IMPERIAL IRRIGATION DISTRICT
WATER USE ASSESSMENT
FOR THE YEARS 1987-1996

March 1998

prepared for

Imperial Irrigation District

by the

Water Study Team (WST)

Imperial Irrigation District

Water Use Assessment for the Years 1987-1996

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Consumption

Irrigation Consumptive Use Coefficient (ICUC). On average, over the 1987-1996 period, about **66%** of the irrigation water entering the IID study area from the All American Canal at the East Highline Canal was consumed within that area. This value is known (95% confidence level) to within approximately ± 2.8%: [63.2% ≤ ICUC ≤ 68.8%]. The consumed portion decreased approximately one-half of one percent per year over the study period, and this trend is statistically significant. Thus a smaller portion of the irrigation water supply is consumed today than was a decade ago (approximately a 4% reduction in consumed portion over the decade). Some of the reduction in ICUC was necessary to offset increased salinity of Colorado River water occurring during the past decade.

Efficiency

District Irrigation Efficiency ($IE_{District}$). On average, over the 1987-1996 period, the district irrigation efficiency within IID averaged **71%**. This value is known (95% confidence level) to within approximately ± 5.5%: [65.5% ≤ $IE_{District}$ ≤ 76.5%]. Variations in district irrigation efficiency over the study period are statistically insignificant.

District Distribution Efficiency ($DE_{District}$). On average, over the 1987-1996 period, the district distribution efficiency for IID averaged **92%**. This value is known (95%) confidence level) to within approximately ±0.9% [91.1% ≤ $DE_{District}$ ≤ 92.9%]. This resulted from a small decrease in distribution system losses combined with an increase in water delivered. This reduction in **percentage** of distribution system losses was statistically significant, although the magnitude of the change is small.

Aggregate Farm Irrigation Efficiency (IE_{Farm}). On average, over the 1987-1996 period, the aggregate farm irrigation efficiency within IID averaged **76%**. This value is known (95%

confidence level) to within approximately ± 6%: [70.0% ≤ IE_{Farm} ≤ 82.0%]. Variations in aggregate farm irrigation efficiency over the study period are statistically insignificant.

Accuracy of Estimates

Water Balance

Water Balance Consumption Estimates are Most Precise. While not applicable in many locations, the unique hydro-geological characteristics of the Imperial Valley make the water balance approach for estimating water consumption appropriate for IID. Water balance consumption estimates are more precise (narrower confidence intervals) than even a detailed and highly refined weather/crop coefficient-based consumption estimate. Based on 1990 volumes, the confidence interval for water balance estimates of irrigation water consumed on agricultural land in IID is ±4.9%. The confidence interval for ET_c estimates from the K_c ET_o model, after calibration to match the water balance, is ±7%.

Further Refinements Unlikely. The most significant item affecting the accuracy of water balance estimates of irrigation water consumed in IID is the measurement of water delivered to the All-American Canal at Pilot Knob (PK). The procedures used in this measurement are very good, and have been examined in detail. It is unlikely that the accuracy of this measurement could be improved substantially. The quantities of the next most important items (e.g., seepage from the All-American Canal from PK to East Highline Canal [EHL] and rainfall volume) are difficult to verify. With extensive study, the accuracy of these estimated volumes might be improved. However, it is questionable whether more detailed studies could be justified.

Weather/Crop Coefficient-Based Estimates of ET_c

Uncalibrated Estimates of ET_c. In the case of IID, even a detailed, highly refined K_c ET_o procedure is less accurate than a water balance determination of Crop ET (ET_c). The K_c ET_o approach over-estimated annual ET_c by about 8%.

Water-Balance-Calibrated Estimates of Annual ET_c. The K_c ET_o procedure can be calibrated with crop ET_c adjustment factors to match water balance ET_c estimates. This calibrated K_c ET_o procedure is capable (95% confidence level) of estimating annual ET_c to within ± 7%. It should be noted that this is an after-the-fact estimate, assuming that weather, cropping patterns, planting and harvest dates and water balance components are already known. Even though these estimates are after-the-fact, they are valuable because the calibrated K_c ET_o model helps to decide how much of the water balance estimated consumption should be assigned to uses supporting agronomic crop production, and how much to other uses. The calibrated model can also be used to explore the impact of possible shifts in weather or cropping patterns.

Water-Balance-Calibrated Estimates of Monthly ET_c. The calibrated K_c ET_o procedure is capable (95% confidence level) of estimating monthly ET_c only to within ± 30%. It should be noted again that this is an after-the-fact estimate, assuming that weather, cropping patterns, planting and harvest dates and water balance components are already known.

Advance Estimates of Annual ET_c. Water balance calibration of the K_c ET_o procedure is necessary even for accurate after-the-fact estimation of ET_c. For estimates in advance, such calibration can only be based on a model of the events of prior years. However, cropped acreages are usually not known ahead of time. Thus, the uncertainty surrounding advance estimates of annual ET_c must exceed ± 7%.

Advance Estimates of Monthly ET_c. The uncertainty surrounding estimates in advance of monthly ET_c must exceed ± 30%. This wide level of uncertainty suggests that estimates in advance of monthly ET_c are highly speculative, and cannot be used with confidence.

New Data and Analyses

Current Study Benefits from New Data and Analyses

Improved Estimates. The present study incorporates significant new data and improved, more detailed analysis in a number of areas, and generally supersedes previous reports. These improvements result in better estimates for:

cropped acreage

planting and harvest dates

CIMIS reference evapotranspiration (ET_o)

wet soil evaporation and crop transpiration

effective precipitation

leaching for salt removal

canal spills and seepage

Leaching Estimates. Estimates of water volumes useful for salt removal were based on a more realistic treatment of conditions within IID than used in previous studies. The details considered included: both maintenance and reclamation leaching; rotation of crops with differing salt tolerances; different flow regimes evident on different soil types; and new field data on the extent to which satisfactory leaching is currently being achieved. The estimated volume of irrigation water used for salt control in Imperial Valley has been increasing from about 240,000 acre-feet in 1987 to about 338,000 acre feet in 1996. These values are not known with great precision, so that the confidence interval is estimated to be ± 40%. Factors contributing to the increase in the volume of water used for salt removal have been the increase in Colorado River water salinity over the same period, and the increase in tile drainage throughout the district, which improved the drainability of difficult soils within the IID study area.

Performance Summary

Table ES-1. Estimated values of irrigation performance parameters for the IID study area for 1987-1996, 95% confidence level.

Year	Irrigation consumptive use coefficient (ICUC) (%)	District irrigation efficiency ($IE_{District}$) (%)	District distribution efficiency ($DE_{District}$) (%)	Aggregate on-farm irrigation efficiency (IE_{Farm}) (%)
1987	68 ± 2.6	71 ± 4.9	92 ± 1.1	77 ± 5.4
1988	68 ± 2.4	72 ± 5.1	92 ± 1.0	78 ± 5.6
1989	67 ± 23	71 ± 5.0	92 ± 1.0	76 ± 5.5
1990	66 ± 2.2	70 ± 5.2	92 ± 1.0	76 ± 5.7
1991	67 ± 2.9	71 ± 5.6	93 ± 0.9	77 ± 6.2
1992	68 ± 4.8	72 ± 6.6	92 ± 1.0	79 ± 7.3
1993	65 ± 3.8	70 ± 6.0	92 ± 0.9	76 ± 6.6
1994	65 ± 2.5	70 ± 5.5	93 ± 0.8	76 ± 5.9
1995	64 ± 2.6	69 ± 5.5	93 ± 0.8	74 ± 5.9
1996	65 ± 2.2	70 ± 5.4	93 ± 0.8	75 ± 5.9
Average	66 ± 2.8	71 ± 5.5	92 ± 0.9	76 ± 6.0
Trend Statistically Significant?	Significant and decreases 0.4% per year	Variations not Statistically Significant	Significant and increases 0.1% per year	Variations not statistically significant

1. Introduction

The Imperial Irrigation District (IID) supplies Colorado River surface water to customers within Imperial Valley. Historically, the effectiveness of water use by IID has been the subject of much scrutiny.

There have been a number of reports examining this question over the years, representing a progression in the awareness and sophistication in the treatment of complex technical issues involved in determining efficient water use on a district wide scale.

The Bookman-Edmonston report, "Water Use Efficiency in Imperial Irrigation District" (1989), used a simplified water balance approach to estimate the portion of irrigation water used within the irrigation district for crop growth and salt removal.

The Boyle Engineering report, "On-Farm Irrigation Efficiency - Special Technical Report for Imperial Irrigation District" (Styles, 1993), also used the water balance approach, but took a more detailed look at many of the components of water use within the district. Later studies have taken some estimates originally made by this Boyle study and have either (1) used them as is, since further work necessary to refine the estimates wasn't justified at the time, or (2) made some modification to the estimates based on more recent data or analysis.

In 1994, a "Water Use Assessment: Coachella Valley Water District and Imperial Irrigation District, Phase I Report" was filed by a Technical Work Group (TWG). The TWG Phase I goal was to review existing data, make estimates of irrigation water volumes consumed or used for crop growth or salt removal, and assign confidence intervals to water use component volumes. Analysis of confidence intervals was to identify those quantities where improved data accuracy (narrower confidence limits) would most significantly improve the accuracy of estimates for irrigation consumptive use coefficient and irrigation efficiency. [Definitive estimates of irrigation consumptive use coefficient and irrigation efficiency within the districts were to be determined later, during a Phase II effort that was never authorized.] The TWG used a combination of water balance and climate-based ET estimation techniques to estimate the volumes of irrigation water used within the irrigation districts for crop growth and salt removal.

In August, 1995, a U.S. Bureau of Reclamation report authored by Dr. Marvin E. Jensen was released ("Water Use Assessment of the Imperial Irrigation District, Final Report"). Jensen used primarily a climate-based ET estimation scheme, with certain components adjusted based on yield-ET relationships and water balances to obtain estimates of irrigation efficiency. In July 1997, Jensen and Walter issued a draft report that reassessed and updated Jensen's 1995 report.

A group known as the Water Study Team (WST) was commissioned by IID to prepare this report. The members of the WST were Dr. Charles M. Burt, Dr. Richard G. Allen, Dr. Albert J. Clemmens and Dr. Kenneth H. Solomon. Dr. Burt was the lead author of Chapter and Appendix 4, Dr. Allen Chapter and Appendix 3, Dr. Clemmens Chapters and Appendices 2 and 5, and Dr. Solomon the Executive Summary, Chapter 1 and Appendix 4a.

The WST tasks were to:

- assess the record for the years 1987 - 1996
- investigate current practice and water management rationale within IID through face-to-face interviews with IID farmers
- check and improve, where possible, individual data items
    - more refined/precise values for specific data items
    - determination of confidence intervals for data estimates
- correct, to the best of our current ability, methodological problems with prior work
- present and document the most accurate possible estimates of irrigation consumptive use coefficient and irrigation efficiency within IID

The WST applied their water balance and other analyses to an area that encompasses all irrigated land within the Imperial Valley. It is bordered on the south by the Mexican Border, on the east by the East Highline canal (and its service area), and on the north-west by the Salton Sea. To the northeast and west, it extends to the outermost irrigated farms. This area, referred to as the "IID study area" does not coincide exactly with the boundaries of IID, because IID also delivers water to several farms east of the East Highline Canal directly from the All-American Canal, and these farms do not fall within the WST's IID study area.

1.1 New Data and Analyses

This WST report includes significant new data or analysis in a number of areas, and generally supersedes previous reports. Methodological or data improvements have been in the areas of water balance, estimation of ET from weather data and crop coefficients, estimation of deep percolation effective for salt management, and in interpretation of the accuracy of the results.

Among the most significant improvements in the WST study relative to earlier work are:

- Smaller confidence intervals for measured flow estimates.
- Better acreage estimates.
- Evaporation estimated independently from basal crop ET.
- Transpiration estimates improved.
- More detailed assessment of effective precipitation.
- More physically based estimates of leaching for salt removal.
- Better estimates of spills and seepage from IID verification studies.

Specific improvements in water balance methodology include:

- Consideration of detailed monthly and annual water balances.
- Better estimates of spills and seepage from IID verification studies.
- Use of sub-unit water balances to check delivery and return-flow figures.
- New analysis to estimate accuracy of measurements of inflow from the Colorado River.
- New data and analysis to check calibration on measurements of outflow to Coachella Valley Irrigation and Drainage District.
- New assessment of New River and Alamo River flow measurement accuracy.

Specific improvements in weather-based ET modeling methodology include:

- Additional quality control checks on raw CIMIS numbers.
- Recalculation of net radiation for CIMIS-based determination of ET_o.
- Detailed analysis and correction of reported cropped acreage.
- Use of monthly acreages for forage crops.
- Improved planting and harvest dates determined from in-field interviews and zanjero records.
- Year-to-year changes in planting and harvest dates considered.
- Relative vigor and in-field bare spots were assessed and used to adjust ET estimates.
- ET reductions due to salinity and other stresses were considered for selected crops.
- Yield-ET relationships for alfalfa were further examined, based on local data.
- Yield-based adjustments to ET_c were made for multiple crops.
- A 3-stage model of evaporation from cracking soils was developed and used for better estimates of soil evaporation, soil moisture status and effective precipitation.
- Basal crop coefficients and a simulated irrigation scheduling model with a daily time step were developed and cross checked against field interviews and water delivery records. The model was used to estimate stress, antecedent soil moisture and effective precipitation.
- The weather-based ET model was used to partition the consumptive use estimated from the water balance.

Specific improvements in salinity/leaching estimation methodology include:

- Recent research and in-field salinity measurements were incorporated into the analysis.
- Salinity management information that was based on interviews with salinity experts and IID growers was incorporated.
- In-field interviews were conducted to develop a better understanding of reclamation, summer flood and pre-plant irrigation practices.
- The analysis considered differences in soil type.

- The increase over time in tile drainage throughout the valley was considered.
- Changes in the Colorado River water salinity were considered.
- Tile sump-pump records were investigated.
- Tail-water removal of salt was considered, but was shown to be inconsequential.

Specific improvements in interpretation methodology include:

- More precise estimates were developed for confidence intervals, based on new data and/or analyses.
- Identified trends were analyzed for statistical significance.
- The measurement accuracy of major water volumes was assessed in detail.
- Detailed cross-checks were made of modeled results with in-field interviews and district data.
- Better understanding of reclamation, summer flood, and pre-plant irrigation practices enabled a more accurate representation of these practices and their consequences.
- An analysis of the sources of uncertainty was made and a prognosis for improving (reducing) confidence intervals is offered.

1.2 Key Concepts

1.2.1 Performance Indicators IE and ICUC

Irrigation performance is quantified using performance indicators, most notably the Irrigation Efficiency (IE) and the Irrigation Consumptive Use Coefficient (ICUC). To accomplish this quantification, the portions of the irrigation water that go to various destinations must be identified.

Destinations of applied water may be classified in different ways. ICUC is determined by the portion of the irrigation water that is consumed through the process of evapotranspiration. IE is determined by the portion of the irrigation water that is beneficial, or necessary to achieve an agronomic objective in the production of the crop.[1] IE and ICUC are defined as follows (Burt et al., 1997):

$$IE = \frac{\text{volume of irrigation water beneficially used}}{\text{volume of irrigation water applied} - \Delta \text{ storage of irrigation water}} \times 100\%$$

$$ICUC = \frac{\text{volume of irrigation water consumptively used}}{\text{volume of irrigation water applied} - \Delta \text{ storage of irrigation water}} \times 100\%$$

Categories and typical examples of water uses (destinations) are given in the sections below. The interested reader is referred to the ASCE report "Irrigation Performance Measures - Efficiency and Uniformity" (Burt et al., 1997) for a complete discussion of the subject.

1.2.2 Irrigation Water Consumptively Used

Irrigation water that goes to the atmosphere as vapor, or is harvested in the plant is considered consumed. Typical consumptive uses include:

- crop evapotranspiration (ET_C)
- evaporation from wet soil
- evaporation from water surfaces, such as canals, rivers or reservoirs

Irrigation water that is not consumed but leaves the study region in liquid form is a considered to be a non-consumptive use. This can be reapplied elsewhere, though perhaps degraded in quality. Examples of water uses that are not counted in the numerator of the expression for ICUC include:

- runoff (tailwater)
- deep percolation
- canal spills

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[1] The word "beneficial" is used here in its technical sense, as generally understood within the fields of agricultural and civil engineering. Note that this is NOT the meaning of "beneficial" as used in The California Water Code (1997), which recognizes irrigation as a beneficial use (§106), and which declares that water diverted for irrigation is beneficial (§100). Within the context of this report, the word "beneficial" is used only to convey its technical meaning: -- that necessary to achieve an agronomic objective in the production of the crop.

1.2.3 Irrigation Water Beneficially Used

Irrigation water necessary to achieve an agronomic objective in the production of the crop (food, fiber, oil, forage, etc.) is considered to be beneficially used, and is counted in the numerator of the expression for IE. Examples of water uses that would be counted in the numerator of the expression for IE include:

- crop ET
- water used for improving or maintaining soil productivity (salinity management)
- water applied for various cultural practices
  - climate control
  - seedbed preparation
  - germination of weed seeds
  - softening of soil crust for seedling emergence
- ET of other plants beneficial to crop harvested
  - windbreaks
  - orchard cover crops
- wet soil evaporation associated with reclamation leaching and necessary irrigation

Examples of water uses that would not be counted in the numerator of the expression for IE include:

- deep percolation in excess of that needed for salinity management
- runoff (tailwater)
- evaporation from wet soil outside the cropped area
- spray drift beyond field boundaries
- wet soil evaporation associated with unnecessarily frequent irrigations
- canal seepage, evaporation and spills
- ET from non-beneficial plants (weeds, phreatophytes)

1.2.4 IE vs. ICUC

It should be noted that IE and ICUC are not the same, conceptually or numerically. There may be consumptive uses that do not contribute to the agronomic production of the crop, such as evaporation from canals and reservoirs. And there may be uses that do contribute to the agronomic production of the crop, but are not consumed, such deep percolation for salinity management. Failure to recognize this distinction can lead to erroneous conclusions. For example, it is incorrect to calculate district IE from the portion of water flowing out of the district. IE is based on contributions to agronomic crop production. District outflow is water that was not consumed, whether or not it contributed to crop production.

1.2.5 Reasonable Uses

Some water uses that cannot be counted in the numerator of the expression for IE are none-the-less reasonable, in the sense that they are justified due to particular conditions at a particular place and time. Physical, economic or managerial constraints, and various environmental requirements are usually such that some amount of the water not counted towards IE is reasonable.

For example, if a seepage study shows it to be uneconomical to line a canal reach, because the water saved would not justify the cost, then that seepage loss is "reasonable" even though it does not contribute towards crop production. The use of reservoirs often facilitates flexibility and allows improved water management. Evaporation from those reservoirs is reasonable, though it wouldn't be counted towards IE. Some deep percolation beyond that needed for salt removal can occur due to soil variability and uncertainties that farmers face when deciding when and how much water to apply. Such deep percolation, while not contributing to agronomic crop production, is reasonable.

IE, which quantifies only beneficial use, gives only a lower bound to the portion of water justifiably used. This study did not attempt to quantify reasonable uses, nor have previous studies.

1.2.6 Confidence Intervals

There is a certain amount of error or uncertainty inherent in all measurement or estimation processes. Therefore, the true or correct values for the water volumes needed to calculate IE or ICUC are unknown to us. We have to make estimates of these volumes, based on measurements or calculations.

Sometimes, there is more than one way to estimate a particular volume. For example, the volume of water delivered to farms may be determined from district delivery records; or it may be determined from canal inflow amounts, subtracting out spills, seepage and evaporation. If none of the factors involved in one estimate of a particular volume are involved in the other estimate, then the two estimates are said to be "independent." When available, independent estimates of a volume allow calculation procedures to be checked, and can help estimate the error or uncertainly associated with particular estimates.

The uncertainties associated with estimates should be acknowledged and specified numerically. Otherwise, there is a great potential to misinterpret numerical estimates expressed by a single value only. A value of, say, 85 by itself might mean "between 80 and 90" or "between 84 and 86." Without some indication of the uncertainty associated with the 85, it is difficult to compare the 85 to another estimated quantity, or even to some benchmark figure.

One way to specify the uncertainty in a single-valued estimate is by specifying the confidence interval for that estimate. If, based on a reasoned evaluation of the factors influencing measurement or analysis, we believe that the correct value of a particular quantity is within 4 units of 85, then the estimate of that quantity should be given as 85±4, not merely 85.

In this study, 95% confidence intervals are used. Therefore, when saying that a particular estimated value is 85±4, the meaning is that there is only a 5% probability that the true or correct value lies outside the range 85±4.

Confidence intervals greatly aid interpretation of results. For example, suppose IE_A=85±1 and IE_B=82±1. We can be confident that IE_A is really greater than IE_B, because the true value of IE_A won't be lower than 85-1=84, while the true value of IE_B won't be higher than 82+1=83. Thus IE_A is definitely greater than IE_B.

However, if IE_A=85±4, and IE_B=82±4, then we cannot be sure the IE for situation A is actually better than the IE for situation B. The true value of IE_A could be as low as 85-4=81, while IE_B could be as high as 82+4=86. Because their confidence intervals overlap, we can't conclude that IE_A is any different than IE_B.

Some previous reports are difficult to interpret because no confidence intervals were specified for measured or estimated values. This study follows the recommendation of the previous TWG study (1994) and consistently uses confidence intervals to indicate the degree of uncertainty in the various quantities measured or estimated. The reader is referred to sections A2.7 and following in Appendix 2 for a thorough discussion of confidence intervals and how they are calculated.

1.3 Organization

The results of the present WST study are summarized in the following chapters. Chapter 2 discusses the water balance calculations. Chapter 3 covers the weather-based ET model, and its use in partitioning the ET determined from the water balance. Chapter 4 discusses salinity and the volume of water useful for salt removal. Chapter 5 presents IE and ICUC estimates and their confidence intervals. Detailed discussions of methods used in each area are presented in Appendices of the same number (i.e., water balance results are summarized in Chapter 2 and the water balance methodology is presented in Appendix 2). Section A2.7 in Appendix 2 presents a detailed discussion of the calculation of confidence intervals, including example calculations for water volumes determined for the year 1990.

1.4 References

Burt, C.M., A.J. Clemmens, T.S. Strelkoff, K.H. Solomon, R.D. Bliesner, L.A.Hardy, and T.A. Howell. 1997. Irrigation Performance Measures: Efficiency and Uniformity. J. Irrigation and Drainage Engineering, ASCE 123(6): 423-442.

California Water Code. 1997.

2. Water Consumption and Use Within the IID Study Area

Due to the unique geohydrologic features and climatological conditions of the Imperial Valley, a water balance method is feasible for estimating the gross consumption of water within the IID study area. A complete water balance is described in Appendix 2. In this section we provide the results from this water balance for the years 1987-96. An important feature of this water balance is the ability to estimate the accuracy of the water balance remainder from the accuracies of the various water balance components. Accuracy is defined in terms of the 95% confidence interval (± 2 standard deviations).

2.1 Water Consumption in the IID Study Area

2.1.1 Water Balance

The concept behind a water balance is that, for a well defined region, the sum of the inflows less changes in storage equals the sum of the outflows. For the IID study area, inflows and outflows can be measured with sufficient accuracy, except for consumption, which is primarily evaporation and evapotranspiration. Since annual changes in storage are small, this total water consumption can be estimated as the remainder in the IID study area water balance. Estimates are made of the various components of this consumption; separating farm consumption on agricultural land from consumption on non-agricultural land, and separating irrigation water consumption from rainfall consumption. Fortunately for the determination of accuracy, irrigation water consumption on agricultural land is by far the largest component of consumption.

For comparison to weather-based estimates of crop evapotranspiration, estimates can be made monthly for the difference between inflows and outflows - in this case the sum of consumption plus changes in storage. On a monthly basis, changes in water storage can be significant relative to monthly consumption.

In addition to the valley-wide water balance, three sub-systems are defined for which a water balance is useful; the irrigation district canal system, the open drain/river system, and the aggregate farm irrigation system. Components of inflow, outflow and change in storage for these sub-systems are useful for understanding the destination of incoming water and for verifying the accuracy of various water volumes.

This water balance is applied to an area that encompasses all irrigated land within the IID study area. It is bordered on the south by the Mexican Border, on the east by the East Highline canal (and its service area), and on the north-west by the Salton Sea. To the northeast and west, it extends to the outermost irrigated farms. The water balance includes all land within these boundaries -- rivers, towns, roads, irrigated farms, etc.

The upper vertical boundary is the land surface, which essentially includes the vegetation such as agricultural crops, trees, phreatophytes, etc. The lower vertical boundary is represented by an impervious layer well below the local groundwater table. As will be discussed below, the exact lower boundary is not critical in this case since regional groundwater flow is such a small quantity in the IID study area.

2.1.2 Water Supply and Consumption

The most accurate measurement of flow in the All American Canal (AAC) is at a gauging station near Pilot Knob, immediately downstream of releases back to the Colorado River for delivery to Mexico. In order to estimate the amount of water flowing into the IID study area, any water losses or diversions must be subtracted from the Pilot Knob measurements. This is essentially a water balance for that portion of the All American Canal. The unknown quantity in a water balance is called the closure term. In this case, water entering IID study area from the All American Canal at the East Highline Canal (AAC @ EHL) is the closure term. The components of this water balance and the average annual volume estimated for each over the period 1987 to 1996 are shown in Figure 2-1. Details on the sources of these estimates are given in Appendix 2. The accuracy of the estimated volume entering the IID study area from the All American Canal is very good (Confidence interval, CI=±2.4%). This is because the accuracy of the largest quantities, the Pilot-Knob and Coachella-Canal measurements, are also very good (CI of 1.9% and 2.3%, respectively). Example calculations for these accuracies are given in Appendix 2.7. A detailed assessment of the accuracy of the major measurement sites is given in Wahlin, et al. (1997).

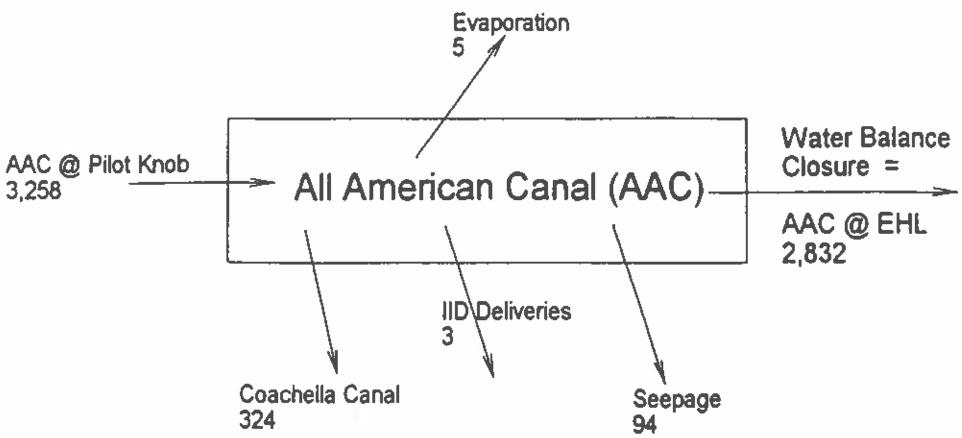

Figure 2-1. All American Canal inflows and outflows upstream from the IID study area. Numbers shown are average annual volumes for 1987 to 1996 in 1,000 ac-ft.

A summary of the water balance for the IID study area is shown in Figure 2-2. Wahlin, et al. (1997) evaluated the accuracy of annual volumes based on measurements for the New River at the Mexican border (the main surface inflow across the border) and for both the New and Alamo Rivers where they enter the Salton Sea. A detailed analysis of rainfall records and variability is given in Appendix 3.2. The All American Canal inflow is discussed above. We assume that on an annual basis, storage changes are negligible. (If this assumption causes an error for one year, it will be compensated for in either the previous or following year. Thus, the long-term average should not be affected). Other, smaller quantities have been previously estimated, and have a small effect on overall accuracy (see Appendix 2.7). The result is an accurate estimate of the total water consumption from the IID study area, on average the confidence interval is ±4.4% (range 4.0 to 5.6%). Accuracy is greatest during years of very low rainfall.

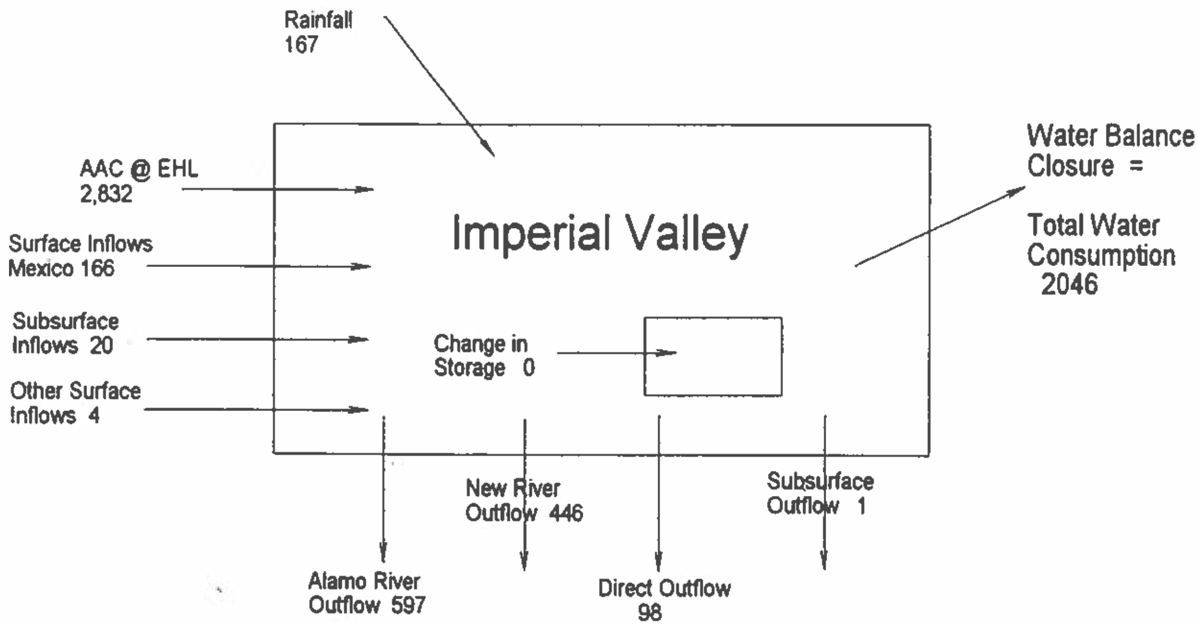

Figure 2-2. Water balance for IID study area with total water consumption as the closure term. Numbers shown are average annual volumes for 1987 to 1996 in 1,000 ac-ft.

Figure 2-3 shows the total inflow, total consumption, and total outflow from the IID study area by year.

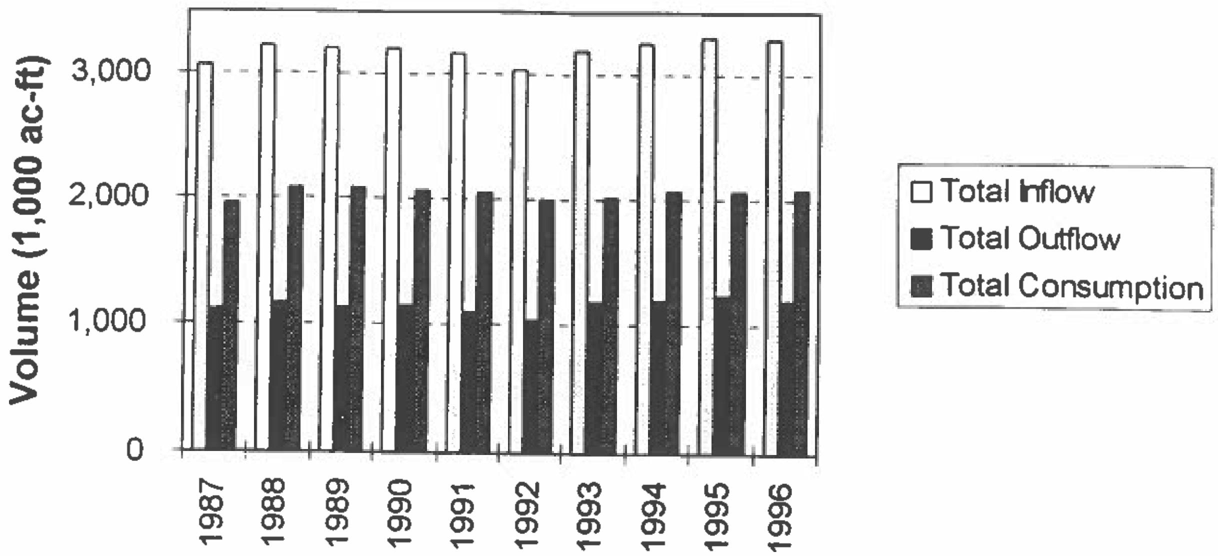

Figure 2-3. Total annual volumes of inflow, outflow and consumption for the IID study area, including all sources (e.g., irrigation water, rainfall, etc.). Assumes no change in storage.

The consumption of water on agricultural land is determined by subtracting out estimates for consumption on non-agricultural land from the total consumption, as show in Figure 2-4. These other volumes of consumption are relatively small and are not as accurately known as some of the measured water volumes. Thus our confidence in on-farm consumption is slightly worse (average ±5.1%) than the confidence in the value of the total consumption.

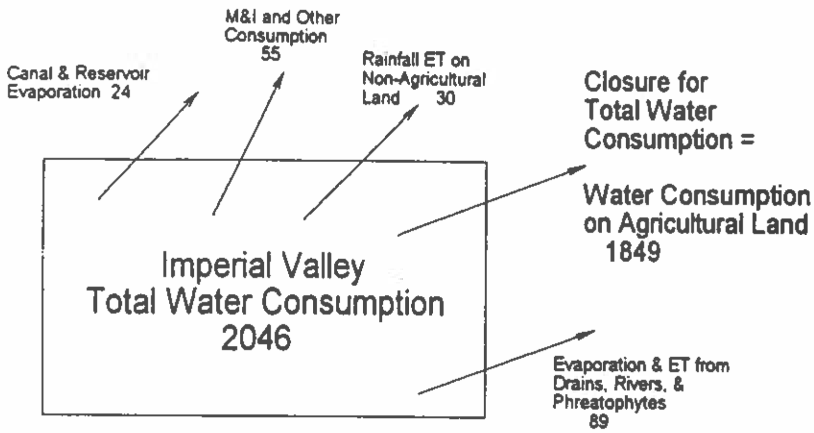

Figure 2-4. Partitioning of total water consumption for the IID study area with total water consumption on agricultural land as the closure term. Numbers shown are average annual volumes for 1987 to 1996 in 1,000 ac-ft.

In order to separate rainfall consumption from irrigation water consumption, a more detailed analysis of rainfall and irrigation patterns for crops was performed. This required an analysis of monthly consumption on agricultural land. However, because of seasonal changes, soil moisture changes were expected to be significant relative to monthly consumption. Therefore, the water balance results computed as in Figure 2-4 on a monthly basis were considered "monthly total water consumption plus change in storage on agricultural land." These were computed for the years 1990 to 1996. These monthly volumes are shown in Figure 2-5. Monthly consumption and storage change was more variable from year to year during January and February compared to the spring (April-June) and fall (October and November), with the variability of the other months in-between. This may correspond to months of higher rainfall, which is variable, or months where more changes in storage take place. The unusually high value for consumption plus change in storage for July 1995 deviates significantly from all other years, and may be an "outlier" possibly caused by errors in one or more of the estimates for the components of the water balance. Comparisons with Figure 3-8 indicate that the large value for consumption in July, 1995 may be compensating in the water balance for unusually low values during June and August of that year.

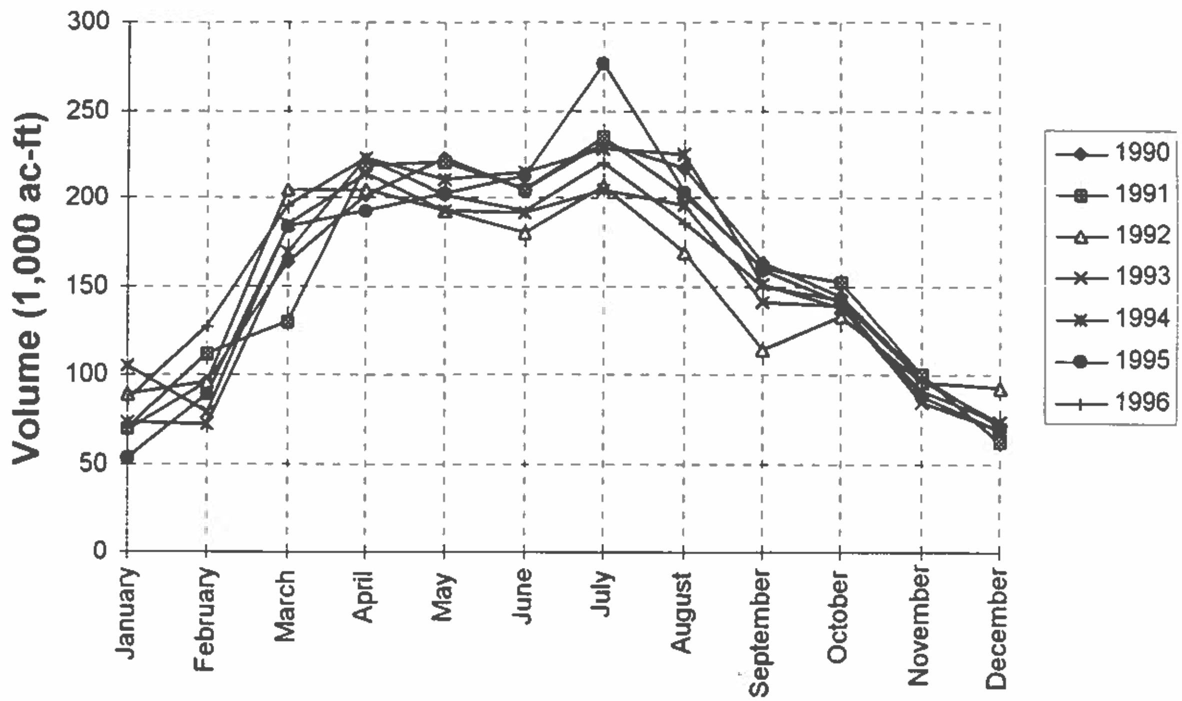

Figure 2-5. Estimates of monthly water consumption plus change in storage on agricultural land.

These monthly volumes of consumption plus change in storage on agricultural land are compared to crop-weather-based estimates of consumption for both irrigation water and rainfall (see Chapter 3). A detailed analysis of rainfall consumption on agricultural land for the years 1989-1996 was performed, and is given in Appendix 3. For 1987 and 1988, an average fraction for rainfall consumption on agricultural land was used. The annual volumes of total and consumed rainfall are given in Figure 2-6. This rainfall consumption on agricultural land was then subtracted from the total consumption on agricultural land (Figure 2-7) to obtain consumption of irrigation water on agricultural land (accuracy ±5.7%). The volumes of irrigation water supply and consumption on agricultural land are shown in Figure 2-8. The total consumption is much more uniform than irrigation water consumption, implying that the overall demand is relatively more uniform than the irrigation water contribution to consumption.

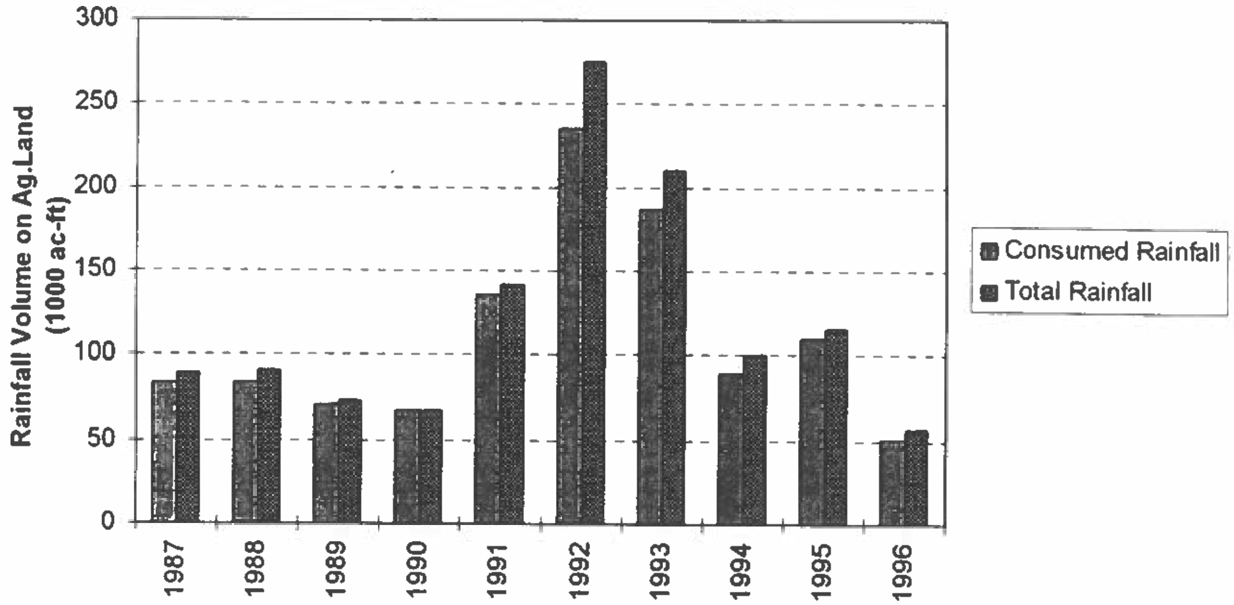

Figure 2-6. Annual rainfall volumes for agricultural land within the IID study area, showing the amount consumed relative to the total.

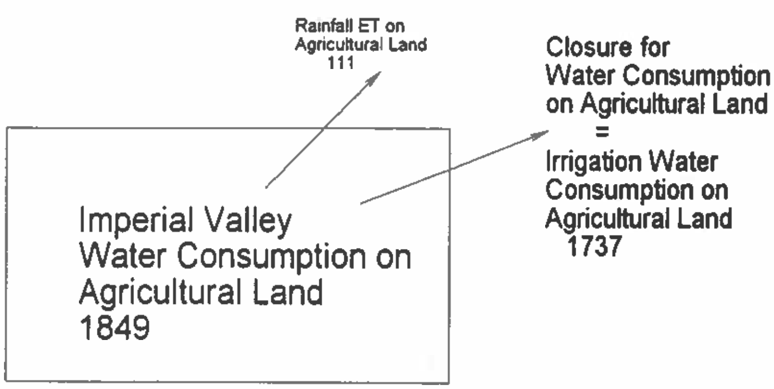

Figure 2-7. Partitioning of total water consumption on agricultural land for the IID study area with irrigation water consumption on agricultural land as the closure term. Numbers shown are average annual volumes for 1987 to 1996 in 1,000 ac-ft.

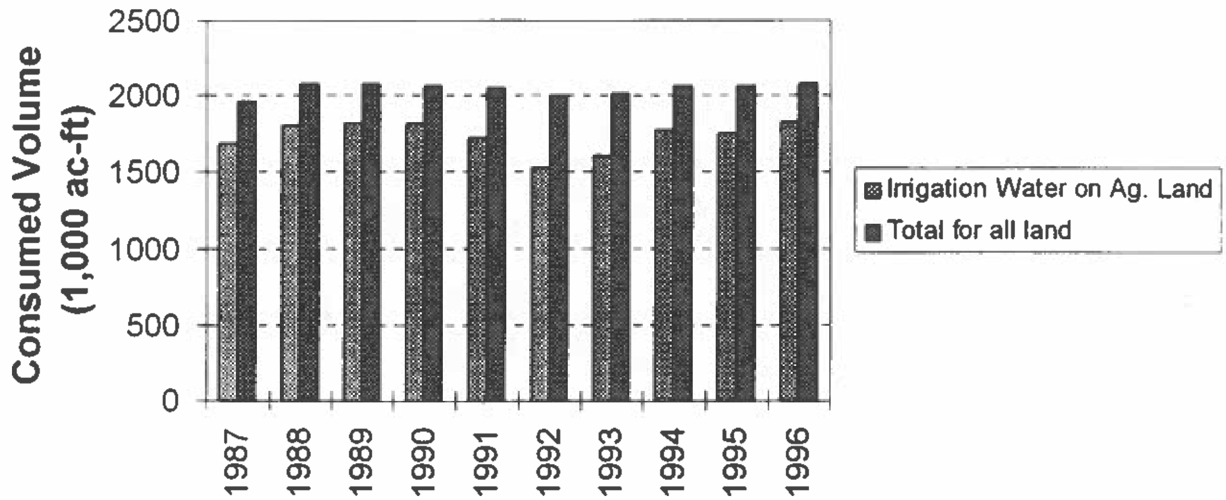

Figure 2-8. Total consumption and irrigation water consumption on agricultural land for the IID study area.

2.2 Other Water Balances

Three other water balances were evaluated for subsystems within the valley. These are detailed below. In the above water balances, we had one quantity that was estimated as the remainder or closure term in the water balance. Each of the other quantities was estimated independently from the other values (regardless of whether this estimate was based on measurements or calculations). The estimate for a closure term is not independent of the other quantities that are used to determine it. For the sub-system water balances, independent estimates are available for each of the remaining quantities. (These remaining quantities are all internal to the valley and do not influence the valley-wide water balance). However, some of these estimated quantities are not known very accurately, and better estimates may result from computing that quantity as the closure term for the subsystem. This will be discussed for two cases below.

2.2.1 Canal Sub-System Water Balance

The canal sub-system includes the entire canal network operated by the Imperial Irrigation District (IID) within the IID study area. It includes reservoirs and any district operated water facilities. Outflows include deliveries to users, spills, seepage, and evaporation. The various components are shown in Figure 2-9. More details on the source and accuracy of these quantities can be found in Appendix 2. The main component of interest for this water balance is the water delivered to agricultural users. IID has records of water delivered to users. When these data are used in the water balance, the closure is simply an error - the difference between inflow and outflow - since all quantities are independently estimated as described in Appendix 2. The resulting mismatch between inflow and outflow is shown in Figure 2-10, as a percent of the inflow. There appears to be a systematic bias in the existing data for inflows and outflows. The data suggest that approximately 3% of the irrigation water supply is "unaccounted for." This is not unusual , particularly where measurement of water deliveries are not continuously recorded. As shown in Appendix 2, the canal-system water balance provides a better estimate of water delivered to users than district delivery records (water balance CI of ±2.9% versus delivery records CI of ±5%). Use of the water balance volumes for water delivered rather than the district's reported volumes also improves the accuracy of other volumes computed with the farm water balance, as discussed below.

Figure 2-11 shows the distribution systems losses over time. The difference between the highest and lowest annual losses is approximately 20,000 ac-ft/yr.

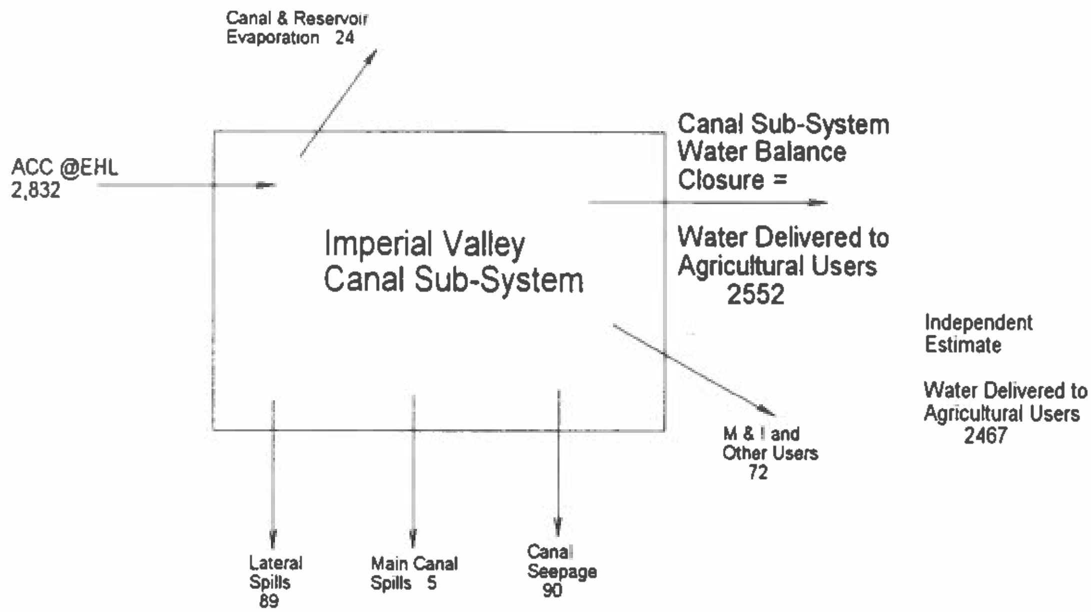

Figure 2-9. Canal sub-system water balance for the IID study area. Numbers shown average annual volumes for 1987 to 1996 in 1,000 ac-ft.

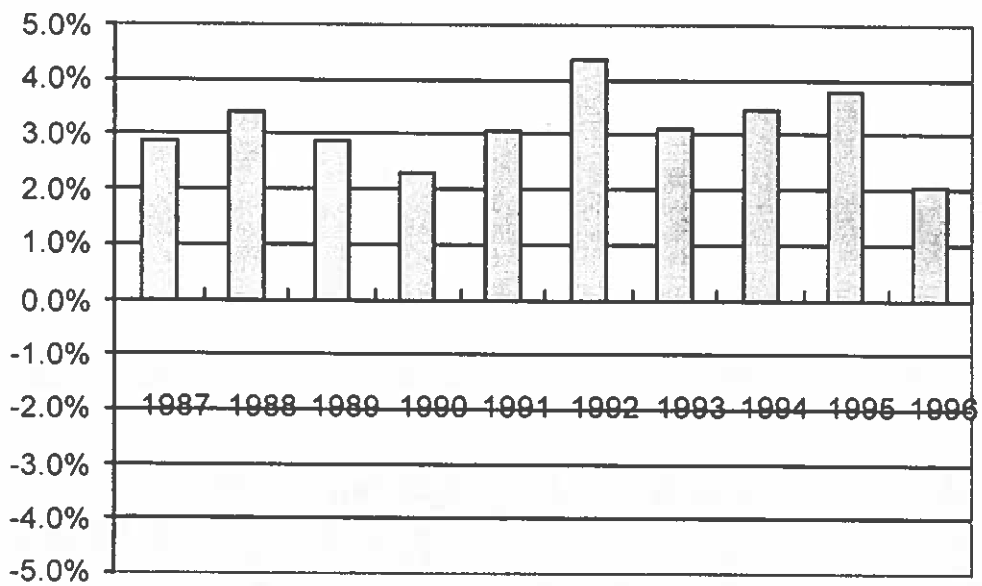

Figure 2-10. Mismatch between inflow and outflow for canal-system water balance as a percentage of inflow for IID study area.

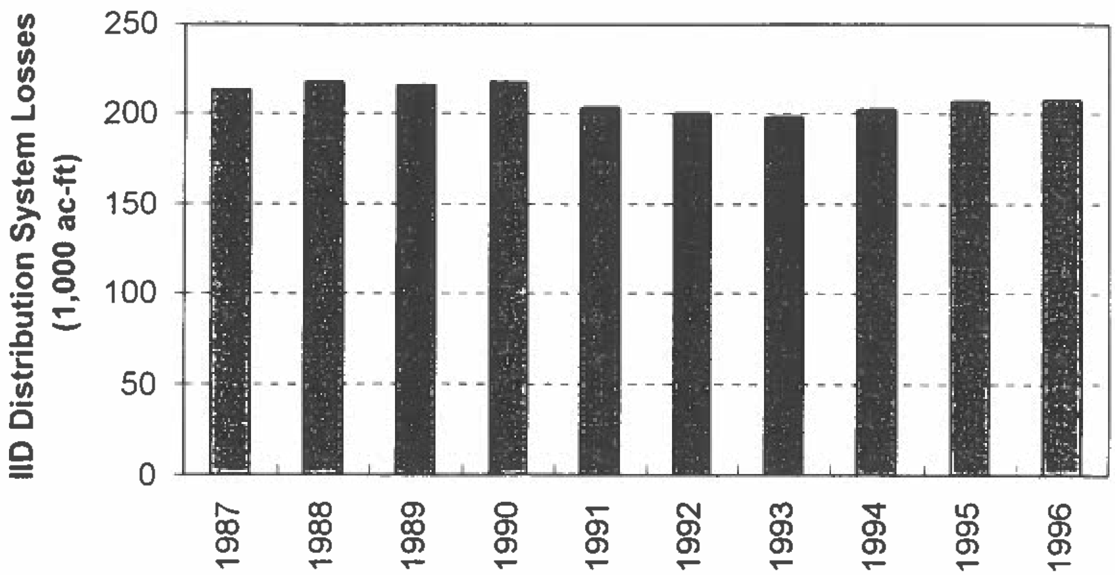

Figure 2-11. Distribution system losses for IID study area.

2.2.2 Aggregate Farm Sub-System Water Balance

The farm system water balance attempts to aggregate all farms within the valley since the gross quantities of inflow and outflow are essentially known. The aggregate inflow to all farms is known from the canal sub-system water balance; the total consumption of water from all farms is known from the overall valley water balance. The rainfall volume has been partitioned between consumption and runoff/deep percolation. From this, we have reasonably good knowledge of the amount of irrigation water entering the open drain and river system (CI = ±7.1%). This subsystem water balance is shown in Figure 2-12. Because the All American Canal inflow is used to determine both the water delivered and the water consumed, it's accuracy doesn't influence the accuracy of the irrigation water going to the drainage system. The other inflows and outflows from the valley-wide water balance influence its accuracy the most. (This quantity could have been computed as the closure term for the drain/river system water balance. The result would have been the same). When expressed as a fraction of the water delivered, the accuracy for water entering the drain/river system is ±2.3% (of 2,552,000 ac-ft).

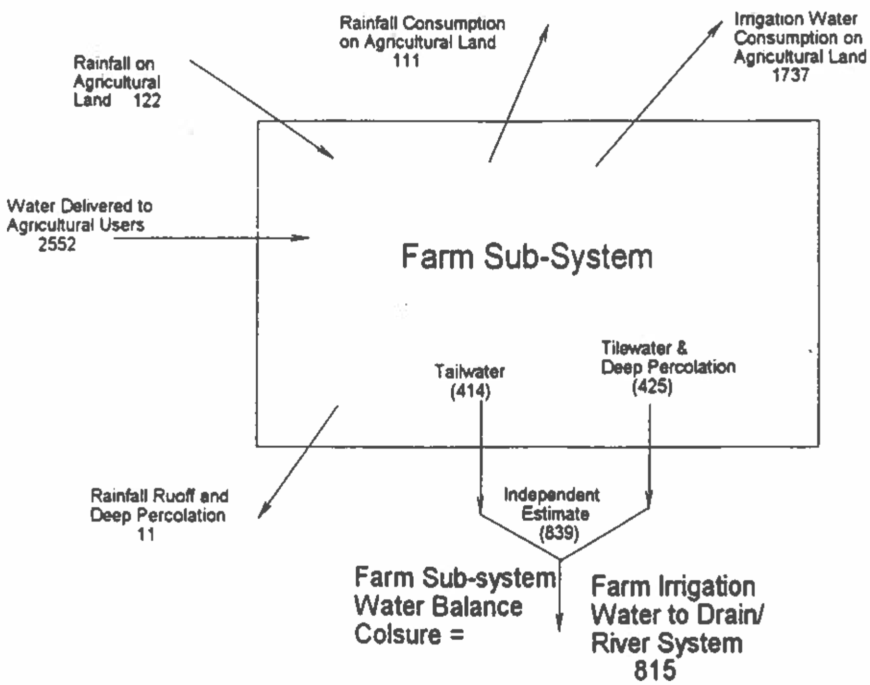

Figure 2-12. Aggregate farm sub-system water balance for the IID study area. Numbers shown are average annual volumes for 1987 to 1996 in 1,000 ac-ft.

Independent estimates of farm outflows to the drain/river system (tailwater and tilewater/deep percolation) are also available from our analysis (Appendix 2.6.4 and Appendix 4). (Note that tilewater estimates include some deep percolation on lighter texture soils that is in addition to that needed for salt removal). However, we do not feel that these estimates have good accuracy. When using these estimates, our analysis suggests that the difference (mismatch) between inflow and outflow, expressed as a percent of inflow, has an accuracy of 8.3% (compared to 2.3% above). The farm water balance mismatch when based on measurements or estimates of direct inflows and outflows from farms is shown in Figure 2-13 as a percentage of the water delivered, assuming that the ET_c portion of the water balance is perfectly known. Considering the apparent inaccuracy of some of the volumes used to compute the farm water balance, the agreement is surprising. In fact, the CI for the mismatch based on Figure 2-13 is 2.9% of the delivered water. Essentially, what is unknown here is the split between tailwater and tilewater. Either we know this split more accurately than we believe, the errors in the two estimates happen to compensate for one another, or we have biased our estimates of tilewater based on knowing the relative magnitude of where the value should be. At this point, we can't separate these possibilities. Also note that there appears to be a shift in the aggregate farm water balance remainder after 1992, from averaging roughly -1.9% during 1987-1992 to +0.1% during 1993-1996.

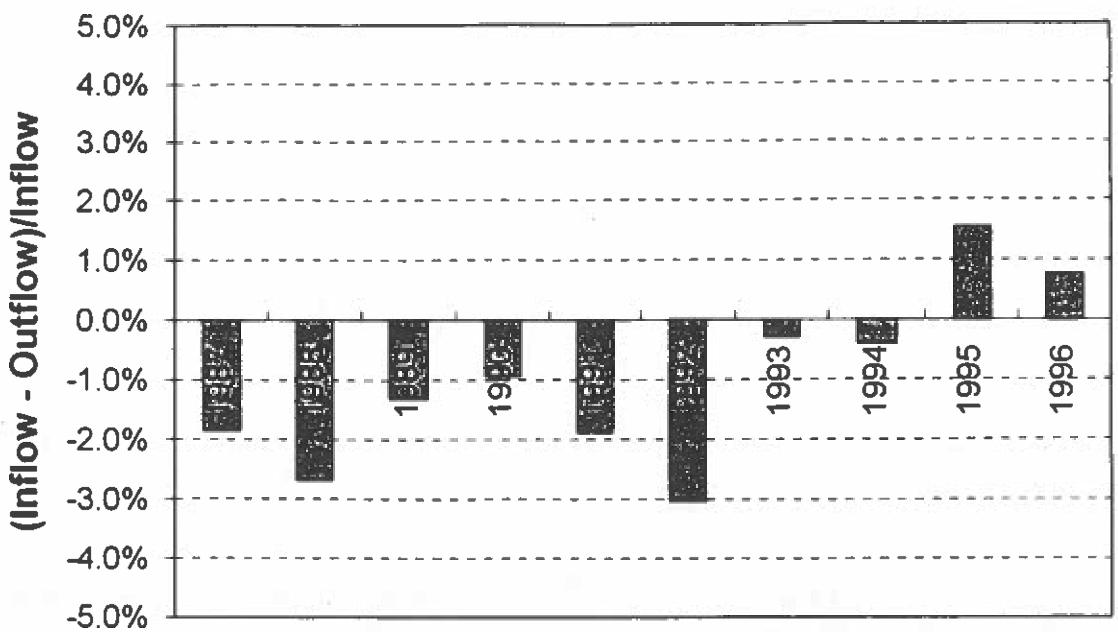

Figure 2-13. Mismatch between inflow and outflow for aggregate farm sub-system water balance as a percentage of inflow for the IID study area.

2.2.3 Open Drain and River Sub-System Water Balance

The open drain and river sub-system comprises that portion of the valley where spill, runoff, and drainage from all land collects and is (nearly all) transported to the Salton Sea. All the components of inflow and outflow have been previously given. The result is shown in Figure 2-14. Inflows and outflows for the system match. The fraction of drain/river system inflow contributed by irrigation water is shown in Figure 2-15. The fact that this is highly variable suggests that other inputs, such as rainfall runoff, have a significant influence on inflows to the Salton Sea.

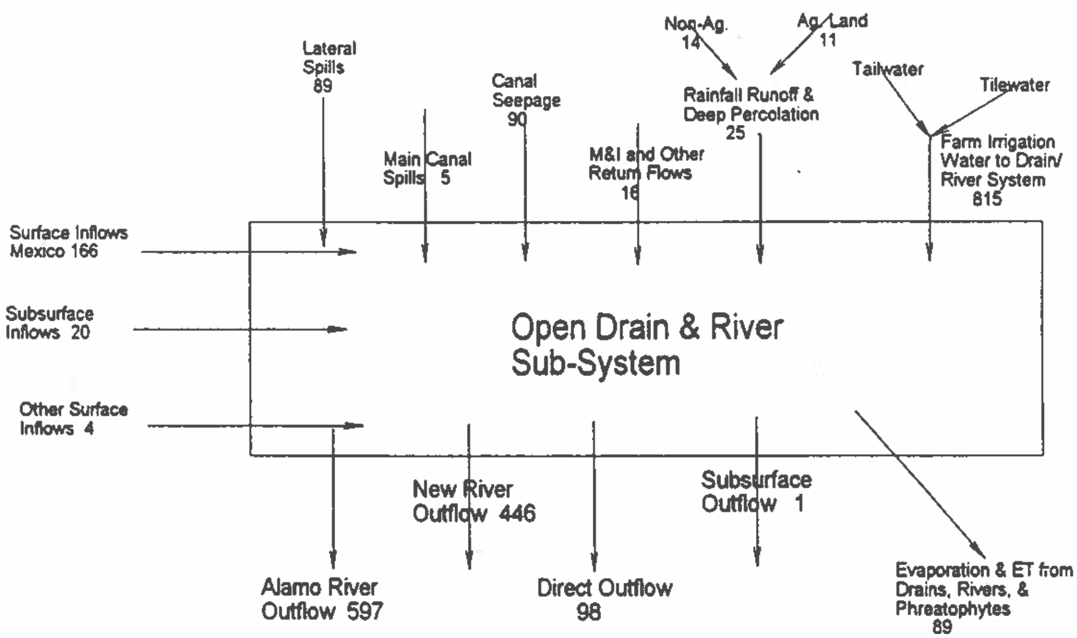

Figure 2-14. Open drain and river system water balance for the IID study area.

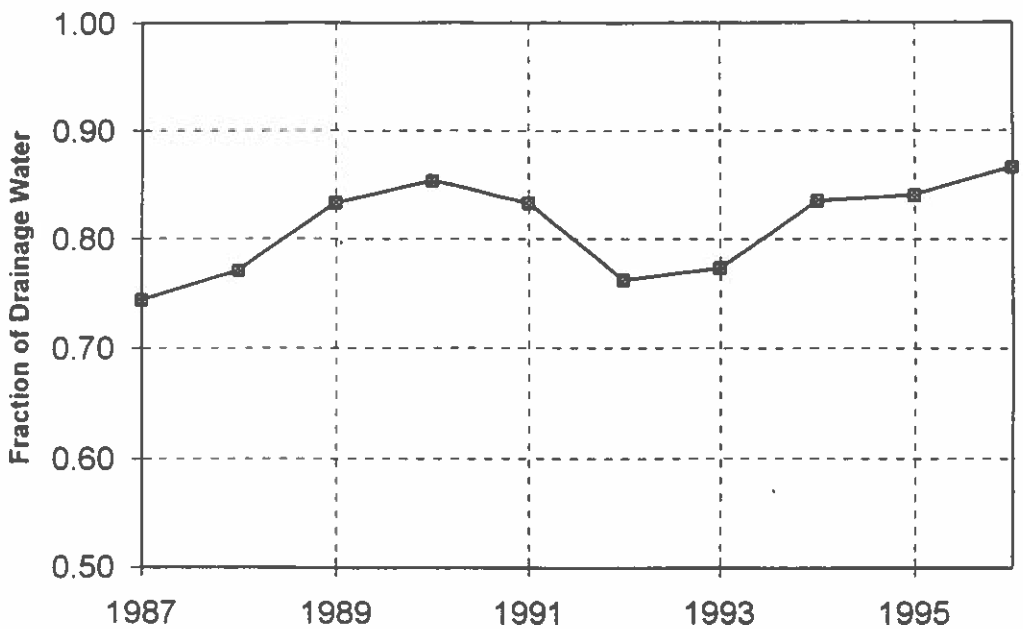

Figure 2-15. Fraction of open drain/river system inflows contributed by irrigation water.

2.3 Influence of Component Accuracy of Volume Estimates from the Water Balance

The influence that measured or estimated volumes have on the accuracy of the various water balance estimates is determined by their relative variances, where the variance is the standard deviation squared. (In this report the accuracy of a quantity is defined as ±2 standard deviations and represents the range over which the quantity should be 95% of the time). The volume with the greatest variance (least accuracy) has the most influence. We need only list those volumes that are independently estimated (i.e., those not calculated from other estimated volumes). Volumes calculated as intermediate values do not add to the overall variance. For the 1990 overall water balance, the variables contributing most are listed in Table 2-1, with the most significant variable listed first. The importance of the various volumes depends on their magnitude and their accuracy. The dominant item in Table 2-1 is the All American Canal flow measurement. The reason this term dominates, even though it is the most accurately estimated volume, is that it is by far the largest independently estimated volume. Thus, even though it is highly accurate, it contributes most to the variance for consumption.

The water measurement procedures used at the All American Canal at Pilot Knob are very good and have been examined in detail. It is unlikely that the accuracy of measurement there could be improved substantially. The next five items are volumes that are very difficult to quantify. With extensive hydro-geologic studies, the accuracy of these volumes might be improved. However, it would take major improvements to reduce the overall variance substantially. It is questionable whether more detailed studies could be justified.

Table 2-1. Volumes contributing most to the inaccuracy of water balance estimates of water consumed on agricultural land within the IID study area, 1990.

	Volume	CI	Variance	Contribution to overall variance
	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2	%
Delivery to AAC at Pilot Knob	3420	1.9%	1055	54
Seepage (PK to EHL)	-94	30%	200	10
ET - drains, rivers, phreatophytes	-89	27%	147	8
Rainfall volume	91	22%	105	5
Subsurface inflows	20	100%	100	5
Change in storage	0	–	100	5
Direct outflow to sea	-91	20%	83	4
Sum of Alamo & New River outflow to sea	-1049	varies	69	4
Sum of all others	-325	varies	77	4
Total water consumption on ag. land	1882	4.7	1936	

Computing irrigation water consumption on agricultural land adds some additional variance components, particularly rainfall consumption of agricultural land. During high rainfall years, the variance contribution of the rainfall and the additional variance of partitioning the rainfall into consumed and unconsumed parts can be a major source of the overall variance. The average variance components contributing to the inaccuracy of water-balance estimates for irrigation water consumption on agricultural land for 1987 through 1996 are shown in Figure 2-16. Total rainfall volume is second on average, rather than fourth, as in Table 2-1 for 1990. The two rainfall variances represent more than a quarter of the variance (28%), the All American Canal measurement represents more than one third of the variance (39%), while the remaining quantities comprise one third of the variance (33%).

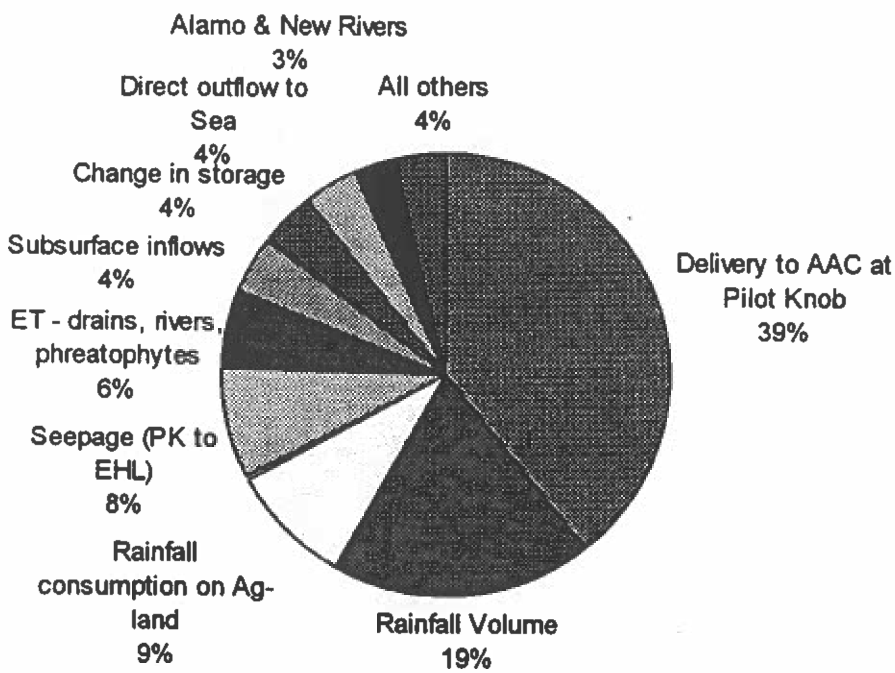

Figure 2-16. Variance components for irrigation water consumption on agricultural land, IID study area water balance, average values for 1987 through 1996.

2.4 Summary of Water Consumption and Water Balance Estimates

The overall water balance diagram for the IID study area is shown in Figure 2-17. The underlined quantities are the closure terms in the water balance: Irrigation Water ET (actually consumption) for the overall water balance, Farm (agricultural) Deliveries for the canal sub-system water balance, and Farm Irrigation Water to the Open Drain and River System for the Farm Sub-System. The quantities in parentheses represent independent estimates that were used to assess the accuracy of the sub-system water balances, but which were replaced with water balance closure terms to improve their relative accuracy.

The sub-system water balances provide a useful method for sorting the various water-balance components within the IID study area. The accuracy with which we can estimate these subsystem balances provides credibility to the overall methodology and provides some insight into the accuracy with which we know some of these internal volume estimates. In particular, we suggest that district records of irrigation water delivered to users are on average about 3% low. Rainfall variability has an important influence on the partitioning of water within the valley and on how accurately we can predict these water balance components. Most of the important quantities can be estimated to within ±2 to 5%. Partitioning unconsumed irrigation water between tailwater flow and tilewater is the computation with the most uncertainty. We see little hope for improving the accuracy of these estimates in the near future, short of undertaking a massive data collection effort.

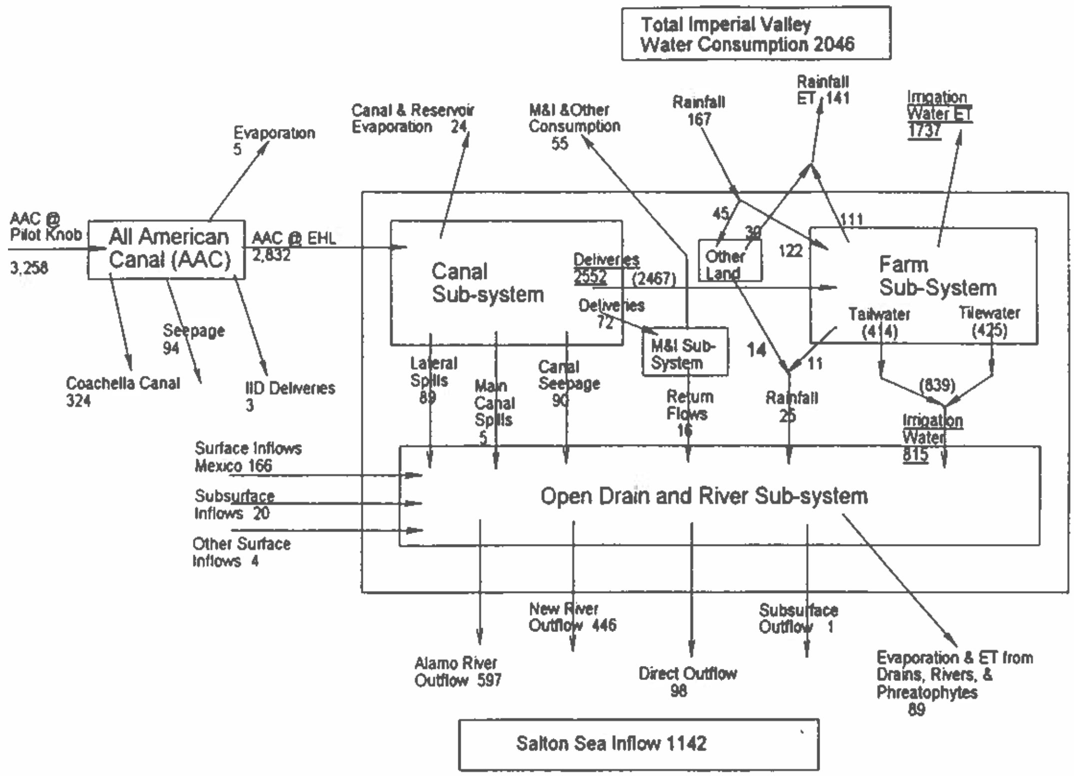

Figure 2-17. Water balance for IID study area including sub-systems. Numbers shown are average annual volumes for 1987 to 1996 in 1,000 ac-ft.

3. Evapotranspiration Components

The approach normally used to quantify the consumptive use of water by irrigated crops within irrigation projects is the crop coefficient - reference evapotranspiration (K_c ET_o) procedure, where reference evapotranspiration (ET_o) is computed for a grass or alfalfa reference crop and is then multiplied by an empirical crop coefficient (K_c) to produce an estimate of crop evapotranspiration (ET_c). The K_c ET_o approach has been the primary approach for most irrigation projects due to difficulties in estimating deep percolation or ground water storage components in water balance computations where ET_c is computed as the closure term.

Within the IID study area, the very small amount of subsurface flow exiting directly into the Salton Sea from the district provides for relatively accurate application of the water balance approach for determining ET_c as the closure term. The IID study area is relatively unique in this regard. The availability of ET_c calculated from the water balance has provided the opportunity to assess the accuracy and consistency of the essentially independent K_c ET_o procedure that has been recommended in various reports for predicting future crop water demands.

The K_c ET_o procedure is valuable in application to the IID study area for purposes of separating evaporation and transpiration components of ET_c and for exploring the effectiveness of rainfall and the consumption of water by special irrigation events. As is shown in this section, the accuracy and confidence of the K_c ET_o estimate is improved when it can be verified and calibrated against ET_c from the water balance - which is necessarily a backward look in time at historical data rather than a prediction of future ET_c.

3.1 Components of Weather-Based ET Prediction

Prediction of weather-based evapotranspiration on a project scale requires the aggregation of ET_c from all crops and fields within the project. This requires accurate determination of cropped acreages, definition of planting dates and dates of crop development, definition of values for the crop coefficients over time, and definition of the scheduling of irrigation events. Definition of these parameters is described briefly in the following. Full and detailed descriptions are given in Appendix 3, with additional detailed computations in Annex 3 (on file with IID).

3.1.1 Crop Acreages

IID collects and maintains information on crop types and planting and harvest dates on a field by field basis. This information is updated daily according to observations by zanjeros. Field sizes are known, so that total acreages of specific crop types as a function of time can be computed. IID summarizes crop acreages in reports and computer spreadsheets by taking a "snapshot" of reported acreages on the thirteenth day of each month. These monthly acreages, provided by IID, were used to determine total acreages for specific crops by growing season.

Total acreages planted to general categories are summarized in Figure 3-1 for years 1989 through 1996. Acres that were doubled cropped, i.e., land that had more than one crop planted during a calendar year, were estimated by subtracting the reported net irrigated land from the sum of all reported crop acreages (sum of field, garden, other). Acreages for specific crops by year are listed in Appendix 3.2.

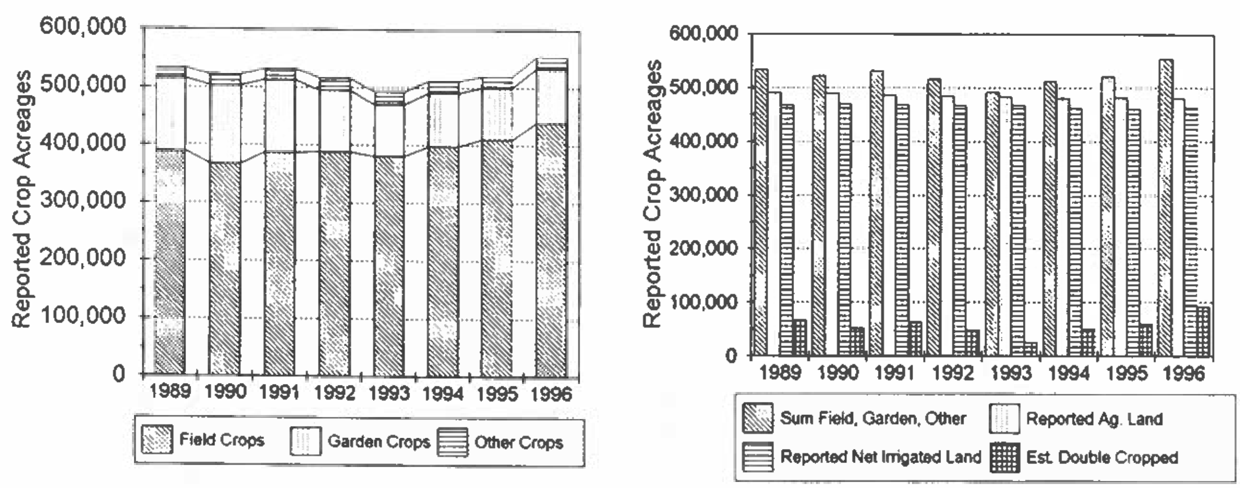

Figure 3-1. General crop acreage categories for 1989–1996 for IID study area.

3.1.2 Planting and Harvest Dates

Mean dates for planting and harvest are necessary to define the timing and duration of growing seasons for crops during computation of crop coefficients. Mean values for planting and for harvest were determined for each crop and for each year from the monthly acreage summaries provided by IID. This was done by computing the dates at which 50% of all acres of each crop category were planted and the dates at which 50% of all acres of each crop category were harvested. This computation required the assumption that the dates of planting and harvest were normally distributed about the mean values, so that normal, statistical population parameters could be used to determine mean values from reported monthly acreages.

Harvest dates for wheat and sugar beet crops were adjusted from the zanjero reports; they were moved up in the calendar year for the K_c calculations to account for maturity or partial harvest of the crops which occurs before the harvest dates are officially reported by zanjeros. These adjustments were based on interviews with **IID staff and with IID farmers.**

3.1.3 Reference Evapotranspiration

Hourly and 24-hour (daily) weather data and reference evapotranspiration estimates are available for the IID study area from three CIMIS (California Irrigation Management Information Service) stations. These stations are Calipatria (Mulberry) (#41), Meloland (#87), and Seeley (#68). The proportions of IID represented by each of these stations are 47%, 35% and 18%, respectively, as determined by Thiessen polygonal computation.

Years of record for the three stations are 1983-1996 for Calipatria, 1990-1996 for Meloland (near Holtville), and 1987-1996 for Seeley. These three stations are automated, electronic stations that measure and report solar radiation, air temperature, relative humidity, wind speed, and precipitation. Reference ET_o is computed hourly in the CIMIS system using the CIMIS Penman equation and is summed daily.

<u>Weather Data and ET_o Integrity</u>. Weather data were screened for instrument malfunction and bias using procedures by Allen (1996). Corrections were made to solar radiation and relative

humidity to account for dust or calibration bias in the pyranometer (for solar radiation) and for bias and sensor drift of the relative humidity sensors. Detailed summaries of corrections made are provided in Annex 3 on file with IID. In general, correction of data caused less than 3% change in ET_0 estimates relative to those reported by CIMIS. However, the magnitude and direction of change varied from year to year.

Net radiation data (R_n) were recalculated due to inconsistencies and errors in the values computed and reported by CIMIS. An improved calculation procedure relative to that used by CIMIS was used to make the recalculations. The procedure and calculations are described in Appendix 3.9. ET_0 was recomputed using the recalculated R_n data and filtered weather data as described in Appendix 3.1. Annual sums of recalculated ET_0 are shown in Figure 3-2.

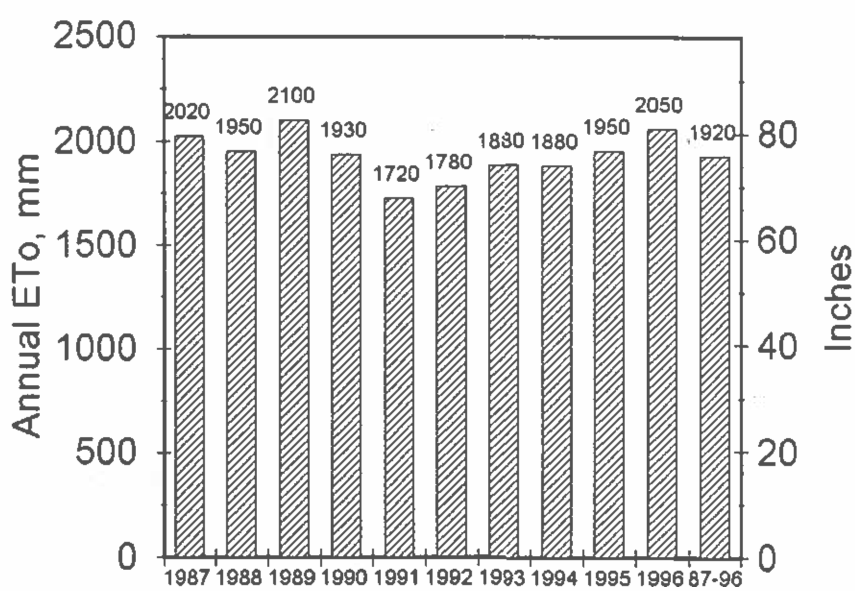

Figure 3-2. Annual totals for grass reference ET_0 during 1989–1996 for the IID study area.

3.1.4 Precipitation

Precipitation totals are available for the IID study area from the three CIMIS stations and from six manually operated volunteer weather stations reported by the National Weather Service (Brawley, Calexico, El Centro, Imperial, Niland, and Ocotillo). Cumulative rainfall totals over the years of record for each of the CIMIS stations were compared to the NWS stations, as detailed in Appendix 3. The CIMIS data tracked closely with neighboring NWS stations over all years of record, indicating consistency, completeness and accuracy of data. Except for two days in July, 1995 at the CIMIS Seeley station, all data were accepted. Annual precipitation averaged 3.86, 3.63, and 3.16 inches per year at the Calipatria, Meloland and Seeley stations for the six year period from 1990 through 1995. Precipitation for the IID study area was computed by weighting the three CIMIS stations according to represented areas (47%, 35% and 18% for Calipatria, Meloland, and Seeley). The average weighted value for the district averaged 3.46 inches (88 mm) over the 1989 – 1996 period. Annual precipitation ranged from 1.5 to 7 inches over the 1989 – 1996 period (Figure 3-3).

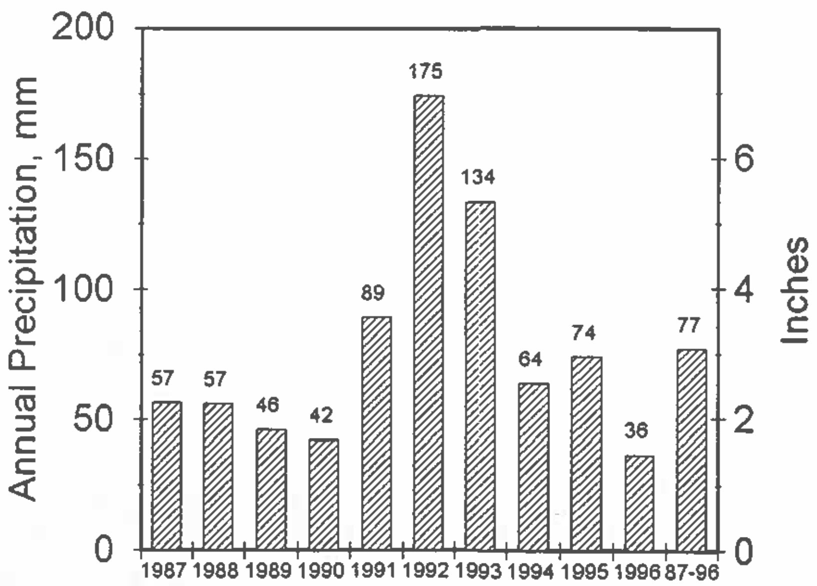

Figure 3-3. Annual totals of precipitation during 1989 – 1996 the IID study area.

3.1.5 Crop Coefficient and Evapotranspiration Procedure

Approximately 50% of the soils in the IID study area have low intake rates and "shrink-swell" characteristics that cause surface cracking as they dry. Another approximately 25% of the soils have low intake rates, but have less shrink-swell potential. The cracking of the soil surface layer of the heavy soils exposes up to 50 cm (20 inches) or more of the soil profile to evaporative drying between irrigations and following the cessation of the growing period. Therefore, it was important to apply a crop coefficient approach that accounted for the significant amount of potential evaporation following irrigation. The K_c procedure proposed for the forthcoming revision of FAO-24 (Allen et al., 1998) was applied. In the FAO-24 procedure, the K_c is decomposed into a basal coefficient K_{cb} representing conditions when the upper portion of the soil profile is relatively dry and an evaporation coefficient K_e that represents the additional evaporation following irrigation and rain. The sum of K_{cb} and K_e is the K_c that is multiplied by ET_o to obtain ET_c for a specific crop and rainfall/irrigation regime. The combined equation for K_c is:

$$K_c = K_s K_{cb} + K_e$$

where K_s is a stress reduction coefficient [0 - 1] used to reduce K_c when soil water is inadequate to sustain full ET_c, and K_e is the soil water evaporation coefficient. K_{cb} represents the ratio of ET_c to ET_o under conditions when the soil surface layer is dry, but where the average soil water content of the root zone is adequate to sustain full plant transpiration. K_{cb} is multiplied by an additional stress coefficient K_s when root zone moisture is too low to support full ET_c. The sum $K_{cb} + K_e$ can not exceed the maximum value for a crop, which is generally about 1.2.

The FAO procedure requires a daily calculation time step and a daily soil water balance for the upper portion of the soil profile that is subject to evaporative drying between wetting events. As the upper part of the soil profile dries, the value for K_e is reduced until it reaches zero. A three "stage" drying process was applied to the cracking soils of the IID study area to reflect the low level evaporative drying from cracks for long periods after wetting. Specific details on the FAO K_c procedure are given in Appendix 3.

Example results of the $K_{cb} + K_e$ computations are illustrated in Figures 3-4 to 3-6, where Figure 3-4 is a plot of daily K_c over the calendar year for alfalfa hay, Figure 3-5 is the same for sugar beets and Figure 3-6 is K_c for onions. The alfalfa and sugar beet crops were presumed grown on the heavier cracking soils in the IID study area and the onions on lighter ground. The width of evaporation "spikes" (following irrigations) are observed to be more narrow during summer months since the higher evaporative demand reduces the number of days required to dry the soil surface layer. The lighter lines in the figures are the basal K_{cb} curves which follow the classical straight line shape introduced in FAO-24 (Doorenbos and Pruitt, 1977) and utilized by the University of California. A summary of basal crop coefficient values is listed in Appendix 3. Values for K_{cb} were based primarily on the FAO-24 revision (Allen et al., 1998) and publications by the University of California (Snyder et al., 1989a, 1989b).

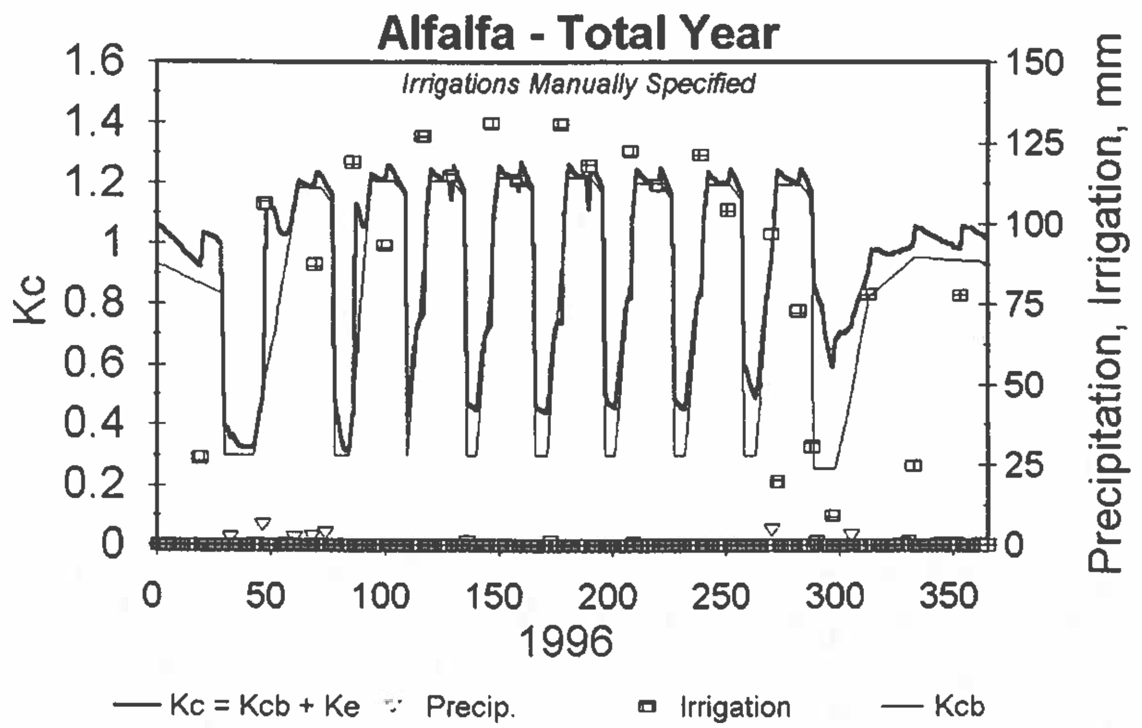

Figure 3-4. Daily values for K_c for alfalfa hay for the IID study area during 1996.

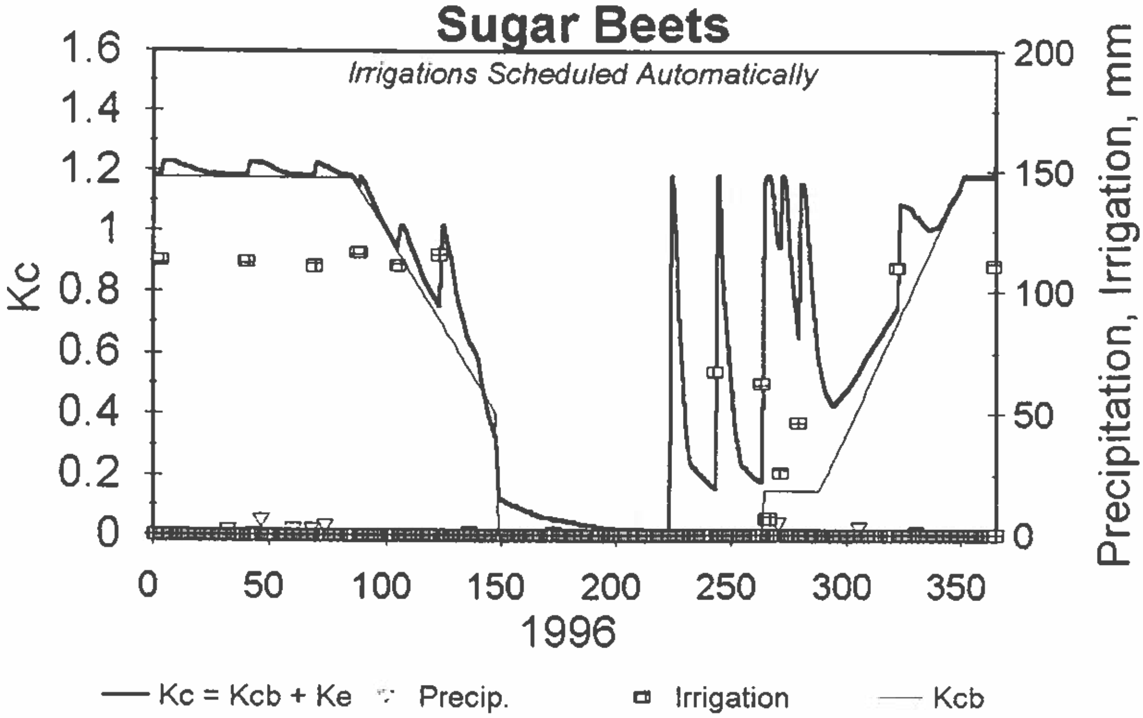

Figure 3-5. Daily values for K_c for sugar beets for the IID study area during 1996.

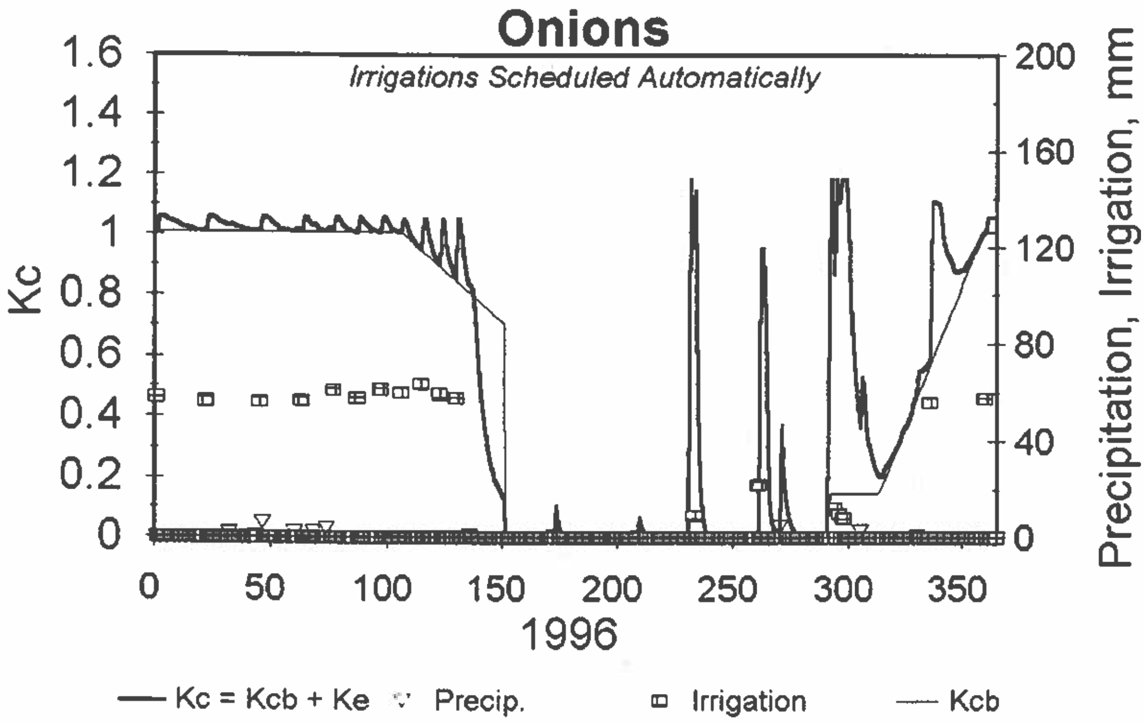

Figure 3-6. Daily values for K_c for onions for the IID study area during 1996.

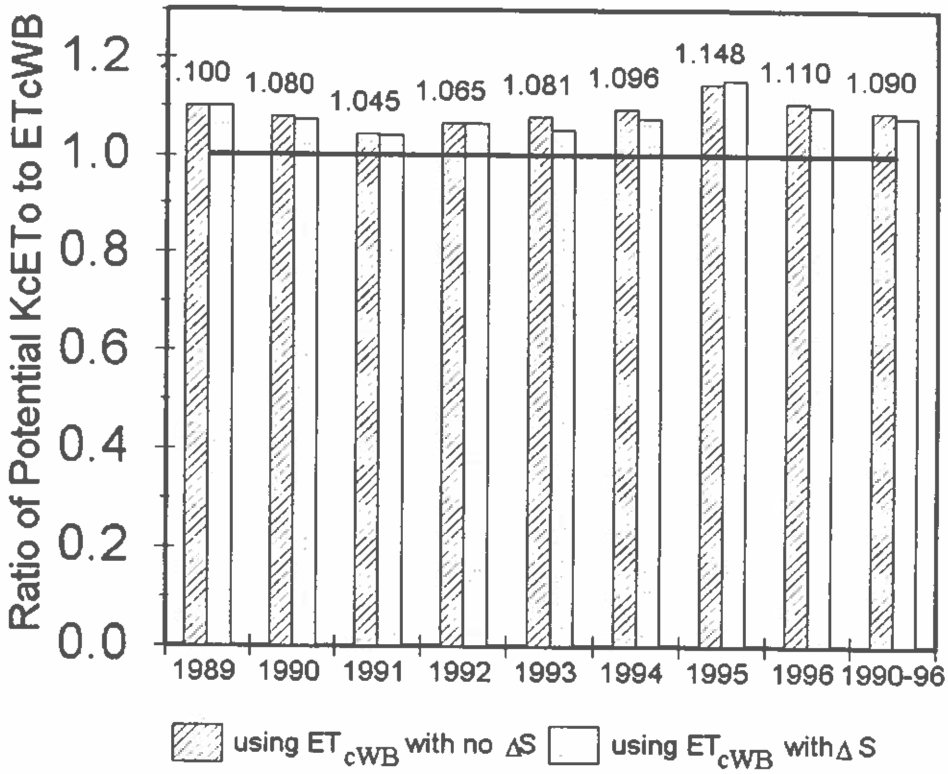

Figure 3-6a. Ratios of potential annual crop evapotranspiration from the K_c ET_o approach to ET_{cWB} computed from the water balance.

On average, the "potential" K_c ET_o computations exceeded the ET_c as computed from the water balance of the IID study area by 8% on an annual basis. The annual potential K_c ET_o averaged 2,008,000 AF from 1990 to 1996, whereas the annual ET_{cWB} averaged 1,864,000 AF. The accuracy of the water-balance determined ET_c (ET_{cWB}) is ±5.1% (Table A2-41) at the 95% confidence interval. Therefore it is concluded that the K_c ET_o procedure, as applied with no reductions for reduced yield or salinity, overpredicted the true ET_c of the IID study area, since the difference between potential K_c ET_o and ET_{cWB} (8%) exceeds the confidence interval (5.1%). The primary cause of the overprediction is the fact that the values used for K_{cb} represent potential and pristine growing conditions. Crops in the IID study area, as in all irrigation projects, are not, on average, in fully pristine condition. As discussed in the next section, yields and ET_c in the IID study area are reduced below potential levels due to occasional water stress between irrigations, occasional suboptimal planting densities or plant vigor, occasional suboptimal fertility, salinity, nonuniformity of irrigation and soils, disease, insect pressures, and tillage traffic. Delays in forage crop removal also reduce ET_c from the portion of the field lying beneath windrows.

Monthly estimates of potential ET_c from the K_c ET_o procedure are plotted in Figure 3-7 for each year from 1990 to 1996, along with monthly ET_{cWB} with and without the estimated ΔS for each month. Also plotted are monthly values for reference ET_o, expressed in AF per month in the IID study area to provide an idea of the magnitude of ET_c in the IID study area relative to the total reference crop evapotranspiration. Lack of good records for cropping patterns precluded monthly K_c ET_o computations for years prior to 1990.

In general, the estimates of potential ET_c followed the trends in ET_{cWB} month to month and year to year, with some overestimation particularly during April - June in some years. This three month period is the period when the largest acreage of the IID study area is under crop and irrigation. The addition of monthly ΔS to the ET_{cWB} brought the estimates closer together for most months, although it often widened the difference between estimates in November when wheat was commonly planted and where the precise timing of preplant irrigations and associated change in soil water storage was unknown.

The bar graph shown in Figure 3-7 illustrates the consistent overprediction of ET_{cWB} by the potential K_cET_o method each year, with the amount of overestimation varying from year to year.

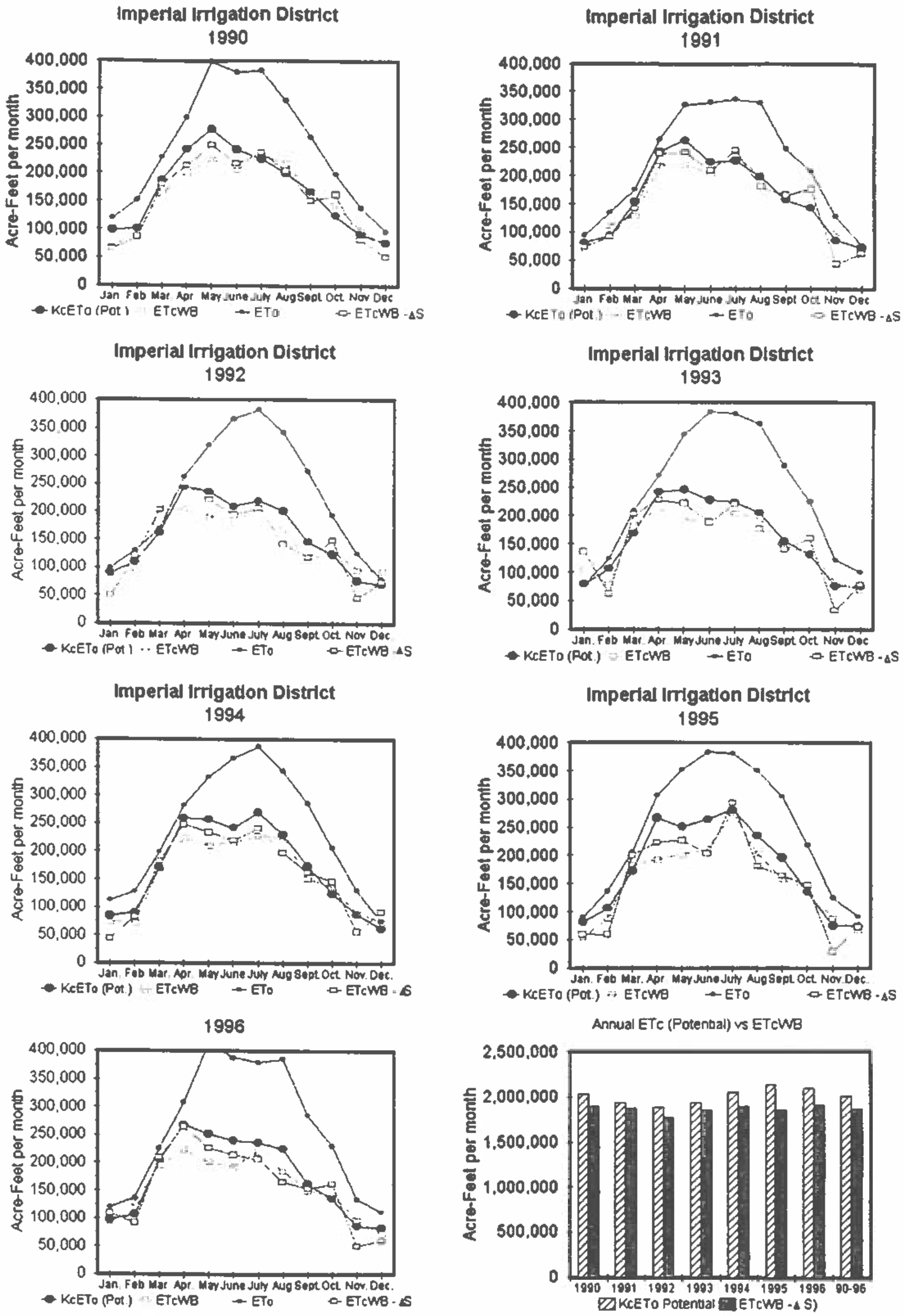

Figure 3-7. Potential K_c ET_o (large circles), ET_c from the water balance (ET_{cWB}) (hollow squares), ET_{cWB} less monthly ΔS (shaded squares), and reference ET_o (small circles).

3.2.2 *Adjustments to Estimates by the K_c ET_0 Procedure*

<u>Reduction of K_c Using a Visual Rating</u>. The potential K_c ET_c values shown in Figure 3-4 were reduced by a constant 6% over all months and years and crops to account for the general reduction in ET_c caused by the various and occasionally nonoptimal agronomic practices that occur over essentially all crops. The 6% reduction was based on a visual rating of field appearances using a composite color aerial photo of the IID study area and was based on blank areas within fields (averaging 2%) and areas of variation in plant density and vigor. The ability to see outlines of subsurface tile lines from the air over portions of the IID study area indicated that portions of fields away from tile lines may have been under some salinity stress. Details of the visual assessment are described in Appendix 3.6. The visual assessment was made prior to and independent from the comparison with the ET_c estimates from the water balance.

The 6% reduction based on visual rating of the agricultural fields of the IID study area reduced the average annual ET_c predicted using K_c ET_0 to 1,905,000 AF for the 1990–1996 period, which was within 2% of ET_c as determined by the water balance method. Monthly ET_c for monthly periods are plotted in Figure 3-8 for each year. Monthly K_c ET_0 followed ET_{cWB} closely over most months, even though the 6% reduction was indiscriminately applied over all months and all crops.

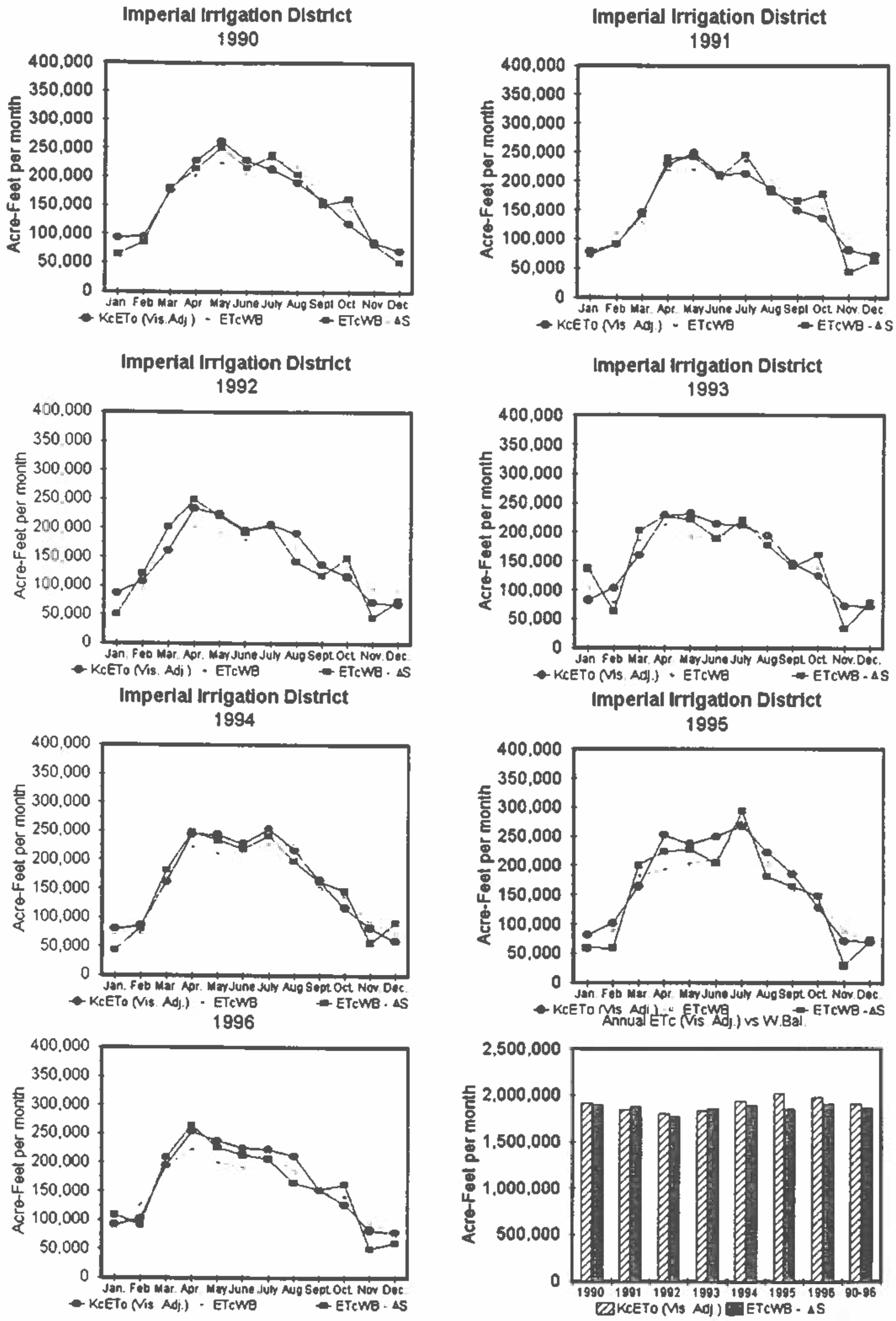

Figure 3-8. K_c ET_o adjusted downward 6% based on a visual rating (circles), ET_c from the water balance (ET_{cWB}) (small squares), and ET_{cWB} less monthly ΔS (large squares).

Additional Reductions for Selected Crops. In addition to the initial 6% reduction over all crops and months, additional reductions were made to five field crops that were judged to be more subject than others to various agronomic, salinity, water and management stresses. These crops, alfalfa, bermuda, sudan, sugar beets, and permanent pasture, were, in addition to the 6% reduction, multiplied by the monthly factors shown in Table 3-2. Water stress and reduction in ET_c from pristine levels can be caused by delayed removal of forage windrows from fields due to rainfall or conditions of high wind and multi-year aging effects on perennials. Alfalfa forage is particularly sensitive to salinity stress. The IID study area is impacted by periods when daily demands for water exceed canal supplies, so that demands must be carried over and irrigations delayed for lower valued crops. These crops are typically the five that were given the additional ET_c reductions. Sugar beets commonly show signs of water stress and leaf wilt during periods of high ET_o. The selection of the five crops to which additional reduction in K_c ET_o was applied and the monthly distribution of the reductions was somewhat speculative and arbitrary, but was based on the above reasoning. This or some similar type of adjustment was required to reduce K_c ET_o computed using the potential K_c values by an additional 2% annually over the district so that computations agreed with ET_c from the water balance.

Table 3-1. Adjustment factors for yield/salinity/stress applied to $K_c\ ET_o$ computations (in addition to the 6% reduction based on a visual rating of crops) to fit ET_c computed from the water balance for the IID study area.

	Alfalfa Hay	Bermuda	Sudan	Sugar Beets	Perm. Pasture
January	1.00	1.00	1.00	1.00	0.95
February	1.00	1.00	1.00	1.00	0.95
March	1.00	1.00	1.00	1.00	0.95
April	0.95	0.95	.097	0.97	0.90
May	0.95	0.95	0.97	0.97	0.90
June	0.95	0.95	0.97	0.97	0.90
July	0.95	0.95	0.97	0.97	0.90
August	0.95	0.95	0.97	0.97	0.90
September	0.95	0.95	0.97	0.97	0.90
October	1.00	1.00	1.00	1.00	0.95
November	1.00	1.00	1.00	1.00	0.95
December	1.00	1.00	1.00	1.00	
Ann. Factor*	0.96	0.96	0.97	0.98	0.90

* The Annual Adjustment Factor was computed by weighting individual months according to $K_c\ ET_o$ for that month.

None of the additional reductions in computed $K_c\ ET_o$ for any particular crop were large, ranging from 2% reduction for sugar beets to 10% reduction for pasture (Figure 3-9a). The net effect of the additional adjustment factors was to reduce the annual $K_c\ ET_o$ computations by 2% so that average annual values, following adjustment, equaled 1,852,000 AF. This value compares to average annual ET_{cWB} = 1,864,000 AF over 1990-1996. Figure 3-9 shows monthly comparisons between adjusted $K_c\ ET_o$ and ET_{cWB} for each year. The additional reductions were during spring and summer months when ET_o demands are greatest.

Monthly $K_c\ ET_o$ following adjustment tracked monthly ET_{cWB} relatively well during all years. It is interesting to note that in 1992, a year when the whitefly infestation was particularly high and alfalfa yields were down and irrigation of alfalfa was suppressed during summer months, that the calculated $K_c\ ET_o$ predicted ET_{cWB} quite closely (Figure 2-9), even though no special adjustments for 1992 were applied. Apparently, the ET_c of the damaged crops was not suppressed by the infestation and reduced irrigation as much as were yields. Farm deliveries of water were lower in 1992 (Fig. 2-8), but rainfall was above normal (Figure 2-7).

Statistical Results. Following the application of reduction factors to potential K_c ET_o computations, monthly values for adjusted K_c ET_o agreed relatively well with monthly measured ET_{cWB}. The r^2 between monthly values over the seven year period from 1990 to 1996 (n = 84) was 0.89 and the standard error of estimate (SEE) for the average monthly ET_c relative to ET_{cWB} was 24,000 AF (15% of the average monthly ET_c). Even though the adjusted K_c ET_o appears to visually fit the measured ET_{cWB} in both Figures 3-8 and 3-9, the regression statistics imply that the K_c ET_o approach, even when used with the ET_c adjustment factors and applied following the procedures used in this study, does not predict actual ET_c accurately. The adjusted K_c ET_o predicted monthly ET_{cWB} to within ±15% only 68% of the time on a monthly basis for all of the IID study area. This implies that monthly diversion requirements for IID would only be predicted to within ±15% only 68% of the time.

The procedure predicts monthly ET_c to within only ±30% with 95% certainty, even though unique cropping acreages and planting and harvest dates are known for each year. In other words, the confidence interval for the monthly K_c ET_o calculations, even following adjustment, is ±30%, based on comparison to ET_{cWB}. These statistics presume that there is no error in the ET_{cWB} measurements or in the ΔS calculations. In actuality, the ±5% confidence intervals for ET_{cWB} would imply that the true confidence interval for the adjusted monthly K_c ET_o could be ±25%. These large confidence intervals would preclude using K_c ET_o to predict or forecast monthly water demands for IID for purposes of operating Hoover Dam releases.

Estimates of ΔS were least certain in months November and January where timing and amounts of irrigation were difficult to predict. When months November and January were excluded from the statistical analysis, the SEE reduced to 22,000 AF for monthly estimates (14% of average monthly ET_c). When ΔS was not used to correct ET_{cWB} for any months, the SEE reduced to 19,000 AF (12% of average monthly ET_c).

Annual ratios of adjusted K_c ET_o to ET_{cWB} are listed in Figure 3-9a. The annual ratios range from 0.97 (in 1991 and 1993) to 1.07 (in 1995) and averaged 1.00. The total reduction required for potential K_c ET_o to match ET_{cWB} was approximately 8% on an annual basis. The SEE for annual adjusted K_c ET_o for the district relative to ET_c from the water balance was 55,000 AF/year, which is about 3.4% of total annual ET_c. This implies that the K_c ET_o approach, when used with the ET_c adjustment factors and applied following the procedures used in this study, would predict within ±3.4% of the true annual ET_c as represented by the water balance 68% of the time. The procedure would predict within ±7% of true annual ET_c 95% of the time. In other words, the confidence intervals for the annual K_c ET_o calculations, following adjustment for various stress, is ±7%, based on comparison to ET_{cWB}.

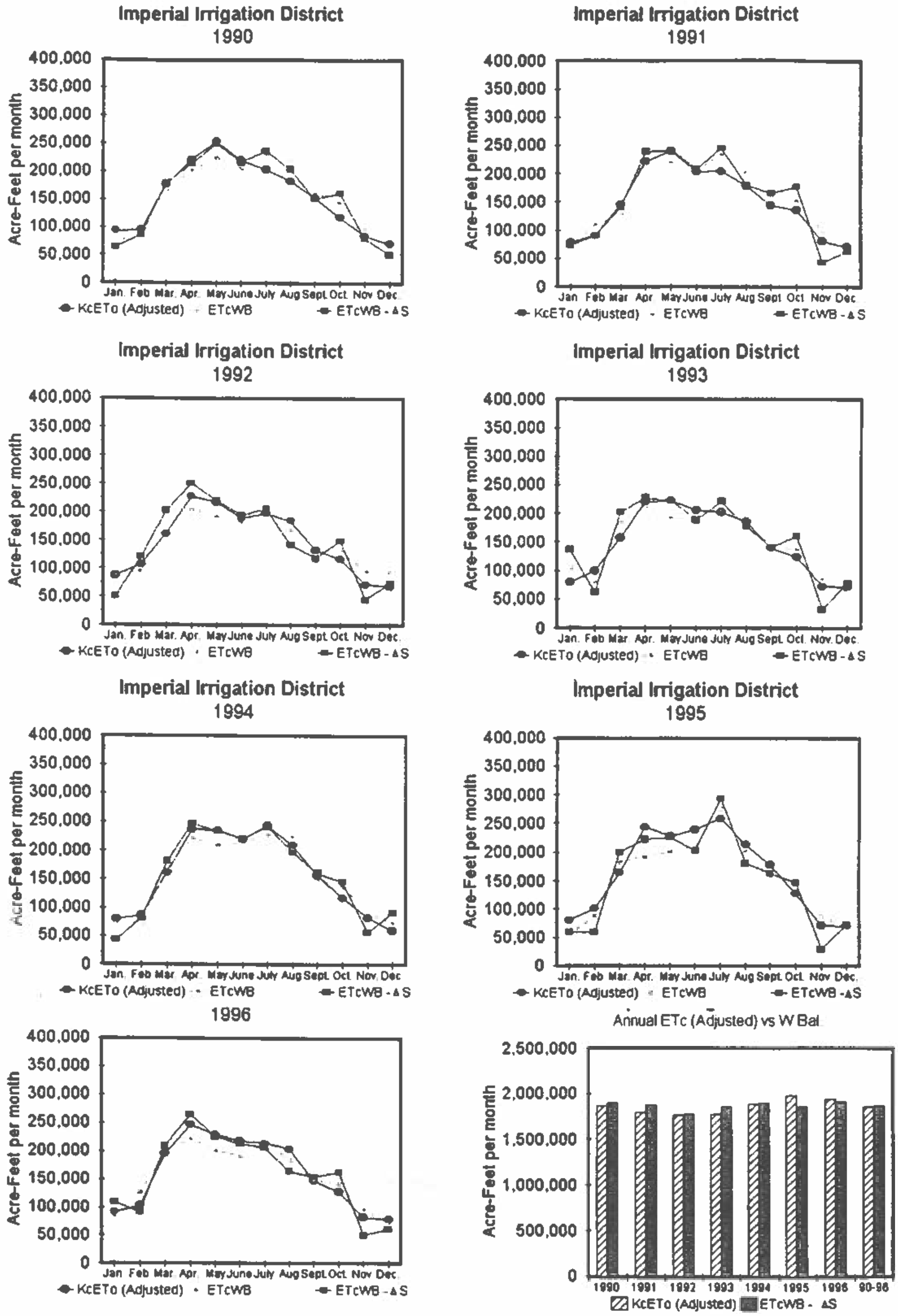

Figure 3-9. K_c ET_o adjusted using visual and additional individual crop ratings (circles), ET_c from the water balance (ET_{cWB}), and ET_{cWB} less monthly ΔS (large squares).

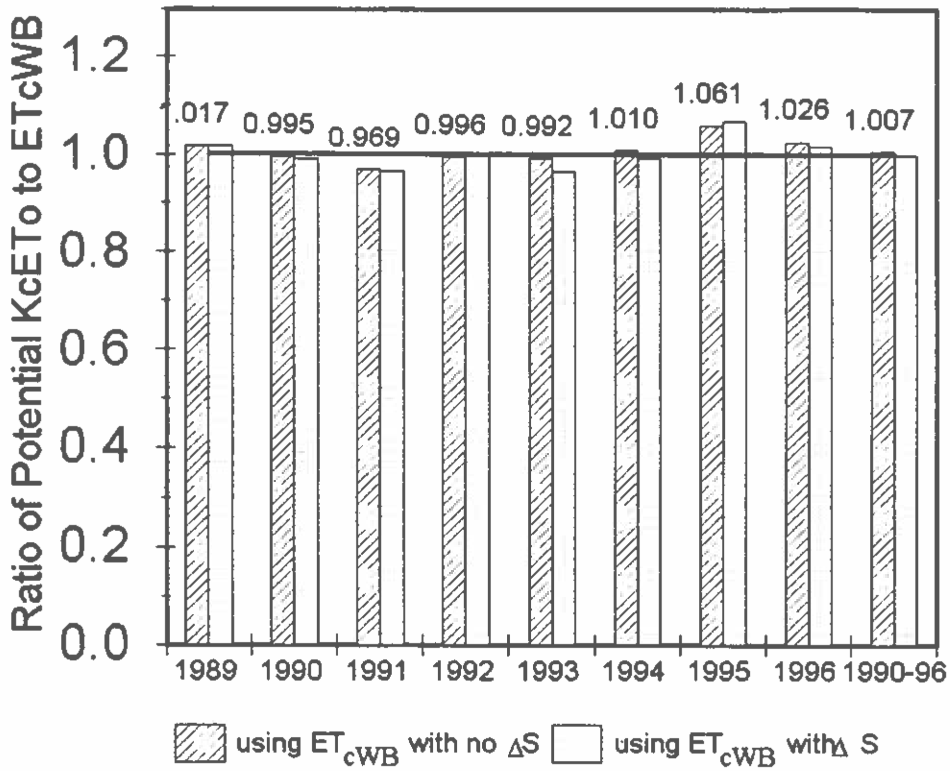

Figure 3-9a. Ratios of annual adjusted crop evapotranspiration from the K_c ET_0 approach to ET_{cWB} computed from the water balance.

Figure 3-10 shows annual volumes of ET_c estimated from the adjusted K_c ET_0 approach and from the water balance of IID. Also plotted (to a different scale) is ET_0 expressed in AF per year. The overlay of ET_0 indicates that some of the year to year variation in ET_c was caused by variation in ET_0. The balance of variation was due to changes in cropping patterns and cropping dates.

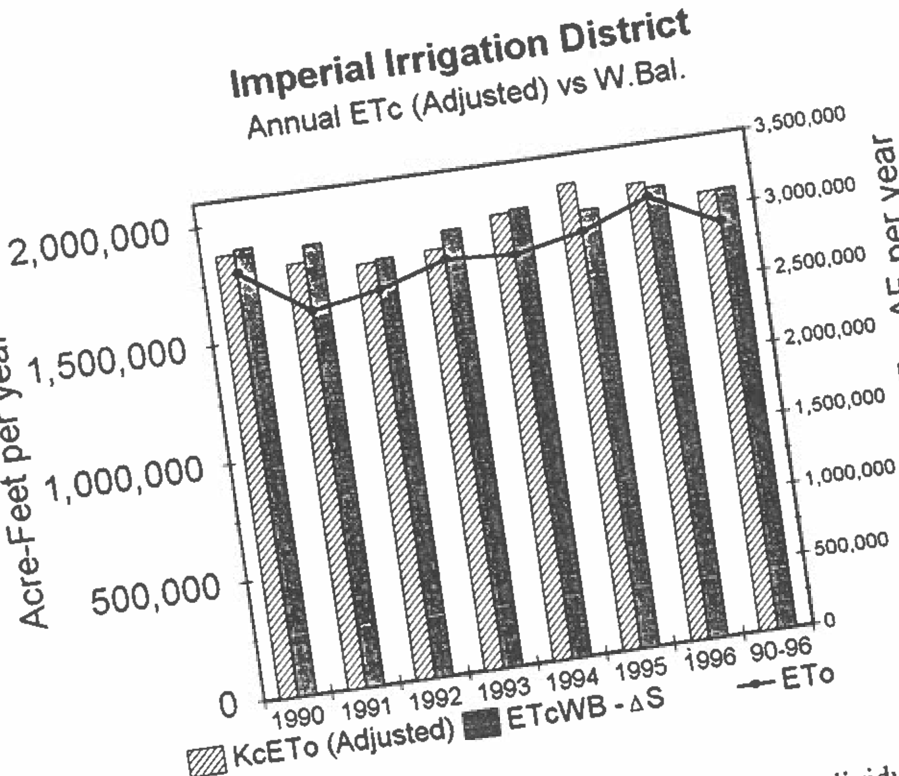

Figure 3-10. Annual $K_c\,ET_o$ adjusted using visual and additional individual crop ratings, ET_c from the water balance (ET_{cWB}) less monthly ΔS, and reference ET_o for the IID study area, 1990 to 1996.

3.2.3 *Evaporation Analysis*

The $K_c\,ET_o$ procedure was useful in evaluating the relative fractions of net applied irrigation water and precipitation that evaporated from soil rather than transpired from vegetation. This evaluation helps to assess the effectiveness of precipitation in the IID study area.

Evaporation of precipitation from non-irrigated land. Lands that are idle or fallow in the II study area characteristically dry to the point that the upper 20 to 50 cm (8 to 20 inches) the profile is completely dry. The dry profile is conducive to infiltration of precipitation subsequent evaporation from the upper soil profile. The $K_c\,ET_o$ model predicted that 1(of precipitation on idle land infiltrates and subsequently evaporates. No transpiration predicted since idle land is generally free of vegetation, and no runoff was predicted from the NRCS (SCS) curve number method. No deep percolation from the soil profile was predicted since precipitation amounts were too low to raise soil moisture to above field capacity on the idle soils.

Evaporation and Transpiration of Precipitation from Irrigated Land. Lands that are under irrigation lose some precipitation to both run off and deep percolation. These losses occur when irrigation events precede a precipitation event, so that the soil surface is relatively moist and the soil profile is recharged to field capacity. Runoff and deep percolation from precipitation on irrigated crops each averaged 5% of gross precipitation for the 1990-1996 period. The fraction of precipitation that evaporated from irrigated soils averaged 56% of gross precipitation. The transpiration component was estimated to average 34% of gross precipitation, based on root extraction functions used in the K_c ET_0 computations. Year to year disposition of precipitation on agricultural lands is shown in Figure 3-11.

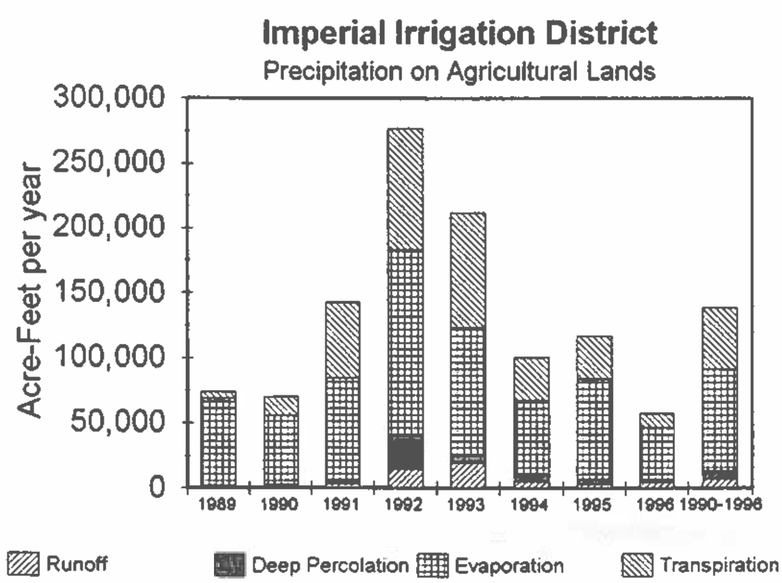

Figure 3-11. Annual disposition of precipitation on agricultural land within the IID study area, 1990 to 1996.

Evaporation from Irrigation Events. Total evaporation of both irrigation and precipitation water from cropped acres in the IID study area was estimated to average 320,000 AF/year, or 16% of total ET_c. Annual variation in evaporation from regular (soil water replacement) irrigations, special irrigations and from precipitation is shown in Figure 3-12. About 240,000 AF/year of evaporation is supplied by irrigation water, which is about 12% of total ET_c. Total evaporation of irrigation water, as a fraction of total ET_c, is shown in Figure 3-13.

Evaporation from Special Irrigation Events. Special irrigations in the IID study area include irrigations on idle and fallow fields for purposes of leaching of salts, for preplant wetting of the soil profile, for seedbed preparation, and for germination of some crops. In addition, many vegetable crops that are planted in late summer or fall months in the IID study area require sprinkle irrigation for germination and cooling during the first week or so after planting. Following establishment of the seedling crops, the sprinkler systems are normally dismantled and surface irrigation is used for the remainder of the season. The K_c ET_o model predicted evaporation from wet soil during and following special irrigations to average 43,000 AF per year or about 2.4% of total ET_c.

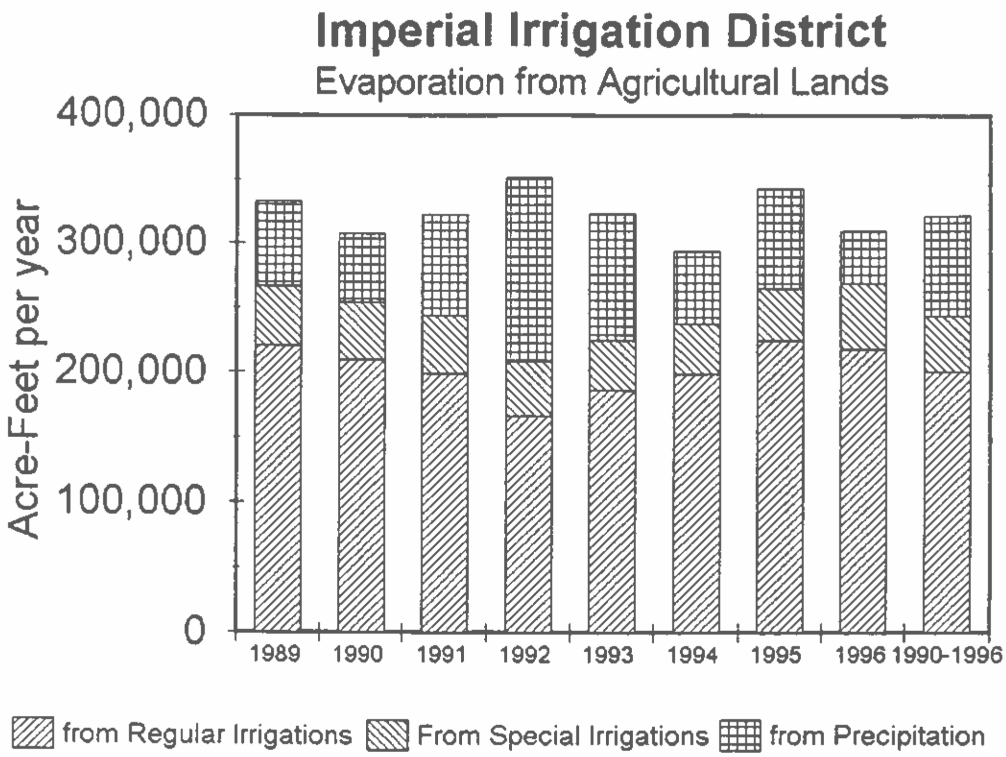

Figure 3-12. Breakdown of water supply for evaporation from agricultural land within the IID study area, 1990 to 1996.

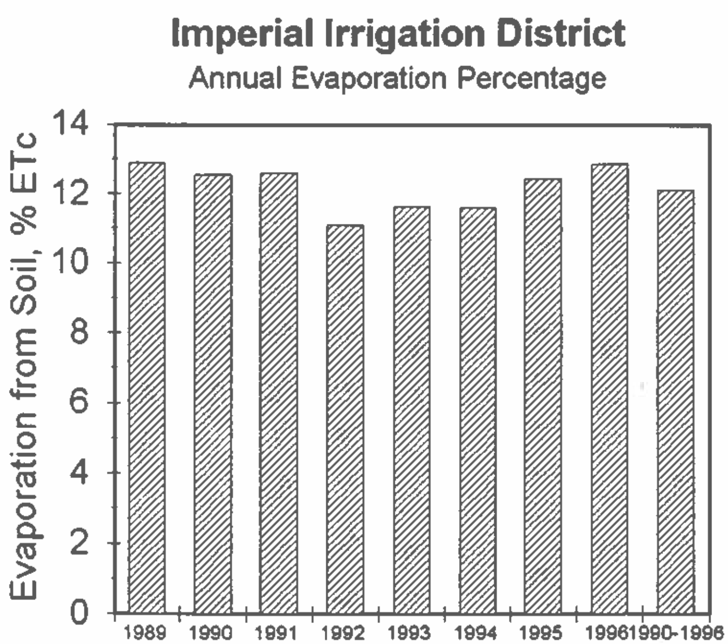

Figure 3-13. Annual fraction of ET_c from irrigation water applied to agricultural land within the IID study area that is in the form of evaporation, 1990 to 1996.

3.3 References

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4. Water Used for Salt Removal

Calculation procedures for determining the amount of water used to remove salts by deep percolation were different for light, non-cracking soils and heavy, cracking soils. Light, non-cracking and heavy, cracking soils each represent about 50% of the agricultural land in the IID study area (Appendix 4). Because we did not have detailed data on the distribution of crops on each soil, we assumed that 50% of the ET_c was associated with each of these soil categories. The procedures and their rationale are described in Appendix 4. The following sections provide a summary.

4.1 Light, Non-Cracking Soils

The net deep percolation water volumes for salt control on **non-cracking, lighter soils** were computed using the traditional leaching requirement (LR) equation based on irrigation water salinity and crop salt sensitivities.

Important factors considered included:

- Irrigation water salinity. The salinity of the irrigation water has increased since 1987.

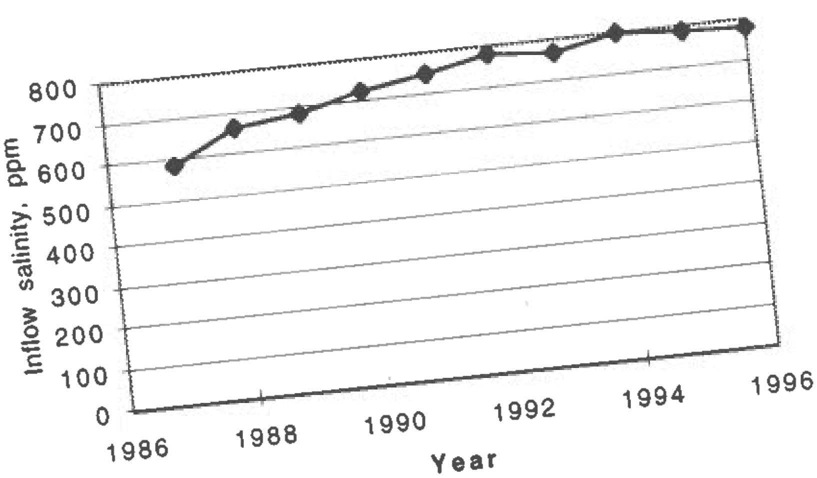

Figure 4-1. Irrigation water salinity in the IID study area over time.

- The leaching volumes for these soils were computed based on 50% of the irrigation water applied in the IID study area, which corresponds to the percentage of the soils which are non-cracking or low-cracking.

- Some salt is removed by tailwater, but computations of deep percolation did not need to be modified to account for that removal.

- Long term sustainability of a desirable salt balance generally includes both maintenance irrigations and reclamation irrigations in the the IID study area. The net effect can be calculated by using standard Leaching Requirement equations with a crop salinity threshold value of 1.7 dS/m to account for crop rotations and different rooting depths.

4.2 Heavy, Cracking Soils

The net deep percolation water volumes for salt control on **cracking, heavy soils** cannot be computed using a standard, non-adjusted Leaching Requirement (LR) equation. This has been well documented by numerous researchers.

The average soil salinities on the cracking, heavy soils are higher (about 3.5 - 4.0 dS/m) than on the lighter, non-cracking soils (about 1.7 dS/m), indicating that leaching effectiveness is less. Researchers have found that an acre-foot of deep percolation on Imperial Valley cracking heavy soils will not remove as much salt as an acre-foot of deep percolation on lighter, non-cracking soils. A "multiplier" must be used if the standard LR equation is used to predict deep percolation volumes.

Because the average soil salinities on the cracking soils are considerably higher than the salt tolerance limit (the soil salinity level at which yields begin to decline) for crops such as alfalfa, all water which deep percolates on these soils is considered to be a "net" water usage. The amount of water that can deep percolate will, in part, depend upon the extent of tile drainage. Tile drainage has increased annually in the district.

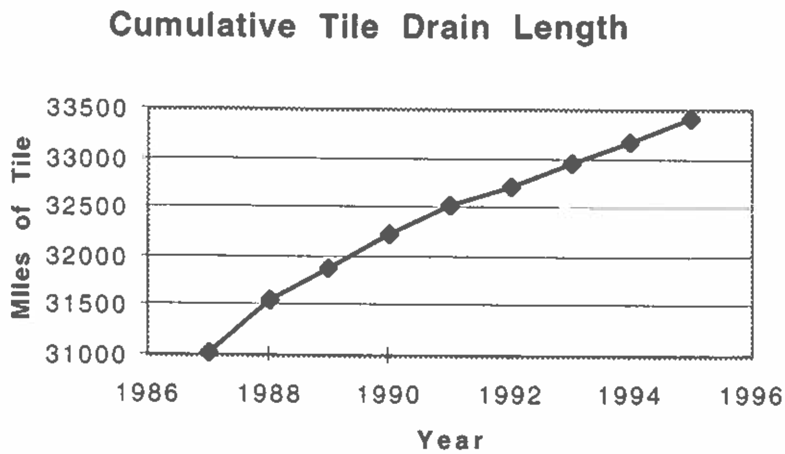

Figure 4-2. Tile drain length in the IID study area over time.

Final computations for the heavy, cracking soils were based on a LR equation multiplier of 2.0, which is less than values recommended in the literature (i.e., this gives a conservative, lower estimate of required deep percolation). The computations use an average soil salinity of 3.75 dS/m, and include annual adjustments for miles of tile drainage pipeline.

4.3 Results

Final estimates of net irrigation water deep percolation were adjusted to consider the rainfall deep percolation occurring annually. The final values have been assigned a confidence interval of ±35%.

Net LF is defined as:

$$NetLF = \frac{\text{Volume of deep percolation of irrigation water needed and used to remove salts}}{\text{Depth of irrigation water that infiltrates the soil}}$$

Table 4-1. Estimated volumes of net irrigation water used for salt control on farms in the IID study area. The values only include irrigation water (i.e., rainwater deep percolation has already been removed). This does not include additional water needed to compensate for non-uniformity of infiltration and uncertainties in irrigation timing or threshold values. All values have a confidence interval of plus or minus 35%.

Year	AF for LIGHT Soils	AF for HEAVY Soils	Total AF	NetLF	% Farm Delivered Water
1987	118,315	122,000	240,315	0.125	10.3
1988	146,987	133,462	280,449	0.135	11.0
1989	156,218	135,996	292,215	0.139	11.1
1990	168,459	137,881	306,341	0.145	11.4
1991	169,845	132,998	302,843	0.149	12.0
1992	146,651	118,167	264,818	0.148	12.2
1993	161,473	125,389	286,862	0.151	11.9
1994	187,621	139,100	326,721	0.156	12.3
1995	183,186	138,720	321,906	0.155	12.1
1996	191,212	146,777	337,989	0.156	12.1

4.4 References

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5. Irrigation Performance Indicators for the IID Study Area

In the previous chapters, we have described the disposition of water supplied by irrigation to the IID study area. In doing so, we have separated consumption from non-consumption separated uses for crop production and salt removal (values in the numerator of irrigation efficiency) from other uses. Additional distinctions are needed in this chapter to allow us to compute the various performance indicators. Details are provided in Appendix 5.

These performance indicators only deal with water that flows into the IID study area. They do not consider losses that may occur during conveyance from the Colorado River across the desert. These losses are considered to be part of the Yuma project and are shared by IID, Coachella Valley Water District, and the Bureau of Reclamation, and thus are not included herein. (See the water balance described in Chapter 2, e.g., Figure 2-17).

5.1 Irrigation Water Uses

5.1.1 Irrigation Water Supply

The annual volumes of irrigation water supplied to the IID study area are shown in Figure 5-1. Not all water entering the valley is used for irrigation, nor is all of the irrigation water delivered to farms.

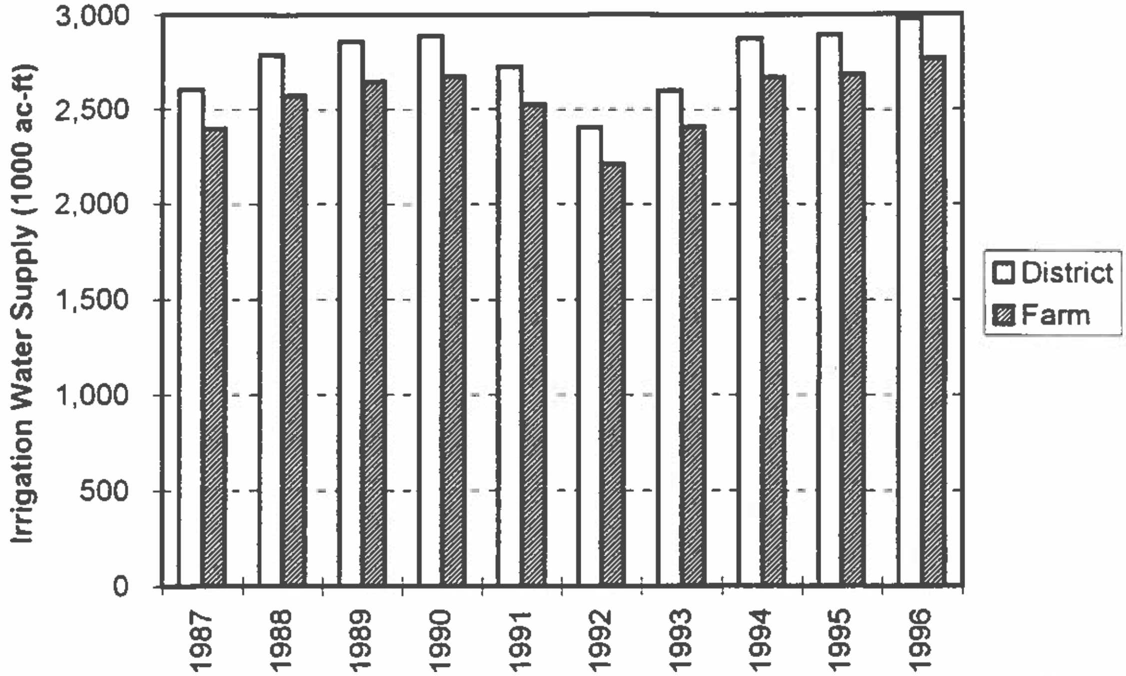

Figure 5-1. Irrigation water supply for the IID study area.

5.1.2 Irrigation Water Consumed

The various components of irrigation water consumption have been presented in Chapter 2. The main components of consumption are evaporation from open water surfaces within the distribution system, ET on farm, and ET from the drain/river system (, from drains, rivers, and phreatophytes). For the latter, we assume that if irrigation water represents 80% of the drain/river inflow, then 80% of the consumption is from irrigation water. Figure 5-2 shows the total volume of irrigation water consumed by year. Also shown are the volumes consumed for crop production. (Note the change in scale from Figure 5-1).

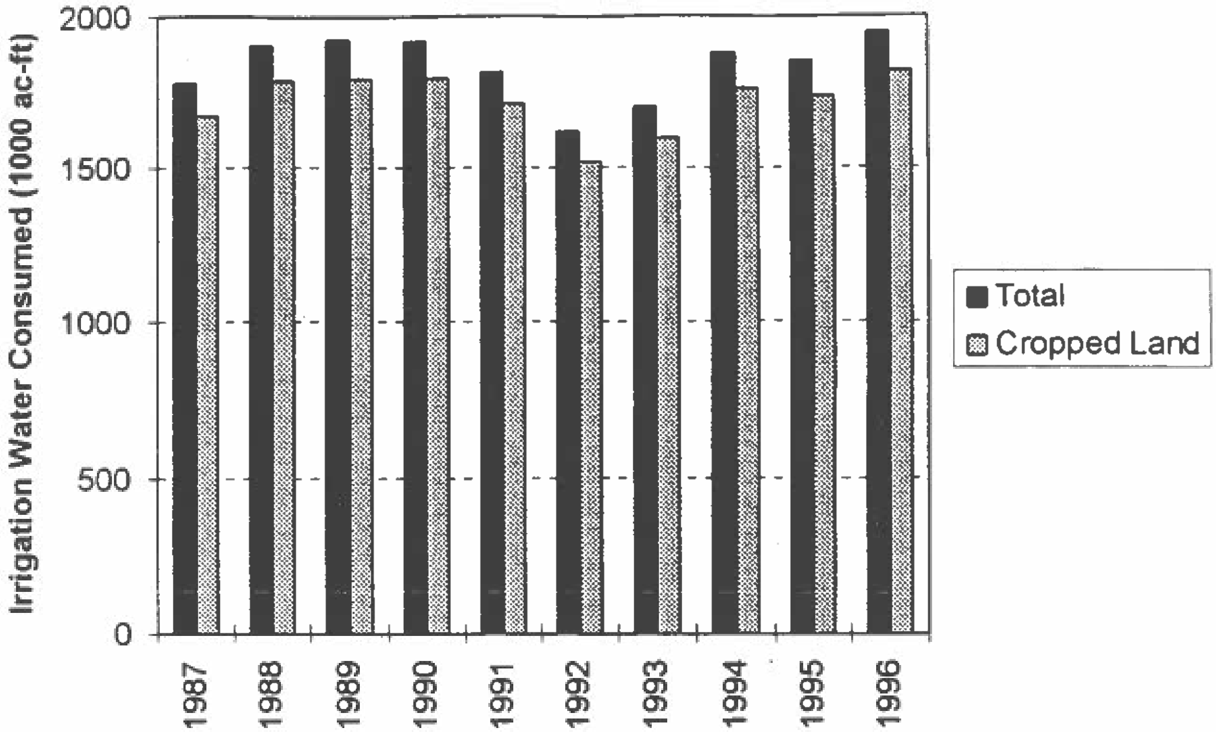

Figure 5-2. Irrigation water consumption for the IID study area.

5.1.3 Irrigation Water Used for Crop Production and Salt Removal

With the district water balance, we have a good estimate of the total volume of water consumed on the farm. Through analysis of crop water use with the crop-coefficient weather-based approach (the K_c ET_0 procedure of Chapter 3), adjusted to match the water balance, we were able to partition the consumption into various parts. In particular, basal crop ET was separated from soil evaporation.

Additional evaporation may result from wetting of non-cropped areas within the field (turn rows, tailwater ditches, etc.) and from unnecessary (i.e., too frequent) irrigations. Based on typical field layouts within the IID study area, we estimate that roughly 2% of the wetted surface area during an irrigation is uncropped. The net ET from this area is estimated to be about half that of cropped areas, thus about 1% of the crop ET is assumed unnecessary for crop production. The soil evaporation within the cropped area of the field has historically been included in crop coefficients and is generally considered necessary for crop production (i.e., included in the numerator for irrigation efficiency). With the weather-based approach, we were able to separate soil evaporation into 1) that associated with special irrigations, such as germination, seed-bed preparation, and reclamation leaching, and 2) that associated with other irrigation events. As discussed in Appendix 5, we assume that some fraction of this soil evaporation is needed for crop production. For special irrigations we assume 60% to 100% of soil evaporation is needed for crop production; for other irrigations, 30% to 100%. We recognize that these are highly subjective estimates, and more analysis of the value of soil evaporation for crop production may be justified.

The volumes of water needed for salt removal are estimated in Chapter 4 (see also Appendix 4). We presume that water for additional crop production uses (e.g., climate control) is either consumed or contributes to the removal of salts, and is thus not added as a separate volume. The volumes of irrigation water that are considered to be used for crop production and salt removal are shown in Figure 5-3.

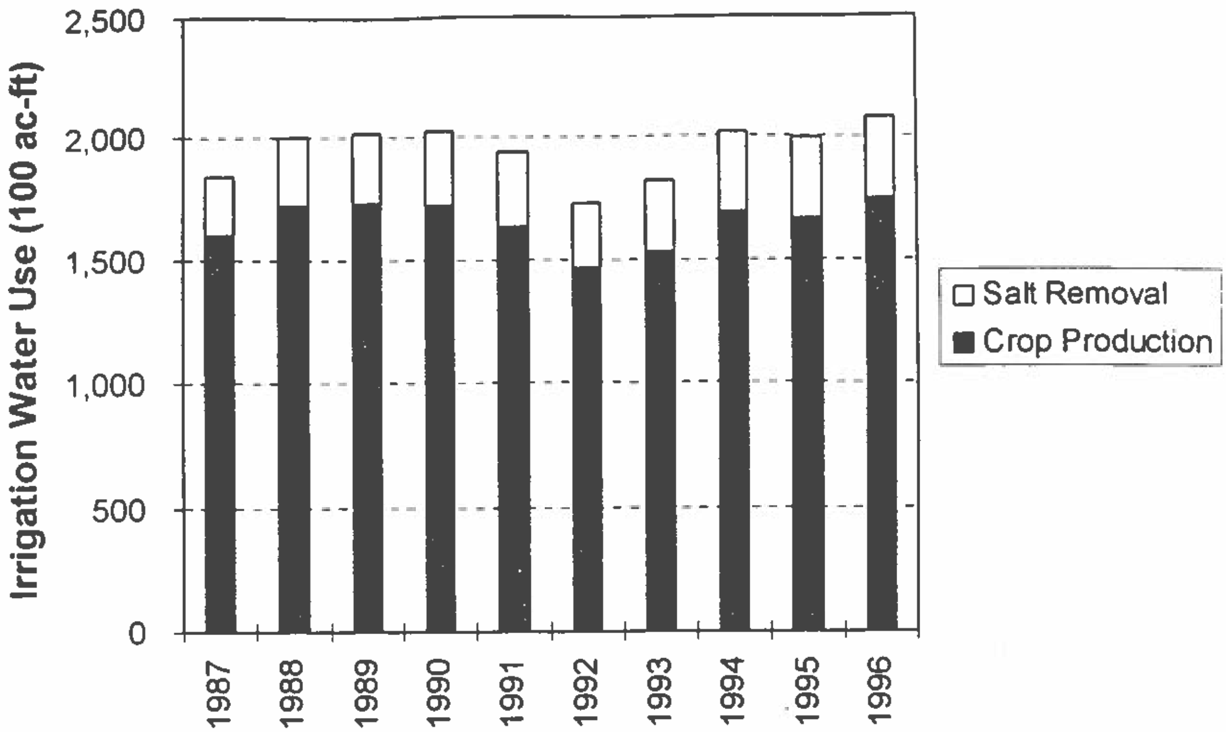

Figure 5-3. Irrigation water used for crop production and salt removal within the IID study area.

5.1.4 Disposition of Irrigation Water

The water balance allows us to determine the disposition or destination of all irrigation water. We distinguish between water consumed or non-consumed, and between water directly useful for crop production and salt removal or that which is not. For water not useful for crop production or salt removal, we also distinguish between that associated with farm practices and that occurring off-farm. The destinations for irrigation water within the IID study area, averaged for 1987 through 1996, are shown in Figure 5-4. Consumption off-farm includes evaporation and evapotranspiration from the open water surfaces and vegetation (phreatophytes) for the open drainage and river system. Only about a quarter of this off-farm consumption consists of evaporation from district canals and reservoirs.

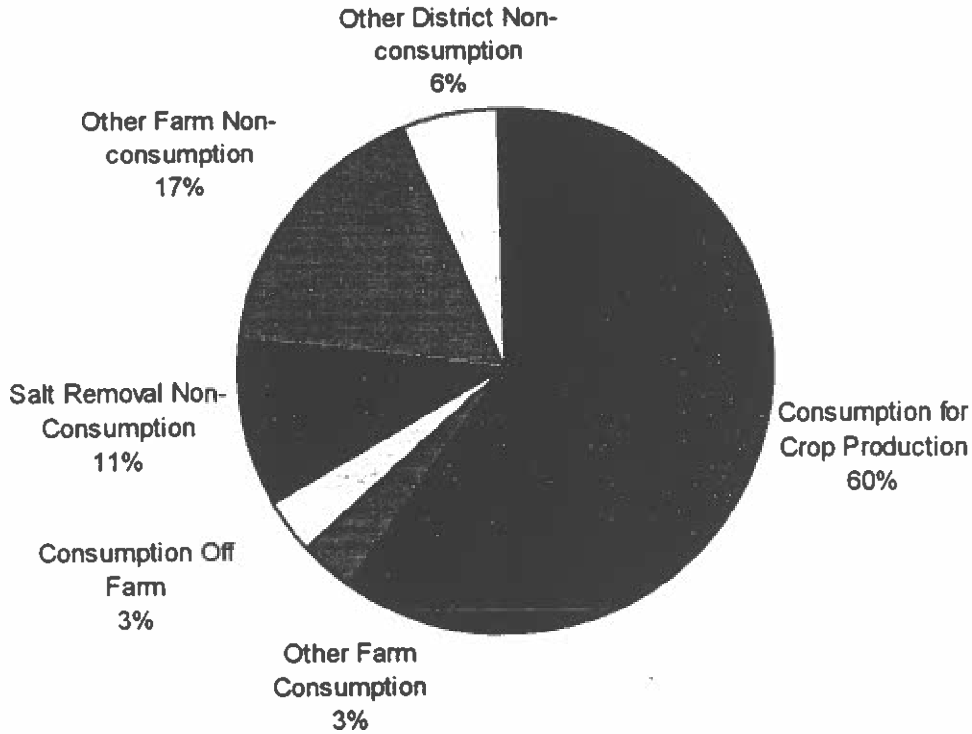

Figure 5-4. Disposition of irrigation water for the IID study area. Average for 1987 - 1996.

5.2 Irrigation Performance Parameters

From the values used to create Figure 5-4, we can determine average values for some of the irrigation water performance parameters for the ten-year period, 1987-1996. On average, 66% of the irrigation water was consumed (60% + 3% + 3%), and 71% of the irrigation water was used for crop production and salt removal (60%+11%). Thus ICUC = 66% and $IE_{District}$ = 71%. For the other performance parameters, some further distinctions are required.

The consumption off-farm that is attributed to the district (i.e., canal and reservoir evaporation) represents about 1% of the total irrigation water supply. About 8% of the irrigation water supply is not delivered to farms (6% from Figure 5-4 plus 1% and round-off error). Thus the district delivered, on average, about 92% of the water supply for the valley and the district's Distribution Efficiency, DE, was about 92%. The aggregate farm irrigation efficiency is the district irrigation efficiency divided by the district distribution efficiency, to account for the water not delivered to the farm, or IE_{Farm} = 100 x (71%/92%) = 76%. (These numbers contain some round-off error).

Figure 5-4 gives a sense of scale for the fraction of the irrigation water that goes to the various uses and provides a sense of the potential for improvements in performance. The total consumption not directly used for crop production is only about 4% of the total. Most of it is likely unavoidable. Of the non-consumed irrigation water, only about a third of it is used for salt removal (11%/[11%+17%+6%]), about one-sixth results from district operations, and about half from on-farm irrigation practices.

In a prior report (Jensen, 1995), the issue was raised that the performance of irrigation practices within the Imperial Valley was declining, even when conservation measures had been taken at the district level. This conclusion was reached based on apparent changes in the fraction of irrigation water consumed. Based on the results of our analysis, given below, we feel that these conclusions may have been overstated.

5.2.1 Irrigation Consumptive Use Coefficient, ICUC

As discussed above, the average ICUC is 66%, meaning that 66% of the irrigation water is consumed. Figure 5-5 shows the ICUC as a function of time and the regression trend line. This trend has a slope of -0.4%/year, or about 0.4% decrease in the consumed fraction per year, and is statistically significant at the 5% level. Also shown in Figure 5-5 are the 95% confidence intervals for the individual annual estimates, which average ±2.8% (relative to unity). This trend is significant regardless of whether these confidence intervals are included in the regression analysis. (See Appendix 5.5 for details). Note that the confidence intervals are wider during 1992 and 1993. This is due to the high amount of rainfall, which has a greater relative uncertainty in the water balance than the irrigation water supply.

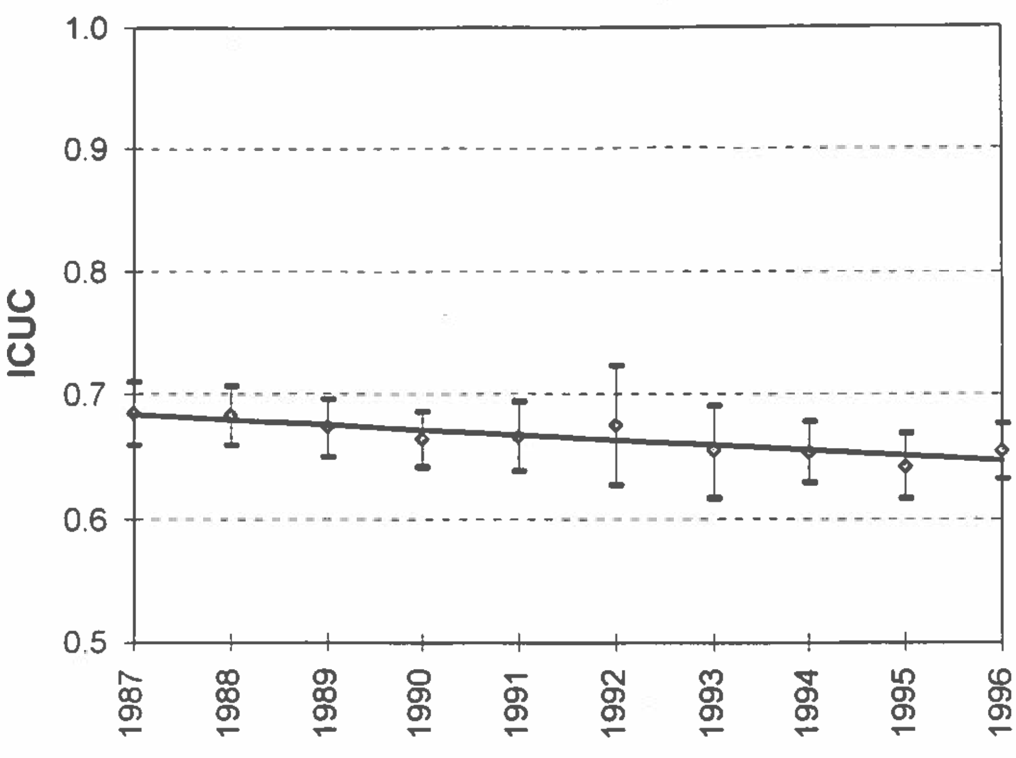

Figure 5-5. Irrigation consumptive use coefficients for the IID study area.

5.2.2 *District Irrigation Efficiency, $IE_{District}$*

The values for district Irrigation Efficiency are shown in Figure 5-6. The slight downward trend in efficiency is not statistically significant (see Appendix 5, Table A5-20). The reason that the fraction of consumptive uses have changed and the fraction of crop production and salt removal uses have not changed results from changes in water used for salt removal. More leaching for salt removal is occurring for two primary reasons. First, the Colorado River water salinity has risen. On all soils, more leaching is needed to keep soil salinities, and thus plant stress, down to acceptable levels. This will occur whether farmers use soil salinity measurements to apply additional water or plant stress indicators to schedule irrigations more frequently. Second on heavy soils that are difficult to drain, more tile drainage has been installed. These soils do not have adequate leaching, on average, and this additional drainage is essentially all useful for salt removal. The 95% confidence intervals on district IE average ±5.5% for the study period (relative to 100%, not as a percent of value).

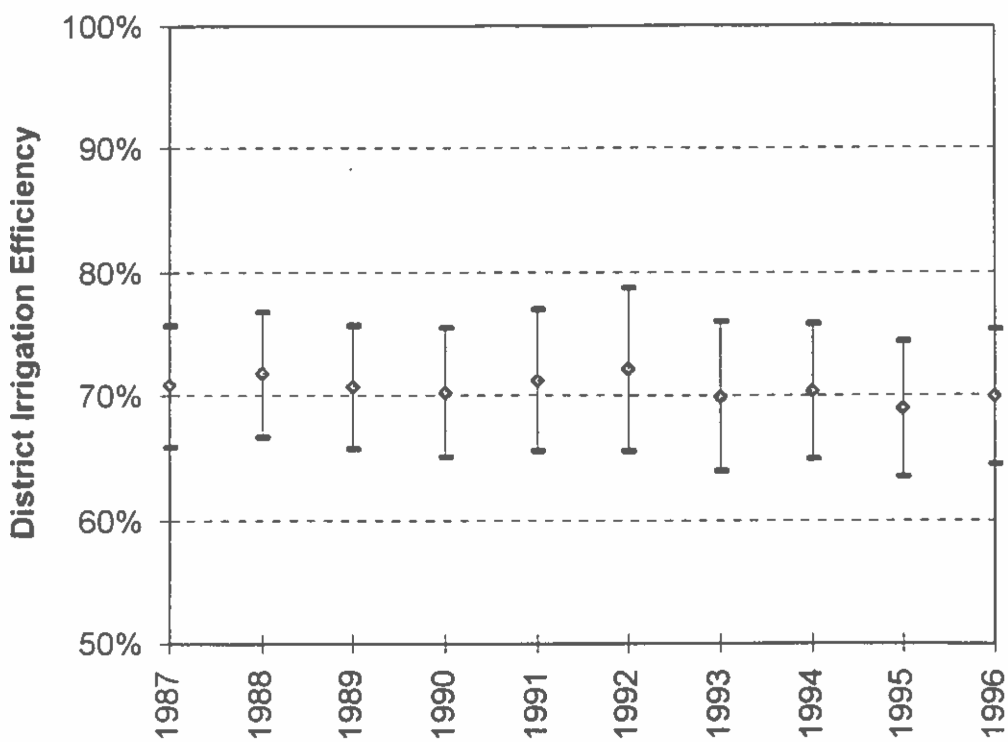

Figure 5-6. District irrigation efficiencies for the IID study area, Imperial Valley, CA.

5.2.3 District Distribution Efficiency, DE

The district distribution efficiency represents the fraction of its water supply that the district delivers to its users. Based on the accuracy of the canal-system water balance, we feel that we have an accurate picture of the district's Distribution Efficiency. The DE over the 10-year period is presented in Figure 5-7, along with its 95% confidence intervals. These confidence intervals average ±0.9%. A regression analysis on DE shows a slight increase over the 10-year period with a slope of about 0.1% per year. This slope is significant at the 5% level even if we include the confidence intervals in the analysis. This statistic is somewhat misleading in that the canal system losses did not change much from 1987 to 1996 (Figure 2-11). However, the relative amount of losses was less since more irrigation water was delivered.

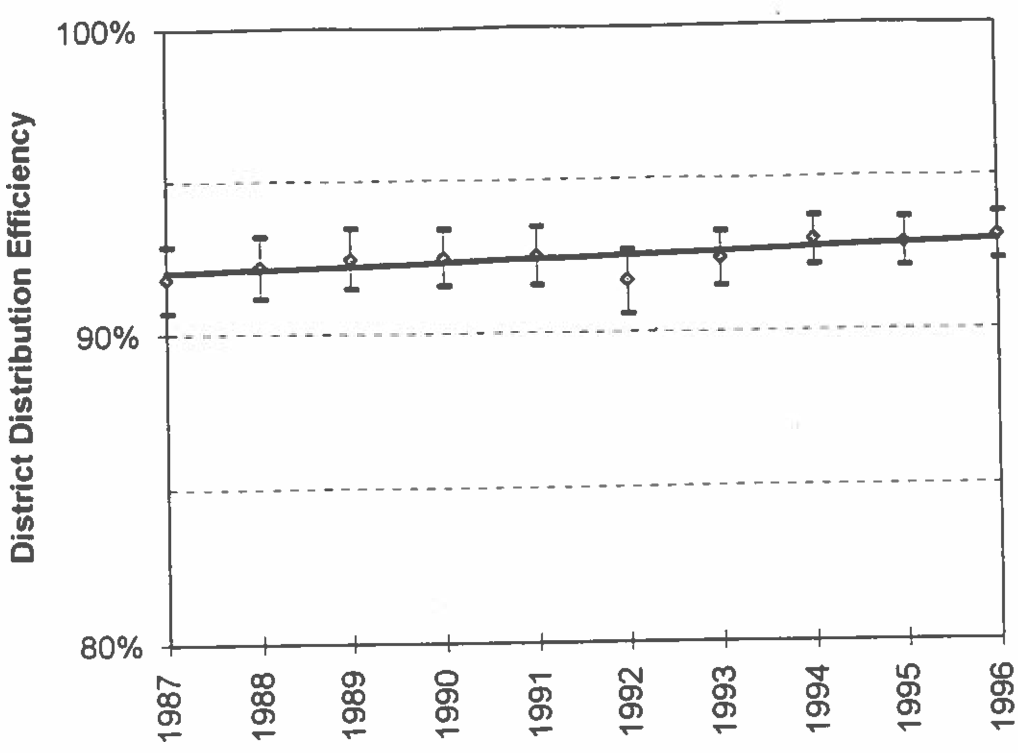

Figure 5-7. District distribution efficiencies for the IID study area, Imperial Valley, CA.

5.2.4 *Farm Irrigation Efficiency, IE_{Farm}*

The aggregate farm Irrigation Efficiency over the ten-year period is shown in Figure 5-8, along with their confidence intervals which average ±6.0%. The slope of the farm IE regression is approximately the sum of the slopes for district IE and DE, as expected. This downward slope of 0.28% per year over 10 years represents a change from 1987 to 1996 of approximately 71,000 ac-ft per year (2.8% times 2.55 million ac-ft delivered per year). The downward trend in farm IE is statistically significant if the confidence intervals are not included in the analysis. However, including even a small random error component makes this trend not statistically significant. Thus we can not conclude that this trend is statistically significant.

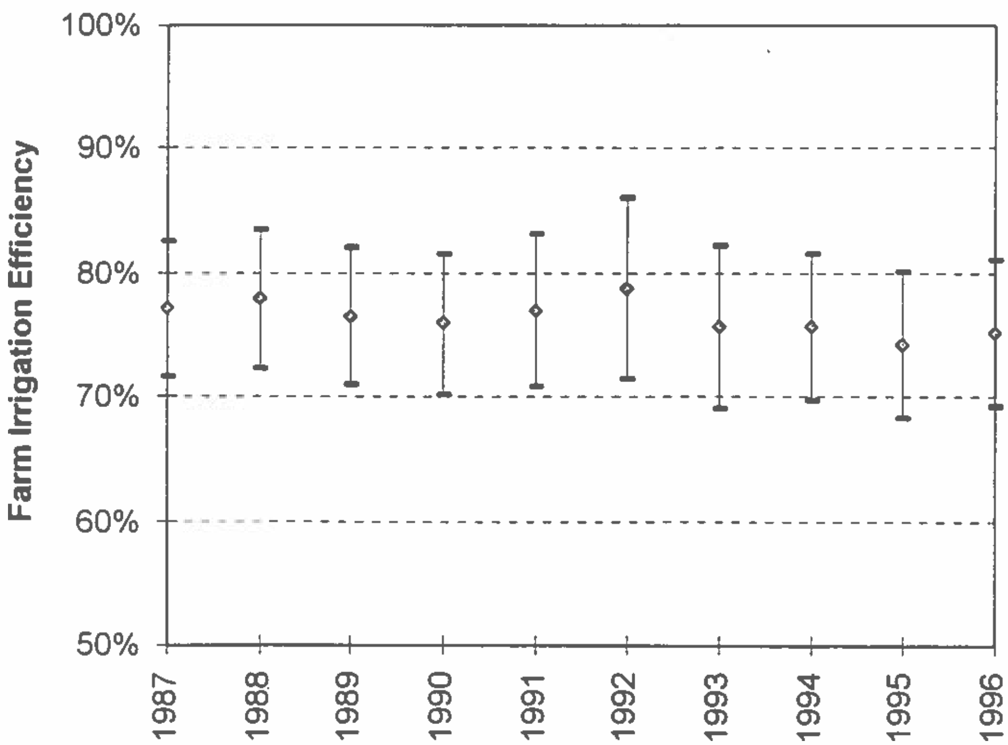

Figure 5-8. Aggregate farm irrigation efficiencies for the IID study area.

The farm IE remained relatively constant from 1987 through 1992. In fact, a regression analysis of these years produces an upward trend, although not a significant one. It appears equally likely that there was a shift in farm irrigation efficiency after 1992. The efficiencies for the years 1993 to 1996 (average 75%) are on average 2% lower than the years 1987 to 1992 (77%). A t-test was run to determine if these populations (years 1987-1992 and 1993-1996) were different, assuming the samples had the same variance. The test was performed for a 1% difference in efficiency and the resulting significance probability was 0.060, meaning that there is only a 6% probability that these two samples are not different by at least 1%. This is about the same as the significance probability for the trend statistic (0.048 in Table A5-21, assuming uncertainty does not influence the probability).

Figure 5-9 shows the farm IE relative to the average for the study period and the negative (to show comparison more clearly) of the farm water balance error (Figure 2-12). These track each other fairly well. Two possible interpretations of this are: 1) the inaccuracy of our water balance is causing the farm IE to appear to have changed or 2) any changes in farm IE are not being detected by our independent estimate of these water quantities. For the former, one explanation would be that our estimates of water used for salt removal are not being adjusted properly from year to year. For the latter interpretation, one explanation would be that our estimates of tailwater are not being adjusted properly from year to year. Clearly, more information is needed to determine factors and trends in the farm irrigation efficiencies within the district.

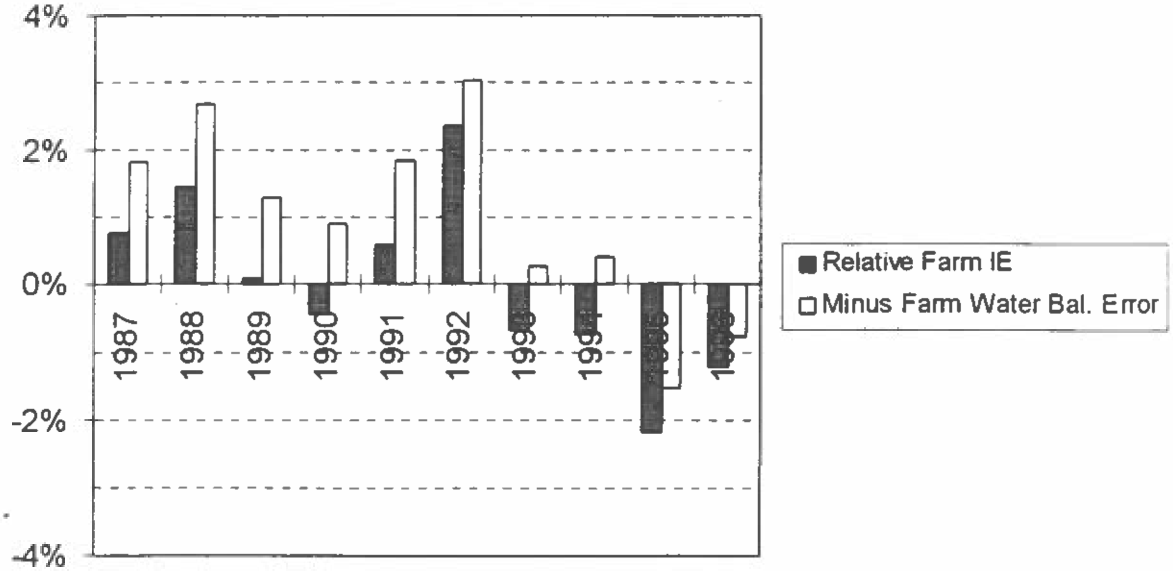

Figure 5-9. Aggregate farm irrigation efficiencies, relative to the average value, and negative error in the aggregate farm water balance for the IID study area.

5.3 Performance Summary

The valley-wide irrigation consumptive use coefficient has decreased by approximately 0.4% per year over the 10-year period 1987-1996 (about 4% in total). This decrease is statistically significant. The district irrigation efficiency has remained essentially unchanged, apparently but not statistically decreasing by 1% to 2% over this 10-year period. The increase in district distribution efficiency of about 1% over this period is statistically significant. Changes in farm irrigation efficiency are not statistically significant, although they appear to decrease by about 2% to 3%. Both a downward trend and a shift after 1992 are equally likely.

The possible (but not statistically significant) downward trend or shift in aggregate farm irrigation efficiency, when coupled with the increases in leaching for salt removal, might explain the downward trend in the consumptive use coefficient and the apparent increase in the fraction of irrigation water going to the Salton Sea, even when some improvement has been made in district operations. The use of the water balance volumes for water delivered to farms rather than district records has increased the estimate for the district's distribution efficiency and has decreased the estimate for aggregate farm irrigation efficiency by about 3%, relative to that computed from delivery records.

These results suggest that much more effort is required to develop an understanding of current farm water management practices and limitations, and how they are changing over time. Identifying potential water conservation practices at the farm level should be a high priority.

IMPERIAL IRRIGATION DISTRICT
WATER USE ASSESSMENT
FOR THE YEARS 1987-1996

ANNEXES

March 1998

prepared for

Imperial Irrigation District

by the

Water Study Team (WST)

ANNEX 2

ANNEX 2

Monthly Water Balances for 1990 - 1996

Annual Water Balances and Performance Calculations for 1990 - 1997

Additional Calculations

Monthly Water Balances for 1990 - 1996

Consumption plus change in storage on Agricultural Land

Water balance component	Units	1990	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	3420	161	201	305	362	388	343	380	345	285	263	211	177	3420
Water Delivered to Coachella Canal	1000 ac-ft	359	19	21	30	36	42	36	40	37	32	23	20	22	359
Deliveries to IID Farms above EHL	1000 ac-ft	3	0.2	0.1	0.3	0.3	0.3	0.3	0.1	0.4	0.5	0.6	0.1	0.2	3
M&I Deliveries	1000 ac-ft	70	4.5	4.4	5.2	5.5	6.9	7.2	7.1	7.5	6.7	6.1	4.3	4.5	70
M&I Returnflows	1000 ac-ft	16	1.0	1.0	1.2	1.2	1.6	1.6	1.6	1.7	1.5	1.4	1.0	1.0	16
Alamo River outflow to Sea	1000 ac-ft	618	39	42	59	64	62	48	51	53	50	57	49	44	618
New River outflow to Sea	1000 ac-ft	431	33	33	40	42	41	35	36	38	34	35	31	32	431
Direct outflow to Sea	1000 ac-ft	91	7	7	9	9	10	7	7	7	7	8	7	6	91
Mesa Storm Inflows	1000 ac-ft	2	0.1	0.0	0.1	0.0	0.2	0.1	0.1	0.6	0.4	0.4	0.0	0.0	2
Subsurface inflow to drains (external sources)	1000 ac-ft	20	2	2	2	2	2	2	2	2	2	2	2	2	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface inflow from Mexico	1000 ac-ft	135	15	12	13	12	11	11	10	12	10	10	9	12	135
Reference ET	ft	6.36	0.25	0.31	0.50	0.64	0.85	0.81	0.82	0.70	0.56	0.42	0.29	0.21	6.36
Rainfall	ft	0.14	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.04	0.03	0.03	0.00	0.00	0.14
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	485863	485863	485863	485863	485863	485863	485863	485863	485863	485863	485863	485863	485863	485863
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	153261	153261	153261	153261	153261	153261	153261	153261	153261	153261	153261	153261	153261	153261
Total Area		656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

1990

Water Balance for			1990		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	3,420	3,420	161	161	201	201	305	305	362	362	388	388
Water Delivered to Coachella Canal	(1)	359	(359)	19	(19)	21	(21)	30	(30)	36	(36)	42	(42)
Deliveries to IID Farms above EHL	(1)	3	(3)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	5	(5)	0	(0)	0	(0)	0	(0)	1	(1)	1	(1)
All American Canal inflow		Sum =	2,957	Sum =	134	Sum =	172	Sum =	266	Sum =	317	Sum =	337
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	2,957	2,957	134	134	172	172	266	266	317	317	337	337
Surface Inflow from Mexico	1	135	135	15	15	12	12	13	13	12	12	11	11
Rainfall Volume	1	91	91	6	6	0	0	5	5	1	1	9	9
Other surface inflows	1	2	2	0	0	0	0	0	0	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,206	Sum =	156	Sum =	185	Sum =	285	Sum =	331	Sum =	359
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	618	618	39	39	42	42	59	59	64	64	62	62
New River outflow to Sea	1	431	431	33	33	33	33	40	40	42	42	41	41
Direct outflow to Sea	1	91	91	7	7	7	7	9	9	9	9	10	10
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,140	Sum =	78	Sum =	81	Sum =	108	Sum =	115	Sum =	113
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,206	3,206	156	156	185	185	285	285	331	331	359	359
Total outflow	-1	1,140	(1,140)	78	(78)	81	(81)	108	(108)	115	(115)	113	(113)
Total water consumption + storage change		Sum =	2,065	Sum =	78	Sum =	104	Sum =	177	Sum =	217	Sum =	246
Total water consumption on Ag. land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,065	2,065	78	78	104	104	177	177	217	217	246	246
Canal and Reservoir Evap.	-1	24	(24)	1	(1)	1	(1)	2	(2)	2	(2)	3	(3)
M & I consumption	-1	54	(54)	3	(3)	3	(3)	4	(4)	4	(4)	5	(5)
ET - drains, rivers, phreatophytes	(1.0)	89.2	(89.2)	3.6	(3.6)	4.4	(4.4)	7.0	(7.0)	8.9	(8.9)	11.9	(11.9)
ET - rainfall on non-Ag land	(1.0)	16.0	(16.0)	1.0	(1.0)	0.0	0.0	0.8	(0.8)	0.2	(0.2)	1.6	(1.6)
Total water consumption on Ag. land + dS			1,882		69		95		163		201		223

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
343	343	380	380	345	345	285	285	263	263	211	211	177	177	3,420	3,420
36	(36)	40	(40)	37	(37)	32	(32)	23	(23)	20	(20)	22	(22)	359	(359)
0	(0)	0	(0)	0	(0)	1	(1)	1	(1)	0	(0)	0	(0)	3	(3)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	0	(0)	5	(5)
Sum =	298	Sum =	331	Sum =	299	Sum =	244	Sum =	231	Sum =	182	Sum =	146	Sum =	2,957
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
298	298	331	331	299	299	244	244	231	231	182	182	146	146	2,957	2,957
11	11	10	10	12	12	10	10	10	10	9	9	12	12	135	135
6	6	4	4	25	25	17	17	18	18	0	0	0	0	91	91
0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	316	Sum =	347	Sum =	338	Sum =	273	Sum =	261	Sum =	193	Sum =	160	Sum =	3,206
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
48	48	51	51	53	53	50	50	57	57	49	49	44	44	618	618
35	35	36	36	38	38	34	34	35	35	31	31	32	32	431	431
7	7	7	7	7	7	7	7	8	8	7	7	6	6	91	91
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	90	Sum =	95	Sum =	98	Sum =	92	Sum =	101	Sum =	86	Sum =	81	Sum =	1,140
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
316	316	347	347	338	338	273	273	261	261	193	193	160	160	3,206	3,206
90	(90)	95	(95)	98	(98)	92	(92)	101	(101)	86	(86)	81	(81)	1,140	(1,140)
Sum =	226	Sum =	252	Sum =	240	Sum =	181	Sum =	160	Sum =	107	Sum =	79	Sum =	2,065
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
226	226	252	252	240	240	181	181	160	160	107	107	79	79	2,065	2,065
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	24	(24)
6	(6)	6	(6)	6	(6)	5	(5)	5	(5)	3	(3)	4	(4)	54	(54)
11.4	(11.4)	11.4	(11.4)	9.8	(9.8)	7.9	(7.9)	5.9	(5.9)	4.1	(4.1)	2.9	(2.9)	89.2	(89.2)
1.0	(1.0)	0.7	(0.7)	4.4	(4.4)	3.1	(3.1)	3.1	(3.1)	0.1	(0.1)	0.0	0.0	16.0	(16.0)
	205		231		217		163		144		99		71		1,882

Water balance component	Units	1991	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	3,211	131	197	217	370	385	348	377	342	269	281	203	90	3211
Water Delivered to Coachella Canal	1000 ac-ft	308	16	23	15	30	37	33	35	34	28	25	18	14	308
Deliveries to IID Farms above EHL	1000 ac-ft	6	0.2	0.1	0.1	0.3	0.4	0.4	1.0	1.1	1.1	1.1	0.1	0.1	6
M&I Deliveries	1000 ac-ft	72	4.6	4.5	5.3	5.7	7.1	7.4	7.4	7.7	6.9	6.3	4.4	4.7	72
M&I Returnflows	1000 ac-ft	16	1.0	1.0	1.2	1.3	1.6	1.7	1.6	1.7	1.5	1.4	1.0	1.0	16
Alamo River outflow to Sea	1000 ac-ft	594	35	43	50	64	65	51	49	49	48	59	48	33	594
New River outflow to Sea	1000 ac-ft	411	31	30	35	40	40	35	35	36	35	34	30	29	411
Direct outflow to Sea	1000 ac-ft	88	6	6	7	9	9	8	7	7	7	9	7	5	88
Mesa Storm inflows	1000 ac-ft	5	0.8	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.6	0.3	0.1	1.5	5
Subsurface inflow to drains (external sources)	1000 ac-ft	20	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface inflow from Mexico	1000 ac-ft	133	14	10	12	11	11	10	11	11	11	8	9	14	133
Reference ET	ft	5.66	0.20	0.28	0.38	0.56	0.70	0.71	0.72	0.70	0.53	0.45	0.27	0.16	5.66
Rainfall	ft	0.29	0.05	0.04	0.05	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.01	0.09	0.29
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	482,833	482833	482833	482833	482833	482833	482833	482833	482833	482833	482833	482833	482833	482833
Phreatophyte acerage	ac	11,424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3,401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2,357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	156,291	156291	156291	156291	156291	156291	156291	156291	156291	156291	156291	156291	156291	156291
Total Area		656,306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

1991

Water Balance for			1991		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	3,211	3,211	131	131	197	197	217	217	370	370	385	385
Water Delivered to Coachella Canal	(1)	308	(308)	16	(16)	23	(23)	15	(15)	30	(30)	37	(37)
Deliveries to IID Farms above EHL	(1)	6	(6)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	5	(5)	0	(0)	0	(0)	0	(0)	0	(0)	1	(1)
All American Canal inflow		Sum =	2,798	Sum =	107	Sum =	166	Sum =	194	Sum =	332	Sum =	340
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	2,798	2,798	107	107	166	166	194	194	332	332	340	340
Surface Inflow from Mexico	1	133	133	14	14	10	10	12	12	11	11	11	11
Rainfall Volume	1	193	193	32	32	27	27	30	30	0	0	0	0
Other surface inflows	1	5	5	1	1	1	1	1	1	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,148	Sum =	155	Sum =	205	Sum =	238	Sum =	345	Sum =	353
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	594	594	35	35	43	43	50	50	64	64	65	65
New River outflow to Sea	1	411	411	31	31	30	30	35	35	40	40	40	40
Direct outflow to Sea	1	88	88	6	6	6	6	7	7	9	9	9	9
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,094	Sum =	72	Sum =	80	Sum =	93	Sum =	113	Sum =	114
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,148	3,148	155	155	205	205	238	238	345	345	353	353
Total outflow	-1	1,094	(1,094)	72	(72)	80	(80)	93	(93)	113	(113)	114	(114)
Total water consumption + storage change		Sum =	2,054	Sum =	83	Sum =	124	Sum =	146	Sum =	232	Sum =	238
Total water consumption on Ag. land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,054	2,054	83	83	124	124	146	146	232	232	238	238
Canal and Reservoir Evap.	-1	21	(21)	1	(1)	1	(1)	1	(1)	2	(2)	3	(3)
M & I consumption	-1	56	(56)	4	(4)	4	(4)	4	(4)	4	(4)	6	(6)
ET - drains, rivers, phreatophytes	-1	79	(79)	3	(3)	4	(4)	5	(5)	8	(8)	10	(10)
ET - rainfall on non-Ag land	-1	34	(34)	6	(6)	5	(5)	5	(5)	0	0	0	0
Total water consumption on Ag. land + dS			1,863		70		111		129		218		220

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
348	348	377	377	342	342	269	269	281	281	203	203	90	90	3,211	3,211
33	(33)	35	(35)	34	(34)	28	(28)	25	(25)	18	(18)	14	(14)	308	(308)
0	(0)	1	(1)	1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	6	(6)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	0	(0)	5	(5)
Sum =	305	Sum =	333	Sum =	298	Sum =	232	Sum =	248	Sum =	177	Sum =	68	Sum =	2,798
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
305	305	333	333	298	298	232	232	248	248	177	177	68	68	2,798	2,798
10	10	11	11	11	11	11	11	8	8	9	9	14	14	133	133
0	0	0	0	2	2	24	24	11	11	6	6	61	61	193	193
0	0	0	0	0	0	1	1	0	0	0	0	2	2	5	5
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	317	Sum =	345	Sum =	312	Sum =	269	Sum =	268	Sum =	194	Sum =	146	Sum =	3,149
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
51	51	49	49	49	49	48	48	59	59	48	48	33	33	594	594
35	35	35	35	36	36	35	35	34	34	30	30	29	29	411	411
8	8	7	7	7	7	7	7	9	9	7	7	5	5	88	88
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	94	Sum =	91	Sum =	93	Sum =	90	Sum =	101	Sum =	84	Sum =	67	Sum =	1,094
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
317	317	345	345	312	312	269	269	268	268	194	194	146	146	3,149	3,149
94	(94)	91	(91)	93	(93)	90	(90)	101	(101)	84	(84)	67	(67)	1,094	(1,094)
Sum =	223	Sum =	254	Sum =	220	Sum =	179	Sum =	167	Sum =	109	Sum =	79	Sum =	2,054
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
223	223	254	254	220	220	179	179	167	167	109	109	79	79	2,054	2,054
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	21	(21)
6	(6)	6	(6)	6	(6)	5	(5)	5	(5)	3	(3)	4	(4)	56	(56)
10	(10)	10	(10)	10	(10)	7	(7)	6	(6)	4	(4)	2	(2)	79	(79)
0	0	0	0	0	(0)	4	(4)	2	(2)	1	(1)	11	(11)	34	(34)
	205		235		201		160		152		100		62		1,863

Water balance component	Units	1992	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	2876	133	137	216	341	343	318	343	264	229	245	199	108	2876
Water Delivered to Coachella Canal	1000 ac-ft	297	13	14	18	29	37	33	35	35	29	22	21	13	297
Deliveries to IID Farms above EHL	1000 ac-ft	4	0.2	0.2	0.0	0.3	0.5	0.5	0.6	0.6	0.7	0.5	0.3	0.0	4
M&I Deliveries	1000 ac-ft	73	4.7	4.6	5.4	5.7	7.2	7.5	7.4	7.8	7.0	6.3	4.4	4.7	73
M&I Returnflows	1000 ac-ft	17	1.1	1.1	1.2	1.3	1.7	1.7	1.7	1.8	1.6	1.5	1.0	1.1	17
Alamo River outflow to Sea	1000 ac-ft	546	31	35	57	58	61	49	47	40	38	53	42	35	546
New River outflow to Sea	1000 ac-ft	397	28	30	42	43	42	31	30	33	30	34	26	28	397
Direct outflow to Sea	1000 ac-ft	81	6	6	8	9	9	7	6	6	6	7	6	5	81
Mesa Storm Inflows	1000 ac-ft	9	1.1	1.3	3.3	0.2	0.3	0.0	0.0	0.9	0.0	0.4	0.0	1.9	9
Subsurface inflow to drains (external sources)	1000 ac-ft	20	2	2	2	2	2	2	2	2	2	2	2	2	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface Inflow from Mexico	1000 ac-ft	145	12	14	17	17	13	9	8	14	9	8	7	15	145
Reference ET	ft	5.86	0.21	0.28	0.37	0.58	0.68	0.79	0.80	0.73	0.58	0.41	0.26	0.16	5.86
Rainfall	ft	0.57	0.07	0.08	0.20	0.01	0.02	0.00	0.00	0.06	0.00	0.03	0.00	0.11	0.57
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	480567	480567	480567	480567	480567	480567	480567	480567	480567	480567	480567	480567	480567	480567
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	158557	158557	158557	158557	158557	158557	158557	158557	158557	158557	158557	158557	158557	158557
Total Area		656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

1992

Water Balance for			1992		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,600 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	2,876	2,876	133	133	137	137	216	216	341	341	343	343
Water Delivered to Coachella Canal	(1)	297	(297)	13	(13)	14	(14)	18	(18)	29	(29)	37	(37)
Deliveries to IID Farms above EHL	(1)	4	(4)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	5	(5)	0	(0)	0	(0)	0	(0)	0	(0)	1	(1)
All American Canal inflow		Sum =	2,475	Sum =	111	Sum =	115	Sum =	190	Sum =	303	Sum =	297
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	2,475	2,475	111	111	115	115	190	190	303	303	297	297
Surface inflow from Mexico	1	145	145	12	12	14	14	17	17	17	17	13	13
Rainfall Volume	1	376	376	43	43	51	51	134	134	9	9	10	10
Other surface inflows	1	9	9	1	1	1	1	3	3	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,025	Sum =	170	Sum =	183	Sum =	346	Sum =	331	Sum =	323
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	546	546	31	31	35	35	57	57	58	58	61	61
New River outflow to Sea	1	397	397	28	28	30	30	42	42	43	43	42	42
Direct outflow to Sea	1	81	81	6	6	6	6	8	8	9	9	9	9
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,024	Sum =	65	Sum =	70	Sum =	107	Sum =	110	Sum =	112
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,025	3,025	170	170	183	183	346	346	331	331	323	323
Total outflow	-1	1,024	(1,024)	65	(65)	70	(70)	107	(107)	110	(110)	112	(112)
Total water consumption + storage change		Sum =	2,001	Sum =	104	Sum =	113	Sum =	239	Sum =	221	Sum =	211
Total water consumption on Ag. land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,001	2,001	104	104	113	113	239	239	221	221	211	211
Canal and Reservoir Evap.	-1	22	(22)	1	(1)	1	(1)	1	(1)	2	(2)	3	(3)
M & I consumption	-1	56	(56)	4	(4)	4	(4)	4	(4)	4	(4)	6	(6)
ET - drains, rivers, phreatophytes	(1.0)	82.1	(82.1)	3.0	(3.0)	3.9	(3.9)	5.2	(5.2)	8.1	(8.1)	9.5	(9.5)
ET - rainfall on non-Ag land	(1.0)	68.1	(68.1)	7.8	(7.8)	9.2	(9.2)	24.2	(24.2)	1.6	(1.6)	1.9	(1.9)
Total water consumption on Ag. land + dS			1,773		89		95		204		205		192

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
318	318	343	343	264	264	229	229	245	245	199	199	108	108	2,876	2,876
33	(33)	35	(35)	35	(35)	29	(29)	22	(22)	21	(21)	13	(13)	297	(297)
0	(0)	1	(1)	1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	4	(4)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	0	(0)	5	(5)
Sum =	276	Sum =	299	Sum =	220	Sum =	191	Sum =	215	Sum =	169	Sum =	87	Sum =	2,475
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
276	276	299	299	220	220	191	191	215	215	169	169	87	87	2,475	2,475
9	9	8	8	14	14	9	9	8	8	7	7	15	15	145	145
0	0	0	0	37	37	0	0	17	17	0	0	75	75	376	376
0	0	0	0	1	1	0	0	0	0	0	0	2	2	9	9
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	287	Sum =	310	Sum =	273	Sum =	202	Sum =	242	Sum =	178	Sum =	181	Sum =	3,025
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
49	49	47	47	40	40	38	38	53	53	42	42	35	35	546	546
31	31	30	30	33	33	30	30	34	34	26	26	28	28	397	397
7	7	6	6	6	6	6	6	7	7	6	6	5	5	81	81
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	87	Sum =	83	Sum =	79	Sum =	74	Sum =	94	Sum =	75	Sum =	68	Sum =	1,024
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
287	287	310	310	273	273	202	202	242	242	178	178	181	181	3,025	3,025
87	(87)	83	(83)	79	(79)	74	(74)	94	(94)	75	(75)	68	(68)	1,024	(1,024)
Sum =	200	Sum =	227	Sum =	194	Sum =	128	Sum =	148	Sum =	104	Sum =	113	Sum =	2,001
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
200	200	227	227	194	194	128	128	148	148	104	104	113	113	2,001	2,001
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	22	(22)
6	(6)	6	(6)	6	(6)	5	(5)	5	(5)	3	(3)	4	(4)	56	(56)
11.1	(11.1)	11.2	(11.2)	10.3	(10.3)	8.1	(8.1)	5.7	(5.7)	3.7	(3.7)	2.3	(2.3)	82.1	(82.1)
0.0	0.0	0.1	(0.1)	6.7	(6.7)	0.0	0.0	3.0	(3.0)	0.0	0.0	13.7	(13.7)	68.1	(68.1)
	180		207		168		113		133		96		92		1,773

Water balance component	Units	1993	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	3085	46	101	319	376	356	337	348	334	274	267	160	166	3085
Water Delivered to Coachella Canal	1000 ac-ft	307	7	9	26	34	36	34	34	36	31	24	20	15	307
Deliveries to IID Farms above EHL	1000 ac-ft	3	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.3	0.3	0.1	0.1	3
M&I Deliveries	1000 ac-ft	75	4.8	4.7	5.6	5.9	7.4	7.7	7.7	8.0	7.2	6.5	4.6	4.9	75
M&I Returnflows	1000 ac-ft	17	1.1	1.1	1.3	1.4	1.7	1.8	1.8	1.9	1.7	1.5	1.1	1.1	17
Alamo River outflow to Sea	1000 ac-ft	617	47	28	64	68	64	54	51	52	51	54	42	43	617
New River outflow to Sea	1000 ac-ft	460	40	29	47	51	46	37	37	36	34	36	32	35	460
Direct outflow to Sea	1000 ac-ft	89	6	5	10	12	9	7	7	7	6	7	6	6	89
Mesa Storm inflows	1000 ac-ft	7	4.5	1.4	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.7	0.0	7
Subsurface inflow to drains (external sources)	1000 ac-ft	20	2	2	2	2	2	2	2	2	2	2	2	2	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface inflow from Mexico	1000 ac-ft	192	20	15	23	23	17	13	13	13	13	12	14	16	192
Reference ET	ft	6.18	0.16	0.25	0.46	0.58	0.74	0.82	0.82	0.78	0.62	0.48	0.26	0.21	6.18
Rainfall	ft	0.44	0.28	0.09	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.44
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	480270	480270	480270	480270	480270	480270	480270	480270	480270	480270	480270	480270	480270	480270
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	158854	158854	158854	158854	158854	158854	158854	158854	158854	158854	158854	158854	158854	158854
Total Area		656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

1993

Water Balance for			1993		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	3,085	3,085	46	46	101	101	319	319	376	376	356	356
Water Delivered to Coachella Canal	(1)	307	(307)	7	(7)	9	(9)	26	(26)	34	(34)	36	(36)
Deliveries to IID Farms above EHL	(1)	3	(3)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	5	(5)	0	(0)	0	(0)	0	(0)	0	(0)	1	(1)
All American Canal inflow		Sum =	2,676	Sum =	31	Sum =	84	Sum =	284	Sum =	334	Sum =	311
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	2,676	2,676	31	31	84	84	284	284	334	334	311	311
Surface Inflow from Mexico	1	192	192	20	20	15	15	23	23	23	23	17	17
Rainfall Volume	1	288	288	181	181	58	58	10	10	0	0	0	0
Other surface inflows	1	7	7	4	4	1	1	0	0	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,183	Sum =	238	Sum =	159	Sum =	319	Sum =	358	Sum =	331
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	617	617	47	47	28	28	64	64	68	68	64	64
New River outflow to Sea	1	460	460	40	40	29	29	47	47	51	51	46	46
Direct outflow to Sea	1	89	89	6	6	5	5	10	10	12	12	9	9
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,167	Sum =	94	Sum =	62	Sum =	121	Sum =	130	Sum =	120
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,183	3,183	238	238	159	159	319	319	358	358	331	331
Total outflow	-1	1,167	(1,167)	94	(94)	62	(62)	121	(121)	130	(130)	120	(120)
Total water consumption + storage change		Sum =	2,016	Sum =	144	Sum =	97	Sum =	198	Sum =	228	Sum =	211
Total water consumption on Ag land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,016	2,016	144	144	97	97	198	198	228	228	211	211
Canal and Reservoir Evap.	-1	23	(23)	1	(1)	1	(1)	2	(2)	2	(2)	3	(3)
M & I consumption	-1	58	(58)	4	(4)	4	(4)	4	(4)	5	(5)	6	(6)
ET - drains, rivers, phreatophytes	(1.0)	86.7	(86.7)	2.3	(2.3)	3.6	(3.6)	6.4	(6.4)	8.1	(8.1)	10.3	(10.3)
ET - rainfall on non-Ag land	(1.0)	52.3	(52.3)	32.8	(32.8)	10.5	(10.5)	1.8	(1.8)	0.0	0.0	0.1	(0.1)
Total water consumption on Ag. land + dS			1,796		105		79		184		213		192

1993

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
337	337	348	348	334	334	274	274	267	267	160	160	166	166	3,085	3,085
34	(34)	34	(34)	36	(36)	31	(31)	24	(24)	20	(20)	15	(15)	307	(307)
0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	3	(3)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	5	(5)
Sum =	294	Sum =	305	Sum =	289	Sum =	234	Sum =	235	Sum =	132	Sum =	142	Sum =	2,676
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
294	294	305	305	289	289	234	234	235	235	132	132	142	142	2,676	2,676
13	13	13	13	13	13	13	13	12	12	14	14	16	16	192	192
0	0	0	0	9	9	0	0	0	0	29	29	0	0	288	288
0	0	0	0	0	0	0	0	0	0	1	1	0	0	7	7
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	309	Sum =	321	Sum =	313	Sum =	249	Sum =	248	Sum =	178	Sum =	160	Sum =	3,183
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
54	54	51	51	52	52	51	51	54	54	42	42	43	43	617	617
37	37	37	37	36	36	34	34	36	36	32	32	35	35	460	460
7	7	7	7	7	7	6	6	7	7	6	6	6	6	89	89
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	98	Sum =	95	Sum =	96	Sum =	91	Sum =	97	Sum =	80	Sum =	83	Sum =	1,167
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
309	309	321	321	313	313	249	249	248	248	178	178	160	160	3,183	3,183
98	(98)	95	(95)	96	(96)	91	(91)	97	(97)	80	(80)	83	(83)	1,167	(1,167)
Sum =	211	Sum =	226	Sum =	218	Sum =	158	Sum =	151	Sum =	97	Sum =	77	Sum =	2,016
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
211	211	226	226	218	218	158	158	151	151	97	97	77	77	2,016	2,016
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	23	(23)
6	(6)	6	(6)	6	(6)	6	(6)	5	(5)	4	(4)	4	(4)	58	(58)
11.5	(11.5)	11.4	(11.4)	10.9	(10.9)	8.7	(8.7)	6.8	(6.8)	3.7	(3.7)	3.0	(3.0)	86.7	(86.7)
0.1	(0.1)	0.1	(0.1)	1.6	(1.6)	0.1	(0.1)	0.0	0.0	5.3	(5.3)	0.0	0.0	52.3	(52.3)
	191		205		196		141		138		84		69		1,796

Water balance component	Units	1994	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	3369	170	145	291	393	358	366	389	356	294	279	192	135	3369
Water Delivered to Coachella Canal	1000 ac-ft	319	19	14	24	33	33	34	36	36	32	25	20	14	319
Deliveries to IID Farms above EHL	1000 ac-ft	2	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.0	2
M&I Deliveries	1000 ac-ft	76	4.9	4.8	5.6	6.0	7.5	7.8	7.8	8.1	7.3	6.6	4.6	4.9	76
M&I Returnflows	1000 ac-ft	18	1.1	1.1	1.3	1.4	1.7	1.8	1.8	1.9	1.7	1.5	1.1	1.1	18
Alamo River outflow to Sea	1000 ac-ft	641	41	36	65	71	61	55	61	56	54	58	46	38	641
New River outflow to Sea	1000 ac-ft	443	32	32	43	44	47	37	35	38	38	39	28	31	443
Direct outflow to Sea	1000 ac-ft	109	7	6	10	12	10	9	10	10	9	11	8	7	109
Mesa Storm inflows	1000 ac-ft	3	0.1	0.4	0.6	0.0	0.3	0.0	0.0	0.7	0.0	0.0	0.3	0.8	3
Subsurface inflow to drains (external sources)	1000 ac-ft	20	2	2	2	2	2	2	2	2	2	2	2	2	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface inflow from Mexico	1000 ac-ft	147	13	15	17	12	16	12	9	11	11	10	7	14	147
Reference ET	ft	6.17	0.25	0.26	0.44	0.61	0.72	0.79	0.84	0.74	0.62	0.45	0.28	0.16	6.17
Rainfall	ft	0.21	0.01	0.03	0.04	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.02	0.05	0.21
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	477705	477705	477705	477705	477705	477705	477705	477705	477705	477705	477705	477705	477705	477705
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	161419	161419	161419	161419	161419	161419	161419	161419	161419	161419	161419	161419	161419	161419
Total Area		656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

1994

Water Balance for			1994		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	3,369	3,369	170	170	145	145	291	291	393	393	358	358
Water Delivered to Coachella Canal	(1)	319	(319)	19	(19)	14	(14)	24	(24)	33	(33)	33	(33)
Deliveries to IID Farms above EHL	(1)	2	(2)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	5	(5)	0	(0)	0	(0)	0	(0)	1	(1)	1	(1)
All American Canal inflow		Sum =	2,949	Sum =	143	Sum =	123	Sum =	259	Sum =	351	Sum =	316
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	2,949	2,949	143	143	123	123	259	259	351	351	316	316
Surface Inflow from Mexico	1	147	147	13	13	15	15	17	17	12	12	16	16
Rainfall Volume	1	137	137	5	5	18	18	26	26	0	0	14	14
Other surface inflows	1	3	3	0	0	0	0	1	1	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,256	Sum =	162	Sum =	158	Sum =	304	Sum =	365	Sum =	348
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	641	641	41	41	36	36	65	65	71	71	61	61
New River outflow to Sea	1	443	443	32	32	32	32	43	43	44	44	47	47
Direct outflow to Sea	1	109	109	7	7	6	6	10	10	12	12	10	10
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,194	Sum =	80	Sum =	74	Sum =	118	Sum =	127	Sum =	117
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,256	3,256	162	162	158	158	304	304	365	365	348	348
Total outflow	-1	1,194	(1,194)	80	(80)	74	(74)	118	(118)	127	(127)	117	(117)
Total water consumption + storage change		Sum =	2,062	Sum =	82	Sum =	84	Sum =	186	Sum =	238	Sum =	231
Total water consumption on Ag. land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,062	2,062	82	82	84	84	186	186	238	238	231	231
Canal and Reservoir Evap.	-1	23	(23)	1	(1)	1	(1)	2	(2)	2	(2)	3	(3)
M & I consumption	-1	59	(59)	4	(4)	4	(4)	4	(4)	5	(5)	6	(6)
ET - drains, rivers, phreatophytes	(1.0)	86.5	(86.5)	3.4	(3.4)	3.7	(3.7)	6.2	(6.2)	8.6	(8.6)	10.1	(10.1)
ET - rainfall on non-Ag land	(1.0)	25.3	(25.3)	0.9	(0.9)	3.4	(3.4)	4.8	(4.8)	0.0	0.0	2.6	(2.6)
Total water consumption on Ag. land + dS			1,869		73		72		169		223		210

1994

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
366	366	389	389	356	356	294	294	279	279	192	192	135	135	3,369	3,369
34	(34)	36	(36)	36	(36)	32	(32)	25	(25)	20	(20)	14	(14)	319	(319)
0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(2)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	5	(5)
Sum =	323	Sum =	345	Sum =	311	Sum =	254	Sum =	246	Sum =	165	Sum =	113	Sum =	2,949
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
323	323	345	345	311	311	254	254	246	246	165	165	113	113	2,949	2,949
12	12	9	9	11	11	11	11	10	10	7	7	14	14	147	147
0	0	0	0	29	29	1	1	0	0	11	11	33	33	137	137
0	0	0	0	1	1	0	0	0	0	0	0	1	1	3	3
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	337	Sum =	356	Sum =	354	Sum =	267	Sum =	258	Sum =	185	Sum =	162	Sum =	3,256
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
55	55	61	61	56	56	54	54	58	58	46	46	38	38	641	641
37	37	35	35	38	38	38	38	39	39	28	28	31	31	443	443
9	9	10	10	10	10	9	9	11	11	8	8	7	7	109	109
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	101	Sum =	106	Sum =	104	Sum =	100	Sum =	108	Sum =	83	Sum =	76	Sum =	1,194
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
337	337	356	356	354	354	267	267	258	258	185	185	162	162	3,256	3,256
101	(101)	106	(106)	104	(104)	100	(100)	108	(108)	83	(83)	76	(76)	1,194	(1,194)
Sum =	235	Sum =	249	Sum =	250	Sum =	168	Sum =	150	Sum =	102	Sum =	86	Sum =	2,062
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
235	235	249	249	250	250	168	168	150	150	102	102	86	86	2,062	2,062
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	23	(23)
6	(6)	6	(6)	6	(6)	6	(6)	5	(5)	4	(4)	4	(4)	59	(59)
11.1	(11.1)	11.8	(11.8)	10.4	(10.4)	8.7	(8.7)	6.3	(6.3)	4.0	(4.0)	2.3	(2.3)	86.5	(86.5)
0.0	0.0	0.1	(0.1)	5.4	(5.4)	0.1	(0.1)	0.0	0.0	2.0	(2.0)	6.0	(6.0)	25.3	(25.3)
	215		228		225		151		137		91		73		1,869

Raw Data

Water balance component	Units	1995	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	3391	66	184	334	368	371	376	401	371	289	271	197	163	3391
Water Delivered to Coachella Canal	1000 ac-ft	321	10	17	24	32	34	35	37	39	33	26	22	14	321
Deliveries to IID Farms above EHL	1000 ac-ft	2	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	2
M&I Deliveries	1000 ac-ft	79	5.0	5.0	5.8	6.2	7.8	8.1	8.0	8.4	7.6	6.8	4.8	5.1	79
M&I Returnflows	1000 ac-ft	18	1.2	1.2	1.4	1.5	1.8	1.9	1.9	2.0	1.8	1.6	1.1	1.2	18
Alamo River outflow to Sea	1000 ac-ft	646	28	38	68	73	63	61	61	62	54	55	44	41	646
New River outflow to Sea	1000 ac-ft	473	32	35	44	47	48	43	44	40	36	37	33	34	473
Direct outflow to Sea	1000 ac-ft	115	6	8	12	14	12	10	10	10	8	9	7	8	115
Mesa Storm inflows	1000 ac-ft	4	1.7	0.1	0.1	0.0	0.0	0.0	1.2	0.0	0.4	0.2	0.0	0.0	4
Subsurface inflow to drains (external sources)	1000 ac-ft	20	2	2	2	2	2	2	2	2	2	2	2	2	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface inflow from Mexico	1000 ac-ft	150	17	13	13	13	14	12	13	10	10	11	10	15	150
Reference ET	ft	6.40	0.19	0.29	0.46	0.67	0.77	0.83	0.83	0.76	0.66	0.48	0.27	0.20	6.40
Rainfall	ft	0.24	0.11	0.01	0.01	0.00	0.00	0.00	0.08	0.00	0.03	0.01	0.00	0.00	0.24
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	478515	478515	478515	478515	478515	478515	478515	478515	478515	478515	478515	478515	478515	478515
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	160609	160609	160609	160609	160609	160609	160609	160609	160609	160609	160609	160609	160609	160609
Total Area		656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

Water Balance for			1995		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	3,391	3,391	66	66	184	184	334	334	368	368	371	371
Water Delivered to Coachella Canal	(1)	321	(321)	10	(10)	17	(17)	24	(24)	32	(32)	34	(34)
Deliveries to IID Farms above EHL	(1)	2	(2)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	5	(5)	0	(0)	0	(0)	0	(0)	1	(1)	1	(1)
All American Canal inflow		Sum =	2,969	Sum =	48	Sum =	159	Sum =	302	Sum =	328	Sum =	329
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	2,969	2,969	48	48	159	159	302	302	328	328	329	329
Surface Inflow from Mexico	1	150	150	17	17	13	13	13	13	13	13	14	14
Rainfall Volume	1	159	159	71	71	5	5	4	4	0	0	0	0
Other surface inflows	1	4	4	2	2	0	0	0	0	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,302	Sum =	140	Sum =	178	Sum =	321	Sum =	343	Sum =	344
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	646	646	28	28	38	38	68	68	73	73	63	63
New River outflow to Sea	1	473	473	32	32	35	35	44	44	47	47	48	48
Direct outflow to Sea	1	115	115	6	6	8	8	12	12	14	14	12	12
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,235	Sum =	66	Sum =	80	Sum =	125	Sum =	134	Sum =	123
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,302	3,302	140	140	178	178	321	321	343	343	344	344
Total outflow	-1	1,235	(1,235)	66	(66)	80	(80)	125	(125)	134	(134)	123	(123)
Total water consumption + storage change		Sum =	2,067	Sum =	74	Sum =	98	Sum =	196	Sum =	209	Sum =	221
Total water consumption on Ag. land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,067	2,067	74	74	98	98	196	196	209	209	221	221
Canal and Reservoir Evap.	-1	24	(24)	1	(1)	1	(1)	2	(2)	2	(2)	3	(3)
M & I consumption	-1	60	(60)	4	(4)	4	(4)	4	(4)	5	(5)	6	(6)
ET - drains, rivers, phreatophytes	(1.0)	89.8	(89.8)	2.7	(2.7)	4.0	(4.0)	6.4	(6.4)	9.4	(9.4)	10.7	(10.7)
ET - rainfall on non-Ag land	(1.0)	29.2	(29.2)	13.0	(13.0)	0.9	(0.9)	0.8	(0.8)	0.1	(0.1)	0.0	0.0
Total water consumption on Ag. land + dS			1,864		53		89		183		192		202

1995

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
376	376	401	401	371	371	289	289	271	271	197	197	163	163	3,391	3,391
35	(35)	37	(37)	39	(39)	33	(33)	26	(26)	22	(22)	14	(14)	321	(321)
0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(2)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	5	(5)
Sum =	332	Sum =	355	Sum =	324	Sum =	247	Sum =	237	Sum =	167	Sum =	140	Sum =	2,969
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
332	332	355	355	324	324	247	247	237	237	167	167	140	140	2,969	2,969
12	12	13	13	10	10	10	10	11	11	10	10	15	15	150	150
0	0	50	50	1	1	18	18	6	6	2	2	2	2	159	159
0	0	1	1	0	0	0	0	0	0	0	0	0	0	4	4
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	347	Sum =	421	Sum =	336	Sum =	277	Sum =	256	Sum =	181	Sum =	158	Sum =	3,302
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
61	61	61	61	62	62	54	54	55	55	44	44	41	41	646	646
43	43	44	44	40	40	36	36	37	37	33	33	34	34	473	473
10	10	10	10	10	10	8	8	9	9	7	7	8	8	115	115
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	114	Sum =	115	Sum =	112	Sum =	98	Sum =	101	Sum =	84	Sum =	83	Sum =	1,235
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
347	347	421	421	336	336	277	277	256	256	181	181	158	158	3,302	3,302
114	(114)	115	(115)	112	(112)	98	(98)	101	(101)	84	(84)	83	(83)	1,235	(1,235)
Sum =	233	Sum =	306	Sum =	223	Sum =	179	Sum =	155	Sum =	97	Sum =	76	Sum =	2,067
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
233	233	306	306	223	223	179	179	155	155	97	97	76	76	2,067	2,067
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	24	(24)
6	(6)	6	(6)	6	(6)	6	(6)	5	(5)	4	(4)	4	(4)	60	(60)
11.7	(11.7)	11.6	(11.6)	10.7	(10.7)	9.3	(9.3)	6.7	(6.7)	3.8	(3.8)	2.8	(2.8)	89.8	(89.8)
0.1	(0.1)	9.1	(9.1)	0.1	(0.1)	3.3	(3.3)	1.2	(1.2)	0.4	(0.4)	0.3	(0.3)	29.2	(29.2)
	212		276		203		158		140		88		68		1,864

Water balance component	Units	1996	January	February	March	April	May	June	July	August	September	October	November	December	total
Delivery to AAC at Pilot Knob	1000 ac-ft	3486	190	213	335	395	365	345	374	339	275	275	205	176	3486
Water Delivered to Coachella Canal	1000 ac-ft	327	18	17	26	34	39	33	35	34	29	24	22	16	327
Deliveries to IID Farms above EHL	1000 ac-ft	2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2
M&I Deliveries	1000 ac-ft	79	5.0	5.0	5.8	6.2	7.8	8.1	8.0	8.4	7.6	6.8	4.8	5.1	79
M&I Returnflows	1000 ac-ft	18	1.2	1.2	1.4	1.5	1.8	1.9	1.9	2.0	1.8	1.6	1.1	1.2	18
Alamo River outflow to Sea	1000 ac-ft	641	42	47	65	70	61	55	53	53	48	58	45	44	641
New River outflow to Sea	1000 ac-ft	437	30	32	42	44	44	40	38	36	35	36	29	30	437
Direct outflow to Sea	1000 ac-ft	114	9	9	12	12	10	10	11	11	9	7	6	7	114
Mesa Storm inflows	1000 ac-ft	2	0.0	0.7	0.4	0.0	0.1	0.1	0.0	0.0	0.3	0.2	0.1	0.1	2
Subsurface inflow to drains (external sources)	1000 ac-ft	20	2	2	2	2	2	2	2	2	2	2	2	2	20
Subsurface outflow to Salton sea	1000 ac-ft	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Surface Inflow from Mexico	1000 ac-ft	120	10	12	14	12	16	10	9	8	10	8	6	6	120
Reference ET	ft	6.76	0.26	0.30	0.50	0.67	0.90	0.84	0.82	0.83	0.61	0.49	0.29	0.24	6.76
Rainfall	ft	0.12	0.00	0.04	0.02	0.00	0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.01	0.12
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Agricultural land	ac	478872	478872	478872	478872	478872	478872	478872	478872	478872	478872	478872	478872	478872	478872
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357
Other Non-ag land area	ac	160252	160252	160252	160252	160252	160252	160252	160252	160252	160252	160252	160252	160252	160252
Total Area		656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306	656306
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Seepage (PK to EHL)	1000 ac-ft	94	8	8	8	8	8	8	8	8	8	8	8	8	94
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	756	756	756

Water Balance for			1996		January		February		March		April		May
All American Canal inflow	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Delivery to AAC at Pilot Knob	1	3,486	3,486	190	190	213	213	335	335	395	395	365	365
Water Delivered to Coachella Canal	(1)	327	(327)	18	(18)	17	(17)	26	(26)	34	(34)	39	(39)
Deliveries to IID Farms above EHL	(1)	2	(2)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Seepage (PK to EHL)	(1)	94	(94)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)
Evaporation between PK and EHL	(1)	6	(6)	0	(0)	0	(0)	0	(0)	1	(1)	1	(1)
All American Canal inflow		Sum =	3,057	Sum =	164	Sum =	188	Sum =	301	Sum =	352	Sum =	317
Surface and subsurface inflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
All American Canal inflow	1	3,057	3,057	164	164	188	188	301	301	352	352	317	317
Surface Inflow from Mexico	1	120	120	10	10	12	12	14	14	12	12	16	16
Rainfall Volume	1	79	79	0	0	27	27	15	15	0	0	4	4
Other surface inflows	1	2	2	0	0	1	1	0	0	0	0	0	0
Subsurface inflows	1	20	20	2	2	2	2	2	2	2	2	2	2
Total Inflow		Sum =	3,277	Sum =	176	Sum =	229	Sum =	331	Sum =	366	Sum =	339
Surface and subsurface outflows	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Alamo River outflow to Sea	1	641	641	42	42	47	47	65	65	70	70	61	61
New River outflow to Sea	1	437	437	30	30	32	32	42	42	44	44	44	44
Direct outflow to Sea	1	114	114	9	9	9	9	12	12	12	12	10	10
Subsurface outflow to Salton sea	1	1	1	0	0	0	0	0	0	0	0	0	0
Total outflow		Sum =	1,193	Sum =	82	Sum =	88	Sum =	120	Sum =	126	Sum =	115
Total water consumption + storage change	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total inflow	1	3,277	3,277	176	176	229	229	331	331	366	366	339	339
Total outflow	-1	1,193	(1,193)	82	(82)	88	(88)	120	(120)	126	(126)	115	(115)
Total water consumption + storage change		Sum =	2,085	Sum =	93	Sum =	141	Sum =	212	Sum =	240	Sum =	224
Total water consumption on Ag. land + dS	Sign	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
		(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
Total water consumption + storage change	1	2,085	2,085	93	93	141	141	212	212	240	240	224	224
Canal and Reservoir Evap.	-1	25	(25)	1	(1)	1	(1)	2	(2)	3	(3)	3	(3)
M & I consumption	-1	60	(60)	4	(4)	4	(4)	4	(4)	5	(5)	6	(6)
ET - drains, rivers, phreatophytes	(1.0)	94.7	(94.7)	3.6	(3.6)	4.1	(4.1)	7.1	(7.1)	9.4	(9.4)	12.6	(12.6)
ET - rainfall on non-Ag land	(1.0)	14.5	(14.5)	0.0	0.0	5.0	(5.0)	2.8	(2.8)	0.1	(0.1)	0.7	(0.7)
Total water consumption on Ag. land + dS			1,890		85		127		196		223		201

1996

	June		July		August		September		October		November		December		total
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
345	345	374	374	339	339	275	275	275	275	205	205	176	176	3,486	3,486
33	(33)	35	(35)	34	(34)	29	(29)	24	(24)	22	(22)	16	(16)	327	(327)
0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(2)
8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	8	(8)	94	(94)
1	(1)	1	(1)	1	(1)	1	(1)	0	(0)	0	(0)	0	(0)	6	(6)
Sum =	304	Sum =	331	Sum =	295	Sum =	237	Sum =	242	Sum =	175	Sum =	152	Sum =	3,057
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
304	304	331	331	295	295	237	237	242	242	175	175	152	152	3,057	3,057
10	10	9	9	8	8	10	10	8	8	6	6	6	6	120	120
3	3	2	2	1	1	11	11	7	7	5	5	4	4	79	79
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	20
Sum =	318	Sum =	343	Sum =	307	Sum =	260	Sum =	259	Sum =	187	Sum =	163	Sum =	3,277
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
55	55	53	53	53	53	48	48	58	58	45	45	44	44	641	641
40	40	38	38	36	36	35	35	36	36	29	29	30	30	437	437
10	10	11	11	11	11	9	9	7	7	6	6	7	7	114	114
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sum =	105	Sum =	102	Sum =	100	Sum =	92	Sum =	102	Sum =	80	Sum =	81	Sum =	1,193
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
318	318	343	343	307	307	260	260	259	259	187	187	163	163	3,277	3,277
105	(105)	102	(102)	100	(100)	92	(92)	102	(102)	80	(80)	81	(81)	1,193	(1,193)
Sum =	214	Sum =	241	Sum =	206	Sum =	168	Sum =	157	Sum =	107	Sum =	82	Sum =	2,084
Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal	Volume	Vol Bal
(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)	(1,000 ac-ft)
214	214	241	241	206	206	168	168	157	157	107	107	82	82	2,084	2,084
3	(3)	3	(3)	3	(3)	2	(2)	2	(2)	1	(1)	1	(1)	25	(25)
6	(6)	6	(6)	6	(6)	6	(6)	5	(5)	4	(4)	4	(4)	60	(60)
11.8	(11.8)	11.6	(11.6)	11.6	(11.6)	8.6	(8.6)	6.9	(6.9)	4.0	(4.0)	3.3	(3.3)	94.7	(94.7)
0.6	(0.6)	0.4	(0.4)	0.2	(0.2)	2.0	(2.0)	1.3	(1.3)	0.8	(0.8)	0.7	(0.7)	14.5	(14.5)
	192		220		185		150		142		97		73		1,890

Annual Water Balances and Performance Calculations for 1987 - 1996

Water balance component	Units	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average	Accuracy	
													CI in %	
Delivery to AAC at Pilot Knob	1000 ac-ft	3,091	3,279	3,377	3,420	3,211	2,876	3,085	3,369	3,391	3,486	3,258	1.9%	
Water Delivered to Coachella Canal	1000 ac-ft	320	325	351	359	308	297	307	319	321	327	324	2.4%	
Deliveries to IID Farms above EHL	1000 ac-ft	3	3	3	3	6	4	3	2	2	2	3	10.0%	
M&I Deliveries	1000 ac-ft	64	62	66	70	72	73	75	76	79	79	72	15.0%	
M&I Returnflows	1000 ac-ft	14	14	15	16	16	17	17	18	18	18	16	50.0%	
Alamo River outflow to Sea	1000 ac-ft	512	559	594	618	594	546	617	641	646	641	597	2.3%	
New River outflow to Sea	1000 ac-ft	493	489	431	431	411	397	460	443	473	437	446	2.0%	
Direct outflow to Sea	1000 ac-ft	99	100	96	91	88	81	89	109	115	114	98	20.0%	
Mesa Storm inflows	1000 ac-ft	3.0	3.0	2.4	2.2	4.7	9.3	7.1	3.4	3.9	1.9	4	100.0%	
Subsurface inflow to drains (external sources)	1000 ac-ft	20	20	20	20	20	20	20	20	20	20	20	100.0%	
Subsurface outflow to Salton sea	1000 ac-ft	1	1	1	1	1	1	1	1	1	1	1	100.0%	
Surface Inflow from Mexico	1000 ac-ft	253	229	155	135	133	145	192	147	150	120	166	2.0%	
Reference ET	ft	6.64	6.42	6.91	6.36	5.66	5.86	6.18	6.17	6.40	6.76	6.34	10.0%	
Rainfall	ft	0.19	0.19	0.15	0.14	0.29	0.57	0.44	0.21	0.24	0.12	0.25	20.0%	
Non-Ag land rainfall E and ET (fraction)		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	20.0%	
Agricultural land	ac	486,456	486,476	486,565	485,863	482,833	480,567	480,270	477,705	478,515	478,872	482,412	10.0%	
Phreatophyte acerage	ac	11424	11424	11424	11424	11424	11424	11424	11424	11424	11424	11,424	15.0%	
Water surface area - canals & reservoirs	ac	3401	3401	3401	3401	3401	3401	3401	3401	3401	3401	3,401	10.0%	
Water surface area of drains and rivers	ac	2357	2357	2357	2357	2357	2357	2357	2357	2357	2357	2,357	10.0%	
Other Non-ag land area	ac	152,668	152,648	152,559	153,261	156,291	158,557	158,854	161,419	160,609	160,252	156,712	10.0%	
Total Area	ac	656,306	656,306	656,306	656,306	656,306	656,306	656,306	656,306	656,306	656,306	656,306	10.0%	
ET factor for canals		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	20.0%	
ET factor for reservoirs and ponds		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	20.0%	
ET factor for phreatophytes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	20.0%	
ET fractor for drains & rivers		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	20.0%	
Seepage (PK to EHL)	1000 ac-ft	94	94	94	94	94	94	94	94	94	94	94	30.0%	
Water surface area (PK to EHL)	ac	756	756	756	756	756	756	756	756	756	756	756	10.0%	
District storage change	1000 ac-ft	0	0	0	0	0	0	0	0	0	0	0	10	(Std)
rainfall consumption fraction on Ag-land		0.92	0.92	0.97	1.00	0.96	0.85	0.88	0.89	0.94	0.89	0.92	10.0%	
Colorado Water Delivered to Farms	1000 ac-ft	2,322	2,482	2,565	2,611	2,448	2,106	2,329	2,577	2,581	2,715	2,474	5.0%	
Delivery to IID farms from Coachella Canal	1000 ac-ft	4	4	4	3	4	4	4	4	4	4	4	10.0%	
Total Internal canal seepage	1000 ac-ft	104	104	104	100	94	89	81	77	76	76	90	25.0%	
Main canal seepage	1000 ac-ft	67	67	67	66	65	65	63	63	63	63	65	25.0%	
Main canal spills to drains	1000 ac-ft	6	7	6	7	7	4	3	3	4	4	5	15.0%	
Lateral canal spills	%	3.1%	3.1%	2.9%	3.1%	3.1%	3.7%	3.6%	3.7%	3.8%	3.8%	3.4%	10.0%	
Delivered to Interceptor canals	1000 ac-ft	0	0	0	0	0	0	0	131	130	298	56	10%	
Interceptor Volume spilled	1000 ac-ft	0	0	0	0	0	0	0	1	1	4	1	20%	
Tailwater	1000 ac-ft	387	419	435	439	409	353	392	440	433	433	414	30.0%	
Beneficial Deep Percolation	1000 ac-ft	240	280	292	306	303	265	287	327	322	338	296	40%	
Other Deep Percolation	1000 ac-ft	120	131	133	134	129	114	121	134	132	139	129	40%	
Evaporation on non-cropped areas	%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	100.0%	
Evaporation fraction from special irrigations		0.021	0.021	0.022	0.022	0.023	0.022	0.020	0.019	0.019	0.024	0.021	20%	
Nonbeneficial Percent of special irrigation evap.	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100.0%	
Evaporation fraction from other irrigations		0.101	0.101	0.098	0.108	0.107	0.088	0.100	0.101	0.101	0.106	0.101	20%	
Nonbeneficial Percent of other irrigation evap.	%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	100.0%	

Water Balance for			1987				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,091	3,090.6	1.9%	29	862	
Water Delivered to Coachella Canal	(1)	320	(320.3)	2.4%	4	15	
Deliveries to IID Farms above EHL	(1)	3	(3.1)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	6	(5.5)	25%	1	0	
All American Canal inflow		Sum =	2,667.4	2.5%	33	1077	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,667	2,667	2.5%	33	1077	
Surface Inflow from Mexico	1	253	253	2.0%	3	6	
Rainfall Volume	1	122	122	22%	14	187	
Other surface inflows	1	3	3	100%	2	2	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,065	2.4%	37	1372	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	512	512	2.3%	6	35	
New River outflow to Sea	1	493	493	2.0%	5	24	
Direct outflow to Sea	1	99	99	20%	10	99	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,106	2.3%	13	158	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,065	3,065	2.4%	37	1372	
Total outflow	-1	1,106	(1,106)	2.3%	13	158	
Change in storage	-1	0	0		10	100	
Total water consumption		Sum =	1,959	4.1%	40	1630	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	1,959	1,959	4.1%	40	1630	
Canal and Reservoir Evap.	-1	25	(25)	24%	3	9	
M & I consumption	-1	50	(50)	24%	6	37	
ET - drains, rivers, phreatophytes	-1	93	(93)	27%	13	161	
ET - rainfall on non-Ag land	-1	21	(21)	30%	3	5	Adjusted!!
Total water consumption on Ag. land			1,770	4.8%	43	1841	
			1684				
			1856				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,770	1,770	4.8%	43	1841	
Rainfall consumption on Ag-land	-1	83	(83)	24%	10	99	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,687	5.2%	44	1940	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,667	2,667	2.5%	33	1077	
Non-Ag deliveries	-1	64	(64)	15%	5	23	
Net Irrigation Water Supply		Sum =	2,603	2.5%	33	1,100	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,603	2,603	2.5%	33	1100	
Canal and Reservoir Evap.	-1	25	(25)	24%	3	9	
Irrigation Water consum. on Ag. land	-1	1,687	(1,687)	5%	44	1940	
Irrigation Water to Drains		Sum =	892	6.7%	30	895	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	253	253	2.0%	3	6	
Irrigation Water to Drains	1	892	892	6.7%	30	895	
Other surface inflows	1	3	3	100.0%	2	2	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	14	14	50.0%	4	12	
Rainfall runoff & deep perc.	1	17	17	20.0%	2	3	
River and Drain Inflows		Sum =	1,199	4.7%	28	802	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	512	512	2.3%	6	35	
New River outflow to Sea	1	493	493	2.0%	5	24	
Direct outflow to Sea	1	99	99	20.0%	10	99	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	93	93	27.2%	13	161	
River and Drain outflow		Sum =	1,199	3.0%	18	318	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,315	2315	5%	58	3350	
Canal and Reservoir Evap.	1	25	25	24%	3	9	
Canal seepage	1	104	104	25%	13	169	
Main canal spills	1	6	6	15%	0	0	
Lateral spills	1	78	78	11%	4	15	Adjusted!
change in storage	1	0	0	.	0	0	
Canal Water Destinations		Sum =	2528	4.7%	60	3543	
	Range	2,409	> value >	2,647			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2603	2603	2.5%	33	1100	
Canal and Reservoir Evap.	-1	25	(25)	24.5%	3	9	
Canal seepage	-1	104	(104)	25.0%	13	169	
Main canal spills	-1	6	(6)	15.0%	0	0	
Lateral spills	-1	78	(78)	11.2%	4	15	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2390	3.0%	36	1294	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,390	2390	3%	36	1294	
Irrigation Water consum. on Ag. land	-1	1,687	(1,687)	5.2%	44	1940	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	703	9.4%	33	1099	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	703	703	9.4%	33	1099	
Tailwater outflow	-1	387	(387)	30.0%	58	3377	
Total Leaching	-1	360	(360)	35.5%	64	4087	
		Sum =	-44	7.7%	93	8562	
		-229	> farm bal >	141	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		93	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.744	6.7%	0.0336	0.001126	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	69	28.0%	0.1402	0.019655	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1687	1,687	5.2%	44	1940	
Canal and Reservoir Evap.	1	25	25	24.5%	3	9	
Irrigation water contributing to Phreat. ET	1	69	69	28.0%	10	94	
Irrigation Water Consumed		Sum =	1781	5.1%	45	2044	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,781	822		989.7466	0.001463	31.4602385
Net Irrigation Water Supply	/	2,603	2,603		1099.9509	0.000162	
			0.316	8.1%	0.0403	0.001625	0.013
		Quotient =	0.684	3.7%			0.025
	Range	0.66	> ICUC >	0.71			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,687	1687	5.2%	0.026	0.000682	
Non-beneficial evaporation	-1	17	-17	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1670	5.3%	0.027	0.000707	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,670	1670	5.3%	0.027	0.000707	
Nonben. E fraction from special irrigations (cal	-1	7	-7	103.9%	0.002	0.000005	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	59	-59	103.9%	0.018	0.000338	Adjusted
Beneficial irrigation water consumed			1604	6.5%	0.032	0.001050	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,604	1,604	6.5%	52	2701	
Beneficial Leaching	1	240	240	40%	48	2310	
Beneficial uses		Sum=	1844	7.7%	71	5,011	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,844	759		3956.6511	0.006861	
Net Irrigation Water Supply	/		2,603		1099.9509	0.000162	
			0.292	16.8%	0.0838	0.007023	0.024
		Quotient =	0.708	6.9%			0.049
	Range	0.66	> Dist. IE >	0.76			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2390	213		193.8808	0.004268	
Net Irrigation Water Supply	/		2603		1099.9509	0.000162	
			0.082	13.3%	0.0666	0.004430	0.005
		Quotient =	0.918	1.2%			0.011
	Range	0.91	> DE >	0.93			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,844	546		4150.5319	0.013909	
Delivered to Farms	/		2,390		1293.8317	0.000226	
			0.229	23.8%	0.1189	0.014136	0.027
		Quotient =	0.771	7.0%			0.054
	Range	0.72	> farm IE >	0.83			

Water Balance for			1988				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,279	3,278.6	1.9%	31	970	
Water Delivered to Coachella Canal	(1)	325	(324.8)	2.4%	4	15	
Deliveries to IID Farms above EHL	(1)	3	(3.1)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(5.3)	25%	1	0	
All American Canal inflow		Sum =	2,851.2	2.4%	34	1185	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,851	2,851	2.4%	34	1185	
Surface inflow from Mexico	1	229	229	2.0%	2	5	
Rainfall Volume	1	122	122	22%	14	189	
Other surface inflows	1	3	3	100%	2	2	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,226	2.4%	38	1482	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	559	559	2.3%	6	41	
New River outflow to Sea	1	489	489	2.0%	5	24	
Direct outflow to Sea	1	100	100	20%	10	100	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,149	2.2%	13	166	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,226	3,226	2.4%	38	1482	
Total outflow	-1	1,149	(1,149)	2.2%	13	166	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,077	4.0%	42	1747	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,077	2,077	4.0%	42	1747	
Canal and Reservoir Evap.	-1	24	(24)	24%	3	9	
M & I consumption	-1	49	(49)	24%	6	35	
ET - drains, rivers, phreatophytes	-1	90	(90)	27%	12	150	
ET - rainfall on non-Ag land	-1	21	(21)	30%	3	5	Adjusted!!
Total water consumption on Ag. land			1,893	4.7%	44	1946	
			1805				
			1981				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,893	1,893	4.7%	44	1946	
rainfall consumption on Ag-land	-1	84	(84)	24%	10	100	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,809	5.0%	45	2045	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,851	2,851	2.4%	34	1185	
Non-Ag deliveries	-1	62	(62)	15%	5	22	
Net Irrigation Water Supply		Sum =	2,789	2.5%	35	1,207	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,789	2,789	2.5%	35	1207	
Canal and Reservoir Evap.	-1	24	(24)	24%	3	9	
Irrigation Water consum. on Ag. land	-1	1,809	(1,809)	5%	45	2045	
Irrigation Water to Drains		Sum =	956	6.2%	30	890	Adjusted!

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River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	229	229	2.0%	2	5	
Irrigation Water to Drains	1	956	956	6.2%	30	890	
Other surface inflows	1	3	3	100.0%	2	2	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	14	14	50.0%	3	12	
Rainfall runoff & deep perc.	1	17	17	20.0%	2	3	
River and Drain Inflows		Sum =	1,239	4.6%	28	797	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	559	559	2.3%	6	41	
New River outflow to Sea	1	489	489	2.0%	5	24	
Direct outflow to Sea	1	100	100	20.0%	10	100	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	90	90	27.2%	12	150	
River and Drain outflow		Sum =	1,239	2.9%	18	316	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,475	2475	5%	62	3828	
Canal and Reservoir Evap.	1	24	24	24%	3	9	
Canal seepage	1	104	104	25%	13	169	
Main canal spills	1	7	7	15%	0	0	
Lateral spills	1	84	84	11%	5	18	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2693	4.7%	63	4023	
	Range	2,566	> value >	2,820			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2789	2789	2.5%	35	1207	
Canal and Reservoir Evap.	-1	24	(24)	24.5%	3	9	
Canal seepage	-1	104	(104)	25.0%	13	169	
Main canal spills	-1	7	(7)	15.0%	0	0	
Lateral spills	-1	84	(84)	11.2%	5	18	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2571	2.9%	37	1402	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,571	2571	3%	37	1402	
Irrigation Water consum. on Ag. land	-1	1,809	(1,809)	5.0%	45	2045	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	762	8.7%	33	1094	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	762	762	8.7%	33	1094	
Tailwater outflow	-1	419	(419)	30.0%	63	3947	
Total Leaching	-1	411	(411)	35.5%	73	5336	
		Sum =	-68	7.9%	102	10377	
		-272	> farm bal >	135	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		90	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.772	6.2%	0.0312	0.000974	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	69	27.9%	0.1396	0.019501	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1809	1,809	5.0%	45	2045	
Canal and Reservoir Evap.	1	24	24	24.5%	3	9	
Irrigation water contributing to Phreat. ET	1	69	69	27.9%	10	94	
Irrigation Water Consumed		Sum =	1902	4.9%	46	2148	

ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,902	887		984.5121	0.001253	31.3769358
Net Irrigation Water Supply	/	2,789	2,789		1207.2359	0.000155	
			0.318	7.5%	0.0375	0.001408	0.012
		Quotient =	0.682	3.5%			0.024
	Range	0.66	> ICUC >	0.71			

Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,809	1809	5.0%	0.025	0.000625	
Non-beneficial evaporation	-1	18	-18	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1791	5.1%	0.025	0.000650	

Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,791	1791	5.1%	0.025	0.000650	
Nonben. E fraction from special irrigations (cal	-1	8	-8	103.9%	0.002	0.000005	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	63	-63	103.9%	0.018	0.000338	Adjusted
Beneficial irrigation water consumed			1720	6.3%	0.032	0.000993	

Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,720	1,720	6.3%	54	2938	
Beneficial Leaching	1	280	280	40%	56	3146	
Beneficial uses		Sum=	2000	7.8%	78	6,084	

District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,000	789		4920.1066	0.007909	
Net Irrigation Water Supply	/		2,789		1207.2359	0.000155	
			0.283	18.0%	0.0898	0.008064	0.025
		Quotient =	0.717	7.1%			0.051
	Range	0.67	> Dist. IE >	0.77			

District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2571	218		195.2214	0.004092	
Net Irrigation Water Supply	/		2789		1207.2359	0.000155	
			0.078	13.0%	0.0652	0.004247	0.005
		Quotient =	0.922	1.1%			0.010
	Range	0.91	> DE >	0.93			

Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,000	570		5115.3280	0.015728	
Delivered to Farms	/		2,571		1402.4573	0.000212	
			0.222	25.3%	0.1263	0.015940	0.028
		Quotient =	0.778	7.2%			0.056
	Range	0.72	> farm IE >	0.83			

Water Balance for			1989				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,377	3,376.8	1.9%	32	1029	
Water Delivered to Coachella Canal	(1)	351	(351.3)	2.4%	4	18	
Deliveries to IID Farms above EHL	(1)	3	(3.1)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	6	(5.7)	25%	1	1	
All American Canal inflow		Sum =	2,922.5	2.4%	35	1247	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,922	2,922	2.4%	35	1247	
Surface Inflow from Mexico	1	155	155	2.0%	2	2	
Rainfall Volume	1	99	99	22%	11	124	
Other surface inflows	1	2	2	100%	1	1	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,199	2.4%	38	1475	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	594	594	2.3%	7	47	
New River outflow to Sea	1	431	431	2.0%	4	19	
Direct outflow to Sea	1	96	96	20%	10	92	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,122	2.2%	13	158	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,199	3,199	2.4%	38	1475	
Total outflow	-1	1,122	(1,122)	2.2%	13	158	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,077	4.0%	42	1732	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,077	2,077	4.0%	42	1732	
Canal and Reservoir Evap.	-1	26	(26)	24%	3	10	
M & I consumption	-1	51	(51)	24%	6	39	
ET - drains, rivers, phreatophytes	-1	97	(97)	27%	13	173	
ET - rainfall on non-Ag land	-1	17	(17)	30%	3	3	Adjusted!!
Total water consumption on Ag. land			1,886	4.7%	44	1958	
			1797				
			1974				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,886	1,886	4.7%	44	1958	
rainfall consumption on Ag-land	-1	71	(71)	24%	9	72	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,815	5.0%	45	2030	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,922	2,922	2.4%	35	1247	
Non-Ag deliveries	-1	66	(66)	15%	5	24	
Net Irrigation Water Supply		Sum =	2,857	2.5%	36	1,271	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,857	2,857	2.5%	36	1271	
Canal and Reservoir Evap.	-1	26	(26)	24%	3	10	
Irrigation Water consum. on Ag. land	-1	1,815	(1,815)	5%	45	2030	
Irrigation Water to Drains		Sum =	1,016	5.6%	29	818	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	155	155	2.0%	2	2	
Irrigation Water to Drains	1	1,016	1,016	5.6%	29	818	
Other surface inflows	1	2	2	100.0%	1	1	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	15	15	50.0%	4	13	
Rainfall runoff & deep perc.	1	10	10	20.0%	1	1	
River and Drain Inflows		Sum =	1,219	4.4%	27	728	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	594	594	2.3%	7	47	
New River outflow to Sea	1	431	431	2.0%	4	19	
Direct outflow to Sea	1	96	96	20.0%	10	92	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	97	97	27.2%	13	173	
River and Drain outflow		Sum =	1,219	3.0%	18	331	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,558	2558	5%	64	4090	
Canal and Reservoir Evap.	1	26	26	24%	3	10	
Canal seepage	1	104	104	25%	13	169	
Main canal spills	1	6	6	15%	0	0	
Lateral spills	1	80	80	11%	4	16	Adjusted!
change in storage	1	0	0	.	0	0	
Canal Water Destinations		Sum =	2774	4.7%	65	4285	
	Range	2,643	> value >	2,905			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2857	2857	2.5%	36	1271	
Canal and Reservoir Evap.	-1	26	(26)	24.5%	3	10	
Canal seepage	-1	104	(104)	25.0%	13	169	
Main canal spills	-1	6	(6)	15.0%	0	0	
Lateral spills	-1	80	(80)	11.2%	4	16	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2641	2.9%	38	1467	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,641	2641	3%	38	1467	
Irrigation Water consum. on Ag. land	-1	1,815	(1,815)	5.0%	45	2030	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	826	7.7%	32	1023	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	826	826	7.7%	32	1023	
Tailwater outflow	-1	435	(435)	30.0%	65	4266	
Total Leaching	-1	425	(425)	35.5%	76	5703	
		Sum =	-34	7.9%	105	10992	
		-244	> farm bal >	175	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		97	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.834	5.6%	0.0281	0.000792	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	81	27.8%	0.1390	0.019315	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1815	1,815	5.0%	45	2030	
Canal and Reservoir Evap.	1	26	26	24.5%	3	10	
Irrigation water contributing to Phreat. ET	1	81	81	27.8%	11	126	
Irrigation Water Consumed		Sum =	1921	4.8%	47	2166	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,921	936		943.4737	0.001078	30.7160167
Net Irrigation Water Supply	/	2,857	2,857		1271.4733	0.000156	
			0.327	7.0%	0.0351	0.001234	0.012
		Quotient =	0.673	3.4%			0.023
	Range	0.65	> ICUC >	0.70			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,815	1815	5.0%	0.025	0.000617	
Non-beneficial evaporation	-1	18	-18	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1796	5.1%	0.025	0.000642	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,796	1796	5.1%	0.025	0.000642	
Nonben. E fraction from special irrigations (cal	-1	8	-8	103.9%	0.002	0.000005	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	62	-62	103.9%	0.018	0.000318	Adjusted
Beneficial irrigation water consumed			1727	6.2%	0.031	0.000965	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,727	1,727	6.2%	54	2876	
Beneficial Leaching	1	292	292	40%	58	3416	
Beneficial uses		Sum=	2019	7.9%	79	6,292	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,019	837		5069.2579	0.007228	
Net Irrigation Water Supply	/		2,857		1271.4733	0.000156	
			0.293	17.2%	0.0859	0.007384	0.025
		Quotient =	0.707	7.1%			0.050
	Range	0.66	> Dist. IE >	0.76			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2641	216		195.0971	0.004184	
Net Irrigation Water Supply	/		2857		1271.4733	0.000156	
			0.076	13.2%	0.0659	0.004340	0.005
		Quotient =	0.924	1.1%			0.010
	Range	0.91	> DE >	0.93			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,019	622		5264.3550	0.013627	
Delivered to Farms	/		2,641		1466.5704	0.000210	
			0.235	23.5%	0.1176	0.013838	0.028
		Quotient =	0.765	7.2%			0.055
	Range	0.71	> farm IE >	0.82			

Water Balance for			1990				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,420	3,419.7	1.9%	32	1055	
Water Delivered to Coachella Canal	(1)	359	(359.4)	2.4%	4	19	
Deliveries to IID Farms above EHL	(1)	3	(3.5)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(5.3)	25%	1	0	
All American Canal inflow		Sum =	2,957.3	2.4%	36	1274	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,957	2,957	2.4%	36	1274	
Surface Inflow from Mexico	1	135	135	2.0%	1	2	
Rainfall Volume	1	91	91	22%	10	105	
Other surface inflows	1	2	2	100%	1	1	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,206	2.4%	38	1482	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	618	618	2.3%	7	50	
New River outflow to Sea	1	431	431	2.0%	4	19	
Direct outflow to Sea	1	91	91	20%	9	83	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,140	2.2%	12	152	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,206	3,206	2.4%	38	1482	
Total outflow	-1	1,140	(1,140)	2.2%	12	152	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,065	4.0%	42	1734	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,065	2,065	4.0%	42	1734	
Canal and Reservoir Evap.	-1	24	(24)	24%	3	8	
M & I consumption	-1	54	(54)	24%	7	43	
ET - drains, rivers, phreatophytes	-1	89	(89)	27%	12	147	
ET - rainfall on non-Ag land	-1	16	(16)	30%	2	3	Adjusted!!
Total water consumption on Ag. land			1,882	4.7%	44	1936	
			1794				
			1970				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,882	1,882	4.7%	44	1936	
rainfall consumption on Ag-land	-1	67	(67)	24%	8	65	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,815	4.9%	45	2001	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,957	2,957	2.4%	36	1274	
Non-Ag deliveries	-1	70	(70)	15%	5	27	
Net Irrigation Water Supply		Sum =	2,888	2.5%	36	1,302	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,888	2,888	2.5%	36	1302	
Canal and Reservoir Evap.	-1	24	(24)	24%	3	8	
Irrigation Water consum. on Ag. land	-1	1,815	(1,815)	5%	45	2001	
Irrigation Water to Drains		Sum =	1,049	5.3%	28	762	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	135	135	2.0%	1	2	
Irrigation Water to Drains	1	1,049	1,049	5.3%	28	762	
Other surface inflows	1	2	2	100.0%	1	1	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	16	16	50.0%	4	16	
Rainfall runoff & deep perc.	1	8	8	20.0%	1	1	
River and Drain Inflows		Sum =	1,230	4.2%	26	676	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	618	618	2.3%	7	50	
New River outflow to Sea	1	431	431	2.0%	4	19	
Direct outflow to Sea	1	91	91	20.0%	9	83	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	89	89	27.2%	12	147	
River and Drain outflow		Sum =	1,230	2.8%	17	299	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,604	2604	5%	65	4239	
Canal and Reservoir Evap.	1	24	24	24%	3	8	
Canal seepage	1	100	100	25%	12	155	
Main canal spills	1	7	7	15%	1	0	
Lateral spills	1	87	87	11%	5	19	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2822	4.7%	66	4422	
	Range	2,689	> value >	2,955			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2888	2888	2.5%	36	1302	
Canal and Reservoir Evap.	-1	24	(24)	24.5%	3	8	
Canal seepage	-1	100	(100)	25.0%	12	155	
Main canal spills	-1	7	(7)	15.0%	1	0	
Lateral spills	-1	87	(87)	11.2%	5	19	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2670	2.9%	39	1485	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,670	2670	3%	39	1485	
Irrigation Water consum. on Ag. land	-1	1,815	(1,815)	4.9%	45	2001	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	855	7.2%	31	954	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	855	855	7.2%	31	954	
Tailwater outflow	-1	439	(439)	30.0%	66	4335	
Total Leaching	-1	441	(441)	35.5%	78	6129	
		Sum =	-25	8.0%	107	11419	
		-238	> farm bal >	189	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		89	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.853	5.3%	0.0263	0.000693	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	76	27.7%	0.1386	0.019214	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1815	1,815	4.9%	45	2001	
Canal and Reservoir Evap.	1	24	24	24.5%	3	8	
Irrigation water contributing to Phreat. ET	1	76	76	27.7%	11	111	
Irrigation Water Consumed		Sum =	1915	4.8%	46	2120	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,915	973		873.6069	0.000923	29.5568411
Net Irrigation Water Supply	/	2,888	2,888		1301.5533	0.000156	
			0.337	6.6%	0.0329	0.001079	0.011
		Quotient =	0.663	3.3%			0.022
	Range	0.64	> ICUC >	0.69			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,815	1815	4.9%	0.025	0.000607	
Non-beneficial evaporation	-1	18	-18	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1797	5.0%	0.025	0.000632	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,797	1797	5.0%	0.025	0.000632	
Nonben. E fraction from special irrigations (cal	-1	8	-8	103.9%	0.002	0.000005	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	68	-68	103.9%	0.020	0.000386	Adjusted
Beneficial irrigation water consumed			1721	6.4%	0.032	0.001023	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,721	1,721	6.4%	55	3031	
Beneficial Leaching	1	306	306	40%	61	3754	
Beneficial uses		Sum=	2027	8.1%	82	6,785	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,027	860		5537.9555	0.007483	
Net Irrigation Water Supply	/		2,888		1301.5533	0.000156	
			0.298	17.5%	0.0874	0.007639	0.026
		Quotient =	0.702	7.4%			0.052
	Range	0.65	> Dist. IE >	0.75			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2670	218		183.0529	0.003866	
Net Irrigation Water Supply	/		2888		1301.5533	0.000156	
			0.075	12.7%	0.0634	0.004022	0.005
		Quotient =	0.925	1.0%			0.010
	Range	0.92	> DE >	0.93			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,027	643		5721.0085	0.013852	
Delivered to Farms	/		2,670		1484.6062	0.000208	
			0.241	23.7%	0.1186	0.014060	0.029
		Quotient =	0.759	7.5%			0.057
	Range	0.70	> farm IE >	0.82			

Water Balance for			1991				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,211	3,211.1	1.9%	31	931	
Water Delivered to Coachella Canal	(1)	308	(307.8)	2.4%	4	14	
Deliveries to IID Farms above EHL	(1)	6	(6.1)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(4.7)	25%	1	0	
All American Canal inflow		Sum =	2,798.3	2.4%	34	1144	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,798	2,798	2.4%	34	1144	
Surface Inflow from Mexico	1	133	133	2.0%	1	2	
Rainfall Volume	1	193	193	22%	22	468	
Other surface inflows	1	5	5	100%	2	6	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,148	2.6%	41	1719	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	594	594	2.3%	7	47	
New River outflow to Sea	1	411	411	2.0%	4	17	
Direct outflow to Sea	1	88	88	20%	9	78	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,094	2.2%	12	142	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,148	3,148	2.6%	41	1719	
Total outflow	-1	1,094	(1,094)	2.2%	12	142	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,054	4.3%	44	1961	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,054	2,054	4.3%	44	1961	
Canal and Reservoir Evap.	-1	21	(21)	24%	3	7	
M & I consumption	-1	56	(56)	24%	7	46	
ET - drains, rivers, phreatophytes	-1	79	(79)	27%	11	117	
ET - rainfall on non-Ag land	-1	34	(34)	30%	5	12	Adjusted!!
Total water consumption on Ag. land			1,863	5.0%	46	2143	
			1771				
			1956				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,863	1,863	5.0%	46	2143	
rainfall consumption on Ag-land	-1	136	(136)	24%	17	262	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,728	5.7%	49	2405	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,798	2,798	2.4%	34	1144	
Non-Ag deliveries	-1	72	(72)	15%	5	29	
Net Irrigation Water Supply		Sum =	2,726	2.5%	34	1,174	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,726	2,726	2.5%	34	1174	
Canal and Reservoir Evap.	-1	21	(21)	24%	3	7	
Irrigation Water consum. on Ag. land	-1	1,728	(1,728)	6%	49	2405	
Irrigation Water to Drains		Sum =	977	7.4%	36	1,297	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	133	133	2.0%	1	2	
Irrigation Water to Drains	1	977	977	7.4%	36	1297	
Other surface inflows	1	5	5	100.0%	2	6	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	16	16	50.0%	4	16	
Rainfall runoff & deep perc.	1	22	22	20.0%	2	5	
River and Drain Inflows		Sum =	1,173	5.9%	35	1211	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	594	594	2.3%	7	47	
New River outflow to Sea	1	411	411	2.0%	4	17	
Direct outflow to Sea	1	88	88	20.0%	9	78	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	79	79	27.2%	11	117	
River and Drain outflow		Sum =	1,173	2.7%	16	258	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,438	2438	5%	61	3716	
Canal and Reservoir Evap.	1	21	21	24%	3	7	
Canal seepage	1	94	94	25%	12	137	
Main canal spills	1	7	7	15%	1	0	
Lateral spills	1	82	82	11%	5	17	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2643	4.7%	62	3877	
	Range	2,518	> value >	2,767			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2726	2726	2.5%	34	1174	
Canal and Reservoir Evap.	-1	21	(21)	24.5%	3	7	
Canal seepage	-1	94	(94)	25.0%	12	137	
Main canal spills	-1	7	(7)	15.0%	1	0	
Lateral spills	-1	82	(82)	11.2%	5	17	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2522	2.9%	37	1334	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,522	2522	3%	37	1334	
Irrigation Water consum. on Ag. land	-1	1,728	(1,728)	5.7%	49	2405	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	794	9.6%	38	1464	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	794	794	9.6%	38	1464	
Tailwater outflow	-1	409	(409)	30.0%	61	3769	
Total Leaching	-1	432	(432)	35.5%	77	5890	
		Sum =	-47	8.4%	105	11123	
		-258	> farm bal >	164	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		79	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.833	7.4%	0.0368	0.001357	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	66	28.2%	0.1410	0.019891	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1728	1,728	5.7%	49	2405	
Canal and Reservoir Evap.	1	21	21	24.5%	3	7	
Irrigation water contributing to Phreat. ET	1	66	66	28.2%	9	87	
Irrigation Water Consumed		Sum =	1815	5.5%	50	2499	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,815	911		1383.7858	0.001666	37.1992721
Net Irrigation Water Supply	/	2,726	2,726		1173.5862	0.000158	
			0.334	8.5%	0.0427	0.001824	0.014
		Quotient =	0.666	4.3%			0.029
	Range	0.64	> ICUC >	0.69			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,728	1728	5.7%	0.028	0.000806	
Non-beneficial evaporation	-1	17	-17	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1710	5.8%	0.029	0.000831	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,710	1710	5.8%	0.029	0.000831	
Nonben. E fraction from special irrigations (cal	-1	8	-8	103.9%	0.002	0.000006	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	64	-64	103.9%	0.019	0.000379	Adjusted
Beneficial irrigation water consumed			1638	7.0%	0.035	0.001215	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,638	1,638	7.0%	57	3262	
Beneficial Leaching	1	303	303	40%	61	3669	
Beneficial uses		Sum=	1941	8.6%	83	6,931	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,941	785		5815.7306	0.009438	
Net Irrigation Water Supply	/		2,726		1173.5862	0.000158	
			0.288	19.6%	0.0980	0.009596	0.028
		Quotient =	0.712	7.9%			0.056
	Range	0.66	> Dist. IE >	0.77			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2522	204		160.6678	0.003854	
Net Irrigation Water Supply	/		2726		1173.5862	0.000158	
			0.075	12.7%	0.0633	0.004012	0.005
		Quotient =	0.925	1.0%			0.009
	Range	0.92	> DE >	0.93			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,941	581		5976.3985	0.017718	
Delivered to Farms	/		2,522		1334.2540	0.000210	
			0.230	26.8%	0.1339	0.017927	0.031
		Quotient =	0.770	8.0%			0.062
	Range	0.71	> farm IE >	0.83			

Water Balance for			1992				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	2,876	2,876.4	1.9%	27	747	
Water Delivered to Coachella Canal	(1)	297	(297.5)	2.4%	4	13	
Deliveries to IID Farms above EHL	(1)	4	(4.5)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(4.9)	25%	1	0	
All American Canal inflow		Sum =	2,475.3	2.5%	31	959	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,475	2,475	2.5%	31	959	
Surface Inflow from Mexico	1	145	145	2.0%	1	2	
Rainfall Volume	1	376	376	22%	42	1781	
Other surface inflows	1	9	9	100%	5	21	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,025	3.5%	54	2864	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	546	546	2.3%	6	39	
New River outflow to Sea	1	397	397	2.0%	4	16	
Direct outflow to Sea	1	81	81	20%	8	65	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,024	2.1%	11	121	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,025	3,025	3.5%	54	2864	
Total outflow	-1	1,024	(1,024)	2.1%	11	121	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,001	5.6%	56	3085	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,001	2,001	5.6%	56	3085	
Canal and Reservoir Evap.	-1	22	(22)	24%	3	7	
M & I consumption	-1	56	(56)	24%	7	46	
ET - drains, rivers, phreatophytes	-1	82	(82)	27%	11	125	
ET - rainfall on non-Ag land	-1	68	(68)	30%	10	49	Adjusted!!
Total water consumption on Ag. land			1,773	6.5%	58	3312	
			1658				
			1888				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,773	1,773	6.5%	58	3312	
rainfall consumption on Ag-land	-1	235	(235)	24%	29	770	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,538	8.3%	64	4082	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,475	2,475	2.5%	31	959	
Non-Ag deliveries	-1	73	(73)	15%	5	30	
Net Irrigation Water Supply		Sum =	2,403	2.6%	31	989	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,403	2,403	2.6%	31	989	
Canal and Reservoir Evap.	-1	22	(22)	24%	3	7	
Irrigation Water consum. on Ag. land	-1	1,538	(1,538)	8%	64	4082	
Irrigation Water to Drains		Sum =	843	13.3%	56	3,160	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	145	145	2.0%	1	2	
Irrigation Water to Drains	1	843	843	13.3%	56	3160	
Other surface inflows	1	9	9	100.0%	5	21	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	17	17	50.0%	4	17	
Rainfall runoff & deep perc.	1	73	73	20.0%	7	53	
River and Drain Inflows		Sum =	1,106	10.1%	56	3106	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	546	546	2.3%	6	39	
New River outflow to Sea	1	397	397	2.0%	4	16	
Direct outflow to Sea	1	81	81	20.0%	8	65	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	82	82	27.2%	11	125	
River and Drain outflow		Sum =	1,106	2.8%	16	245	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,098	2098	5%	52	2750	
Canal and Reservoir Evap.	1	22	22	24%	3	7	
Canal seepage	1	89	89	25%	11	123	
Main canal spills	1	4	4	15%	0	0	
Lateral spills	1	86	86	11%	5	18	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2298	4.7%	54	2899	
	Range	2,191	> value >	2,406			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2403	2403	2.6%	31	989	
Canal and Reservoir Evap.	-1	22	(22)	24.5%	3	7	
Canal seepage	-1	89	(89)	25.0%	11	123	
Main canal spills	-1	4	(4)	15.0%	0	0	
Lateral spills	-1	86	(86)	11.2%	5	18	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2202	3.1%	34	1138	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,202	2202	3%	34	1138	
Irrigation Water consum. on Ag. land	-1	1,538	(1,538)	8.3%	64	4082	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	664	17.3%	58	3315	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	664	664	17.3%	58	3315	
Tailwater outflow	-1	353	(353)	30.0%	53	2797	
Total Leaching	-1	378	(378)	35.5%	67	4518	
		Sum =	-67	9.4%	103	10630	
		-273	> farm bal >	139	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		82	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.762	13.3%	0.0667	0.004447	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	63	30.4%	0.1518	0.023038	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1538	1,538	8.3%	64	4082	
Canal and Reservoir Evap.	1	22	22	24.5%	3	7	
Irrigation water contributing to Phreat. ET	1	63	63	30.4%	9	90	
Irrigation Water Consumed		Sum =	1622	8.0%	65	4180	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,622	780		3249.7655	0.005337	57.0067143
Net Irrigation Water Supply	/	2,403	2,403		989.2344	0.000171	
			0.325	14.8%	0.0742	0.005509	0.024
		Quotient =	0.675	7.1%			0.048
	Range	0.63	> ICUC >	0.72			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,538	1538	8.3%	0.042	0.001726	
Non-beneficial evaporation	-1	15	-15	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1522	8.4%	0.042	0.001751	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,522	1522	8.4%	0.042	0.001751	
Nonben. E fraction from special irrigations (cal	-1	7	-7	103.9%	0.002	0.000005	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	47	-47	103.9%	0.016	0.000256	Adjusted
Beneficial irrigation water consumed			1469	9.0%	0.045	0.002013	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,469	1,469	9.0%	66	4342	
Beneficial Leaching	1	265	265	40%	53	2805	
Beneficial uses		Sum=	1734	9.8%	85	7,147	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,734	669		6217.4171	0.013894	
Net Irrigation Water Supply	/		2,403		989.2344	0.000171	
			0.278	23.7%	0.1186	0.014065	0.033
		Quotient =	0.722	9.2%			0.066
	Range	0.66	> Dist. IE >	0.79			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2202	201		148.6498	0.003688	
Net Irrigation Water Supply	/		2403		989.2344	0.000171	
			0.084	12.4%	0.0621	0.003859	0.005
		Quotient =	0.916	1.1%			0.010
	Range	0.91	> DE >	0.93			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,734	468		6366.0669	0.029044	
Delivered to Farms	/		2,202		1137.8842	0.000235	
			0.213	34.2%	0.1711	0.029278	0.036
		Quotient =	0.787	9.2%			0.073
	Range	0.71	> farm IE >	0.86			

Water Balance for			1993				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,085	3,084.9	1.9%	29	859	
Water Delivered to Coachella Canal	(1)	307	(307.0)	2.4%	4	14	
Deliveries to IID Farms above EHL	(1)	3	(2.8)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(5.1)	25%	1	0	
All American Canal inflow		Sum =	2,675.7	2.4%	33	1073	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,676	2,676	2.4%	33	1073	
Surface Inflow from Mexico	1	192	192	2.0%	2	4	
Rainfall Volume	1	288	288	22%	32	1046	
Other surface inflows	1	7	7	100%	4	13	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,183	3.0%	47	2234	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	617	617	2.3%	7	50	
New River outflow to Sea	1	460	460	2.0%	5	21	
Direct outflow to Sea	1	89	89	20%	9	78	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,167	2.1%	12	150	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,183	3,183	3.0%	47	2234	
Total outflow	-1	1,167	(1,167)	2.1%	12	150	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,016	4.9%	50	2485	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,016	2,016	4.9%	50	2485	
Canal and Reservoir Evap.	-1	23	(23)	24%	3	8	
M & I consumption	-1	58	(58)	24%	7	49	
ET - drains, rivers, phreatophytes	-1	87	(87)	27%	12	139	
ET - rainfall on non-Ag land	-1	52	(52)	30%	8	29	Adjusted!!
Total water consumption on Ag. land			1,796	5.8%	52	2710	
			1692				
			1900				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,796	1,796	5.8%	52	2710	
rainfall consumption on Ag-land	-1	187	(187)	24%	23	488	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,610	7.0%	57	3198	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,676	2,676	2.4%	33	1073	
Non-Ag deliveries	-1	75	(75)	15%	6	32	
Net Irrigation Water Supply		Sum =	2,601	2.6%	33	1,104	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,601	2,601	2.6%	33	1104	
Canal and Reservoir Evap.	-1	23	(23)	24%	3	8	
Irrigation Water consum. on Ag. land	-1	1,610	(1,610)	7%	57	3198	
Irrigation Water to Drains		Sum =	968	9.6%	47	2,165	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	192	192	2.0%	2	4	
Irrigation Water to Drains	1	968	968	9.6%	47	2165	
Other surface inflows	1	7	7	100.0%	4	13	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	17	17	50.0%	4	19	
Rainfall runoff & deep perc.	1	49	49	20.0%	5	24	
River and Drain Inflows		Sum =	1,254	7.3%	46	2091	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	617	617	2.3%	7	50	
New River outflow to Sea	1	460	460	2.0%	5	21	
Direct outflow to Sea	1	89	89	20.0%	9	78	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	87	87	27.2%	12	139	
River and Drain outflow		Sum =	1,254	2.7%	17	289	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,322	2322	5%	58	3371	
Canal and Reservoir Evap.	1	23	23	24%	3	8	
Canal seepage	1	81	81	25%	10	102	
Main canal spills	1	3	3	15%	0	0	
Lateral spills	1	91	91	11%	5	21	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2521	4.7%	59	3502	
	Range	2,402	> value >	2,639			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2601	2601	2.6%	33	1104	
Canal and Reservoir Evap.	-1	23	(23)	24.5%	3	8	
Canal seepage	-1	81	(81)	25.0%	10	102	
Main canal spills	-1	3	(3)	15.0%	0	0	
Lateral spills	-1	91	(91)	11.2%	5	21	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2402	2.9%	35	1235	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,402	2402	3%	35	1235	
Irrigation Water consum. on Ag. land	-1	1,610	(1,610)	7.0%	57	3198	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	793	12.1%	48	2304	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	793	793	12.1%	48	2304	
Tailwater outflow	-1	392	(392)	30.0%	59	3451	
Total Leaching	-1	407	(407)	35.5%	72	5237	
		Sum =	-6	8.7%	105	10993	
		-216	> farm bal >	203	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		87	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.772	9.6%	0.0481	0.002311	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	67	28.9%	0.1444	0.020862	

1993

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1610	1,610	7.0%	57	3198	
Canal and Reservoir Evap.	1	23	23	24.5%	3	8	
Irrigation water contributing to Phreat. ET	1	67	67	28.9%	10	93	
Irrigation Water Consumed		Sum =	1700	6.8%	57	3299	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,700	901		2258.2376	0.002782	47.5209178
Net Irrigation Water Supply	/	2,601	2,601		1104.2393	0.000163	
			0.346	10.9%	0.0543	0.002946	0.019
		Quotient =	0.654	5.8%			0.038
	Range	0.62	> ICUC >	0.69			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,610	1610	7.0%	0.035	0.001234	
Non-beneficial evaporation	-1	16	-16	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1594	7.1%	0.035	0.001259	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,594	1594	7.1%	0.035	0.001259	
Nonben. E fraction from special irrigations (cal	-1	6	-6	103.9%	0.002	0.000004	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	56	-56	103.9%	0.018	0.000331	Adjusted
Beneficial irrigation water consumed			1531	8.0%	0.040	0.001594	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,531	1,531	8.0%	61	3739	
Beneficial Leaching	1	287	287	40%	57	3292	
Beneficial uses		Sum=	1818	9.2%	84	7,030	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,818	782		5989.4956	0.009786	
Net Irrigation Water Supply	/		2,601		1104.2393	0.000163	
			0.301	19.9%	0.0997	0.009949	0.030
		Quotient =	0.699	8.6%			0.060
	Range	0.64	> Dist. IE >	0.76			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2402	198		131.1593	0.003337	
Net Irrigation Water Supply	/		2601		1104.2393	0.000163	
			0.076	11.8%	0.0592	0.003500	0.005
		Quotient =	0.924	1.0%			0.009
	Range	0.91	> DE >	0.93			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,818	584		6120.6549	0.017940	
Delivered to Farms	/		2,402		1235.3987	0.000214	
			0.243	26.9%	0.1347	0.018155	0.033
		Quotient =	0.757	8.7%			0.066
	Range	0.69	> farm IE >	0.82			

Water Balance for			1994				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,369	3,368.6	1.9%	32	1024	
Water Delivered to Coachella Canal	(1)	319	(318.9)	2.4%	4	15	
Deliveries to IID Farms above EHL	(1)	2	(1.8)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(5.1)	25%	1	0	
All American Canal inflow		Sum =	2,948.6	2.4%	35	1239	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,949	2,949	2.4%	35	1239	
Surface Inflow from Mexico	1	147	147	2.0%	1	2	
Rainfall Volume	1	137	137	22%	15	237	
Other surface inflows	1	3	3	100%	2	3	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,256	2.4%	40	1581	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	641	641	2.3%	7	54	
New River outflow to Sea	1	443	443	2.0%	4	20	
Direct outflow to Sea	1	109	109	20%	11	118	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,194	2.3%	14	193	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,256	3,256	2.4%	40	1581	
Total outflow	-1	1,194	(1,194)	2.3%	14	193	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,062	4.2%	43	1874	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,062	2,062	4.2%	43	1874	
Canal and Reservoir Evap.	-1	23	(23)	24%	3	8	
M & I consumption	-1	59	(59)	24%	7	51	
ET - drains, rivers, phreatophytes	-1	86	(86)	27%	12	138	
ET - rainfall on non-Ag land	-1	25	(25)	30%	4	7	Adjusted!!
Total water consumption on Ag. land			1,869	4.9%	46	2078	
			1778				
			1960				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,869	1,869	4.9%	46	2078	
rainfall consumption on Ag-land	-1	89	(89)	24%	11	111	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,780	5.3%	47	2189	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,949	2,949	2.4%	35	1239	
Non-Ag deliveries	-1	76	(76)	15%	6	33	
Net Irrigation Water Supply		Sum =	2,873	2.5%	36	1,271	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,873	2,873	2.5%	36	1271	
Canal and Reservoir Evap.	-1	23	(23)	24%	3	8	
Irrigation Water consum. on Ag. land	-1	1,780	(1,780)	5%	47	2189	
Irrigation Water to Drains		Sum =	1,070	5.9%	31	991	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	147	147	2.0%	1	2	
Irrigation Water to Drains	1	1,070	1,070	5.9%	31	991	
Other surface inflows	1	3	3	100.0%	2	3	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	18	18	50.0%	4	19	
Rainfall runoff & deep perc.	1	23	23	20.0%	2	5	
River and Drain Inflows		Sum =	1,280	4.7%	30	910	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	641	641	2.3%	7	54	
New River outflow to Sea	1	443	443	2.0%	4	20	
Direct outflow to Sea	1	109	109	20.0%	11	118	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	86	86	27.2%	12	138	
River and Drain outflow		Sum =	1,280	2.8%	18	331	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,570	2570	5%	64	4129	
Canal and Reservoir Evap.	1	23	23	24%	3	8	
Canal seepage	1	77	77	25%	10	93	
Main canal spills	1	3	3	15%	0	0	
Lateral spills	1	100	100	11%	6	25	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2773	4.7%	65	4255	
	Range	2,643	> value >	2,904			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2873	2873	2.5%	36	1271	
Canal and Reservoir Evap.	-1	23	(23)	24.5%	3	8	
Canal seepage	-1	77	(77)	25.0%	10	93	
Main canal spills	-1	3	(3)	15.0%	0	0	
Lateral spills	-1	100	(100)	11.2%	6	25	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2670	2.8%	37	1397	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,670	2670	3%	37	1397	
Irrigation Water consum. on Ag. land	-1	1,780	(1,780)	5.3%	47	2189	
Farm irrigation water outflow to drains (tailwater and leachin		Sum =	890	7.5%	34	1124	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	890	890	7.5%	34	1124	
Tailwater outflow	-1	440	(440)	30.0%	66	4355	
Total Leaching	-1	461	(461)	35.5%	82	6699	
		Sum =	-11	8.3%	110	12179	
		-231	> farm bal >	210	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		86	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.835	5.9%	0.0294	0.000866	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	72	27.8%	0.1392	0.019390	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1780	1,780	5.3%	47	2189	
Canal and Reservoir Evap.	1	23	23	24.5%	3	8	
Irrigation water contributing to Phreat. ET	1	72	72	27.8%	10	101	
Irrigation Water Consumed		Sum =	1875	5.1%	48	2298	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,875	997		1091.8546	0.001097	33.0432225
Net Irrigation Water Supply	/	2,873	2,873		1271.4053	0.000154	
			0.347	7.1%	0.0354	0.001252	0.012
		Quotient =	0.653	3.8%			0.025
	Range	0.63	> ICUC >	0.68			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,780	1780	5.3%	0.026	0.000691	
Non-beneficial evaporation	-1	18	-18	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1762	5.4%	0.027	0.000716	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,762	1762	5.4%	0.027	0.000716	
Nonben. E fraction from special irrigations (cal	-1	7	-7	103.9%	0.002	0.000004	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	62	-62	103.9%	0.018	0.000337	Adjusted
Beneficial irrigation water consumed			1693	6.5%	0.033	0.001057	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,693	1,693	6.5%	55	3030	
Beneficial Leaching	1	327	327	40%	65	4270	
Beneficial uses		Sum=	2020	8.5%	85	7,300	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,020	853		6094.0285	0.008378	
Net Irrigation Water Supply	/		2,873		1271.4053	0.000154	
			0.297	18.5%	0.0924	0.008532	0.027
		Quotient =	0.703	7.8%			0.055
	Range	0.65	> Dist. IE >	0.76			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2670	203		125.4987	0.003051	
Net Irrigation Water Supply	/		2873		1271.4053	0.000154	
			0.071	11.3%	0.0566	0.003205	0.004
		Quotient =	0.929	0.9%			0.008
	Range	0.92	> DE >	0.94			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,020	650		6219.5272	0.014719	
Delivered to Farms	/		2,670		1396.9041	0.000196	
			0.243	24.4%	0.1221	0.014915	0.030
		Quotient =	0.757	7.9%			0.059
	Range	0.70	> farm IE >	0.82			

Water Balance for			1995				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,391	3,391.4	1.9%	32	1038	
Water Delivered to Coachella Canal	(1)	321	(320.8)	2.4%	4	15	
Deliveries to IID Farms above EHL	(1)	2	(1.8)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	5	(5.3)	25%	1	0	
All American Canal inflow		Sum =	2,969.3	2.4%	35	1253	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,969	2,969	2.4%	35	1253	
Surface Inflow from Mexico	1	150	150	2.0%	1	2	
Rainfall Volume	1	159	159	22%	18	319	
Other surface inflows	1	4	4	100%	2	4	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,302	2.5%	41	1678	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	646	646	2.3%	7	55	
New River outflow to Sea	1	473	473	2.0%	5	22	
Direct outflow to Sea	1	115	115	20%	12	133	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,235	2.3%	15	210	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,302	3,302	2.5%	41	1678	
Total outflow	-1	1,235	(1,235)	2.3%	15	210	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,067	4.3%	45	1989	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,067	2,067	4.3%	45	1989	
Canal and Reservoir Evap.	-1	24	(24)	24%	3	9	
M & I consumption	-1	60	(60)	24%	7	54	
ET - drains, rivers, phreatophytes	-1	90	(90)	27%	12	149	
ET - rainfall on non-Ag land	-1	29	(29)	30%	4	9	Adjusted!!
Total water consumption on Ag. land			1,864	5.0%	47	2209	
			1770				
			1958				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,864	1,864	5.0%	47	2209	
rainfall consumption on Ag-land	-1	109	(109)	24%	13	168	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,755	5.6%	49	2378	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	2,969	2,969	2.4%	35	1253	
Non-Ag deliveries	-1	79	(79)	15%	6	35	
Net Irrigation Water Supply		Sum =	2,891	2.5%	36	1,288	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,891	2,891	2.5%	36	1288	
Canal and Reservoir Evap.	-1	24	(24)	24%	3	9	
Irrigation Water consum. on Ag. land	-1	1,755	(1,755)	6%	49	2378	
Irrigation Water to Drains		Sum =	1,112	6.1%	34	1,168	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface inflow from Mexico	1	150	150	2.0%	1	2	
Irrigation Water to Drains	1	1,112	1,112	6.1%	34	1168	
Other surface inflows	1	4	4	100.0%	2	4	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	18	18	50.0%	5	21	
Rainfall runoff & deep perc.	1	21	21	20.0%	2	4	
River and Drain Inflows		Sum =	1,325	5.0%	33	1087	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	646	646	2.3%	7	55	
New River outflow to Sea	1	473	473	2.0%	5	22	
Direct outflow to Sea	1	115	115	20.0%	12	133	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	90	90	27.2%	12	149	
River and Drain outflow		Sum =	1,325	2.9%	19	359	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,575	2575	5%	64	4144	
Canal and Reservoir Evap.	1	24	24	24%	3	9	
Canal seepage	1	76	76	25%	10	91	
Main canal spills	1	4	4	15%	0	0	
Lateral spills	1	103	103	11%	6	27	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2782	4.7%	65	4269	
	Range	2,651	> value >	2,913			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2891	2891	2.5%	36	1288	
Canal and Reservoir Evap.	-1	24	(24)	24.5%	3	9	
Canal seepage	-1	76	(76)	25.0%	10	91	
Main canal spills	-1	4	(4)	15.0%	0	0	
Lateral spills	-1	103	(103)	11.2%	6	27	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2684	2.8%	38	1414	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,684	2684	3%	38	1414	
Irrigation Water consum. on Ag. land	-1	1,755	(1,755)	5.6%	49	2378	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	929	7.8%	36	1303	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	929	929	7.8%	36	1303	
Tailwater outflow	-1	433	(433)	30.0%	65	4226	
Total Leaching	-1	454	(454)	35.5%	81	6506	
		Sum =	41	8.2%	110	12034	
		-178	> farm bal >	261	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		90	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.839	6.1%	0.0307	0.000945	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	75	27.9%	0.1395	0.019471	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1755	1,755	5.6%	49	2378	
Canal and Reservoir Evap.	1	24	24	24.5%	3	9	
Irrigation water contributing to Phreat. ET	1	75	75	27.9%	11	110	
Irrigation Water Consumed		Sum =	1854	5.4%	50	2497	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,854	1,036		1278.5266	0.001190	35.7564906
Net Irrigation Water Supply	/	2,891	2,891		1287.7649	0.000154	
			0.359	7.3%	0.0367	0.001344	0.013
		Quotient =	0.641	4.1%			0.026
	Range	0.62	> ICUC >	0.67			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,755	1755	5.6%	0.028	0.000772	
Non-beneficial evaporation	-1	18	-18	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1737	5.6%	0.028	0.000797	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,737	1737	5.6%	0.028	0.000797	
Nonben. E fraction from special irrigations (cal	-1	7	-7	103.9%	0.002	0.000004	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	61	-61	103.9%	0.018	0.000337	Adjusted
Beneficial irrigation water consumed			1669	6.7%	0.034	0.001138	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,669	1,669	6.7%	56	3172	
Beneficial Leaching	1	322	322	40%	64	4145	
Beneficial uses		Sum=	1991	8.6%	86	7,317	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,991	899		6099.0131	0.007540	
Net Irrigation Water Supply	/		2,891		1287.7649	0.000154	
			0.311	17.5%	0.0877	0.007694	0.027
		Quotient =	0.689	7.9%			0.055
	Range	0.63	> Dist. IE >	0.74			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2684	207		125.8512	0.002933	
Net Irrigation Water Supply	/		2891		1287.7649	0.000154	
			0.072	11.1%	0.0556	0.003087	0.004
		Quotient =	0.928	0.9%			0.008
	Range	0.92	> DE >	0.94			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	1,991	692		6224.8643	0.012991	
Delivered to Farms	/		2,684		1413.6160	0.000196	
			0.258	23.0%	0.1148	0.013187	0.030
		Quotient =	0.742	8.0%			0.059
	Range	0.68	> farm IE >	0.80			

1996

Water Balance for			1996				
All American Canal inflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivery to AAC at Pilot Knob	1	3,486	3,485.7	1.9%	33	1097	
Water Delivered to Coachella Canal	(1)	327	(327.5)	2.4%	4	15	
Deliveries to IID Farms above EHL	(1)	2	(1.5)	10%	0	0	
Seepage (PK to EHL)	(1)	94	(94.2)	30%	14	200	
Evaporation between PK and EHL	(1)	6	(5.6)	25%	1	0	
All American Canal inflow		Sum =	3,056.9	2.4%	36	1312	
Surface and subsurface inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	3,057	3,057	2.4%	36	1312	
Surface Inflow from Mexico	1	120	120	2.0%	1	1	
Rainfall Volume	1	79	79	22%	9	78	
Other surface inflows	1	2	2	100%	1	1	
Subsurface inflows	1	20	20	100%	10	100	
Total Inflow		Sum =	3,277	2.4%	39	1492	
Surface and subsurface outflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	641	641	2.3%	7	54	
New River outflow to Sea	1	437	437	2.0%	4	19	
Direct outflow to Sea	1	114	114	20%	11	130	
Subsurface outflow to Salton sea	1	1	1	100%	1	0	
Total outflow		Sum =	1,193	2.4%	14	204	
Total water consumption	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total inflow	1	3,277	3,277	2.4%	39	1492	
Total outflow	-1	1,193	(1,193)	2.4%	14	204	
change in storage	-1	0	0		10	100	
Total water consumption		Sum =	2,085	4.1%	42	1796	
Total water consumption on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption	1	2,085	2,085	4.1%	42	1796	
Canal and Reservoir Evap.	-1	25	(25)	24%	3	10	
M & I consumption	-1	60	(60)	24%	7	54	
ET - drains, rivers, phreatophytes	-1	95	(95)	27%	13	166	
ET - rainfall on non-Ag land	-1	14	(14)	30%	2	2	Adjusted!!
Total water consumption on Ag. land			1,890	4.8%	45	2027	
			1800				
			1980				
Irrigation Water consum. on Ag. land	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Total water consumption on Ag. land	1	1,890	1,890	4.8%	45	2027	
rainfall consumption on Ag-land	-1	51	(51)	24%	6	36	Adjusted!!
Irrigation Water consum. on Ag. land		Sum =	1,839	4.9%	45	2064	
Net Irrigation Water Supply	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
All American Canal inflow	1	3,057	3,057	2.4%	36	1312	
Non-Ag deliveries	-1	79	(79)	15%	6	35	
Net Irrigation Water Supply		Sum =	2,978	2.5%	37	1,347	
Irrigation Water to Drains	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2,978	2,978	2.5%	37	1347	
Canal and Reservoir Evap.	-1	25	(25)	24%	3	10	
Irrigation Water consum. on Ag. land	-1	1,839	(1,839)	5%	45	2064	
Irrigation Water to Drains		Sum =	1,114	5.1%	28	796	Adjusted!

River and Drain Inflows	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Surface Inflow from Mexico	1	120	120	2.0%	1	1	
Irrigation Water to Drains	1	1,114	1,114	5.1%	28	796	
Other surface inflows	1	2	2	100.0%	1	1	
Subsurface inflows	1	20	20	100.0%	10	100	
M&I return flow	1	18	18	50.0%	5	21	
Rainfall runoff & deep perc.	1	13	13	20.0%	1	2	
River and Drain Inflows		Sum =	1,287	4.2%	27	717	Adjusted!
River and Drain outflow	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Alamo River outflow to Sea	1	641	641	2.3%	7	54	
New River outflow to Sea	1	437	437	2.0%	4	19	
Direct outflow to Sea	1	114	114	20.0%	11	130	
Subsurface outflow to Salton sea	1	1	1	100.0%	1	0	
ET - drains, rivers, phreatophytes	1	95	95	27.2%	13	166	
River and Drain outflow		Sum =	1,287	3.0%	19	370	
Canal Water Destinations	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,709	2709	5%	68	4588	
Canal and Reservoir Evap.	1	25	25	24%	3	10	
Canal seepage	1	76	76	25%	10	91	
Main canal spills	1	4	4	15%	0	0	
Lateral spills	1	103	103	11%	6	26	Adjusted!
change in storage	1	0	0		0	0	
Canal Water Destinations		Sum =	2917	4.7%	69	4714	
	Range	2,780	> value >	3,055			
Canal deliveries as remainder	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Net Irrigation Water Supply	1	2978	2978	2.5%	37	1347	
Canal and Reservoir Evap.	-1	25	(25)	24.5%	3	10	
Canal seepage	-1	76	(76)	25.0%	10	91	
Main canal spills	-1	4	(4)	15.0%	0	0	
Lateral spills	-1	103	(103)	11.2%	6	26	
change in storage	-1	0	0	0	0	0	
Delivered to Farms	=		2770	2.8%	38	1474	
Farm irrigation water outflow to drains (tailwate	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Delivered to Farms	1	2,770	2770	3%	38	1474	
Irrigation Water consum. on Ag. land	-1	1,839	(1,839)	4.9%	45	2064	
Farm irrigation water outflow to drains (tailwater and leachir		Sum =	931	6.6%	31	932	Adjusted!
Farm inflow-outflow balance	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Farm outflow to drains	1	931	931	6.6%	31	932	
Tailwater outflow	-1	433	(433)	30.0%	65	4226	
Total Leaching	-1	477	(477)	35.5%	85	7170	
		Sum =	21	8.0%	111	12328	
		-201	> farm bal >	243	(1,000 ac-ft)		
Irrigation water contributing to Phreat. ET	Sign	Volume	Result	CI	CV	CV^2	
				% reading			
ET - drains, rivers, phreatophytes	(1,000 ac-ft)		95	27.2%	0.1360	0.018509	
Fraction of river inflow by irrigation water			0.866	5.1%	0.0253	0.000641	
Irrigation water contributing to Phreat. ET	(1,000 ac-ft)	Product =	82	27.7%	0.1384	0.019162	

Irrigation Water Consumed	Sign	Volume	Vol Bal	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Irrigation Water consum. on Ag. land	1	1839	1,839	4.9%	45	2064	
Canal and Reservoir Evap.	1	25	25	24.5%	3	10	
Irrigation water contributing to Phreat. ET	1	82	82	27.7%	11	129	
Irrigation Water Consumed		Sum =	1946	4.8%	47	2202	
ICUC	Sign	Volume	Difference	CI	Varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)^2		
Irrigation Water Consumed	1	1,946	1,032		925	0.000868	30.41
Net Irrigation Water Supply	/	2,978	2,978		1347	0.000152	
			0.347	6.4%	0.0319	0.001020	0.011
		Quotient =	0.653	3.4%			0.022
	Range	0.63	> ICUC >	0.68			
Irrigation water consumed on cropped land	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation Water consum. on Ag. land	1	1,839	1839	4.9%	0.025	0.000610	
Non-beneficial evaporation	-1	18	-18	100%	0.005	0.000025	Adjusted
Irrigation water consumed on cropped land		Sum =	1820	5.0%	0.025	0.000635	
Beneficial irrigation water consumed	Sign	Volume	Vol Bal	CI	CV	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Irrigation water consumed on cropped land	1	1,820	1820	5.0%	0.025	0.000635	
Nonben. E fraction from special irrigations (cal	-1	9	-9	103.9%	0.002	0.000006	Adjusted
Nonben. E fraction from other irrigations (calc)	-1	68	-68	103.9%	0.019	0.000372	Adjusted
Beneficial irrigation water consumed			1744	6.4%	0.032	0.001013	
Beneficial uses		Volume	Result	CI	s	s^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading	(1,000 ac-ft)	(1,000 ac-ft)^2	
Beneficial irrigation water consumed	1	1,744	1,744	6.4%	56	3082	
Beneficial Leaching	1	338	338	40%	68	4569	
Beneficial uses		Sum=	2082	8.4%	87	7,652	
District Irrigation Efficiency	Sign	Volume	Result	CI	Variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,082	896		6374	0.007937	
Net Irrigation Water Supply	/		2,978		1347	0.000152	
			0.301	18.0%	0.0899	0.008089	0.027
		Quotient =	0.699	7.7%			0.054
	Range	0.64	> Dist. IE >	0.75			
District Conveyance-Distribution Efficiency	Sign	Volume	Result	CI	varinace	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Delivered to Farms	1	2770	208		127	0.002925	
Net Irrigation Water Supply	/		2978		1347	0.000152	
			0.070	11.1%	0.0555	0.003077	0.004
		Quotient =	0.930	0.8%			0.008
	Range	0.92	> DE >	0.94			
Farm Irrigation Efficiency	Sign	Volume	Result	CI	variance	CV^2	
		(1,000 ac-ft)	(1,000 ac-ft)	% reading			
Beneficial uses	1	2,082	688		6501	0.013730	
Delivered to Farms	/		2,770		1474	0.000192	
			0.248	23.6%	0.1180	0.013922	0.029
		Quotient =	0.752	7.8%			0.059
	Range	0.69	> farm IE >	0.81			

Additional Calculations

IID Canal Seepage (unrecovered)								
Main canals (1,000 ac-ft)						Lateral canals		Grand
	EHL	Westside	Earth	Lined	Total	reductions	Total	Total
1987	45	10.258	11.316	0.1496	66.7236	0	37.33	104.05
1988	45	10.258	11.178	0.1598	66.5958	0	37.33	103.92
1989	45	10.258	11.178	0.1598	66.5958	0	37.33	103.92
1990	45	9.964	10.465	0.2363	65.6653	6.535	34.06	99.72
1991	45	9.523	10.281	0.2856	65.0896	4.596	28.49	93.58
1992	45	9.523	10.281	0.2856	65.0896	5.207	23.59	88.68
1993	45	7.488	10.281	0.2856	63.0546	6.138	17.92	80.97
1994	45	7.488	10.281	0.2856	63.0546	1.772	13.97	77.02
1995	45	7.488	10.281	0.2856	63.0546	0	13.08	76.13
						Seepage at end of 1992		
							(1000 ac-ft)	
						unlined	18.79	
						lined	2.20	
						total	20.99	

Analysis of Lateral Canal Spills							
1988							
	Volume	%spill	Spill				
	1.7326	3.7%	0.064106		0.00013		
	4.3538	5.6%	0.243813		0.006202		
	5.4718	1.5%	0.082077		0.003432		
	2.353	5.1%	0.120003		0.00213		
	5.5084	2.6%	0.143218		0.00037		
	7.9024	1.2%	0.094829		0.006942		
	89.8878	2.1%	1.887644		0.0226		
	7.8106	9.6%	0.749818		0.076547		
	3.9374	2.7%	0.10631		0.000175		
	18.02	3.0%	0.5406		7.75E-05		
	2.95	5.1%	0.15045		0.00267		
	15.4852	2.6%	0.402615		0.001041		
	4.453	1.5%	0.066795		0.002793		
	11.883	1.7%	0.202011		0.005742		
	21.234	3.2%	0.679488		2.08E-05		
	10.481	7.7%	0.807037		0.051211		
	19.274	2.5%	0.48185		0.001825		
	2.4	12.8%	0.3072		0.05257		
	4.978	5.2%	0.258856		0.004976		
	3.462	1.0%	0.03462		0.003702		
	13.532	5.1%	0.690132		0.012248		
	45.558	1.1%	0.501138		0.044263		
	4.024	6.8%	0.273632		0.012673		
	2.324	17.5%	0.4067		0.112457		
	10.2368	8.9%	0.911075		0.079774		
	11.948	1.3%	0.155324		0.009439		
	35.998	3.2%	1.151936		3.52E-05		
Totals	367.1988	3.1%	11.51328	Sum =	0.516046		
Ave	13.59996	3.1%	0.426418	Variance =	0.019113		
				CV=	0.138249		
IID spreadsheet had 3.2% due to				CVmean =	0.026606		
bad data where spill >> 100%.				CI mean=	0.053212		
				Add for accuray of measurement			
				Add for nonrandomness of sample			
				Be conservative, CI = 0.10			

Calculation of additional deep percolation due to nonuniformity

DU	0.8
ET fraction - light	0.5
Fraction of light soils with other DP	0.500
	1

Charles' Numbers

	light	heavy	total	LF	Other DP	Total DP	ET
1987	118.315	122.000	240	0.125	120.2	361	1687
1988	146.987	133.462	280	0.134	131.4	412	1809
1989	156.218	135.996	292	0.139	132.9	425	1815
1990	168.459	137.881	306	0.144	134.5	441	1815
1991	169.845	132.998	303	0.149	129.2	432	1728
1992	146.651	118.167	265	0.147	114.4	379	1538
1993	161.473	125.389	287	0.151	120.8	408	1610
1994	187.621	139.100	327	0.155	134.7	461	1780
1995	183.186	138.720	322	0.155	132.6	454	1755
1996	191.212	146.777	338	0.155	138.8	477	1839
Average	162.997	133.049	296	0.145	129.0	425	1737

Calculations for significance of trends in performance parameters

	Intercept at 1987	Regressior Slope (1/yr	Probability -no error	Probability 0.1	Probability -all random
ICUC	0.683	-0.0041	0.0007	0.002	0.050
District IE	0.714	-0.0018	0.082	0.208	0.582
District DE	0.920	0.0010	0.030	0.041	0.152
Farm IE	0.776	-0.0028	0.048	0.117	0.450

Following pages use 20% of variance from uncertainty in revised analysis.

Regression for IID ICUC					Equation	a=	0.682911		
						b=	-0.004115		
		ICUC						Addition SSE	
Year		Ratio	2*s	Variance	predicted	error	SSE	Uncertainty	Total
1987	0	0.684	0.0255	0.00016	0.683	-0.001	0.000001	0.000129	
1988	1	0.682	0.0239	0.00014	0.679	-0.003	0.000011	0.000114	
1989	2	0.673	0.0230	0.00013	0.675	0.002	0.000005	0.000106	
1990	3	0.663	0.0221	0.00012	0.671	0.007	0.000055	0.000098	
1991	4	0.666	0.0286	0.00020	0.666	0.001	0.000001	0.000163	
1992	5	0.675	0.0482	0.00058	0.662	-0.013	0.000166	0.000464	
1993	6	0.654	0.0376	0.00035	0.658	0.005	0.000022	0.000282	
1994	7	0.653	0.0246	0.00015	0.654	0.001	0.000002	0.000120	
1995	8	0.641	0.0263	0.00017	0.650	0.009	0.000073	0.000138	
1996	9	0.653	0.0221	0.00012	0.646	-0.008	0.000056	0.000098	
							0.000392	0.001711	0.002103

Revised analysis			
SS	MS	F	Signific. F
0.001397	0.001397	19.84978	0.002124
0.000563	7.04E-05		
0.001960			

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.8836969
R Square	0.7809202
Adjusted R Square	0.7535353
Standard Error	0.0069987
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001396788	0.001397	28.51638	0.000694074
Residual	8	0.000391856	4.9E-05		
Total	9	0.001788644			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.6829109	0.004113519	166.0162	1.94E-15	0.673425104	0.6923967	0.6734251	0.6923967
X Variable 1	-0.004115	0.000770533	-5.34007	0.000694	-0.00589155	-0.0023378	-0.0058916	-0.0023378

Regression for IID District IE					Equation	a=	0.713989							
						b=	-0.001814							
		District IE						Addition SSE			Revised analysis			
Year		Ratio	2*s	Variance	predicted	error	SSE	Uncertainty	Total					
1987	0	0.708	0.0489	0.00060	0.714	0.006	0.000032	0.000477			SS	MS	F	Signific. F
1988	1	0.717	0.0508	0.00064	0.712	-0.005	0.000025	0.000515			0.000271	0.000271	1.87972	0.207592
1989	2	0.707	0.0504	0.00063	0.710	0.004	0.000013	0.000506			0.001155	0.000144		
1990	3	0.702	0.0521	0.00068	0.709	0.006	0.000042	0.000541			0.001427			
1991	4	0.712	0.0564	0.00080	0.707	-0.005	0.000028	0.000635						
1992	5	0.722	0.0660	0.00109	0.705	-0.017	0.000277	0.000870						
1993	6	0.699	0.0600	0.00090	0.703	0.004	0.000016	0.000719						
1994	7	0.703	0.0549	0.00075	0.701	-0.002	0.000003	0.000600						
1995	8	0.689	0.0546	0.00074	0.699	0.011	0.000112	0.000594						
1996	9	0.699	0.0541	0.00073	0.698	-0.001	0.000002	0.000584						
							0.000551	0.006042	0.006593					
	SUMMARY OUTPUT													
	Regression Statistics													
	Multiple R	0.5744879												
	R Square	0.3300364												
	Adjusted R Square	0.2462909												
	Standard Error	0.0082988												
	Observations	10												
	ANOVA													
		df	*SS*	*MS*	*F*	*Significance F*								
	Regression	1	0.000271413	0.000271	3.940947	0.082385279								
	Residual	8	0.00055096	6.89E-05										
	Total	9	0.000822372											
		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*					
	Intercept	0.7139893	0.004877647	146.3799	5.31E-15	0.702741426	0.72523719	0.70274143	0.72523719					
	X Variable 1	-0.001814	0.000913667	-1.98518	0.082385	-0.00392072	0.00029313	-0.0039207	0.00029313					

Regression for IID District DE					Equation	a=	0.919616							
						b=	0.001020							
		District DE						Addition SSE			Revised analysis			
Year		Ratio	2*s	Variance	predicted	error	SSE	Uncertainty	Total					
1987	0	0.918	0.0109	0.00003	0.920	0.001	0.000002	0.000024			SS	MS	F	Signific. F
1988	1	0.922	0.0102	0.00003	0.921	-0.001	0.000001	0.000021			0.000086	8.58E-05	5.926302	0.04092
1989	2	0.924	0.0100	0.00002	0.922	-0.003	0.000008	0.000020			0.000116	1.45E-05		
1990	3	0.925	0.0096	0.00002	0.923	-0.002	0.000004	0.000018			0.000202			
1991	4	0.925	0.0095	0.00002	0.924	-0.001	0.000002	0.000018						
1992	5	0.916	0.0104	0.00003	0.925	0.008	0.000069	0.000022						
1993	6	0.924	0.0090	0.00002	0.926	0.002	0.000004	0.000016						
1994	7	0.929	0.0080	0.00002	0.927	-0.003	0.000007	0.000013						
1995	8	0.928	0.0080	0.00002	0.928	-0.001	0.000000	0.000013						
1996	9	0.930	0.0078	0.00002	0.929	-0.001	0.000002	0.000012						
							0.000098	0.000176	0.000274					
	SUMMARY OUTPUT													
	Regression Statistics													
	Multiple R	0.6827542												
	R Square	0.4661534												
	Adjusted R Square	0.3994225												
	Standard Error	0.0035041												
	Observations	10												
	ANOVA													
		df	*SS*	*MS*	*F*	*Significance F*								
	Regression	1	8.57752E-05	8.58E-05	6.985577	0.029574199								
	Residual	8	9.82312E-05	1.23E-05										
	Total	9	0.000184006											
		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*					
	Intercept	0.9196162	0.002059564	446.5102	7.09E-19	0.914866818	0.92436555	0.91486682	0.92436555					
	X Variable 1	0.0010197	0.000385792	2.643024	0.029574	0.000130019	0.00190929	0.00013002	0.00190929					

Regression for IID Farm IE					Equation	a=	0.776358							
						b=	-0.002799							
		Farm IE						Addition SSE			Revised analysis			
Year		Ratio	2*s	Variance	predicted	error	SSE	Uncertainty	Total					
1987	0	0.771	0.0543	0.00074	0.776	0.005	0.000024	0.000589			SS	MS	F	Signific. F
1988	1	0.778	0.0560	0.00078	0.774	-0.005	0.000021	0.000626			0.000646	0.000646	3.082442	0.117214
1989	2	0.765	0.0554	0.00077	0.771	0.006	0.000038	0.000612			0.001677	0.00021		
1990	3	0.759	0.0571	0.00081	0.768	0.009	0.000075	0.000650			0.002324			
1991	4	0.770	0.0617	0.00095	0.765	-0.005	0.000021	0.000759						
1992	5	0.787	0.0728	0.00132	0.762	-0.025	0.000625	0.001056						
1993	6	0.757	0.0655	0.00107	0.760	0.003	0.000007	0.000856						
1994	7	0.757	0.0595	0.00088	0.757	0.000	0.000000	0.000706						
1995	8	0.742	0.0592	0.00088	0.754	0.012	0.000142	0.000700						
1996	9	0.752	0.0586	0.00086	0.751	0.000	0.000000	0.000686						
							0.000953	0.007240	0.008193					

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.6356303
R Square	0.4040259
Adjusted R Square	0.3295291
Standard Error	0.0109162
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.000646269	0.000646	5.423402	0.048250496
Residual	8	0.000953305	0.000119		
Total	9	0.001599574			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.7763577	0.00641603	121.0028	2.43E-14	0.761562289	0.79115309	0.76156229	0.79115309
X Variable 1	-0.002799	0.001201833	-2.32882	0.04825	-0.00557028	-2.742E-05	-0.0055703	-2.742E-05

Analysis of Variance

	0.771	0.7569
	0.778	0.7565
	0.765	0.7420
	0.759	0.7516
	0.770	
	0.787	

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*			
Mean	0.7717697	0.75175258	Difference =		0.020
Variance	9.898E-05	4.76819E-05			
Observations	6	4			
Pooled Variance	7.974E-05				
Hypothesized Mean I	0.01				
df	8				
t Stat	1.7378317				
P(T<=t) one-tail	0.0602203		Means 6.0% chance that means are different by less than 0.01.		
t Critical one-tail	1.8595483				
P(T<=t) two-tail	0.1204406				
t Critical two-tail	2.3060056				

ANNEX 4

ppm/Ece =	623	
Year	PPM	ECiw
1989	682	1.09
1990	721	1.16
1991	751	1.21
1992	781	1.25
1993	767	1.23
1994	797	1.28
1995	787	1.26
1996	782	1.26

The values above are found in Table 5 of the text

Crop Evapotranspiration of Irrigation Water (ETc-Rinf), AF/month

		Fraction of ETiw, for Leaching (Note that this is larger than LR)								ETiw of each crop, by year (AF)		
	ECe thresh	1989	1990	1991	1992	1993	1994	1995	1996	1989 Total	1990	1991
Alfalfa	2	0.140156	0.150585	0.15884095	0.167309	0.16333	0.17192	0.16903	0.17	906664	979698	866138
Sudan	2.8	0.092688	0.099038	0.10401662	0.109078	0.10671	0.11181	0.1101	0.11	172646	129597	185424
Wheat	6	0.039363	0.041802	0.04369327	0.045598	0.04471	0.04662	0.04598	0.05	139349	87208	61170
Bermuda	6.9	0.033881	0.035957	0.03756597	0.039184	0.03843	0.04005	0.03951	0.04	91684	81591	76701
Sugar Beets	7	0.033364	0.035407	0.03698961	0.038581	0.03784	0.03943	0.0389	0.04	118128	120547	119792
Lettuce - Early	1.3	0.253956	0.27651	0.29479882	0.31397	0.30491	0.32458	0.31792	0.31	32545	19697	24339
Lettuce - Late	1.3	0.253956	0.27651	0.29479882	0.31397	0.30491	0.32458	0.31792	0.31	18280	11744	10046
Carrots	1	0.389492	0.430962	0.46559206	0.502898	0.48514	0.524	0.51071	0.5	31660	31692	25683
Cantaloupes - Spring	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	30110	49986	36585
Cantaloupes - Fall	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	13481	10026	11997
Alfalfa Seed	5	0.047991	0.051015	0.0533646	0.055734	0.05463	0.05701	0.05621	0.06	2200	5826	20436
Cotton (upland and PIMA)	7.7	0.030148	0.031983	0.03340227	0.03483	0.03416	0.03559	0.03512	0.03	38333	40682	27813
Honeydew	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	6572	6737	5441
Watermelon	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	8825	8926	5526
Onions	1.2	0.287279	0.314024	0.33586762	0.358915	0.348	0.37174	0.36368	0.36	28145	29813	27832
Onion Seed	1.5	0.206136	0.223185	0.23687116	0.251085	0.24438	0.25889	0.25399	0.25	9726	11352	8078
Rye - Pastured	5.6	0.042413	0.045057	0.04710827	0.049175	0.04821	0.05028	0.04959	0.05	31843	23601	20757
Oats and Barley	7	0.033364	0.035407	0.03698961	0.038581	0.03784	0.03943	0.0389	0.04	15108	6142	5764
Misc. Field Crops	2	0.140156	0.150585	0.15884095	0.167309	0.16333	0.17192	0.16903	0.17	2207	2423	1881
Tomatoes	2.5	0.106173	0.113624	0.11948135	0.125452	0.12265	0.12868	0.12666	0.13	31966	37751	15431
Potatoes	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	417	496	761
Broccoli	2.8	0.092688	0.099038	0.10401662	0.109078	0.10671	0.11181	0.1101	0.11	12101	8994	8580
Cabbage	1.8	0.160735	0.173109	0.18294762	0.193078	0.18831	0.1986	0.19514	0.19	1485	1470	1420
Cauliflower	2.8	0.092688	0.099038	0.10401662	0.109078	0.10671	0.11181	0.1101	0.11	9588	7867	4946
Corn, Ear	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	3651	5925	7249
Misc. Garden Crops	1.5	0.206136	0.223185	0.23687116	0.251085	0.24438	0.25889	0.25399	0.25	3485	4223	3707
Asparagas	4.1	0.059785	0.063639	0.06664005	0.069673	0.06825	0.0713	0.07028	0.07	25722	25816	24926
Citrus	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	9248	8920	9152
Jojoba	5	0.047991	0.051015	0.0533646	0.055734	0.05463	0.05701	0.05621	0.06	8519	8110	6553
Peach Trees	1.7	0.173471	0.187103	0.19797021	0.209187	0.20391	0.21532	0.21147	0.21	2305	2002	1283
Perm. Pasture + Misc	1.5	0.206136	0.223185	0.23687116	0.251085	0.24438	0.25889	0.25399	0.25	2536	2511	2248
Total (incl. ponds, etc. /w LF)										1,835,572	1796542	1649517
ETo, AF										3,218,021	2983774	2652964
Total Garden Crops										242,037	246702	197623
Total Field Crops										1,518,162	1477314	1385874
Total Other										75,372	72526	66021

	1989	1990	1991	1992	1993	1994	1995	1996
Alfalfa	127,075	147,528	137,578	130,989	127,244	150,463	150,576	132,954
Sudan	16,002	12,835	19,287	16,338	21,554	28,354	26,716	24,823
Wheat	5,485	3,645	2,673	4,284	3,965	5,223	5,824	9,409
Bermuda	3,106	2,934	2,881	4,126	5,468	5,984	6,950	7,182
Sugar Beets	3,941	4,268	4,431	4,414	4,172	3,747	4,510	5,217
Lettuce - Early	8,265	5,447	7,175	5,949	4,557	4,902	5,168	6,294
Lettuce - Late	4,642	3,247	2,962	1,353	1,235	2,648	2,651	3,495
Carrots	12,331	13,658	11,958	10,566	13,413	15,652	13,215	16,031
Cantaloupes - Spring	5,223	9,353	7,243	3,270	4,450	5,224	5,418	5,500
Cantaloupes - Fall	2,339	1,876	2,375	753	103	198	3	242
Alfalfa Seed	106	297	1,091	507	615	489	980	995
Cotton (upland and PIMA)	1,156	1,301	929	430	933	920	881	676
Honeydew	1,140	1,260	1,077	295	151	381	523	461
Watermelon	1,531	1,670	1,094	884	1,264	1,837	1,366	1,407
Onions	8,085	9,362	9,348	8,002	8,517	10,941	11,661	12,304
Onion Seed	2,005	2,534	1,913	1,762	1,838	1,498	1,502	2,119
Rye - Pastured	1,351	1,063	978	716	627	733	507	496
Oats and Barley	504	217	213	104	75	141	104	60
Misc. Field Crops	309	365	299	280	752	712	1,148	1,983
Tomatoes	3,394	4,289	1,844	999	1,175	828	722	721
Potatoes	72	93	151	101	384	457	636	911
Broccoli	1,122	891	892	637	531	775	656	687
Cabbage	239	255	260	157	212	340	192	226
Cauliflower	889	779	514	384	354	393	282	307
Corn, Ear	633	1,109	1,435	1,521	1,409	2,278	2,573	3,031
Misc. Garden Crops	718	942	878	970	879	885	1,301	1,376

Asparagas		1,538	1,643	1,661	1,965	2,025	2,071	1,861	1,780
Citrus		1,604	1,669	1,812	2,231	2,679	3,171	3,367	3,921
Jojoba		409	414	350	364	403	399	403	396
Peach Trees		400	375	254	211	185	134	10	2
Perm. Pasture + Misc.		523	560	532	588	724	900	824	810
		216,137	235,880	226,088	205,150	211,892	252,680	252,528	245,817

The first AF values below were based on the ETo * Kc approach

The second set of values applies the R.Allen Table 3.5 correction factor from the Water Balance approach

Year	AF for LR	AF for ETiw	Corr. factor	AF for LR	LR
1989	216,137	1,835,572	1.015	219,379	0.105
1990	235,880	1,796,542	0.989	233,285	0.116
1991	226,088	1,649,517	0.963	217,723	0.121
1992	205,150	1,485,257	0.994	203,920	0.121
1993	211,892	1,598,078	0.963	204,052	0.117
1994	252,680	1,781,306	0.989	249,900	0.124
1995	252,528	1,852,165	1.065	268,943	0.120
1996	245,817	1,871,502	1.013	249,012	0.116

Table 7 in text - Procedure #1

Year	AF for LR	LR
1989	219,379	0.105
1990	233,285	0.116
1991	217,723	0.121
1992	203,920	0.121
1993	204,052	0.117
1994	249,900	0.124
1995	268,943	0.120
1996	249,012	0.116

	Spreadsheet name = ETCbymonth			
1992	1993	1994	1995	1996
782915	779057	875215	890829	793306
149786	201999	253582	242652	227213
93957	88680	112040	126668	206057
105298	142300	149418	175906	183034
114420	110254	95010	115931	135040
18947	14944	15104	16255	20005
4311	4051	8159	8339	11107
21010	27647	29871	25876	31795
15631	21823	24262	25618	26244
3600	506	920	14	1156
9088	11252	8573	17431	17821
12348	27310	25845	25086	19388
1410	739	1772	2474	2200
4224	6200	8532	6461	6713
22294	24473	29432	32064	34206
7017	7523	5786	5913	8425
14557	12999	14576	10229	10070
2691	1980	3564	2670	1542
1673	4602	4144	6793	11829
7962	9581	6434	5696	5735
481	1883	2123	3007	4348
5839	4979	6928	5960	6290
816	1128	1712	984	1170
3518	3321	3518	2557	2814
7271	6909	10582	12168	14463
3865	3596	3418	5121	5468
28203	29667	29044	26475	25515
10667	13136	14727	15921	18712
6533	7379	7003	7164	7104
1009	907	622	47	11
2342	2962	3478	3242	3221
1485257	1598078	1781306	1852165	1871502
2732930	2885160	2846690	2942169	3115375
128196	139304	158552	158509	182137
1286734	1380433	1541968	1614196	1605300
70327	78342	80786	79460	84064

The values are below are from the sheet Std. LR with EC mult.

Year	PPM	ECw
1989	682	1.09
1990	721	1.16
1991	751	1.21
1992	781	1.25
1993	767	1.23
1994	797	1.28
1995	787	1.26
1996	782	1.26

Avg. ECw 3 years before 19	1.15
Avg. ECe in soils =	8.4
LR =	0.08464319

**Use this value for the year 1990

Year	Miles of Tile	Adj. LF	ETiw, AF	Water Balance ETiw factor	.5*ET*ETfactor	Leach AF
1987	31,021	0.081				
1988	31,552	0.083				
1989	31,894	0.084	1,835,572	1.015	931,553	85,169
1990	32,227	0.085	1,796,542	0.989	888,390	82,150
1991	32,538	0.085	1,649,517	0.963	794,243	74,219
1992	32,721	0.086	1,485,257	0.994	738,173	69,404
1993	32,963	0.087	1,598,078	0.963	769,475	72,932
1994	33,175	0.087	1,781,306	0.989	880,856	84,078
1995	33,432	0.088	1,852,165	1.065	986,278	94,940
1996	33,700	0.089	1,871,502	1.013	947,916	92,049

The values above are used in Table 8 of the report

The values below are used in Table 9 or 10 of the report

Year	AF for BenLF
1989	85,169
1990	82,150
1991	74,219
1992	69,404
1993	72,932
1994	84,078
1995	94,940
1996	92,049

ECw multiplier =		1
ppm/Ece =	625	
Year	PPM	ECw
1989	682	1.09
1990	721	1.16
1991	751	1.21
1992	781	1.25
1993	767	1.23
1994	797	1.28
1995	787	1.26
1996	782	1.26

Crop Evapotranspiration of Irrigation Water (ETc-Pinf), AF/month

Fraction of ETiw, for Leaching (Note that this is larger than LR)

	ECe thresh	1989	1990	1991	1992	1993	1994	1995	1996
Alfalfa	2	0.14015619	0.1505848	0.158840948	0.16731	0.16333049	0.1719154	0.169	0.17
Sudan	2.8	0.09268823	0.0990385	0.10401662	0.10908	0.10670562	0.1118126	0.1101	0.11
Wheat	6	0.03936281	0.0418019	0.043693274	0.0456	0.04470739	0.0466191	0.046	0.05
Bermuda	6.9	0.03389062	0.0359574	0.037565966	0.03918	0.03842782	0.0400513	0.0395	0.04
Sugar Beets	7	0.03336432	0.0354074	0.036989607	0.03858	0.0378373	0.039434	0.0389	0.04
Lettuce - Early	1.3	0.25395643	0.2765101	0.294798822	0.31397	0.30490956	0.3245775	0.3179	0.31
Lettuce - Late	1.3	0.25395643	0.2765101	0.294798822	0.31397	0.30490956	0.3245775	0.3179	0.31
Carrots	1	0.38949172	0.4309823	0.465592064	0.5029	0.48513599	0.5239974	0.5107	0.5
Cantaloupes - Spring	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Cantaloupes - Fall	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Alfalfa Seed	5	0.04799099	0.0510154	0.053364599	0.05573	0.05462574	0.0570059	0.0562	0.06
Cotton (upland and PIMA)	7.7	0.03014831	0.0319828	0.033402273	0.03483	0.03416253	0.0355939	0.0351	0.03
Honeydew	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Watermelon	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2116	0.21
Onions	1.2	0.29727885	0.3140244	0.335867621	0.35892	0.34800363	0.3717361	0.3637	0.36
Onion Seed	1.5	0.20613571	0.2231853	0.236871156	0.25109	0.24438426	0.2588923	0.254	0.25
Rye - Pastured	5.6	0.04241294	0.0450569	0.047108267	0.04918	0.04820887	0.0502839	0.0498	0.05
Oats and Barley	7	0.03336432	0.0354074	0.036989607	0.03858	0.0378373	0.039434	0.0389	0.04
Misc. Field Crops	2	0.14015619	0.1505848	0.158840948	0.16731	0.16333049	0.1719154	0.169	0.17
Tomatoes	2.5	0.10617265	0.1136238	0.119481346	0.12545	0.12265132	0.1286833	0.1267	0.13
Potatoes	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Broccoli	2.8	0.09268823	0.0990385	0.10401662	0.10908	0.10670562	0.1118126	0.1101	0.11
Cabbage	1.9	0.16073533	0.1731092	0.182947625	0.19308	0.18831328	0.1986045	0.1951	0.19
Cauliflower	2.8	0.09268823	0.0990385	0.10401662	0.10908	0.10670562	0.1118126	0.1101	0.11
Corn, Ear	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Misc. Garden Crops	1.5	0.20613571	0.2231853	0.236871156	0.25109	0.24438426	0.2588923	0.254	0.25
Asparagus	4.1	0.05978523	0.0636392	0.066640046	0.06967	0.06825362	0.071304	0.0703	0.07
Citrus	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Jojoba	5	0.04799099	0.0510154	0.053364599	0.05573	0.05462574	0.0570059	0.0562	0.06
Peach Trees	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Perm. Pasture + Misc.	1.5	0.20613571	0.2231853	0.236871156	0.25109	0.24438426	0.2588923	0.254	0.25
Total ETiw (not incl ponds, etc. w/o LF)									
ETo, AF									
Total Garden Crops									
Total Field Crops									
Total Other									

ETiw of each crop, by year (AF) — Spreadsheet name = ETCbymonth

	1989 Total	1990	1991	1992	1993	1994	1995	1996
Alfalfa	906664	979696	866138	782915	779057	875215	890829	793306
Sudan	172646	129597	185424	149786	201999	253582	242852	227213
Wheat	138349	87208	61170	93957	88680	112040	126668	208057
Bermuda	91684	81591	76701	106298	142300	149418	175906	183034
Sugar Beets	118128	120547	119792	114420	110254	95010	115931	136040
Lettuce - Early	32545	19697	24339	18947	14944	15104	16256	20005
Lettuce - Late	16280	11744	10046	4311	4061	8159	8339	11107
Carrots	31680	31692	25683	21010	27647	29871	25876	31796
Cantaloupes - Spring	30110	49988	36586	15631	21923	24262	25818	26244
Cantaloupes - Fall	13481	10028	11997	3600	506	920	14	1156
Alfalfa Seed	2200	5828	20436	9088	11252	8573	17431	17821
Cotton (upland and PIMA)	38333	40682	27813	12348	27310	25845	25088	19388
Honeydew	6572	6737	5441	1410	739	1772	2474	2200
Watermelon	8825	8926	5526	4224	6200	8532	6461	8713
Onions	28145	29813	27832	22294	24473	29432	32064	34206
Onion Seed	9726	11352	8078	7017	7523	5796	5913	8425
Rye - Pastured	31843	23601	20757	14557	12999	14576	10229	10070
Oats and Barley	15108	6142	5764	2691	1980	3564	2670	1542
Misc. Field Crops	2207	2423	1881	1673	4602	4144	6793	11829
Tomatoes	31968	37751	15431	7962	9581	6434	5896	5735
Potatoes	417	496	761	481	1883	2123	3007	4348
Broccoli	12101	8994	8580	5839	4979	8929	5960	6290
Cabbage	1485	1470	1420	816	1128	1712	984	1170
Cauliflower	9588	7867	4946	3518	3321	3518	2567	2814
Corn, Ear	3651	5925	7249	7271	6909	10582	12168	14463
Misc. Garden Crops	3485	4223	3707	3865	3596	3418	5121	5488
Asparagus	25722	25816	24926	28203	29667	29044	26475	25515
Citrus	9248	8920	9152	10667	13136	14727	15821	18712
Jojoba	8519	8110	6553	6533	7379	7003	7164	7104
Peach Trees	2305	2002	1283	1009	907	622	47	11
Perm. Pasture + Misc.	2536	2511	2248	2342	2962	3478	3242	3221
Total ETiw (not incl ponds, etc. w/o LF)	1,808,529	1,771,375	1,627,658	1,463,685	1,573,769	1,755,393	1,825,564	1,842,000
ETo, AF	3,218,021	2883774	2652964	2732930	2885160	2946690	2942169	3115375
Total Garden Crops	242,037	246702	197623	128196	139304	158562	158509	182137
Total Field Crops	1,518,162	1477314	1365874	1286734	1390433	1541968	1614196	1605300
Total Other	75,372	72526	66021	70327	78342	80786	79460	84064

The computations below are made by assigning 50% of the acreage an ECe threshold of 2
and the others a threshold of 1.5.

LR #1	2
LR #2	1.5

Year	Factor#1	Factor#2	Total ETiw	AF for LR#1	AF for LR#2	WB ETiw factor	Year	Total AF for L	LR
1989	0.140156	0.2061357	1,808,529	126,738	186,401	1.015	1989	317,836	0.149
1990	0.150585	0.2231853	1,771,375	133,371	197,672	0.989	1990	327,402	0.156
1991	0.158841	0.2368712	1,627,658	129,269	192,773	0.983	1991	310,126	0.160
1992	0.167309	0.251095	1,463,685	122,444	183,756	0.994	1992	304,362	0.172
1993	0.16333	0.2443843	1,573,769	128,524	192,305	0.983	1993	308,958	0.164
1994	0.171915	0.2588923	1,755,393	150,890	227,229	0.989	1994	373,959	0.176
1995	0.169029	0.2539939	1,825,554	154,286	231,840	1.065	1995	411,224	0.184
1996	0.167595	0.2515683	1,842,000	154,356	231,694	1.013	1996	391,068	0.175

ECw multiplier =		1
ppm/Ece =	623	
Year	PPM	ECw
1989	682	1.09
1990	721	1.16
1991	751	1.21
1992	781	1.25
1993	767	1.23
1994	797	1.28
1995	787	1.26
1996	782	1.26

Crop Evapotranspiration of Irrigation Water (ETc-Pinf), AF/month

Fraction of ETiw, for Leaching (Note that this is larger than LR)

	ECe thresh	1989	1990	1991	1992	1993	1994	1995	1996
Alfalfa	2	0.14015619	0.1505848	0.158840948	0.16731	0.16333049	0.1719154	0.169	0.17
Sudan	2.8	0.09268823	0.0990385	0.10401662	0.10908	0.10670562	0.1118126	0.1101	0.11
Wheat	6	0.03936281	0.0418019	0.043693274	0.0456	0.04470739	0.0466191	0.046	0.05
Bermuda	6.9	0.03380062	0.0359674	0.037565966	0.03918	0.03842782	0.0400513	0.0395	0.04
Sugar Beets	7	0.03336432	0.0354074	0.036989607	0.03858	0.0378373	0.039434	0.0389	0.04
Lettuce - Early	1.3	0.25395643	0.2765101	0.294798822	0.31397	0.30490956	0.3245775	0.3179	0.31
Lettuce - Late	1.3	0.25395643	0.2765101	0.294798822	0.31397	0.30490956	0.3245775	0.3179	0.31
Carrots	1	0.38949172	0.4309623	0.465592064	0.5029	0.48513599	0.5239874	0.5107	0.5
Cantaloupes - Spring	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Cantaloupes - Fall	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Alfalfa Seed	5	0.04799099	0.0510154	0.053364599	0.05573	0.05462574	0.0570059	0.0562	0.06
Cotton (upland and PIMA)	7.7	0.03014831	0.0319826	0.033402273	0.03483	0.03416253	0.0355839	0.0351	0.03
Honeydew	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Watermelon	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Onions	1.2	0.28727885	0.3140244	0.335887621	0.35892	0.34800363	0.3717351	0.3637	0.36
Onion Seed	1.5	0.20613571	0.2231853	0.236871156	0.25109	0.24438426	0.2588923	0.254	0.25
Rye - Pastured	5.6	0.04241294	0.0450569	0.047108267	0.04918	0.04820887	0.0502839	0.0496	0.05
Oats and Barley	7	0.03336432	0.0354074	0.036989607	0.03858	0.0378373	0.039434	0.0389	0.04
Misc. Field Crops	2	0.14015619	0.1505848	0.158840948	0.16731	0.16333049	0.1719154	0.169	0.17
Tomatoes	2.5	0.10617265	0.1136238	0.119481346	0.12545	0.12265132	0.1286833	0.1267	0.13
Potatoes	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Broccoli	2.8	0.09268823	0.0990385	0.10401662	0.10908	0.10670562	0.1118126	0.1101	0.11
Cabbage	1.9	0.16073533	0.1731092	0.182947825	0.19308	0.18831329	0.1988045	0.1951	0.19
Cauliflower	2.8	0.09268823	0.0990385	0.10401662	0.10908	0.10670562	0.1118126	0.1101	0.11
Corn, Ear	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Misc. Garden Crops	1.5	0.20613571	0.2231853	0.236871156	0.25109	0.24438426	0.2588923	0.254	0.25
Asparagus	4.1	0.05978523	0.0636392	0.066640046	0.06967	0.06825362	0.071304	0.0703	0.07
Citrus	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Jojoba	5	0.04799099	0.0510154	0.053364599	0.05573	0.05462574	0.0570059	0.0562	0.06
Peach Trees	1.7	0.17347069	0.1871026	0.197970212	0.20919	0.20390802	0.2153181	0.2115	0.21
Perm. Pasture + Misc.	1.5	0.20613571	0.2231853	0.236871156	0.25109	0.24438426	0.2588923	0.254	0.25

ETiw of each crop, by year (AF) — Spreadsheet name = ETCbymonth

	1989 Total	1990	1991	1992	1993	1994	1995	1996
Alfalfa	905664	979698	866138	782915	779057	875215	890829	793306
Sudan	172646	129587	165424	149786	201999	253592	242652	227213
Wheat	139349	87208	61170	93957	88680	112040	128668	208057
Bermuda	91684	91591	76701	105298	142300	149418	175906	183034
Sugar Beets	118128	120547	119792	114420	110254	95010	115931	135040
Lettuce - Early	32545	19697	24339	18947	14944	15104	18256	20005
Lettuce - Late	18280	11744	10046	4311	4051	8159	8339	11107
Carrots	31680	31692	25683	21010	27647	29871	25876	31796
Cantaloupes - Spring	30110	49986	36585	15631	21623	24262	25618	28244
Cantaloupes - Fall	13481	10026	11997	3600	506	920	14	1156
Alfalfa Seed	2200	5826	20436	9088	11252	8573	17431	17821
Cotton (upland and PIMA)	38333	40682	27813	12348	27310	25845	25086	19388
Honeydew	6572	6737	5441	1410	739	1772	2474	2200
Watermelon	8825	8928	5526	4224	6200	8532	6481	6713
Onions	28145	29813	27832	22294	24473	29432	32064	34208
Onion Seed	9726	11352	8078	7017	7523	5786	5913	8425
Rye - Pastured	31843	23601	20757	14557	12999	14576	10229	10070
Oats and Barley	15109	8142	5764	2891	1980	3564	2670	1542
Misc. Field Crops	2207	2423	1881	1673	4602	4144	6793	11829
Tomatoes	31966	37751	15431	7962	9581	6434	5696	5735
Potatoes	417	498	761	481	1883	2123	3007	4348
Broccoli	12101	8994	8580	5839	4979	6929	5860	6290
Cabbage	1485	1470	1420	816	1128	1712	984	1170
Cauliflower	9588	7867	4946	3518	3321	3518	2567	2814
Corn, Ear	3651	5925	7249	7271	6909	10582	12168	14463
Misc. Garden Crops	3485	4223	3707	3865	3596	3418	5121	5468
Asparagus	25722	25816	24926	28203	29667	29044	26475	25615
Citrus	9248	8920	9152	10667	13136	14727	15921	18712
Jojoba	8519	8110	6563	6533	7379	7003	7164	7104
Peach Trees	2305	2002	1283	1009	907	622	47	11
Perm. Pasture + Misc.	2536	2511	2248	2342	2962	3478	3242	3221
Total ETiw (not incl ponds, etc, w/o LR)	1,808,529	1,771,375	1,627,658	1,463,685	1,573,789	1,755,393	1,825,554	1,842,000
ETo, AF	3,218,021	2983774	2652964	2732930	2885160	2946690	2942169	3115375
Total Garden Crops	242,037	246702	197623	128198	139304	158562	158509	182137
Total Field Crops	1,518,162	1477314	1385874	1286734	1380433	1541968	1614196	1605300
Total Other	75,372	72526	66021	70327	78342	80786	79460	84064

The computations below are made by assigning 50% of the acreage an ECe threshold of 2 and the others a threshold of 1.5.

LR #1	2
LR #2	1.5

Year	Factor#1	Factor#2	Total ETiw	AF for LR#1	AF for LR#2	WB ETiw factor	Year	Total AF for LR	LR
1989	0.140156	0.2061357	1,808,529	126,738	186,401	1.015	1989	317,836	0.149
1990	0.150585	0.2231853	1,771,375	133,371	197,672	0.989	1990	327,402	0.156
1991	0.158841	0.2368712	1,627,658	129,269	192,773	0.963	1991	310,126	0.160
1992	0.167309	0.251085	1,463,685	122,444	183,755	0.994	1992	304,362	0.172
1993	0.16333	0.2443843	1,573,789	128,524	192,305	0.963	1993	308,958	0.164
1994	0.171915	0.2588923	1,755,393	150,890	227,229	0.989	1994	373,959	0.176
1995	0.169029	0.2539939	1,825,554	154,286	231,840	1.065	1995	411,224	0.164
1996	0.167595	0.2515683	1,842,000	154,356	231,694	1.013	1996	391,068	0.175

ECw multiplier =			1
ppm/Ece =		623	
Year	PPM	ECw	
1989	682	1.09	
1990	721	1.16	
1991	781	1.21	
1992	781	1.26	
1993	767	1.23	
1994	797	1.28	
1995	787	1.26	
1996	782	1.26	

Crop Evapotranspiration of Irrigation Water (ETc-Pinf), AF/month

Fraction of ETIw. for Leaching (Note that this is larger than LF)

	ECe thresh	1989	1990	1991	1992	1993	1994	1995	1996
Alfalfa	2	0.14015619	0.1505848	0.158840948	0.16730934	0.163330494	0.1719154	0.16903	0.17
Sudan	2.8	0.09268823	0.09903846	0.10401662	0.109078212	0.10670662	0.1118126	0.1101	0.11
Wheat	6	0.03936201	0.04180196	0.043693274	0.045697851	0.044707391	0.0466191	0.04690	0.05
Bermuda	6.9	0.03368062	0.03595741	0.037565966	0.039184206	0.038427816	0.0400613	0.03951	0.04
Sugar Beets	7	0.03336432	0.03540736	0.036989807	0.038581238	0.037837306	0.039434	0.0389	0.04
Lettuce - Early	1.3	0.26396643	0.27651007	0.294798822	0.313969849	0.304909561	0.3245775	0.31792	0.31
Lettuce - Late	1.3	0.26396643	0.27651007	0.294798822	0.313969849	0.304909561	0.3245775	0.31792	0.31
Carrots	1	0.38949172	0.43089234	0.466692064	0.502897618	0.46613699	0.5239974	0.51071	0.5
Cantaloupes - Spring	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Cantaloupes - Fall	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Alfalfa Seed	5	0.04799099	0.05101535	0.053364599	0.055733961	0.054625739	0.0570069	0.05621	0.06
Cotton (upland and PIMA)	7.7	0.03014831	0.03198261	0.033402273	0.034829532	0.034162528	0.0356939	0.03512	0.03
Honeydew	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Watermelon	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Onions	1.2	0.28727885	0.31402439	0.335867621	0.358915441	0.34800363	0.3717361	0.36368	0.36
Onion Seed	1.5	0.20613571	0.22318527	0.236871156	0.251085035	0.24438426	0.2588923	0.25399	0.25
Rye - Pastured	5.6	0.04241294	0.04505587	0.047108267	0.049175187	0.048208674	0.0502839	0.04959	0.05
Oats and Barley	7	0.03336432	0.03540736	0.036989807	0.038581238	0.037837306	0.039434	0.0389	0.04
Misc. Field Crops	2	0.14015619	0.1505848	0.158840948	0.16730934	0.163330494	0.1719154	0.16903	0.17
Tomatoes	2.5	0.10617265	0.11362383	0.119461346	0.125451771	0.122651316	0.1288833	0.12866	0.13
Potatoes	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Broccoli	2.8	0.09268823	0.09903846	0.10401662	0.109078212	0.10670662	0.1118126	0.1101	0.11
Cabbage	1.8	0.16073533	0.17310924	0.182947625	0.193077874	0.188313283	0.1988046	0.19514	0.19
Cauliflower	2.8	0.09268823	0.09903846	0.10401662	0.109078212	0.10670662	0.1118126	0.1101	0.11
Corn, Ear	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Misc. Garden Crops	1.5	0.20613571	0.22318527	0.236871156	0.251085035	0.24438426	0.2588923	0.25399	0.25
Asparagus	4.1	0.05970523	0.06363917	0.066640046	0.069673045	0.068253615	0.071304	0.07029	0.07
Citrus	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Jojoba	5	0.04799099	0.05101535	0.053364599	0.055733961	0.054625739	0.0570069	0.05621	0.06
Peach Trees	1.7	0.17347069	0.18710263	0.197970212	0.20918709	0.203908015	0.2153181	0.21147	0.21
Perm. Pasture + Misc.	1.5	0.20613571	0.22318527	0.236871156	0.251085035	0.24438426	0.2588923	0.25399	0.25

ETIw of each crop, by year (AF) — Spreadsheet name = ETCbymonth

	1989 Total	1990	1991	1992	1993	1994	1995	1996
Alfalfa	906664	979690	866138	782915	779057	875215	890829	793306
Sudan	172646	129597	185424	149786	201999	253582	242652	227213
Wheat	139349	87208	61170	93957	89680	112040	126668	206067
Bermuda	91604	81591	76701	105298	142300	149416	175906	183034
Sugar Beets	118128	120547	119792	114420	110254	95010	116931	135040
Lettuce - Early	32549	19697	24339	18947	14944	15104	16256	20006
Lettuce - Late	18280	11744	10046	4311	4061	8159	8339	11107
Carrots	31640	31692	26683	21010	27647	29871	25876	31796
Cantaloupes - Spring	30110	49986	36586	18631	21823	24262	25610	26244
Cantaloupes - Fall	13481	10029	11997	3600	606	920	14	1156
Alfalfa Seed	2200	5826	20436	9088	11262	8573	17431	17821
Cotton (upland and PIMA)	38333	40682	27813	12348	27310	25845	25086	19388
Honeydew	6572	6737	5441	1410	739	1772	2474	2200
Watermelon	8825	8926	5826	4224	6200	6532	6461	6713
Onions	26145	29813	27832	22294	24473	29432	32064	34206
Onion Seed	9726	11352	8078	7017	7523	5786	6913	8425
Rye - Pastured	31843	23601	20757	14587	12999	14576	10229	10070
Oats and Barley	15108	6142	5764	2691	1980	3584	2670	1542
Misc. Field Crops	2207	2423	1881	1673	4602	4144	6793	11829
Tomatoes	31966	37751	18431	7962	9601	8434	8696	8735
Potatoes	417	496	761	481	1883	2123	3007	4348
Broccoli	12101	8994	8580	8638	4979	6928	8960	6290
Cabbage	1488	1470	1420	816	1128	1712	984	1170
Cauliflower	9589	7967	4946	3618	3321	3518	2567	2814
Corn, Ear	3651	5926	7249	7271	6909	10582	12168	14463
Misc. Garden Crops	3485	4223	3707	3865	3596	3418	5121	5468
Asparagus	29722	25816	24926	28203	29667	29044	26475	25818
Citrus	9248	8920	9152	10667	13136	14727	15921	16712
Jojoba	8519	8110	6563	6533	7379	7003	7164	7104
Peach Trees	2305	2002	1283	1009	907	822	47	11
Perm. Pasture + Misc.	2536	2511	2248	2342	2962	3478	3242	3221
Total ETIw (not incl ponds, etc. w/o LF)	1,808,529	1,771,375	1,627,658	1,463,685	1,573,789	1,755,393	1,825,554	1,842,000
ETo, AF	3,218,021	2983774	2652964	2732930	2885160	2846690	2942169	3115375
Total Garden Crops	242,037	246702	197623	128196	139304	158552	158509	182137
Total Field Crops	1,818,162	1477314	1385874	1286734	1380433	1541968	1614196	1605300
Total Other	75,372	72526	66021	70327	78342	80786	79460	84064

The computations below are made by assigning 50% of the acreage an ECe threshold of 1.7

LR #1: 1.7
LR #2: 0

From Rick Allen

Year	Factor#1	All acres Total ETIw	water bal ETIw adjust.	AF for LR#1	Year	Total AF for LR	AF DPrain	AF of LRIw	LRIw
1989	0.173470686	1,808,529	1.015	159,216	1989	159,216	27,399	145,517	0.137
1990	0.187102634	1,771,375	0.989	163,892	1990	163,892	26,940	150,422	0.147
1991	0.197970212	1,627,658	0.963	155,153	1991	155,153	28,984	140,661	0.152
1992	0.20918709	1,463,685	0.994	152,173	1992	152,173	38,985	132,681	0.154
1993	0.203908016	1,573,789	0.963	154,517	1993	154,517	27,508	140,763	0.157
1994	0.215318114	1,755,393	0.989	186,905	1994	186,905	21,031	175,990	0.169
1995	0.211473068	1,825,554	1.065	205,575	1995	206,575	22,784	194,183	0.166
1996	0.209567198	1,842,000	1.013	195,521	1996	195,521	25,709	182,666	0.164

Final values for the whole setup, including light soils and heavy soils

Year	AF for Light Soils	for Heavy S	Total AF	RealLF
1989	145,517	85,169	230,686	0.112
1990	150,422	82,150	232,571	0.117
1991	140,661	74,219	214,879	0.121
1992	132,681	69,404	202,085	0.122
1993	140,763	72,932	213,696	0.124
1994	175,990	84,078	260,067	0.130
1995	194,183	94,940	289,123	0.129
1996	182,666	92,049	274,715	0.128

ANNEX 4a

Annex 4a

Annex 4a Leaching Calculations for Crop Rotations

Annex 4a.1 Source of Equations

Maintenance Leaching

For light, non-cracking soils in IID (these are the "traditional equations"):

$$LR_{NC} = \frac{EC_{iw}}{5\,ECe - EC_{iw}}$$

$$DR_{Maint/NC} = \left[ET_{iw}\left(\frac{LR_{NC}}{1 - LR_{NC}}\right)\right] = \left[ET_{iw}\left(\frac{EC_{iw}}{5ECe - 2EC_{iw}}\right)\right]$$

For heavy, cracking soils in IID (using a "2x" multiplier):

$$LR_{C} = \frac{2\,EC_{iw}}{5\,ECe}$$

$$DR_{Maint/C} = \left[ET_{iw}\left(\frac{LR_{C}}{1 - LR_{C}}\right)\right] = 2\,DR_{Maint/NC}$$

Derivation for $DR_{Maint/NC}$:

$$DR_{Maint/NC} = \left[ET_{iw}\left(\frac{LR_{NC}}{1 - LR_{NC}}\right)\right] = \left[ET_{iw}\left(\frac{\frac{EC_{iw}}{5ECe - EC_{iw}}}{1 - \frac{EC_{iw}}{5ECe - EC_{iw}}}\right)\right] = \left[ET_{iw}\left(\frac{\frac{EC_{iw}}{5ECe - EC_{iw}}}{\frac{5ECe - EC_{iw}}{5ECe - EC_{iw}} - \frac{EC_{iw}}{5ECe - EC_{iw}}}\right)\right]$$

$$= \left[ET_{iw}\left(\frac{EC_{iw}}{5\,ECe - EC_{iw} - EC_{iw}}\right)\right] = \left[ET_{iw}\left(\frac{EC_{iw}}{5\,ECe - 2\,EC_{iw}}\right)\right]$$

Derivation for $DR_{Maint/C}$:

$$DR_{Maint/C} = 2\ DR_{Maint/NC} = 2\ ET_{iw}\left(\frac{LR_{NC}}{1 - LR_{NC}}\right)$$

however, from above

$$LR_{NC} = \frac{EC_{iw}}{5\ ECe - EC_{iw}} \quad \text{, so}$$

$$DR_{Maint/C} = 2\ ET_{iw}\left(\frac{\dfrac{EC_{iw}}{5\ ECe - EC_{iw}}}{1 - \dfrac{EC_{iw}}{5\ ECe - EC_{iw}}}\right) = 2\ ETiw\left(\frac{\dfrac{EC_{iw}}{5\ ECe - EC_{iw}}}{\dfrac{5\ ECe - EC_{iw}}{5\ ECe - EC_{iw}} - \dfrac{EC_{iw}}{5\ ECe - EC_{iw}}}\right)$$

$$DR_{Maint/C} = 2\ ET_{iw}\left(\frac{EC_{iw}}{(5\ ECe - EC_{iw}) - EC_{iw}}\right) = 2\ ET_{iw}\left(\frac{EC_{iw}}{5\ ECe - 2\ EC_{iw}}\right) = \frac{2\ ET_{iw}\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}$$

Now by definition,

$$LR_C = \frac{DR_{Maint/C}}{ET_{iw} + DR_{Maint/C}} \quad , \quad \text{so}$$

$$LR_C = \frac{DR_{Maint/C}}{ET_{iw} + DR_{Maint/C}} = \frac{\dfrac{2\ ET_{iw}\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}}{ET_{iw} + \dfrac{2\ ET_{iw}\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}} = \frac{\dfrac{2\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}}{1 + \dfrac{2\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}} = \frac{\dfrac{2\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}}{\dfrac{5\ ECe - 2\ EC_{iw}}{5\ ECe - 2\ EC_{iw}} + \dfrac{2\ EC_{iw}}{5\ ECe - 2\ EC_{iw}}}$$

$$LR_C = \frac{2\ EC_{iw}}{(5\ ECe - 2\ EC_{iw}) + 2\ EC_{iw}} = \frac{2\ EC_{iw}}{5\ ECe}$$

Reclamation Leaching

From Hoffman (1980), using ECe as a surrogate for concentration

$$\frac{ECe_{required} - EC_{iw}}{ECe_{initial} - EC_{iw}} = \frac{k}{DR_{Rec}/Ds}$$

where

$ECe_{required}$ is the soil salinity desired after reclamation
$ECe_{initial}$ is the soil salinity existing prior to reclamation
DR_{Rec} is the required depth of deep percolation to achieve the reclamation leaching
Ds is the depth of soil to be reclaimed.

The parameter k varies with soil type and texture. For non-cracking sandy loam soil, k=0.1. For a cracking, clay or silty clam soil, k=0.3.

The required depth of deep percolation for reclamation leaching may be calculated from

$$DR_{Rec} = k\left(\frac{ECe_{initial} - EC_{iw}}{ECe_{required} - EC_{iw}}\right) Ds$$

Transient Conditions

Increasing ECe without Maintenance Leaching

If maintenance leaching is foregone during the first portion of the cropping season, the soil salinity will increase to

$$ECe_{incr} = ECe_{old} + \frac{p\, ET_{iw}\, EC_{iw}}{PS\ Ds}$$

where

ECe_{incr} is the increased ECe
ECe_{old} is the ECe left from the preceding crop
p is the portion of the irrigation season (portion of ET_{iw}) during which there is no maintenance leaching
PS is the portion of the bulk soil volume that is open pore space

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Derivation

Consider a bulk volume of soil with horizontal surface area A and depth Ds. Let PS be the portion of this bulk volume that is pore space.

At saturation, this soil holds a volume of water equal to:
A Ds PS

If the soil salinity is indicated by ECe_{old}, then the total salt dissolved in the water is:
ECe_{old} A Ds PS

Suppose maintenance leaching is foregone for p part of the irrigation season. The irrigation water volume during that period is

$$p\ ET_{iw}\ A$$

and the amount of salt brought in with the irrigation water is:

$$EC_{iw}\ p\ ET_{iw}\ A$$

Without leaching, the total salt now in the soil is:

$$ECe_{old}\ A\ Ds\ PS + EC_{iw}\ p\ ET_{iw}\ A$$

and it is dissolved in the same volume of soil water (at saturation, for the saturation extract);

$$A\ Ds\ PS$$

Thus the new, increased ECe_{incr} is:

$$ECe_{incr} = \frac{ECe_{old}\ A\ Ds\ PS + EC_{iw}\ p\ ET_{iw}\ A}{A\ Ds\ PS} = ECe_{old} + \frac{EC_{iw}\ p\ ET_{iw}}{Ds\ PS}$$

$$ECe_{incr} = ECe_{old} + \frac{EC_{iw}\ p\ ET_{iw}}{Ds\ PS}$$

Tolerant Crop Following a Sensitive One

This expression is first solved for p, then the remaining maintenance leaching requirement is calculated as (1-p) times the usual maintenance leaching requirement for that crop:

$$p = (ECe_{new} - ECe_{old})\left(\frac{PS\ Ds}{EC_{iw}\ ET_{iw}}\right)$$

$$DR_{Maint/NC} = (1-p)\,(ET_{iw})\left(\frac{LR_{NC}}{1-LR_{NC}}\right)$$ for light, non-cracking soils in IID.

$$DR_{Maint/C} = (1-p)\,(ET_{iw})\left(\frac{LR_{C}}{1-LR_{C}}\right)$$ for heavy, cracking soils in IID.

In these expressions, p is limited to the interval [0, 1]. For any $p \geq 1$, required maintenance deep percolation (whether $DR_{Maint/NC}$ or $DC_{Maint/C}$) is zero. The practical significance of this is that if the ECe increase during the entire following season will not bring the salinity above the threshold allowed for that crop, no maintenance leaching at all during that season is needed.

Annex 4a.2 Crop Rotation Leaching Spreadsheets

Table		Soil	Rotation	Leaching Approach
Annex 4a	-01	Light, Non-Cracking	All	Maint. Leach. Only, to Each Crop's ECe
Annex 4a	-02	Light, Non-Cracking	Alfalfa-Wheat-Lettuce	Maint. Leach. Only, to Lowest ECe
Annex 4a	-03	Light, Non-Cracking	Alfalfa-Wheat-Lettuce	Maint. + Recl. Leaching
Annex 4a	-04	Light, Non-Cracking	Alfalfa-Wheat-Lettuce	Maint. + Reclam. Leaching, DR Minimized
Annex 4a	-05	Light, Non-Cracking	Alfalfa-Wheat-Wheat	Maint. Leach. Only, to Lowest ECe
Annex 4a	-06	Light, Non-Cracking	Alfalfa-Wheat-Wheat	Maint. + Recl. Leaching
Annex 4a	-07	Light, Non-Cracking	Alfalfa-Wheat-Wheat	Maint. + Reclam. Leaching, DR Minimized
Annex 4a	-08	Light, Non-Cracking	Alfalfa-Wheat-Sudan	Maint. Leach. Only, to Lowest ECe
Annex 4a	-09	Light, Non-Cracking	Alfalfa-Wheat-Sudan	Maint. + Recl. Leaching
Annex 4a	-10	Light, Non-Cracking	Alfalfa-Wheat-Sudan	Maint. + Reclam. Leaching, DR Minimized
Annex 4a	-11	Heavy, Cracking	All	Maint. Leach. Only, to Each Crop's ECe
Annex 4a	-12	Heavy, Cracking	Alfalfa-Wheat-Lettuce	Maint. Leach. Only, to Lowest ECe
Annex 4a	-13	Heavy, Cracking	Alfalfa-Wheat-Lettuce	Maint. + Recl. Leaching
Annex 4a	-14	Heavy, Cracking	Alfalfa-Wheat-Lettuce	Maint. + Reclam. Leaching, DR Minimized
Annex 4a	-15	Heavy, Cracking	Alfalfa-Wheat-Wheat	Maint. Leach. Only, to Lowest ECe
Annex 4a	-16	Heavy, Cracking	Alfalfa-Wheat-Wheat	Maint. + Recl. Leaching
Annex 4a	-17	Heavy, Cracking	Alfalfa-Wheat-Wheat	Maint. + Reclam. Leaching, DR Minimized
Annex 4a	-18	Heavy, Cracking	Alfalfa-Wheat-Sudan	Maint. Leach. Only, to Lowest ECe
Annex 4a	-19	Heavy, Cracking	Alfalfa-Wheat-Sudan	Maint. + Recl. Leaching
Annex 4a	-20	Heavy, Cracking	Alfalfa-Wheat-Sudan	Maint. + Reclam. Leaching, DR Minimized

DR=Total Deep Percolation Required for all Leaching

khs-3/24/98

Table Annex 4a-01. khs - 3/24/98

Light, Non-Cracking Soils

All Rotations

Maintenance Leaching Only, to Each Crop's ECe

Alfalfa-Wheat-Lettuce Rotation

year	crop	ETiw	ECe	LR	DRmaint/nc
1	Alfalfa	5.0	2.0	0.1312	0.7552
2	Alfalfa	5.0	2.0	0.1312	0.7552
3	Alfalfa	5.0	2.0	0.1312	0.7552
4	Alfalfa	5.0	2.0	0.1312	0.7552
5	Wheat	2.2	6.0	0.0402	0.0922
6	Lettuce	2.3	1.3	0.2172	0.6383
	tot ETiw	24.5		tot DR	3.7513
Eff Rot Ave			1.979	0.1328	

Alfalfa-Wheat-Wheat Rotation

year	crop	ETiw	ECe	LR	DRmaint/nc
1	Alfalfa	5.0	2.0	0.1312	0.7552
2	Alfalfa	5.0	2.0	0.1312	0.7552
3	Alfalfa	5.0	2.0	0.1312	0.7552
4	Alfalfa	5.0	2.0	0.1312	0.7552
5	Wheat	2.2	6.0	0.0402	0.0922
6	Wheat	2.2	6.0	0.0402	0.0922
	tot ETiw	24.4		tot DR	3.2052
Eff Rot Ave			2.230	0.1161	

Alfalfa-Wheat-Sudan Rotation

year	crop	ETiw	ECe	LR	DRmaint/nc
1	Alfalfa	5.0	2.0	0.1312	0.7552
2	Alfalfa	5.0	2.0	0.1312	0.7552
3	Alfalfa	5.0	2.0	0.1312	0.7552
4	Alfalfa	5.0	2.0	0.1312	0.7552
5	Wheat	2.2	6.0	0.0402	0.0922
6	Sudan	3.6	2.8	0.0903	0.3575
	tot ETiw	25.8		tot DR	3.4706
Eff Rot Ave			2.189	0.1186	

Table Annex 4a-02. khs-3/24/98

Light, Non-Cracking Soils

Alfalfa-Wheat-Lettuce Rotation

Maintenance Leaching Only, to Lowest ECe

ECiw = 1.16

k= 0.1

Tot DR= 6.799

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Lettuce	2.3	1.3	0.217	1.300	0.217	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	1.300	0.217	1.39		1.39
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	1.300	0.217	1.39		1.39
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	1.300	0.217	1.39		1.39
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	1.300	0.217	1.39		1.39
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	1.300	0.217	0.61		0.61
	5-6								0.00	0.00
6		Lettuce	2.3	1.3	0.217	1.300	0.217	0.64		0.64
Totals			24.50					6.80	0.00	6.80
Equiv. LR						1.300	0.217			

Table Annex 4a-03.
Light, Non-Cracking Soils
Alfalfa-Wheat-Lettuce Rotation
Maintenance + Reclamation Leaching

khs-3/24/98

ECiw = 1.16
k= 0.1
Tot DR= 8.4137

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Lettuce	2.3	1.3	0.217	1.300	0.217	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.66		0.66
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	4.552	0.054	0.00		0.00
	5-6								4.85	4.85
6		Lettuce	2.3	1.3	0.217	1.300	0.217	0.64		0.64
Totals			24.50					3.57	4.85	8.41
Equivalent LR						1.140	0.256			

Table Annex 4a-04.

khs-3/24/98

Light, Non-Cracking Soils

Alfalfa-Wheat-Lettuce Rotation

Maintenance + Reclamation Leaching, adjusted to minimize DR

ECiw = 1.16

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k= 0.1

Tot DR= 5.0249

DP Minimized

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR'	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Lettuce	2.3	1.3	0.217	1.300	0.217	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.66		0.66
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.41	0.41
5		Wheat	2.2	6.0	0.040	1.567	0.174	0.46		0.46
	5-6								0.58	0.58
6		Lettuce	2.3	1.3	0.217	1.300	0.217	0.64		0.64
Totals			24.50					4.03	0.99	5.02
Equiv LR						1.595	0.170			

Table Annex 4a-05.
Light, Non-Cracking Soils
Alfalfa-Wheat-Wheat Rotation
Maintenance Leaching Only, to Lowest ECe

khs-3/24/98

ECiw = 1.16
k= 0.1
Tot DR= 3.6854

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Wheat	2.2	6.0	0.040	2.000	0.131	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	2.000	0.131	0.33		0.33
	5-6								0.00	0.00
6		Wheat	2.2	6.0	0.040	2.000	0.131	0.33		0.33
Totals			24.40					3.69	0.00	3.69
Equiv LR						2.000	0.131			

Table Annex 4a-06.
Light, Non-Cracking Soils
Alfalfa-Wheat-Wheat Rotation
Maintenance + Reclamation Leaching

khs-3/24/98

ECiw = 1.16
k= 0.1
Tot DR= 4.2131

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Wheat	2.2	6.0	0.040	6.000	0.040	---	---	---
	6-1								1.15	1.15
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	4.552	0.054	0.00		0.00
	5-6								0.00	0.00
6		Wheat	2.2	6.0	0.040	6.000	0.040	0.04		0.04
Totals			24.40					3.06	1.15	4.21
Equiv LR						1.808	0.147			

Table Annex 4a-07. khs-3/24/98
Light, Non-Cracking Soils
Alfalfa-Wheat-Wheat Rotation
Maintenance + Reclamation Leaching, adjusted to minimize DR

ECiw = 1.16
k= 0.1
Tot DR= 3.6854

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Wheat	2.2	6.0	0.040	2.000	0.131	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	2.000	0.131	0.33		0.33
	5-6								0.00	0.00
6		Wheat	2.2	6.0	0.040	2.000	0.131	0.33		0.33
Totals			24.40					3.69	0.00	3.69
Equiv LR						2.000	0.131			

Table Annex 4a-08.

Light, Non-Cracking Soils

Alfalfa-Wheat-Sudan Rotation

Maintenance Leaching Only, to Lowest ECe

khs-3/24/98

ECiw = 1.16

k= 0.1

Tot DR= 3.8969

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR.	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Sudan	3.6	2.8	0.090	2.000	0.131	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	2.000	0.131	0.33		0.33
	5-6								0.00	0.00
6		Sudan	3.6	2.8	0.090	2.000	0.131	0.54		0.54
Totals			25.80					3.90	0.00	3.90
Equiv LR						2.000	0.131			

Table Annex 4a-09.
Light, Non-Cracking Soils
Alfalfa-Wheat-Sudan Rotation
Maintenance + Reclamation Leaching

khs-3/24/98

ECiw = 1.16
k= 0.1
Tot DR= 4.1825

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Sudan	3.6	2.8	0.090	2.800	0.090	---	---	---
	6-1								0.39	0.39
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	4.552	0.054	0.00		0.00
	5-6								0.41	0.41
6		Sudan	3.6	2.8	0.090	2.800	0.090	0.36		0.36
Totals			25.80					3.38	0.80	4.18
Equiv LR						1.895	0.139			

Table Annex 4a-10.
Light, Non-Cracking Soils
Alfalfa-Wheat-Sudan Rotation
Maintenance + Reclamation Leaching, adjusted to minimize DR

khs-3/24/98

ECiw = 1.16
k= 0.1
Tot DR= 3.8969

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LR	Mangd ECe	Mangd LR	Maint DR (ft)	Reclam Dr (ft)	Total DR (ft)
6		Sudan	3.6	2.8	0.090	2.000	0.131	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.131	2.000	0.131	0.76		0.76
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.040	2.000	0.131	0.33		0.33
	5-6								0.00	0.00
6		Sudan	3.6	2.8	0.090	2.000	0.131	0.54		0.54
Totals			25.80					3.90	0.00	3.90
Equiv LR						2.000	0.131			

Table Annex 4a-11. khs - 3/24/98

Heavy, Cracking Soils

All Rotations

Maintenance Leaching Only, to Each Crop's ECe

Alfalfa-Wheat-Lettuce Rotation

year	crop	ETiw	ECe	LR	DRmaint/nc
1	Alfalfa	5.0	2.0	0.2320	1.5104
2	Alfalfa	5.0	2.0	0.2320	1.5104
3	Alfalfa	5.0	2.0	0.2320	1.5104
4	Alfalfa	5.0	2.0	0.2320	1.5104
5	Wheat	2.2	6.0	0.0773	0.1844
6	Lettuce	2.3	1.3	0.3569	1.2766
	tot ETiw	24.5		tot DR	7.5026
Eff Rot Ave			1.979	0.2344	

Alfalfa-Wheat-Wheat Rotation

year	crop	ETiw	ECe	LR	DRmaint/nc
1	Alfalfa	5.0	2.0	0.2320	1.5104
2	Alfalfa	5.0	2.0	0.2320	1.5104
3	Alfalfa	5.0	2.0	0.2320	1.5104
4	Alfalfa	5.0	2.0	0.2320	1.5104
5	Wheat	2.2	6.0	0.0773	0.1844
6	Wheat	2.2	6.0	0.0773	0.1844
	tot ETiw	24.4		tot DR	6.4105
Eff Rot Ave			2.230	0.2081	

Alfalfa-Wheat-Sudan Rotation

year	crop	ETiw	ECe	LR	DRmaint/nc
1	Alfalfa	5.0	2.0	0.2320	1.5104
2	Alfalfa	5.0	2.0	0.2320	1.5104
3	Alfalfa	5.0	2.0	0.2320	1.5104
4	Alfalfa	5.0	2.0	0.2320	1.5104
5	Wheat	2.2	6.0	0.0773	0.1844
6	Sudan	3.6	2.8	0.1657	0.7151
	tot ETiw	25.8		tot DR	6.9411
Eff Rot Ave			2.189	0.2120	

Table Annex 4a-12. khs-3/24/98
Heavy, Cracking Soils
Alfalfa-Wheat-Lettuce Rotation
Maintenance Leaching Only, to Lowest ECe

ECiw = 1.16
k= 0.3
Tot DR= 13.598

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Lettuce	2.3	1.3	0.454	1.300	0.357	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	1.300	0.357	2.78		2.78
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	1.300	0.357	2.78		2.78
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	1.300	0.357	2.78		2.78
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	1.300	0.357	2.78		2.78
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	1.300	0.357	1.22		1.22
	5-6								0.00	0.00
6		Lettuce	2.3	1.3	0.454	1.300	0.357	1.28		1.28
Totals			24.50					13.60	0.00	13.60
Equivalent LR						1.300	0.357			

Table Annex 4a-13.
Heavy, Cracking Soils
Alfalfa-Wheat-Lettuce Rotation
Maintenance + Reclamation Leaching

khs-3/24/98

ECiw = 1.16
k= 0.3
Tot DR= 21.673

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Lettuce	2.3	1.3	0.454	1.300	0.357	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.33		1.33
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	4.552	0.102	0.00		0.00
	5-6								14.54	14.54
6		Lettuce	2.3	1.3	0.454	1.300	0.357	1.28		1.28
Totals			24.50					7.14	14.54	21.67
Equivalent LR						0.989	0.469			

Table Annex 4a-14. khs-3/24/98

Heavy, Cracking Soils

Alfalfa-Wheat-Lettuce Rotation

Maintenance + Reclamation Leaching, adjusted to minimize DR

ECiw = 1.16

k= 0.3

Tot DR= 11.039

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Lettuce	2.3	1.3	0.454	1.300	0.357	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.33		1.33
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								1.31	1.31
5		Wheat	2.2	6.0	0.112	1.545	0.300	0.94		0.94
	5-6								1.65	1.65
6		Lettuce	2.3	1.3	0.454	1.300	0.357	1.28		1.28
Totals			24.50					8.08	2.96	11.04
Equivalent LR						1.494	0.311			

Table Annex 4a-15.
Heavy, Cracking Soils
Alfalfa-Wheat-Wheat Rotation
Maintenance Leaching Only, to Lowest ECe

khs-3/24/98

ECiw = 1.16
k= 0.3
Tot DR= 7.371

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Wheat	2.2	6.0	0.112	2.000	0.232	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	2.000	0.232	0.66		0.66
	5-6								0.00	0.00
6		Wheat	2.2	6.0	0.112	2.000	0.232	0.66		0.66
Totals			24.40					7.37	0.00	7.37
Equivalent LR						2.000	0.232			

Table Annex 4a-16.
Heavy, Cracking Soils
Alfalfa-Wheat-Wheat Rotation
Maintenance + Reclamation Leaching

khs-3/24/98

ECiw = 1.16
k= 0.3
Tot DR= 9.579

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc.	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Wheat	2.2	6.0	0.112	6.000	0.077	---	---	---
	6-1								3.46	3.46
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	4.552	0.102	0.00		0.00
	5-6								0.00	0.00
6		Wheat	2.2	6.0	0.112	6.000	0.077	0.08		0.08
Totals			24.40					6.12	3.46	9.58
Equiv LR						1.646	0.282			

Table Annex 4a-17.
Heavy, Cracking Soils
Alfalfa-Wheat-Wheat Rotation
Maintenance + Reclamation Leaching, adjusted to minimize DR

khs-3/24/98

ECiw = 1.16
k= 0.3
Tot DR= 7.371

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Wheat	2.2	6.0	0.112	2.000	0.232	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	2.000	0.232	0.66		0.66
	5-6								0.00	0.00
6		Wheat	2.2	6.0	0.112	2.000	0.232	0.66		0.66
Totals			24.40					7.37	0.00	7.37
Equivalent LR						2.000	0.232			

Table Annex 4a-18.
Heavy, Cracking Soils
Alfalfa-Wheat-Sudan Rotation
Maintenance Leaching Only, to Lowest ECe

khs-3/24/98

ECiw = 1.16
k= 0.3
Tot DR= 7.794

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Sudan	3.6	2.8	0.230	2.000	0.232	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	2.000	0.232	0.66		0.66
	5-6								0.00	0.00
6		Sudan	3.6	2.8	0.230	2.000	0.232	1.09		1.09
Totals			25.80					7.79	0.00	7.79
Equivalent LR						2.000	0.232			

Table Annex 4a-19.
Heavy, Cracking Soils
Alfalfa-Wheat-Sudan Rotation
Maintenance + Reclamation Leaching

khs-3/24/98

ECiw = 1.16
k= 0.3
Tot DR= 9.594

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Sudan	3.6	2.8	0.230	2.800	0.166	---	---	---
	6-1								1.17	1.17
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	6.000	0.077	-0.10		-0.10
	5-6								1.77	1.77
6		Sudan	3.6	2.8	0.230	2.800	0.166	0.72		0.72
Totals			25.80					6.65	2.94	9.59
Equivalent LR						1.712	0.271			

Table Annex 4a-20.

khs-3/24/98

Heavy, Cracking Soils

Alfalfa-Wheat-Sudan Rotation

Maintenance + Reclamation Leaching, adjusted to minimize DR

ECiw = 1.16

k= 0.3

Tot DR= 7.794

Year	Betwn Years	Crop	ETiw (ft/yr)	Threshold ECe	LRc	Mangd ECe	Mangd LRc	Maint DRc (ft)	Reclam DRc (ft)	Total DRc (ft)
6		Sudan	3.6	2.8	0.230	2.000	0.232	---	---	---
	6-1								0.00	0.00
1		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	1-2								0.00	0.00
2		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	2-3								0.00	0.00
3		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	3-4								0.00	0.00
4		Alfalfa	5.0	2.0	0.312	2.000	0.232	1.51		1.51
	4-5								0.00	0.00
5		Wheat	2.2	6.0	0.112	2.000	0.232	0.66		0.66
	5-6								0.00	0.00
6		Sudan	3.6	2.8	0.230	2.000	0.232	1.09		1.09
Totals			25.80					7.79	0.00	7.79
Equivalent LR						2.000	0.232			