210.80
		TOTAL	144.17		5,766.80

TOTAL ACRE FEET
USED TO DATE
222.17

PAYMENT DUE ON OR BEFORE AUGUST 25, 2002

TOTAL ALL OUTLETS $5,766.80

DELINQUENT ACCOUNTS WILL BE CHARGED AN INTEREST RATE OF 1.5% PER MONTH

PLEASE DETACH AND RETURN THIS PORTION

REMIT TO:
Chowchilla Water District
P.O. Box 905
Chowchilla, CA 93610

Attachment E

District Water Shortage Plan

Chowchilla Water District Water Shortage Plan

The water supply available to the District is extremely variable. In wet years as much as 121,000 acre-feet (1.9 acre-foot per acre) is available for delivery to the 65,000 of irrigated land in the District. In average years the water supply is about 68,000 acre-feet (1.1 acre-foot per acre). In critically dry years the water supply is less than 8,000 acre-feet (0.12 acre-foot per acre). Waterusers in the District must have a private deep well in order to supplement surface water available from the District.

Water supply forecasts are reviewed to determine the date when District water deliveries begins. Determination of a beginning date takes into account crop water demands and maximization of delivery efficiencies. If forecasts indicate water will be available throughout the year, deliveries are scheduled to begin on or about the first of March and continue until late fall. When forecasts indicate water will not be available throughout the year, the period of mid-June thru mid-August is given priority when scheduling water for delivery. When in the opinion of the District, water demands exceed the design or actual capacity of the distribution system or the supply of water, the district reserves the right to rotate the use of water by basic time and quantity method in order to deliver approximately equal amounts of water in acre-feet per acre to each water user requesting water deliveries.

Attachment F

District Map of Groundwater Facilities

Not Applicable

Attachment G

Groundwater Management Plan

CWD-RED TOP RCD
JOINT POWERS AUTHORITY

Groundwater Management Plan

In accordance with AB 3030

1997

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SECTION 1
INTRODUCTION

1.1 Groundwater Management Act

Groundwater is relied upon to meet water supply requirements in many areas throughout the state. In some locations, excessive use of groundwater has led to groundwater overdraft, land subsidence and groundwater quality degradation. For these reasons, the California State Legislature has declared groundwater a valuable natural resource, and has determined groundwater should be managed to ensure both its safe production and its quality. The Groundwater Management Act (AB 3030) was passed by the State Legislature in 1992; it became law January 1, 1993. The act is codified as Sections 10750 *et seq.* of the California Water Code. This groundwater management plan has been developed pursuant to the provisions of AB 3030.

1.2 Plan Components

According to California Water Code Section 10753.7, a groundwater management plan may include components relating to all of the following:

- The control of saline water intrusion
- Identification and management of wellhead protection areas and recharge areas
- Regulation of the migration of contaminated groundwater
- The administration of a well abandonment and well destruction program
- Mitigation of conditions of overdraft
- Replenishment of groundwater extracted by water producers
- Monitoring of groundwater levels and storage
- Facilitating conjunctive use operations
- Identification of well construction policies
- The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling and extraction projects
- The development of relationships with state and federal regulatory agencies
- The review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination

1.3 Agency Authorization

California Water Code Section 10753 (a) authorizes any local agency, whose service area includes a groundwater basin, or a portion of a groundwater basin, that is not already subject to groundwater management, to adopt and implement a groundwater management plan, which is defined by Section 10752 (e) as "a document that describes the activities intended to be included in a groundwater management program." A groundwater management program is defined by Section 10752 (d) as "a coordinated and ongoing

activity undertaken for the benefit of a groundwater basin, or a portion of a groundwater basin, pursuant to a groundwater management plan adopted pursuant to this part."

"Local agency" is defined as any local public agency that provides water service to all or a portion of its service area (Section 10752 (g)). The definition also includes a local public agency that provides flood control, groundwater management, or groundwater replenishment, or a local agency formed pursuant to the Water Code for the principal purpose of providing water service that has not yet provided that service (Section 10753 (b)). These local agencies may exercise the authority of this part, and are authorized by Section 10752 (g) to form Joint Powers Authorities in order to work cooperatively in establishing a groundwater management program.

According to Water Code Section 10754, for purposes of groundwater management, a local agency that adopts a groundwater management plan has the authority of a water replenishment district pursuant to Part 4 (commencing with Section 60220) of Division 18 and may fix and collect fees and assessments for groundwater management in accordance with Part 6 (commencing with Section 60300) of Division 18, subject to the approval of voters within the agency's boundaries.

1.4 Eligible Groundwater Basins

The act applies to all groundwater basins in the state of California, except those already subject to groundwater management by a local agency or watermaster pursuant to other provisions of law or a court order, judgment or decree, unless the local agency or watermaster agrees to the applications of the act. The Chowchilla Groundwater Basin is eligible for groundwater management under AB 3030.

1.5 Objective

The Chowchilla Water District ("CWD" or "District") and Chowchilla-Red Top Resource Conservation District ("RCD") value the importance of groundwater in the state of California. The two Districts recognize that proper management of groundwater basins is necessary to sustain the environmental, social and economic conditions that prevail in today's society. More importantly, the well-being of future societies is dependent on the effectiveness of current groundwater resources planning. For these reasons, the Chowchilla Water District and Chowchilla-Red Top Resource Conservation District have decided to protect the groundwater in their area. As shown in Appendix 1, the agencies adopted a resolution of intention to draft a groundwater management plan on November 13, 1996. In order to complete and administer a groundwater management plan, the agencies formed a Joint Powers Authority on October 30, 1997 (see Appendix 2). The resulting agency is known as the CWD-Red Top RCD Joint Powers Authority ("Authority").

The objective of this groundwater management plan is to identify, formulate and implement effective groundwater management practices in order to maintain the long-term availability of groundwater resources throughout the Chowchilla Basin.

SECTION 2
THE DISTRICTS

2.1 Chowchilla Water District

The Chowchilla Water District was formed in 1949 for the purpose of furnishing a supplemental water supply for lands within its boundaries. Until that time, the District had been a part of the original Madera Irrigation District. In 1989, the La Branza Water District and Chowchilla Water District consolidated. The consolidated district is known as the Chowchilla Water District. The District consists of approximately 80,000 acres, including lands in Madera and Merced counties.

2.2 Chowchilla-Red Top Resource Conservation District

The Chowchilla Resource Conservation District and Red Top Resource Conservation District were formed by California State Law for the purpose of providing local leadership and guidance regarding resource conservation issues. The two Districts were combined in the late 1970s, resulting in the Chowchilla-Red Top Resource Conservation District. The combined District works closely with the United States Department of Agriculture National Resources Conservation Service; the two agencies address topics relating to soil, water, air quality, environmental assessment, conservation education, and wildlife preservation. The RCD encompasses the entire Chowchilla Groundwater Basin, excepting that portion of the Basin located in Merced County.

SECTION 3
THE CHOWCHILLA GROUNDWATER BASIN

3.1 Boundaries

The Chowchilla Basin encompasses approximately 250 square miles and includes lands in both Madera and Merced counties. The Basin is bounded on the west by the San Joaquin River and the eastern boundary of the Columbia Canal Company service area and on the north by the southern boundary of the Merced Groundwater Basin. (The northern boundary runs Westerly along the Chowchilla River, then along the southern boundary of the Le Grand-Athlone Water District. The boundary then follows the northern boundaries of the former La Branza Water District and El Nido Irrigation District. The boundary turns southerly and follows the western boundary of El Nido Irrigation District, then runs westerly along the northern boundary of the Sierra Water District, to the San Joaquin River.) The southern boundary of the Chowchilla Basin runs along the southern boundary of Township 11 South, Range 14 East and the southern boundary of Progressive Water District, then northerly along the eastern boundary of Progressive Water District and Sections 9 and 16 of Township 11 South, Range 15 East. The boundary then runs northeasterly along the southern and eastern boundaries of the Chowchilla Water District, then northeasterly following Berenda Slough and Ash Slough to the Chowchilla River.

3.2 Agencies Within

Besides the Chowchilla Water District and the Chowchilla-Red Top Resource Conservation District, five other agencies exist wholly within the boundaries of the Chowchilla Basin, as shown in Appendix 3. The City of Chowchilla is considering entering into a Memorandum of Understanding with the Authority regarding this groundwater management plan. The other four agencies include El Nido Irrigation District, Sierra Water District, Clayton Water District and Progressive Water District. Lands within the boundaries of these four agencies are excluded from this plan.

3.3 Major Streams

As shown in Appendix 4, the Chowchilla Bypass, Fresno River, Chowchilla River and Dutchman Creek are the major natural stream channels that flow into the groundwater basin.

As previously described, the San Joaquin River forms the western boundary of the basin. Although it does not flow directly into the basin, one of its bypasses does. The

Chowchilla Bypass of the San Joaquin River crosses the southern boundary of the basin and flows northwesterly. At the southern basin boundary, the San Joaquin River and Chowchilla Bypass are separated by approximately six miles of land.

The Fresno River enters the southeastern portion of the Basin and flows westerly. Several miles into the basin, the Chowchilla Bypass and Fresno River merge, forming the Eastside Bypass. The Eastside Bypass continues northwesterly, exiting the basin. Eventually, the bypass rejoins the San Joaquin River.

Near the easternmost basin boundary, the Chowchilla River divides into three distributary channels. The northern channel continues as the Chowchilla River, which comprises the northern basin boundary for approximately nine miles, then flows through the basin. The other two channels, Ash Slough and Berenda Slough, flow southwestwardly through the basin to the Eastside Bypass.

Dutchman Creek enters the eastern side of the most northerly tip of the basin. It flows westwardly through the basin approximately three miles, then exits. Outside the boundaries of the basin, Dutchman Creek merges with Deadman Creek.

Although manmade, the Madera Canal is another channel that enters the basin. The Madera Canal is used to transport surface water from Friant Dam on the San Joaquin River. The Madera Canal terminates when it reaches the heading of the CWD conveyance system.

SECTION 4
DESCRIPTION OF STUDY AREA

4.1 Climate

The study area is characterized by hot, dry summers and fairly mild winters, accompanied by low to moderate precipitation. Fogs are common during the cool winter months; snow is very rare. Winds are gentle throughout most of the year, prevailing from the northwest.

The dry Mediterranean climate is well suited for irrigated agriculture. The long, warm-to-hot, dry summers allow ripening of crops without the threat of mildew. The summers are virtually rainless, permitting the attainment of high irrigation efficiencies. The mild, wet winters provide some water for winter crops, as well as leaching water to flush salts that may accumulate during dry periods.

4.2 Topography

The eastern side of the survey area is located on old alluvial terraces; the central portion, recent alluvial fans. The mid-westerly portion of the area is located on the basin rim of the east side of the San Joaquin Valley. Overflow lands occur in a nearly flat plain along the San Joaquin River, which constitutes the western boundary of the area.

The alluvial fans are the largest geomorphic features in the area. They are gently sloping with gradients toward the west. The area generally slopes westwardly about 9 feet per mile; however, the overflow lands slope only 2 feet per mile. The elevation is close to 110 feet above sea level at the northwestern edge of the study area, and 325 feet near the northeast corner.

4.3 Geology

The geologic features of the area were formed by alluvium deposited from streams originating in the nearby Sierra Nevada mountains. The older alluvium is believed to be of Pleistocene age and contains indurated hardpans cemented by iron and silica. The recent alluvium on the alluvial fans may also contain developed compact layers, but these layers are lime cemented and are not as hard as the iron silica hardpans. Both the older and younger alluvium are of granitic origin and tend to be coarse textured and nonsaline.

Under natural conditions, many areas were underlain by the aforementioned slowly permeable hardpans. Most of these areas have now been ripped, which has greatly improved the internal soil drainage. The material underlying the hardpan is typically softly consolidated sandy loam.

4.4 Subsurface Conditions

The stratigraphy of the area includes a non-water bearing complex (which underlies most of the study area), and various water bearing sediments on top of the basement complex. The basement complex consists of granitic and schistose rocks which do not yield water freely to wells. The basement complex outcrops in the Sierra Nevada foothills east of the area, yet is more than 10,000 feet deep under the western edge of the area. The basement complex dips to the southwest.

The basement complex is overlain by marine and continental sedimentary rocks (sandstone, claystone, siltstone, and shale) of pre-Tertiary and Tertiary age. The marine and continental rocks are not penetrated by water wells. These rocks are overlain by the continental deposit of Tertiary and Quaternary age. The top of the continental deposit ranges from about 100 to 1,000 feet deep and ranges in thickness from 1,000 to 2,200 feet. The deposit consists of interbedded, poorly-sorted sand, silt, clay and conglomerate with layers of hardpan and traces of volcanic glass and andesitic tuff. The deposit becomes finer grained with depth and distance from the foothills.

The older alluvium overlies the continental deposit and varies in thickness up to 1,000 feet. The older alluvium consists mostly of intercalated lenses of clay, silt, sand and some gravel. Near the surface of the older alluvium, a cemented-sediment hardpan occurs throughout the area. Within the older alluvium is an extensive clay bed called the E-clay or Corcoran clay of Pleistocene age. The E-clay varies in depth from 80 feet below the town of Chowchilla to 200 feet below the southwest corner of the area. The E-clay underlies all of the area except that portion east of highway 99. The E-clay divides the aquifer into the confined and unconfined zones. The thickness of the E-clay varies up to 80 feet. The E-clay consists mostly of clay, silty clay and silt. It is virtually impermeable and is considered an aquiclude. Nearly all ground water wells in the area tap the older alluvium. The base of fresh water (water less than 2,000 p/m) under the area is about 1,400 feet deep.

The younger alluvium is a thin-sedimentary, mostly-oxidized deposit of interbedded, poorly-to-well-sorted clay, silty clay, silt, silty sand, and fine to coarse grained sand. Because it is not as weathered as the older alluvium, the younger alluvium does not contain a hardpan. This feature distinguishes it from the older alluvium. The thickness of the younger alluvium varies up to 50 feet. Due to these characteristics, the younger alluvium is more permeable than the older alluvium.

SECTION 5
WATER SUPPLY

5.1 Precipitation

The heaviest rainfall in the Chowchilla Basin occurs between December and March. No significant amount falls from May through September. Precipitation increases with elevation; therefore, there is a gradual increase in total rainfall from west to east across the basin. The western area receives about 8.5 inches per year, while the eastern area receives about 12 inches per year. Most of the moisture falls as steady rain in winter storms that cover broad areas.

5.2 Surface Water

The Chowchilla Water District delivers surface water to lands within its boundaries, and administers the delivery of most local riparian water rights.

The District's first water contract was signed in 1951 for supply from the Friant Unit of the Central Valley Project. An additional contract for water from Buchanan Dam on the Chowchilla River was signed in 1967. The dam was completed in 1977 and deliveries began in 1978.

First deliveries of project water were through natural channels and ditches constructed by District farmers. Major construction of delivery facilities occurred in the early 1960s. The District now operates approximately 160 miles of unlined canals and laterals, and 46 miles of pipeline.

The District's present contract provides for an annual maximum of 55,000 acre-feet of class 1 water, an annual average of 77,000 acre-feet of class 2 water, and an annual maximum of 160,000 acre-feet of class 2 water (all via the Madera Canal from the Friant Unit, CVP). In addition to this, the District also receives an average of 24,000 acre-feet per year from the Buchanan Dam on the Chowchilla River.

5.3 Groundwater

The general movement of groundwater in the area is southwestward. Most irrigation wells tap the older alluvium. Well depths range from approximately 75 to 700 feet and average 260 feet. The capacity of wells ranges from 40 gallons per minute to 4,750 gallons per minute. The specific capacity of wells ranges from approximately 8 to 136 gallons per minute per foot of draw down and averages about 40 gallons per minute per foot of draw down. The specific capacities are generally greater in the western portion of

the study area. Table 1 contains statistical information describing groundwater conditions in the Chowchilla Basin. The statistics were derived from a sample of 222 wells.

Table 1

LEVEL OF DEVELOPMENT
CHOWCHILLA BASIN
1990

Extraction	252,000	ac-ft/yr
Perennial Yield	239,000	ac-ft/yr
Overdraft	13,000	ac-ft/yr
Usable Storage	1,043,000	ac-ft
Pump Lift	150	est. feet

Source: California Department of Water Resources

Appendix 5 shows the average depth to groundwater in both spring and fall since 1971. The data was derived from a sample of approximately 175 wells in the Chowchilla Water District. The chart shows obvious changes in depths to groundwater due to periods of drought and seasons of extensive rainfall. Groundwater levels recovered after the 1977 drought, then declined with the continuance of the late eighties/early nineties drought. There has not been a significant amount of recovery since this most recent drought.

Appendix 6 consists of thirteen groundwater contour maps, containing spring groundwater measurements. The first two maps show lines of equal depth to water in wells for the years 1988 and 1995. The remaining maps show lines of equal elevation of water in wells for the years 1986 through 1996. Again, the most recent period of drought is evident from these maps.

SECTION 6
WATER QUALITY

6.1 TOTAL DISSOLVED SOLIDS

Table 2 shows average water qualities described by total dissolved solids. Water in intermittent streams (i.e. Chowchilla River) generally contains more dissolved solids than does water in perennial streams (i.e. San Joaquin River). The quality of all surface water supplies in the basin is excellent. Due to factors such as differing well depths and locations, the quality of groundwater varies, but is good overall. The averages are shown below:

Table 2

TOTAL DISSOLVED SOLIDS IN WATER SOURCES

Source	TDS Parts Per Million
San Joaquin River (Madera Canal)	40
Chowchilla River	150
Groundwater	385

Source: United States Bureau of Reclamation

6.2 CHEMISTRY

Surface waters in the area are dominated by the bicarbonate ion and are very low in sulfate. Well waters are also dominated by bicarbonate, while the dominant cation is usually calcium. The bicarbonate ion does not concentrate in drainage waters as the chloride ion does; therefore, the effective salinity of this water is reduced. The bicarbonate ion tends to precipitate with calcium in the form of calcium carbonate.

Well waters within the boundaries of the Chowchilla Water District are considered safe from a trace element perspective. In the western part of the study area, however, larger concentrations of sodium and chloride increase the amount of total dissolved solids.

SECTION 7
PLAN COMPONENTS

The following plan components describe the actions that will be taken by the Authority.

7.1 Monitor Groundwater Levels and Storage

In the spring and fall of each year, the Chowchilla Water District measures 143 wells in the area. The Authority plans to continue and improve this practice.

To ensure a representative sample of wells, the Authority first intends to plot and analyze the current network. The integrity of the current sample of wells will be judged according to factors such as location, well depth, depth to groundwater, water quality, tapped aquifer zones, and other groundwater characteristics. From this analysis, the Authority will modify the existing network as needed.

Most of the wells currently measured are within the boundaries of the District; therefore, wells outside the District (yet still within the Chowchilla Basin) will need to be identified so they may be included in the sample. The United States Bureau of Reclamation maintains information that will be useful in locating and choosing new wells; the Authority plans to obtain assistance from the Bureau with respect to this matter.

As data is collected, it will be entered into a computer database to enable further analysis. The analysis will include a series of maps, charts and graphs. It is the intention of the Authority to track changing groundwater patterns and trends.

7.2 Facilitate Conjunctive Use Operations

Department of Water Resources Bulletin 118-80 defines conjunctive operation as:

> *"operation of a groundwater basin in coordination with a surface water reservoir system. The purpose is to artificially recharge the basin during years of above-average precipitation so that the water can be withdrawn during years of below-average precipitation, when surface supplies are below normal."*

7.2.1 Conjunctive Use Program

On the spectrum of limited to comprehensive conjunctive use programs (limited being a program that uses surplus water for recharge only when it is readily available; comprehensive, a program that aggressively secures water for recharge, meters groundwater extraction, and utilizes other groundwater control methodologies), the policy of the Chowchilla Water District has leaned more toward the limited operations end in the

past. The District does purchase water for recharge when available, but is not able to secure an additional water supply solely for recharge. However, with the increasing price and decreasing availability of water, the District foresees the possibility of formulating a more comprehensive conjunctive use plan in the future.

7.2.2 Recharge

Recharge is imperative to conjunctive use operations. The underground aquifer must be recharged in order to maintain an adequate groundwater supply. Recharge helps alleviate the strain on the underground aquifer and prevents other groundwater problems caused by excessive extractions.

Recharge prepares the underground aquifer for unfavorable conditions, such as drought. Prolonged periods of below normal precipitation usually result in reduced surface water supplies, thereby necessitating heavy groundwater extraction. During these times, water is borrowed from the underground reservoir. This water must be returned in order to re-fill the basin and prepare for the next drought or water shortage.

Since the recent drought of the late eighties/early nineties, wet winters have enabled a considerable amount of groundwater recharge. The Chowchilla Water District took advantage of the surplus water supplies during this time; the District sent water through its conveyance system solely for recharge for many months. More information regarding groundwater recharge is given in Section 7.3, Groundwater Recharge.

7.2.3 Standby Charge

In 1995, the Chowchilla Water District instituted a standby charge on lands being irrigated for agriculture within its boundaries. The purpose of this charge is to increase the amount of surface water being used, thereby decreasing the amount of groundwater being pumped.

7.2.4 Expand Conjunctive Use Area

To increase conjunctive use operations near the Chowchilla Water District, the District plans to annex approximately 10,000 acres during late 1997. In the past, these lands have relied solely on groundwater for irrigation. Once annexed, these lands will be eligible to receive federal project water. The annexation will expand the conjunctive use area and decrease the pumping strain on the underground aquifer.

As a simple example, suppose that currently 3.0 acre-feet per acre per year of groundwater is applied to each of the 10,000 acres. Substituting 2.0 acre-feet per acre of surface water will result in a groundwater savings of 20,000 acre-feet per year.

7.3 Groundwater Recharge

Groundwater recharge is an integral component of the replenishment of groundwater extracted by producers, the mitigation of conditions of overdraft, and the facilitation of

conjunctive use operations. Due to groundwater extraction, recharge must be performed in order to maintain an adequate groundwater supply. In the Chowchilla Basin, there are three methods of groundwater recharge: natural, incidental and intentional.

7.3.1 Natural Recharge

Natural recharge is defined as rain, runoff, and natural stream flows. All three of these occurrences contribute to groundwater recharge within the Chowchilla Basin.

7.3.2 Incidental Recharge

Incidental recharge occurs as a by-product of another event. For example, the Chowchilla Water District delivers surface water for irrigation through a system of unlined canals. During this process, seepage losses occur; water is absorbed by the canals in which it travels. This water then percolates to the underground basin. Of all water that flows through the District's conveyance system, it is estimated that as much as 30 percent of it is lost to seepage. An average of 43,000 acre-feet of water is recharged through the District's conveyance system each year. During years of above average precipitation, the amount of recharge is considerably higher. Recharge is lower during years of below normal precipitation.

As irrigation water is applied to crops, a portion of the applied water percolates past the root zone and continues downward, also recharging the groundwater basin. Irrigation seepage (and resulting percolation) is estimated to be as much as 20 percent of total applied water. Assuming 140,000 acres in the Chowchilla Basin are irrigated at a rate of 3.0 acre-feet per acre per year, it can be concluded that 84,000 acre-feet of applied water is returned to the underground aquifer.

Another form of incidental recharge within the basin is the City of Chowchilla Sewer Treatment Plant. The plant process 500,000 gallons of sewage per day. A very small portion of this is treated and re-used within the plant. The rest of the water is spread on 120 acres of ponds.

7.3.3 Intentional Recharge

Intentional recharge is purposely performed in order to combat the effects of excessive groundwater usage. Groundwater Management Facilities (such as percolation basins, injection wells, or spreading grounds) are necessary to operate intentional recharge programs.

Within the Chowchilla Basin, the following areas exist that promote intentional groundwater recharge:

- Surface water conveyance system
- Four natural stream channels

Chowchilla River	Ash Slough
Dutchman Creek	Berenda Slough

- Two surface water retention reservoirs

Berenda Reservoir	Minturn Dam

- Eight regulating/recharge basins

Dairyland Pond	Askew Pond
Haynes Pond	Vera Pond
Townsend Pond	Gregory Pond
Rutherford Pond	Berenda Pond

Although use of the surface water conveyance system and natural stream channels results in incidental and natural recharge, they are also used as intentional recharge vehicles. As mentioned previously, in years of above normal precipitation, water is delivered through these systems for the sole purpose of recharging the underground aquifer. Stream channels are naturally favorable for groundwater recharge.

The reservoirs and basins are intended for recharge, storage and surface water regulation. The subsurface conditions of several of these recharge basins make them favorable for groundwater recharge, as well.

During seasons of extreme precipitation, water is purposely diverted into the Fresno River and Chowchilla and Eastside Bypasses to control flooding. Water seeps into these stream beds and percolates to the underground aquifer. This activity could be considered natural, incidental, or intentional recharge.

The Authority plans to research the possibility of constructing new recharge facilities and locating sites for new basins. As situations arise, warranting additional or improved groundwater recharge, feasible solutions will be determined and implemented.

7.4 Construct Groundwater Management Facilities

In order to regulate surface water and promote groundwater recharge, the Chowchilla Water District is in the process of constructing two additional recharge basins. The first basin has a capacity of 35 acre-feet. Construction of this facility began in May of 1996 and is expected to be completed in late 1997.

The District also purchased over 20 acres for a recharge basin in August 1997. The future basin site is located in the east side of the groundwater basin; it is removed from any

natural channels or other recharge basins. Construction of the facility is expected to be completed before 1999.

7.5 Wellhead Protection/Well Abandonment/Well Destruction

Serious groundwater problems can result if wellhead areas are contaminated or if wells are not properly destroyed. In these situations, wells can become conduits for contaminants, pollutants, and poor quality water. All situations relating to wells, wellhead protection and contamination resulting therefrom are currently administered by divisions of Madera and Merced counties, or other state and local agencies. The Authority is willing to provide these agencies with any relevant information upon request. The Authority is also ready to assist with any public education efforts these agencies may attempt.

7.6 Water Conservation

In 1995, the Chowchilla Water District submitted a Water Conservation Plan to the Bureau of Reclamation, which has been approved. The District must submit yearly updates detailing the continuation of water conservation practices. The issues addressed in the plan include:

- Measurement
- Pricing
- Conservation Staff
- Conservation Service
    - On Farm Evaluations
    - Real Time Evapotranspiration Information
- Construction of Reservoirs
- Tiered Block Pricing
- Flexible Deliveries
- Spill Reuse Systems
- Financial Incentives
- Increasing Conjunctive Use
- Measuring by Crop and Field
- Facilitating Transfers
- Pump Efficiencies

Water conservation measures reduce the amount of surface and groundwater being utilized inefficiently. Conservation is a beneficial practice that directly or indirectly reduces the amount of groundwater being pumped.

SECTION 8
IMPLEMENTATION

Upon adoption, several issues must be addressed by the Authority in order to implement the plan effectively.

8.1 Rules and Regulations

According to Water Code Section 10753.8 (a), a local agency shall adopt rules and regulations to implement and enforce an adopted groundwater management plan. The local agency is not authorized to make a binding determination of the water rights of any person or entity (Section 10753.8 (b)). The local agency is also not authorized to limit or suspend extractions unless the local agency has determined through study and investigation that groundwater replenishment programs or other alternative sources of water supply have proved insufficient or infeasible to lessen the demand for groundwater (Section 10753.8 (c)).

In adopting rules and regulations, the local agency shall consider the potential impact of those rules and regulations on business activities, including agricultural operations, and to the extent practicable and consistent with the protection of the groundwater resources, minimize any adverse impacts on those business activities (Section 10753.9).

8.2 Prioritize Plan Components

The Authority shall prioritize plan components according to urgency, time constraints, budget constraints, general feasibility and other conditions. From this, the Authority may present an estimated time frame of when the described plan components will be addressed and when results are to be expected.

8.3 Monitor Plan Progress

The Authority shall monitor the degree of progress made regarding groundwater management plan components. To do this, the Authority shall meet annually to review, discuss and evaluate activities previously undertaken and/or completed and to coordinate future groundwater management planning efforts. From this assessment, the Authority will determine if the plan and its implementation are achieving desired results, or if any adjustments are necessary.

8.4 Adjust Plan

The Authority shall establish a procedure to amend, adjust or alter the groundwater management plan or activities derived therefrom as conditions change. From the evaluation of groundwater management activities at the annual meeting, it may be determined that certain continuing efforts are ineffective, or that other situations have arisen demanding priority treatment. As a result of this information, the plan and its time frame may be modified. The Authority intends to maintain a plan that is flexible to changing conditions and emerging situations, in order to effectively manage and protect the Chowchilla Groundwater Basin.

LIST OF SOURCES

Mitten, Hugh T., et al. United States Geological Survey, Water Resources Division. "Geology, Hydrology and Quality of Water in the Madera Area, San Joaquin Valley, California." 1970.

State of California, Department of Water Resources. "Ground Water Basins in California, Bulletin 118-80." January 1980.

State of California, Department of Water Resources. "California Water Plan Update, Bulletin 160-93." October 1994.

United States Bureau of Reclamation, Land Suitability Section, Denver Office. "Land Classification Report - Chowchilla Water District." March 1991.

United States Soil Conservation Service. "Soil Survey - Madera Area, California." 1962.

APPENDIX 1

Resolution of Intention to Draft a Groundwater Management Plan

CHOWCHILLA WATER DISTRICT
RESOLUTION NO. 96-12

WHEREAS, the Chowchilla Water District is considering whether or not to adopt a Groundwater Management Plan with the Chowchilla-Red Top Resource Conservation District pursuant to a Joint Power Authority to be established between the Water District and the Conservation District, and

WHEREAS, Water Code Section 10753.2 requires that prior to adopting a resolution of intention to draft a groundwater management plan the District must hold a public hearing, after publication of notice thereof, on whether or not to adopt a resolution of intention to draft a groundwater management plan, and

WHEREAS, the Water District and the Conservation District published notices as required by law that a public hearing on whether or not the Water District and the Conservation District should adopt resolutions of intention to draft a groundwater management plan pursuant to Part 2.75 of Division 6 of the Water Code of the State of California which said hearing would be held at the District Office, 327 South Chowchilla Blvd. on November 13, 1996 at the hour of 1:30 p.m.. At such hearing the Board of Directors of the District would hear evidence from landowners in favor of or against whether such resolution should be adopted, and

WHEREAS, said hearing was held and the Boards of Directors of the Water District and the Conservation District heard evidence from landowners as to whether or not such resolution should be adopted, and

WHEREAS, after hearing such evidence the Board of Directors of both the Water District and the Conservation District determined that it was to the best interests of the lands within both Districts that a resolution of intention to form a Joint Power Authority to draft a groundwater management plan be adopted,

Chowchilla Water District
Resolution No. 96-12

NOW THEREFORE BE IT RESOLVED:

The Chowchilla Water District shall enter into an agreement with the Chowchilla-Red Top Resource Conservation District to form a Joint Power Authority pursuant to Water Code Section 10755.2 (b).

BE IT FURTHER RESOLVED:

That upon the establishment of a Joint Power Authority, the Authority adopt a groundwater management plan pursuant to the provisions of Part 2.75 Division 6 of the Water Code of the State of California.

The foregoing Resolution was adopted at a regular meeting of the Board of Directors of the Chowchilla Water District held on the 13th day of November, 1996 upon the motion of Director Tarabini seconded by Director Mandala on the following vote:

Ayes: Directors, Mandala, Tarabini, Thiel and Upton.
Noes: None
Abstain: None
Absent: Capehart

Kole M. Upton, President

ATTEST:

Douglas Welch, Secretary

APPENDIX 2

Joint Exercise of Powers Agreement

JOINT EXERCISE OF POWERS AGREEMENT
BY AND BETWEEN
CHOWCHILLA WATER DISTRICT AND
CHOWCHILLA-RED TOP RESOURCE CONSERVATION DISTRICT
FORMING THE
CWD-RED TOP RCD JOINT POWERS AUTHORITY

This Agreement, dated for convenience as of October 30, 1997 by and between the CHOWCHILLA WATER DISTRICT, a California Water District in the State of California ("CWD") and the CHOWCHILLA-RED TOP RESOURCE CONSERVATION DISTRICT, a Resource Conservation District ("Chowchilla-Red Top RCD").

WITNESSETH

WHEREAS, CWD and Chowchilla-Red Top RCD are empowered by law to adopt and enforce Groundwater Management Plans, and

WHEREAS, it is to the best interest of CWD and Chowchilla-Red Top RCD that they join in adopting a Groundwater Management Plan so as to cover the area embraced within both districts, and

WHEREAS, the formation of a Joint Powers Authority makes such a Plan available;

NOW, THEREFORE, CWD and Chowchilla-Red Top RCD, for and in consideration of the mutual agreements and covenants herein contained, do agree as follows:

SECTION 1. Definitions

1.01 Unless the context otherwise requires, the terms defined in this section shall, for all purposes of the Agreement have the meanings herein specified.

Agreement

The term "Agreement" shall mean this joint exercise of powers agreement as originally executed and as it may from time to time be amended by all supplemental agreements entered into pursuant to the provisions hereof.

Authority

The term "Authority" shall mean the CWD-Red Top RCD Joint Powers Authority, being a separate entity consisting of a joint exercise of powers authority created by the Members pursuant to the Agreement.

Board of Directors, or Board

"Board of Directors" or "Board" shall mean governing body of the Authority.

CWD

The term "CWD" shall mean the Chowchilla Water District, a California Water District, duly organized and existing under the Constitution and laws of the State of California.

Groundwater Management Plan

The term "Groundwater Management Plan" shall mean a plan adopted by the Authority pursuant to the Groundwater Management Act.

Law

The term "Law" shall mean Articles 1 and 2 of Chapter 5 of Division 7 of Title 1 of the Government Code of the State of California, and all laws amendatory thereof or supplemental thereto.

Member

The term "Member" shall be either CWD or Chowchilla-Red Top RCD.

Chowchilla-Red Top RCD

The term "Chowchilla-Red Top RCD" shall mean the Chowchilla-Red Top Resource Conservation District duly organized and existing under the Constitution and laws of the State of California.

SECTION 2. Formation of the Authority

2.01 There is hereby created pursuant to the Law an agency and public entity to be known as the "CWD-Red Top RCD Joint Powers Authority." As provided in the Law, the Authority shall be a public entity separate from the Members, and the debts, liabilities and obligations of the Authority shall not constitute debts, liabilities or obligations of the

Members or either of them. The Authority shall own and hold title to all funds, property and works acquired by it during the term of this Agreement.

SECTION 3. Contributions to and Revenues from the Authority

3.01 The Members shall pay for the costs and expenses associated with the maintenance and operation of the Authority in such amounts as are agreed to be contributed to the Authority, and are entitled to all the revenues of the Authority in the following percentages:

CWD: 100% unless and until Chowchilla-Red Top RCD can secure funds to contribute to the Authority.

Chowchilla-Red Top RCD: 0% unless and until Chowchilla-Red Top RCD can secure funds to contribute to the Authority.

If Chowchilla-Red Top RCD secures funds which it can contribute to the Authority, to the extent that funds are available, it shall make contributions until its contributions equal the contributions of CWD.

SECTION 4. Term

4.01 The Agreement shall become effective as of the date hereof and shall continue in full force and effect until terminated by a member giving ninety (90) days notice of termination to the other member.

SECTION 5. Powers; Restrictions Upon Exercise

5.01 The Authority shall have power to adopt and enforce a Groundwater Management Plan, subject, however, to the conditions and restrictions contained in the Agreement.

5.02 The Authority is authorized, in its own name, to do all acts necessary or convenient for the exercise of such powers for such purposes that each of its Members could do separately, including but not limited to any or all of the following: to make and enter into contracts; to exercise the power of eminent domain for the acquisition of property for Projects; to employ agents and employees; to acquire, construct, manage, maintain and operate any buildings, works or improvements; to acquire, hold or dispose of property; to incur debts, liabilities or obligations (which do not constitute debts,

liabilities or obligations of the Members or either of them); and to sue and be sued in its own name.

5.03 Such powers shall be exercised subject only to such restrictions upon the manner of exercising such powers as are imposed upon CWD as set forth in Division 13 of the California Water Code and other applicable statutes in the exercise of similar powers.

SECTION 6. Termination of Powers

6.01 The Authority shall continue to exercise the powers herein conferred upon it until the termination of the Authority under the provisions of Section 5 hereof. Upon such termination, the groundwater management plan adopted by the Authority shall remain in force and effect for the lands within CWD until modified or rescinded by CWD and shall remain in force and effect for the lands within Chowchilla-Red Top RCD outside of the boundaries of CWD until modified or rescinded by Chowchilla-Red Top RCD.

6.02 Upon the termination of the Authority, CWD shall have no power to adopt a groundwater management plan outside of its boundaries and within the boundaries of Chowchilla-Red Top RCD without the written consent of Chowchilla-Red Top RCD.

6.03 Upon the termination of the Authority, Chowchilla Red-Top RCD shall have no power to adopt a groundwater management plan within the boundaries of CWD without the written consent of CWD.

SECTION 7. Board of Directors

7.01 The Authority shall be administered by the Board of Directors which shall consist of ten members, each serving in his or her individual capacity as a member of the Board, constituting the members of the Board of Directors of CWD and five members of the Board of Directors of Chowchilla-Red Top RCD. The term of office of each member of the Board shall continue only so long as such member is a member of either of said boards of directors, and shall terminate if such member of the Board shall cease to be a member of either of said boards of directors.

7.02 Members of the Board shall receive such compensation or serving as such is set by the Board from time to time, and shall be entitled to reimbursement for any

expenses actually incurred in connection with serving as a member if the Board shall determine that such expenses shall be reimbursed and there are unencumbered funds available for such purpose.

SECTION 8. Officers; Duties

8.01 The Board shall annually elect a President and Vice President of the Authority from among its members and shall appoint a General Manager of the Authority and a Secretary of the Authority, neither of whom shall be a member of the Board.

8.02 The General Manager of the Authority may be designated pursuant to the Law as Auditor-Treasurer of the Authority or at the pleasure of the Board a separate Auditor-Treasurer may be appointed. The Auditor-Treasurer is designated as the depository of the Authority to have custody of all money of the Authority from whatever source and to draw checks to pay demands against the Authority when such demands have been approved by the Authority, and such officer shall have the powers, duties and responsibilities of the offices of auditor and treasurer specified in the law.

8.03 The Auditor-Treasurer of the Authority is designated as the public officer or person who has charge of, handles, or has access to any property of the Authority, and such officer shall file an official bond with the Authority in the amount of $100,000, the expense thereof to be paid by the Authority.

8.04 The Board shall have the power to appoint such other officers and employees as it may deem necessary, and to retain independent accountants, counsel, engineers and their consultants, and to determine the salary or compensation of all such persons.

SECTION 9. Meetings of the Board

9.01 The Board shall hold at least one regular meeting each year, and, by resolution, may provide for the holding of regular meetings at more frequent intervals. The date upon which, and the hour and place at which, each such regular meeting shall be held shall be fixed by resolution of the Board.

9.02 Special meetings of the Board may be called in accordance with the provisions of Section 54956 of the Government Code of the State of California, or as said section may be amended or superseded.

9.03 All meetings of the Board shall be called, noticed, held and conducted subject to the provisions of Sections 54950-54962 of the Government Code of the State of California, or as said Sections may be amended or superseded.

9.04 The Secretary of the Authority shall cause minutes of all meetings of open sessions of the Board to be kept and shall, as soon as possible after each meeting, cause a copy of the minutes to be forwarded to each member of the Board and to the Secretary of the Board of Directors of each Member.

9.05 Three members of the Board of Directors of CWD and three members of the Board of Directors of Chowchilla-Red Top RCD shall constitute a quorum for the transaction of business, except that less than a quorum may adjourn from time to time. The Board shall take no other action except upon the affirmative vote of at least three members of the board of directors of each Member.

SECTION 10. Fiscal Year

10.01 Unless and until changed by resolution of the Board, the fiscal year of the Authority shall be the period from January 1 of each year to and including the following December 31.

SECTION 11. Disposition of Assets

11.01 In the event of termination of the Authority, all assets of the Authority shall be distributed to the respective member grantor or assignor thereof, and any surplus money or other assets on hand shall be returned to the members in proportion to their contributions to the Authority.

SECTION 12. Adoption of Groundwater Management Plan

12.01 Immediately following the adoption of this Agreement, the Authority shall institute the formulation of a Groundwater Management Plan for the area embraced within the boundaries of both CWD and Chowchilla-Red Top RCD, within the Chowchilla Groundwater Basin, excluding therefrom, unless consent is given to include the area, any portions within the combined boundaries that is governed by a political agency which is authorized by law to adopt its own Plan.

SECTION 13. Agreement Not Exclusive

13.01 This Agreement shall not be exclusive and shall not be deemed to amend or alter the terms of other agreements by and between the Members.

SECTION 14. Contributions and Advances

14.01 Contributions or advances of public funds, or funds from their respective treasuries, and of personnel, equipment or property may be made to the Authority by either Member for any of the purposes of the Agreement. Any such advance may be made subject to repayment, and in such case shall be repaid in the manner agreed upon by the Member making such advance and the Authority at the time of making such advance.

SECTION 15. Accounts and Reports

15.01 The Authority shall establish and maintain such funds and accounts as may be required by good accounting practice. The books and records of the Authority shall be open to inspection at all reasonable times by the members and their representatives.

15.02 The Auditor-Treasurer of the Authority, subject to the approval of the Board, shall contract with a certified public accountant or public accountant to make an annual audit of the accounts and records of the Authority, and in each case the minimum requirements of the audit shall be those prescribed by the State Controller for special districts under Section 26909 of the Government Code of the State of California, or as the same may be amended or superseded, and shall conform to generally accepted auditing standards; except that the Members may, by unanimous request of the Boards of Directors thereof, replace the annual special audit with an audit covering a two-year period. A report of each such audit shall be filed as a public record with each Member and with the County Auditor of Madera County, the county in which both Members are located, which such report shall be filed within twelve (12) months of the end of the fiscal year or years under examination. All costs of such audit shall be borne by the Authority and shall be a charge against any unencumbered funds of the Authority available for the purpose.

SECTION 16. Breach

16.01 If default shall be made by either member in any covenant contained in the Agreement, such default shall not excuse the other Member from fulfilling its obligations

under the Agreement and such other Member shall continue to be liable for the payment of all contributions and the performance of all obligations herein contained. The Members hereby declare that the Agreement is entered into for the benefit of the Authority created hereby and the Members hereby grant to the Authority the right to enforce by whatever lawful means the Authority deems appropriate all of the obligations of each member hereunder. Each and all of the remedies given to the Authority hereunder or by any law now or hereafter enacted are cumulative and the exercise of any one right or remedy shall not impair the right of the Authority to any or all other remedies.

SECTION 17. Severability

17.01 Should any part, term or provision of the Agreement be decided by the courts to be illegal or in conflict with any law of the State of California, or otherwise be rendered unenforceable or ineffectual, the validity of the remaining parts, terms or provisions hereof shall not be affected thereby.

SECTION 18. Successors; Assignment

18.01 The Agreement shall be binding upon and shall inure to the benefit of the successors of each Member. Neither Member may assign any right or obligation hereunder without the consent of the other Member.

SECTION 19. Amendment of the Agreement

19.01 The Agreement may be amended by a supplemental agreement executed by the members at any time.

SECTION 20. Office

20.01 The office of the Authority shall be maintained at 327 South Chowchilla Boulevard, Chowchilla, CA 93610, until such time as the location thereof is changed by the Board.

SECTION 21. Notices

21.01 Any notice authorized or required to be given pursuant to this Agreement shall be in writing and shall be deemed to have been given when mailed, postage prepaid, or delivered during working hours to the following address, or to such changed addressess as are communicated to the Authority and the member entities in writing:

CWD:

P.O. Box 905, Chowchilla, CA 93610

Chowchilla-Red Top RCD:

c/o John Wolfshorndl, 11791 Avenue 22, Chowchilla, CA 93610.

SECTION 22. Section Headings

22.01 All section headings contained herein are for convenience of reference only and are not intended to define or limit the scope of any provision of the Agreement.

IN WITNESS WHEREOF the parties hereto have caused the Agreement to be executed and attested by their proper officers thereunto duly authorized, and their official seals to be hereto affixed, as of the day and year first above written.

CHOWCHILLA WATER DISTRICT

By:_____
Kole M. Upton, President

ATTEST:

_____
Douglas Welch, Secretary

[Seal]

CHOWCHILLA-RED TOP RESOURCE CONSERVATION DISTRICT

By:_____
Norman Kuhr, Chairman

ATTEST:

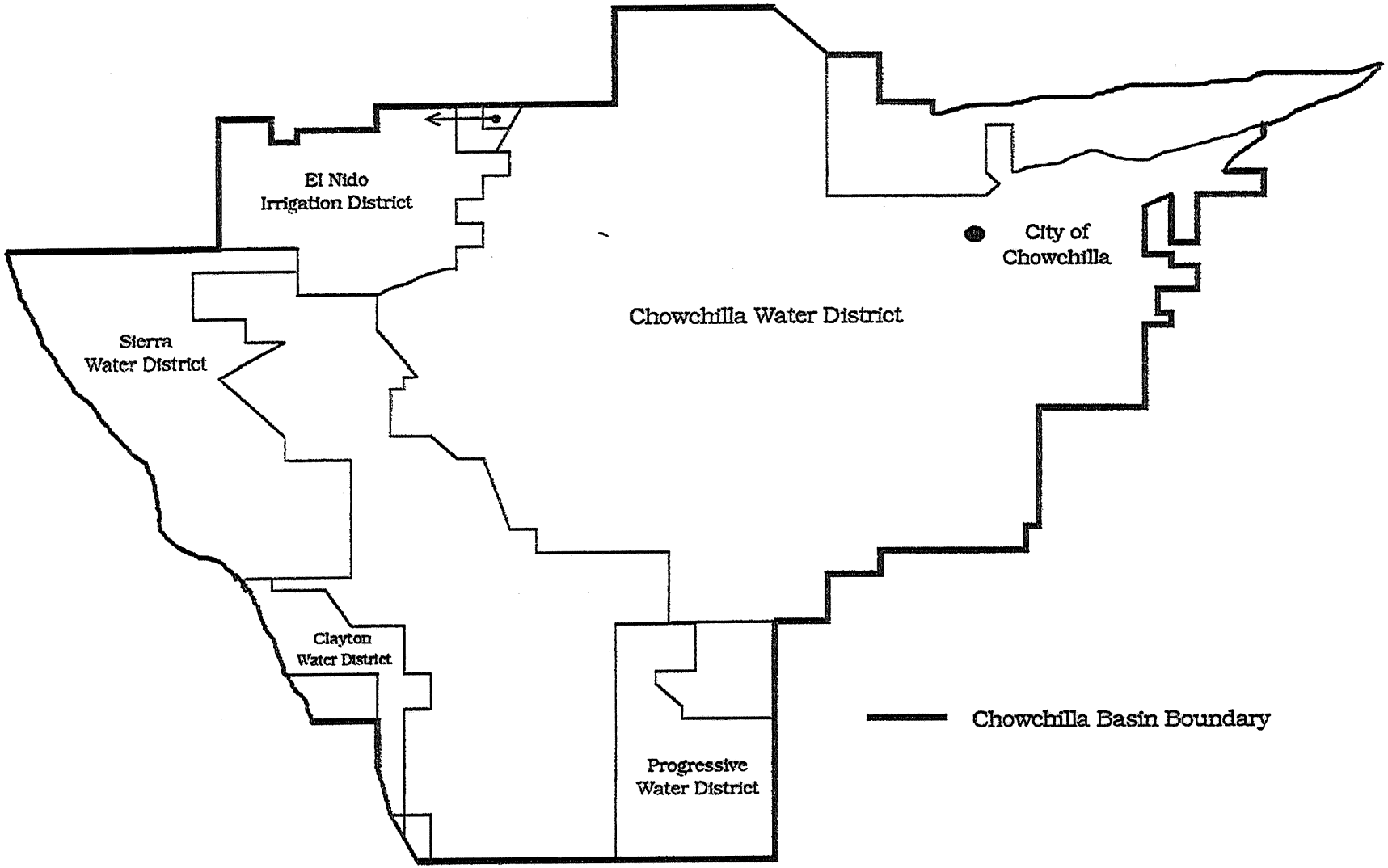
_____
John Wolfshorndl, Secretary

[Seal]

APPENDIX 3

Agencies Within the Chowchilla Basin

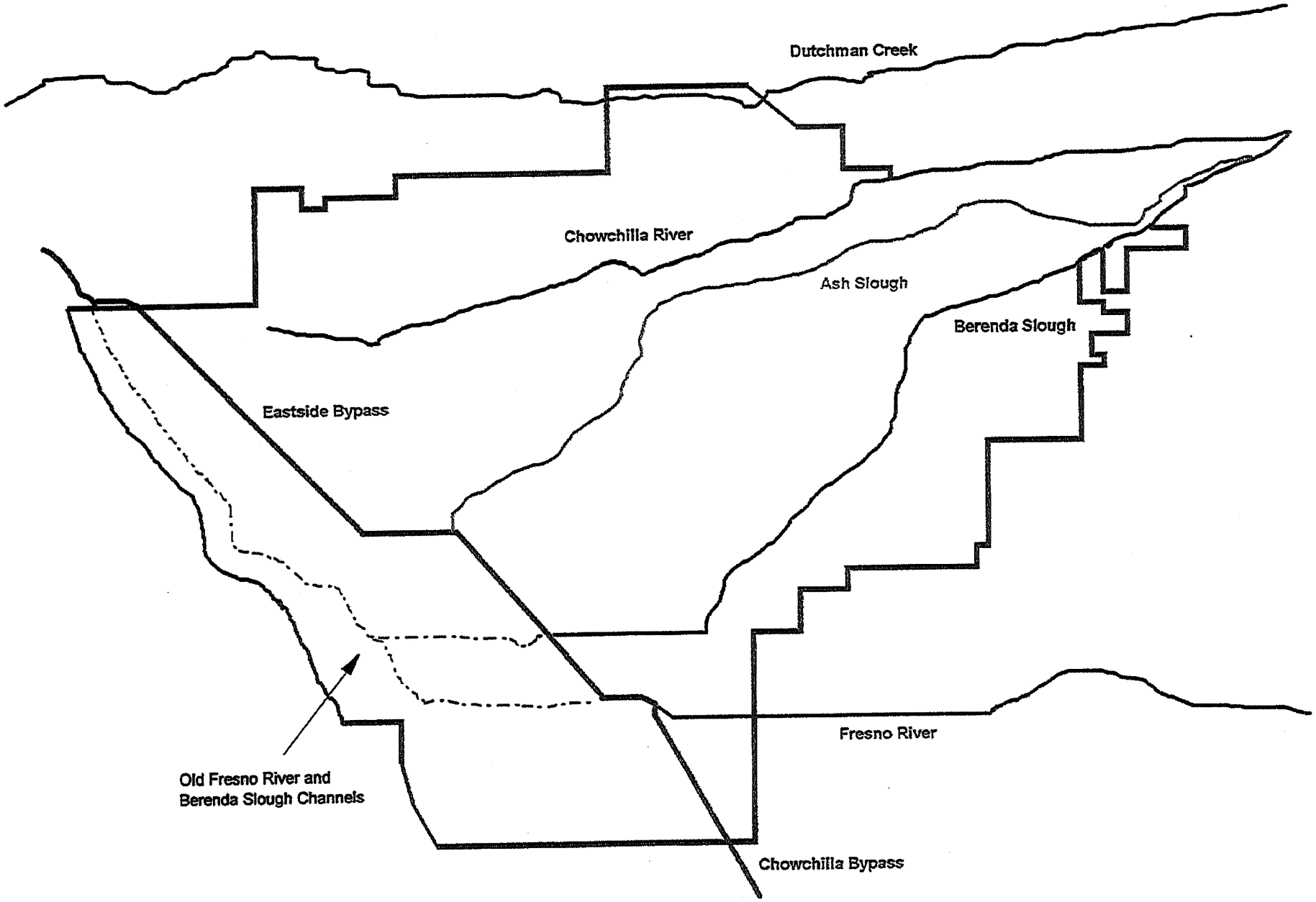
Map



AGENCIES WITHIN THE CHOWCHILLA BASIN

APPENDIX 4

Chowchilla Basin - Major Streams
Map

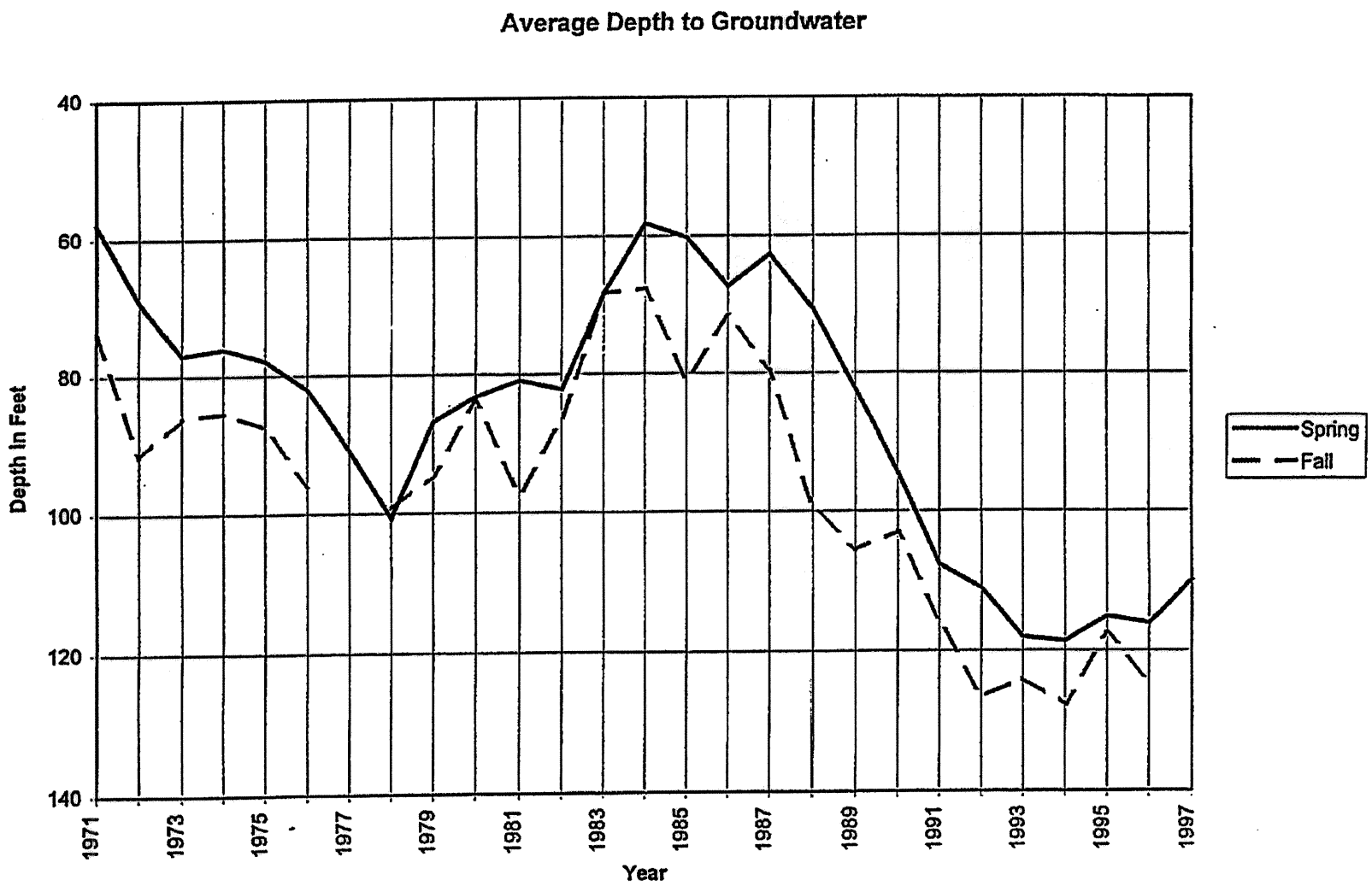


CHOWCHILLA BASIN - MAJOR STREAMS

APPENDIX 5

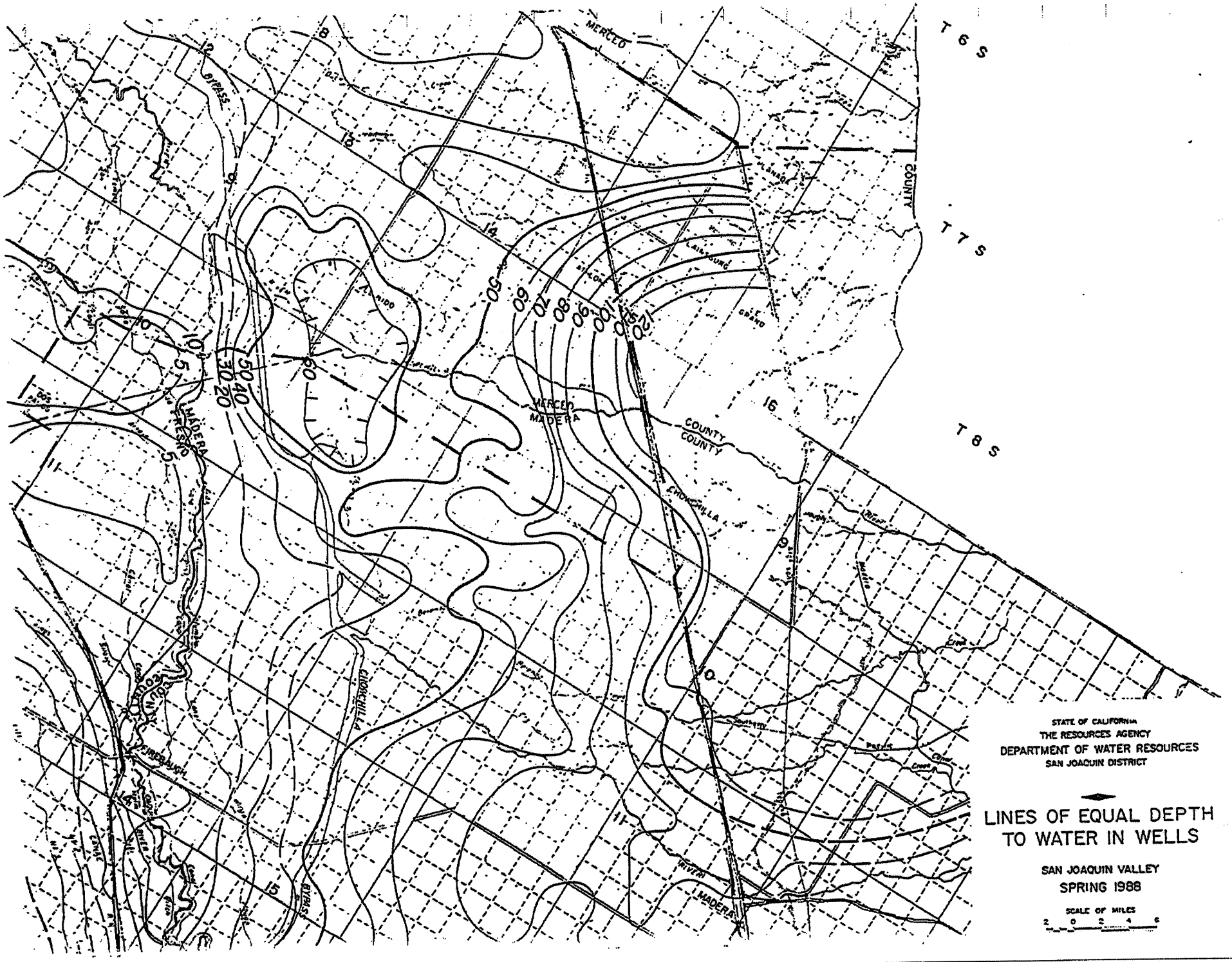
Average Depth to Groundwater
Chart

Chowchilla Water District



APPENDIX 6

Groundwater Contour Maps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MERCED
COUNTY
MADERA
FRESNO
CHOWCHILLA
BYPASS
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COUNTY
COUNTY
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STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN JOAQUIN DISTRICT
LINES OF EQUAL DEPTH
TO WATER IN WELLS
SAN JOAQUIN VALLEY
SPRING 1988
SCALE OF MILES
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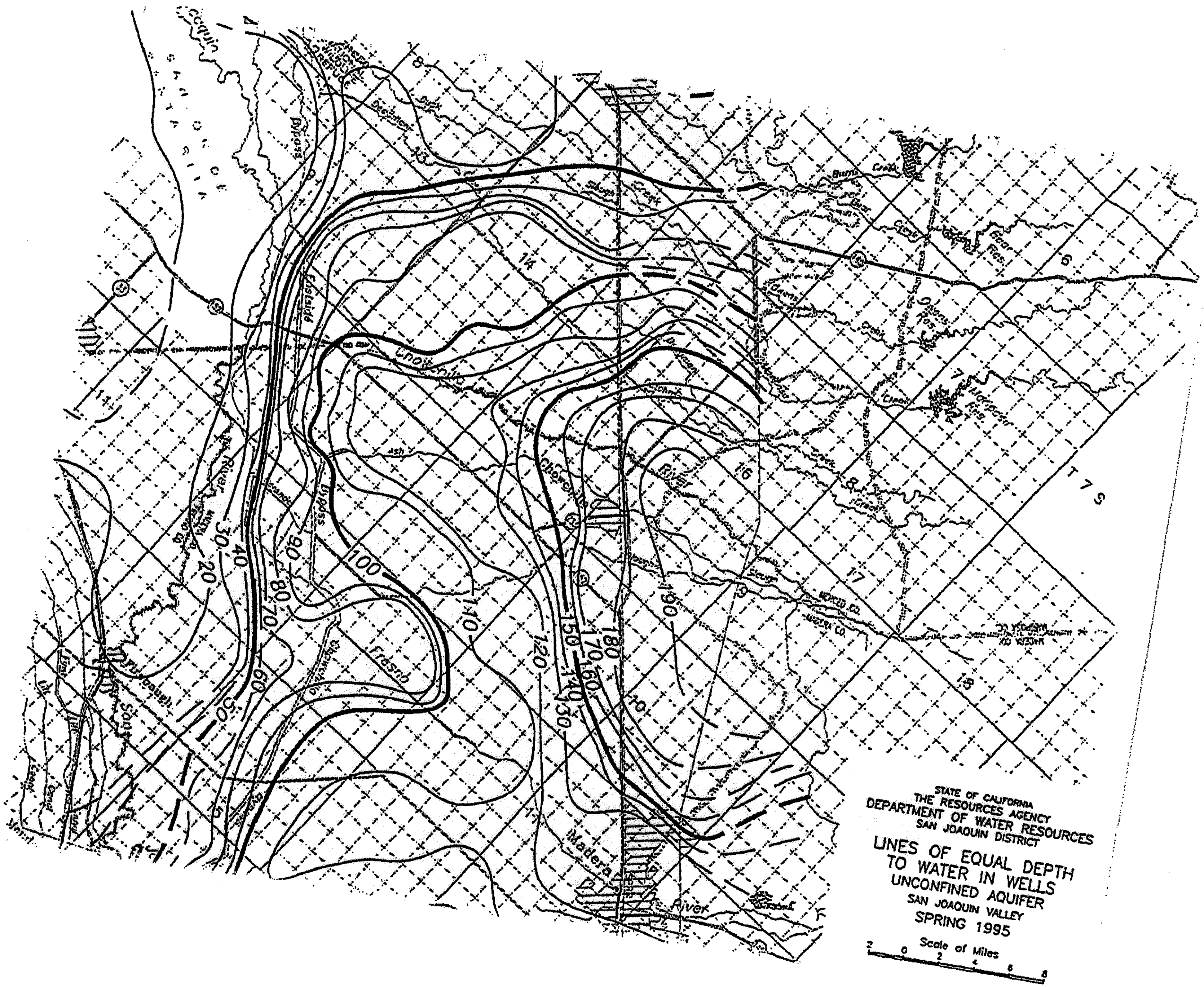
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SAN JOAQUIN DISTRICT
LINES OF EQUAL DEPTH
TO WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1995
Scale of Miles
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Fresno
Madera
River
Eastside
Bypass
Berenda
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Creek
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Mariposa
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Bear
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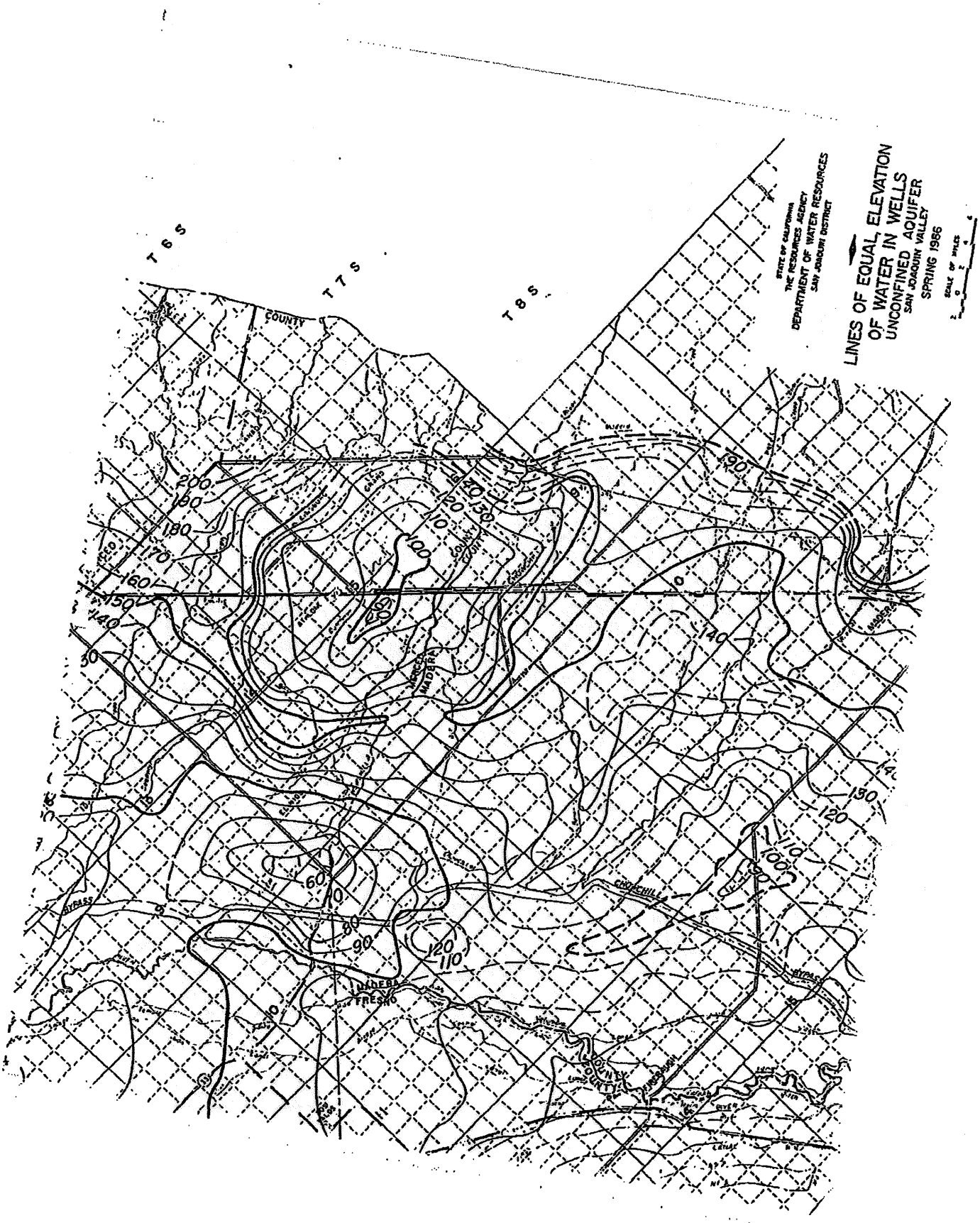
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LINES OF EQUAL ELEVATION
OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1966
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COUNTY
MERCED
MADERA
CHOWCHILLA
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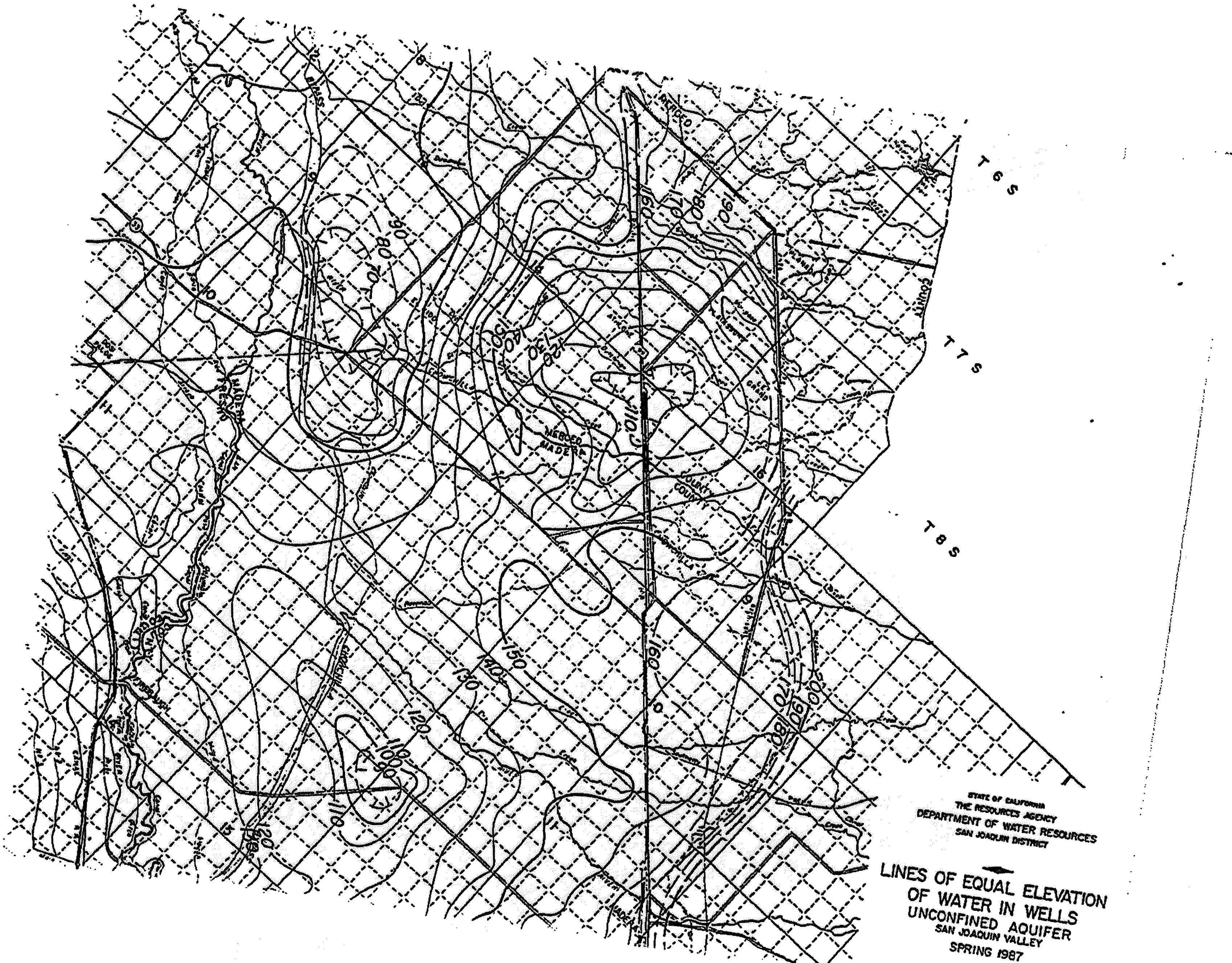

STATE OF CALIFORNIA
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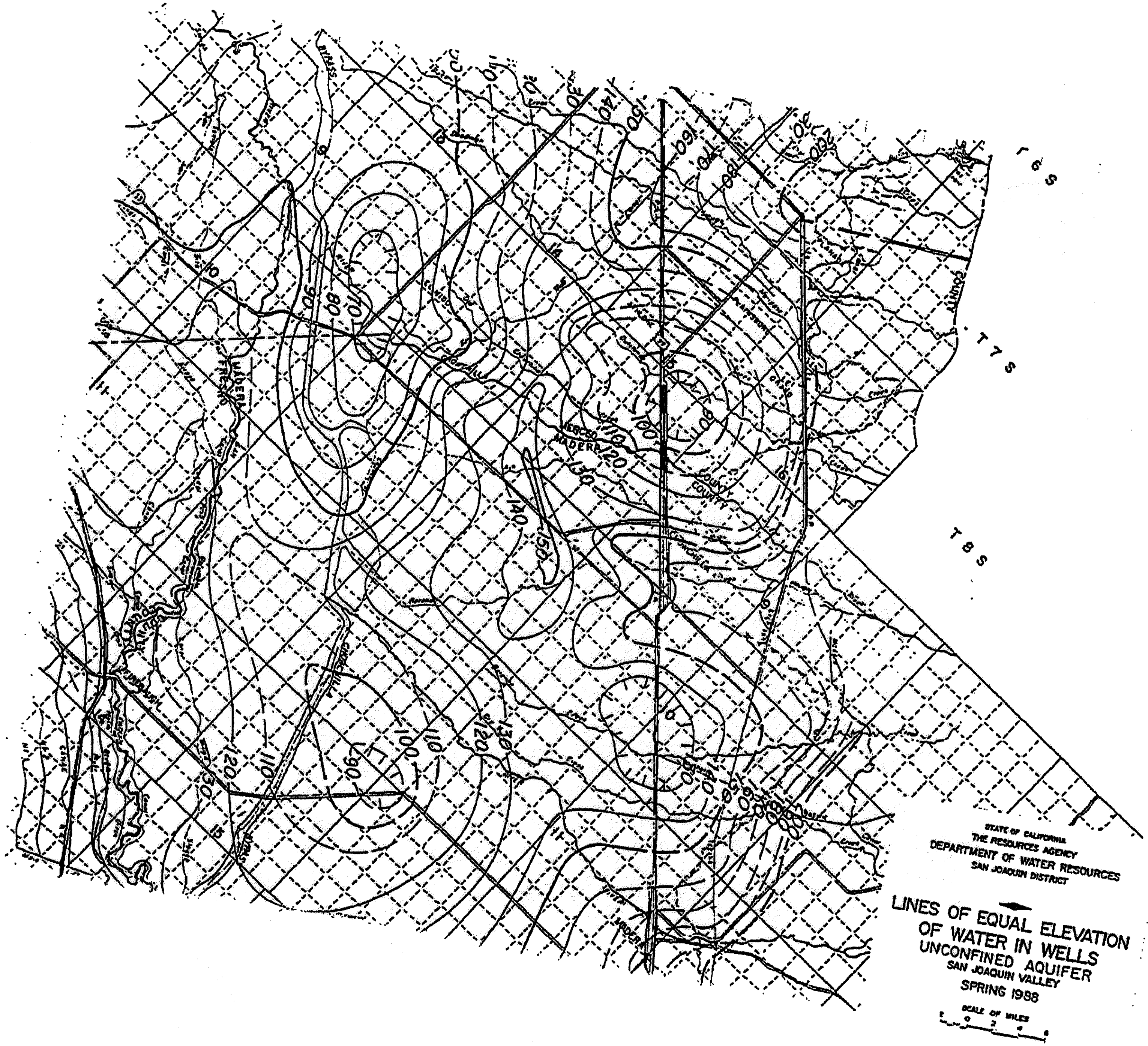
DEPARTMENT OF WATER RESOURCES
SAN JOAQUIN DISTRICT

LINES OF EQUAL ELEVATION OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1987

SCALE OF MILES
2 0 2 4 6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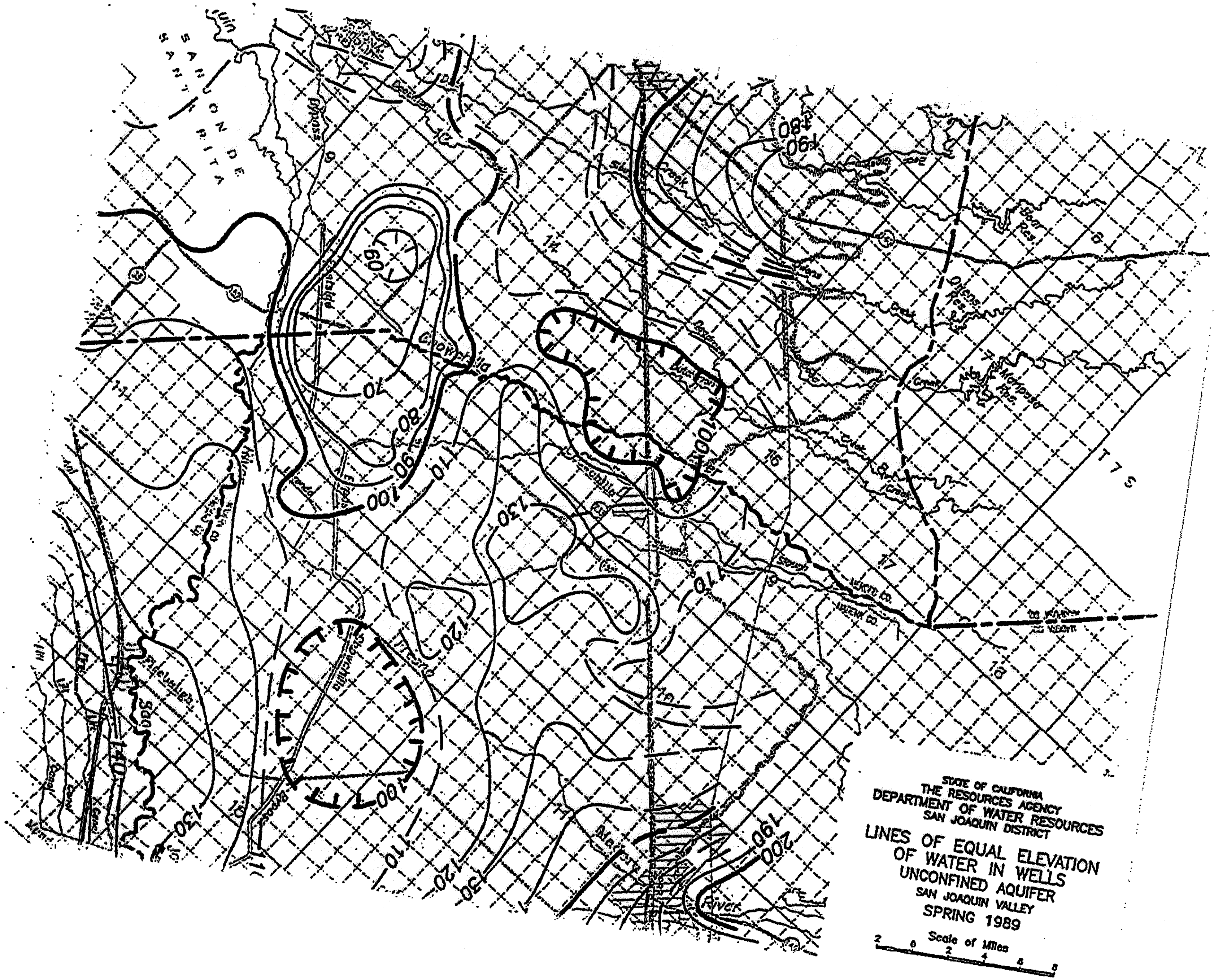
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OF WATER IN WELLS
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SAN JOAQUIN VALLEY
SPRING 1989
Scale of Miles
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SAN JON DE
SANTA RITA
Bear Res.
Owens Res.
Mariposa Res.
Chowchilla
Fresno
Madera
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Bypass
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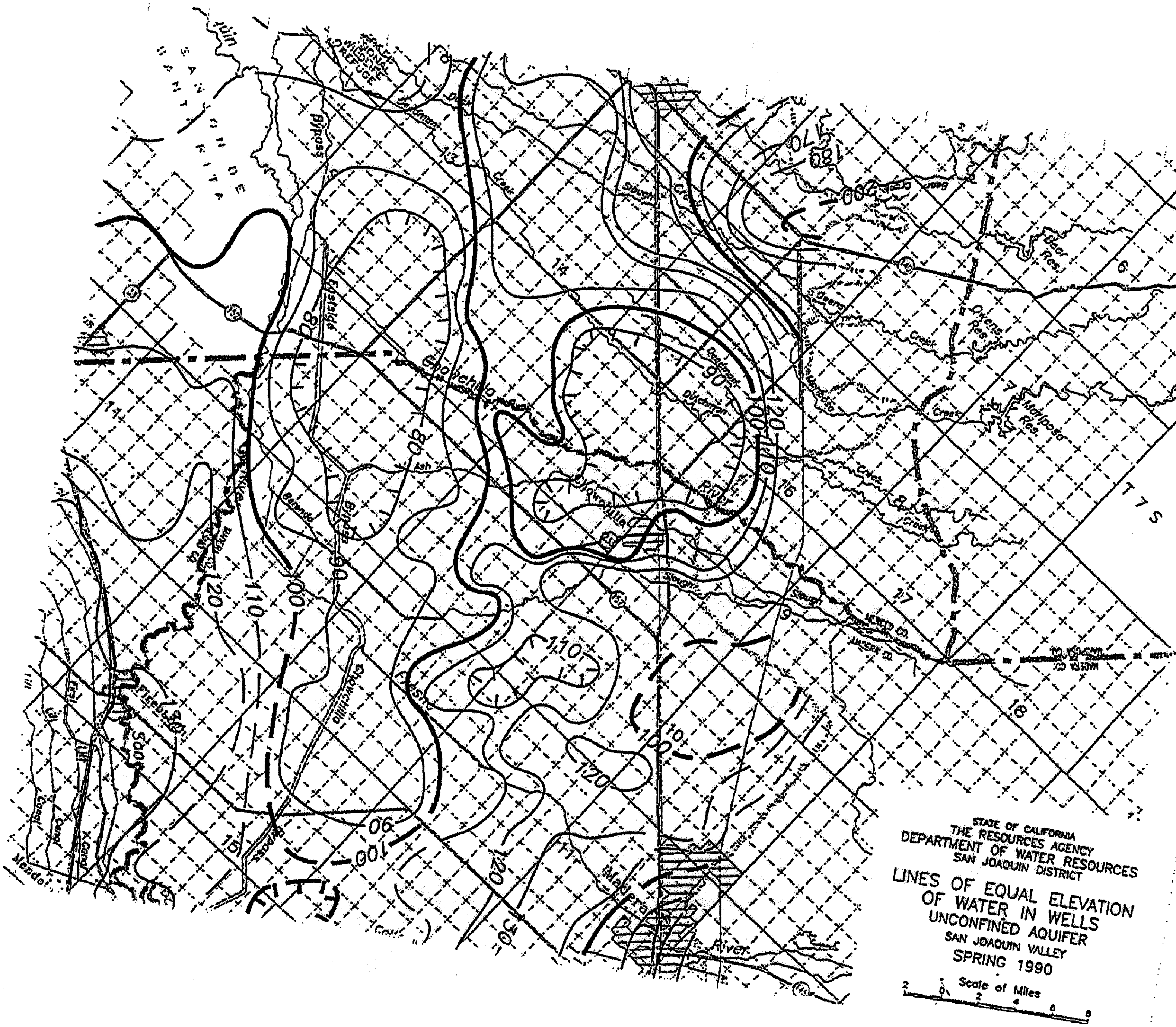
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OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1990
Scale of Miles
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Eastside
Bypass
Berenda
Ash
Dutchman
Deadman
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River
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Sand Slough
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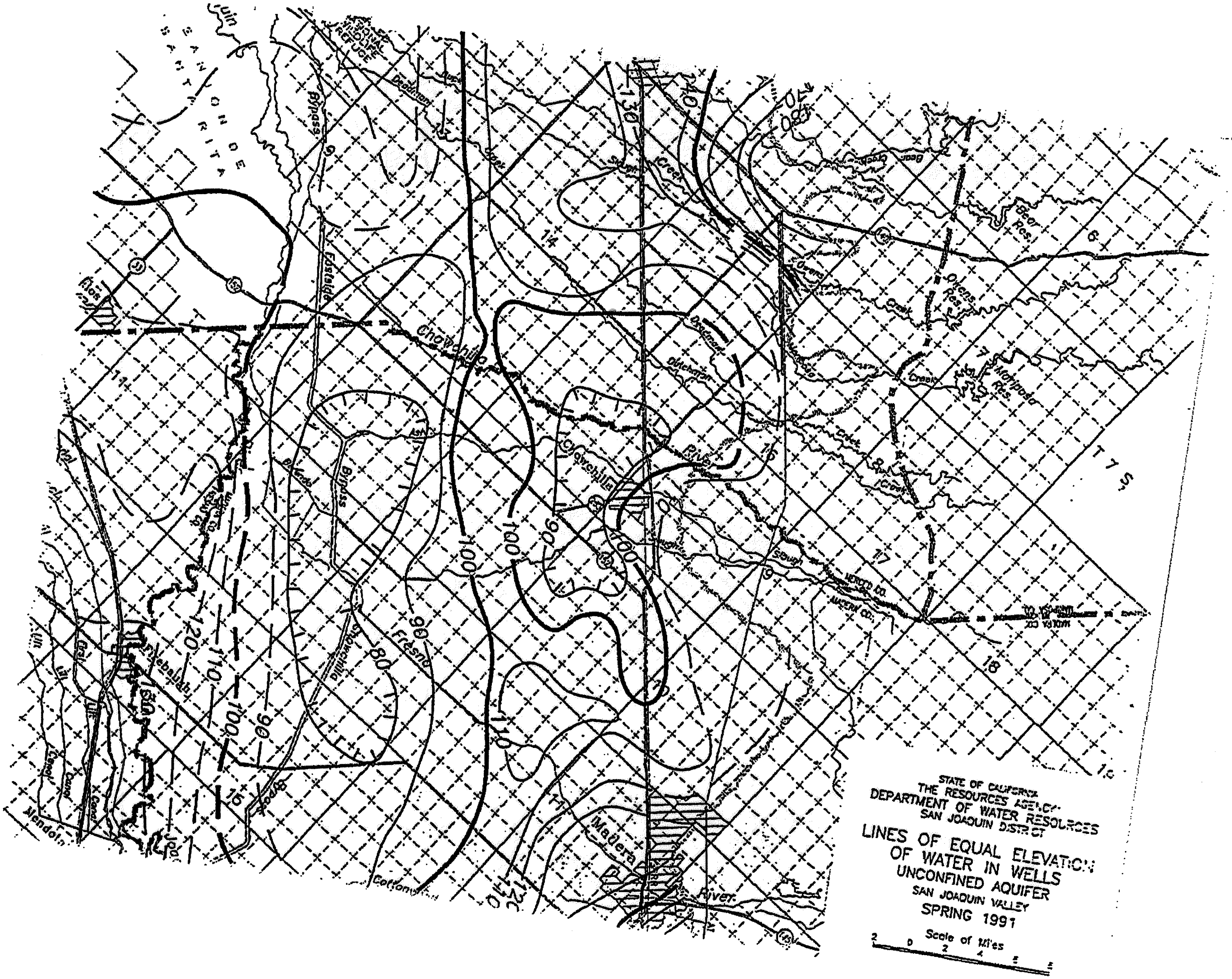
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SAN JOAQUIN DISTRICT
LINES OF EQUAL ELEVATION
OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1991
Scale of Miles
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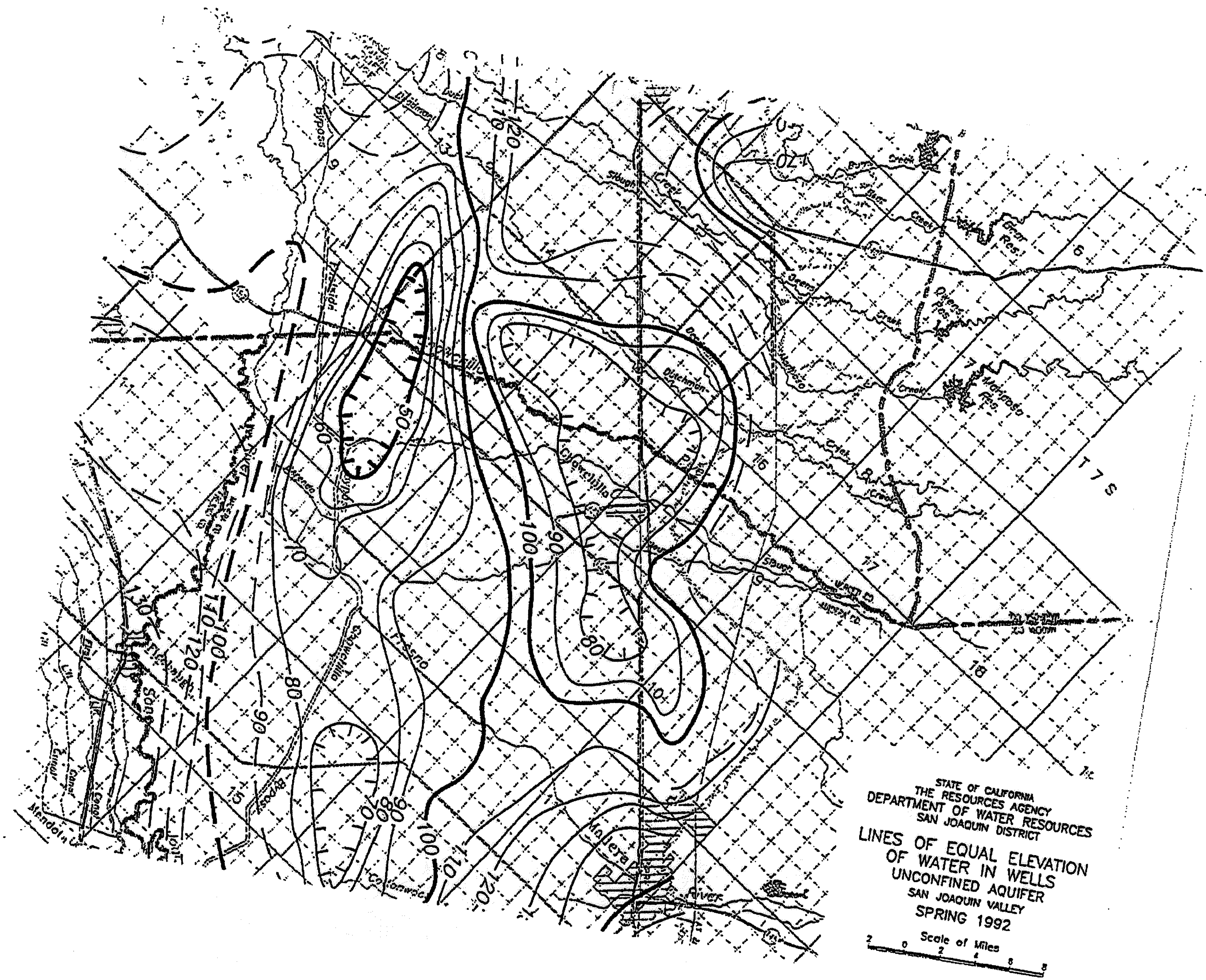
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OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1992
Scale of Miles
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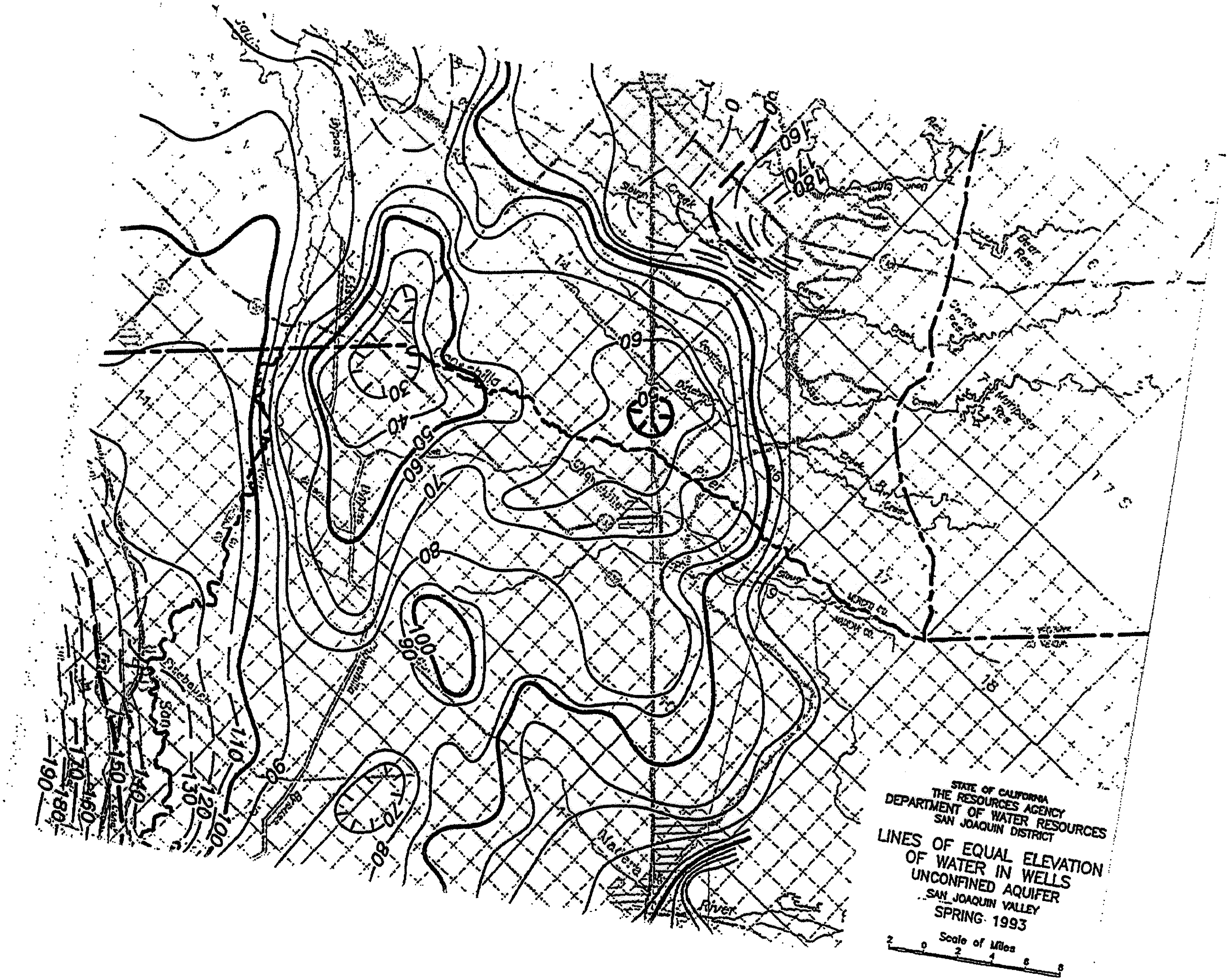
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UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
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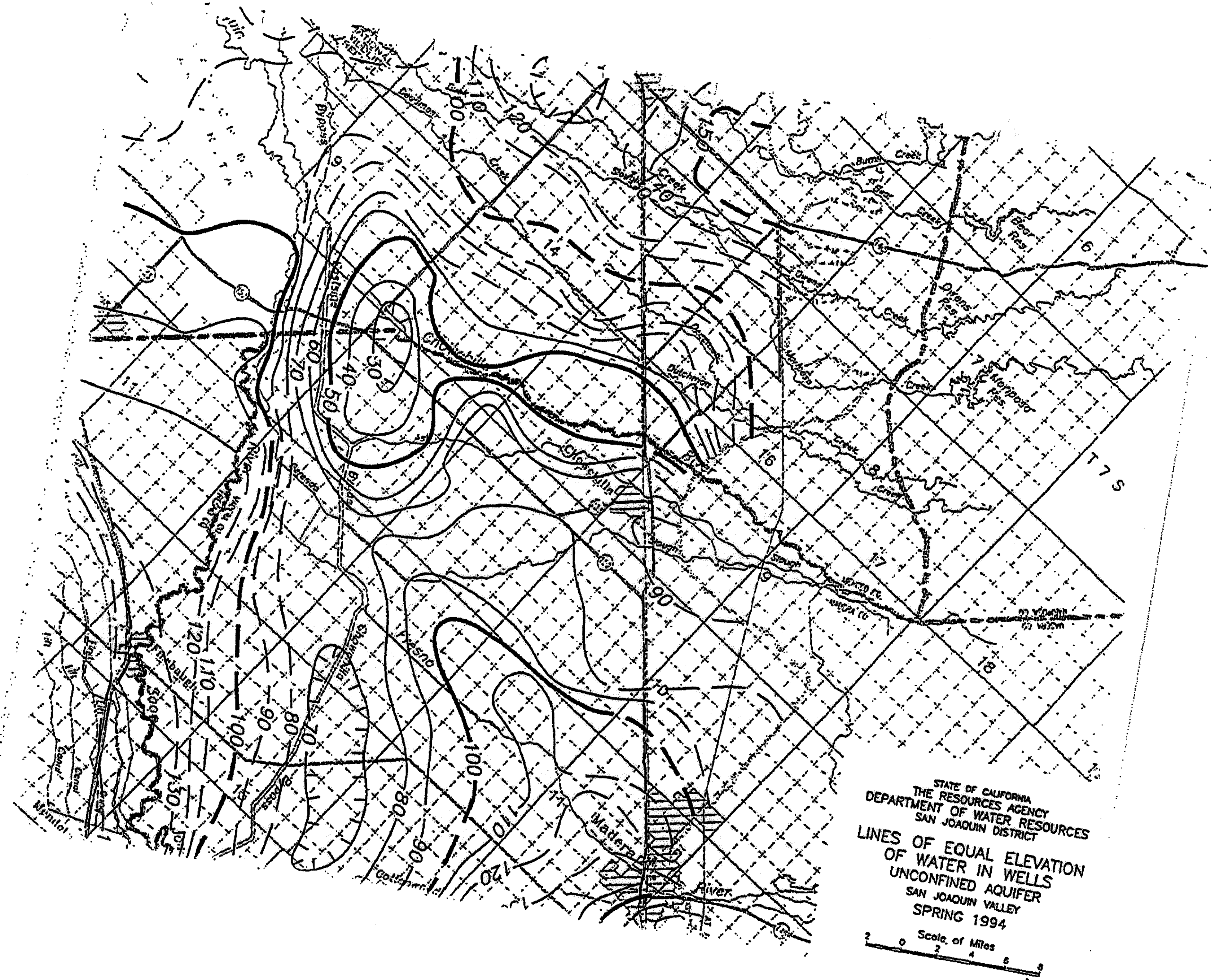
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LINES OF EQUAL ELEVATION
OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1994
Scale of Miles
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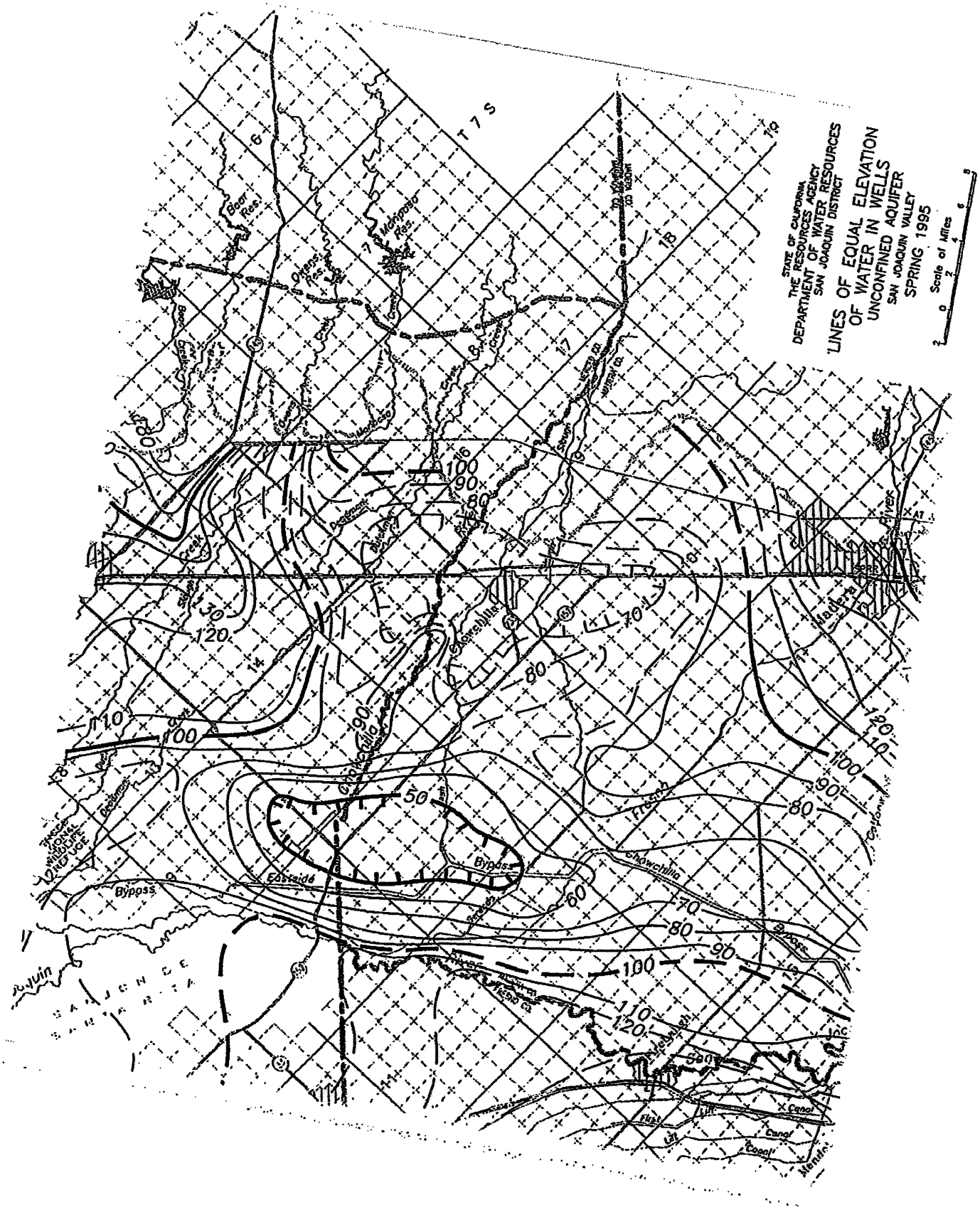
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OF WATER IN WELLS
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SAN JOAQUIN VALLEY
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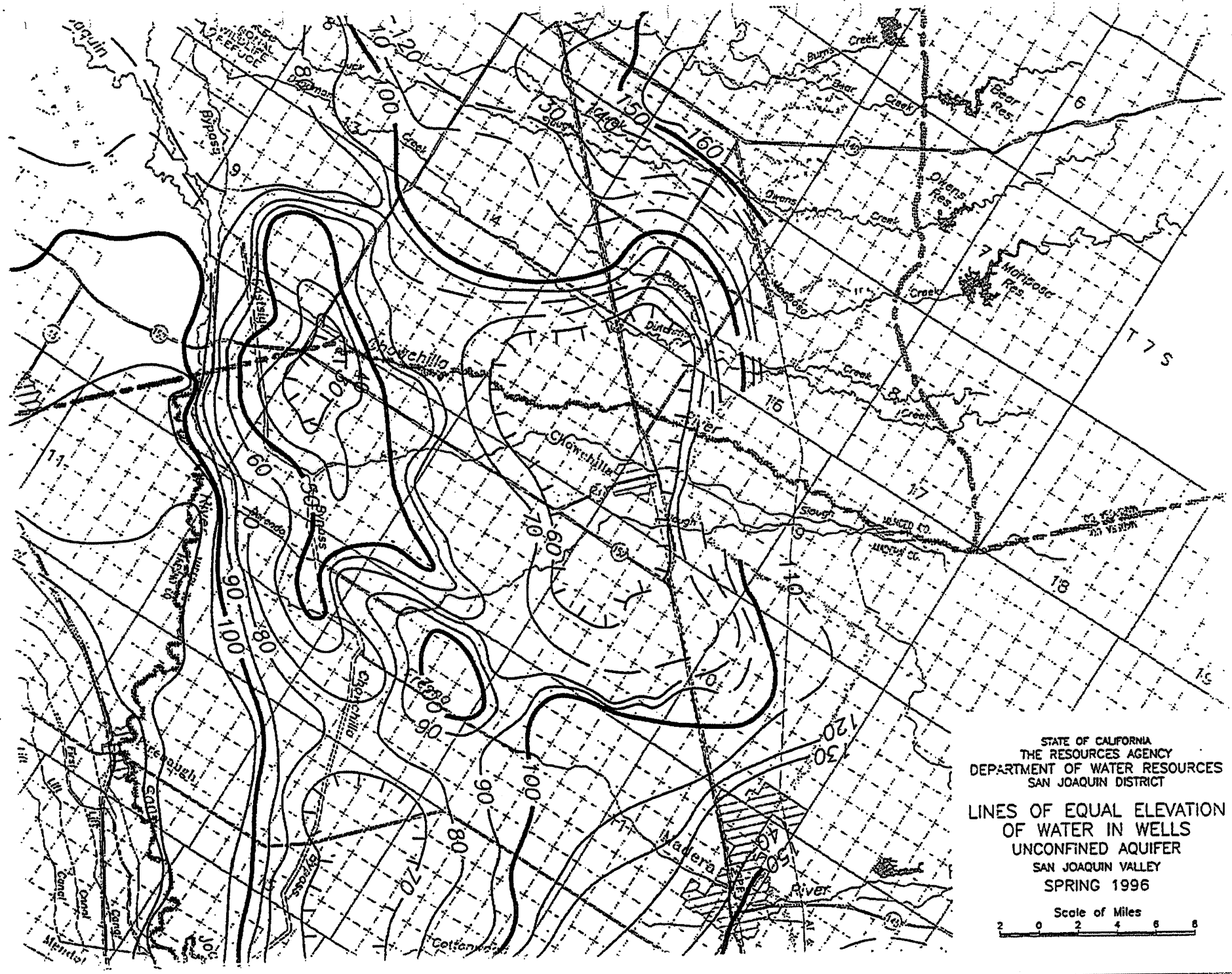

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN JOAQUIN DISTRICT

LINES OF EQUAL ELEVATION
OF WATER IN WELLS
UNCONFINED AQUIFER
SAN JOAQUIN VALLEY
SPRING 1996

APPENDIX 7

AMENDED Joint Exercise of Powers Agreement

(This Joint Exercise of Powers Agreement was amended January 1, 1999 to include the City of Chowchilla as a member agency of the Joint Powers Authority.)

AMENDED JOINT EXERCISE OF POWERS AGREEMENT BY AND BETWEEN CHOWCHILLA WATER DISTRICT, CHOWCHILLA-RED TOP RESOURCE CONSERVATION DISTRICT AND CITY OF CHOWCHILLA FORMING THE CWD-RED TOP-CITY JOINT POWERS AUTHORITY

This Agreement, dated for convenience as of January 1, 1999, by and between the CHOWCHILLA WATER DISTRICT, a California Water District, ("Chowchilla"), the CHOWCHILLA-RED TOP RESOURCE CONSERVATION DISTRICT, a Resource Conservation District, (Red Top) and the CITY OF CHOWCHILLA, a Municipality, ("City") all located in the State of California.

WITNESSETH

WHEREAS, prior hereto by an agreement dated October 30, 1997 Chowchilla and Red Top formed the CWD-Red Top RCD Joint Powers Authority to adopt and enforce a Groundwater Management Plan, and

WHEREAS, the CWD-Red Top RCD Joint Powers Authority on December 3, 1997 pursuant to Resolution 97-02 adopted the CWD-Red Top RCD Joint Powers Authority Groundwater Management Plan, and

WHEREAS, the lands within City are also within the boundaries of Chowchilla and Red Top, and

WHEREAS, City was not a party to the Authority at the time of the adoption of the Plan and was not covered thereby, and

WHEREAS, it is the mutual desire of the parties that the CWD-Red Top RCD Joint Powers Authority Groundwater Management Plan as adopted, cover the lands within all three entities, and

WHEREAS, it is the desire of Chowchilla and Red Top to amend the CWD-Red Top RCD Joint Powers Authority Agreement so as to include the City, and

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WHEREAS, Chowchilla, Red Top and City are empowered by law to adopt and enforce Groundwater Management Plans, and

WHEREAS, it is to the best interest of Chowchilla, Red Top and City that they join in adopting the CWD-Red Top RCD Joint Powers Authority Groundwater Management Plan so as to cover the area embraced within both districts and the City, and

WHEREAS, the execution of an Amended Joint Powers Authority Agreement makes such a Plan available;

NOW, THEREFORE, Chowchilla, Red Top and City, for and in consideration of the mutual agreements and covenants herein contained, do agree as follows:

SECTION 1. Definitions

1.01 Unless the context otherwise requires, the terms fined in this section shall for all purposes of the Agreement have the meanings herein specified.

Agreement

The term "Agreement" shall mean this amended joint exercise of powers agreement as originally executed and as it may from time to time be amended by all supplemental agreements entered into pursuant to the provisions hereof.

Authority

The term "Authority" shall mean the CWD-Red Top-City Joint Powers Authority, being a separate entity consisting of a joint exercise of powers authority created by the Members pursuant to the Agreement.

Board of Directors, or Board

"Board of Directors" or "Board" shall mean governing body of the Authority.

*****

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City

"City" shall mean the City of Chowchilla, a municipal corporation, duly organized and existing under the Constitution and laws of the State of California.

Chowchilla

The term "Chowchilla" shall mean the Chowchilla Water District, a California Water District, duly organized and existing under the Constitution and laws of the State of California.

Groundwater Management Plan

The term "Groundwater Management Plan" shall mean the CWD-Red Top RCD Joint Powers Authority Groundwater Management Plan adopted by the CWD-Red Top RCD Joint Powers Authority pursuant to the Groundwater Management Act on December 3, 1997.

Law

The term "Law" shall mean Articles 1 and 2 of Chapter 5 of Division 7 of Title 1 of the Government Code of the State of California, and all laws amendatory thereof or supplemental thereto.

Member

The term "Member" shall be either Chowchilla, Red Top or City.

Red Top

The term "Red Top" shall mean the Chowchilla-Red Top Resource Conservation District duly organized and existing under the Constitution and laws of the State of California.

SECTION 2. Amendment to Formation of the Authority

2.01 There is hereby created pursuant to the Law, an agency and public entity to be known as the "CWD-Red Top-City Joint Powers Authority." which

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is a successor to and continuation of the CWD-Red Top RCD Joint Powers Authority. As provided in the Law, the Authority shall be a public entity separate from the Members, and the debts, liabilities and obligations of the Authority shall not constitute debts, liabilities or obligations of the Members or either of them. The Authority shall own and hold title to all funds, property and works acquired by it during the term of this Agreement.

SECTION 3. Contributions to and Revenues from the Authority

3.01 The Members shall pay for the costs and expenses associated with the maintenance and operation of the Authority in such amounts as are agreed to be contributed to the Authority, and are entitled to all the revenues of the Authority in the following percentages:

Chowchilla: 100% unless and until Red Top and or City can secure funds to contribute to the Authority.

Red Top and City: 0% unless and until Red Top and/or City can secure funds to contribute to the Authority.

3.02 If Red Top or City secure funds which either can contribute to the Authority, to the extent that funds are available, it shall make contributions until its contributions equal the contributions of Chowchilla and any other member.

SECTION 4. Term

4.01 The Agreement shall become effective as of the date hereof and shall continue in full force and effect until terminated by two members giving ninety (90) days notice of termination to the other member. If one member terminates its interest in the Authority, the Authority shall continue with the other two members until terminated by ninety (90) notice by a remaining member.

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SECTION 5. Powers: Restrictions Upon Exercise

5.01 The Authority shall have power to adopt and enforce a Groundwater Management Plan, subject, however, to the conditions and restrictions contained in the Agreement.

5.02 The Authority is authorized, in its own name, to do all acts necessary or convenient for the exercise of such powers for such purposes that each of its Members could do separately, including but not limited to any or all of the following: to make and enter into contracts; to exercise the power of eminent domain for the acquisition of property for Projects; to employ agents and employees; to acquire, construct, manage, maintain and operate any buildings, works or improvements; to acquire, hold or dispose of property; to incur debts, liabilities or obligations (which do not constitute debts, liabilities or obligations of the Members or either of them); and to sue and be sued in its own name.

5.03 Such powers shall be exercised subject only to such restrictions upon the manner of exercising such powers as are imposed upon the Chowchilla Water District as set forth in Division 13 of the California Water Code and other applicable statutes in the exercise of similar powers.

SECTION 6. Termination of Powers

6.01 The Authority shall continue to exercise the powers herein conferred upon it until the termination of the Authority under the provisions of Section 5 hereof. Upon such termination, the groundwater management plan adopted by the Authority shall remain in force and effect for the lands within Chowchilla until modified or rescinded by Chowchilla and shall remain in force and effect for the lands within Red Top outside of the boundaries of Chowchilla until

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modified or rescinded by Red Top, and shall remain in force and effect for the land within City until modified or rescinded by City.

6.02 Upon termination of the Authority, Chowchilla shall have no power to adopt a groundwater management plan outside of its boundaries and within the boundaries of Red Top or City without the written consent of Red Top or City.

6.03 Upon termination of the Authority, Red Top shall have no power to adopt a groundwater management plan within the boundaries of Chowchilla or City without the written consent of Chowchilla or City.

6.04 Upon termination of the Authority, City shall have no power to adopt a groundwater management plan outside of the boundaries of City and within the boundaries of Chowchilla or Red Top without the written consent of Chowchilla or Red Top.

SECTION 7. Board of Directors

7.01 The Authority shall be administered by the Board of Directors which shall consist of twelve (12) members, each serving in his or her individual capacity as a member of the Board, constituting the five (5) members of the Board of Directors of Chowchilla, five (5) members of the Board of Directors of Red Top and two members from the City Council of City. The term of office of each member of the Board shall continue only so long as such member is a member of either of said boards of directors or council, and shall terminate if such member of the Board shall cease to be a member of either of said boards of directors or council.

7.02 Members of the Board shall receive such compensation or serving as such as is set by the Board from time to time, and shall be entitled to reimbursement for any expenses actually incurred in connection with serving as a

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member if the Board shall determine that such expenses shall be reimbursed and there are unencumbered funds available for such purpose.

7.03 All directors shall take office on January 1, 1999 and hold office until their successors are elected or appointed.

SECTION 8. Officers: Duties

8.01 The Board shall annually elect a President and Vice President of the Authority from among its members and shall appoint a General Manager of the Authority and a Secretary of the Authority, neither of whom shall be a member of the Board.

8.02 The General Manager of the Authority may be designated pursuant to the Law as Auditor-Treasurer of the Authority or at the pleasure of the Board a separate Auditor-Treasurer may be appointed. The Auditor-Treasurer is designated as the depository of the Authority to have custody of all money of the Authority from whatever source and to draw checks to pay demands against the Authority when such demands have been approved by the Authority, and such officer shall have the powers, duties and responsibilities of the offices of auditor and treasurer specified in the law.

8.03 The Auditor-Treasurer of the Authority is designated as the public officer or person who has charge of, handles, or has access to any property of the Authority, and such officer shall file an official bond with the Authority in the amount of $100,000, the expense thereof to be paid by the Authority.

8.04 The Board shall have the power to appoint such other officers and employees as it may deem necessary, and to retain independent accountants, counsel, engineers and there consultants, and to determine the salary or compensation of all such persons.

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SECTION 9. Meetings of the Board

9.01 The Board shall hold at least one regular meeting each year, and, by resolution, may provide for the holding of regular meetings at more frequent intervals. The date upon which, and the hour and place at which, each such regular meeting shall be held shall be fixed by resolution of the Board.

9.02 Special meetings of the Board may be called in accordance with the provisions of Section 54956 of the Government Code of the State of California, or as said sections may be amended or superseded.

9.03 All meetings of the Board shall be called, noticed, held and conducted subject to the provisions of Sections 54950-54962 of the Government Code of the State of California, or as said Sections may be amended or superseded.

9.04 The Secretary of the Authority shall cause minutes of all meetings of open sessions of the Board to be kept and shall, as soon as possible after each meeting, cause a copy of the minutes to be forwarded to each member of the Board and to the Secretary of the Board of Directors of each Member.

9.05 Three members of the Board of Directors of Chowchilla, three members of the Board of Directors of Red Top and one director from City shall constitute a quorum for the transaction of business, except that less than a quorum may adjourn from time to time. The Board shall take no other action except upon the affirmative vote of at least three members of the board of directors of Chowchilla and Red Top and one member from City.

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(209) 674-5656

SECTION 10. Fiscal Year

10.01 Unless and until changed by resolution of the Board, the fiscal year of the Authority shall be the period from January 1 of each year to and including the following December 31.

SECTION 11. Disposition of Assets

11.01 In the event of termination of the Authority, all assets of the Authority shall be distributed to the respective member grantor or assignor thereof, and any surplus money or other assets on hand shall be returned to the members in proportion to their contributions to the Authority.

SECTION 12. Adoption of Groundwater Management Plan

12.01 The Authority adopts as its Groundwater Management Plan the CWD-Red Top RCD Joint Powers Authority Groundwater Management Plan adopted on December 3, 1997 by the CWD-Red Top RCD Joint Powers Authority.

SECTION 13. Agreement Not Exclusive

13.01 This Agreement shall not be exclusive and shall not be deemed to amend or alter the terms of other agreements [except the Agreement forming the CWD-Red Top RCD Joint Powers Authority] by and between the Members.

SECTION 14. Contributions and Advances

14.01 Contributions or advances of public funds, or funds from their respective treasuries, and of personnel, equipment or property may be made to the Authority by any Member for any of the purposes of the Agreement. Any such advance may be made subject to repayment, and in such case shall be repaid in the manner agreed upon by the Member making such advance and the Authority at the time of making such advance.

GREEN, GREEN
& RIGBY
219 SOUTH O STREET
MADERA, CA 93638
(209) 674-5656

SECTION 15. Accounts and Reports

15.01 The Authority shall establish and maintain such funds and accounts as may be required by good accounting practice. The books and records of the Authority shall be open to inspection at all reasonable times by the members and their representatives.

15.02 The Auditor-Treasurer of the Authority, subject to the approval of the Board, shall contract with a certified public accountant or public accountant to make an annual audit of the accounts and records of the Authority, and in each case the minimum requirements of the audit shall be those prescribed by the State Controller for special districts under Section 26909 of the Government Code of the State of California, or as the same may be amended or superseded, and shall conform to generally accepted auditing standards; except that the Members may, by unanimous request of the Boards of Directors thereof, replace the annual special audit with an audit covering a two-year period. A report of each such audit shall be filed as a public record with each Member and with the County Auditor of Madera County, the county in which both Members are located, which such report shall be filed within twelve (12) months of the end of the fiscal year or years under examination. All costs of such audit shall be borne by the Authority and shall be a charge against any unencumbered funds of the Authority available for the purpose.

SECTION 16. Breach

16.01 If default shall be made by any Member of any covenant contained in the Agreement, such default shall not excuse the other Members from fulfilling its obligations under the Agreement, and such other Member shall continue to be liable for the payment of all contributions and the performance of all obligations herein contained.

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& RIGBY
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(209) 674-5656

16.02 The Members hereby declare that the Agreement is entered into for the benefit of the Authority created hereby and the Members hereby grant to the Authority the right to enforce by whatever lawful means the Authority deems appropriate all of the obligations of each member hereunder. Each and all of the remedies given to the Authority hereunder or by any law now or hereafter enacted are cumulative and the exercise of any one right or remedy shall not impair the right of the Authority to any or all other remedies.

SECTION 17. Severability

17.01 Should any part, term or provision of the Agreement be decided by the courts to be illegal or in conflict with any law of the State of California, or otherwise be rendered unenforceable or ineffectual, the validity of the remaining parts, terms or provisions hereof shall not be affected thereby.

SECTION 18. Successors: Assignment

18.01 The Agreement shall be binding upon and shall inure to the benefit of the successors of each Member. No Member may assign any right or obligation hereunder without the consent of the other Members.

SECTION 19. Amendment of the Agreement

19.01 The Agreement may be amended by a supplemental or amended agreement executed by all of the Members at any time.

SECTION 20. Office

20.01 The office of the Authority shall be maintained at 327 South Chowchilla Blvd., Chowchilla, CA. 93610, until such time as the location thereof is changed by the Board.

SECTION 21. Notices

22.01 Any notice authorized or required to be given pursuant to this Agreement shall be in writing and shall be deemed to have been given when

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& RIGBY
219 SOUTH D STREET
MADERA, CA 93638
(209) 674-5656

mailed, postage prepaid, or delivered during working hours to the following address, or to such changed addresses as are communicated to the Authority and the member entities in writing:

Chowchilla:

P.O. Box 905, Chowchilla, CA. 93610

Red Top:

c/o John Wolfshorndl, 11791 Ave. 22, Chowchilla, CA. 93610

City:

145 West Robinson Blvd., Chowchilla CA. 93610

SECTION 22. Section Headings

22.01 All section headings contained herein are for convenience of reference only and are not intended to define or limit the scope of any provision of the Agreement.

SECTION 23. Prior Agreement and Merger

23.01 This Agreement supercedes the agreement dated October 30, 1997 Chowchilla and Red Top which formed the CWD-Red Top RCD Joint Powers Authority.

23.02 The CWD-Red Top RCD Joint Powers Authority is hereby merged with the CWD-Red Top-City Joint Powers Authority formed hereunder.

IN WITNESS WHEREOF the parties hereto have caused the Agreement to be executed and attested by their proper officers thereunto duly authorized, and their official seals to be hereto affixed, as of the day and year first above written.

*****
*****
*****

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& RIGBY
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MADERA, CA 93638
(209) 674-5656

CHOWCHILLA WATER DISTRICT

By: _____
Robert Capehart, President

ATTEST:
_____
Douglas Welch, Secretary

[Seal]

CITY OF CHOWCHILLA

By: _____
Ronald Harris, Mayor

ATTEST:
_____
Lori Stayner, City Clerk

CHOWCHILLA-RED TOP RESOURCE CONSERVATION DISTRICT

By: _____
Norman Kuhr, Chairman

ATTEST:
_____
John Wolfshordl, Secretary

[Seal]

[Seal]

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& RIGBY
219 SOUTH O STREET
MADERA, CA 93638
(209) 674-5656

Attachment H

Groundwater Banking Plan

Not Applicable

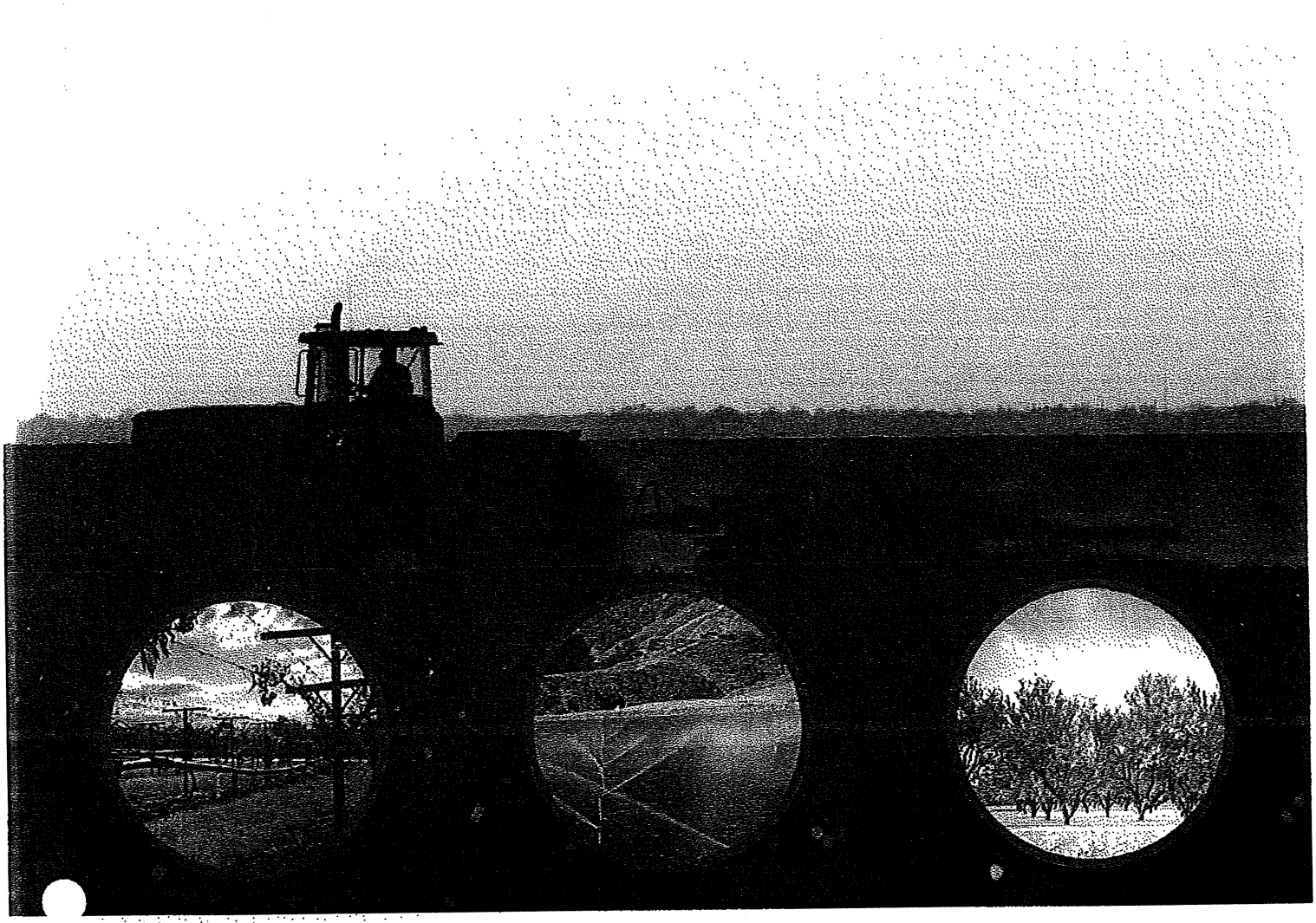
Attachment I

Annual Potable Water Quality Report – Urban

Not Applicable

Attachment J

Notices of District Education Programs and Services Available to Customers



IRRIGATION TECH SEMINAR SERIES

AGENDA: Basic Micro Irrigation for Permanent Crops • October 29, 2008

• Work Shop Registration and Manufacturer Displays		8:00 - 8:30 am	
• Welcome	David Zoldoske, Director CIT	8:30 - 8:35 am	
• Drip Basics	Jim King, Eurodrip USA	8:35 - 9:15 am	Pages 2 - 7
• Other Equipment and Issues	Dennis Hannaford, Netafim USA	9:15 - 9:55 am	Pages 8 - 14
• Bottom Line Issues	Bill Green, CIT	9:55 - 10:30 am	Pages 15 - 19
• Break	Manufacturer Displays	10:30 - 11:00 am	
• Tour - University Farm Field Trip	Almond and Olive Drip Systems	11:00 - 12:30 pm	

Participating Irrigation Equipment Manufacturers: Eurodrip USA · Netafim USA · Jain Irrigation Systems Ltd. John Deere Water Technologies · Bowsmith · Toro

Brought to you by:

Irrigation Tech Seminar Series
California State University, Fresno
CIT Center for Irrigation Technology

IRRIGATION TECH SEMINAR SERIES

AGENDA: Irrigation Performance - Tips & Tools • December 11, 2008

Presented by Bill Green, CIT

- Work Shop Registration
- Welcome
- Effective vs. Efficient Irrigations
- Distribution Uniformity vs. Irrigation Efficiency (DU vs. IE)
- Factors in Obtaining High DU in All Systems
- Irrigation System Evaluations
- Irrigation Management for Conserving Water and Obtaining High IE
- Irrigation Performance and Fertilizer/Chemicals/Yield/Water Quality/Conservation
- CIT Pump and Sprinkler Demonstration

Brought to you by:

Irrigation Tech Seminar Series

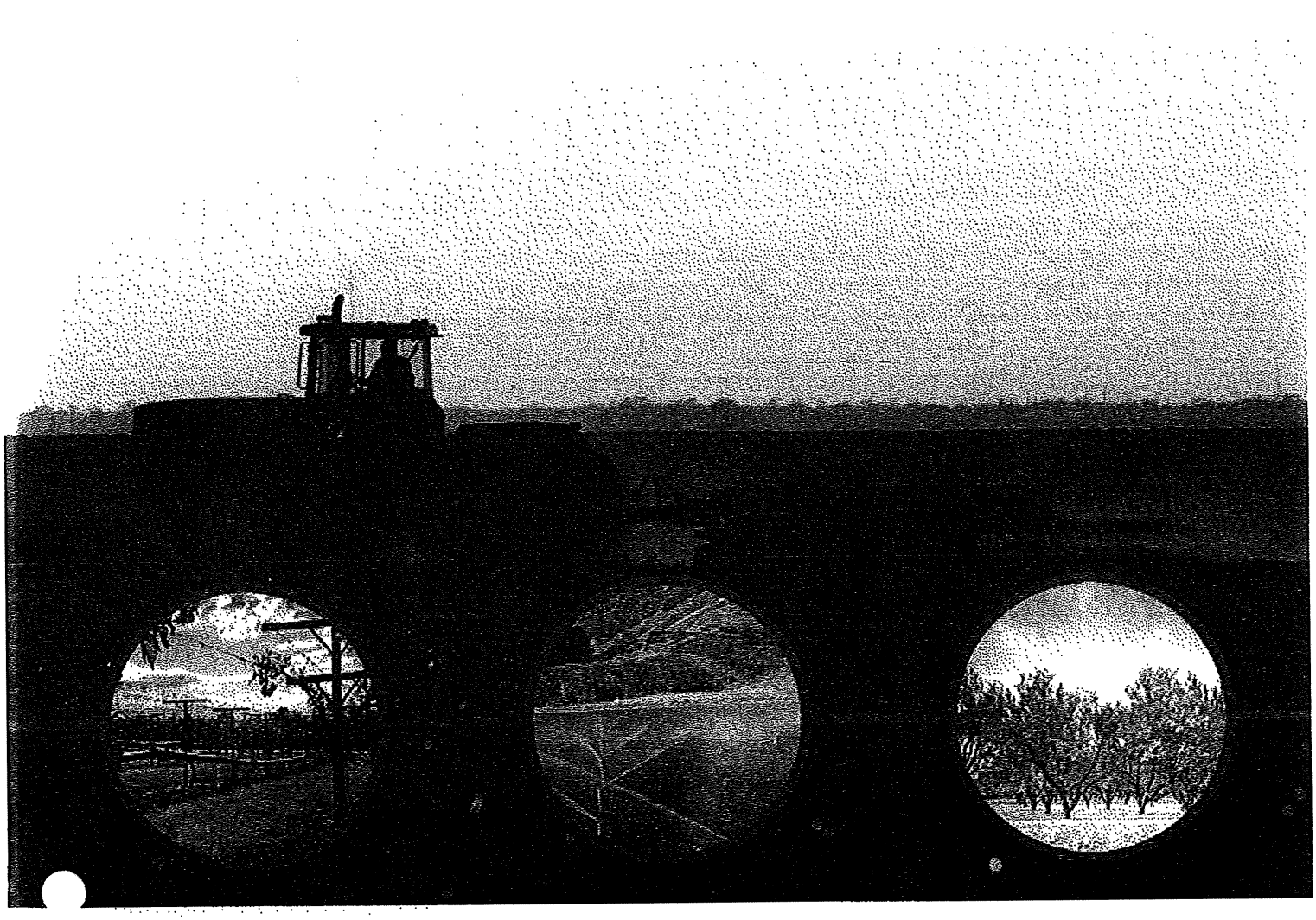
IRRIGATION TECH SEMINAR SERIES

AGENDA: WATERIGHT Web-Based Irrigation Scheduling • January 15, 2009

- Work Shop Registration
- Welcome — Bill Green, CIT
- Introduction — Pete Canessa, CIT
- Overview of WATERIGHT
- Break
- Example
- Break
- More Examples

Brought to you by:

Irrigation Tech Seminar Series
California State University, Fresno
CIT Center for Irrigation Technology



IRRIGATION TECH SEMINAR SERIES

AGENDA: Irrigation with Center Pivots: In the Field at the Fresno State Campus Farm • November 20, 2009

• 8:30 am	Welcome	Bill Green - CIT	Page 2
• 8:45 am	Center Pivot Basics	Ray Batten- Valmont	Page 3 - 15
• 9:30 am	Nozzles	Craig Stafford - Nelson	
• 9:40 am	Flow Meters	Tony Pereira- SeaMetrics	
• 9:50 am	Filtration	Steve Johnson- Jain	
• 10:00 am	Break		
• 10:15 am	Pivot Nozzles and Uniformity	Ed Norum - CIT	Page 16
• 10:45 am	Field Trip	Fresno State Center Pivot	

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California State University, Fresno
CIT Center for Irrigation Technology

IRRIGATION TECH SEMINAR SERIES

AGENDA: Irrigation Water: Monitoring Tools to Make the Most Out of Every Drop
December 15, 2009

• 8:00 - 8:30 am	Registration and Breakfast	CATI Conference Center	
• 8:30 - 8:45 am	Welcome	Bill Green - CIT	Page 2
• 8:45 - 9:30 am	Soil/Water/Crop Dynamics	Matt Angell Strategic Farming - Western Ag & Turf	Pages 3 - 14
• 9:30 - 10:15 am	Tensiometers and Electrical Resistance	Lanny Sewell - Irrometer	Pages 15 - 27
• 10:15 - 10:30 am	Break		
• 10:30 - 11:15 am	Soil Moisture and Beyond	Chris Higgins - Netafim USA	Pages 28 - 33
• 11:15 - 11:30 am	Reducing Water Applied	Bill Green - CIT	Pages 34 - 36

Brought to you by: CIT Center for Irrigation Technology

Irrigation Tech Seminar Series
California State University, Fresno
CIT Center for Irrigation Technology

01-18-10 10:41 IN

ITRC

moving water in new directions

Professional Education Opportunities at ITRC

Visit our website at **www.itrc.org** to obtain the latest information.

Pump Training – March 2-4, 2010
Sponsor: USBR Mid-Pacific Region

PUMPS I, Mar. 2: Basic pumps course covering types; terms; curves; pumps in series and parallel; system curves; TDH computations; efficiency; WHP, BHP, input HP; pump selection; trimming impellers; common pump questions and answers.

PUMPS II, Mar. 3-4: Class covering advanced topics such as: NPSH, submersible pumps; well screens and well development, shaft losses, shaft sizing; maintenance and troubleshooting; adjustable seed drive (ASD) basics; variable frequency drive (VFD) basics; retrofitting VFDs on existing motors; affinity laws for variable speed operation; estimating savings from VFDs; hands-on ASD applications; power factor correction; inlet and sump design.

Irrigation District School of Irrigation Winter 2010
Sponsor: USBR Mid-Pacific Region

ITRC is providing several training and educational opportunities for staff, engineers, and board members of agricultural irrigation districts, as well as water operators. These classes utilize the excellent indoor and outdoor facilities at Cal Poly.

Water Operator Classes	1st session	2nd session
FLOW MEASUREMENT – General & Pipeline	Jan. 12, 2010	Feb. 23, 2010
FLOW MEASUREMENT – Canals	Jan. 13, 2010	Feb. 24, 2010
CANAL OPERATION	Jan. 14, 2010	Feb. 25, 2010

Ag Irrigation System Evaluation Short Course - June 2010
Sponsor: DWR

ISE I: Theory and Laboratory Practice of Evaluations. This 2½-day course will be held **June 14-16, 2010.** The class combines classroom (50%) and outdoor laboratory (50%) activities. Efficiency definitions and techniques of evaluation are emphasized, ranging from how to take a pressure measurement to what specific measurements are needed for the evaluation of six distinct irrigation methods (furrow, border strip, hand move/side roll sprinkler, linear move sprinkler, undertree sprinkler, and drip/micro). The course is not mathematically oriented, since the calculations are manipulated by the new and revised Cal Poly/DWR expert system Irrigation Evaluation programs.

ISE II: San Joaquin Valley Field Evaluations of Drip/Micro Systems. This 2½-day class, held on **June 16-18, 2010,** travels to the San Joaquin Valley and performs the entire evaluations on 2 fields. Emphasis is on performing the field evaluations for drip and microspray irrigation systems on trees/vines. This class allows for more extensive field training to help with the comprehension of the materials from Class 1.

Drip Irrigation Workshop – February 11, 2010
Sponsor: Southern California Edison, AgTAC

This ½ day class is done to coincide with the World Ag Expo in Tulare. The class is designed for growers interested in drip irrigation. Topics covered include product selection, filter requirements, remote data collection, and energy requirements.

Irrigation District – Custom Classes

In addition to the classes offered throughout the year, the ITRC can provide training specifically tailored to the needs of individual districts or companies. For example, in the past, we have offered modified classes in flow measurement, canal operation, SCADA, and drip irrigation.

For more information, please contact:
Dr. Stuart Styles, sstyles@calpoly.edu

SCADA
February 9-12, 2010
Sponsor: USBR Mid-Pacific Region
NEW MATERIAL

Training for individuals involved in planning, designing, installing, operating and maintaining SCADA systems. The four-day long class will introduce participants to more advanced SCADA topics and give them the opportunity to test their skills in the electronics lab at Cal Poly's BioResource and Agricultural Engineering Dept. Recent applications with ClearSCADA HMI will be highlighted. The class will also offer specialized topics on automation performance.

The lab has 10 complete SCADA work stations, allowing for unprecedented "hands-on" electronic training. The knowledge gained from the class will help make the participants better able to understand, plan, design, install, manage, and maintain the telemetry systems that have become so important to improving the efficient use of water and power in agriculture.

Designer/Manager School of Irrigation - August 2010
Sponsor: USBR Mid-Pacific Region

The Designer/Manger School is a comprehensive educational program offering a variety of classes designed for both agricultural and landscape irrigation professionals.

August 2010

Monday	Tuesday	Wednesday	Thursday	Friday
2	3	4 Basic Soil, Plant & Water Relationships	5 Irrigation Scheduling, Salinity & Drainage	6 Irrigation Scheduling, Salinity, & Drainage Certification Exam
9 Basic Pipeline Hydraulics I	10 Basic Pipeline Hydraulics II	11 Pumps I	12 Pumps II Chemigation	13 Pumps II Row Crop Drip Irrigation
16 Drip/Micro Irrigation Design	17 Drip/Micro Irrigation Design	18 Drip/Micro Irrigation Design	19	20

FRIANT
WATER USERS AUTHORITY

ROUTE TO:
MGR. _____
A/MGR. _____
SUPT. _____
TAX COLL. _____
ENGR. _____
SECY. _____
INITIAL & FORWARD
DEC 16 2002

MEMORANDUM

DATE: December 13, 2002

TO: Member Districts

FROM: John Roldan, Chief Engineer JR

SUBJECT: Summary of Services Provided for District Water Management Plans in 2002

In an effort to assist you with your USBR Water Management Plans and the Annual Updates, the following list is a summary of services available from the Authority and/or provided during the last year.

1. *Irrigation Tech-Line* – This educational water management newsletter is published approximately four (4) times per year. Articles typically feature grower success stories and a corresponding technical article (soil/water/plant) with each issue. The newsletter is distributed to those receiving the Friant *Waterline.*

2. Evapo-transpiration (ET) information – Normal year and real-time ET data for 12 local CIMIS stations are provided to the member districts on a weekly basis with the Water Data Report during the growing season. Crop coefficients, as developed by Kings River Conservation District, are also provided in the same report. Typically, the USBR requires that your water users be notified of the availability of this data at your office.

3. Surface Water Quality – Surface water quality for water conveyed through the FKC from Friant Dam is typically analyzed on an annual basis. To the extent that certain constituents are analyzed for the water supply report, this data is available to the districts and water users upon request. Water samples from two (2) locations on the Madera Canal and six (6) locations on the Friant-Kern Canal are analyzed.

4. Financial Assistance and On-Farm Water Management Lists – The Authority has compiled and maintains lists of:

   A. Organizations providing loans, grants, and cost sharing.
   B. Organizations performing irrigation pump efficiency testing.
   C. On-farm irrigation management consultants.
   D. Irrigation management software.
   E. Sources of real-time CIMIS ET data.

   Water users are notified annually regarding the availability of these lists by publishing a notice in the *Irrigation Tech-Line.*

854 N. Harvard Ave. • Lindsay, CA 93247-1715
559-562-6305 • Fax: 559-562-3496
Website: www.fwua.org

5. Radio Public Service Water Conservation Program – The Authority participates in the annual United Broadcasting's "Conserve America" community public service campaign on behalf of the member districts. The announcements are aired twice per day for seven days on KTIP – 1450 AM. This announcement was run during the week of Earth Day in 2002.

6. Educational Seminars - Local water related educational seminars are announced in the Friant Waterline. The Authority also participates, on the behalf of member districts, in educational sessions where possible.

Please do not hesitate to call if you have any questions.

cc: Dan Fults, General Manager
Mario Santoyo, Water, Environmental and Facilities Resources Manager
Ronald D. Jacobsma, Business Operations Manager

LOANS/GRANTS/COST SHARING

Farm Service Agency	Madera Co.	(559) 674-4628
	Fresno Co.	(559) 276-7494
	Tulare Co.	(559) 734-5814
	Kern Co.	(661) 861-4125
Natural Resources Conservation Service	Madera Co.	(559) 674-2108
	Fresno Co.	(559) 276-7494
	Tulare Co.	(559) 732-9163
	Kern Co.	(661) 861-4125
Fresno-Madera Farm Credit Services (Federal Land Bank Assn./ Production Credit Assn.)	Madera	(559) 674-2437
	Fresno	(559) 277-3276
	Selma	(559) 896-5040
Valley Farm Credit Services (Federal Land Bank Assn./ Production Credit Assn.)	Visalia	(559) 627-5050
	Hanford	(559) 584-2681
	Tipton	(559) 688-7844
	Wasco	(661) 758-5371
	Bakersfield	(661) 327-2741

Local Branches of Banks and Financial Institutions

Agricultural Energy Assistance Program (Energy Conservation)	Sacramento	(916) 654-4147
Pacific Gas & Electric Company (Energy Conservation)	Fresno	(559) 263-5575
Southern California Edison (Energy Conservation)	Tulare	(800) 634-9175

IRRIGATION PUMP EFFICIENCY TESTING

Pacific Gas & Electric Company (if funding is available)	Selma Bakersfield	(559) 891-2147 (661) 321-4448
Southern California Edison	Tulare	(800) 634-9175
Provost and Pritchard Engineering	Fresno	(559) 449-2700
Local Pump and Irrigation Companies		

LIST OF IRRIGATION MANAGEMENT CONSULTANTS

Dale Handley
16359 Ave 320
Visalia, CA 93292
(559) 798-2184

Pete Canessa, P.E.
P.O. Box 1721
Clovis, CA 93613
(559) 278-8449

Ag-Water Management
Andy Hensel
3635 E. Platt
Fresno, CA 93702
(559) 268-9158

ASI Consulting
Dean Striebich
1220 W. Fairmont
Fresno, CA 93705
(559) 221-7945

J.M. Lord, Inc.
267 N. Fulton St.
Fresno, CA 93701-1610
(559) 268-9755

Gabrielsen & Associates
Byron C. Gabrielsen
5921 W. Crowley Court
Visalia, CA 93291
(559) 739-7442

Pacific Agronomics, Inc.
Gary Jorgensen
3435 West Shaw, #104
Fresno, CA 93711
(559) 276-0401

Dellavalle Laboratory, Inc.
1910 W. McKinley Ave., Suite #110
Fresno, CA 93728
(559) 233-6129
soillab@aol.com

Bryner Consulting
John Bryner
260 Asilomar Blvd.
Pacific Grove, CA 93950
(559) 438-7911
(559) 289-9930 Mobile

California AgQuest Consulting, Inc.
Ron Brase
4325 North Golden State Blvd., Ste. 105
Fresno, CA 93722
(559) 275-8095
ronebrase@agquest.com

Aguabono
Jacinto Gonzales, Sr.
P.O. Box 2408
Porterville, CA 93258
(559) 784-7060

Anderson Associates International
Doug Anderson
2130 Brandage Lane
Bakersfield, CA 93304
(661) 633-5400

Pond-Shafter-Wasco Resources Conservation District
Brian Hockett
1601 New Stine Road, #270
Bakersfield, CA 93309
(661) 861-4129
Mobile Lab Unit - Irrigation Systems Evaluation only

LIST OF IRRIGATION MANAGEMENT SOFTWARE

Orange Enterprises, Inc.
Shlomo Pleban, PhD
2377 West Shaw, Suite 205
Fresno, CA 93711
(559) 229-2195

Computer programs for irrigation scheduling, CIMIS access, and record keeping.

Pete Canessa, P.E.
P.O. Box 1721
Clovis, CA 93613
(559) 278-8449

Custom Programmer to design programs to customers needs. Programs available for irrigation scheduling, irrigation system design, irrigation systems evaluation, and electrical energy cost evaluation.

Jerry Robb
2434 S. Pruess
Fresno, CA 93727
(559) 441-8468

Custom Programmer to design programs to customers needs. Programs available for irrigation management. Also specializing in customizing PDA's (personal digital assistants).

Center for Irrigation Technology, California State University, Fresno
Web page: http:\\www.wateright.org - Allows user to develop site-specific guidelines for scheduling irrigations. The program references CIMIS weather stations to provide irrigation schedule guidelines for local sites. The irrigation schedule produces estimates of plant/water requirements.

SOURCES OF REAL-TIME CIMIS ET DATA

Newspapers

Bakersfield Californian
Fresno Bee

Radio

KMJ 580AM - Fresno
J.M. Lord ETP report - 5:30 a.m.
KMPH 107.5FM - Fresno - 5:30 a.m.

Television

KMPH Channel 26 - Fresno - 5:30 a.m.

Telephone

KRCD Ag-Line - (559) 237-4800

Computer

CIMIS - Department of Water Resources
Call (800) 922-4647 to establish user ID and password.
On the web: http:\\wwwdla.water.ca.gov/cgi-bin/cimis/cimis/hq/main.pl
Ceres Group
On-the-web: http:\\www.ceresgroup.com/col/weather/index.html

Other

ET and Crop Coefficients are provided weekly to districts by FWUA
U.C. Cooperative Extension Farm Advisor's Office

Madera County	(559) 675-7879
Fresno County	(559) 456-7285
Tulare County	(559) 733-6363
Kern County	(661) 868-6218

FRIANT
WATER USERS AUTHORITY

MARCH 2001

Waterline

IRRIGATION TECH-LINE

Water Saving Ideas From The Friant Water Users Authority

Both Drip And Furrow Irrigation Can Make Sense

When Paul Parvanian began farming 80 acres in Sanger in 1948, he never imagined that 50 years later the family would be irrigating 40 of the acres with a drip system.

On the other hand, the Parvanian ranch in Fresno County demonstrates clearly that drip irrigation and furrow irrigation can make sense to a grower, depending upon conditions.

DRIP SYSTEM

The 40 acres on the north side are planted on coarse sand," Paul says.

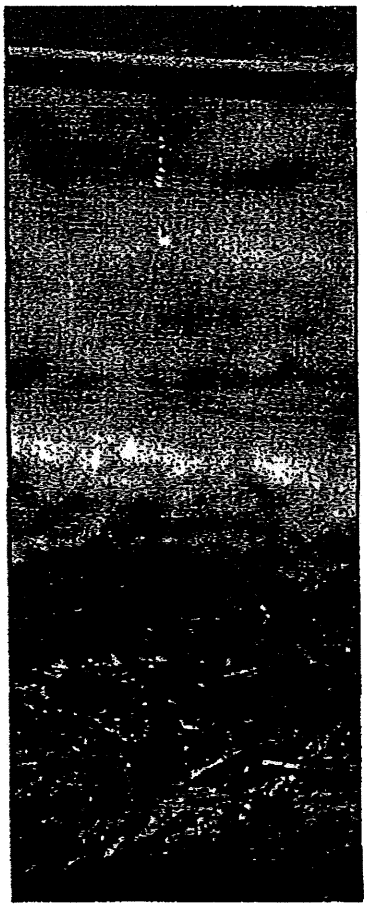
"To irrigate it properly, we have to run a big head to get the water out in a few hours. Irrigating it is a fulltime job. I would start the water in the spring and not shut off until harvest.

When his son Roger began taking over, the family considered all factors and decided that a drip system was the best way to irrigate the vineyards.

"We received many benefits from the drip system," says Roger. "We are now able to control the amount of water applied which saved water, fertilizer and relieved stress. Under the furrows, there were some vines that basically never produced a crop. That changed the very first year on drip."

Labor and equipment savings were significant.

"With furrows, it was costing us $800 per month in labor to irrigate," says Roger. "The extra pumping costs for drip are much less than that. We also saved several trips through the field with discing and furrowing equipment. With furrow irrigation, we had to work the field twice per month just to keep it in shape." Two battles faced by the Parvanians with drip irrigation are the amount of nutgrass that sprouted under vines as well as higher mildew levels.



A drip emitter at work.

"While our vines loved the drip system, it also made a great environment for weeds and mildew," Roger said.

FURROW IRRIGATION

The ranch's southerly 40 acres are a different story. These vines are on a heavier soil. Row lengths are uniform. It irrigates in a 12-hour set.

"The furrow irrigation system works well on that field," Paul said. "The labor requirements are reasonable and yield has been good."

In comparing the two fields, an argument can be made for the "best" irrigation system.

On ground such as sand, a drip system overcomes many of the problems associated with furrow irrigation.

On relatively level fields that have uniform soil and the right row length for the soil type, furrow irrigation can be quite efficient.

The bottom line is that drip systems will usually have the most benefits when irrigation conditions are challenging. ❑

High Irrigation Performance Recorded

A three-year study by the Kings River Conservation District not only found generally good average irrigation uniformity and efficiency on four Fresno County farms, it demonstrated that making improvements results in even better performance.

TERMS THAT MEASURE PERFORMANCE

Two terms used to measure the performance of an irrigation system are *distribution uniformity* (DU) and *irrigation efficiency* (IE).

DU is a measure of how evenly water is spread on a field.

IE is an estimate of how much of that water was used beneficially for crop production.

Irrigation scheduling or the timing of irrigations has a big influence on the IE estimate.

In a typical irrigated field, IE is usually lower than DU. If irrigations are perfectly timed and there is no uncollected tailwater, IE and DU are the same. When under irrigation occurs, IE can be higher than DU.

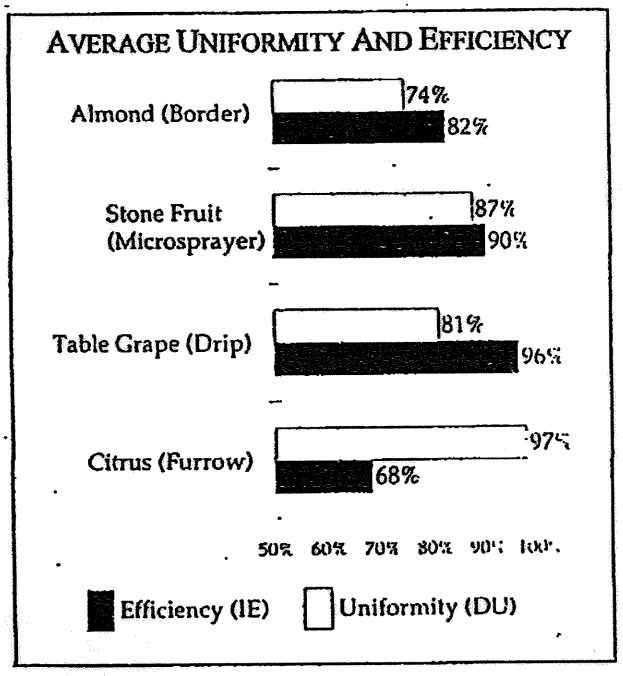
The farms were all equipped with flow meters and soil moisture measuring systems.

Rainfall was also monitored. Growers irrigated normally although as they learned of improvements that could be made, these were incorporated into their operations.

Some characteristics were shared by all of the farms.

Poor water penetration was a handicap on each field. Very little or no deep percolation of irrigation water occurred.

Winter rainfall completely recharged all soil moisture deficits and provided leaching of salts. Each field was under irrigated at some point during the season, usually just before or after harvest.



Kings River Conservation District / 1998

ALMONDS

Using border (or flood) irrigation, this 30-acre field had severe water penetration problems. No tailwater was allowed and water would sit at the end of the field for three days after the irrigation. While the average DU was 74%, individual irrigations ranged from 57%-95%. The highest DU was achieved when water advance down the check was slowed by a cover crop, a reduced flow rate and gypsum injection. Poor water penetration led to severe under irrigation in July and August, resulting in IE that was higher than the DU.

STONE FRUIT

Irrigated by a low volume system with two jets per tree, this 35-acre field had excellent DU and IE. The soil is mostly sandy loam with a few acres of sandier soil that holds less water. Initially irrigated weekly, the set was changed to twice per week to avoid deep percolation on the sandier area.

TABLE GRAPES

Drip irrigated by two 0.5 gpm emitters per vine, this 28-acre vineyard initially had a DU of 77%. Replacement of the original emitters with others of a higher flow rate and also a variable row spacing of 11 and 12 feet were the main factors. Standardizing the emitter flow rate led to an improved DU of 84%. The IE was a high 96% due to severe cutbacks in irrigations just before and during the eight-week harvest in September and October. While usually not recommended, the severe under irrigation seems to have worked to aid color and sugar levels in the grapes. Sizing has not been a problem. Yields have averaged 15 tons per acre over a three-year span.

CITRUS

Irrigated by furrows on a field of steeply slowing Porterville clay, this 36-acre navel orange grove had an average DU of 97%. Water penetration is so limited on this clay soil that irrigation sets of 36 hours were needed every 10-14 days. Even with this strategy, the trees are deficit irrigated in the summer and fruit sizing is difficult. IE is low because about 28% of the applied water ends up as uncollected tailwater. Using alternate furrow irrigation in the spring and fall was effective in reducing the amount of tailwater and may have discouraged *phytophthora* root rot problems.

❑

The Friant Water Users Authority contributed to these articles which are otherwise condensed from the Kings River Conservation District's Irrigation News.

Attachment K

District Agricultural Water Order Form

Chowchilla Water District
Daily Order Report

Tuesday, April 20, 2010
Car 15

Canal/Gate	Water User	CFS	Requested Time	Assigned Time	Hours	Comment
ASH MAIN CANAL						
8	Fagundes Dairy	1.16				
13	Martens, Herbert Henry	1.20				
14-A	Bruce Chapman Farms	2.88				
ASHVIEW CANAL						
2	Bruce Chapman Farms	2.29				
18	Costa View Farms #2	1.40	08:00			
20	Costa View Farms #2	0.68				
21	Costa View Farms #2	1.28	08:00		0800	
25-A	Bruce Chapman Farms	3.40	18:00			
32	K & T Ranches	2.24				
39	Haynes Precision Spreading, Inc.	1.62				
ASHVIEW LATERAL-B						
25	Roduner, W.P. Cattle & Farming Co.	5.00				
IUGHES CANAL						
16	L & L Ranch	1.62	07:00		0700	
29	Carter, James E.	1.83	07:00		0700	
31	Carter, James E.	2.12	07:00		0700	
IUGHES LATERAL-C						
3	L & L Ranch	2.42	07:00		0700	

Attachment L

Drainage Problem Area Report

Not Applicable

CHOWCHILLA WATER DISTRICT

SBx7-7 SUPPLEMENT REPORT

2015 UPDATE

ATTACHMENT 2

PRACTICAL GUIDE FOR METERGATES

moving water in new directions
IRRIGATION TRAINING & RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Phone: (805) 756-2434 FAX: (805) 756-2433 www.itrc.org

Practical Guide for Metergates

by
Dr. Charles Burt and Dr. Daniel Howes
Rev June 30, 2015

Background

This document contains brief instructions on the use of special round canal gates called "metergates" for flow measurement. A metergate differs from a traditional canal gate turnout because it has a hole in the top of the pipe attached to a stilling well downstream of the gate so that the downstream water level can be measured.

Metergates have been used since the early 1900's for flow measurement in addition to on-off control. Recent research conducted by the authors at the Irrigation Training and Research Center has shown that the existing tables for "Armco"-type metergates, published after the 1950's, provide good accuracy for flow measurement (if measurements are made correctly).

Armco-type metergates include round gates from Fresno Valve and Casting (101), Waterman (C-10), and X-CAD (model unknown) gates. In order to properly use these gates, a hole (5/8 to 3/4 inch in diameter) must be drilled in the pipe 12 inches downstream of the back face of the gate (or at the top of a corrugation as close to 12 inches as possible). This hole must be attached to a stilling well at least 6 inches in diameter that protrudes up to the elevation of the top of the gate frame.

Figure 1 shows a common metergate design drawing.

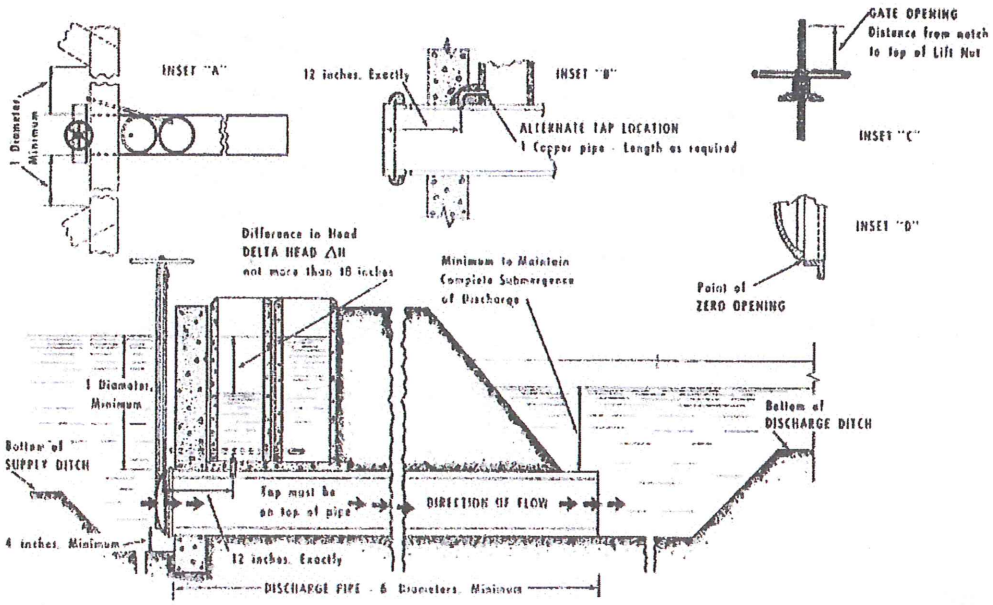


Figure 1. Metergate drawing used by various manufacturers, USBR, etc.

ITRC Research

ITRC evaluated the calibration of a variety of Armco-type round and square gates to determine if published "metergate" calibration tables are accurate. These gates were installed at the ITRC gate calibration facility (**Figure 2**). The gate calibration facility is set up so that the turnout gate is perpendicular to the main supply channel flow, which is typical in field installations.

Figure 2. ITRC gate calibration facility

Summary of ITRC Research Results

1) A high level of accuracy (+/-5%) was found if all of the following conditions are met:
   a. Gate opening range: 20% < Gate Opening < 75%
   b. Upstream submergence > 0.5D (where D is the gate diameter)
   c. Stilling well location was 4" to 12" downstream of the face of the gate
2) The distance downstream of the gate at which the stilling well is located (as long as it is within the 4" to 12" range) does not have a significant effect on the flow rate obtained using the tables **unless** the gate is **open** more than 70-75% (percent of fully open).

3) The preliminary evaluation of tangential supply channel flow velocity did not seem to have a significant impact on the flow through the turnout gates. Supply channel velocities up to 1.9 feet per second (fps) were examined in this evaluation.
4) Higher uncertainty (error) occurred at smaller gate openings.
5) Optimum range of operation for the highest accuracy was an opening between 20% and 75% under most conditions. Smaller gate openings seemed to be more problematic than larger gate openings.
6) One issue that is not discussed here but was apparent was the submergence (water level) in the supply canal above the turnout pipeline. Care should be taken to ensure that the water level upstream of the top of the turnout pipe remains above (0.5 × gate diameter). The USBR standard is (1 × gate diameter).

Correction for Stilling Well 4" from Gate

Standard flow tables are based on a stilling well located 12" downstream of the back of the gate. Stilling well measurements were made at multiple locations downstream of the gate to analyze the effects of stilling well location. It was found that, at gate openings less than 70% open, there was **minimal** impact on the change in head from any stilling well closer than 12" to the gate. Once the gate reached an opening of 70% or greater, the ΔH measurement measured at the closer stilling wells (e.g., at 4") began to vary depending on gate size resulting in more significant error.

On average, at gate openings above 75%, the flow rate for a 4" stilling well was 8%-10% greater than the value shown on a 12" stilling well-based table. This adjustment could be applied in the case where gates must be opened more than 75%.

Practical Details

Figure 3 shows one recommended configuration for a metergate. There are some significant differences between **Figures 1** and **3**. With metergates, "the devil is in the details". These are discussed on the next few pages.

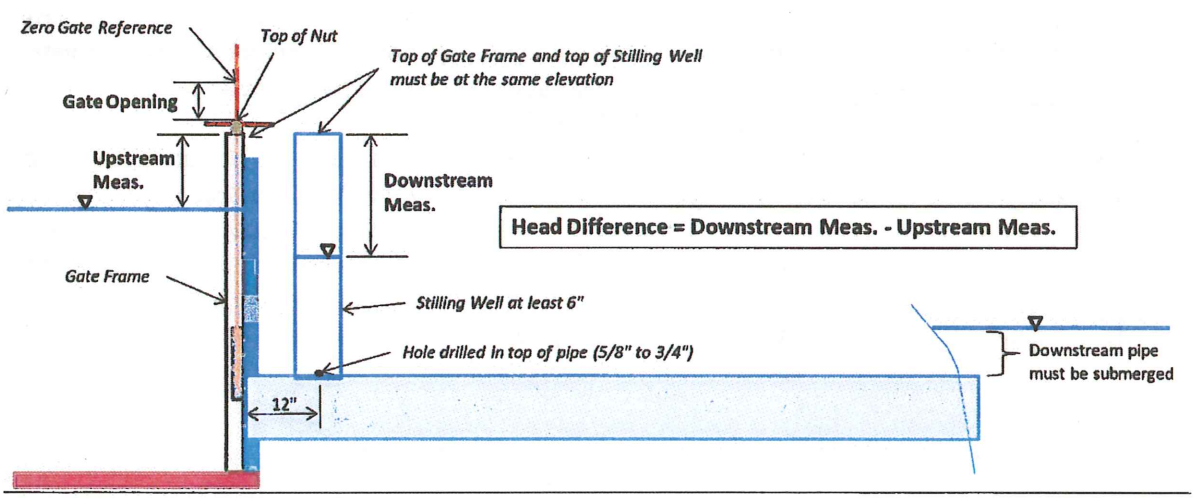


Figure 3. ITRC recommendation for proper metergate installation. These have been improved by Glenn Colusa ID with pre-cast concrete structures.

Practical Detail #1 – The pipe downstream of the metergate needs to be full. The water level needs to rise to some measurable level in the downstream stilling well.

Practical Detail #2 – Sufficient upstream submergence is needed. The required water level in the canal, above the top of the pipe, must be at least ½ of the gate (or pipe) diameter. In other words, if there is a 12" pipe, the water level in the supply canal needs to be at least 6" above the top of the pipe.

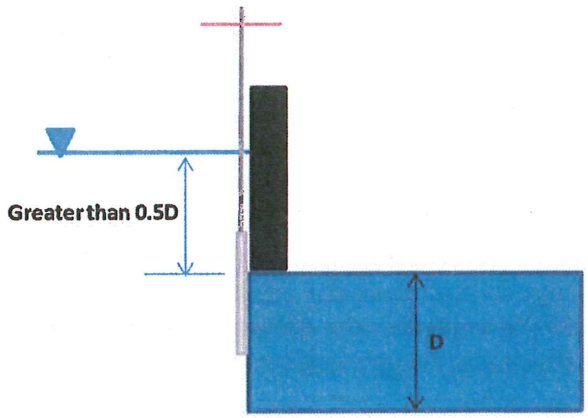


Figure 4. Recommended upstream submergence above the gate to ensure accurate flow measurement

Practical Detail #3 – All of the calibration charts require knowledge of the **gate opening**, as measured by the shaft opening. The "zero" gate opening must be properly determined and marked on the gate shaft. This is not a trivial detail. Specific points are:

1. All measurements of gate opening, as well as the initial marking, must be made after the gate stem has been lifted (opened). This is because there is some "slop" or movement between the shaft and the gate itself.
2. The gate stem will move up some distance before the gate plate itself reaches the bottom of the pipe. The charts depend on knowing the gate opening, not the movement from the gate seating position. The gate must be closed beyond the bottom of the pipe to seal off completely. That sealed position is not the "zero" position.
3. There must be some specific way to measure the shaft position when the bottom of the gate just barely clears the bottom of the pipe – in other words, when there is a "zero opening". This is fairly easy to set and measure if the canal is full. The gate is opened until a narrow strip of paper can be inserted into the crack. **Figure 5** shows photos taken at San Luis Canal Company of a customized tool that is used to detect the actual gate opening, but a similar device can be used to detect the initial "cracking (zero) open" position.

Figure 5. Special tool to detect actual gate opening

4. The shaft needs to be marked in a clear manner so that operators know where the "zero" opening is for the gate when they open the gate. **Figure 6** shows a properly cut notch. It has a sharp bottom edge that was cut with a grinding wheel so that the bottom of the cut is at the same elevation as the top of the bushing. Notice from the color on the shaft that the shaft can be lowered from this position to properly seat the gate.

   The operator will measure from the bottom of cut to the top of the bushing, when the gate is open, to determine the gate opening. This is always measured after an "uplift" action.

Practical Detail #4 – The stilling well needs to have sufficient diameter to dampen the turbulence, and so that operators can see into it. ITRC recommends a stilling well of 6" – 8" diameter, with an access hole of about 5/8" or 3/4" diameter.

Figure 6. Proper cut in shaft to mark the "zero" opening

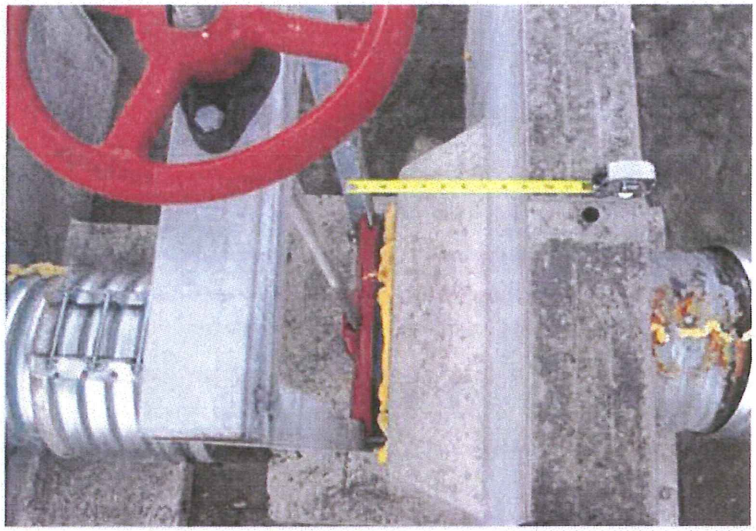


Figure 7. Stilling well is located the correct distance downstream of the gate, but is so small that there will be tremendous surging (up/down movement), and operators cannot see the water surface

Practical Detail #5 – The stilling well does not need to be centered over the access hole in the top of the discharge pipe. In general, it is good to have the stilling well close to the gate frame/bulkhead, so that it can be supported.

Practical Detail #6 – Make it easy to measure the difference in head (between the water level in the canal, and the water level in the stilling well). In other words, use the same datum (elevation) for both measurements. **Figure 8** shows a stilling well with the top correctly placed at the same elevation as the gate frame, and with a proper diameter. **The top of the stilling well should be at the same elevation as the top of the gate frame (where the bottom of the nut rests), or have the same elevation as another reference point.** Then the upstream measurement should be taken from the top of the gate frame to the water level. The downstream measurement should be taken from the top of the stilling well to the water level. The head difference is the difference between the upstream and downstream water levels.

Figure 8. Stilling well installed on an existing discharge pipe. It is constructed of PVC pipe that is too thin for long life, but it serves as an example of the correct diameter, position, and height.

Figure 9. An old type of dual-stilling well commonly found in Central California irrigation districts. One stilling well was connected to the canal, and the second was directly over the discharge pipe. The idea of measuring down into both stilling wells from the same center point was good, but the top of the stilling well was so close to the ground surface that road maintenance quickly filled these stilling wells with dirt. Also, the side connection between the canal stilling well and the canal itself was too difficult to clean.

Figure 10. This stilling well is properly located, but it has too small a diameter. The operator also needs to know the elevation difference between the top of the stilling well and the gate frame, which requires an extra computation to determine the difference in head across the gate.

Figure 11. Correct height of stilling well to match top of gate frame. However, the diameter is too small. Steel pipe material is good

Figure 12. Large diameter stilling well, with cover to minimize having it fill with dirt from the road. Strong concrete, with the rim of the stilling well at the same elevation as the bulkhead top.

The tables on the next few pages show the key measurements needed to properly use a metergate. The gate opening should be measured from the top of the gate opening nut to a zero gate opening reference. **As mentioned previously, the zero gate opening reference should be marked with a grinder at the gate opening nut on the shaft when the gate is just open enough to breach the bottom of the pipe.**

The Glenn-Colusa ID Configuration

Glenn-Colusa ID (GCID) worked with Briggs (a local pre-cast concrete structure company near Willows, CA) to incorporate the ITRC recommendations into a pre-cast structure. The following figures illustrate their solution, which appears to be excellent.

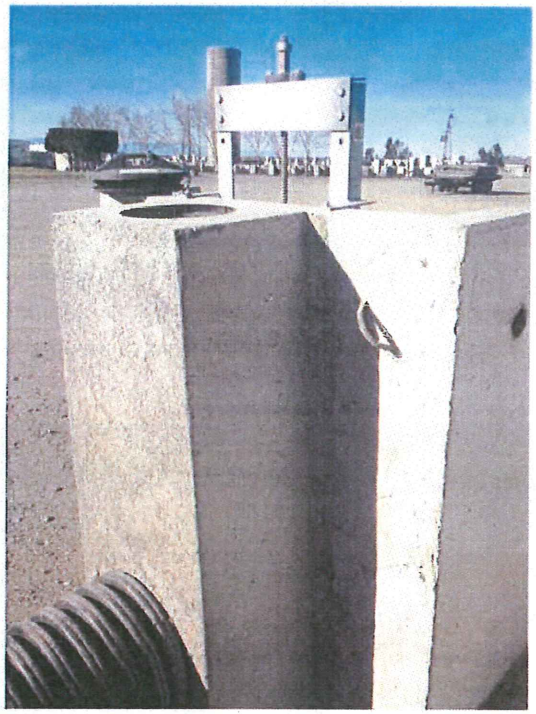


Figure 13. GCID metergate at Briggs

Figure 14. Pre-cast metergate ready for transport

Figure 15. Installation of GCID metergate

Figure 16. Final concrete for GCID metergate, showing downstream pre-cast outlet box

Table 1. Approximate cost for GCID metergate installation

18" X 6' H-Metergate with precast concrete tailbox

1). MATERIAL COST		QUANTITY			UNIT	COST/UNIT	COST
STILLING WELL 12" X 6' H W/ LID		1			EA	$340	$340
PRE/FAB 6' H BRIGG'S (metergate box)		1			EA	$470	$470
PLYWOOD					EA	$1	$0
SNAP TIES					YD	$1	$0
PIPE (18"PLASTIC)		25			Ft.	$11	$278
GATE 18" 5' FRAME		1			EA	$1,270	$1,270
CONCRETE		3			YD	$105	$315
METER BOX 5' H (tailbox)		1			EA	$550	$550
						TOTAL COST =	$3,223

2). LABOR COST		QUANTITY	HRS/JOB	COST/HR	UNIT	COST/UNIT	COST
						TOTAL COST =	$650

3). EQUIPMENT COST		QUANTITY	HRS/JOB	COST/HR*	UNIT	COST/UNIT	COST
BACKHOE				$25.00	P/H		$0
EXCAVATOR		1	$1.00	$50.00	P/H		$50
LONG REACH				$50.00	P/H		$0
TRUCK		1	$12.00	$25.00	P/H		$300
TRANSPORT		1	$1.00	$44.00	P/H		$44
CRANE				$50.00	P/H		$0
PICKUPS		1	$4.00	$5.50	P/H		$22
D-6 DOZER				$35.00	P/H		$0
D-4 DOZER				$25.00	P/H		$0
MISC.(WELDERS,PUMPS,GENERATORS)		1	$4.00	$8.00	P/H		$32
						TOTAL COST =	$448
						TOTAL HOURS =	22
						TOTAL =	$4,321

ITRC Water Measurement Tables for
ROUND (Armco-Type) Gates on Round Pipes
Discharge Values in CFS

ITRC Water Measurement Tables – 12" Armco-Type Gate, Stilling Well Located 12" d/s of Back of Gate [Blue center represents best accuracy range]

ΔH (feet)	Net Gate Opening (feet)																	
	0.042	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00
0.08	0.07	0.16	0.25	0.34	0.42	0.48	0.55	0.61	0.67	0.73	0.79	0.85	0.97	1.10	1.20	1.27	1.32	1.34
0.10	0.08	0.18	0.28	0.38	0.47	0.54	0.61	0.68	0.75	0.81	0.89	0.96	1.09	1.23	1.34	1.42	1.47	1.50
0.13	0.09	0.20	0.31	0.42	0.51	0.59	0.67	0.74	0.82	0.89	0.97	1.05	1.19	1.35	1.46	1.56	1.61	1.64
0.15	0.09	0.21	0.33	0.45	0.55	0.64	0.72	0.80	0.88	0.96	1.05	1.13	1.28	1.46	1.58	1.68	1.74	1.77
0.17	0.10	0.23	0.36	0.49	0.59	0.68	0.77	0.86	0.94	1.03	1.12	1.21	1.37	1.56	1.69	1.80	1.86	1.89
0.19	0.10	0.24	0.38	0.52	0.63	0.72	0.82	0.91	1.00	1.09	1.19	1.28	1.46	1.66	1.79	1.91	1.98	2.01
0.21	0.11	0.25	0.40	0.54	0.66	0.76	0.87	0.96	1.06	1.15	1.25	1.35	1.53	1.74	1.89	2.01	2.08	2.12
0.23	0.12	0.26	0.42	0.57	0.69	0.80	0.91	1.00	1.11	1.20	1.31	1.42	1.61	1.83	1.98	2.11	2.19	2.22
0.25	0.12	0.28	0.44	0.60	0.72	0.84	0.95	1.05	1.16	1.26	1.37	1.48	1.68	1.91	2.07	2.21	2.28	2.32
0.27	0.13	0.29	0.45	0.62	0.75	0.87	0.99	1.09	1.20	1.31	1.43	1.54	1.75	1.99	2.16	2.30	2.38	2.41
0.29	0.13	0.30	0.47	0.64	0.78	0.90	1.02	1.13	1.25	1.36	1.48	1.60	1.82	2.06	2.24	2.38	2.47	2.50
0.31	0.14	0.31	0.49	0.67	0.81	0.94	1.06	1.17	1.29	1.41	1.53	1.66	1.88	2.14	2.32	2.47	2.55	2.59
0.33	0.14	0.32	0.50	0.69	0.84	0.97	1.09	1.21	1.34	1.45	1.58	1.71	1.94	2.21	2.39	2.55	2.64	2.68
0.35	0.14	0.33	0.52	0.71	0.86	1.00	1.13	1.25	1.38	1.50	1.63	1.76	2.00	2.27	2.46	2.63	2.72	2.76
0.38	0.15	0.34	0.53	0.73	0.89	1.03	1.16	1.28	1.42	1.54	1.68	1.81	2.06	2.34	2.54	2.70	2.80	2.84
0.40	0.15	0.35	0.55	0.75	0.91	1.05	1.19	1.32	1.46	1.58	1.73	1.86	2.12	2.40	2.61	2.78	2.87	2.92
0.42	0.16	0.36	0.56	0.77	0.93	1.08	1.22	1.35	1.49	1.62	1.77	1.91	2.17	2.47	2.67	2.85	2.95	2.99
0.46	0.16	0.37	0.59	0.81	0.98	1.13	1.28	1.42	1.57	1.70	1.86	2.00	2.28	2.59	2.80	2.99	3.09	3.14
0.50	0.17	0.39	0.62	0.84	1.02	1.18	1.34	1.48	1.64	1.78	1.94	2.09	2.38	2.70	2.93	3.12	3.23	3.28
0.54	0.18	0.41	0.64	0.88	1.06	1.23	1.40	1.54	1.70	1.85	2.02	2.18	2.47	2.81	3.05	3.25	3.36	3.41
0.58	0.19	0.42	0.66	0.91	1.10	1.28	1.45	1.60	1.77	1.92	2.10	2.26	2.57	2.92	3.16	3.37	3.49	3.54
0.63	0.19	0.44	0.69	0.94	1.14	1.32	1.50	1.66	1.83	1.99	2.17	2.34	2.66	3.02	3.27	3.49	3.61	3.67
0.67	0.20	0.45	0.71	0.97	1.18	1.37	1.55	1.71	1.89	2.06	2.24	2.42	2.75	3.12	3.38	3.60	3.73	3.79
0.71	0.20	0.46	0.73	1.00	1.22	1.41	1.60	1.76	1.95	2.12	2.31	2.49	2.83	3.22	3.49	3.71	3.84	3.90
0.75	0.21	0.48	0.75	1.03	1.25	1.45	1.64	1.82	2.00	2.18	2.38	2.56	2.91	3.31	3.59	3.82	3.96	4.02
0.79	0.22	0.49	0.77	1.06	1.29	1.49	1.69	1.87	2.06	2.24	2.44	2.63	2.99	3.40	3.68	3.93	4.06	4.13
0.83	0.22	0.50	0.79	1.09	1.32	1.53	1.73	1.91	2.11	2.30	2.50	2.70	3.07	3.49	3.78	4.03	4.17	4.23
0.92	0.23	0.53	0.83	1.14	1.39	1.60	1.82	2.01	2.22	2.41	2.63	2.83	3.22	3.66	3.97	4.22	4.37	4.44
1.00	0.24	0.55	0.87	1.19	1.45	1.67	1.90	2.10	2.31	2.52	2.74	2.96	3.36	3.82	4.14	4.41	4.57	4.64
1.08	0.25	0.57	0.91	1.24	1.51	1.74	1.97	2.18	2.41	2.62	2.86	3.08	3.50	3.98	4.31	4.59	4.75	4.83
1.17	0.26	0.60	0.94	1.29	1.56	1.81	2.05	2.26	2.50	2.72	2.96	3.20	3.63	4.13	4.47	4.77	4.93	5.01
1.25	0.27	0.62	0.97	1.33	1.62	1.87	2.12	2.34	2.59	2.81	3.07	3.31	3.76	4.27	4.63	4.93	5.11	5.19
1.33	0.28	0.64	1.00	1.37	1.67	1.93	2.19	2.42	2.67	2.91	3.17	3.42	3.88	4.41	4.78	5.09	5.27	5.36
1.42	0.29	0.66	1.04	1.42	1.72	1.99	2.26	2.50	2.75	3.00	3.27	3.52	4.00	4.55	4.93	5.25	5.44	5.52
1.50	0.30	0.68	1.07	1.46	1.77	2.05	2.32	2.57	2.83	3.08	3.36	3.63	4.12	4.68	5.07	5.40	5.59	5.68
1.58	0.30	0.69	1.09	1.50	1.82	2.11	2.39	2.64	2.91	3.17	3.45	3.73	4.23	4.81	5.21	5.55	5.75	5.84
1.67	0.31	0.71	1.12	1.54	1.87	2.16	2.45	2.71	2.99	3.25	3.54	3.82	4.34	4.93	5.35	5.70	5.90	5.99
1.75	0.32	0.73	1.15	1.57	1.91	2.21	2.51	2.77	3.06	3.33	3.63	3.92	4.45	5.06	5.48	5.84	6.04	6.14
1.83	0.33	0.75	1.18	1.61	1.96	2.27	2.57	2.84	3.13	3.41	3.71	4.01	4.55	5.18	5.61	5.97	6.18	6.28
1.92	0.34	0.76	1.20	1.65	2.00	2.32	2.63	2.90	3.20	3.48	3.80	4.10	4.66	5.29	5.73	6.11	6.32	6.42
2.00	0.34	0.78	1.23	1.68	2.05	2.37	2.68	2.96	3.27	3.56	3.88	4.19	4.76	5.41	5.86	6.24	6.46	6.56
2.08	0.35	0.80	1.26	1.72	2.09	2.42	2.74	3.03	3.34	3.63	3.96	4.27	4.85	5.52	5.98	6.37	6.59	6.69
2.17	0.36	0.81	1.28	1.75	2.13	2.46	2.79	3.09	3.41	3.70	4.04	4.36	4.95	5.63	6.10	6.49	6.72	6.83
2.25	0.36	0.83	1.31	1.79	2.17	2.51	2.84	3.14	3.47	3.78	4.11	4.44	5.04	5.73	6.21	6.62	6.85	6.96
2.33	0.37	0.84	1.33	1.82	2.21	2.56	2.90	3.20	3.53	3.84	4.19	4.52	5.14	5.84	6.33	6.74	6.98	7.09
2.42	0.38	0.86	1.35	1.85	2.25	2.60	2.95	3.26	3.60	3.91	4.26	4.60	5.23	5.94	6.44	6.86	7.10	7.21
2.50	0.38	0.87	1.38	1.88	2.29	2.65	3.00	3.31	3.66	3.98	4.34	4.68	5.32	6.04	6.55	6.98	7.22	7.33
2.58	0.39	0.89	1.40	1.91	2.33	2.69	3.05	3.37	3.72	4.05	4.41	4.76	5.40	6.14	6.66	7.09	7.34	7.45
2.67	0.40	0.90	1.42	1.94	2.36	2.73	3.10	3.42	3.78	4.11	4.48	4.84	5.49	6.24	6.76	7.20	7.46	7.57
2.75	0.40	0.91	1.44	1.97	2.40	2.78	3.15	3.48	3.84	4.17	4.55	4.91	5.58	6.34	6.87	7.32	7.57	7.69
2.83	0.41	0.93	1.46	2.00	2.44	2.82	3.19	3.53	3.89	4.24	4.62	4.98	5.66	6.43	6.97	7.43	7.69	7.81

ITRC Water Measurement Tables – 18" Armco-Type Gate, Stilling Well Located 12" d/s of Back of Gate [Blue center represents best accuracy range]

ΔH (feet)	Net Gate Opening (feet)																							
	0.042	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50
0.04	0.07	0.16	0.25	0.35	0.44	0.52	0.61	0.68	0.75	0.81	0.87	0.93	1.05	1.17	1.29	1.40	1.54	1.67	1.81	1.95	2.05	2.14	2.17	2.17
0.06	0.08	0.20	0.31	0.43	0.54	0.64	0.74	0.84	0.92	1.00	1.07	1.14	1.29	1.43	1.58	1.72	1.88	2.05	2.22	2.39	2.51	2.62	2.66	2.66
0.08	0.10	0.23	0.36	0.50	0.62	0.74	0.86	0.96	1.06	1.15	1.24	1.31	1.49	1.65	1.82	1.98	2.18	2.36	2.57	2.76	2.90	3.02	3.07	3.07
0.10	0.11	0.25	0.40	0.56	0.70	0.83	0.96	1.08	1.19	1.29	1.38	1.47	1.67	1.85	2.04	2.22	2.43	2.64	2.87	3.09	3.24	3.38	3.43	3.43
0.13	0.12	0.28	0.44	0.61	0.76	0.91	1.05	1.18	1.30	1.41	1.51	1.61	1.83	2.03	2.23	2.43	2.66	2.89	3.14	3.38	3.55	3.70	3.76	3.76
0.15	0.13	0.30	0.48	0.66	0.82	0.98	1.13	1.28	1.40	1.52	1.63	1.73	1.97	2.19	2.41	2.62	2.88	3.12	3.39	3.65	3.84	4.00	4.06	4.06
0.17	0.14	0.32	0.51	0.70	0.88	1.05	1.21	1.36	1.50	1.63	1.75	1.85	2.11	2.34	2.58	2.80	3.08	3.34	3.63	3.90	4.10	4.27	4.34	4.34
0.19	0.15	0.34	0.54	0.75	0.93	1.11	1.28	1.45	1.59	1.73	1.85	1.97	2.24	2.48	2.74	2.97	3.26	3.54	3.85	4.14	4.35	4.53	4.60	4.61
0.21	0.15	0.36	0.57	0.79	0.98	1.17	1.35	1.52	1.68	1.82	1.95	2.07	2.36	2.62	2.88	3.13	3.44	3.74	4.06	4.36	4.58	4.78	4.85	4.85
0.23	0.16	0.37	0.60	0.82	1.03	1.23	1.42	1.60	1.76	1.91	2.05	2.17	2.47	2.74	3.02	3.29	3.61	3.92	4.25	4.58	4.81	5.01	5.08	5.09
0.25	0.17	0.39	0.62	0.86	1.08	1.28	1.48	1.67	1.84	2.00	2.14	2.27	2.58	2.87	3.16	3.43	3.77	4.09	4.44	4.78	5.02	5.23	5.31	5.32
0.27	0.17	0.41	0.65	0.90	1.12	1.34	1.54	1.74	1.91	2.08	2.23	2.36	2.69	2.98	3.29	3.57	3.92	4.26	4.62	4.98	5.23	5.44	5.53	5.54
0.29	0.18	0.42	0.67	0.93	1.16	1.39	1.60	1.80	1.99	2.16	2.31	2.45	2.79	3.10	3.41	3.71	4.07	4.42	4.80	5.16	5.42	5.65	5.74	5.74
0.31	0.19	0.44	0.70	0.96	1.20	1.44	1.66	1.87	2.06	2.23	2.39	2.54	2.89	3.20	3.53	3.84	4.21	4.57	4.97	5.35	5.62	5.85	5.94	5.95
0.33	0.19	0.45	0.72	0.99	1.24	1.48	1.71	1.93	2.12	2.30	2.47	2.62	2.98	3.31	3.65	3.96	4.35	4.72	5.13	5.52	5.80	6.04	6.13	6.14
0.35	0.20	0.46	0.74	1.02	1.28	1.53	1.76	1.99	2.19	2.38	2.55	2.70	3.07	3.41	3.76	4.09	4.48	4.87	5.29	5.69	5.98	6.23	6.32	6.33
0.38	0.21	0.48	0.76	1.05	1.32	1.57	1.82	2.05	2.25	2.44	2.62	2.78	3.16	3.51	3.87	4.20	4.61	5.01	5.44	5.86	6.15	6.41	6.50	6.51
0.40	0.21	0.49	0.78	1.08	1.36	1.62	1.87	2.10	2.31	2.51	2.69	2.86	3.25	3.61	3.98	4.32	4.74	5.15	5.59	6.02	6.32	6.58	6.68	6.69
0.42	0.22	0.50	0.81	1.11	1.39	1.66	1.91	2.16	2.37	2.58	2.76	2.93	3.33	3.70	4.08	4.43	4.86	5.28	5.74	6.17	6.48	6.75	6.86	6.87
0.46	0.23	0.53	0.84	1.17	1.46	1.74	2.01	2.26	2.49	2.70	2.90	3.08	3.50	3.88	4.28	4.65	5.10	5.54	6.02	6.47	6.80	7.08	7.19	7.20
0.50	0.24	0.55	0.88	1.22	1.52	1.82	2.10	2.36	2.60	2.82	3.03	3.21	3.65	4.05	4.47	4.85	5.33	5.79	6.28	6.76	7.10	7.40	7.51	7.52
0.54	0.25	0.57	0.92	1.27	1.59	1.89	2.18	2.46	2.71	2.94	3.15	3.34	3.80	4.22	4.65	5.05	5.55	6.02	6.54	7.04	7.39	7.70	7.82	7.83
0.58	0.26	0.60	0.95	1.31	1.65	1.96	2.26	2.55	2.81	3.05	3.27	3.47	3.94	4.38	4.83	5.24	5.75	6.25	6.79	7.30	7.67	7.99	8.11	8.12
0.63	0.26	0.62	0.99	1.36	1.70	2.03	2.34	2.64	2.91	3.16	3.38	3.59	4.08	4.53	5.00	5.43	5.96	6.47	7.02	7.56	7.94	8.27	8.40	8.41
0.67	0.27	0.64	1.02	1.41	1.76	2.10	2.42	2.73	3.00	3.26	3.49	3.71	4.22	4.68	5.16	5.61	6.15	6.68	7.25	7.81	8.20	8.54	8.67	8.68
0.71	0.28	0.66	1.05	1.45	1.81	2.16	2.50	2.81	3.10	3.36	3.60	3.82	4.35	4.82	5.32	5.78	6.34	6.89	7.48	8.05	8.45	8.81	8.94	8.95
0.75	0.29	0.68	1.08	1.49	1.87	2.23	2.57	2.89	3.19	3.46	3.71	3.93	4.47	4.96	5.47	5.95	6.53	7.09	7.70	8.28	8.70	9.06	9.20	9.21
0.79	0.30	0.69	1.11	1.53	1.92	2.29	2.64	2.97	3.27	3.55	3.81	4.04	4.59	5.10	5.62	6.11	6.70	7.28	7.91	8.51	8.94	9.31	9.45	9.46
0.83	0.31	0.71	1.14	1.57	1.97	2.35	2.71	3.05	3.36	3.64	3.91	4.15	4.71	5.23	5.77	6.27	6.88	7.47	8.11	8.73	9.17	9.55	9.70	9.71
0.92	0.32	0.75	1.19	1.65	2.06	2.46	2.84	3.20	3.52	3.82	4.10	4.35	4.94	5.49	6.05	6.57	7.21	7.83	8.51	9.15	9.62	10.02	10.17	10.18
1.00	0.34	0.78	1.25	1.72	2.15	2.57	2.97	3.34	3.68	3.99	4.28	4.54	5.16	5.73	6.32	6.86	7.53	8.18	8.89	9.56	10.04	10.46	10.62	10.64
1.08	0.35	0.81	1.30	1.79	2.24	2.67	3.09	3.48	3.83	4.15	4.45	4.73	5.37	5.96	6.58	7.15	7.84	8.52	9.25	9.95	10.45	10.89	11.05	11.07
1.17	0.36	0.84	1.35	1.86	2.33	2.78	3.20	3.61	3.97	4.31	4.62	4.91	5.58	6.19	6.83	7.41	8.14	8.84	9.60	10.33	10.85	11.30	11.47	11.49
1.25	0.37	0.87	1.39	1.92	2.41	2.87	3.32	3.73	4.11	4.46	4.78	5.08	5.77	6.41	7.06	7.68	8.42	9.15	9.93	10.69	11.23	11.70	11.87	11.89
1.33	0.39	0.90	1.44	1.99	2.49	2.97	3.42	3.86	4.25	4.61	4.94	5.25	5.96	6.62	7.30	7.93	8.70	9.45	10.26	11.04	11.60	12.08	12.26	12.28
1.42	0.40	0.93	1.49	2.05	2.56	3.06	3.53	3.98	4.38	4.75	5.09	5.41	6.15	6.82	7.52	8.17	8.97	9.74	10.58	11.38	11.96	12.45	12.64	12.66
1.50	0.41	0.96	1.53	2.11	2.64	3.15	3.63	4.09	4.51	4.89	5.24	5.56	6.32	7.02	7.74	8.41	9.23	10.02	10.88	11.71	12.30	12.81	13.01	13.03
1.58	0.42	0.98	1.57	2.17	2.71	3.23	3.73	4.20	4.63	5.02	5.39	5.72	6.50	7.21	7.95	8.64	9.48	10.30	11.18	12.03	12.64	13.17	13.36	13.38
1.67	0.43	1.01	1.61	2.22	2.78	3.32	3.83	4.31	4.75	5.15	5.53	5.86	6.67	7.40	8.16	8.86	9.73	10.56	11.47	12.34	12.97	13.51	13.71	13.73
1.75	0.44	1.03	1.65	2.28	2.85	3.40	3.92	4.42	4.87	5.28	5.66	6.01	6.83	7.58	8.36	9.08	9.97	10.83	11.75	12.65	13.29	13.84	14.05	14.07
1.83	0.45	1.06	1.69	2.33	2.92	3.48	4.01	4.52	4.98	5.40	5.79	6.15	6.99	7.76	8.56	9.29	10.20	11.08	12.03	12.95	13.60	14.17	14.38	14.40
1.92	0.46	1.08	1.73	2.38	2.98	3.56	4.11	4.62	5.09	5.53	5.93	6.29	7.15	7.93	8.75	9.50	10.43	11.33	12.30	13.24	13.91	14.48	14.70	14.72
2.00	0.47	1.10	1.76	2.43	3.05	3.63	4.19	4.72	5.20	5.64	6.05	6.42	7.30	8.10	8.94	9.71	10.66	11.57	12.57	13.52	14.20	14.80	15.02	15.04
2.08	0.48	1.13	1.80	2.48	3.11	3.71	4.28	4.82	5.31	5.76	6.18	6.56	7.45	8.27	9.12	9.91	10.88	11.81	12.83	13.80	14.50	15.10	15.33	15.35
2.17	0.49	1.15	1.84	2.53	3.17	3.78	4.36	4.92	5.41	5.88	6.30	6.69	7.60	8.44	9.30	10.10	11.09	12.05	13.08	14.07	14.79	15.40	15.63	15.66
2.25	0.50	1.17	1.87	2.58	3.23	3.85	4.45	5.01	5.52	5.99	6.42	6.81	7.75	8.60	9.48	10.30	11.30	12.27	13.33	14.34	15.07	15.69	15.93	15.95
2.33	0.51	1.19	1.91	2.63	3.29	3.93	4.53	5.10	5.62	6.10	6.54	6.94	7.89	8.75	9.65	10.49	11.51	12.50	13.57	14.61	15.34	15.98	16.22	16.25
2.42	0.52	1.21	1.94	2.68	3.35	3.99	4.61	5.19	5.72	6.21	6.65	7.06	8.03	8.91	9.82	10.67	11.71	12.72	13.81	14.86	15.61	16.26	16.51	16.53
2.50	0.53	1.23	1.97	2.72	3.41	4.06	4.69	5.28	5.82	6.31	6.77	7.18	8.16	9.06	9.99	10.85	11.91	12.94	14.05	15.12	15.88	16.54	16.79	16.82
2.58	0.54	1.26	2.01	2.77	3.46	4.13	4.77	5.37	5.91	6.42	6.88	7.30	8.30	9.21	10.16	11.03	12.11	13.15	14.28	15.37	16.14	16.82	17.07	17.09
2.67	0.55	1.28	2.04	2.81	3.52	4.20	4.84	5.45	6.01	6.52	6.99	7.42	8.43	9.36	10.32	11.21	12.30	13.36	14.51	15.61	16.40	17.09	17.34	17.37
2.75	0.56	1.30	2.07	2.85	3.57	4.26	4.92	5.54	6.10	6.62	7.10	7.53	8.56	9.50	10.48	11.38	12.50	13.57	14.73	15.86	16.66	17.35	17.61	17.64
2.83	0.56	1.31	2.10	2.90	3.63	4.33	4.99	5.62	6.19	6.72	7.20	7.65	8.69	9.65	10.64	11.56	12.68	13.77	14.96	16.09	16.91	17.61	17.88	17.90

ITRC Water Measurement Tables – 24" Armco-Type Gate, Stilling Well Located 12" d/s of Back of Gate [Blue center represents best accuracy range]

ΔH (feet)	Net Gate Opening (feet)																													
	0.042	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50	1.58	1.67	1.75	1.83	1.92	2.00
0.04	0.10	0.22	0.35	0.49	0.61	0.73	0.84	0.95	1.05	1.14	1.23	1.31	1.49	1.65	1.81	1.96	2.14	2.32	2.45	2.57	2.71	2.85	3.01	3.16	3.30	3.51	3.68	3.71	3.77	3.57
0.06	0.12	0.27	0.43	0.60	0.75	0.89	1.03	1.17	1.29	1.40	1.51	1.61	1.82	2.02	2.22	2.40	2.63	2.84	3.00	3.14	3.32	3.49	3.68	3.87	4.04	4.30	4.51	4.54	4.62	4.37
0.08	0.14	0.31	0.50	0.69	0.86	1.03	1.19	1.35	1.49	1.62	1.74	1.85	2.10	2.33	2.56	2.78	3.03	3.28	3.46	3.63	3.84	4.03	4.25	4.47	4.67	4.97	5.20	5.24	5.34	5.04
0.10	0.15	0.35	0.56	0.77	0.96	1.15	1.33	1.51	1.66	1.81	1.95	2.07	2.35	2.61	2.87	3.10	3.39	3.67	3.87	4.06	4.29	4.51	4.76	4.99	5.22	5.56	5.82	5.86	5.97	5.64
0.13	0.17	0.39	0.61	0.84	1.06	1.26	1.46	1.65	1.82	1.98	2.13	2.27	2.58	2.86	3.14	3.40	3.71	4.02	4.24	4.44	4.70	4.94	5.21	5.47	5.72	6.09	6.37	6.42	6.54	6.18
0.15	0.18	0.42	0.66	0.91	1.14	1.36	1.58	1.78	1.97	2.14	2.30	2.45	2.78	3.09	3.39	3.67	4.01	4.34	4.58	4.80	5.07	5.33	5.63	5.91	6.17	6.57	6.88	6.93	7.06	6.67
0.17	0.19	0.44	0.71	0.97	1.22	1.46	1.69	1.91	2.10	2.29	2.46	2.62	2.98	3.30	3.63	3.93	4.29	4.64	4.90	5.13	5.43	5.70	6.02	6.32	6.60	7.03	7.36	7.41	7.55	7.13
0.19	0.20	0.47	0.75	1.03	1.29	1.55	1.79	2.02	2.23	2.43	2.61	2.78	3.16	3.50	3.85	4.17	4.55	4.92	5.20	5.44	5.75	6.05	6.38	6.70	7.00	7.45	7.81	7.86	8.01	7.56
0.21	0.22	0.50	0.79	1.09	1.36	1.63	1.89	2.13	2.35	2.56	2.75	2.93	3.33	3.69	4.05	4.39	4.80	5.19	5.48	5.74	6.07	6.38	6.73	7.06	7.38	7.86	8.23	8.29	8.44	7.97
0.23	0.23	0.52	0.83	1.14	1.43	1.71	1.98	2.23	2.47	2.68	2.89	3.07	3.49	3.87	4.25	4.61	5.03	5.44	5.74	6.02	6.36	6.69	7.05	7.41	7.74	8.24	8.63	8.69	8.85	8.36
0.25	0.24	0.54	0.87	1.19	1.49	1.78	2.07	2.33	2.58	2.80	3.02	3.21	3.65	4.04	4.44	4.81	5.25	5.68	6.00	6.28	6.64	6.98	7.37	7.74	8.08	8.61	9.01	9.08	9.24	8.74
0.27	0.25	0.57	0.90	1.24	1.55	1.86	2.15	2.43	2.68	2.92	3.14	3.34	3.79	4.21	4.62	5.01	5.47	5.92	6.24	6.54	6.92	7.27	7.67	8.05	8.41	8.96	9.38	9.45	9.62	9.09
0.29	0.26	0.59	0.94	1.29	1.61	1.93	2.23	2.52	2.78	3.03	3.26	3.47	3.94	4.37	4.80	5.20	5.67	6.14	6.48	6.79	7.18	7.54	7.96	8.36	8.73	9.30	9.74	9.80	9.98	9.43
0.31	0.26	0.61	0.97	1.33	1.67	2.00	2.31	2.61	2.88	3.13	3.37	3.59	4.08	4.52	4.96	5.38	5.87	6.36	6.71	7.03	7.43	7.81	8.24	8.65	9.04	9.62	10.08	10.15	10.33	9.77
0.33	0.27	0.63	1.00	1.38	1.72	2.06	2.38	2.69	2.97	3.24	3.48	3.71	4.21	4.67	5.13	5.55	6.07	6.56	6.93	7.26	7.67	8.06	8.51	8.93	9.33	9.94	10.41	10.48	10.67	10.09
0.35	0.28	0.65	1.03	1.42	1.78	2.12	2.46	2.78	3.07	3.34	3.59	3.82	4.34	4.81	5.29	5.72	6.25	6.77	7.14	7.48	7.91	8.31	8.77	9.21	9.62	10.25	10.73	10.80	11.00	10.40
0.38	0.29	0.67	1.06	1.46	1.83	2.19	2.53	2.86	3.16	3.43	3.69	3.93	4.46	4.95	5.44	5.89	6.43	6.96	7.35	7.70	8.14	8.55	9.02	9.47	9.90	10.54	11.04	11.12	11.32	10.70
0.40	0.30	0.69	1.09	1.50	1.88	2.25	2.60	2.94	3.24	3.53	3.79	4.04	4.59	5.09	5.59	6.05	6.61	7.15	7.55	7.91	8.36	8.79	9.27	9.73	10.17	10.83	11.34	11.42	11.63	10.99
0.42	0.31	0.70	1.12	1.54	1.93	2.30	2.67	3.01	3.33	3.62	3.89	4.15	4.71	5.22	5.73	6.21	6.78	7.34	7.75	8.11	8.58	9.02	9.51	9.99	10.44	11.11	11.64	11.72	11.93	11.28
0.46	0.32	0.74	1.17	1.61	2.02	2.42	2.80	3.16	3.49	3.80	4.08	4.35	4.94	5.47	6.01	6.51	7.11	7.70	8.12	8.51	9.00	9.46	9.98	10.47	10.94	11.66	12.20	12.29	12.52	11.83
0.50	0.33	0.77	1.22	1.69	2.11	2.52	2.92	3.30	3.64	3.96	4.26	4.54	5.16	5.72	6.28	6.80	7.43	8.04	8.48	8.89	9.40	9.88	10.42	10.94	11.43	12.17	12.75	12.84	13.07	12.35
0.54	0.35	0.80	1.27	1.75	2.20	2.63	3.04	3.44	3.79	4.13	4.44	4.73	5.37	5.95	6.54	7.08	7.73	8.37	8.83	9.25	9.78	10.28	10.85	11.39	11.90	12.67	13.27	13.36	13.61	12.86
0.58	0.36	0.83	1.32	1.82	2.28	2.73	3.15	3.56	3.94	4.28	4.61	4.91	5.57	6.17	6.78	7.35	8.03	8.68	9.16	9.60	10.15	10.67	11.26	11.82	12.35	13.15	13.77	13.87	14.12	13.34
0.63	0.37	0.86	1.37	1.88	2.36	2.82	3.27	3.69	4.07	4.43	4.77	5.08	5.76	6.39	7.02	7.61	8.31	8.99	9.49	9.94	10.51	11.04	11.65	12.23	12.78	13.61	14.25	14.35	14.62	13.81
0.67	0.39	0.89	1.41	1.95	2.44	2.91	3.37	3.81	4.21	4.58	4.92	5.24	5.95	6.60	7.25	7.85	8.58	9.28	9.80	10.26	10.85	11.41	12.03	12.63	13.20	14.06	14.72	14.82	15.10	14.26
0.71	0.40	0.92	1.46	2.01	2.51	3.00	3.48	3.93	4.34	4.72	5.08	5.41	6.14	6.80	7.47	8.10	8.84	9.57	10.10	10.58	11.18	11.76	12.40	13.02	13.61	14.49	15.17	15.28	15.56	14.70
0.75	0.41	0.94	1.50	2.06	2.59	3.09	3.58	4.04	4.46	4.86	5.22	5.56	6.31	7.00	7.69	8.33	9.10	9.85	10.39	10.89	11.51	12.10	12.76	13.40	14.00	14.91	15.61	15.72	16.01	15.13
0.79	0.42	0.97	1.54	2.12	2.66	3.18	3.67	4.15	4.58	4.99	5.37	5.71	6.49	7.19	7.90	8.56	9.35	10.12	10.68	11.18	11.82	12.43	13.11	13.77	14.38	15.32	16.04	16.15	16.45	15.54
0.83	0.43	0.99	1.58	2.18	2.73	3.26	3.77	4.26	4.70	5.12	5.50	5.86	6.66	7.38	8.11	8.78	9.59	10.38	10.95	11.47	12.13	12.75	13.45	14.12	14.76	15.72	16.46	16.57	16.88	15.95
0.92	0.45	1.04	1.66	2.28	2.86	3.42	3.95	4.47	4.93	5.37	5.77	6.15	6.98	7.74	8.50	9.21	10.06	10.88	11.49	12.03	12.72	13.37	14.11	14.81	15.48	16.48	17.26	17.38	17.70	16.73
1.00	0.47	1.09	1.73	2.38	2.99	3.57	4.13	4.67	5.15	5.61	6.03	6.42	7.29	8.08	8.88	9.62	10.51	11.37	12.00	12.57	13.29	13.97	14.74	15.47	16.17	17.22	18.03	18.15	18.49	17.47
1.08	0.49	1.13	1.80	2.48	3.11	3.72	4.30	4.86	5.36	5.84	6.28	6.69	7.59	8.41	9.24	10.01	10.94	11.83	12.49	13.08	13.83	14.54	15.34	16.10	16.83	17.92	18.76	18.90	19.24	18.18
1.17	0.51	1.18	1.87	2.57	3.23	3.86	4.46	5.04	5.57	6.06	6.51	6.94	7.87	8.73	9.59	10.39	11.35	12.28	12.96	13.58	14.35	15.09	15.92	16.71	17.46	18.60	19.47	19.61	19.97	18.87
1.25	0.53	1.22	1.94	2.66	3.34	3.99	4.62	5.22	5.76	6.27	6.74	7.18	8.15	9.04	9.93	10.76	11.75	12.71	13.41	14.05	14.86	15.62	16.48	17.30	18.07	19.25	20.15	20.30	20.67	19.53
1.33	0.55	1.26	2.00	2.75	3.45	4.12	4.77	5.39	5.95	6.47	6.96	7.42	8.42	9.33	10.26	11.11	12.13	13.13	13.85	14.51	15.34	16.13	17.02	17.87	18.67	19.88	20.81	20.96	21.35	20.17
1.42	0.56	1.30	2.06	2.84	3.56	4.25	4.92	5.56	6.13	6.67	7.18	7.64	8.68	9.62	10.57	11.45	12.51	13.53	14.28	14.96	15.82	16.63	17.54	18.42	19.24	20.49	21.46	21.61	22.00	20.79
1.50	0.58	1.33	2.12	2.92	3.66	4.37	5.06	5.72	6.31	6.87	7.39	7.87	8.93	9.90	10.88	11.78	12.87	13.92	14.70	15.40	16.28	17.11	18.05	18.95	19.80	21.09	22.08	22.24	22.64	21.40
1.58	0.59	1.37	2.18	3.00	3.76	4.49	5.20	5.87	6.48	7.06	7.59	8.08	9.17	10.17	11.18	12.10	13.22	14.31	15.10	15.82	16.72	17.58	18.54	19.47	20.34	21.66	22.68	22.84	23.26	21.98
1.67	0.61	1.41	2.24	3.08	3.86	4.61	5.33	6.03	6.65	7.24	7.79	8.29	9.41	10.44	11.47	12.42	13.56	14.68	15.49	16.23	17.16	18.03	19.03	19.97	20.87	22.23	23.27	23.44	23.87	22.55
1.75	0.63	1.44	2.29	3.15	3.95	4.72	5.46	6.17	6.82	7.42	7.98	8.50	9.64	10.69	11.75	12.73	13.90	15.04	15.87	16.63	17.58	18.48	19.50	20.47	21.39	22.77	23.85	24.02	24.46	23.11
1.83	0.64	1.48	2.35	3.23	4.04	4.83	5.59	6.32	6.98	7.59	8.17	8.70	9.87	10.95	12.03	13.03	14.23	15.39	16.25	17.02	17.99	18.91	19.95	20.95	21.89	23.31	24.41	24.58	25.03	23.65
1.92	0.65	1.51	2.40	3.30	4.14	4.94	5.72	6.46	7.13	7.76	8.35	8.89	10.09	11.19	12.30	13.32	14.55	15.74	16.61	17.40	18.40	19.34	20.40	21.42	22.38	23.83	24.96	25.13	25.60	24.19
2.00	0.67	1.54	2.45	3.37	4.22	5.05	5.84	6.60	7.29	7.93	8.53	9.08	10.31	11.43	12.56	13.60	14.86	16.08	16.97	17.78	18.79	19.75	20.84	21.88	22.86	24.35	25.49	25.67	26.15	24.71
2.08	0.68	1.57	2.50	3.44	4.31	5.15	5.96	6.74	7.44	8.09	8.70	9.27	10.52	11.67	12.82	13.88	15.17	16.41	17.32	18.14	19.18	20.16	21.27	22.33	23.33	24.85	26.02	26.20	26.68	25.22
2.17	0.70	1.60	2.55	3.51	4.40	5.25	6.08	6.87	7.58	8.25	8.88	9.45	10.73	11.90	13.07	14.16	15.47	16.73	17.66	18.50	19.56	20.56	21.69	22.77	23.80	25.34	26.53	26.72	27.21	25.72
2.25	0.71	1.63	2.60	3.58	4.48	5.35	6.20	7.00	7.73	8.41	9.05	9.63	10.94	12.13	13.32	14.43	15.76	17.05	18.00	18.85	19.93	20.95	22.11	23.21	24.25	25.82	27.04	27.23	27.73	26.21
2.33	0.72	1.66	2.65	3.64	4.56	5.45	6.31	7.13	7.87	8.56	9.21	9.81	11.14	12.35	13.57	14.69	16.05	17.37	18.33	19.20	20.30	21.34	22.51	23.63	24.69	26.30	27.54	27.73	28.24	26.69
2.42	0.73	1.69	2.69	3.71	4.64	5.55	6.42	7.26	8.01	8.72	9.37	9.98	11.33	12.57	13.81	14.95	16.33	17.67	18.65	19.54	20.66	21.71	22.91	24.05	25.13	26.76	28.02	28.22	28.74	27.16
2.50	0.75	1.72	2.74	3.77	4.72	5.64	6.53	7.38	8.15	8.87	9.53	10.16	11.53	12.78	14.04	15.21	16.61	17.98	18.97	19.87	21.01	22.09	23.30	24.46	25.56	27.22	28.50	28.71	29.23	27.62
2.58	0.76	1.75	2.78	3.83	4.80	5.74	6.64	7.50	8.28	9.01	9.69	10.32	11.72	12.99	14.28	15.46	16.89	18.27	19.29	20.20	21.36	22.45	23.69	24.87	25.98	27.67	28.97	29.18	29.71	28.08
2.67	0.77	1.78	2.83	3.89	4.88	5.83	6.74	7.62	8.41	9.16	9.85	10.49	11.91	13.20	14.50	15.71	17.16	18.56	19.59	20.53	21.70	22.81	24.07	25.27	26.40	28.11	29.44	29.65	30.19	28.53
2.75	0.78	1.81	2.87	3.95	4.95	5.92	6.85	7.74	8.54	9.30	10.00	10.65	12.09	13.41	14.73	15.95	17.42	18.85	19.90	20.84	22.04	23.16	24.44	25.66	26.81	28.55	29.89	30.11	30.66	28.97
2.83	0.80	1.83	2.92	4.01	5.03	6.01	6.95	7.86	8.67	9.44	10.15	10.81	12.27	13.61	14.95	16.19	17.69	19.14	20.20	21.16	22.37	23.51	24.81	26.04	27.21	28.98	30.34	30.56	31.12	29.41

Preliminary Tables for
Round Gates on Round Pipes
Discharge Values in CFS

These tables are from the original ARMCO Flow Measurement Tables and will be replaced as these gate sizes are tested by ITRC

Armco-Type Metergate Tables - Preliminary

8-inch Round Gate

Head Difference (feet)	Net Gate Opening (feet)												
	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.54	0.58	0.63	0.67
	Discharge (cfs)												
0.08	0.27	0.32	0.38	0.42	0.46	0.51	0.55	0.57	0.59	0.61	0.62	0.63	0.64
0.10	0.30	0.36	0.42	0.46	0.51	0.56	0.60	0.63	0.65	0.68	0.70	0.71	0.71
0.13	0.32	0.39	0.46	0.50	0.56	0.61	0.67	0.69	0.72	0.75	0.77	0.78	0.78
0.15	0.35	0.42	0.49	0.54	0.60	0.66	0.72	0.75	0.78	0.81	0.83	0.84	0.85
0.17	0.37	0.44	0.52	0.58	0.64	0.70	0.76	0.80	0.83	0.86	0.89	0.90	0.91
0.19	0.39	0.46	0.54	0.61	0.67	0.74	0.80	0.84	0.88	0.92	0.94	0.96	0.97
0.21	0.41	0.49	0.57	0.64	0.70	0.77	0.85	0.89	0.93	0.96	1.00	1.01	1.02
0.23	0.42	0.51	0.60	0.66	0.74	0.81	0.88	0.93	0.97	1.01	1.04	1.06	1.07
0.25	0.44	0.53	0.62	0.70	0.76	0.84	0.92	0.97	1.02	1.06	1.09	1.11	1.12
0.27	0.46	0.55	0.64	0.72	0.79	0.87	0.95	1.01	1.06	1.10	1.13	1.15	1.16
0.29	0.47	0.57	0.67	0.74	0.82	0.90	0.99	1.05	1.10	1.14	1.18	1.20	1.21
0.31	0.49	0.59	0.69	0.77	0.85	0.93	1.02	1.08	1.14	1.18	1.22	1.24	1.26
0.33	0.50	0.60	0.71	0.79	0.88	0.96	1.05	1.12	10.18	1.22	1.26	1.28	1.30
0.35	0.52	0.62	0.73	0.82	0.90	0.99	1.08	1.15	1.22	1.26	1.30	1.33	1.34
0.38	0.53	0.64	0.75	0.84	0.92	1.02	1.11	1.19	1.25	1.30	1.34	1.37	1.38
0.40	0.54	0.65	0.76	0.86	0.95	1.04	1.14	1.22	1.29	1.34	1.38	1.41	1.42
0.42	0.56	0.67	0.78	0.88	0.97	1.07	1.17	1.25	1.32	1.37	1.42	1.44	1.46
0.46	0.58	0.70	0.81	0.91	1.01	1.12	1.22	1.31	1.38	1.44	1.49	1.52	1.54
0.50	0.60	0.72	0.84	0.95	1.06	1.17	1.27	1.36	1.44	1.50	1.55	1.58	1.60
0.54	0.62	0.75	0.87	0.99	1.10	1.22	1.32	1.42	1.50	1.56	1.61	1.65	1.67
0.58	0.64	0.77	0.90	1.03	1.15	1.26	1.37	1.47	1.55	1.62	1.67	1.71	1.74
0.63	0.66	0.80	0.94	1.06	1.19	1.31	1.42	1.53	1.61	1.68	1.73	1.77	1.80
0.67	0.68	0.82	0.96	1.10	1.22	1.35	1.47	1.58	1.66	1.73	1.79	1.83	1.86
0.71	0.70	0.85	1.00	1.13	1.26	1.39	1.52	1.62	1.71	1.78	1.84	1.88	1.92
0.75	0.72	0.87	1.02	1.16	1.30	1.43	1.56	14.67	1.76	1.84	1.89	1.94	1.97
0.79	0.74	0.90	1.05	1.19	1.33	1.47	1.60	1.72	1.81	1.89	1.94	1.99	2.02
0.83	0.76	0.92	1.08	1.22	1.37	1.51	1.64	1.76	1.85	1.94	1.99	2.04	2.08
0.92	0.79	0.96	1.13	1.28	1.44	1.58	1.72	1.85	1.94	2.03	2.09	2.14	2.18
1.00	0.83	1.01	1.18	1.34	1.50	1.66	1.80	1.93	2.03	2.12	2.18	2.24	2.27
1.08	0.86	1.05	1.23	1.40	1.56	1.72	1.87	2.01	2.12	2.21	2.29	2.33	2.37
1.17	0.89	1.09	1.28	1.45	1.62	1.79	1.94	2.08	2.20	2.29	2.36	2.42	2.46
1.25	0.92	1.13	1.32	1.50	1.68	1.85	2.01	2.16	2.27	2.37	2.44	2.50	2.54
1.33	0.95	1.16	1.37	1.55	1.73	1.91	2.08	2.23	2.35	2.45	2.52	2.58	2.62
1.42	0.98	1.20	1.41	1.60	1.78	1.97	2.14	2.30	2.42	2.52	2.60	2.66	2.71
1.50	1.01	1.23	1.45	1.64	1.84	2.03	2.20	2.36	2.49	2.60	2.68	2.74	2.79

Armco-Type Metergate Tables - Preliminary

15-inch Round Gate

Head Difference (feet)	Net Gate Opening (feet)																	
	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25
	Discharge (cfs)																	
0.08	0.46	0.57	0.66	0.75	0.83	0.91	0.98	1.07	1.14	1.30	1.43	1.58	1.71	1.84	1.94	2.04	2.13	2.18
0.10	0.51	0.62	0.73	0.83	0.92	1.02	1.09	1.19	1.27	1.44	1.59	1.75	1.90	2.05	2.17	2.29	2.38	2.43
0.13	0.55	0.67	0.79	0.91	1.00	1.11	1.19	1.30	1.38	1.57	1.74	1.91	2.08	2.24	2.38	2.51	2.62	2.67
0.15	0.59	0.72	0.85	0.98	1.08	1.19	1.28	1.39	1.49	1.68	1.87	2.06	2.24	2.41	2.57	2.72	2.83	2.90
0.17	0.63	0.77	0.90	1.04	1.15	1.27	1.37	1.48	1.59	1.79	1.99	2.20	2.39	2.58	2.75	2.90	3.03	3.09
0.19	0.67	0.81	0.95	1.10	1.22	1.34	1.45	1.57	1.48	1.89	2.11	2.33	2.54	2.73	2.91	3.07	3.22	3.28
0.21	0.70	0.85	1.00	1.15	1.28	1.41	1.53	1.65	1.76	1.99	2.22	2.45	2.68	2.87	3.07	3.24	3.40	3.46
0.23	0.73	0.89	1.05	1.20	1.33	1.48	1.60	1.73	1.84	2.09	2.33	2.57	2.81	3.01	3.21	3.40	3.57	6.64
0.25	0.76	3.93	1.09	1.25	1.38	1.54	1.67	1.80	1.92	2.18	2.43	2.69	2.93	3.14	3.35	3.54	3.73	3.81
0.27	0.79	0.97	1.13	1.29	1.43	1.60	1.73	1.87	2.00	2.27	2.53	2.80	3.05	3.27	3.49	3.68	3.88	3.97
0.29	0.82	1.00	1.17	1.33	1.48	1.65	1.79	1.94	2.08	2.36	2.63	2.90	3.17	3.39	3.62	3.82	4.01	4.11
0.31	0.85	1.03	1.21	1.37	1.53	1.70	1.85	2.01	2.15	2.44	2.72	3.00	3.28	3.51	3.75	3.96	4.14	4.25
0.33	0.88	1.06	1.25	1.41	1.58	1.75	1.91	2.07	1.22	2.52	2.81	3.10	3.39	3.63	3.87	4.09	4.27	4.39
0.35	0.91	1.09	1.29	1.45	1.63	1.80	1.97	2.13	2.29	2.60	2.90	3.20	3.49	3.74	3.99	4.21	4.40	4.53
0.38	0.93	1.12	1.32	1.49	1.68	1.85	2.03	2.19	2.36	2.68	2.98	3.29	3.59	3.85	4.10	4.33	4.53	4.67
0.40	0.95	1.15	1.35	1.53	1.73	1.90	2.09	2.25	2.42	2.75	3.06	3.38	3.69	3.96	4.21	4.45	4.65	4.80
0.42	0.97	1.18	1.38	1.57	1.77	1.95	2.14	2.31	2.48	2.82	3.14	3.47	3.79	4.06	2.32	4.57	4.77	4.92
0.46	1.01	1.23	1.44	1.64	1.85	2.05	2.24	2.43	2.60	2.96	3.30	3.63	3.97	4.26	4.54	4.79	5.00	5.14
0.50	1.05	1.28	1.50	1.71	1.93	2.14	2.34	2.54	2.72	3.09	3.44	3.79	4.15	4.44	4.74	5.00	5.22	5.36
0.54	1.09	1.33	1.56	1.78	2.01	2.23	2.44	2.64	2.83	3.22	3.58	3.95	4.32	4.62	4.93	5.20	5.43	5.58
0.58	1.13	1.38	1.62	1.85	2.09	2.31	2.53	2.74	2.93	3.34	3.72	4.10	4.48	4.79	5.11	5.40	5.64	5.79
0.63	1.17	1.42	1.68	1.92	2.16	2.39	2.62	2.84	3.03	3.46	2.85	4.25	4.64	4.96	5.29	5.59	5.84	5.99
0.67	1.21	1.46	1.73	1.98	2.23	2.47	2.71	2.93	3.13	3.57	2.98	4.39	4.79	5.13	5.47	5.78	6.03	6.19
0.71	1.24	1.50	1.78	2.04	2.30	2.55	2.79	3.02	3.23	3.68	4.10	4.52	4.93	5.29	5.64	5.95	6.22	6.38
0.75	1.27	1.54	1.83	2.10	2.37	2.62	2.87	3.11	3.33	3.79	4.22	4.65	5.07	5.44	5.80	6.12	6.40	6.56
0.79	1.30	1.58	1.88	2.16	2.43	2.69	2.95	3.19	3.42	3.89	4.34	4.78	5.21	5.59	5.96	6.29	6.58	6.74
0.83	1.33	1.62	1.93	2.22	2.49	2.76	3.03	3.27	3.51	3.99	4.45	4.91	5.35	5.73	6.11	6.46	6.75	6.92
0.92	1.39	1.70	2.03	2.32	2.61	2.90	3.17	3.43	3.68	4.18	4.66	5.14	5.61	6.01	6.41	6.77	7.07	7.26
1.00	1.45	1.78	2.12	2.42	2.73	3.03	3.31	3.59	3.84	4.37	4.87	5.37	5.86	6.29	6.70	7.07	7.39	7.59
1.08	1.50	1.85	2.21	2.52	2.84	3.15	3.45	3.73	4.00	4.55	5.07	5.59	6.10	6.54	6.97	7.36	7.69	7.89
1.17	1.55	1.92	2.29	2.62	2.95	2.37	3.58	3.87	4.15	4.72	5.26	5.80	6.34	6.79	7.24	7.64	7.98	8.19
1.25	1.60	1.99	2.37	2.71	3.05	3.38	3.70	4.01	4.30	4.88	5.44	6.00	6.56	7.03	7.49	7.91	8.26	8.47
1.33	1.65	2.05	2.45	2.80	3.15	3.49	3.82	4.14	4.44	5.04	5.62	6.20	6.77	7.26	7.73	8.17	8.53	8.75
1.42	1.70	2.11	2.52	2.89	3.25	3.60	3.94	4.27	4.57	5.20	5.80	6.39	6.98	7.48	7.97	8.42	8.80	9.02
1.50	1.75	2.17	2.59	2.97	3.34	3.70	4.05	4.39	4.70	5.35	5.96	6.58	7.18	7.69	8.20	8.66	9.05	9.28

Armco-Type Metergate Tables - Preliminary

16-inch Round Gate

Head Difference (feet)	Net Gate Opening (feet)																		
	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33
	Discharge (cfs)																		
0.08	0.49	0.59	0.70	0.79	0.89	0.97	1.05	1.14	1.22	1.37	1.53	1.68	1.83	1.96	2.10	2.24	2.35	2.43	2.47
0.10	0.55	0.66	0.77	0.88	0.98	1.08	1.16	1.27	1.36	1.52	1.70	1.87	2.04	2.19	2.34	2.50	2.63	2.72	2.78
0.13	0.59	0.72	0.84	0.96	1.07	1.18	1.27	1.39	1.48	1.66	1.86	2.04	2.22	2.39	2.56	2.74	2.89	2.98	3.05
0.15	0.63	0.77	0.90	1.03	1.15	1.27	1.37	1.49	1.59	1.79	1.99	2.20	2.40	2.57	2.76	2.96	3.12	3.23	3.31
0.17	0.67	0.82	0.96	1.10	1.23	1.35	1.46	1.59	1.69	1.91	2.12	2.34	2.56	2.74	2.94	3.16	3.31	3.46	3.54
0.19	0.71	0.86	1.02	1.16	1.30	1.43	1.54	1.68	1.79	2.02	2.25	2.48	2.71	2.91	3.11	3.33	3.50	3.66	3.75
0.21	0.75	0.90	1.07	1.21	1.36	1.50	1.62	1.76	1.89	2.13	2.37	2.61	2.85	3.08	3.28	3.50	3.68	3.85	3.95
0.23	0.78	0.94	1.12	1.26	1.42	1.57	1.69	1.84	1.98	2.23	2.49	2.74	2.99	3.23	3.44	3.67	3.86	4.03	4.14
0.25	0.81	0.98	1.16	1.31	1.48	1.64	1.76	1.92	2.06	2.33	2.60	2.86	3.12	3.37	3.59	3.83	4.04	4.20	4.33
0.27	0.84	1.02	1.20	1.36	1.54	1.70	1.84	2.00	2.14	2.43	2.71	2.98	3.25	3.51	3.74	3.99	4.20	4.37	4.51
0.29	0.87	1.06	1.24	1.41	1.59	1.75	1.91	2.08	2.22	2.52	2.81	3.09	3.37	3.64	3.88	4.14	4.36	4.53	4.69
0.31	0.90	1.09	1.28	1.46	1.64	1.81	1.98	2.15	2.30	2.61	2.91	3.20	3.49	3.77	4.02	4.28	4.52	4.69	4.86
0.33	0.93	1.12	1.32	1.51	1.69	1.87	2.05	2.22	2.38	2.69	3.00	3.31	3.61	3.89	4.15	4.42	4.67	4.85	5.02
0.35	0.96	1.15	1.36	1.56	1.74	1.93	2.11	2.29	2.45	2.77	3.09	3.41	3.72	4.01	4.28	4.56	4.81	5.00	5.18
0.38	0.99	1.18	1.40	1.61	1.79	1.99	2.17	2.36	2.52	2.85	3.18	3.51	3.83	4.13	4.40	4.69	4.95	5.15	5.32
0.40	1.02	1.21	1.44	1.65	1.84	2.04	2.23	2.42	2.59	2.93	3.27	3.61	3.94	4.24	4.52	4.82	5.09	5.29	5.46
0.42	1.04	1.24	1.48	1.69	1.89	2.09	2.29	2.48	2.66	3.01	3.36	3.70	4.04	4.35	4.64	4.95	5.22	5.43	5.59
0.46	1.08	1.30	1.55	1.76	1.98	2.19	2.40	2.60	2.79	3.16	3.52	3.88	4.24	4.56	4.87	5.19	5.47	5.69	5.85
0.50	1.12	1.36	1.61	1.83	2.07	2.28	2.50	2.71	2.91	3.30	3.68	4.05	4.42	4.76	5.08	5.42	5.71	5.94	6.10
0.54	1.16	1.41	1.67	1.90	2.15	2.37	2.60	2.82	3.03	3.43	3.83	4.21	4.60	4.96	5.29	5.64	5.95	6.18	6.35
0.58	1.20	1.46	1.73	1.97	2.23	2.46	2.70	2.93	3.14	3.56	3.97	4.37	4.77	5.15	5.49	5.85	6.18	6.41	6.59
0.63	1.24	1.51	1.79	2.04	2.31	2.55	2.80	3.04	3.25	3.69	4.11	4.53	4.94	5.33	5.68	6.06	6.39	6.64	6.82
0.67	1.28	1.56	1.85	2.11	2.39	2.63	2.89	3.14	3.36	3.81	4.25	4.68	5.11	5.50	5.87	6.26	6.60	6.86	7.05
0.71	1.31	1.60	1.90	2.18	2.46	2.71	2.98	3.24	3.46	3.93	4.38	4.82	5.26	5.67	6.05	6.45	6.81	7.07	7.27
0.75	1.34	1.64	1.95	2.24	2.53	2.79	3.07	3.33	3.56	4.04	4.51	4.96	5.41	5.83	6.23	6.64	7.01	7.27	7.48
0.79	1.37	1.68	2.00	2.30	2.60	2.87	3.15	3.42	3.66	4.15	4.63	5.10	5.56	5.99	6.40	6.83	7.20	7.47	7.68
0.83	1.40	1.72	2.05	2.36	2.67	2.95	3.23	3.51	3.75	4.26	4.75	5.23	5.71	6.15	6.56	7.00	7.39	7.67	7.88
0.92	1.46	1.80	2.15	2.48	2.80	3.09	3.39	3.68	3.93	4.46	4.98	5.48	5.98	6.45	6.88	7.34	7.74	8.04	8.26
1.00	1.52	1.88	2.25	2.59	2.92	3.23	3.54	3.84	4.11	4.66	5.20	5.73	6.25	6.74	7.19	7.66	8.09	8.40	8.63
1.08	1.58	1.96	2.34	2.69	3.04	3.36	3.68	4.00	4.28	4.85	5.41	5.96	6.50	7.01	7.48	7.98	8.41	8.74	8.98
1.17	1.64	2.04	2.43	2.79	3.15	3.49	3.82	4.15	4.44	5.03	5.61	6.19	6.75	7.28	7.76	8.27	8.73	9.07	9.32
1.25	1.70	2.11	2.51	2.89	3.26	3.61	3.96	4.29	4.60	5.21	5.81	6.40	6.99	7.54	8.04	8.56	9.04	9.39	9.65
1.33	1.76	2.18	2.59	2.99	3.37	3.73	4.09	4.43	4.75	5.38	6.00	6.61	7.22	7.79	8.30	8.85	9.34	9.70	9.96
1.42	1.81	2.25	2.67	3.08	3.48	3.84	4.22	4.57	4.90	5.55	6.19	6.82	7.44	8.03	8.56	9.13	9.63	10.00	10.27
1.50	1.86	2.31	2.75	3.16	3.58	3.95	4.34	4.70	5.04	5.71	6.37	7.01	7.65	8.25	8.80	9.39	9.90	10.28	10.56

Armco-Type Metergate Tables - Preliminary

20-Inch Round Gate

Head Difference (feet)	Net Gate Opening (feet)																						
	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50	1.58	1.67
	Discharge (cfs)																						
0.08	0.58	0.73	0.86	0.96	1.10	1.21	1.32	1.43	1.54	1.75	1.92	2.12	2.29	2.48	2.66	2.84	3.01	3.16	3.31	3.44	3.57	3.68	3.71
0.10	0.66	0.81	0.96	1.09	1.23	1.35	1.42	1.60	1.72	1.95	2.16	2.37	2.56	2.77	2.98	3.18	3.37	3.54	3.71	3.86	4.01	4.14	4.19
0.13	0.72	0.88	1.04	1.18	1.35	1.47	1.61	1.74	1.88	2.12	2.35	2.58	2.79	3.03	3.25	3.47	3.69	3.88	4.06	4.23	4.39	4.52	4.61
0.15	0.77	0.95	1.11	1.27	1.44	1.58	1.72	1.87	2.02	2.27	2.52	2.77	3.00	3.26	3.50	3.73	3.95	4.18	3.36	4.55	4.71	4.86	4.97
0.17	0.82	1.01	1.18	1.36	1.53	1.68	1.83	1.99	2.15	2.42	2.69	2.95	3.21	3.48	3.73	3.97	4.20	4.46	4.66	4.85	5.02	5.20	5.31
0.19	0.87	1.07	1.25	1.44	1.62	1.78	1.94	2.11	2.27	2.56	2.86	3.13	3.42	3.69	3.96	4.21	4.45	4.72	4.95	5.15	5.33	5.53	5.65
0.21	0.91	1.12	1.31	1.51	1.70	1.87	2.04	2.21	2.38	2.70	3.02	3.31	3.62	3.89	4.18	4.45	4.70	4.97	5.21	5.43	5.63	5.83	5.95
0.23	0.95	1.17	1.37	1.58	1.78	1.96	2.13	2.31	2.49	2.84	3.16	3.49	3.80	4.08	4.39	4.66	4.95	5.21	5.46	5.70	5.91	6.13	6.24
0.25	0.99	1.22	1.43	1.65	1.85	2.04	2.22	2.41	2.60	2.96	3.30	3.64	3.96	4.26	4.58	4.86	5.16	5.44	5.70	5.95	6.17	6.41	6.52
0.27	1.03	1.27	1.49	1.71	1.92	2.12	2.31	2.51	2.71	3.08	3.44	3.79	4.12	4.44	4.77	5.06	5.37	5.66	5.94	6.20	6.43	6.68	6.80
0.29	1.07	1.31	1.54	1.77	1.99	2.19	2.40	2.61	2.82	3.20	5.56	3.93	4.28	4.60	4.95	5.25	5.57	5.88	6.16	6.43	6.67	6.92	7.08
0.31	1.10	1.35	1.59	1.83	2.06	2.26	2.49	2.70	2.92	3.31	3.68	4.07	4.43	4.76	5.13	5.44	5.77	6.09	6.38	6.65	6.90	7.15	7.32
0.33	1.13	1.39	1.64	1.88	2.12	2.33	2.57	2.79	3.02	3.42	3.80	4.20	4.57	4.92	5.29	5.62	5.96	6.29	6.58	6.87	7.12	7.38	7.56
0.35	1.16	1.43	1.69	1.93	2.18	2.40	2.65	2.88	3.12	3.52	3.92	4.33	4.71	5.07	5.45	5.79	6.14	6.48	6.78	7.08	7.34	7.61	7.79
0.38	1.19	1.47	1.73	1.98	2.24	2.47	2.73	2.96	3.21	3.62	4.04	4.46	4.85	5.22	5.61	5.96	6.32	6.67	6.98	7.29	7.56	7.84	8.02
0.40	1.22	1.51	1.77	2.03	2.30	2.54	2.80	3.04	3.29	3.72	4.16	4.58	4.99	5.36	6.76	6.13	6.50	6.85	7.18	7.50	7.77	8.05	8.25
0.42	1.25	1.55	1.81	2.08	2.36	2.61	2.87	3.12	3.37	3.82	4.26	4.70	5.12	5.50	5.91	6.29	6.66	7.03	7.36	7.69	7.97	8.26	8.46
0.46	1.31	1.61	1.89	2.18	2.48	2.74	3.02	3.28	3.53	1.01	4.47	4.93	5.36	5.77	6.20	6.59	6.98	7.37	7.72	8.06	8.36	8.66	8.87
0.50	1.37	1.67	1.97	2.28	2.59	2.86	3.15	3.42	3.69	4.19	4.67	5.15	5.60	6.04	6.48	6.89	7.30	7.70	8.06	8.41	8.73	9.05	9.26
0.54	1.42	1.73	2.05	2.38	2.69	2.98	3.28	3.56	3.85	4.36	4.86	5.37	5.84	6.28	6.76	7.17	7.60	8.02	8.40	8.76	9.10	9.44	9.65
0.58	1.47	1.79	2.12	2.47	2.79	3.09	3.40	3.70	3.99	4.53	5.05	5.57	6.06	6.51	7.01	7.45	7.89	8.32	8.72	9.10	9.43	9.78	10.02
0.63	1.52	1.85	2.19	2.56	2.89	3.20	3.52	3.82	4.13	4.68	5.22	5.76	6.26	6.74	7.25	7.70	8.16	8.61	9.02	9.42	9.76	10.12	10.37
0.67	1.57	1.91	2.26	2.65	2.98	3.30	3.63	3.94	4.26	4.83	5.39	5.95	6.46	6.96	7.48	7.95	8.43	8.88	9.31	9.72	10.08	10.44	10.70
0.71	1.61	1.97	2.33	2.73	3.07	3.40	3.74	4.06	4.39	4.98	5.55	6.13	6.66	7.17	7.70	8.19	8.69	9.15	9.60	10.01	10.40	10.76	11.03
0.75	1.65	2.02	2.40	2.80	3.16	3.50	3.85	4.18	4.52	5.13	5.71	6.31	6.86	7.38	7.92	8.43	8.95	9.42	9.88	10.30	10.70	11.08	11.34
0.79	1.69	2.07	2.47	2.87	3.25	3.60	3.96	4.30	4.65	5.27	5.87	6.49	7.06	7.59	8.14	8.67	9.20	9.69	10.15	10.59	11.00	11.40	11.65
0.83	1.73	2.12	2.54	2.94	3.34	3.70	4.07	4.42	4.77	5.41	6.03	6.65	7.25	7.79	8.36	8.90	9.44	9.95	10.41	10.88	11.28	11.69	11.96
0.92	1.81	2.22	2.67	3.08	3.50	3.87	4.28	4.63	5.00	5.67	6.31	6.97	7.60	8.16	8.76	9.32	9.88	10.42	10.91	11.44	11.82	12.24	12.53
1.00	1.88	2.32	2.79	3.22	3.66	4.04	4.47	4.84	5.22	5.92	6.59	7.29	7.93	8.53	9.16	9.74	10.32	10.89	11.41	11.93	12.34	12.79	13.10
1.08	1.95	2.42	2.91	3.36	3.81	4.21	4.64	5.04	5.44	6.17	6.87	7.60	8.26	8.88	9.55	10.13	10.76	11.33	11.88	12.40	12.86	13.32	13.65
1.17	2.02	2.52	3.02	3.49	3.95	4.38	4.81	5.23	5.64	6.40	7.13	7.89	8.57	9.21	9.90	10.52	11.16	11.77	12.32	12.87	13.33	13.82	14.17
1.25	2.08	2.61	3.12	3.61	4.09	4.53	4.97	5.41	5.84	6.62	7.38	8.15	8.86	9.53	10.24	10.88	11.53	12.18	12.74	13.30	13.80	14.30	14.65
1.33	2.14	2.70	3.22	3.73	4.22	4.67	5.13	5.58	6.03	6.84	7.62	8.41	9.15	9.85	10.58	11.23	11.90	12.56	13.16	13.72	14.25	14.78	15.13
1.42	2.20	2.78	3.32	3.84	4.35	4.81	5.29	5.75	6.22	7.05	7.85	8.67	9.43	10.15	10.90	11.58	12.27	12.94	13.58	14.14	14.69	15.24	15.59
1.50	2.26	2.86	3.41	3.95	4.47	4.95	5.45	5.92	6.40	7.25	8.08	8.93	9.70	10.44	11.22	11.92	12.64	13.32	13.98	14.56	15.11	15.68	16.05

Armco-Type Metergate Tables - Preliminary

30-inch Round Gate

Head Difference (feet)	Net Gate Opening (feet)																									
	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
	Discharge (cfs)																									
0.08	0.84	1.05	1.25	1.45	1.63	1.84	2.00	2.20	2.34	2.69	3.03	3.35	3.64	3.92	4.20	4.48	4.75	5.03	5.28	5.84	6.34	6.76	7.10	7.46	7.70	7.86
0.10	0.93	1.17	1.39	1.62	1.82	2.04	2.23	2.45	2.61	2.99	3.36	3.71	4.04	4.36	4.67	4.99	5.30	5.61	5.89	6.49	7.04	7.51	7.90	8.31	8.58	8.77
0.13	1.01	1.27	1.52	1.76	1.97	2.22	2.43	2.66	2.85	3.25	3.63	4.05	4.41	4.75	5.11	5.46	5.80	6.12	6.46	7.08	7.67	8.19	8.65	9.07	9.40	9.59
0.15	1.08	1.37	1.63	1.89	2.12	2.39	2.62	2.87	3.06	3.50	3.88	4.37	4.73	5.11	5.49	5.86	6.22	6.57	6.94	7.60	8.25	8.81	9.29	9.72	10.15	10.32
0.17	1.16	1.46	1.74	2.02	2.27	2.54	2.80	3.05	3.27	3.73	4.13	4.64	5.03	5.45	5.86	6.26	6.63	7.02	7.41	8.11	8.78	9.40	9.91	10.34	10.88	11.04
0.19	1.23	1.55	1.85	2.14	2.40	2.69	2.96	3.22	3.46	3.95	4.38	4.90	5.33	5.78	6.21	6.64	7.04	7.45	7.86	8.61	9.31	9.94	10.48	10.94	11.56	11.74
0.21	1.30	1.63	1.94	2.25	2.52	2.84	3.11	3.38	3.63	4.15	4.63	5.15	5.61	6.09	6.55	7.00	7.41	7.85	8.29	9.07	9.81	10.48	11.03	11.52	12.16	12.40
0.23	1.36	1.70	2.03	2.35	2.64	2.98	3.25	3.53	3.80	4.34	4.86	5.40	5.89	6.39	6.87	7.34	7.78	8.23	8.69	9.51	10.28	19.98	11.56	12.08	12.68	13.00
0.25	1.41	1.77	2.11	2.45	2.75	3.11	3.38	3.67	3.95	4.53	5.08	5.64	6.16	6.68	7.17	7.67	8.13	8.60	9.08	9.94	10.75	11.47	12.07	12.62	13.18	13.55
0.27	1.46	1.84	2.19	2.55	2.86	3.22	3.50	3.81	4.10	4.71	5.29	5.87	6.41	6.95	7.46	7.98	8.46	8.95	9.45	10.34	11.20	11.95	12.57	13.15	13.68	14.05
0.29	1.51	1.90	2.27	2.64	2.96	3.33	3.62	3.94	4.25	4.88	5.49	6.09	6.65	7.21	7.75	8.28	8.78	9.29	9.81	10.74	11.62	12.40	13.06	13.65	14.18	14.52
0.31	1.56	1.96	2.35	2.72	3.06	3.43	3.74	4.07	4.40	5.05	5.68	6.30	6.88	7.47	8.02	8.57	9.09	9.62	10.14	11.12	12.03	12.83	13.50	14.12	14.67	14.98
0.33	1.61	2.02	2.42	2.80	3.15	3.53	3.85	4.20	4.54	5.21	5.86	6.51	7.10	7.71	8.28	8.85	9.38	9.93	10.47	11.48	12.42	13.25	13.94	15.58	15.15	15.44
0.35	1.65	2.08	2.49	2.88	3.24	3.63	3.96	4.33	4.68	5.38	6.04	6.71	7.32	7.95	8.54	9.12	9.67	10.23	10.80	11.83	12.80	13.66	14.37	15.03	15.61	15.90
0.38	1.69	2.14	2.56	2.96	3.33	3.73	4.07	4.45	4.82	5.54	6.22	6.91	7.54	8.18	8.79	9.39	9.95	10.53	11.12	12.17	13.17	14.06	14.80	15.47	16.07	16.36
0.40	1.73	2.20	2.62	3.04	3.42	3.82	4.18	4.57	4.95	5.69	6.39	7.10	7.75	8.40	9.03	9.65	13.23	10.82	11.43	12.51	13.54	14.45	15.20	15.90	16.52	16.82
0.42	1.77	2.25	2.68	3.11	3.50	3.91	4.29	4.69	5.08	5.84	6.56	7.29	7.95	8.62	9.26	9.90	10.50	11.11	11.73	12.84	13.90	14.83	15.60	16.32	16.95	17.26
0.46	1.85	2.35	2.80	3.25	3.66	4.09	4.50	4.92	5.33	6.12	6.88	7.64	8.34	9.05	9.72	10.38	11.02	11.65	12.30	13.47	14.57	15.56	16.36	17.10	17.77	18.10
0.50	1.93	2.45	2.92	3.39	3.82	4.27	4.70	5.14	5.56	6.39	7.19	7.98	8.70	9.45	10.14	10.84	11.50	12.16	12.83	14.06	15.20	16.23	17.08	17.85	18.55	18.90
0.54	2.01	2.55	3.04	3.53	3.97	4.44	4.89	5.35	5.79	6.65	7.48	8.31	9.06	9.84	10.56	11.29	11.96	12.66	13.36	14.63	15.83	16.90	17.77	18.58	19.30	19.65
0.58	2.09	2.64	3.15	3.64	4.13	4.61	5.07	5.55	6.01	6.90	7.76	8.62	9.40	10.20	10.96	11.72	12.42	13.14	13.87	15.19	16.43	17.53	18.45	19.30	20.04	20.40
0.63	2.16	2.72	3.25	3.76	4.27	4.77	5.25	5.75	6.21	7.15	8.03	8.92	9.74	10.56	11.35	12.13	12.85	13.60	14.36	15.72	17.00	18.15	19.10	19.97	20.74	21.12
0.67	2.23	2.80	3.34	3.88	4.41	4.92	5.42	5.94	6.42	7.38	8.30	9.21	10.06	10.90	11.72	12.52	13.27	14.04	14.83	16.23	17.56	18.73	19.72	20.62	21.42	21.82
0.71	2.30	2.88	3.43	3.99	4.54	5.07	5.59	6.12	6.61	7.60	8.55	9.49	10.36	11.23	12.08	12.91	13.68	14.47	15.29	16.73	18.10	19.30	20.32	21.26	22.08	22.52
0.75	2.36	2.96	3.52	4.10	4.67	5.22	5.75	6.30	6.81	7.82	8.80	9.76	10.66	11.56	12.44	13.28	14.07	14.90	15.74	17.21	18.62	19.87	20.91	21.87	22.72	23.17
0.79	2.42	3.04	3.61	4.21	4.80	5.36	5.91	6.47	7.00	8.04	9.04	10.03	10.95	11.89	19.79	13.64	14.46	15.30	16.15	17.68	19.14	20.41	21.49	22.47	23.34	23.80
0.83	2.48	3.12	3.70	4.32	4.93	5.50	6.06	6.64	7.18	8.26	9.28	10.30	11.24	12.20	13.12	14.00	14.85	15.70	16.60	18.15	19.65	20.95	22.06	23.06	23.95	24.40
0.92	2.59	3.27	3.88	4.53	5.17	5.78	6.36	6.96	7.53	8.66	9.73	10.80	11.78	12.79	13.74	14.69	15.57	16.47	17.40	19.03	20.50	21.96	23.13	24.20	25.12	25.58
1.00	2.70	3.40	4.05	4.74	5.4	6.04	6.64	7.27	7.86	9.04	10.16	11.28	12.31	13.36	14.35	15.33	16.26	17.20	18.16	19.88	21.50	22.95	24.15	25.25	26.23	26.72
1.08	2.81	3.52	4.21	4.93	5.62	6.28	6.91	7.57	8.19	9.40	10.57	11.74	12.82	13.90	14.94	15.96	16.93	17.90	18.90	20.70	22.40	23.90	25.15	26.28	27.30	27.80
1.17	2.91	3.64	4.37	5.11	5.84	6.51	7.17	7.86	8.49	9.76	10.97	12.18	13.30	14.43	15.50	15.56	17.56	18.57	19.60	21.48	23.23	24.80	26.10	27.28	28.32	28.85
1.25	3.01	3.76	4.52	5.29	6.04	6.74	7.42	8.13	8.79	10.10	11.37	12.62	13.76	14.93	16.04	17.14	18.18	19.23	20.30	22.23	24.05	25.66	27.00	28.23	29.32	29.86
1.33	3.11	3.88	4.67	5.47	6.24	6.96	7.66	8.40	9.08	10.43	11.74	13.03	14.22	15.42	16.57	17.70	18.77	19.86	20.97	22.95	24.84	26.50	27.87	29.15	30.30	30.84
1.42	3.20	3.99	4.81	5.64	6.43	7.18	7.90	8.66	9.36	10.76	12.10	13.43	14.65	15.90	17.08	18.26	19.36	20.48	21.62	23.66	25.60	27.32	28.73	30.06	31.25	31.80
1.50	3.28	4.10	4.95	5.79	6.61	7.39	8.13	8.91	9.63	11.06	12.43	13.81	15.08	16.36	17.57	18.78	19.90	21.05	22.25	24.34	26.34	28.10	29.56	30.92	32.15	32.70

Armco-Type Metergate Tables - Preliminary

36-inch Round Gate

Head Difference (feet)	Net Gate Opening (feet)																												
	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50	2.67	2.83	3.00
	Discharge (cfs)																												
0.08	0.96	1.22	1.47	1.71	1.94	2.16	2.41	2.61	2.82	3.24	3.67	4.05	4.42	4.77	5.10	5.47	5.83	6.13	6.50	7.12	7.86	8.43	8.92	9.37	9.84	10.10	10.35	10.56	10.74
0.10	1.07	1.35	1.62	1.89	2.15	2.41	2.69	2.90	3.12	3.59	4.05	4.50	4.91	5.31	5.67	6.10	6.49	6.82	7.22	7.87	8.67	9.30	9.88	10.38	10.89	11.20	11.50	11.74	11.92
0.13	1.17	1.47	1.77	2.06	2.34	2.63	2.94	3.16	3.40	3.92	4.43	4.93	5.36	5.79	6.20	6.68	7.08	7.44	7.89	8.59	9.44	10.14	10.81	11.33	11.86	12.24	12.57	12.84	13.02
0.15	1.26	1.59	1.92	2.22	2.53	2.84	3.18	3.42	3.67	4.24	4.77	5.32	4.79	6.25	6.70	7.20	7.63	8.04	8.52	9.28	10.17	10.95	11.65	12.25	12.80	13.24	13.60	13.91	14.09
0.17	1.34	1.70	2.05	2.36	2.69	3.04	3.39	3.66	3.92	4.53	5.08	5.68	6.18	6.66	7.17	7.67	8.13	8.60	9.10	9.95	10.87	11.71	12.43	13.09	13.67	14.16	14.54	14.87	15.05
0.19	1.42	1.80	2.17	2.50	2.85	3.21	3.58	3.87	4.14	4.79	5.38	6.00	6.52	7.04	7.61	8.12	8.62	9.12	9.65	10.57	11.52	12.42	13.18	13.86	14.47	15.00	15.39	15.74	15.95
0.21	1.50	1.89	2.28	2.63	3.00	3.37	3.76	4.07	4.35	5.04	5.65	6.30	6.85	7.42	8.02	8.56	9.09	9.61	10.18	11.13	12.16	13.10	13.88	14.60	15.21	15.76	16.17	16.54	16.78
0.23	1.57	1.98	2.39	2.76	3.14	3.52	3.93	4.26	4.55	5.28	5.91	6.60	7.18	7.79	8.42	8.98	9.54	10.07	10.68	11.68	12.76	13.73	14.55	15.31	15.93	16.50	16.94	17.34	17.60
0.25	1.63	2.06	2.49	2.88	3.28	3.67	4.10	4.45	4.75	5.50	6.17	6.89	7.50	8.13	8.79	9.37	9.95	10.52	11.15	12.20	13.31	14.35	15.20	16.00	16.64	17.23	17.68	18.10	18.38
0.27	1.69	2.14	2.59	3.00	3.41	3.82	4.27	4.63	1.95	5.72	6.42	7.17	7.81	8.46	9.15	9.76	10.35	10.96	11.60	12.70	13.86	14.95	15.83	16.66	17.33	17.94	18.40	18.85	19.14
0.29	1.75	2.21	2.68	3.11	3.53	3.95	4.42	4.79	5.13	5.93	6.66	7.44	8.10	8.78	9.49	10.12	10.74	11.37	12.04	13.18	14.37	15.50	16.42	17.28	17.98	18.61	19.08	19.54	19.85
0.31	1.81	2.28	2.76	3.22	3.65	4.08	4.56	4.95	5.31	6.14	6.90	7.70	8.39	9.09	9.82	10.48	11.11	11.77	12.46	13.63	14.89	16.04	16.99	17.89	18.60	19.27	19.74	20.23	20.55
0.33	1.86	2.35	2.84	3.31	3.76	4.20	4.68	5.11	5.49	6.34	7.13	7.95	8.66	9.38	10.14	10.83	11.48	12.15	12.87	14.08	15.37	169.56	17.55	18.46	19.20	19.90	20.40	20.89	21.25
0.35	1.91	1.42	2.92	3.40	3.86	4.32	4.81	5.27	5.66	6.54	7.35	8.20	8.93	9.67	10.45	11.16	11.83	12.52	13.27	14.51	15.84	17.08	18.10	19.03	19.80	20.50	21.05	21.53	21.90
0.38	1.96	2.49	3.00	3.49	3.96	4.44	4.94	5.42	5.82	6.73	7.56	8.44	9.19	9.95	10.76	11.49	12.18	12.89	13.66	14.94	16.31	17.57	18.61	19.60	20.38	21.10	21.65	22.17	22.55
0.40	2.01	2.56	3.08	3.58	4.06	4.56	5.07	5.57	5.98	6.92	7.77	8.67	9.45	10.22	11.06	11.80	12.52	13.25	14.04	15.35	16.76	18.05	19.13	20.15	20.95	21.68	22.25	22.80	23.20
0.42	2.06	2.62	3.16	3.67	4.16	4.68	5.19	5.72	6.14	7.10	7.97	8.89	9.70	10.49	11.34	12.10	12.85	13.60	14.40	15.75	17.20	18.53	19.64	20.65	21.50	22.25	22.80	23.40	23.80
0.46	2.16	2.74	3.31	3.84	4.36	4.90	5.43	6.00	6.43	7.44	8.36	9.33	10.17	11.00	11.90	12.70	13.47	14.25	15.10	16.52	18.03	19.43	20.60	21.65	22.55	23.35	23.90	24.50	24.90
0.50	2.26	2.86	3.45	4.00	4.55	5.11	5.67	6.26	4.71	7.77	8.73	9.73	10.61	11.50	12.42	13.26	14.07	14.88	15.77	17.25	18.82	20.28	21.50	22.62	23.55	24.39	24.95	25.60	26.00
0.54	2.35	2.98	3.59	4.16	4.72	5.32	5.91	6.52	6.99	8.09	9.09	10.13	11.04	11.97	12.93	13.80	14.64	15.50	16.41	17.97	19.60	21.13	22.40	23.65	24.50	26.39	26.00	26.65	27.10
0.58	2.44	3.09	3.72	4.31	4.89	5.52	6.14	6.76	7.25	8.39	9.43	10.51	11.46	12.41	13.42	14.32	15.20	16.09	17.03	18.64	20.35	21.94	23.25	24.44	25.43	26.33	27.00	27.67	28.15
0.63	2.53	3.19	3.85	4.45	5.06	5.72	6.36	7.00	7.51	8.69	9.76	10.89	11.87	12.85	13.90	14.83	15.74	16.67	17.64	19.30	21.08	22.72	24.08	25.30	26.34	27.25	27.95	28.65	19.15
0.67	2.61	3.29	3.97	4.59	5.23	5.91	6.57	7.23	7.76	8.97	10.09	11.24	12.26	13.28	14.35	15.32	16.25	17.20	18.21	19.92	21.75	23.45	24.84	26.13	27.20	28.13	28.85	29.55	30.10
0.71	2.69	3.38	4.08	4.72	5.39	6.09	6.77	7.45	8.00	9.25	10.40	11.59	12.63	13.68	14.79	15.79	16.74	17.72	18.77	20.54	22.42	24.15	25.60	26.95	28.05	29.00	29.75	3.0.45	31.00
0.75	2.76	3.47	4.19	4.85	5.55	6.27	6.97	7.60	8.23	9.52	10.70	11.93	13.00	14.08	15.21	16.25	17.23	18.23	19.31	21.15	23.07	24.85	26.33	27.73	28.85	29.84	30.62	31.35	31.88
0.79	2.83	3.56	4.30	4.98	5.70	6.44	7.16	7.87	8.45	9.78	11.00	12.26	13.37	14.47	15.63	16.68	17.70	18.73	19.84	21.72	23.70	15.55	27.05	28.47	29.63	30.65	31.45	32.20	32.75
0.83	2.90	3.65	4.41	5.11	5.85	6.61	7.35	8.07	8.67	10.03	11.28	12.58	13.71	14.83	16.03	17.10	18.17	19.21	20.35	22.27	24.30	26.20	27.75	29.20	30.40	31.45	32.25	33.05	33.60
0.92	3.05	3.82	4.60	5.36	6.13	6.92	7.70	8.46	9.10	10.52	11.82	13.18	14.37	15.55	16.81	17.93	19.05	20.14	21.33	23.35	25.47	27.45	29.10	30.60	31.85	32.95	33.80	34.65	35.20
1.00	3.16	3.98	4.79	5.61	6.40	7.23	8.05	8.85	9.51	10.99	12.35	13.78	15.01	16.25	17.58	18.74	19.90	21.05	22.30	24.40	26.62	18.70	30.40	32.00	33.30	34.45	35.35	36.20	36.80
1.08	3.28	4.14	4.98	5.85	6.67	7.52	8.39	9.22	9.89	11.44	12.85	14.35	15.62	16.93	18.30	19.53	20.72	21.92	23.22	25.40	27.75	29.87	31.65	33.32	34.65	35.85	36.80	37.68	38.30
1.17	3.39	4.29	5.16	6.06	6.91	7.81	8.70	9.56	10.26	11.88	13.33	14.88	16.21	17.58	18.99	20.25	21.50	22.75	24.10	26.35	28.80	31.00	32.85	34.60	35.98	37.20	38.18	39.10	39.75
1.25	3.50	4.43	5.34	6.27	7.15	8.08	9.00	9.89	10.62	12.30	13.80	15.40	16.78	18.19	19.64	20.95	22.24	23.54	24.93	27.30	29.80	32.10	34.00	35.80	37.25	28.50	39.50	40.45	41.15
1.33	3.61	4.56	5.51	6.48	7.39	8.34	9.29	10.22	10.98	12.69	14.27	15.90	17.33	18.78	20.29	54.65	22.98	24.30	25.75	28.20	30.75	33.15	35.10	36.95	38.45	29.80	40.80	41.80	42.50
1.42	3.72	4.69	5.68	6.68	7.62	8.60	9.58	10.54	11.32	13.08	14.70	16.39	17.86	19.34	20.92	22.32	23.69	25.05	26.55	29.03	31.70	34.15	36.20	38.10	39.60	41.10	42.05	43.10	43.80
1.50	3.82	4.82	5.85	6.87	7.84	8.85	9.86	10.84	11.64	13.45	15.12	16.88	18.39	19.89	21.54	22.97	24.36	25.78	27.33	29.85	32.63	35.15	37.25	39.20	40.75	42.30	43.25	44.35	45.10

ITRC Water Measurement Tables for

RECTANGULAR Gates on Round Pipes

Discharge Values in CFS

ITRC Water Measurement Tables – 18" Rectangular Gate, Stilling Well Located 12" d/s of Back of Gate [Blue center represents best accuracy range]

ΔH (feet)	Net Gate Opening (feet)																							
	0.042	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50
	Discharge (cfs)																							
0.04	0.02	0.05	0.09	0.13	0.18	0.23	0.28	0.34	0.40	0.46	0.52	0.58	0.72	0.86	1.01	1.17	1.34	1.51	1.71	1.92	2.07	2.21	2.26	2.28
0.06	0.02	0.06	0.11	0.16	0.22	0.28	0.35	0.42	0.49	0.56	0.64	0.71	0.88	1.05	1.24	1.43	1.64	1.85	2.10	2.36	2.54	2.70	2.77	2.79
0.08	0.02	0.07	0.12	0.19	0.25	0.33	0.40	0.48	0.56	0.65	0.73	0.82	1.01	1.21	1.43	1.65	1.89	2.13	2.43	2.72	2.93	3.12	3.20	3.22
0.10	0.03	0.08	0.14	0.21	0.28	0.37	0.45	0.54	0.63	0.72	0.82	0.92	1.13	1.36	1.60	1.85	2.11	2.39	2.71	3.04	3.28	3.49	3.58	3.60
0.13	0.03	0.08	0.15	0.23	0.31	0.40	0.49	0.59	0.69	0.79	0.90	1.01	1.24	1.49	1.75	2.02	2.32	2.61	2.97	3.33	3.59	3.82	3.92	3.95
0.15	0.03	0.09	0.16	0.25	0.34	0.43	0.53	0.63	0.74	0.86	0.97	1.09	1.34	1.61	1.89	2.19	2.50	2.82	3.21	3.60	3.88	4.13	4.24	4.26
0.17	0.03	0.09	0.17	0.26	0.36	0.46	0.57	0.68	0.80	0.92	1.04	1.16	1.44	1.72	2.02	2.34	2.67	3.02	3.43	3.85	4.15	4.42	4.53	4.56
0.19	0.04	0.10	0.18	0.28	0.38	0.49	0.60	0.72	0.84	0.97	1.10	1.23	1.52	1.82	2.15	2.48	2.84	3.20	3.64	4.08	4.40	4.68	4.80	4.84
0.21	0.04	0.11	0.19	0.29	0.40	0.52	0.64	0.76	0.89	1.02	1.16	1.30	1.60	1.92	2.26	2.61	2.99	3.37	3.83	4.30	4.63	4.94	5.06	5.10
0.23	0.04	0.11	0.20	0.31	0.42	0.54	0.67	0.79	0.93	1.07	1.22	1.36	1.68	2.01	2.37	2.74	3.14	3.54	4.02	4.51	4.86	5.18	5.31	5.35
0.25	0.04	0.12	0.21	0.32	0.44	0.57	0.70	0.83	0.97	1.12	1.27	1.42	1.76	2.10	2.48	2.86	3.28	3.70	4.20	4.71	5.08	5.41	5.55	5.58
0.27	0.04	0.12	0.22	0.34	0.46	0.59	0.72	0.86	1.01	1.17	1.32	1.48	1.83	2.19	2.58	2.98	3.41	3.85	4.37	4.90	5.28	5.63	5.77	5.81
0.29	0.04	0.13	0.23	0.35	0.48	0.61	0.75	0.90	1.05	1.21	1.37	1.54	1.90	2.27	2.68	3.09	3.54	3.99	4.54	5.09	5.48	5.84	5.99	6.03
0.31	0.05	0.13	0.24	0.36	0.49	0.63	0.78	0.93	1.09	1.25	1.42	1.59	1.97	2.35	2.77	3.20	3.66	4.13	4.70	5.27	5.68	6.05	6.20	6.24
0.33	0.05	0.13	0.24	0.37	0.51	0.65	0.80	0.96	1.12	1.30	1.47	1.64	2.03	2.43	2.86	3.30	3.78	4.27	4.85	5.44	5.86	6.24	6.41	6.45
0.35	0.05	0.14	0.25	0.38	0.52	0.67	0.83	0.99	1.16	1.33	1.51	1.69	2.09	2.50	2.95	3.41	3.90	4.40	5.00	5.61	6.04	6.44	6.60	6.65
0.38	0.05	0.14	0.26	0.40	0.54	0.69	0.85	1.02	1.19	1.37	1.56	1.74	2.15	2.57	3.03	3.50	4.01	4.53	5.14	5.77	6.22	6.62	6.79	6.84
0.40	0.05	0.15	0.27	0.41	0.55	0.71	0.88	1.04	1.23	1.41	1.60	1.79	2.21	2.65	3.12	3.60	4.12	4.65	5.29	5.93	6.39	6.81	6.98	7.03
0.42	0.05	0.15	0.27	0.42	0.57	0.73	0.90	1.07	1.26	1.45	1.64	1.84	2.27	2.71	3.20	3.69	4.23	4.77	5.42	6.08	6.55	6.98	7.16	7.21
0.46	0.06	0.16	0.29	0.44	0.60	0.77	0.94	1.12	1.32	1.52	1.72	1.93	2.38	2.85	3.35	3.87	4.44	5.00	5.69	6.38	6.87	7.32	7.51	7.56
0.50	0.06	0.16	0.30	0.46	0.62	0.80	0.98	1.17	1.38	1.59	1.80	2.01	2.49	2.97	3.50	4.05	4.63	5.23	5.94	6.66	7.18	7.65	7.84	7.90
0.54	0.06	0.17	0.31	0.48	0.65	0.83	1.03	1.22	1.43	1.65	1.87	2.10	2.59	3.09	3.65	4.21	4.82	5.44	6.18	6.93	7.47	7.96	8.16	8.22
0.58	0.06	0.18	0.32	0.49	0.67	0.86	1.06	1.27	1.49	1.71	1.94	2.17	2.69	3.21	3.78	4.37	5.00	5.65	6.42	7.20	7.75	8.26	8.47	8.53
0.63	0.07	0.18	0.33	0.51	0.70	0.90	1.10	1.31	1.54	1.77	2.01	2.25	2.78	3.32	3.92	4.52	5.18	5.84	6.64	7.45	8.03	8.55	8.77	8.83
0.67	0.07	0.19	0.35	0.53	0.72	0.92	1.14	1.36	1.59	1.83	2.08	2.32	2.87	3.43	4.05	4.67	5.35	6.04	6.86	7.69	8.29	8.83	9.06	9.12
0.71	0.07	0.20	0.36	0.54	0.74	0.95	1.17	1.40	1.64	1.89	2.14	2.40	2.96	3.54	4.17	4.82	5.51	6.22	7.07	7.93	8.55	9.10	9.34	9.40
0.75	0.07	0.20	0.37	0.56	0.76	0.98	1.21	1.44	1.69	1.94	2.20	2.47	3.04	3.64	4.29	4.96	5.67	6.40	7.28	8.16	8.79	9.37	9.61	9.67
0.79	0.07	0.21	0.38	0.57	0.78	1.01	1.24	1.48	1.73	2.00	2.26	2.53	3.13	3.74	4.41	5.09	5.83	6.58	7.47	8.38	9.03	9.62	9.87	9.94
0.83	0.08	0.21	0.39	0.59	0.81	1.03	1.27	1.52	1.78	2.05	2.32	2.60	3.21	3.84	4.52	5.22	5.98	6.75	7.67	8.60	9.27	9.87	10.13	10.20
0.92	0.08	0.22	0.41	0.62	0.84	1.08	1.33	1.59	1.87	2.15	2.43	2.73	3.37	4.03	4.74	5.48	6.27	7.08	8.04	9.02	9.72	10.36	10.62	10.69
1.00	0.08	0.23	0.42	0.65	0.88	1.13	1.39	1.66	1.95	2.24	2.54	2.85	3.52	4.20	4.96	5.72	6.55	7.39	8.40	9.42	10.15	10.82	11.09	11.17
1.08	0.09	0.24	0.44	0.67	0.92	1.18	1.45	1.73	2.03	2.33	2.65	2.96	3.66	4.38	5.16	5.96	6.82	7.69	8.74	9.81	10.57	11.26	11.55	11.62
1.17	0.09	0.25	0.46	0.70	0.95	1.22	1.50	1.79	2.10	2.42	2.75	3.08	3.80	4.54	5.35	6.18	7.08	7.98	9.07	10.18	10.97	11.68	11.98	12.06
1.25	0.09	0.26	0.47	0.72	0.99	1.27	1.56	1.86	2.18	2.51	2.84	3.18	3.93	4.70	5.54	6.40	7.33	8.26	9.39	10.53	11.35	12.09	12.40	12.49
1.33	0.10	0.27	0.49	0.75	1.02	1.31	1.61	1.92	2.25	2.59	2.94	3.29	4.06	4.86	5.72	6.61	7.57	8.53	9.70	10.88	11.72	12.49	12.81	12.90
1.42	0.10	0.28	0.50	0.77	1.05	1.35	1.66	1.98	2.32	2.67	3.03	3.39	4.18	5.00	5.90	6.81	7.80	8.80	10.00	11.21	12.09	12.87	13.20	13.29
1.50	0.10	0.28	0.52	0.79	1.08	1.39	1.71	2.03	2.39	2.75	3.11	3.49	4.31	5.15	6.07	7.01	8.02	9.05	10.29	11.54	12.44	13.25	13.59	13.68
1.58	0.10	0.29	0.53	0.81	1.11	1.42	1.75	2.09	2.45	2.82	3.20	3.58	4.42	5.29	6.24	7.20	8.24	9.30	10.57	11.86	12.78	13.61	13.96	14.05
1.67	0.11	0.30	0.55	0.83	1.14	1.46	1.80	2.14	2.52	2.90	3.28	3.68	4.54	5.43	6.40	7.39	8.46	9.54	10.85	12.16	13.11	13.96	14.32	14.42
1.75	0.11	0.31	0.56	0.85	1.17	1.50	1.84	2.20	2.58	2.97	3.36	3.77	4.65	5.56	6.56	7.57	8.67	9.78	11.11	12.46	13.43	14.31	14.68	14.77
1.83	0.11	0.31	0.57	0.87	1.19	1.53	1.89	2.25	2.64	3.04	3.44	3.85	4.76	5.69	6.71	7.75	8.87	10.01	11.37	12.76	13.75	14.65	15.02	15.12
1.92	0.11	0.32	0.59	0.89	1.22	1.57	1.93	2.30	2.70	3.11	3.52	3.94	4.87	5.82	6.86	7.92	9.07	10.23	11.63	13.04	14.06	14.97	15.36	15.46
2.00	0.12	0.33	0.60	0.91	1.25	1.60	1.97	2.35	2.76	3.17	3.60	4.03	4.97	5.95	7.01	8.09	9.27	10.45	11.88	13.32	14.36	15.30	15.69	15.79
2.08	0.12	0.34	0.61	0.93	1.27	1.63	2.01	2.40	2.81	3.24	3.67	4.11	5.07	6.07	7.15	8.26	9.46	10.67	12.13	13.60	14.66	15.61	16.01	16.12
2.17	0.12	0.34	0.62	0.95	1.30	1.67	2.05	2.44	2.87	3.30	3.74	4.19	5.18	6.19	7.29	8.42	9.64	10.88	12.37	13.87	14.95	15.92	16.33	16.44
2.25	0.12	0.35	0.64	0.97	1.32	1.70	2.09	2.49	2.92	3.36	3.81	4.27	5.27	6.31	7.43	8.58	9.83	11.09	12.60	14.13	15.23	16.22	16.64	16.75
2.33	0.13	0.36	0.65	0.99	1.35	1.73	2.13	2.54	2.98	3.43	3.88	4.35	5.37	6.42	7.57	8.74	10.01	11.29	12.83	14.39	15.51	16.52	16.95	17.06
2.42	0.13	0.36	0.66	1.00	1.37	1.76	2.17	2.58	3.03	3.49	3.95	4.43	5.47	6.54	7.70	8.90	10.19	11.49	13.06	14.65	15.78	16.81	17.25	17.36
2.50	0.13	0.37	0.67	1.02	1.39	1.79	2.20	2.63	3.08	3.55	4.02	4.50	5.56	6.65	7.84	9.05	10.36	11.69	13.28	14.90	16.05	17.10	17.54	17.66
2.58	0.13	0.37	0.68	1.04	1.42	1.82	2.24	2.67	3.13	3.61	4.09	4.58	5.65	6.76	7.96	9.20	10.53	11.88	13.50	15.14	16.32	17.38	17.83	17.95
2.67	0.14	0.38	0.69	1.05	1.44	1.85	2.27	2.71	3.18	3.66	4.15	4.65	5.74	6.87	8.09	9.34	10.70	12.07	13.72	15.39	16.58	17.66	18.12	18.24
2.75	0.14	0.39	0.70	1.07	1.46	1.88	2.31	2.75	3.23	3.72	4.22	4.72	5.83	6.97	8.22	9.49	10.87	12.26	13.93	15.62	16.84	17.94	18.40	18.52
2.83	0.14	0.39	0.71	1.09	1.48	1.91	2.34	2.80	3.28	3.78	4.28	4.79	5.92	7.08	8.34	9.63	11.03	12.44	14.14	15.86	17.09	18.21	18.67	18.80

ITRC Water Measurement Tables – 24" Rectangular Gate, Stilling Well Located 12" d/s of Back of Gate [Blue center represents best accuracy range]

ΔH (feet)	Net Gate Opening (feet)																													
	0.042	0.08	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50	1.58	1.67	1.75	1.83	1.92	2.00
	Discharge (cfs)																													
0.04	0.04	0.07	0.12	0.18	0.25	0.31	0.38	0.44	0.52	0.60	0.68	0.76	0.93	1.11	1.30	1.49	1.68	1.86	2.06	2.25	2.45	2.65	2.87	3.08	3.28	3.70	3.89	4.05	4.06	4.07
0.06	0.04	0.08	0.15	0.23	0.30	0.38	0.46	0.54	0.64	0.73	0.83	0.93	1.14	1.36	1.60	1.83	2.06	2.28	2.52	2.75	3.00	3.25	3.51	3.77	4.02	4.54	4.76	4.96	4.97	4.98
0.08	0.05	0.09	0.17	0.26	0.35	0.44	0.54	0.63	0.74	0.85	0.96	1.07	1.32	1.57	1.84	2.11	2.38	2.64	2.91	3.18	3.47	3.75	4.06	4.36	4.64	5.24	5.50	5.73	5.74	5.75
0.10	0.06	0.10	0.19	0.29	0.39	0.50	0.60	0.70	0.82	0.95	1.07	1.20	1.48	1.76	2.06	2.36	2.66	2.95	3.25	3.55	3.88	4.20	4.54	4.87	5.19	5.85	6.15	6.41	6.42	6.43
0.13	0.06	0.11	0.21	0.32	0.43	0.54	0.66	0.77	0.90	1.04	1.18	1.32	1.62	1.93	2.26	2.59	2.91	3.23	3.56	3.89	4.25	4.60	4.97	5.33	5.69	6.41	6.73	7.02	7.03	7.04
0.15	0.07	0.12	0.23	0.34	0.46	0.59	0.71	0.83	0.97	1.12	1.27	1.42	1.75	2.08	2.44	2.80	3.14	3.49	3.85	4.20	4.59	4.96	5.37	5.76	6.14	6.93	7.27	7.58	7.59	7.61
0.17	0.07	0.13	0.24	0.37	0.50	0.63	0.76	0.89	1.04	1.20	1.36	1.52	1.87	2.23	2.60	2.99	3.36	3.73	4.11	4.49	4.90	5.31	5.74	6.16	6.57	7.41	7.77	8.10	8.12	8.13
0.19	0.08	0.14	0.26	0.39	0.53	0.66	0.80	0.94	1.10	1.27	1.44	1.61	1.98	2.36	2.76	3.17	3.56	3.96	4.36	4.77	5.20	5.63	6.09	6.53	6.97	7.86	8.24	8.59	8.61	8.62
0.21	0.08	0.15	0.27	0.41	0.55	0.70	0.85	0.99	1.16	1.34	1.52	1.70	2.09	2.49	2.91	3.34	3.76	4.17	4.60	5.02	5.48	5.93	6.41	6.89	7.34	8.28	8.69	9.06	9.07	9.09
0.23	0.08	0.15	0.28	0.43	0.58	0.73	0.89	1.04	1.22	1.41	1.59	1.78	2.19	2.61	3.05	3.50	3.94	4.37	4.82	5.27	5.75	6.22	6.73	7.22	7.70	8.68	9.11	9.50	9.52	9.53
0.25	0.09	0.16	0.30	0.45	0.61	0.77	0.93	1.09	1.28	1.47	1.66	1.86	2.29	2.73	3.19	3.66	4.12	4.57	5.04	5.50	6.00	6.50	7.03	7.54	8.05	9.07	9.52	9.92	9.94	9.96
0.27	0.09	0.17	0.31	0.47	0.63	0.80	0.97	1.13	1.33	1.53	1.73	1.94	2.38	2.84	3.32	3.81	4.28	4.75	5.24	5.73	6.25	6.77	7.31	7.85	8.37	9.44	9.91	10.33	10.35	10.37
0.29	0.10	0.17	0.32	0.49	0.66	0.83	1.00	1.18	1.38	1.59	1.80	2.01	2.47	2.95	3.45	3.95	4.45	4.93	5.44	5.94	6.49	7.02	7.59	8.15	8.69	9.80	10.28	10.72	10.74	10.76
0.31	0.10	0.18	0.33	0.50	0.68	0.86	1.04	1.22	1.43	1.64	1.86	2.08	2.56	3.05	3.57	4.09	4.60	5.11	5.63	6.15	6.71	7.27	7.86	8.43	8.99	10.14	10.64	11.09	11.11	11.13
0.33	0.10	0.19	0.34	0.52	0.70	0.89	1.07	1.26	1.47	1.70	1.92	2.15	2.64	3.15	3.68	4.23	4.75	5.27	5.82	6.35	6.93	7.51	8.11	8.71	9.29	10.47	10.99	11.46	11.48	11.50
0.35	0.11	0.19	0.35	0.54	0.72	0.91	1.11	1.29	1.52	1.75	1.98	2.22	2.72	3.25	3.80	4.36	4.90	5.44	6.00	6.55	7.15	7.74	8.36	8.98	9.58	10.80	11.33	11.81	11.83	11.85
0.38	0.11	0.20	0.36	0.55	0.74	0.94	1.14	1.33	1.56	1.80	2.04	2.28	2.80	3.34	3.91	4.48	5.04	5.59	6.17	6.74	7.35	7.96	8.61	9.24	9.85	11.11	11.66	12.15	12.17	12.20
0.40	0.11	0.20	0.37	0.57	0.76	0.97	1.17	1.37	1.61	1.85	2.09	2.34	2.88	3.43	4.01	4.61	5.18	5.75	6.34	6.92	7.55	8.18	8.84	9.49	10.12	11.41	11.98	12.49	12.51	12.53
0.42	0.11	0.21	0.38	0.58	0.78	0.99	1.20	1.40	1.65	1.90	2.15	2.40	2.96	3.52	4.12	4.73	5.31	5.90	6.50	7.10	7.75	8.39	9.07	9.74	10.39	11.71	12.29	12.81	12.83	12.86
0.46	0.12	0.22	0.40	0.61	0.82	1.04	1.26	1.47	1.73	1.99	2.25	2.52	3.10	3.69	4.32	4.96	5.57	6.18	6.82	7.45	8.13	8.80	9.51	10.21	10.89	12.28	12.89	13.44	13.46	13.48
0.50	0.13	0.23	0.42	0.64	0.86	1.09	1.31	1.54	1.80	2.08	2.35	2.63	3.24	3.86	4.51	5.18	5.82	6.46	7.12	7.78	8.49	9.19	9.94	10.67	11.38	12.83	13.46	14.03	14.06	14.08
0.54	0.13	0.24	0.43	0.66	0.89	1.13	1.37	1.60	1.88	2.16	2.45	2.74	3.37	4.01	4.70	5.39	6.06	6.72	7.42	8.10	8.84	9.57	10.34	11.10	11.84	13.35	14.01	14.61	14.63	14.66
0.58	0.14	0.25	0.45	0.69	0.93	1.17	1.42	1.66	1.95	2.24	2.54	2.84	3.50	4.17	4.87	5.59	6.29	6.98	7.70	8.40	9.17	9.93	10.73	11.52	12.29	13.85	14.54	15.16	15.18	15.21
0.63	0.14	0.26	0.47	0.71	0.96	1.21	1.47	1.72	2.02	2.32	2.63	2.94	3.62	4.31	5.04	5.79	6.51	7.22	7.97	8.70	9.49	10.28	11.11	11.93	12.72	14.34	15.05	15.69	15.72	15.75
0.67	0.14	0.26	0.48	0.74	0.99	1.25	1.52	1.78	2.08	2.40	2.72	3.04	3.74	4.45	5.21	5.98	6.72	7.46	8.23	8.98	9.80	10.61	11.47	12.32	13.14	14.81	15.55	16.20	16.23	16.26
0.71	0.15	0.27	0.50	0.76	1.02	1.29	1.56	1.83	2.15	2.47	2.80	3.13	3.85	4.59	5.37	6.16	6.93	7.69	8.48	9.26	10.11	10.94	11.83	12.70	13.54	15.27	16.02	16.70	16.73	16.76
0.75	0.15	0.28	0.51	0.78	1.05	1.33	1.61	1.88	2.21	2.54	2.88	3.22	3.97	4.72	5.53	6.34	7.13	7.91	8.73	9.53	10.40	11.26	12.17	13.07	13.93	15.71	16.49	17.19	17.22	17.25
0.79	0.16	0.29	0.53	0.80	1.08	1.37	1.65	1.94	2.27	2.61	2.96	3.31	4.07	4.85	5.68	6.51	7.32	8.13	8.97	9.79	10.68	11.57	12.50	13.42	14.32	16.14	16.94	17.66	17.69	17.72
0.83	0.16	0.30	0.54	0.82	1.11	1.40	1.70	1.99	2.33	2.68	3.04	3.40	4.18	4.98	5.82	6.68	7.52	8.34	9.20	10.05	10.96	11.87	12.83	13.77	14.69	16.56	17.38	18.12	18.15	18.18
0.92	0.17	0.31	0.57	0.86	1.16	1.47	1.78	2.08	2.44	2.81	3.19	3.57	4.38	5.22	6.11	7.01	7.88	8.75	9.65	10.54	11.50	12.45	13.45	14.44	15.41	17.37	18.23	19.00	19.03	19.07
1.00	0.18	0.32	0.59	0.90	1.21	1.53	1.86	2.18	2.55	2.94	3.33	3.72	4.58	5.45	6.38	7.32	8.23	9.14	10.08	11.00	12.01	13.00	14.05	15.09	16.09	18.14	19.04	19.85	19.88	19.92
1.08	0.18	0.34	0.61	0.94	1.26	1.60	1.93	2.26	2.66	3.06	3.46	3.88	4.77	5.68	6.64	7.62	8.57	9.51	10.49	11.45	12.50	13.53	14.63	15.70	16.75	18.88	19.82	20.66	20.69	20.73
1.17	0.19	0.35	0.64	0.98	1.31	1.66	2.01	2.35	2.76	3.17	3.59	4.02	4.95	5.89	6.89	7.91	8.89	9.87	10.88	11.89	12.97	14.04	15.18	16.30	17.38	19.59	20.57	21.44	21.47	21.51
1.25	0.20	0.36	0.66	1.01	1.36	1.72	2.08	2.43	2.85	3.28	3.72	4.16	5.12	6.10	7.13	8.18	9.20	10.21	11.27	12.30	13.43	14.53	15.71	16.87	17.99	20.28	21.29	22.19	22.23	22.27
1.33	0.20	0.37	0.68	1.04	1.40	1.77	2.14	2.51	2.95	3.39	3.84	4.30	5.29	6.30	7.37	8.45	9.51	10.55	11.63	12.71	13.87	15.01	16.23	17.42	18.58	20.95	21.99	22.92	22.95	23.00
1.42	0.21	0.39	0.70	1.07	1.45	1.83	2.21	2.59	3.04	3.49	3.96	4.43	5.45	6.49	7.59	8.71	9.80	10.87	11.99	13.10	14.29	15.47	16.73	17.96	19.15	21.59	22.66	23.62	23.66	23.71
1.50	0.22	0.40	0.72	1.11	1.49	1.88	2.27	2.66	3.13	3.60	4.08	4.56	5.61	6.68	7.81	8.97	10.08	11.19	12.34	13.48	14.71	15.92	17.21	18.48	19.71	22.22	23.32	24.31	24.35	24.39
1.58	0.22	0.41	0.74	1.14	1.53	1.93	2.34	2.74	3.21	3.69	4.19	4.69	5.76	6.86	8.03	9.21	10.36	11.50	12.68	13.85	15.11	16.36	17.68	18.98	20.25	22.83	23.96	24.97	25.01	25.06
1.67	0.23	0.42	0.76	1.17	1.57	1.98	2.40	2.81	3.29	3.79	4.30	4.81	5.91	7.04	8.24	9.45	10.63	11.79	13.01	14.21	15.50	16.78	18.14	19.48	20.77	23.42	24.58	25.62	25.66	25.71
1.75	0.23	0.43	0.78	1.19	1.61	2.03	2.46	2.88	3.38	3.88	4.40	4.93	6.06	7.22	8.44	9.68	10.89	12.08	13.33	14.56	15.89	17.20	18.59	19.96	21.29	24.00	25.19	26.25	26.30	26.35
1.83	0.24	0.44	0.80	1.22	1.64	2.08	2.51	2.95	3.45	3.98	4.51	5.04	6.20	7.38	8.64	9.91	11.15	12.37	13.64	14.90	16.26	17.60	19.03	20.43	21.79	24.56	25.78	26.87	26.92	26.97
1.92	0.24	0.45	0.82	1.25	1.68	2.13	2.57	3.01	3.53	4.07	4.61	5.16	6.34	7.55	8.83	10.14	11.40	12.65	13.95	15.23	16.62	18.00	19.46	20.89	22.28	25.11	26.36	27.48	27.52	27.57
2.00	0.25	0.46	0.84	1.28	1.72	2.17	2.63	3.08	3.61	4.15	4.71	5.27	6.47	7.71	9.02	10.35	11.64	12.92	14.25	15.56	16.98	18.39	19.87	21.34	22.76	25.65	26.93	28.07	28.11	28.17
2.08	0.26	0.47	0.85	1.30	1.75	2.22	2.68	3.14	3.68	4.24	4.80	5.37	6.61	7.87	9.21	10.57	11.88	13.19	14.54	15.88	17.33	18.76	20.28	21.78	23.22	26.18	27.48	28.65	28.69	28.75
2.17	0.26	0.48	0.87	1.33	1.79	2.26	2.73	3.20	3.76	4.32	4.90	5.48	6.74	8.03	9.39	10.78	12.12	13.45	14.83	16.20	17.68	19.14	20.69	22.21	23.68	26.70	28.03	29.21	29.26	29.32
2.25	0.27	0.49	0.89	1.35	1.82	2.30	2.79	3.26	3.83	4.40	4.99	5.59	6.87	8.18	9.57	10.98	12.35	13.70	15.11	16.51	18.01	19.50	21.08	22.63	24.14	27.21	28.56	29.77	29.82	29.88
2.33	0.27	0.49	0.90	1.38	1.86	2.34	2.84	3.32	3.90	4.49	5.08	5.69	6.99	8.33	9.75	11.18	12.58	13.95	15.39	16.81	18.34	19.86	21.47	23.05	24.58	27.71	29.08	30.32	30.37	30.42
2.42	0.27	0.50	0.92	1.40	1.89	2.39	2.89	3.38	3.97	4.56	5.17	5.79	7.12	8.48	9.92	11.38	12.80	14.20	15.66	17.11	18.67	20.21	21.85	23.45	25.01	28.20	29.60	30.85	30.90	30.96
2.50	0.28	0.51	0.93	1.43	1.92	2.43	2.94	3.44	4.03	4.64	5.26	5.89	7.24	8.62	10.09	11.58	13.02	14.44	15.93	17.40	18.99	20.56	22.22	23.85	25.44	28.68	30.11	31.38	31.43	31.49
2.58	0.28	0.52	0.95	1.45	1.95	2.47	2.99	3.50	4.10	4.72	5.35	5.99	7.36	8.77	10.25	11.77	13.23	14.68	16.19	17.69	19.30	20.90	22.59	24.25	25.86	29.16	30.60	31.90	31.95	32.01
2.67	0.29	0.53	0.96	1.47	1.98	2.51	3.03	3.55	4.17	4.80	5.43	6.08	7.48	8.91	10.42	11.95	13.44	14.92	16.45	17.97	19.61	21.23	22.95	24.64	26.28	29.62	31.09	32.41	32.46	32.52
2.75	0.29	0.54	0.98	1.50	2.01	2.55	3.08	3.61	4.23	4.87	5.52	6.18	7.59	9.04	10.58	12.14	13.65	15.15	16.71	18.25	19.91	21.56	23.30	25.02	26.68	30.08	31.57	32.91	32.97	33.03
2.83	0.30	0.54	0.99	1.52	2.04	2.58	3.13	3.66	4.29	4.94	5.60	6.27	7.71	9.18	10.74	12.32	13.86	15.38	16.96	18.52	20.21	21.88	23.65	25.39	27.08	30.53	32.05	33.41	33.46	33.52

CHOWCHILLA WATER DISTRICT

SBx7-7 SUPPLEMENT REPORT

2015 UPDATE

ATTACHMENT 3

SCHEDULE TO IMPLEMENT EWMPS

Schedule to Implement EWMPs (Water Code §10608.56 (d)) See USBR Water Management Plan for additional details					
			Budget Allotment		
EWMP	Implementation Schedule	Finance Plan	Dollars	Staff Hrs	USBR BMPs
Critical					
1 – Water Measurement	On-going implementation	Assessments and water toll rates	$100,000	300	Critical A1
2 - Volume-Based Pricing	Already implemented	Assessments and water toll rates	$100	1	Critical A4
Conditional					
1 – Alternate Land Use	N/A - No areas of poor drainage or salt issues within District	N/A	$0	0	Exemptible B1
2 – Recycled Water Use	The District is investigating the potential to use recycled urban wastewater.	N/A	$0	0	Exemptible B2
3 – On-Farm Irrigation Capital Improvements	Already implemented. District cost shares 25% of the cost of a water meter, installs the meter at no cost and maintains the meter.	Assessments and water toll rates	$0	8	Exemptible B3
4 – Incentive Pricing Structure	Already implemented	Assessments and water toll rates	$0	8	Exemptible B4
5 – Infrastructure Improvements	On-going implementation	Assessments and water toll rates	$0	10	Exemptible B5a Exemptible B5b
6 – Order/Delivery Flexibility	On-going implementation	Assessments and water toll rates	$400	8	Exemptible B6
7 – Supplier Spill and Tailwater Systems	Already implemented. Outflow measurement is on-going.	Assessments and water toll rates	$100	728	Exemptible B7 Exemptible B8
8 – Conjunctive Use	Already implemented	Assessments and water toll rates	$0	8	Exemptible B9
9 – Automated Canal Controls	On-going implementation	Assessments and water toll rates	$0	40	Exemptible B10
10 – Customer Pump Test/Eval.	On-going implementation	Assessments and water toll rates	$0	8	Exemptible B11
11 – Water Conservation Coordinator	Already implemented	Assessments and water toll rates	$1,000	10	Critical A2
12 – Water Management Services to Customers	Already implemented	Assessments and water toll rates	$300	25	Critical A3
13 – Identify Institutional Changes	CWD has very little ability to impact USBR policies and regulations.	N/A	$0	0	No equivalent
14 – Supplier Pump Improved Efficiency	On-going implementation	Assessments and water toll rates	$300	3	Critical A5
Grand Total all EWMPs			$102,200	1,157	
Note: There is no equivalent USBR BMP for Conditional EWMP #13					

CHOWCHILLA WATER DISTRICT

SBX7-7 SUPPLEMENT REPORT

2015 UPDATE

ATTACHMENT 4

RESOLUTION ADOPTING SBX7-7 SUPPLEMENTAL REPORT 2015 UPDATE

CHOWCHILLA WATER DISTRICT

RESOLUTION NO. 2015-10

A RESOLUTION APPROVING ADOPTION OF A
SENATE BILLx7-7 SUPPLEMENT REPORT 2015 UPDATE

WHEREAS, The Chowchilla Water District (District) is a U.S. Bureau of Reclamation (USBR) water supply contractor that receives water from the Friant Division of the Central Valley Project (CVP).

WHEREAS, the USBR requires all contractors to prepare a water management plan in accordance with criteria established by USBR and the District most recently prepared a 5-year water management plan in 2009, with final acceptance by USBR in 2011.

WHEREAS, Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, mandated water conservation and measurement and reporting activities for certain agricultural water suppliers, including the preparation of water management plans in 2012, 2015 and every five years thereafter.

WHEREAS, the provisions of SBx7-7 were incorporated in the California Water Code, and Water Code §10828 allows agricultural water suppliers subject to the USBR CVPIA/RRA water management/conservation plan process to submit their USBR plan along with additional documentation to the California Department of Water Resources (DWR) to comply with the requirements of SBx7-7.

WHEREAS, The District prepared a SBx7-7 Supplement Report in December 2012 and submitted it to DWR, along with the District's current USBR water management plan, to satisfy the requirement to prepare an agricultural water management plan in 2012.

WHEREAS, The District has prepared a SBx7-7 Supplement Report in order to meet the requirements for additional documentation in 2015 and the District has made the plan available for public inspection.

WHEREAS, the District has posted a Public Hearing Notice in the newspaper pursuant to Section 6066 of the Government Code and on the District's web site, cwdwater.com.

WHEREAS, the District has conducted said Public Hearing on December 9, 2015 in order to receive comments from the public.

NOW, THEREFORE, BE IT RESOLVED that the draft SBx7-7 Supplement Report 2015 Update for the Chowchilla Water District is adopted and the General Manager is directed to submit the SBx7-7 Supplement Report 2015 Update for the Chowchilla Water District, along with the District's current USBR water management plan, to the California Department of Water Resources.

RESOLVED FURTHER, that District staff are authorized and directed to take any other actions they determine to be necessary in order to fully implement the preceding resolution.

PASSED, ADOPTED AND APPROVED at a regular Board meeting of the Board of Directors of the Chowchilla Water District held on December 9, 2015, by the following vote:

AYES: Directors: Maddalena, Mandala, Taylor, Harris, and Upton
NOES: none
ABSTAINING: none
ABSENT: none

I HEREBY CERTIFY that the foregoing resolution is the resolution of the Chowchilla Water District as duly passed and adopted by said board of directors at a meeting thereof, duly and regularly held on December 9, 2015 at which meeting a quorum of the board of directors was at all times present and acting.

IN WITNESS WHEREOF, I have set my hand this 9th day of December, 2015.

Brandon Tomlinson, Secretary

CHOWCHILLA WATER DISTRICT

SBX7-7 SUPPLEMENT REPORT

2015 UPDATE

ATTACHMENT 5

SUPPORTING DOCUMENTATION

PUBLIC HEARING NOTICE

Notice is hereby given that the Chowchilla Water District (CWD) will hold a public hearing on:

Wednesday, December 9, 2015 at 1:30 p.m.

Regarding:

2015 Update SBx7-7 Supplement Report

Agricultural water agencies in California are required to comply with Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, which requires, among other things, the preparation of an updated agricultural water management plan in 2015. CWD is a United States Bureau of Reclamation (USBR) contractor that has an approved water management plan that was prepared according to the USBR criteria; however, additional supplemental information must be submitted to California Department of Water Resources (DWR) to comply with the requirements of SBx7-7. CWD has prepared an update to its prior SBx7-7 Supplement Report and the CWD Board of Directors will hold a hearing to consider public comments on the proposed revisions to the SBx7-7 Supplement Report.

A copy of the updated SBx7-7 Supplement Report, along with the current USBR water management plan, may be viewed at the CWD office at 327 S. Chowchilla Blvd., Chowchilla, CA 93610 or viewed on the CWD website at cwdwater.com.

Written comments, submitted prior to the public hearing, should be directed to: Douglas Welch, 327 S. Chowchilla Blvd., Chowchilla, CA 93610 Comments may also be provided at the public hearing.

MERCED SUN-STAR
www.mercedsunstar.com
Los Banos Enterprise
www.losbanosenterprise.com
Chowchilla News
www.chowchillanews.com
Livingston Chronicle
Atwater Signal
Vida en el valle

Customer
CHOWCHILLA WATER DISTRICT - L

Payor Customer
CHOWCHILLA WATER DISTRICT - L

Customer Account
336260

Payor Account
336260

Customer Address
PO BOX 905, ,
CHOWCHILLA CA 93610 USA

Payor Address
PO BOX 905, ,
CHOWCHILLA CA 93610 USA

Customer Phone
559-665-3747

Payor Phone
559-665-3747

Sales Rep.
cmcnamara@modbee.com

Order Taker
cmcnamara@modbee.com

PO Number	Payment Method	Blind Box
MS/CN PUB HEARING SE		

Tear Sheets	Proofs	Affidavits
0	0	0

Net Amount	Tax Amount	Total Amount
$390.72	$0.00	$390.72

Payment Amt	Amount Due
$0.00	$390.72

Ad Number	Ad Size	Color
0002112854-01	1.0 X 52 Li	<NONE>

Product Information	# Inserts	Cost
Placement/Classification		
Position		
Run Dates		
Run Schedule Invoice Text		
MER-Chowchilla News:Print:	2	$152.88
0300 - Legals Classified		
0301-Legals & Public Notices		
11/25/2015, 12/2/2015		
PUB HEARING 2015 SBX7-7 SUP REPORT LELA BEATTY		
MER-upsell.mercedsunstar.com:Online:	2	$30.00
0300 - Legals Classified		
0301-Legals & Public Notices		
11/25/2015, 12/2/2015		
PUB HEARING 2015 SBX7-7 SUP REPORT LELA BEATTY		

PUBLIC HEARING NOTICE

Notice is hereby given that the Chowchilla Water District (CWD) will hold a public hearing on:

Wednesday, December 9, 2015 at 1:30 p.m.

Regarding:
2015 Update SBx7-7 Supplement Report

Agricultural water agencies in California are required to comply with Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, which requires, among other things, the preparation of an updated agricultural water management plan in 2015. CWD is a United States Bureau of Reclamation (USBR) contractor that has an approved water management plan that was prepared according to the USBR criteria; however, additional supplemental information must be submitted to California Department of Water Resources (DWR) to comply with the requirements of SBx7-7. CWD has prepared an update to its prior SBx7-7 Supplement Report and the CWD Board of Directors will hold a hearing to consider public comments on the proposed revisions to the SBx7-7 Supplement Report.

A copy of the updated SBx7-7 Supplement Report, along with the current USBR water management plan, may be viewed at the CWD office at 327 S. Chowchilla Blvd., Chowchilla, CA 93610 or viewed on the CWD website at cwdwater.com.

Written comments, submitted prior to the public hearing, should be directed to: Douglas Welch, 327 S. Chowchilla Blvd., Chowchilla, CA 93610 Comments may also be provided at the public hearing.
CN-2112854 11/25, 12/2

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MER-2112854 11/25, 12/2

Chowchilla Water District

Post Office Box 905 ♦ 327 S. Chowchilla Blvd. ♦ Chowchilla, CA 93610
Phone (559) 665-3747 ♦ Fax (559) 665-3740 ♦ Email dwelch@cwdwater.com

Board of Directors
Dan Maddalena ♦ Michael Mandala ♦ Vince Taylor ♦ Kole M. Upton ♦ Mark Wolfshorndl

December 2, 2015

James Brown
County Executive Officer
Merced County
2222 M Street
Merced, CA 95340

Subject: 2015 Update SBx7-7 Supplement Report

Dear Mr. Brown:

Agricultural water agencies in California are required to comply with Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, which requires, among other things, the preparation of an updated agricultural water management plan in 2015. Chowchilla Water District (CWD) is a United States Bureau of Reclamation (USBR) contractor that has an approved water management plan that was prepared according to the USBR criteria; however, additional supplemental information must be submitted to California Department of Water Resources (DWR) to comply with the requirements of SBx7-7. CWD has prepared an update to its prior SBx7-7 Supplement Report and the CWD Board of Directors will hold a hearing on Wednesday, December 9, 2015 at 1:30 p.m. to consider public comments on the proposed revisions to the SBx7-7 Supplement Report.

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Sincerely,

Douglas Welch
General Resources Manager

Chowchilla Water District

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Board of Directors
Dan Maddalena ♦ Michael Mandala ♦ Vince Taylor ♦ Kole M. Upton ♦ Mark Wolfshorndl

December 2, 2015

Eric Fleming
County Administrative Officer
Madera County
200 West 4th Street
Madera, CA 93637

Subject: 2015 Update SBx7-7 Supplement Report

Dear Mr. Fleming:

Agricultural water agencies in California are required to comply with Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, which requires, among other things, the preparation of an updated agricultural water management plan in 2015. Chowchilla Water District (CWD) is a United States Bureau of Reclamation (USBR) contractor that has an approved water management plan that was prepared according to the USBR criteria; however, additional supplemental information must be submitted to California Department of Water Resources (DWR) to comply with the requirements of SBx7-7. CWD has prepared an update to its prior SBx7-7 Supplement Report and the CWD Board of Directors will hold a hearing on Wednesday, December 9, 2015 at 1:30 p.m. to consider public comments on the proposed revisions to the SBx7-7 Supplement Report.

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General Resources Manager

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Board of Directors
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December 2, 2015

Brian Haddix
City Administrator
City of Chowchilla
130 S. Second Street
Chowchilla, CA 93610

Subject: 2015 Update SBx7-7 Supplement Report

Dear Mr. Haddix:

Agricultural water agencies in California are required to comply with Senate Bill X7-7 (SBx7-7), the Water Conservation Act of 2009, which requires, among other things, the preparation of an updated agricultural water management plan in 2015. Chowchilla Water District (CWD) is a United States Bureau of Reclamation (USBR) contractor that has an approved water management plan that was prepared according to the USBR criteria; however, additional supplemental information must be submitted to California Department of Water Resources (DWR) to comply with the requirements of SBx7-7. CWD has prepared an update to its prior SBx7-7 Supplement Report and the CWD Board of Directors will hold a hearing on Wednesday, December 9, 2015 at 1:30 p.m. to consider public comments on the proposed revisions to the SBx7-7 Supplement Report.

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Douglas Welch
General Resources Manager