RECLAMATION

Managing Water in the West

Calendar Year 2014

Lower Colorado River Annual Summary of Evapotranspiration and Evaporation

U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Region
Boulder Canyon Operations Office

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August 2019

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms

AF	Acre-Feet
AZ	Arizona
AZMET	Arizona Meteorological Network
CA	California
CIMIS	California Irrigation Management Information System
CVWD	Coachella Valley Water District
ET	Evapotranspiration
ET_o	Reference Evapotranspiration
GIS	Geographic Information System
IID	Imperial Irrigation District
LCRAS	Lower Colorado River Annual Summary (previously known as Lower Colorado River Accounting System)
NAIP	National Agriculture Imagery Program
NCR	Non-Colorado River
NV	Nevada
NWR	National Wildlife Refuge
NWS	National Weather Service
RS	Remote Sensing
SIB	Southerly International Boundary
TM	Thematic Mapper
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WMIDD	Wellton-Mohawk Irrigation and Drainage District
YMIDD	Yuma Mesa Irrigation and Drainage District
YPG	Yuma Proving Ground

Glossary

AZMET: A network of automated weather stations within the state of Arizona that provide reference evapotranspiration estimates.

CIMIS: A network of automated weather stations within the state of California that provide reference evapotranspiration estimates.

Crop Group: Crops with similar water use rates, grouped for the purpose of calculating evapotranspiration.

Crop Coefficient: The ratio of evapotranspiration observed for the crop studied over that observed for the reference crop under the same conditions.

Evapotranspiration: The combined effect of evaporation from the soil surface and transpiration from the plant canopy.

Fallowed/Idle Acres: The total number of acres that were left fallow or idle for the entire calendar year.

Geographic Information System: An information system that integrates, stores, edits, analyzes, shares, and displays geographic information.

Gross Cropped Acres: The total acres of crops grown, which includes multiple cropping on individual fields. Because permanent crops (i.e. alfalfa, bermuda grass, orchards and dates) may be pulled or replanted during the calendar year, the gross cropped acreage reported for permanent crops represents an average of the quarterly acreage values for a given water user. Gross cropped acres for a particular water user may be less than or greater than net cropped acres based on the following scenarios:

- When gross cropped acres are less than net cropped acres, it reflects a year in which permanent crops were pulled or replanted during the calendar year. Example: A given water user had 200 net acres of land. Of those, all 200 acres were planted in alfalfa in quarter 1. Beginning in quarter 2, 50 acres of alfalfa were pulled, leaving 150 acres of alfalfa in quarters 2, 3 and 4. In this scenario, the gross cropped acreage would be 162.5 acres (i.e. 200 + 150 + 150 + 150)/4 = 162.5 acres). The net cropped acreage would be 200 acres.
- When gross cropped acres are greater than net cropped acres, it reflects a year in which multiple crops were grown on a single field. Example: A given water user had 200 net acres of land. Of those, 200 acres of wheat were planted in the spring and 200 acres of lettuce were planted on the same fields in the fall. In this scenario, the gross cropped acreage would be reported as 200+200 = 400 acres. The net cropped acreage would be 200 acres.

Irrigable Acres: The total acres that can be irrigated and for which there exists adequate infrastructure to irrigate.

Moist Soil Unit: An area gradually flooded in winter to develop migratory waterfowl forage and not irrigated in summer.

Non-Colorado River (NCR): For water users designated as NCR, the origin of water used for agricultural irrigation or consumed by riparian vegetation and open water is either considered: (1) to come from sources other than the Colorado River, or (2) to be groundwater that is flowing towards Mexico downstream of the Northerly International Boundary and therefore not available for consumptive use in the United States or in satisfaction of the Mexican Treaty Obligation.

Net Cropped Acres: The total acres on which one or more crops were grown, which does not include multiple cropping on individual fields. Does not include fallowed/idle acres. Because Reclamation's method uses the average annual acreage for permanent crops (i.e. alfalfa, bermuda, orchards and dates), gross cropped acres may be less than net cropped acres.

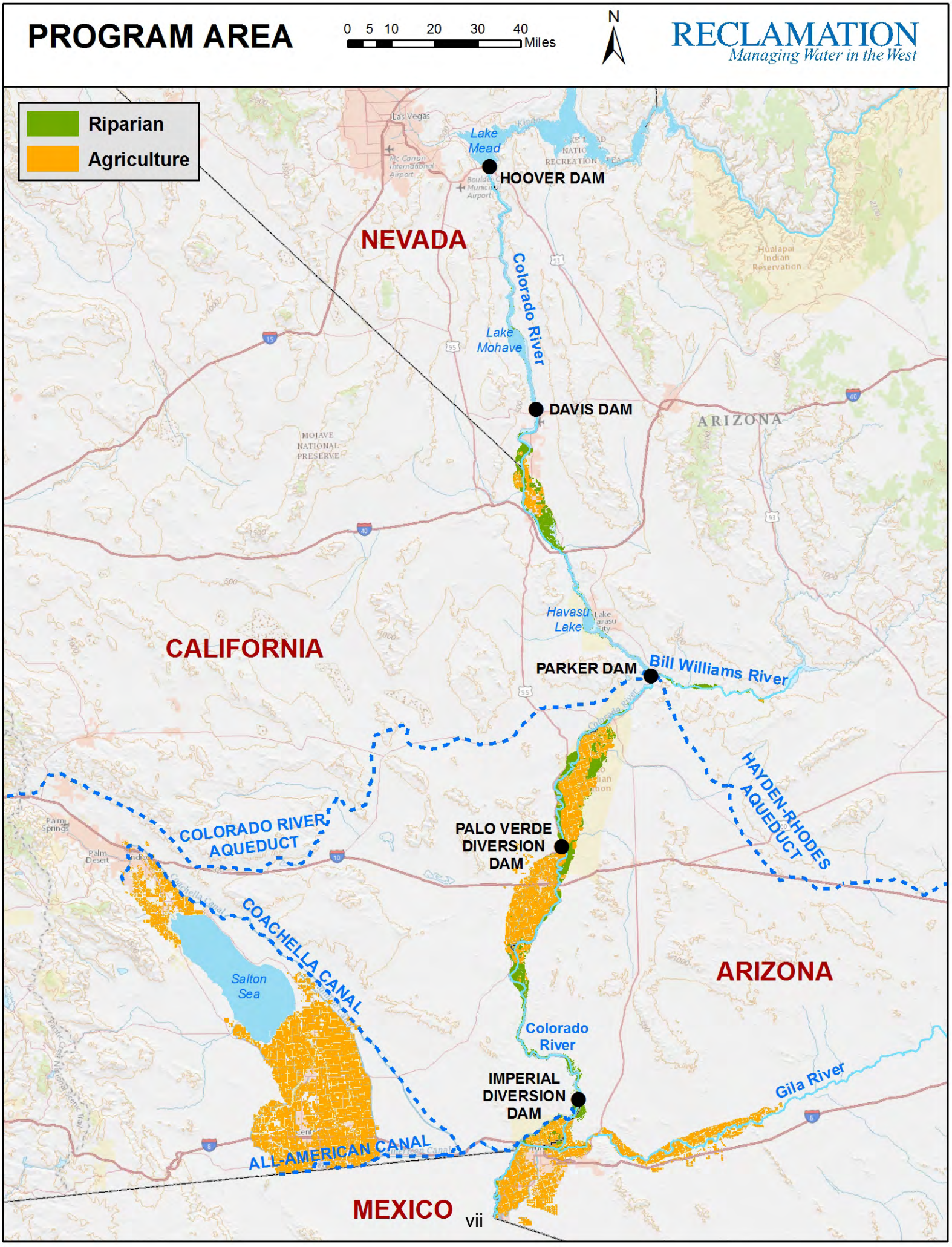
Program Area: The area in which Reclamation routinely monitors agricultural and riparian vegetation evapotranspiration and open water evaporation. Includes the lower Colorado River valley from Hoover Dam to the Southerly International Boundary with Mexico; the Wellton-Mohawk Irrigation and Drainage District on the Gila River in Arizona, and the Imperial Irrigation District and the Coachella Valley Water District in California.

Remote Sensing: A technique for obtaining information from a surface without coming into physical contact with it, using sensors and imagers that are sensing the electromagnetic radiation coming from the surface at specific wavelengths.

Reference Evapotranspiration: The evapotranspiration rate from a reference surface. The reference surface is a hypothetical reference crop with specific characteristics.

Riparian Vegetation: Riparian vegetation refers to the vegetation that grows along the shores of freshwater rivers and lakes, or along some canals. As used in this report, riparian vegetation classes also include wetland types and natural vegetation within the lower Colorado River floodplain.

Spectral Characteristics: The amount of spectral reflectance from the Earth's surface recorded by the satellite sensors in different portions of the electromagnetic spectrum for different land cover types.


PROGRAM AREA
0 5 10 20 30 40
Miles
N
RECLAMATION
Managing Water in the West
Riparian
Agriculture
Las Vegas
Lake Mead
HOOVER DAM
NEVADA
Colorado River
Lake Mohave
DAVIS DAM
ARIZONA
MOJAVE NATIONAL PRESERVE
Havasu Lake
CALIFORNIA
PARKER DAM
Bill Williams River
HAYDEN-RHODES AQUEDUCT
COLORADO RIVER AQUEDUCT
PALO VERDE DIVERSION DAM
COACHELLA CANAL
Salton Sea
ARIZONA
Colorado River
IMPERIAL DIVERSION DAM
Gila River
ALL-AMERICAN CANAL
MEXICO

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Executive Summary

The Secretary of the Interior, as the "Watermaster" for the lower Colorado River, acts through the Bureau of Reclamation (Reclamation) to manage the waters of the Colorado River for the benefit of water users in the Southwestern United States and Mexico. A significant component of the Watermaster role, a component mandated by Article V of the Consolidated Decree of the United States Supreme Court in *Arizona* v. *California* (547 U.S. 150 (2006)), is to account for water use by each state and individual water user. In this capacity, Reclamation administers a number of programs, some of which utilize remote sensing technology to monitor and estimate annual agricultural and riparian vegetation water use, and open water evaporation along the lower Colorado River from Hoover Dam to the Southerly International Border with Mexico. Reclamation provides an annual summary of this information through publication of this report.[1]

Specifically, Reclamation calculates estimates of:

- Evapotranspiration (ET) from irrigated agricultural areas.
- ET from riparian vegetation.
- Evaporation from the mainstream channel and reservoirs of the lower Colorado River.
- Evaporation from major delivery canals, lakes, lagoons, and other open water areas along the river.
- Agricultural data, by water user, including the types of crops grown and acreages.

More than 3.5 million acres are monitored within the program area. This acreage includes:

- Irrigation districts, Indian reservations, Federal recreation areas, and wildlife refuges located along the mainstream of the lower Colorado River.
- The Bill Williams River below Alamo Dam.
- The Wellton-Mohawk Irrigation and Drainage District on the Gila River in Arizona.
- The Imperial Irrigation District and the Coachella Valley Water District in California.

The total estimated agricultural ET in 2014 is 3,044,077 acre-feet[2] (AF), representing a 3.0% increase from the 2013 total of 2,954,361 AF.

Table ES-1 provides a summary of the predominant crops grown within the program area during calendar year 2014 and the acreages associated with each crop. More detailed information

[1] Copies of this and previous years' reports may be found on Reclamation's website at: www.usbr.gov/lc/region/g4000/wtracct.html.

[2] See Tables 4 and 5 for additional information. Note: In previous years' reports, this value included estimated ET from lands irrigated with non-Colorado River water (NCR). Beginning with the 2013 report, ET from NCRs is not included in the calculation of total ET. Table 6 separately tabulates the estimated ET for NCRs.

including water users' agricultural acreage (irrigable, gross cropped, net cropped, and fallowed/idle acres), crop types and acreages, agricultural ET by crop type, riparian vegetation acreage and ET, and open water acreage and evaporation has been included in Appendix 1. For select water users, the appendix also provides the historical 5-year trend (calendar years 2010-2014) of the user's total diversions, consumptive use (diversions less measured and unmeasured return flows, as reported in Reclamation's annual *Colorado River Accounting and Water Use Report: Arizona, California, and Nevada* reports), and agricultural ET (crop ET minus effective precipitation).

Table ES-1. Major Crops Grown in the Program Area in Calendar Year 2014.

Crop	**Gross Cropped Acres**
Alfalfa	293,293
Lettuce (Head, Leaf Red, Leaf Green, Spinach)	193,062
Sudan (Includes Sesbania and Clover)	89,065
Small Grains (Wheat, Oats, Rye, Barley, Millet)	85,285
Bermuda/Grass (Bermuda Overseeded with Rye, Klein, Timothy)	77,617
Sugar Beets	52,447
Other (e.g. Small Vegetables, Sugar Beets, Citrus, Crucifers, Dates, Field grains, Grapes, Melons, etc.)	230,909
Total	**1,021,678**

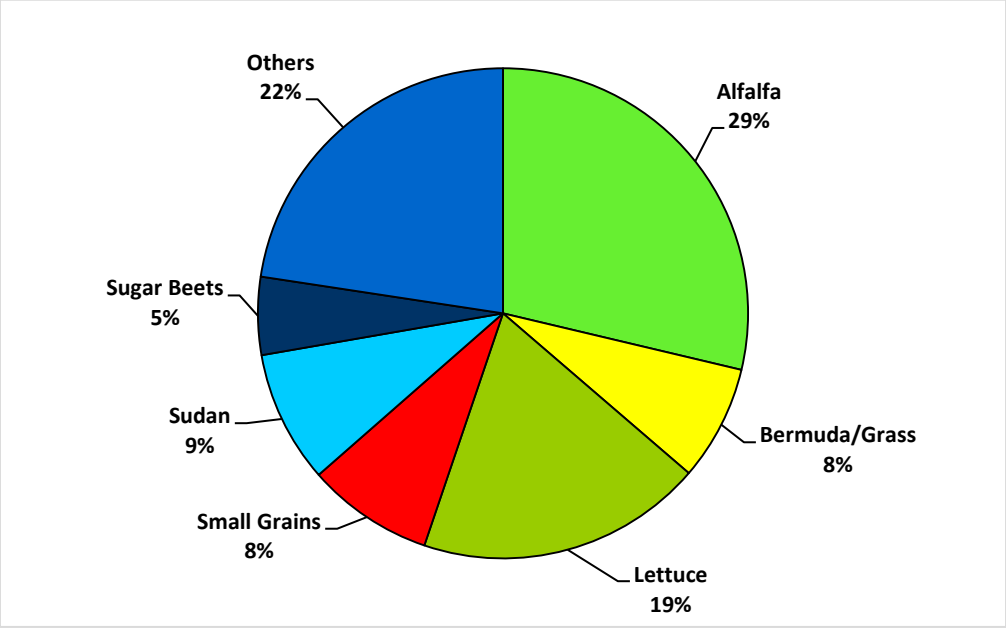


Figure ES-1. Major Crops Grown in the Program Area in Calendar Year 2014. (Based on Gross Cropped Acres.)

1.0 Introduction

The Colorado River has often been termed the "Lifeblood of the Southwest." Beginning in the Rocky Mountains of north central Colorado, the river travels more than 1,400 miles before it empties into the Gulf of California, commonly referred to the Sea of Cortez. Together with its tributaries, the Colorado River drains approximately 242,000 square miles in the United States, one-twelfth of the country's continental land area, and 2,000 square miles in Mexico.

The Colorado River and its tributaries provide water to nearly 40 million people for municipal use, supply water to irrigate nearly 5.5 million acres of land, and are the lifeblood for at least 22 federally recognized tribes, 7 National Wildlife Refuges, 4 National Recreation Areas, and 11 National Parks. In the Lower Division States of Arizona, California, and Nevada, the river serves major cities such as Phoenix, Los Angeles, and Las Vegas. The dry, arid climate of the lower Colorado River Basin (Lower Basin) lends itself to being one of the most productive agricultural regions in the nation. Agriculture use accounts for the largest component of the river's consumptive use in the Lower Basin, supporting an agricultural economy worth billions of dollars.

Figure 1. Map of the Colorado River hydrologic basin and areas adjacent to the hydrologic basin that receive Colorado River water.

As the Watermaster for the lower Colorado River, the Bureau of Reclamation must understand the disposition of water once it is released from Hoover Dam in order to effectively manage resources of the lower Colorado River. Because the agricultural sector comprises such a large component of the river's use in this region, it is important to have a comprehensive understanding of current agricultural practices and their associated water use. As competition for the Colorado River resource continues to escalate, water managers will increasingly rely on accurate and reliable sources of data upon which to make sound decisions regarding future water management policies to ensure a sustainable water supply is available to meet future demands.

This is particularly true for the Lower Division States, as each of these states has the ability to fully utilize its Colorado River apportionment.

2.0 Lower Colorado River Acreage and Water Use Estimates

This report provides estimates of agricultural, riparian vegetation, and open water acreages and water uses along the lower Colorado River from Hoover Dam to the Southerly International Border (SIB) with Mexico. Reclamation has reported these data since 1995, in reports previously entitled, *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations* (LCRAS). A detailed history of the LCRAS program and the work that was performed related to its development is presented in the United States Geological Survey (USGS) Water Supply Paper 2407 (Owen-Joyce and Raymond, 1996). Beginning with the 2009 report, Reclamation reformatted the way in which the data are presented in an effort to provide a more user-friendly product that better serves the end-user. Beginning with the 2012 report this report has been entitled *Lower Colorado River Annual Summary of Evapotranspiration and Evaporation (LCRAS).*

This section provides a general overview of Reclamation's acreage and water use monitoring program, including a description of the program area and program elements. Section 3 provides a description of the procedures and methods; Section 4 provides the results of the 2014 monitoring program; and Section 5 discusses program improvements and/or changes that occurred in 2014.

2.1 Program Area

The area monitored by Reclamation includes the lower Colorado River valley from Hoover Dam to the SIB. Reclamation has routinely monitored agricultural and riparian vegetation ET and open water evaporation along the mainstream since 1994, and along the mainstream and Bill Williams River below Alamo Dam since 2001. Beginning in 2004, the program area was expanded to include the Wellton-Mohawk Irrigation and Drainage District (WMIDD) on the Gila River in Arizona, and the Imperial Irrigation District (IID) and the Coachella Valley Water District (CVWD) in California. With this expansion, the extent of the area analyzed more than doubled from approximately 1.2 million acres to nearly 3.5 million acres (Figure 2). Correspondingly, the number of fields analyzed also increased from approximately 50,000 fields to over 125,000 fields. Figure 2 illustrates the program area before and after the expansion.

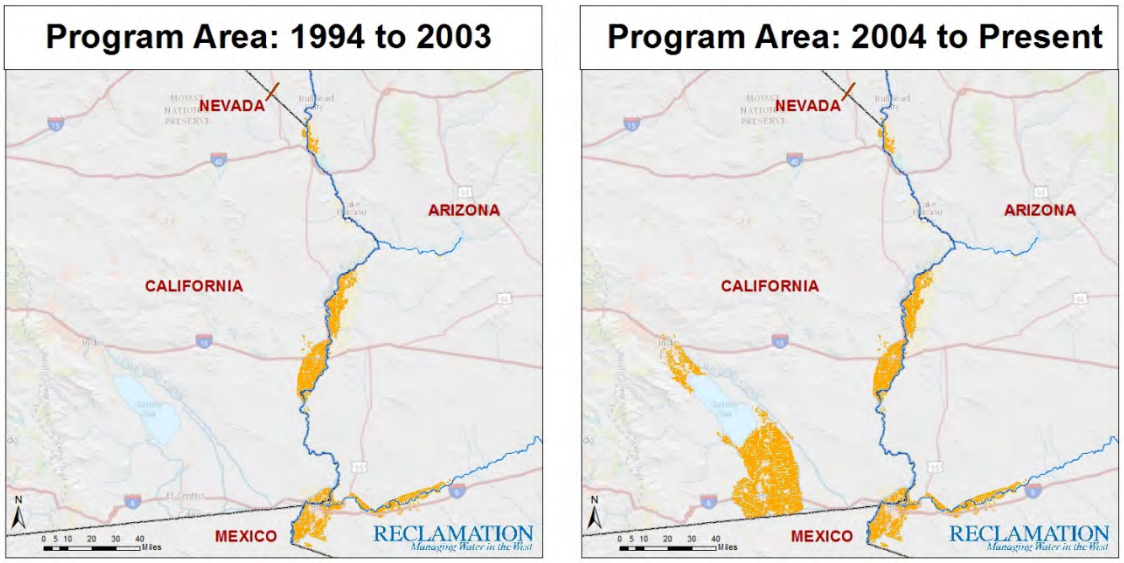


Figure 2. Program Area Extent: (1) 1994-2003 (original) and (2) 2004-Present (with the addition of WMIDD, IID, and CVWD). Program area includes riparian and open water areas, which are not shown here.

2.2 Program Elements

Reclamation's remotely-sensed data collection and monitoring program provides the following types of data:

1. Estimates of ET from irrigated agricultural areas.
2. Estimates of ET from riparian vegetation.
3. Estimates of evaporation from the mainstream channel and reservoirs of the lower Colorado River.
4. Estimates of evaporation from major delivery canals, lakes, lagoons, and other open water areas along the river.
5. Estimates of agricultural data, by water user, including the types of crops grown and acreages.

Reclamation uses this information to support a variety of program-related administrative requirements, including to monitor the current state of the river system, to assess potential impacts of changes to the river system, and as inputs to management decisions involving the administration of the federal laws, compacts, court decisions and decrees, contracts, and regulatory guidelines, collectively known as "The Law of the River," which govern the diversion and use of Colorado River water. Examples of how Reclamation uses this data include:

1. To assist in verifying Colorado River water users' success in meeting conservation targets under the Inadvertent Overrun and Payback Policy, Intentionally Created Surplus, and/or System Conservation programs.
2. To develop spatial databases representing locations of crops, riparian vegetation, and open water surfaces of the Colorado River, lakes, and canal systems.
3. To statistically quantify the types and acres of crops, riparian vegetation groups, and open water surface areas.
4. To perform economic analyses for land use conversions.
5. To refine and improve upon unmeasured return flow estimates.
6. To assist in making water entitlement and beneficial use determinations.
7. To assist in making determinations of unauthorized use.

Reclamation provides an annual summary of the land cover types, acreages, and associated evapotranspiration and evaporation for agricultural, riparian vegetation, and open water areas within the program area through publication of this report. Copies of this and previous years' reports can be found on Reclamation's website at: www.usbr.gov/lc/region/g4000/wtracct.html.

3.0 Procedures and Methods

Reclamation uses Remote Sensing (RS) and Geographic Information Systems (GIS) technologies to identify the location and quantify the acreages of crop groups, riparian vegetation groups, and open water areas in the program area. Riparian vegetation is monitored only in the Colorado River floodplain and along the Bill Williams River below Alamo Dam; it is not monitored in the IID, CVWD, or WMIDD areas. The spatial extent (location and area of coverage) of the crop groups, riparian vegetation groups, and open water areas is stored in digital spatial databases collectively referred to as a GIS database. Reclamation uses the data generated from the RS and GIS processes to calculate ET from crops and riparian vegetation, and evaporation from open water areas.

When RS processes alone are insufficient to map crop and riparian vegetation groups or open water areas, data collected on the ground (ground reference surveys) are also used. For example, orchards are mapped using data collected from ground reference surveys due to the difficulty of correctly identifying features related to this type of crop using RS processes alone. Once the data are entered into a GIS database, programs are used to calculate the number of acres of each crop group and riparian vegetation group for each water user, as well as the number of acres of open water areas. Acreage calculations are completed for areas located within the program area.

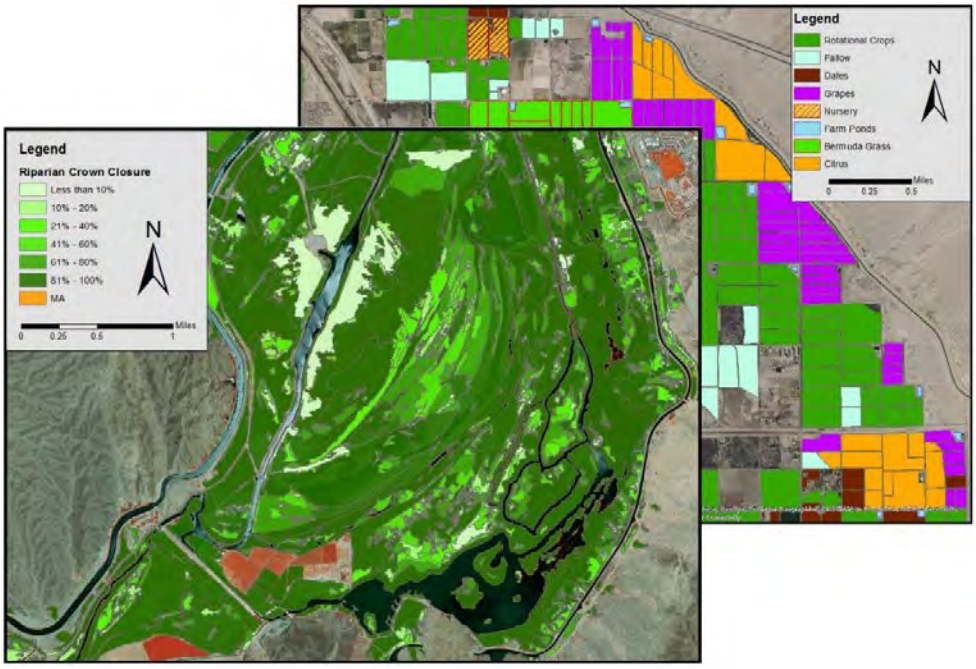


Figure 3. Reclamation uses RS and GIS processes to map crop and riparian vegetation groups and to estimate the evapotranspiration associated with these groups.

Once Reclamation maps the crop and riparian vegetation groups and open water areas (as discussed in the following sections), Reclamation calculates the ET from crops and riparian vegetation for each water user, and evaporation from open water areas. Currently, this analysis does not include estimates of ET or evaporation within the boundaries of domestic water users. Areas with identified crops and/or riparian vegetation located outside of a known water user boundary are mapped and labeled with the name of the state and river reach in which they are located (e.g. State of Arizona, Other Users, Davis Dam to Parker Dam).

The key components of ET and evaporation calculations include:

1. Identifying crop and riparian vegetation groups, and open water areas.
2. Calculating ET for crop groups and riparian vegetation groups.
3. Calculating evaporation from open water areas (i.e. the mainstream channel and reservoirs of the lower Colorado River, major delivery canals, lakes, lagoons, and other open water areas).

Sections 3.1 through 3.3 present a brief description of each of these components.

3.1 Identifying Crop Groups, Riparian Vegetation Groups, and Open Water Areas

This section provides an overview of the image classification processes and GIS technologies Reclamation uses to identify and map crop and riparian vegetation groups, and open water areas within the program area.

3.1.1 Collecting and Analyzing Remotely-Sensed Data

Satellite data is acquired primarily through the Enhanced Thematic Mapper (ETM+, Landsat 7) and Operational Land Imager (OLI, Landsat 8). Other satellite and airborne imaging systems are utilized as needed. For its analysis, Reclamation selects satellite images that adequately cover the program area, have minimal cloud cover, and capture the variation in crop planting practices during the year.

3.1.2 Collecting Ground Reference Data

Correctly identifying and mapping crop and riparian vegetation groups using remotely-sensed data requires a thorough understanding of the spectral characteristics of vegetation types for representative (ground reference survey) sites throughout the program area. TM satellite image data contain digital values that represent the spectral characteristics of these crop and riparian vegetation groups. Reclamation analyzes these digital values within ground reference survey sites to generate spectral statistics for specific crop and riparian vegetation groups.

Reclamation collects ground reference survey data for approximately 12 percent of the irrigated fields in the program area. Reclamation uses 60 to 65 percent of the ground reference survey data for image classification processing (to identify crop groups) and the remaining 35 to 40 percent to assess the accuracy of the image classifications. Reclamation selects ground reference survey sites in each major irrigated area involved in this analysis. To provide a statistically valid data set, Reclamation selects irrigated fields from a GIS database using a stratified random sample and adds additional fields to the random sample, where necessary, to ensure representation of all major crop groups.

Table 1 provides a listing and description of the common crop groups identified within the program area. Although cropping patterns may vary yearly depending on market conditions, the types of crops grown within the program area generally remain consistent over the long-term.

Table 1. Crop Groups Identified within the Program Area.

Crop Group	Description
Alfalfa	Alfalfa
Aloe	Aloe
Bermuda/Grass	Bermuda, Bermuda Overseeded with Rye, Klein grass, Timothy grass
Cane/Bamboo	Cane/Bamboo
Citrus	Young (1-2 meters tall) Mature (2+ meters tall) Declining
Cotton	Cotton
Crucifers	Broccoli, Cauliflower, Cabbage, Bok-Choy, Mustard, Kale, Okra
Dates	Dates
Deciduous Orchards	Pecans, Peaches, Almonds
Fallow/Idle	Fields currently not in production; includes bare cultivated soil
Field grains	Field Corn, Sorghum, Milo
Grapes	Grapes
Jojoba	Jojoba
Legumes/Solanum Vegetables	Green, Dry and Garbanzo Beans; Peas, Peanuts, Fresh Peppers, Potatoes
Lettuce	Spring and Fall (Head, Leaf [Red], Leaf [Green], Spinach, Other Lettuce)
Maintained Marsh	Maintained Marsh
Melons	Spring and Fall (Watermelon, Honeydew, Cantaloupe, Squash, Cucumbers)
Miscellaneous Herbs	Anise, Mint, other
Moist Soil Unit	An area gradually flooded in winter to develop migratory waterfowl forage and not irrigated in summer
Nursery or Greenhouse	Citrus Nursery, Native Nursery, Greenhouse, Other Nursery
Oil Crops	Safflower, Canola, Sunflower, Sesame
Perennial Vegetables	Artichoke, Asparagus, Guayule
Restoration Areas	Irrigated lands where natural vegetation has been planted for purposes of increasing wildlife habitat along the lower Colorado River
Root Vegetables	Table Beets, Parsnip, Turnip, Rutabaga
Small Grains	Oats, Rye, Barley, Millet, Wheat
Small Vegetables	Carrots, Cilantro, Celery, Garlic, Dry Onions, Onions, Parsley, Radishes, Flowers
Sudan	Includes Sesbania and Clover
Sugar Beets	Summer and Winter
Tomatoes	Tomatoes
Wildlife Forage Maintained	Wildlife Forage Maintained

Table 2 provides a list and description of the riparian vegetation groups identified within the program area.

Table 2. Riparian Vegetation Groups Identified within the Program Area.

Riparian Group	Description
Barren	Less than 10% vegetation
Cottonwood/Willow	61% to 100% cottonwood and willow
Marsh	40% cattail, bulrush, and phragmites
Mixed Veg Low	Mixed vegetation types that may include salt cedar, mesquite, or arrowweed with crown closure greater than or equal to 10% and less than 40%
Mixed Veg Medium	Mixed vegetation types that may include salt cedar, mesquite, or arrowweed with crown closure greater than or equal to 40% and less than or equal to 80%
Salt Cedar Dense	Predominant salt cedar with crown closure greater than 80%

3.1.3 Delineating Cropped Areas

Reclamation has developed a spatial relational database that delineates field borders for all irrigated areas included in this analysis (field-border database). Reclamation has linked all ground reference survey data collected for image classification to this field-border database.

Reclamation routinely updates the field border database to reflect actual conditions observed in the field during collection of the ground reference sample data. Reclamation also uses 30 meter TM imagery, and 1- and 2-meter United States Department of Agriculture National Agricultural Imaging Program (NAIP) digital photography to update and create new field-border databases.

Delineated cropped areas include all areas known by Reclamation to divert or pump water along the mainstream of the lower Colorado River from Davis Dam to Mexico, WMIDD, IID, CVWD, and irrigated areas along the Bill Williams River from below Alamo Dam to Lake Havasu. (See Appendix 3, Exhibit 1 for an index of water user boundaries, and Exhibits 1 through 7 for illustrations of these areas.)

Using the RS technology with the GIS field border database, Reclamation identifies the crop(s) grown in each agricultural field throughout the calendar year. Post-classification accuracy assessments show that, overall, Reclamation routinely achieves an average accuracy of 90 percent or greater when mapping crop groups in the program area.

Reclamation completed a study with an independent statistician to quantify the effects of remote sensing-based crop classification error on accuracies of ET estimates. To review the results of this study, see Stehman, S.V. and Milliken, J.A. (2007), "Estimating the effect of crop classification error on evapotranspiration derived from remote sensing in the lower Colorado River basin, USA." *Remote Sensing of Environment*, 106, pp. 217 – 227.

Figure 4. Landsat satellite image showing agricultural fields in the Imperial Irrigation District with digitized field borders.

3.1.4 Delineating Riparian Vegetation Areas

Reclamation updates riparian vegetation areas along the Colorado River floodplain by comparing the current year Landsat TM summer satellite images to the previous year's images (change detection methods[3]). Reclamation field checks areas of spectral change to confirm that the change is actually due to a change in land cover. Reclamation then remaps areas of land cover change and uses these maps to update the riparian vegetation database.

3.1.5 Delineating Open Water Areas

Reclamation maintains an open water GIS database which contains the spatial boundaries of open water surfaces within the program area including: the mainstream of the Colorado River, reservoirs, major delivery canals, lakes, lagoons, and other backwater areas. Reclamation annually compares current-year satellite imagery to previous year imagery and updates the open water surface area as necessary.

Reclamation calculates evaporation from major delivery canals that serve water users within the Yuma area. Reclamation identifies bank-to-bank area (in acres) in these canals by digitizing canal banks from satellite and airborne imagery.

[3]See, Lower Colorado River Accounting System, Calendar Year 2001, Demonstration of Technology Report, Chapter 6, 6.23 - 6.26.

3.2 Calculating Crop and Riparian Vegetation ET

Reclamation calculates ET from crop groups and riparian vegetation groups using the following data:

1. Reference ET.
2. ET coefficients for each crop and riparian vegetation group.
3. Number of acres and location of each crop and riparian vegetation group.
4. Effective precipitation (used to calculate crop ET only).

The following sections describe the methods utilized by Reclamation to calculate these data.

3.2.1 Calculating Reference ET

Reference ET represents a fundamental measure of the rate of water use by vegetation (in linear units, such as inches) to which the rate of water use of all types of vegetation (as well as the rate of evaporation from a water body) can be related.

Reclamation calculates reference ET values using the standardized Penman-Monteith equation developed by the American Society of Civil Engineers (standardized equation), and climatological data provided by California Irrigation Management Information System (CIMIS) and Arizona Meteorological Network (AZMET) automated weather stations located in irrigated areas along the Colorado River from Davis Dam to Mexico. The standardized equation is widely accepted by science/engineering communities, and is considered the most accurate method currently available. The AZMET and CIMIS stations continuously collect maximum, minimum, and average air temperature and relative humidity; average soil temperature at depths of 2- and 4-inches, wind speed, and precipitation data; and calculate net solar radiation. These parameters, with the exception of precipitation, are used to calculate hourly and daily reference ET values.

Table 3 provides a list of the stations used to collect the reference ET data used in Reclamation's calculations and the corresponding geographical areas for which each station's data are applied. Appendix 2 contains the following additional information (averaged for each geographical area referenced in Table 3): monthly reference ET, monthly precipitation, and monthly ET rates for crop and riparian groups.

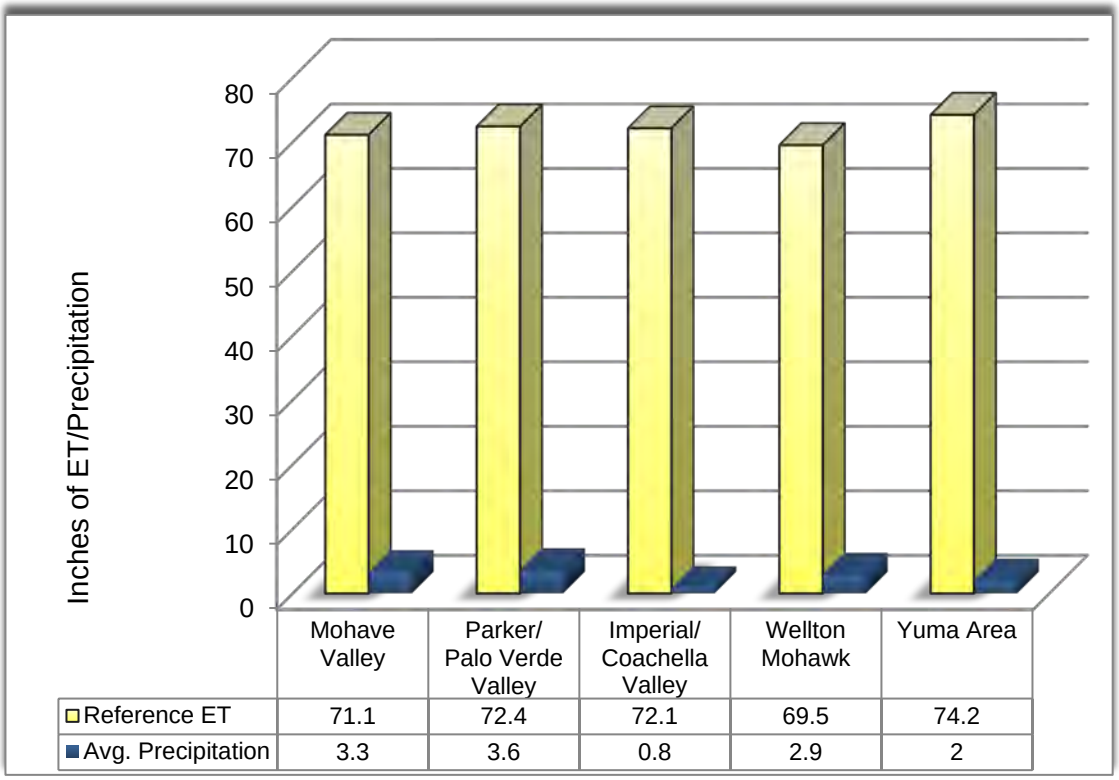
Table 3. Area Weather Stations Used for the Calculation of Average Reference ET and Precipitation.

Geographical Area	Weather Stations		
	AZMET	CIMIS	NWS*
Mohave Valley area	Mohave Mohave II Mohave ETo	--	Bullhead City Laughlin
Parker/Palo Verde valleys	Parker Parker II	Blythe NE Ripley Palo Verde II	Blythe-Airport Ehrenberg 2E Parker Blythe
Wellton-Mohawk area	Roll Roll ETo	--	Tacna 3 NE
Imperial/Coachella valleys	--	Calipatria/Mulberry Seeley Meloland La Quinta II Indio 2 Oasis Westmorland North	El Centro 2 SSW El Centro NAF, CA Imperial Indio FS Mecca FS Niland Desert Resorts Airport
Yuma area	Yuma North Gila Yuma South Yuma Valley Yuma Valley ETo	--	Yuma Proving Ground Yuma Quartermaster Yuma 13.8 ESE Yuma MCAS

*Only precipitation data from National Weather Service (NWS) stations are used in this analysis.

Although the AZMET and CIMIS networks perform calculations of reference ET, it was discovered that there was a disparity in the values reported by each network for the lower Colorado River. Upon investigation, it was determined that the reason for the disparity was because the AZMET and CIMIS networks each use slightly different equations to calculate reference ET. Within the Parker and Palo Verde valleys, both CIMIS and AZMET stations are used to derive average reference ET values. By calculating reference ET using the standardized equation with the climatological data provided by the AZMET and CIMIS networks, this disparity is eliminated, and leaves only site conditions, equipment calibration, and micro-climatic differences between sites as sources of site to site variations in reference-ET values. Reclamation currently uses the reference ET values provided by the CIMIS network for the Imperial and Coachella valleys, and reference ET values from the AZMET network for the Mohave Valley and Wellton-Mohawk areas.

Reclamation develops area-specific reference ET values for the Mohave Valley, the Parker/ Palo Verde Valleys, the Imperial/Coachella valleys, the Wellton-Mohawk area (when more than one station is available), and the Yuma Area by averaging reference ET values from multiple sites within these areas. Figure 5 shows the reference ET and precipitation values used to develop the 2014 ET rates, which are then used to calculate ET from crop and riparian vegetation groups.



	Mohave Valley	Parker/ Palo Verde Valley	Imperial/ Coachella Valley	Wellton Mohawk	Yuma Area
Reference ET	71.1	72.4	72.1	69.5	74.2
Avg. Precipitation	3.3	3.6	0.8	2.9	2

Figure 5. Reference ET and precipitation. Units: Inches.

3.2.2 ET Coefficients for Crop and Riparian Vegetation Groups

ET coefficients are the values that relate reference ET to the ET rate of a specific crop or riparian vegetation group, as well as to the evaporation rate from a water body. Jensen, Marvin E. (1998*), Coefficients for Vegetative Evapotranspiration and Open Water Evaporation for the Lower Colorado River Accounting System*, presents the rationale used to develop the original crop and riparian vegetation groups along the lower Colorado River and the Bill Williams River, their respective ET coefficients, and open water evaporation coefficients. Jensen, Marvin E. (2003), *Vegetative and Open Water Coefficients for the Lower Colorado River Accounting System (LCRAS), Addendum to the 1998 Report*, presents the adjustments made to the crop and riparian vegetation groups and the ET and evaporation coefficients, which are used in this report. The ET coefficients developed for the Yuma area are used to calculate crop ET for WMIDD.

The ET coefficients used for crops grown in IID and CVWD are derived from coefficients reported in Jensen, Marvin E. and Walter, Ivan A. (1997), *Assessment of 1987-1996 Water Use by the Imperial Irrigation District using Water Balance and Cropping Data Special Report, June 1997*. These ET coefficients were compared with crop ET coefficients for CVWD developed by Lord, J.M. (1994), reported in *Water Use Assessment, Coachella Valley Water District and Imperial Irrigation District, Phase I Report*, and found to be similar; therefore the same ET coefficients are used for IID and CVWD. For a more in-depth description of the ET coefficients

used for IID and CVWD, see *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations, Calendar Year 2004.*

3.2.3 Calculating Effective Precipitation

Effective precipitation is that portion of precipitation which infiltrates and remains in the soil so as to be available for crop consumptive use. A correction to the ET rate for crop groups is required to remove the impact of precipitation so the ET calculated reflects only the consumptive use of Colorado River water. Reclamation calculates effective precipitation as the product of recorded precipitation and an effective precipitation coefficient. Precipitation is recorded by rain gauges located at CIMIS and AZMET stations, and at stations operated by the NWS along the lower Colorado River. Table 3 provides a list of the stations used to collect the precipitation data used in Reclamation's calculations and the corresponding geographical areas for which each station's data are applied.

Reclamation developed a single daily, area-specific precipitation value for the Mohave Valley, the Parker/Palo Verde valleys, the Wellton-Mohawk area, the Imperial and Coachella valleys, and the Yuma area by averaging precipitation measured at the CIMIS, AZMET, and NWS stations in each area. Jensen, Marvin E. (1993), *Evaluating Effective Rainfall in CVWD,* contains the documentation for the effective precipitation coefficients used in this report. Reclamation uses the following equation to calculate effective precipitation:

$$\textit{Effective Precipitation} = \textit{Daily Precipitation} \times \textit{Monthly Effective Precipitation Coefficient}$$

Because the amount of precipitation in the Lower Basin is typically very small, the correction to the ET rate for precipitation is also typically very small.

3.2.4 Calculating Crop ET

To calculate ET from crops in the program area, Reclamation calculates an ET rate (in inches) for each crop group by multiplying the average daily reference ET values (inches) by each group's unique daily ET coefficient (dimensionless). (See Appendix, Part 2 of the *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations, Calendar Year 2008* report for daily Kc values.) Reclamation considers the effect of rainfall on crop water use by subtracting effective precipitation (inches) from the ET rate for each crop group to yield a net ET rate (inches). Reclamation sums the daily ET rates to produce a monthly ET rate (inches) for each crop group.

Reclamation determines the acreage of each crop group within each water user's boundary using GIS technologies, RS, and field survey data as previously described. For multi-year crops that are present during only part of the year, such as alfalfa and orchards, Reclamation uses quarterly acreage estimates for the ET calculation.

Figure 6. AZMET weather station, Mohave 2, located in the Mohave Valley, AZ.

Reclamation calculates the ET (in acre-feet) within each water user's boundary by multiplying the ET rate for each crop group by the acreage of each crop group. These calculations are performed on a monthly time-step and the results summed to produce annual agricultural ET values within each water user's boundary. The following equation is used to calculate ET for a specific crop group:

$$\text{Annual ET} = \sum_{t=0}^{n} \frac{[(ET_o \times K_c) - \text{Effective PPT}]\ AC}{12 \text{ inches/foot}}$$

Where:

ET	=	Annual ET by crop group (acre-feet)
n	=	Time-step (monthly)
ET_o	=	Daily reference ET (inches)
K_c	=	Daily ET coefficient for a specific crop (dimensionless)
AC	=	Acres of crop
Effective PPT	=	Effective precipitation (inches)

3.2.5 Calculating ET from Riparian Vegetation

Reclamation calculates ET from riparian vegetation for this report the same way it calculates agricultural ET, except that no correction is made to the ET rates of riparian vegetation for effective precipitation. The sum of the ET from all riparian vegetation groups within a water user's boundary yields the riparian vegetation ET for that individual water user. Riparian vegetation is monitored only in the Colorado River floodplain and along the Bill Williams River below Alamo Dam; it is not monitored in the IID, CVWD, or WMIDD areas.

3.3 Calculating Evaporation from Open Water Areas

Reclamation calculates evaporation from open water areas within the program area using the following data:

1. Reference ET.
2. Monthly evaporation coefficients.
3. Number of acres and location of the open water area.
4. Precipitation.

The following sections describe the methods utilized by Reclamation to calculate open water evaporation from the mainstream and from major delivery canals.

3.3.1 Mainstream

Reclamation calculates evaporation from Lakes Mohave and Havasu, and the open water areas of the mainstream Colorado River channel and its adjacent backwaters (such as Topock Marsh and Mittry Lake) from below Hoover Dam to Mexico. The following equation is used to calculate evaporation from open water areas:

$$\text{Annual EVAP} = \sum_{t=0}^{n} \frac{[(ET_o \times K_c)\text{-PPT}]\ AC}{12 \text{ inches/foot}}$$

Where:

EVAP	=	Annual Evaporation by open water (acre-feet)
n	=	Time-step (monthly)
ET_o	=	Daily reference ET (inches)
K_c	=	Monthly Evaporation coefficient for water (dimensionless)
AC	=	Acres of water
PPT	=	Precipitation (inches)

Reclamation verified the open water area for this report using the method described in Section 3.1.5, “Delineating Open Water Areas.”

3.3.2 Calculating Evaporation from Major Delivery Canals

Reclamation calculates evaporation from the All-American Canal, Gila Gravity Main Canal and other major delivery canals in the Yuma area using the same equation used to calculate evaporation from the mainstream. Reclamation categorized major delivery canals into two groups: (1) those that deliver water to a single water user (single-user canals) and, (2) those that deliver water to two or more water users (shared canals).

Evaporation from a shared canal is proportioned among the water users which receive water from the canal. Reclamation calculates each water user's proportionate share of evaporation using the following process:

1. Calculate the distance from the canal headworks to the user's point(s) of delivery. In cases where a user has more than one delivery point, Reclamation calculates a single point of delivery using a weighted average based on the user's diversion amounts at each point of delivery. These values have units of miles.
2. Multiply the mileage value from (1) by the user's total diversion to derive what is referred to as the pro-rata factor. These values have units of acre-foot miles.
3. Divide the pro-rata factor for each water user (derived in (2)) by the sum of the pro-rata factors for all water users that receive water from the canal. This value, which can be expressed as a fraction or percentage, represents each user's percentage use of the canal.
4. Multiply each user's percentage use of the canal by the total volume of evaporation from the canal to determine each user's share of evaporation from the canal.

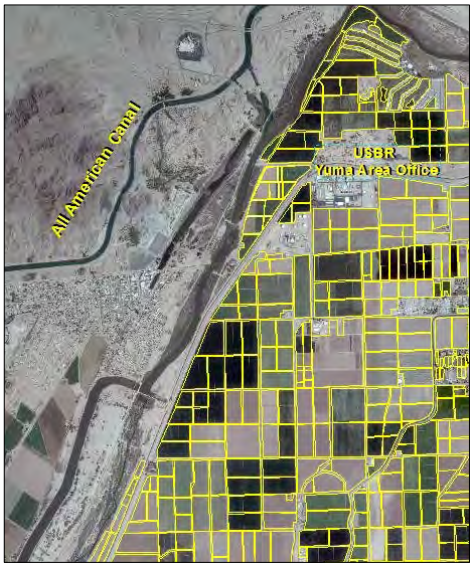


Figure 7. Digital image showing the All-American Canal, one of the canals from which Reclamation estimates evaporation.

4.0 Results

For each specified water user, Table 4 shows the ET from agriculture and riparian vegetation; and evaporation from the open water surfaces within that water user's boundary. As previously mentioned, areas with identified crops and/or riparian vegetation not located within a known water user boundary are mapped and labeled with the name of the state and river reach in which they are located. Table 4 includes water users which are not located on the river but are irrigated with water diverted from the Colorado River; specifically WMIDD in Arizona, and IID and CVWD in California.

The data used to develop the results presented in Tables 4 through 6 can be found on Reclamation's website at http://www.usbr.gov/lc/region/g4000/wtracct.html.

Table 4. Agricultural ET, Riparian Vegetation ET, and Open Water Evaporation by Water User, Lower Colorado River, Hoover Dam to Mexico. Units: Annual Acre-Feet.

Water User	Agricultural ET	Riparian Vegetation ET[4]	Open Water Evaporation
Nevada (below Hoover Dam)			
Fort Mojave Indian Reservation	1,832	5,251	54
Lake Mead National Recreation Area (Hoover Dam to Davis Dam)	0	2,034	11
Lake Mead National Recreation Area (Davis Dam to Parker Dam)	0	0	0
State of Nevada (Davis Dam to Parker Dam)	0	9,241	284
Nevada Totals*	**1,832**	**16,526**	**349**
California			
Arizona State Trust Lands, CA	5,543	1,722	105
Chemehuevi Indian Reservation	0	2,175	34
Cibola National Wildlife Refuge	0	12,983	613
Coachella Valley Water District	173,273	0	5,760
Colorado River Indian Reservation	3,626	33,349	864
Fort Mojave Indian Reservation	10,124	2,648	4
Fort Yuma Indian Reservation	343	10,786	358
Fort Yuma Indian Reservation Ranch 1	400	0	0
Fort Yuma Indian Reservation Ranch 2 Parcel 1	16	0	0
Fort Yuma Indian Reservation Ranch 2 Parcel 2	71	0	0
Fort Yuma Indian Reservation Ranch 2 Parcel 3	214	0	0
Fort Yuma Indian Reservation Ranch 3	10	14	0
Fort Yuma Indian Reservation Ranch 4	532	0	0
Fort Yuma Indian Reservation Ranch 5	857	0	0
Fort Yuma Indian Reservation Ranch 7	300	0	0
Fort Yuma Indian Reservation Ranch 15	604	11	0
Fort Yuma Indian Reservation Ranch 17	0	0	0

[4] Riparian Vegetation ET is monitored only in the Colorado River floodplain.

Water User	Agricultural ET	Riparian Vegetation ET[4]	Open Water Evaporation
Havasu National Wildlife Refuge	0	3,697	412
Imperial Irrigation District	1,515,621	0	12,939
Imperial National Wildlife Refuge (Parker Dam to Imperial Dam)	0	10,506	1,112
Lake Enterprises of California, LLC	0	663	49
Palo Verde Irrigation District	366,091	8,502	1,208
State of California, Other Users (Davis Dam to Parker Dam)	0	9,286	423
State of California, Other Users (Parker Dam to Imperial Dam)	1,656	18,983	5,427
State of California, Other Users (Imperial Dam to Mexico)	0	8,545	422
Yuma Project Reservation Division, Bard Unit	24,924	784	175
Yuma Project Reservation Division, Indian Unit	21,112	716	125
California Totals*	**2,125,316**	**125,371**	**30,028**
Arizona			
Arizona Game and Fish Commission/Mohave County Water Authority	4,003	240	0
Arizona State Land Department (Parker Dam to Imperial Dam)	1,309	1,974	0
Arizona State Land Department (Imperial Dam to Mexico)	3,688	571	67
Beattie Farms Southwest	517	243	0
Bill Williams National Wildlife Refuge	0	7,538	217
BLM	212	135	0
BLM (Monty Lee)	194	0	0
BLM (Pratt)	290	0	0
Cha Cha, LLC	1,848	28	11
Cibola National Wildlife Refuge	9,543	27,505	1,891
Cibola Valley Irrigation and Drainage District	5,513	3,050	4
City of Yuma	0	0	93
City of Yuma (Yuma East Wetlands)	0	403	102
Cocopah Indian Tribe, Fee Lands	532	53	0

Water User	Agricultural ET	Riparian Vegetation ET[4]	Open Water Evaporation
Colorado River Indian Reservation	335,119	91,616	952
Curtis, Armon	184	18	0
Cocopah Indian Tribe – East Reservation	12	0	0
Cocopah Indian Tribe - North Reservation	1,197	96	29
Cocopah Indian Tribe – West Reservation	3,049	14	0
Fort Mojave Indian Reservation	39,385	20,702	51
Fort Yuma Indian Reservation	186	4,494	268
Fort Yuma Indian Reservation, Ranch 5	348	2	0
Fort Yuma Indian Reservation, Yuma East Wetlands	0	639	2
Gila Monster Farms	4,615	164	50
Griffin, R.	78	0	0
Griffin Ranches	187	1	0
GSC Farm, LLC	1,080	0	0
Havasu National Wildlife Refuge	0	43,145	15,248
Hopi Tribe	2,858	1,103	0
Imperial National Wildlife Refuge	229	21,242	3,450
JRJ Partners, LLC	763	11	0
Lake Havasu State Park	0	1,305	243
Lake Mead National Recreation Area (Hoover Dam to Davis Dam)	0	2,067	33
Lake Mead National Recreation Area (Davis Dam to Parker Dam)	0	101	5
Mittry Lake Management Area	0	15,134	3,067
Mohave Valley Irrigation and Drainage District	17,982	15,306	466
North Baja Pipeline, LLC	130	2	0
North Gila Valley Irrigation District	23,059	2,422	72
Ogram Boys Enterprises, Inc.	530	11	0
Ogram, George	336	0	0
Pasquinelli, Gary & Barbara	291	0	0

Water User	Agricultural ET	Riparian Vegetation ET[4]	Open Water Evaporation
Peach, John	255	0	0
Phillips, Milton	98	0	0
Power	211	0	0
Power, Victor	47	2	0
Rayner Ranches	2,676	2	0
State of Arizona, Other Users (Davis Dam to Parker Dam)	0	2,131	346
State of Arizona, Other Users (Parker Dam to Imperial Dam)	711	21,960	3,776
State of Arizona, Other Users (Imperial Dam to Mexico)	1,959	8,372	598
Unit B Irrigation and Drainage District	6,817	0	126
University of Arizona	202	0	0
Wellton-Mohawk Irrigation and Drainage District	212,780	0	747
Yuma County Water Users Association	140,880	1	1,961
Yuma Irrigation District	37,650	672	380
Yuma Mesa Irrigation and Drainage District	53,376	0	1,062
Yuma Proving Ground	0	266	0
Arizona Totals*	**916,929**	**294,741**	**35,316**
Hoover Dam to Mexico Totals*	**3,044,077**	**436,638**	**65,692**

*Due to rounding, totals shown may differ from the sum of the individual values.

Table 5 provides a summary, by river reach, of ET and evaporation results along the lower Colorado River from Hoover Dam to Mexico. (Note: Bill Williams River National Wildlife Refuge (NWR) is included in the Davis Dam to Parker Dam reach; WMIDD, IID, and CVWD are included in the Imperial Dam to Mexico reach.)

Table 5. Summary of ET and Evaporation along the lower Colorado River from Hoover Dam to Mexico.
Units: Annual Acre-Feet.

ET Category/Evaporation	Hoover Dam to Davis Dam	Davis Dam to Parker Dam	Parker Dam to Imperial Dam	Imperial Dam To Mexico	Total: Hoover Dam To Mexico*
Agricultural ET	0	69,323	734,544	2,240,210	3,044,077
Riparian Vegetation[4]	4,101	122,528	253,680	56,330	436,638
Evaporation – Open Water	44	17,785	19,346	28,517	65,692
Evaporation – Mainstream	132,025	97,360	48,466	3,838	281,689

*Due to rounding, totals shown may differ from the totals shown in Table 4.

[4] Riparian Vegetation ET is monitored only in the Colorado River floodplain.

Table 6 shows the ET from agriculture and riparian vegetation, and evaporation from open water areas that are considered to be NCRs (Non-Colorado River water users). For water users designated as NCR, the origin of water used for agricultural irrigation or consumed by riparian vegetation and open water is presently considered either to come from sources other than the

Table 6. Agricultural ET, Riparian Vegetation ET, and Open Water Evaporation by Non-Colorado River Water Users.
Units: Annual Acre-Feet.

Water User Name	Agricultural ET	Riparian Vegetation ET[4]	Open Water Evaporation
Bill Williams River National Wildlife Refuge, AZ (NCR)[5]	0	1,602	49
Cocopah Indian Tribe – West Reservation, AZ (NCR)[6]	180	4,833	0
Hillander C Irrigation District, AZ (NCR)[6]	3,994	0	0
State of Arizona (Alamo Dam to Bill Williams NWR) (NCR)[7]	1,796	15,425	533
State of Arizona (Gila River Valley) (NCR)[8]	3,453	0	41
State of Arizona, Down Gradient of YMIDD (NCR)[6]	32,156	0	0
State of Arizona, (Imperial Dam to Mexico) (NCR)[6]	1,039	0	0
State of Arizona, Limitrophe (NCR)[6]	3,158	4,141	0
Yuma Mesa Irrigation and Drainage District, AZ (NCR)[6]	11,103	0	0
Totals	**56,879**	**26,001**	**623**

*Due to rounding, totals shown may differ from the sum of the individual values.

[4] Riparian Vegetation ET is monitored only in the Colorado River floodplain.

[5] Bill Williams River NWR, from the eastern extent of the Colorado River aquifer to the eastern extent of the refuge boundary.

[6] Lands downstream of the Northerly International Boundary that use groundwater only.

[7] Bill Williams River, from Alamo Dam to the eastern boundary of the Bill Williams River NWR.

[8] Agricultural land outside of WMIDD that is irrigated with wells pumping Gila River Valley groundwater.

Colorado River, or to be groundwater that is flowing towards Mexico downstream of the Northerly International Boundary and therefore not available for consumptive use in the United States or in satisfaction of the Mexican Treaty Obligation.

5.0 Data Comparisons in Appendix 1

Additional information on the water users identified in Tables 4 through 6, including agricultural acreage (irrigable, gross cropped, net cropped, and fallowed/idle acres), crop types and acreages, agricultural ET by crop type, riparian vegetation acreage and open water acreage has been included in Appendix 1. For select water users, the appendix also provides the historical 5-year trend (calendar years 2010-2014) of the user's total diversions and consumptive use (as reported in Reclamation's *Colorado River Accounting and Water Use Report: Arizona, California, and Nevada (*Water Accounting Report)), and agricultural ET (crop ET minus effective precipitation).

5.1 Differences between LCRAS Report and Water Accounting Report Values

Estimates of ET from irrigated agricultural areas presented in the LCRAS report may differ from the consumptive use values contained in the Water Accounting Report. In the LCRAS report, the terms "consumptive use" and "ET" are used interchangeably and represent the estimates of consumptive use of Colorado River water from agriculture, riparian vegetation, and permanent open water. These estimates are based on computations of ET and evaporation using weather data, crop acreage, crop type, regionally estimated planting and harvest dates, and crop-specific ET coefficients.

In the Water Accounting Report, tabulated consumptive use values are computed as diversions minus the sum of measured and unmeasured return flows, and incorporate the following types of consumptive use that are not included in the LCRAS report:

1. The total volume of water exported from the mainstream (e.g. Imperial Irrigation District and Coachella Valley Water District).
2. Municipal and industrial diversions.
3. Delivery system losses within and along irrigation canals from the point of diversion to the agricultural fields.
4. Irrigations performed outside of a standard crop cycle (e.g. irrigations to remove salt from the soil column and dust control irrigations during times of fallowing).

6.0 Program Improvements for Calendar Year 2014

Reclamation annually reviews each application of the methodology and incorporates "lessons learned" into subsequent reports. Reclamation also modifies each application of the methodology in response to information provided by water users and as modified processes

become available after analysis of long-term questions and issues. The following paragraphs describe the program improvements implemented beginning with this calendar year 2014 report.

6.1 Adjustments to Water User Names and Boundaries

For the 2014 report, a number of changes were made to water user names and boundaries in the Yuma area. The nature of the changes are described below. Some water users were changed to NCRs, meaning water used within their boundaries is generally not considered to be Colorado River Water. See Appendix 3, Map 5 for the current user names and boundaries.

Water User	Description of Update
Arizona	
State of Arizona, Downgradient of YMIDD	This water user was changed to an NCR and the name was changed to "State of Arizona, Downgradient of YMIDD (NCR)."
Yuma Mesa Irrigation and Drainage District, AZ	A portion of this water user was separated into an NCR called the "Yuma Mesa Irrigation and Drainage District, AZ (NCR)." The remaining portion retained the original name.
Some areas previously called State of Arizona (Imperial Dam to Mexico)	Areas located downstream of the Northerly International Boundary that receive only groundwater were changed to an NCR named "State of Arizona (Imperial Dam to Mexico) (NCR)."
State of Arizona, Limitrophe	This water user was changed to an NCR named "State of Arizona, Limitrophe (NCR)."
Fort Yuma Indian Reservation, CA	Two new water users were split off from the Fort Yuma Indian Reservation, CA. These new water users are called "Fort Yuma Indian Reservation, CA, Ranch 2, Parcel 1" and "Fort Yuma Indian Reservation, CA Ranch 2, Parcel 2."
Yuma Project Reservation, Bard and Indian Units	Some changes to the boundaries of the Bard and Indian Units were made to reflect updated information. This resulted in an increase of 149.5 acres in the Bard Unit, and a decrease of 218.6 acres in the Indian Unit.

6.2 Refinement of Open Water Areas

In 2014, changes in open water acreage were identified by inspecting the most recent imagery available, including NAIP, Landsat, Google Earth, and ESRI imagery. The 2013 open water data set was compared to these image sources and updated by adding or removing open water areas where differences occurred.

Evaporation calculations for open water surfaces along the main stem of the Lower Colorado River use unique evaporation coefficients for each geographical area (Jensen, 2003), which have been included in Appendix 2.

7.0 References

Bureau of Reclamation. 1997. *Lower Colorado River Accounting System, Calendar Year 1995, Demonstration of Technology Report*.

Bureau of Reclamation. 2002. *Lower Colorado River Accounting System, Calendar Year 2001, Demonstration of Technology Report*.

Bureau of Reclamation. 2006. *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations, Calendar Year 2004*.

Bureau of Reclamation. 2009. *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations, Calendar Year 2008*.

ESRI, Inc. 1994. *Understanding GIS: The ARC/INFO Method*.

Jensen, Marvin E. 1993. *Evaluating Effective Rainfall in CVWD*. Appendix 3 of *Water Use Assessment, Coachella Valley Water District and Imperial Irrigation District, Phase I Report,* (Draft April 1994) from the Technical Work Group, Stephen M. Jones, Charles M. Burt, Albert J. Clemmens, Marvin E. Jensen, Joseph M. Lord, Jr., Kenneth H. Solomon. (Copies of Appendix 3 are available from the Bureau of Reclamation, Boulder Canyon Operations Office, Boulder City, Nevada).

Jensen, Marvin E. 1997. *Assessment of 1987-1996 Water Use by the Imperial Irrigation District using Water Balance and Cropping Data Special Report June 1997*. (Copies available from the Bureau of Reclamation, Boulder Canyon Operations Office, Boulder City, Nevada).

Jensen, Marvin E. 1998. *Coefficients for Vegetative Evapotranspiration and Open-Water Evaporation for the Lower Colorado River Accounting System*. (Copies available from the Bureau of Reclamation, Boulder Canyon Operations Office, Boulder City, Nevada).

Jensen, Marvin E. 2003. *Vegetative and Open Water Coefficients for the Lower Colorado River Accounting System (LCRAS) Addendum to the 1998 Report*. (Copies available from the Bureau of Reclamation Boulder Canyon Operations Office in Boulder City, Nevada).

Stehman, S.V. and Milliken, J.A. 2007. "Estimating the effect of crop classification error on evapotranspiration derived from remote sensing in the lower Colorado River basin, USA." *Remote Sensing of Environment*, 106, pp. 217 – 227.

United States Geological Survey. 2006. "Evapotranspiration by Phreatophytes Along the Lower Colorado River at Havasu National Wildlife Refuge, Arizona." *Scientific Investigations Report 2006-5043*.

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Appendix 1: Water User Fact Sheets

This appendix is intended to supplement the information contained in Table 4, and includes the following information for each water user: agricultural acreage (irrigable acres, gross cropped acres, net cropped acres and fallowed/idle acres); crop types and acreages; agricultural ET by crop type; riparian vegetation acreage and ET; and open water acreage and evaporation. For select users, the appendix also provides a historical 5-year trend (calendar years 2010-2014) of the user's total Colorado River diversions and consumptive use (diversions less measured and unmeasured return flows) – as reported in Reclamation's annual *Colorado River Accounting and Water Use Report: Arizona, California, and Nevada* reports– and agricultural ET (crop ET minus effective precipitation – as reported in Reclamation's annual *Lower Colorado River Annual Summary of Evapotranspiration and Evaporation* (LCRAS) reports. Copies of these reports may be found on Reclamation's website at: www.usbr.gov/lc/region/g4000/wtracct.html.

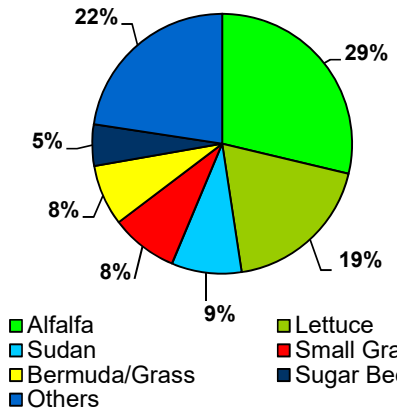
Executive Summary

2014

River Reach:	Hoover Dam to Mexico
Agriculture	
Irrigable Acres:	837,025
Gross Cropped Acres:	1,021,678
Net Cropped Acres:	768,738
Fallowed/Idle Acres:	68,287
Agricultural Evapotranspiration (acre-feet):	3,044,077
Riparian	
Riparian Vegetation - Acres:	134,575
Riparian Evapotranspiration (acre-feet):	436,638
Open Water	
Open Water - Acres:	12,081
Open Water - Evaporation (acre-feet):	65,692
Mainstream (Lake and River)	
Acres:	57,472
Evaporation (acre-feet):	281,689

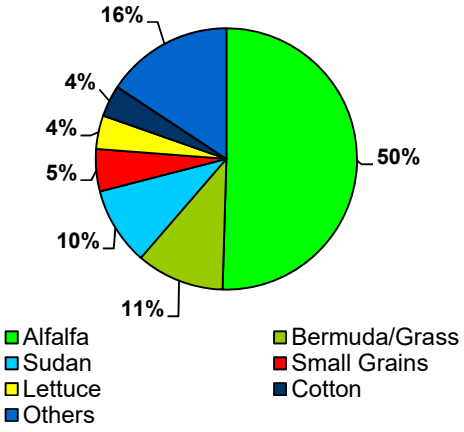
Major Crop Types

Percent of Total Gross Cropped Acres

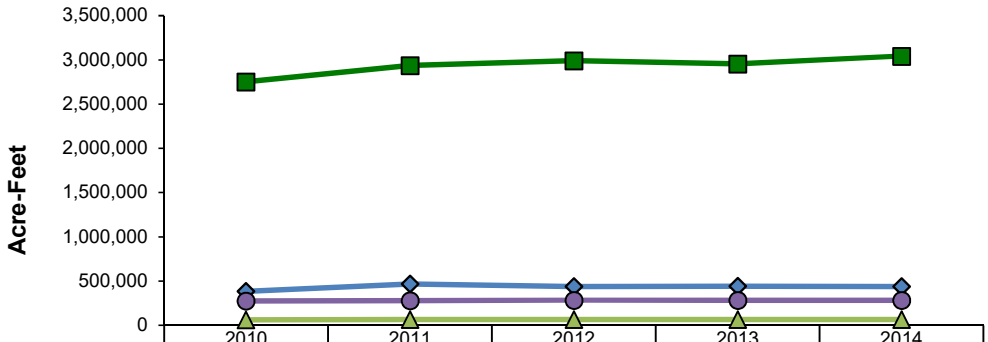


Annual Agricultural ET

Percent of Total Acre-Feet



Evapotranspiration and Evaporation, 2010-2014



	2010	2011	2012	2013	2014
Agricultural ET	2,753,764	2,936,239	2,990,807	2,954,361	3,044,077
Riparian Vegetation ET	383,480	467,263	438,039	443,598	436,638
Open Water Evaporation	63,074	65,351	64,750	64,346	65,692
Mainstream Evaporation	274,507	278,617	284,264	283,489	281,689

Executive Summary
2014

Crop Type	Gross Cropped Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	293,293	29	1,535,545	50
Aloe	25	<1	54	<1
Bermuda/Grass	77,617	8	331,692	11
Cane/Bamboo	561	<1	3,130	<1
Citrus	22,908	2	77,275	3
Cotton	39,819	4	118,556	4
Crucifers	43,818	4	30,579	1
Dates	12,001	1	69,414	2
Deciduous Orchards	1,422	<1	6,482	<1
Field Grain	10,229	1	28,490	1
Grapes	8,054	1	24,869	1
Legume/Solanum Veg.	10,252	1	22,835	1
Lettuce	193,062	19	126,060	4
Marsh Maintained	303	<1	1,773	<1
Melons	18,755	2	32,715	1
Miscellaneous herbs	2,003	<1	5,025	<1
Moist Soil Unit	1,728	<1	8,799	<1
Nursery/Greenhouse	2,576	<1	5,621	<1
Oil Crops	27	<1	86	<1
Perennial Vegetables	2,644	<1	12,285	<1
Root Vegetables	409	<1	398	<1
Small Grains	85,285	8	159,951	5
Small Vegetables	49,665	5	59,289	2
Sudan	89,065	9	293,466	10
Sugar Beets	52,447	5	77,749	3
Tomatoes	594	<1	1,342	<1
Wildlife Forage Maintained	1,095	<1	2,336	<1
Restoration Area	2,021	<1	8,264	<1
Total*	**1,021,678**	**100%**	**3,044,077**	**100%**

*Due to rounding, totals may differ from the sum of the individual values.

Hoover Dam to Davis Dam

2014

Agriculture
There is no agricultural use in this reach.

Riparian	
Riparian Vegetation Acres:	1,356
Riparian Evapotranspiration (acre-feet):	4,101

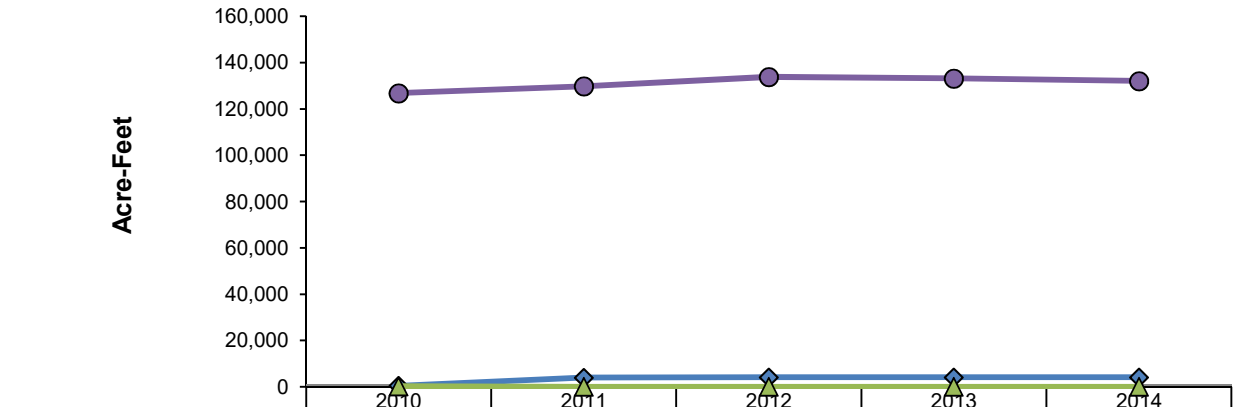
Open Water	
Open Water Acres:	9
Open Water Evaporation (acre-feet):	44

Mainstream (Lake and River)	
Acres:	27,365
Evaporation (acre-feet):	132,025

Water Users within Reach
Lake Mead National Recreation Area - AZ & NV

Crop Types within Reach	Acres	Annual ET (acre-feet)
Note: There were no crops grown in this reach.		

Evapotranspiration and Evaporation, 2010-2014



	2010	2011	2012	2013	2014
Riparian Vegetation ET	474	3,984	4,149	4,132	4,101
Open Water Evaporation	237	56	57	44	44
Mainstream Evaporation	126,813	129,805	133,823	133,179	132,025

Davis Dam to Parker Dam

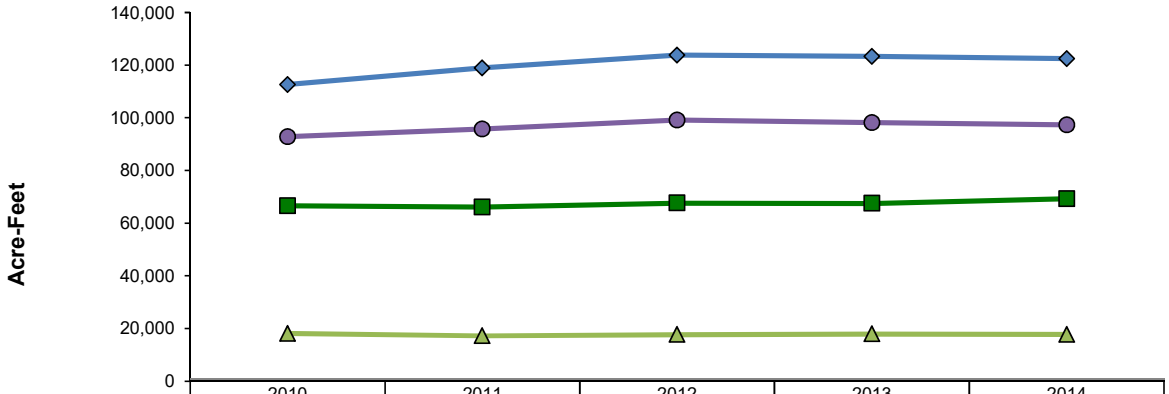
2014

Agriculture	
Irrigable Acres:	18,222
Gross Cropped Acres:	17,765
Net Cropped Acres:	17,154
Fallowed/Idle Acres:	1,068
Agricultural Evapotranspiration (acre-feet):	69,323
Riparian	
Riparian Vegetation Acres:	38,370
Riparian Evapotranspiration (acre-feet):	122,528
Open Water	
Open Water Acres:	3,686
Open Water Evaporation (acre-feet):	17,785
Mainstream (Lake and River)	
Acres:	20,180
Evaporation (acre-feet):	97,360

Water Users within Reach
Bill Williams River National Wildlife Refuge - AZ
Chemehuevi Indian Reservation - CA
Fort Mojave Indian Reservation - AZ, CA, & NV
Havasu National Wildlife Refuge - AZ & CA
Lake Havasu State Park - AZ
Lake Mead National Recreation Area - AZ & NV
Mohave Valley Irrigation & Drainage District - AZ
State of Arizona (Other Users)
State of California (Other Users)
State of Nevada (Other Users)

Crop Types within Reach	Acres	Annual ET (acre-feet)
Alfalfa	8,761	45,901
Bermuda/Grass	1,685	4,600
Cotton	5,484	14,502
Small Grains	1,005	1,444
Sudan	830	2,876
Total	**17,765**	**69,323**

Evapotranspiration and Evaporation, 2010-2014



	2010	2011	2012	2013	2014
Agricultural ET	66,672	66,097	67,670	67,555	69,323
Riparian Vegetation ET	112,657	119,044	123,827	123,369	122,528
Open Water Evaporation	18,128	17,243	17,747	17,968	17,785
Mainstream Evaporation	92,906	95,782	99,146	98,227	97,360

Parker Dam to Imperial Dam

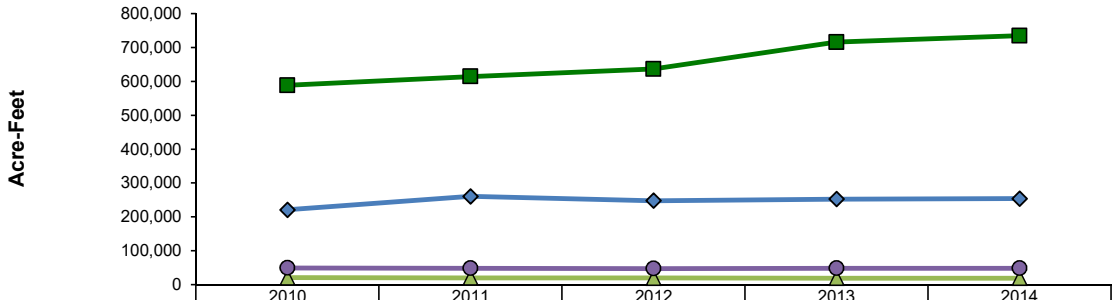
2014

Agriculture	
Irrigable Acres:	174,064
Gross Cropped Acres:	164,370
Net Cropped Acres:	162,986
Fallowed/Idle Acres:	11,078
Agricultural Evapotranspiration (acre-feet):	734,544
Riparian	
Riparian Vegetation Acres:	79,281
Riparian Evapotranspiration (acre-feet):	253,680
Open Water	
Open Water Acres:	3,710
Open Water Evaporation (acre-feet):	19,346
Mainstream (Lake and River)	
Acres:	9,295
Evaporation (acre-feet):	48,466

Water Users within Reach
Arizona Game and Fish Commission/Mohave County Water Authority - AZ
Arizona State Land Department - AZ
Cibola National Wildlife Refuge - AZ & CA
Cibola Valley Irrigation & Drainage District - AZ
Colorado River Indian Reservation - AZ & CA
GSC Farm, LLC - AZ
Hopi Tribe - AZ
Imperial National Wildlife Refuge - AZ & CA
Lake Enterprises of California, LLC - CA
North Baja Pipeline, LLC - AZ
Palo Verde Irrigation District - AZ & CA
Rayner Ranches - AZ
State of Arizona (Other Users)
State of California (Other Users)

Crop Types within Reach	Acres	Annual ET (acre-feet)
Alfalfa	109,013	585,218
Bermuda/Grass	6,579	21,724
Citrus	1,735	6,379
Cotton	20,055	56,486
Crucifers	1,611	815
Dates	469	2,731
Deciduous Orchards	23	115
Field Grain	2,021	5,282
Grapes	5	15
Legume/Solanum Veg.	644	295
Lettuce	824	502
Melons	1,336	2,857
Moist Soil Unit	331	1,684
Nursery/Greenhouse	9	19
Oil Crops	22	72
Small Grains	12,054	22,964
Small Vegetables	443	261
Sudan	5,195	18,969
Restoration Area	2,001	8,157
Total	**164,370**	**734,544**

Evapotranspiration and Evaporation, 2010-2014



	2010	2011	2012	2013	2014
Agricultural ET	587,900	614,318	636,221	715,674	734,544
Riparian Vegetation ET	220,474	260,370	247,804	252,334	253,680
Open Water Evaporation	20,220	19,950	19,500	18,791	19,346
Mainstream Evaporation	49,248	48,700	47,031	48,387	48,466

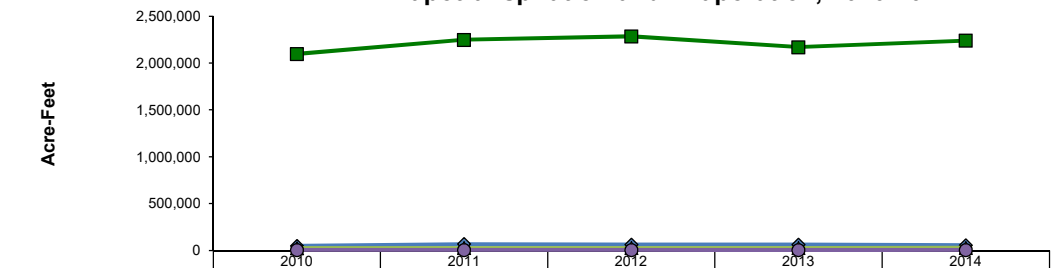
Imperial Dam to Mexico

2014

Agriculture	
Irrigable Acres:	644,739
Gross Cropped Acres:	839,543
Net Cropped Acres:	588,598
Fallowed/Idle Acres:	56,141
Agricultural Evapotranspiration (acre-feet):	2,240,210
Riparian	
Riparian Vegetation Acres:	15,568
Riparian Evapotranspiration (acre-feet):	56,330
Open Water	
Open Water Acres:	4,675
Open Water Evaporation (acre-feet):	28,517
Mainstream (Lake and River)	
Acres:	632
Evaporation (acre-feet):	3,838

Water Users within Reach	Crop Types within Reach	Acres	Annual ET (acre-feet)
Arizona State Land Department - AZ	Alfalfa	175,518	904,426
AZ State Trust Lands, CA	Aloe	25	54
Beattie Farms Southwest - AZ	Bermuda/Grass	69,353	305,367
BLM, BLM (Monty Lee) & BLM (Pratt) - AZ	Cane/Bamboo	561	3,130
Cha Cha, LLC - AZ	Citrus	21,173	70,895
City of Yuma (Yuma East Wetlands), AZ	Cotton	14,280	47,568
Coachella Valley Water District - CA	Crucifers	42,207	29,763
Cocopah Indian Reservation (East, North, West, Fee Lands) - AZ	Dates	11,532	66,684
Curtis, Armon - AZ	Deciduous Orchards	1,398	6,367
Fort Yuma Indian Reservation (inc. Ranches & Yuma East Wetlands) - AZ & CA	Field Grain	8,208	23,208
Gila Monster Farms, AZ	Grapes	8,050	24,854
Griffin Ranches & Griffin, R. - AZ	Legume/Solanum Veg.	9,608	22,539
Imperial Irrigation District - CA	Lettuce	192,238	125,558
JRJ Partners, LLC - AZ	Marsh Maintained	303	1,773
Mittry Lake Management Area - AZ	Melons	17,418	29,858
North Gila Valley Irrigation District - AZ	Miscellaneous herbs	2,003	5,025
Ogram Boys Enterprises, Inc. & Ogram, George - AZ	Moist Soil Unit	1,397	7,115
Pasquinelli, Gary & Barbara - AZ	Nursery/Greenhouse	2,568	5,602
Peach, John - AZ	Oil Crops	5	15
Phillips, Milton - AZ	Perennial Vegetables	2,644	12,285
Power & Power, Victor - AZ	Root Vegetables	409	398
State of Arizona (Downgradient of YMIDD, Limitrophe, Other Users)	Small Grains	72,226	135,544
State of California (Other Users)	Small Vegetables	49,221	59,027
Unit B Irrigation and Drainage District - AZ	Sudan	83,040	271,621
University of Arizona - AZ	Sugar Beets	52,447	77,749
Wellton Mohawk Irrigation and Drainage District - AZ	Tomatoes	594	1,342
Yuma County Water Users' Association - AZ	Wildlife Forage Maintained	1,095	2,336
Yuma Irrigation District - AZ	Restoration Area	21	107
Yuma Mesa Irrigation and Drainage District - AZ			
Yuma Project Reservation Division, Bard Unit & Indian Unit - CA			
Yuma Proving Ground - AZ	**Total**	**839,543**	**2,240,210**

Evapotranspiration and Evaporation, 2010-2014



	2010	2011	2012	2013	2014
Agricultural ET	2,099,192	2,249,292	2,286,916	2,171,133	2,240,210
Riparian Vegetation ET	49,875	67,269	62,259	63,764	56,330
Open Water Evaporation	24,489	27,532	27,446	27,542	28,517
Mainstream Evaporation	5,539	4,328	4,264	3,698	3,838

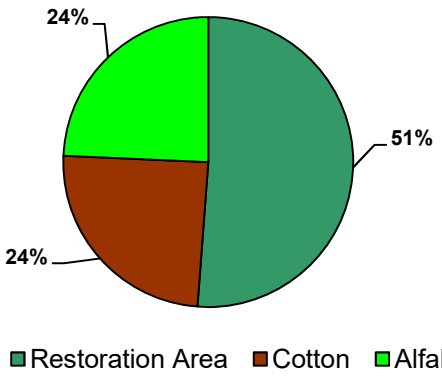
*The Imperial Dam to Mexico reach includes water diverted from the Colorado River to the Wellton-Mohawk Irrigation and Drainage District in Arizona, and to the Imperial Irrigation District and Coachella Valley Water District in California.

Arizona Game and Fish Commission/Mohave County Water Authority
2014

River Reach:	Parker Dam to Imperial Dam
Agriculture	
Irrigable Acres:	1,178
Gross Cropped Acres:	1,044
Net Cropped Acres:	1,097
Fallowed/Idle Acres:	81
Agricultural Evapotranspiration (acre-feet):	4,003
Riparian	
Riparian Vegetation Acres:	71
Riparian Evapotranspiration (acre-feet):	240
Open Water	
Open Water Acres:	0
Open Water Evaporation (acre-feet):	0

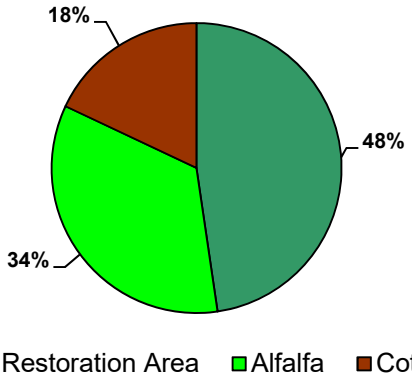
Major Crop Types

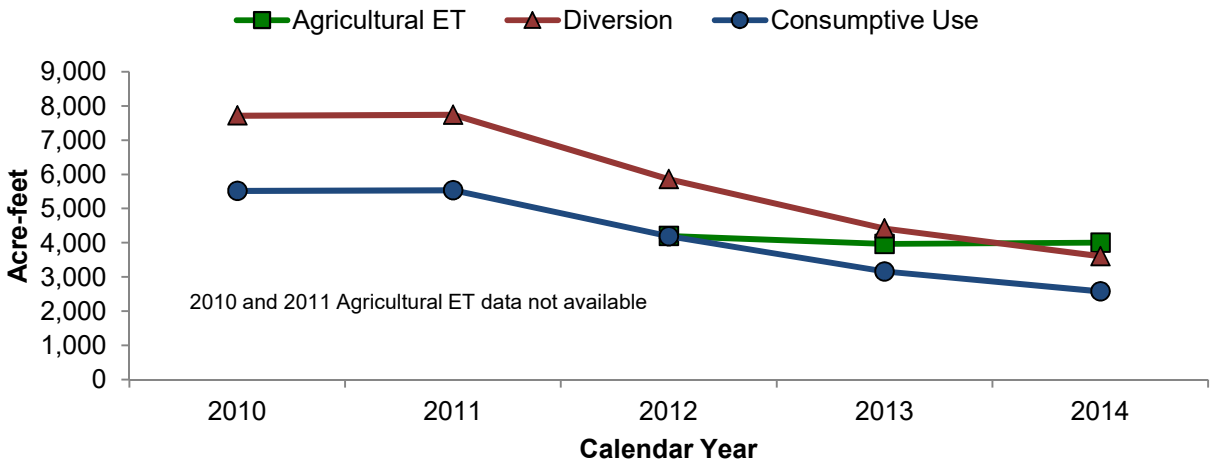
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Arizona Game and Fish Commission/Mohave County Water Authority 2014

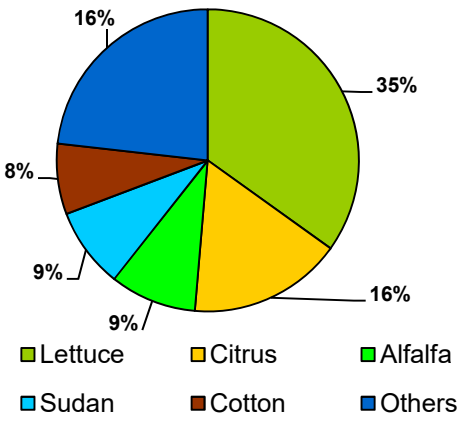
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	254	24	1,374	34
Cotton	256	24	720	18
Restoration Area	534	51	1,909	48
Total*	**1,044**	**100%**	**4,003**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

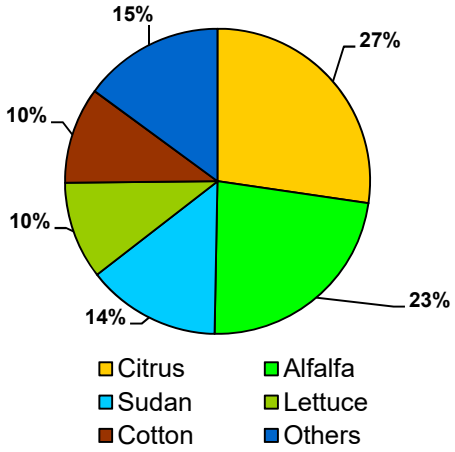
Arizona State Land Department - AZ
2014

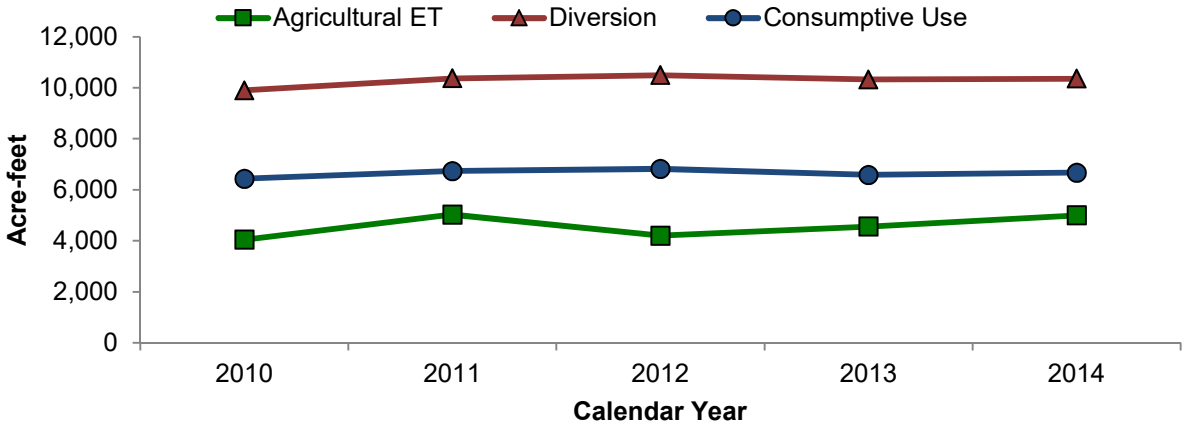
River Reach:	Parker Dam to Mexico
Agriculture	
Irrigable Acres:	1,452
Gross Cropped Acres:	2,291
Net Cropped Acres:	1,414
Fallowed/Idle Acres:	38
Agricultural Evapotranspiration (acre-feet):	4,997
Riparian	
Riparian Vegetation Acres:	909
Riparian Evapotranspiration (acre-feet):	2,545
Open Water	
Open Water Acres:	11
Open Water Evaporation (acre-feet):	67

Major Crop Types
Percent of Total Gross Cropped Acres



Annual Agricultural ET
Percent of Total Acre-Feet





Arizona State Land Department - AZ

2014

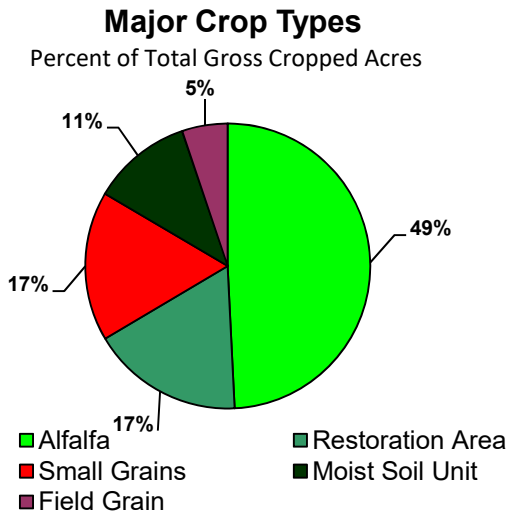
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	212	9	1,151	23
Citrus	377	16	1,364	27
Cotton	173	8	512	10
Crucifers	118	5	43	1
Lettuce	800	35	516	10
Melons	159	7	295	6
Root Vegetables	20	1	20	<1
Small Grains	158	7	294	6
Small Vegetables	76	3	93	2
Sudan	197	9	709	14
Total*	**2,291**	**100%**	**4,997**	**100%**

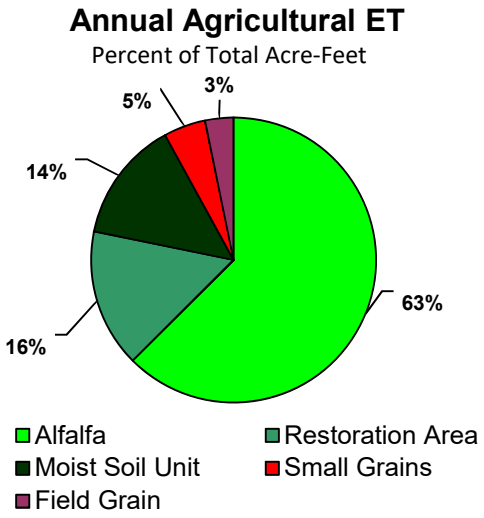
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

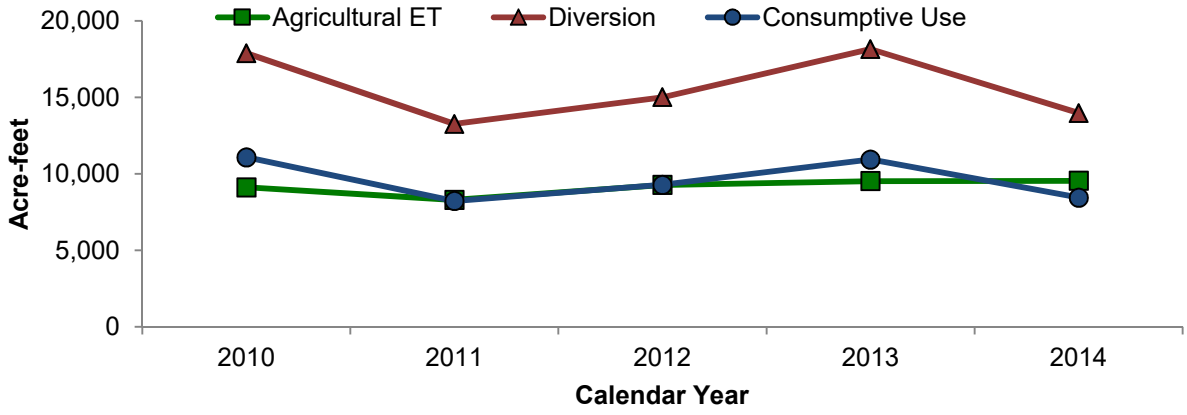
Cibola National Wildlife Refuge - AZ

2014

River Reach:	Parker Dam to Imperial Dam
Agriculture	
Irrigable Acres:	2,497
Gross Cropped Acres:	2,275
Net Cropped Acres:	2,300
Fallowed/Idle Acres:	197
Agricultural Evapotranspiration (acre-feet):	9,543
Riparian	
Riparian Vegetation Acres:	9,071
Riparian Evapotranspiration (acre-feet):	27,505
Open Water	
Open Water Acres:	363
Open Water Evaporation (acre-feet):	1,891







Cibola National Wildlife Refuge - AZ

2014

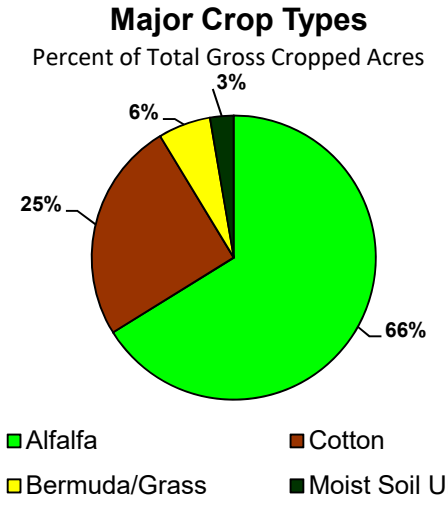
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	1,120	49	5,967	63
Field Grain	118	5	308	3
Moist Soil Unit	259	11	1,316	14
Restoration Area	392	17	1,498	16
Small Grains	386	17	455	5
Total*	**2,275**	**100%**	**9,543**	**100%**

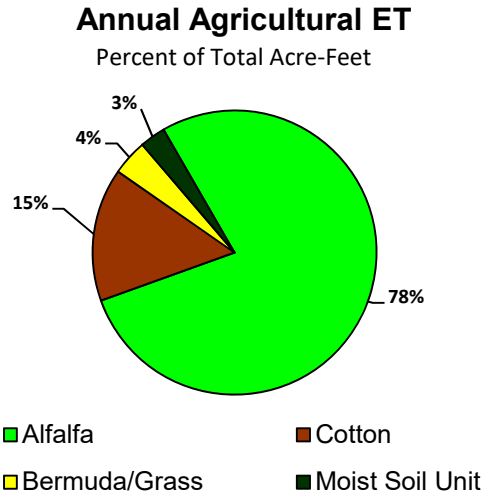
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

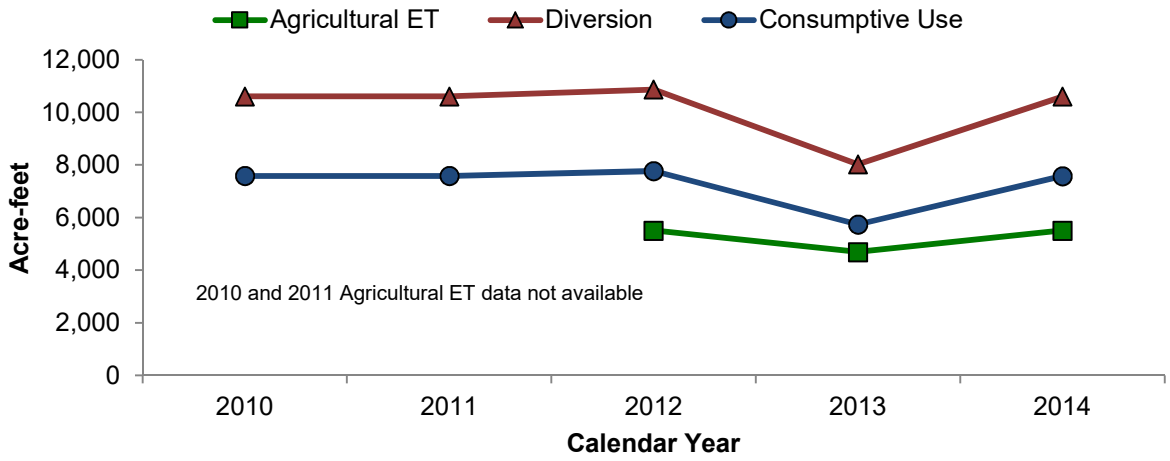
Cibola Valley Irrigation and Drainage District - AZ

2014

River Reach:	Parker Dam to Imperial Dam
Agriculture	
Irrigable Acres:	1,208
Gross Cropped Acres:	1,180
Net Cropped Acres:	1,200
Fallowed/Idle Acres:	8
Agricultural Evapotranspiration (acre-feet):	5,513
Riparian	
Riparian Vegetation Acres:	1,057
Riparian Evapotranspiration (acre-feet):	3,050
Open Water	
Open Water Acres:	1
Open Water Evaporation (acre-feet):	4







Cibola Valley Irrigation and Drainage District - AZ

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	781	66	4,291	78
Bermuda/Grass	71	6	224	4
Cotton	297	25	836	15
Moist Soil Unit	32	3	162	3
Total*	**1,180**	**100%**	**5,513**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

Cocopah Indian Tribe - AZ

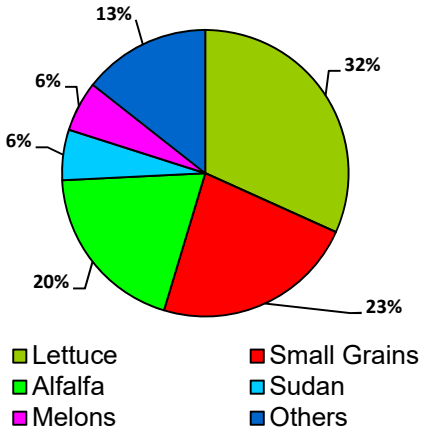
(Includes East, North and West Reservations)

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	1,224
Gross Cropped Acres:	1,929
Net Cropped Acres:	1,191
Fallowed/Idle Acres:	33
Agricultural Evapotranspiration (acre-feet):	4,258
Riparian	
Riparian Vegetation Acres:	24
Riparian Evapotranspiration (acre-feet):	110
Open Water	
Open Water Acres:	5
Open Water Evaporation (acre-feet):	29

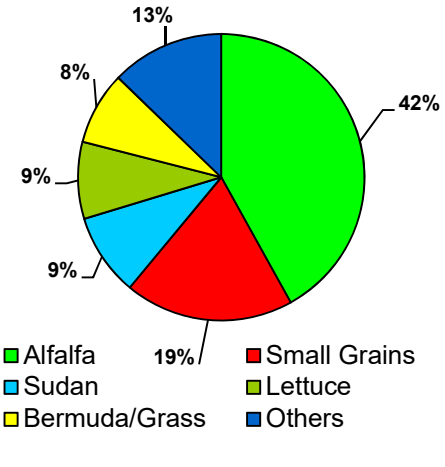
Major Crop Types

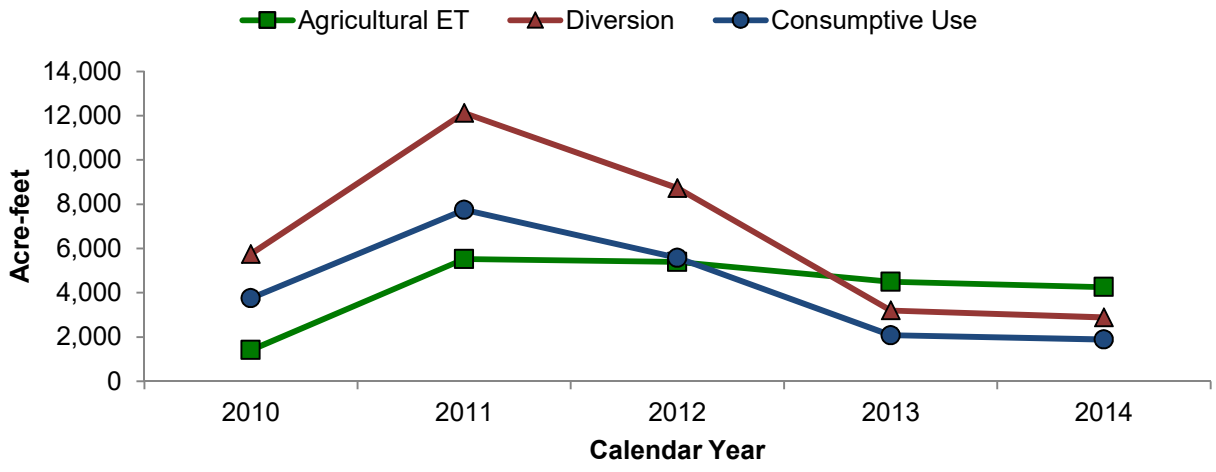
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Cocopah Indian Tribe - AZ

(Includes East, North and West Reservations)

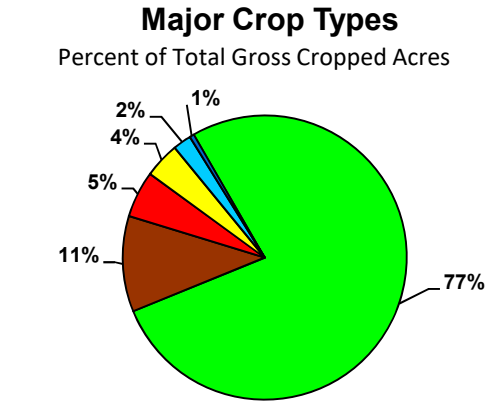
2014

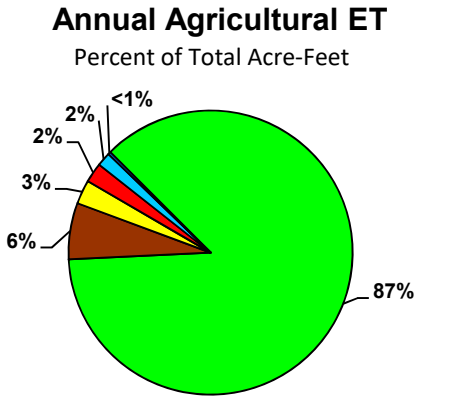
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	377	20	1,786	42
Bermuda/Grass	105	5	350	8
Cotton	55	3	187	4
Crucifers	26	1	11	<1
Legume/Solanum Veg.	19	1	14	<1
Lettuce	612	32	370	9
Melons	110	6	203	5
Miscellaneous herbs	9	<1	28	1
Small Grains	442	23	813	19
Small Vegetables	23	1	10	<1
Sudan	110	6	396	9
Sugar Beets	41	2	91	2
Total*	**1,929**	**100%**	**4,258**	**100%**

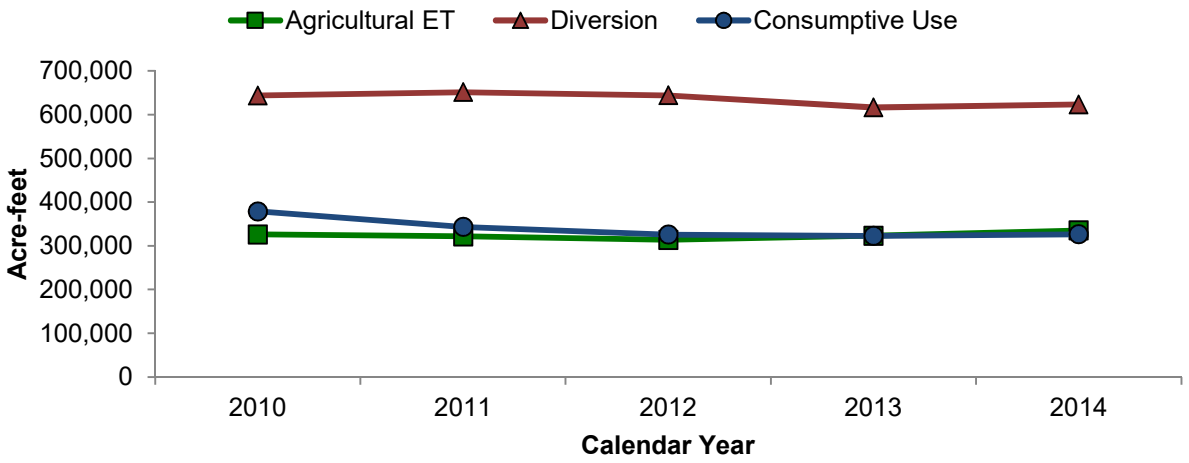
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

Colorado River Indian Reservation - AZ
2014

River Reach:	Parker Dam to Imperial Dam
Agriculture	
Irrigable Acres:	74,980
Gross Cropped Acres:	70,102
Net Cropped Acres:	71,500
Fallowed/Idle Acres:	3,480
Agricultural Evapotranspiration (acre-feet):	335,119
Riparian	
Riparian Vegetation Acres:	31,712
Riparian Evapotranspiration (acre-feet):	91,616
Open Water	
Open Water Acres:	183
Open Water Evaporation (acre-feet):	952







Colorado River Indian Reservation - AZ

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	54,104	77	290,702	87
Bermuda/Grass	2,828	4	9,132	3
Cotton	7,637	11	21,511	6
Crucifers	83	<1	83	<1
Deciduous Orchards	6	<1	28	<1
Grapes	5	<1	15	<1
Oil Crops	22	<1	72	<1
Restoration Area	139	<1	675	<1
Small Grains	3,720	5	7,532	2
Small Vegetables	105	<1	62	<1
Sudan	1,454	2	5,308	2
Total*	**70,102**	**100%**	**335,119**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

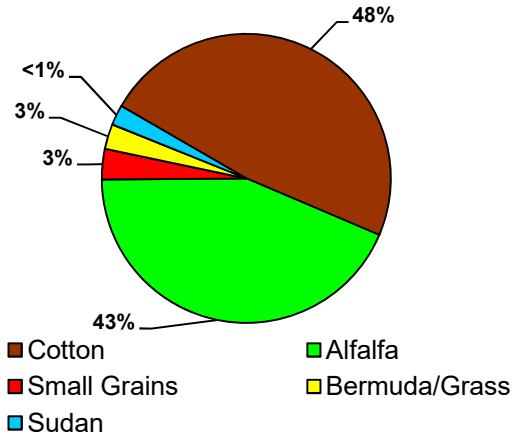
Fort Mojave Indian Reservation - AZ

2014

River Reach:	Davis Dam to Parker Dam
Agriculture	
Irrigable Acres:	10,021
Gross Cropped Acres:	10,488
Net Cropped Acres:	10,001
Fallowed/Idle Acres:	21
Agricultural Evapotranspiration (acre-feet):	39,385
Riparian	
Riparian Vegetation Acres:	7,506
Riparian Evapotranspiration (acre-feet):	20,702
Open Water	
Open Water Acres:	11
Open Water Evaporation (acre-feet):	51

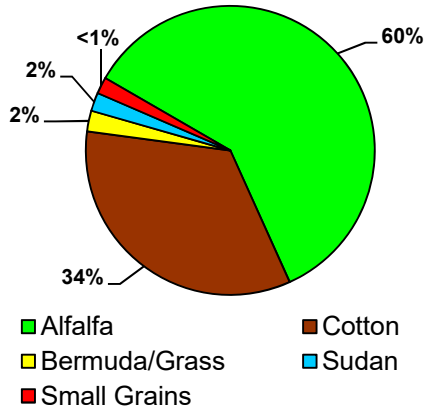
Major Crop Types

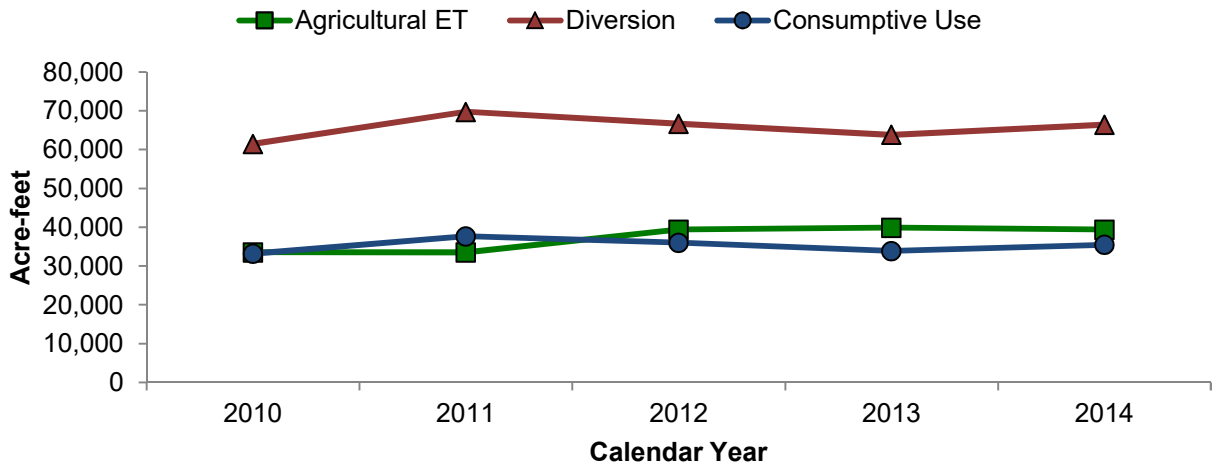
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Fort Mojave Indian Reservation - AZ

2014

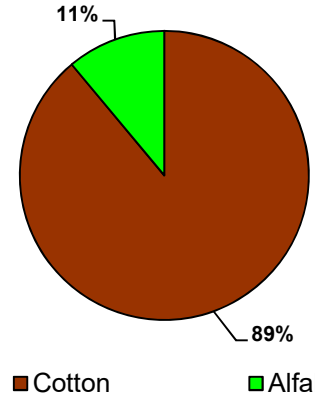
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	4,559	43	23,601	60
Bermuda/Grass	296	3	915	2
Cotton	5,041	48	13,332	34
Small Grains	357	3	724	2
Sudan	235	2	814	2
Total*	**10,488**	**100%**	**39,385**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

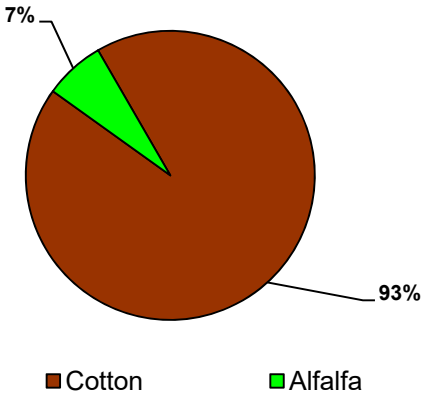
Hopi Tribe
2014

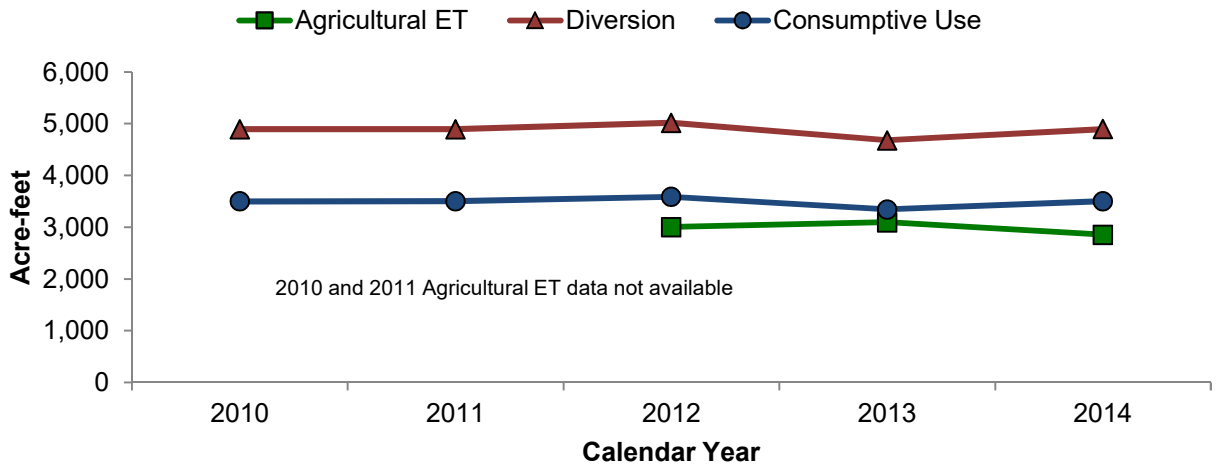
River Reach:	Parker Dam to Imperial Dam
Agriculture	
Irrigable Acres:	986
Gross Cropped Acres:	1,064
Net Cropped Acres:	946
Fallowed/Idle Acres:	40
Agricultural Evapotranspiration (acre-feet):	2,858
Riparian	
Riparian Vegetation Acres:	393
Riparian Evapotranspiration (acre-feet):	1,103
Open Water	
Open Water Acres:	0
Open Water Evaporation (acre-feet):	0

Major Crop Types
Percent of Total Gross Cropped Acres



Annual Agricultural ET
Percent of Total Acre-Feet





Hopi Tribe

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	118	11	193	7
Cotton	946	89	2,665	93
Total*	**1,064**	**100%**	**2,858**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

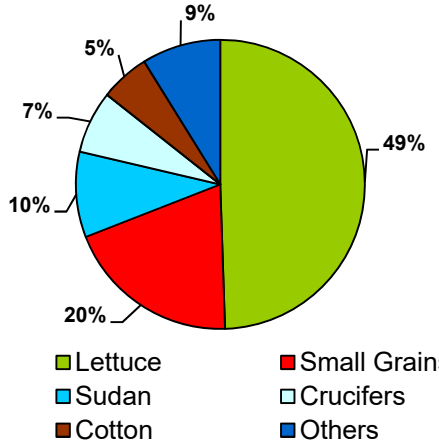
Gila Monster Farms - AZ

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	1,375
Gross Cropped Acres:	3,244
Net Cropped Acres:	1,375
Fallowed/Idle Acres:	0
Agricultural Evapotranspiration (acre-feet):	4,615
Riparian	
Riparian Vegetation Acres:	39
Riparian Evapotranspiration (acre-feet):	164
Open Water	
Open Water Acres:	8
Open Water Evaporation (acre-feet):	50

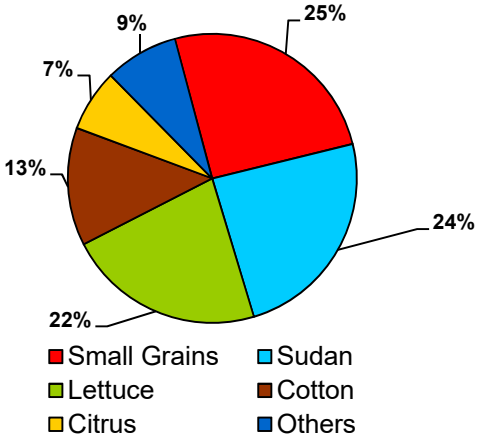
Major Crop Types

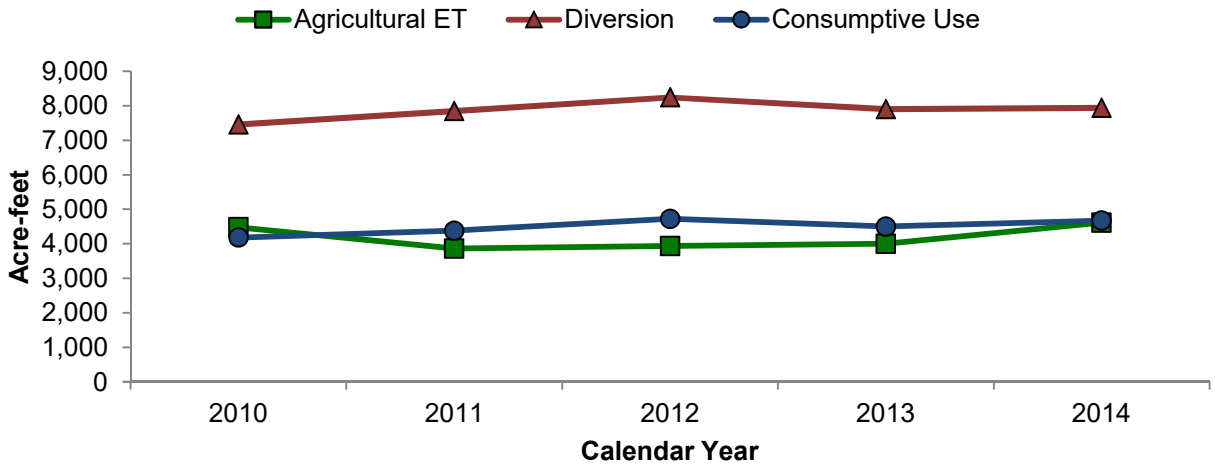
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Gila Monster Farms - AZ

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Bermuda/Grass	19	1	63	1
Citrus	102	3	320	7
Cotton	178	5	610	13
Crucifers	227	7	117	3
Lettuce	1,605	49	1,021	22
Melons	87	3	150	3
Small Grains	636	20	1,169	25
Small Vegetables	79	2	49	1
Sudan	310	10	1,115	24
Total*	**3,244**	**100%**	**4,615**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

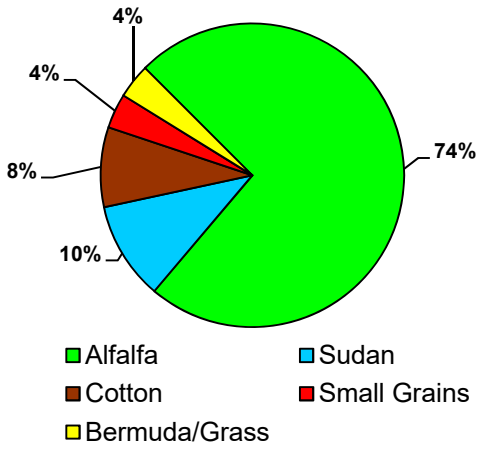
Mohave Valley Irrigation and Drainage District - AZ

2014

River Reach:	Davis Dam to Parker Dam
Agriculture	
Irrigable Acres:	4,136
Gross Cropped Acres:	3,850
Net Cropped Acres:	3,747
Fallowed/Idle Acres:	389
Agricultural Evapotranspiration (acre-feet):	17,982
Riparian	
Riparian Vegetation Acres:	5,419
Riparian Evapotranspiration (acre-feet):	15,306
Open Water	
Open Water Acres:	97
Open Water Evaporation (acre-feet):	466

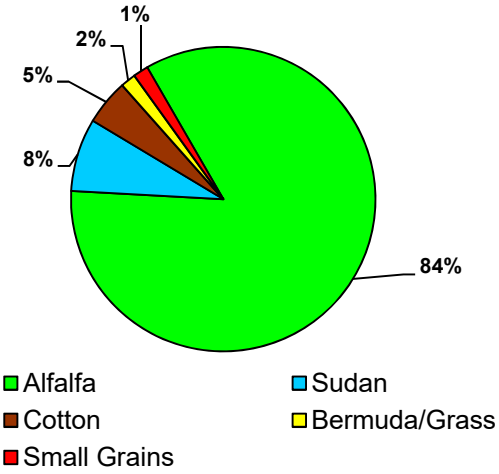
Major Crop Types

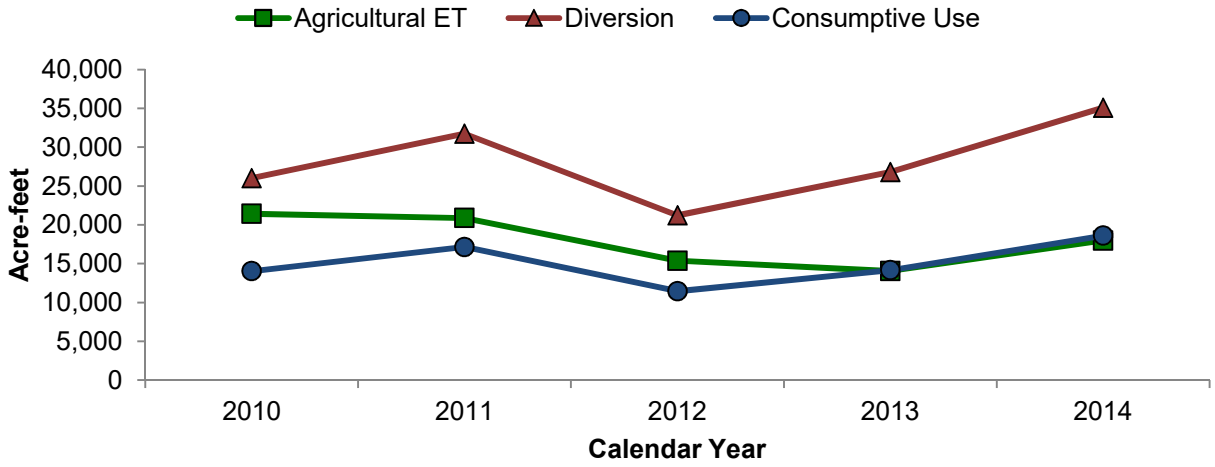
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Mohave Valley Irrigation and Drainage District - AZ

2014

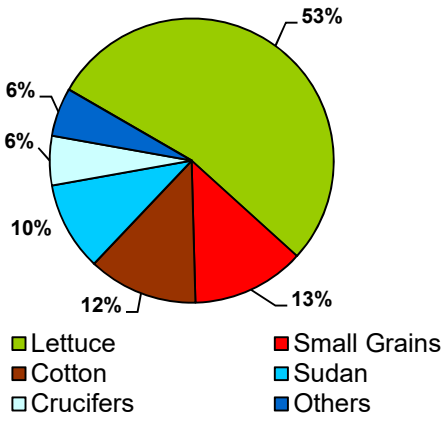
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	2,836	74	15,141	84
Bermuda/Grass	141	4	291	2
Cotton	328	9	866	5
Small Grains	143	4	289	2
Sudan	402	10	1,394	8
Total*	**3,850**	**100%**	**17,982**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

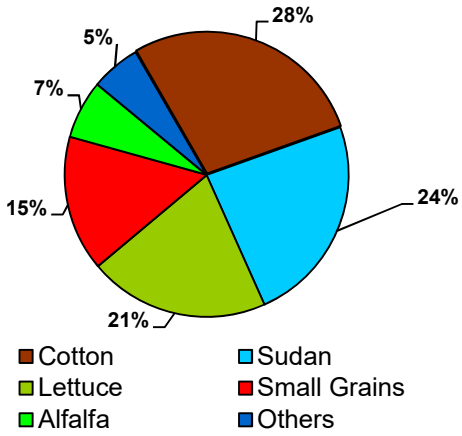
North Gila Valley Irrigation District - AZ
2014

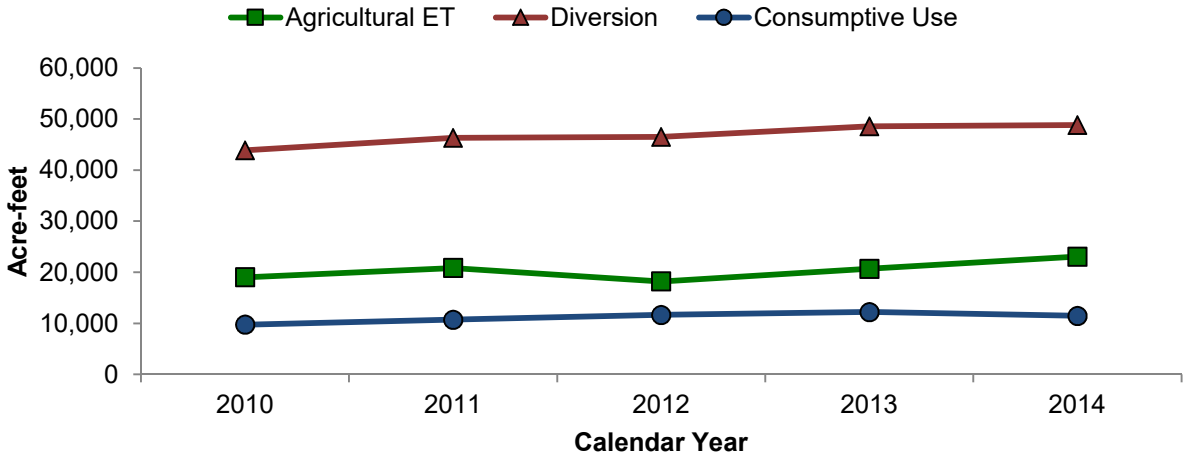
River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	5,942
Gross Cropped Acres:	15,062
Net Cropped Acres:	5,934
Fallowed/Idle Acres:	8
Agricultural Evapotranspiration (acre-feet):	23,059
Riparian	
Riparian Vegetation Acres:	682
Riparian Evapotranspiration (acre-feet):	2,422
Open Water	
Open Water Acres:	12
Open Water Evaporation (acre-feet):	72

Major Crop Types
Percent of Total Gross Cropped Acres



Annual Agricultural ET
Percent of Total Acre-Feet





North Gila Valley Irrigation District - AZ

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	283	2	1,542	7
Bermuda/Grass	20	<1	23	<1
Citrus	13	<1	45	<1
Cotton	1,881	12	6,428	28
Crucifers	847	6	410	2
Dates	17	<1	102	<1
Field Grain	25	<1	59	<1
Legume/Solanum Veg.	39	<1	99	<1
Lettuce	8,042	53	4,743	21
Melons	135	1	236	1
Small Grains	1,936	13	3,557	15
Small Vegetables	287	2	303	1
Sudan	1,526	10	5,484	24
Tomatoes	11	<1	27	<1
Total*	**15,062**	**100%**	**23,059**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

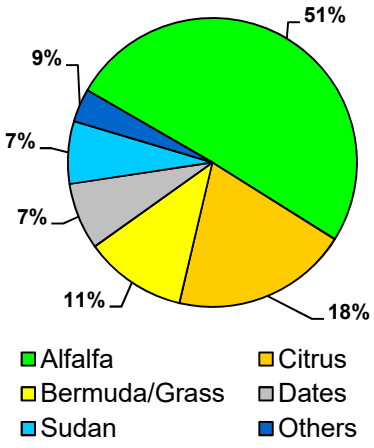
Unit B Irrigation and Drainage District - AZ

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	1,879
Gross Cropped Acres:	1,486
Net Cropped Acres:	1,524
Fallowed/Idle Acres:	355
Agricultural Evapotranspiration (acre-feet):	6,817
Riparian	
Riparian Vegetation Acres:	0
Riparian Evapotranspiration (acre-feet):	0
Open Water	
Open Water Acres:	21
Open Water Evaporation (acre-feet):	126

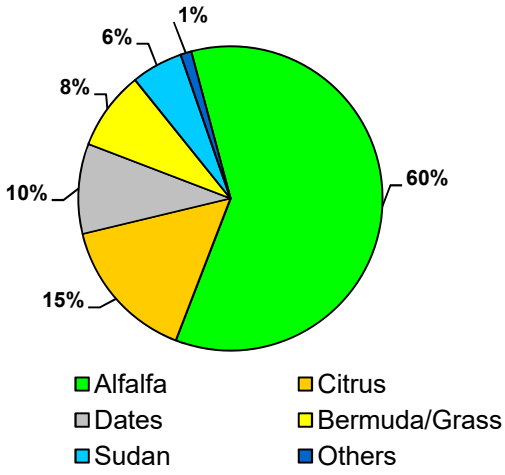
Major Crop Types

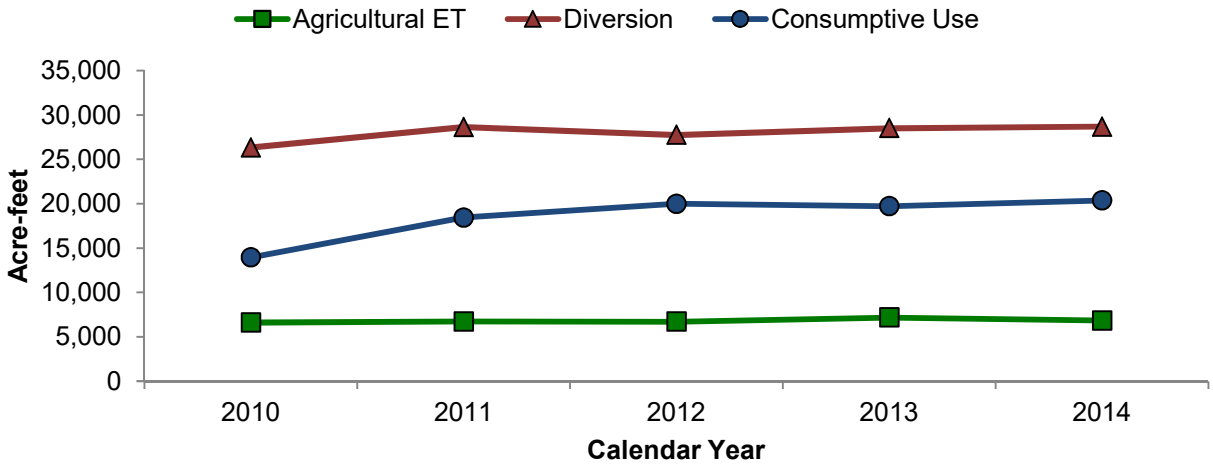
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Unit B Irrigation and Drainage District - AZ

2014

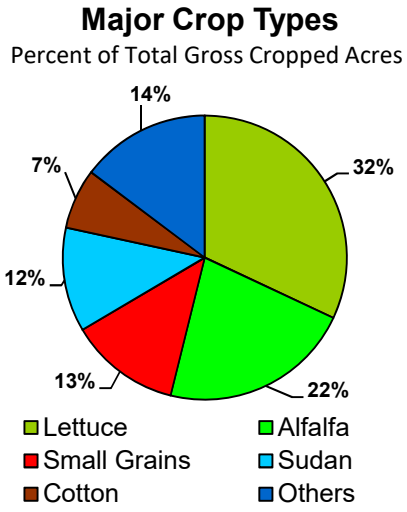
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	752	51	4,091	60
Bermuda/Grass	170	11	572	8
Citrus	293	20	1,050	15
Crucifers	4	<1	3	<1
Dates	111	7	652	10
Deciduous Orchards	1	<1	6	<1
Lettuce	18	1	3	<1
Nursery/Greenhouse	14	1	32	<1
Small Grains	18	1	34	<1
Sudan	104	7	373	5
Total*	**1,486**	**100%**	**6,817**	**100%**

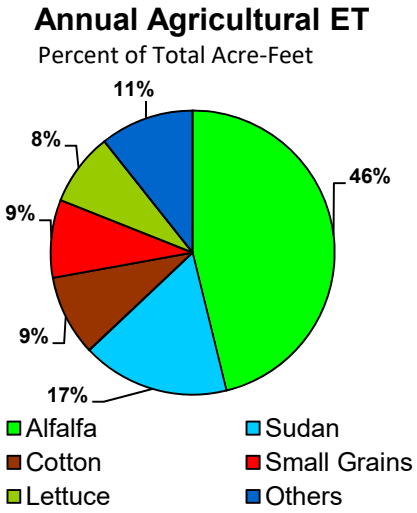
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

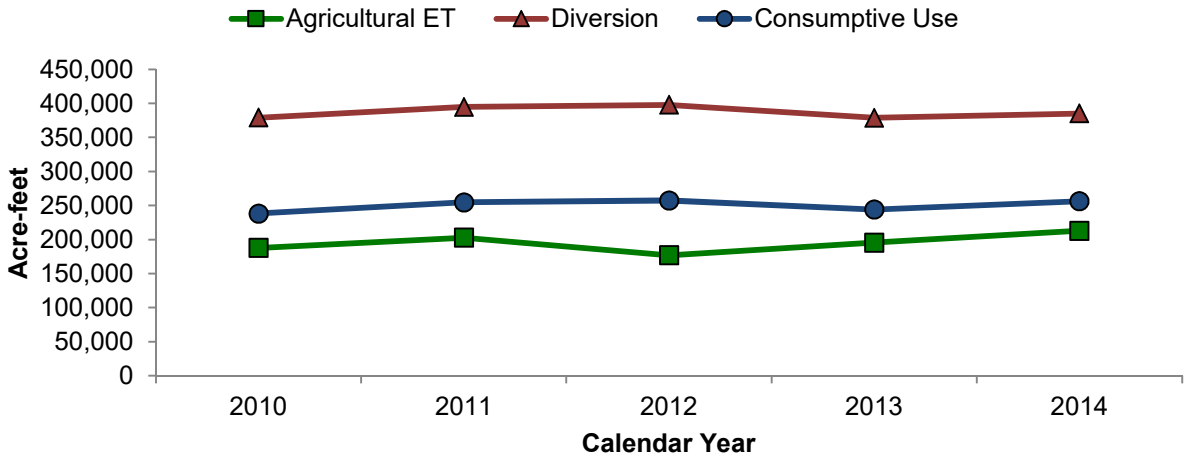
Wellton-Mohawk Irrigation and Drainage District - AZ

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	58,632
Gross Cropped Acres:	88,395
Net Cropped Acres:	56,736
Fallowed/Idle Acres:	1,896
Agricultural Evapotranspiration (acre-feet):	212,780
Riparian	
Riparian Vegetation Acres:	0
Riparian Evapotranspiration (acre-feet):	0
Open Water	
Open Water Acres:	133
Open Water Evaporation (acre-feet):	747







Wellton-Mohawk Irrigation and Drainage District - AZ

2014

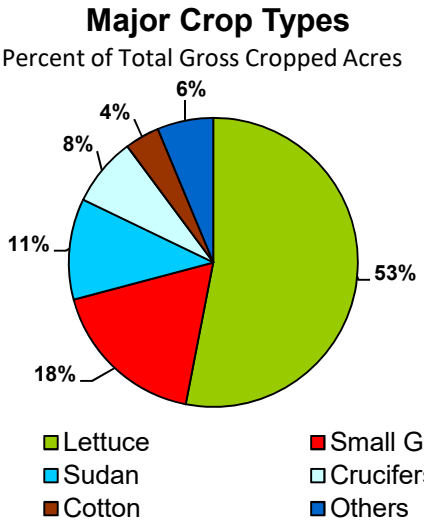
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	19,346	22	98,195	46
Bermuda/Grass	2,697	3	8,502	4
Citrus	336	<1	1,074	1
Cotton	6,071	7	19,510	9
Crucifers	3,754	4	2,042	1
Dates	12	<1	69	<1
Deciduous Orchards	53	<1	236	<1
Field Grain	1,190	1	2,767	1
Legume/Solanum Veg.	694	1	1,516	1
Lettuce	28,275	32	17,657	8
Melons	1,843	2	2,562	1
Miscellaneous herbs	603	1	1,745	1
Oil Crops	5	<1	15	<1
Perennial Vegetables	7	<1	30	<1
Root Vegetables	217	<1	205	<1
Small Grains	11,165	13	18,899	9
Small Vegetables	1,500	2	1,780	1
Sudan	10,517	12	35,747	17
Sugar Beets	101	<1	206	<1
Tomatoes	10	<1	22	<1
Total*	**88,395**	**100%**	**212,780**	**100%**

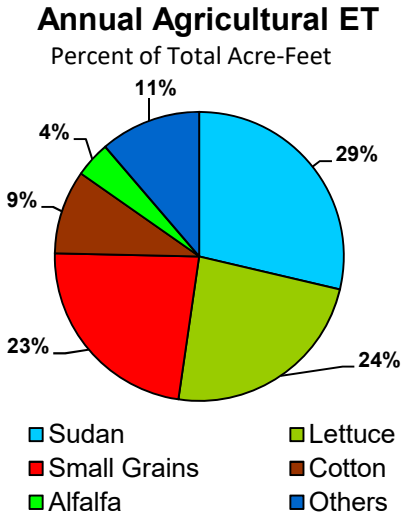
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

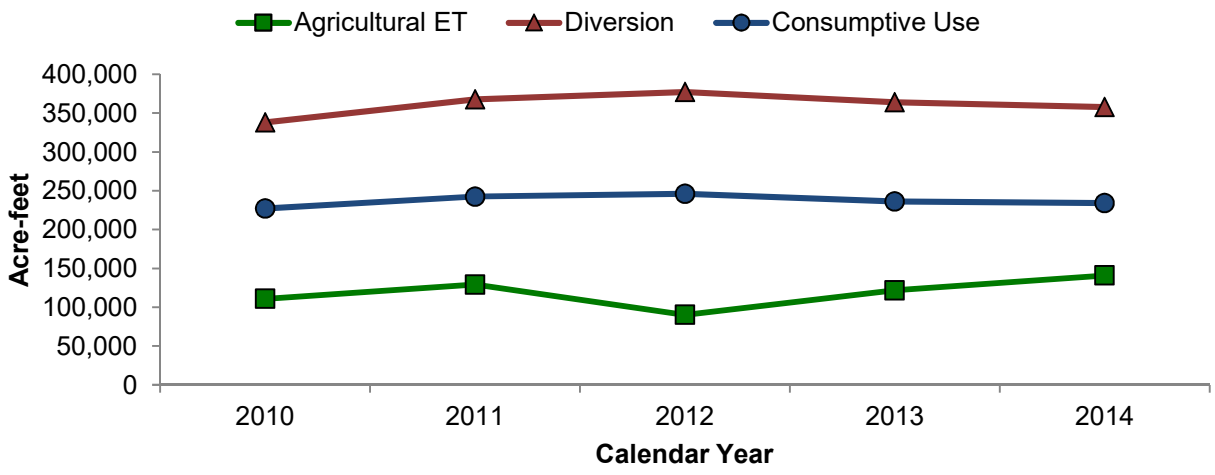
Yuma County Water Users' Association - AZ

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	41,197
Gross Cropped Acres:	99,408
Net Cropped Acres:	41,088
Fallowed/Idle Acres:	109
Agricultural Evapotranspiration (acre-feet):	140,880
Riparian	
Riparian Vegetation Acres:	2
Riparian Evapotranspiration (acre-feet):	1
Open Water	
Open Water Acres:	323
Open Water Evaporation (acre-feet):	1,961







Yuma County Water Users' Association - AZ

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	1,069	1	5,635	4
Bermuda/Grass	349	<1	919	1
Citrus	242	<1	879	1
Cotton	3,864	4	13,205	9
Crucifers	7,647	8	3,592	3
Dates	432	<1	2,556	2
Deciduous Orchards	89	<1	419	<1
Field Grain	99	<1	239	<1
Legume/Solanum Veg.	368	<1	935	1
Lettuce	52,744	53	33,304	24
Melons	2,181	2	4,033	3
Miscellaneous herbs	130	<1	396	<1
Nursery/Greenhouse	277	<1	618	<1
Perennial Vegetables	64	<1	300	<1
Root Vegetables	20	<1	20	<1
Small Grains	17,679	18	32,457	23
Small Vegetables	855	1	838	1
Sudan	11,239	11	40,399	29
Sugar Beets	24	<1	52	<1
Tomatoes	36	<1	85	<1
Total*	**99,408**	**100%**	**140,880**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

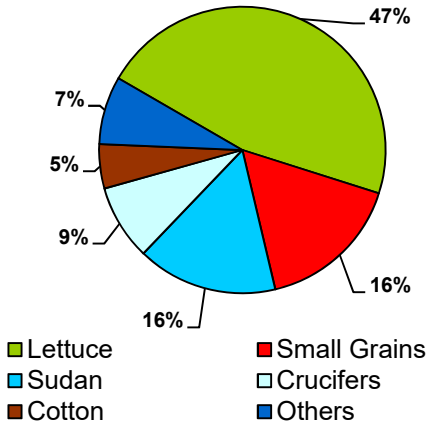
Yuma Irrigation District - AZ

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	10,062
Gross Cropped Acres:	22,557
Net Cropped Acres:	9,996
Fallowed/Idle Acres:	66
Agricultural Evapotranspiration (acre-feet):	37,650
Riparian	
Riparian Vegetation Acres:	224
Riparian Evapotranspiration (acre-feet):	672
Open Water	
Open Water Acres:	63
Open Water Evaporation (acre-feet):	380

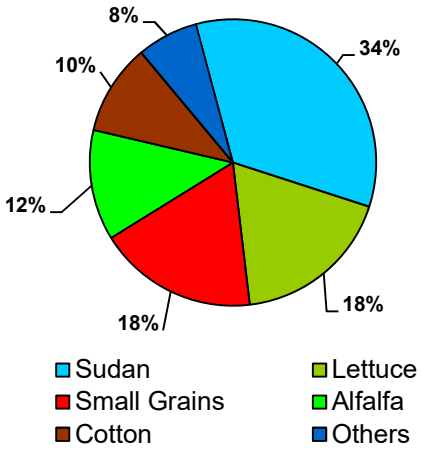
Major Crop Types

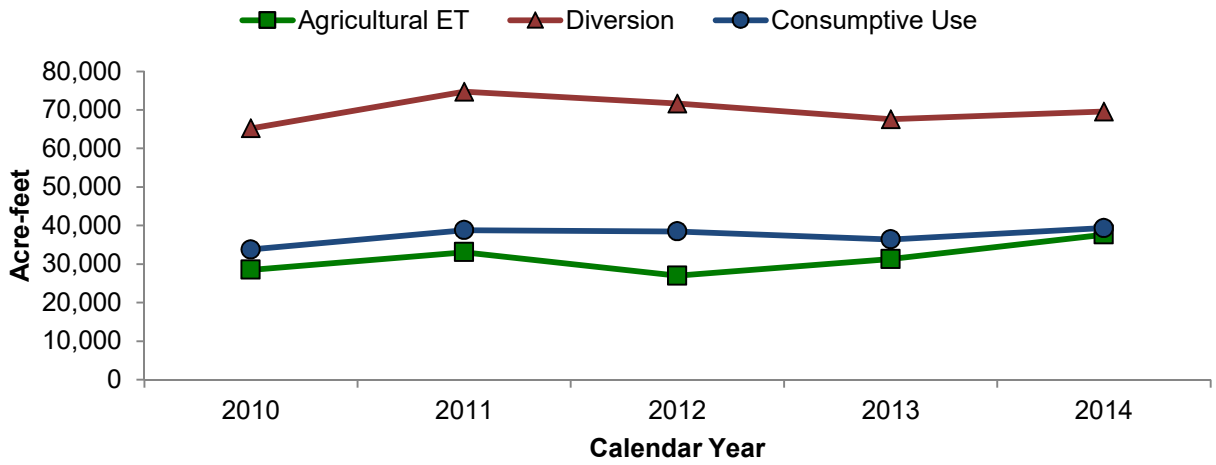
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Yuma Irrigation District - AZ

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	855	4	4,696	12
Bermuda/Grass	32	<1	109	<1
Citrus	1	<1	3	<1
Cotton	1,131	5	3,867	10
Crucifers	1,920	9	879	2
Dates	66	<1	387	1
Legume/Solanum Veg.	214	1	545	1
Lettuce	10,503	47	6,827	18
Melons	157	1	268	1
Miscellaneous herbs	19	<1	58	<1
Nursery/Greenhouse	28	<1	63	<1
Small Grains	3,699	16	6,797	18
Small Vegetables	337	1	251	1
Sudan	3,578	16	12,861	34
Sugar Beets	10	<1	22	<1
Tomatoes	8	<1	18	<1
Total*	**22,557**	**100%**	**37,650**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

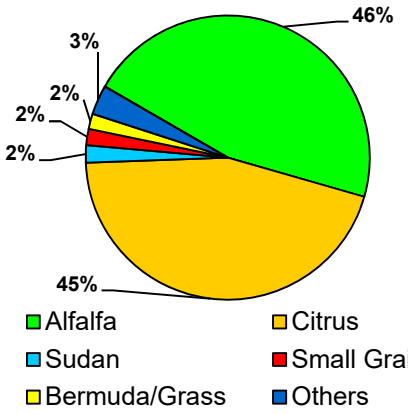
Yuma Mesa Irrigation and Drainage District - AZ

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	14,611
Gross Cropped Acres:	12,300
Net Cropped Acres:	13,270
Fallowed/Idle Acres:	1,341
Agricultural Evapotranspiration (acre-feet):	53,376
Riparian	
Riparian Vegetation Acres:	0
Riparian Evapotranspiration (acre-feet):	0
Open Water	
Open Water Acres:	175
Open Water Evaporation (acre-feet):	1,062

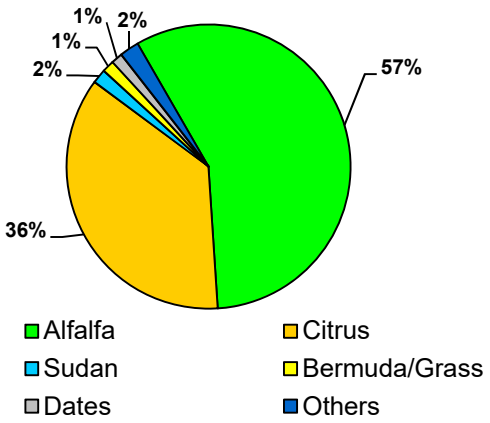
Major Crop Types

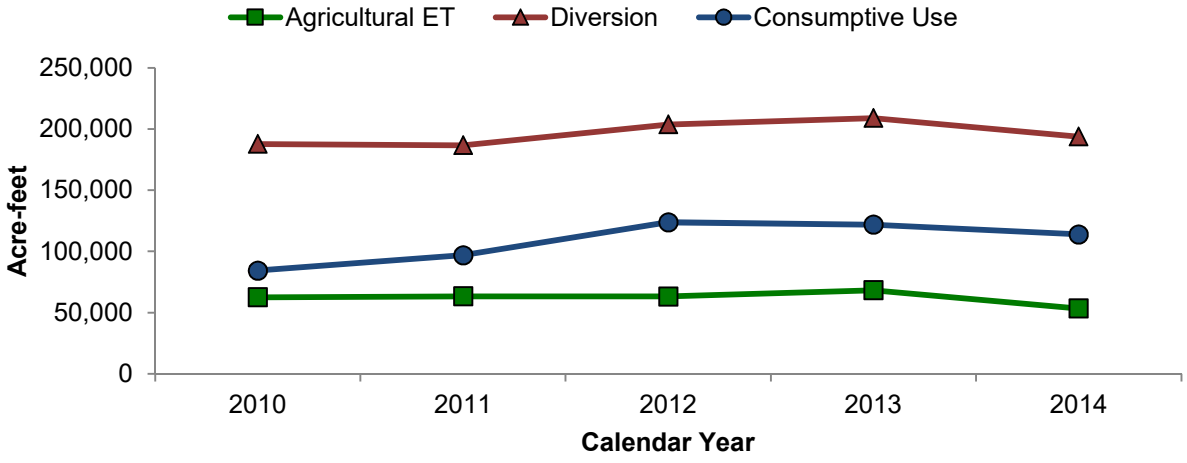
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Yuma Mesa Irrigation and Drainage District - AZ

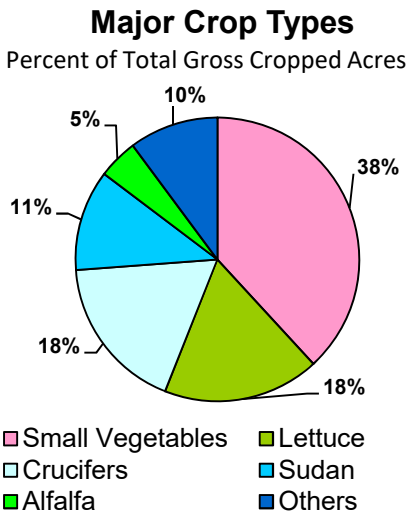
2014

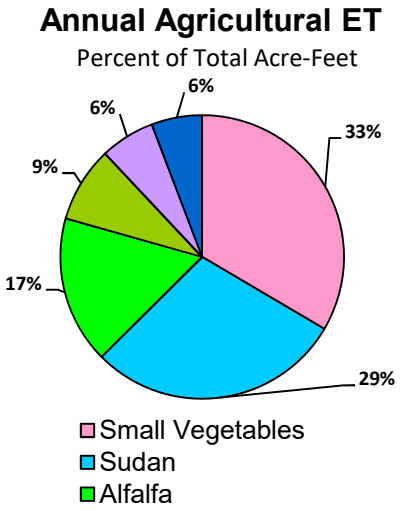
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	5,672	46	30,583	57
Bermuda/Grass	214	2	729	1
Citrus	5,533	45	19,328	36
Dates	121	1	700	1
Deciduous Orchards	114	1	541	1
Lettuce	95	1	36	<1
Melons	15	<1	27	<1
Nursery/Greenhouse	66	1	148	<1
Small Grains	228	2	420	1
Sudan	241	2	866	2
Total*	**12,300**	**100%**	**53,376**	**100%**

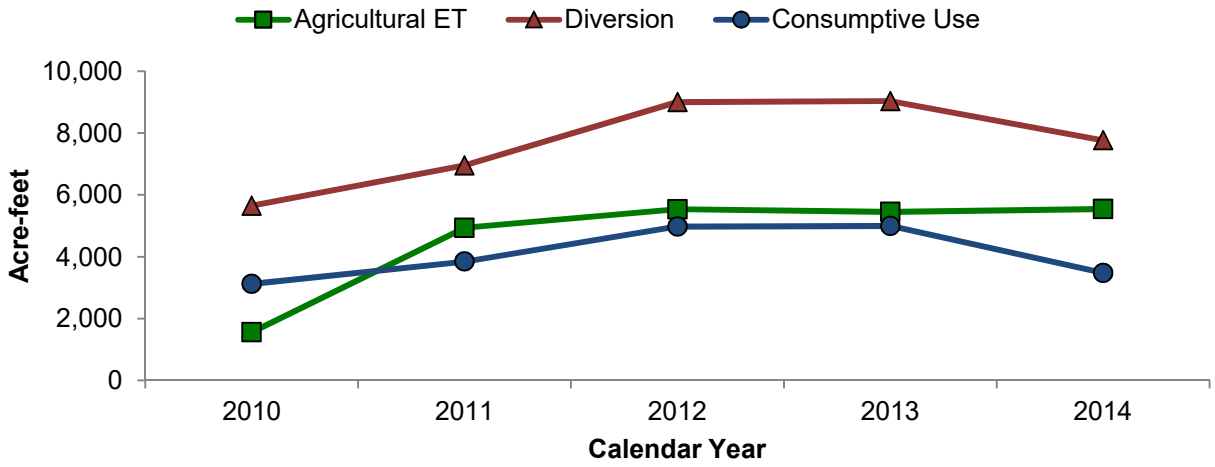
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

Arizona State Trust Lands, CA
2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	1,970
Gross Cropped Acres:	3,610
Net Cropped Acres:	1,922
Fallowed/Idle Acres:	48
Agricultural Evapotranspiration (acre-feet):	5,543
Riparian	
Riparian Vegetation Acres:	511
Riparian Evapotranspiration (acre-feet):	1,722
Open Water	
Open Water Acres:	17
Open Water Evaporation (acre-feet):	105







Arizona State Trust Lands, CA

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	164	5	862	16
Bermuda/Grass	19	1	64	1
Citrus	27	1	100	2
Crucifers	642	18	296	5
Legume/Solanum Veg.	125	3	319	6
Lettuce	644	18	441	8
Melons	70	2	129	2
Root Vegetables	126	3	126	2
Small Vegetables	1,378	38	1,714	31
Sudan	415	11	1,491	27
Total*	**3,610**	**100%**	**5,543**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

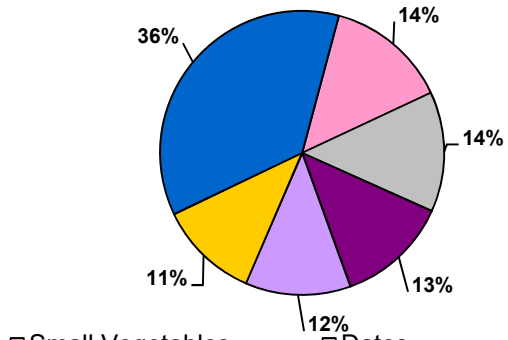
Coachella Valley Water District - CA

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	58,518
Gross Cropped Acres:	63,030
Net Cropped Acres:	51,165
Fallowed/Idle Acres:	7,353
Agricultural Evapotranspiration (acre-feet):	173,273
Riparian	
Riparian Vegetation Acres:	0
Riparian Evapotranspiration (acre-feet):	0
Open Water	
Open Water Acres:	908
Open Water Evaporation (acre-feet):	5,760

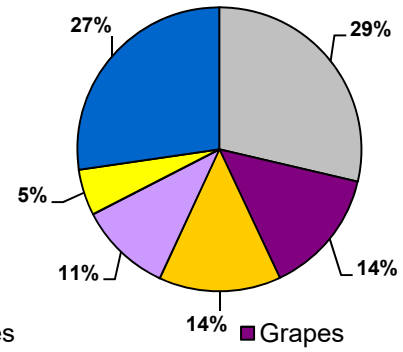
Major Crop Types

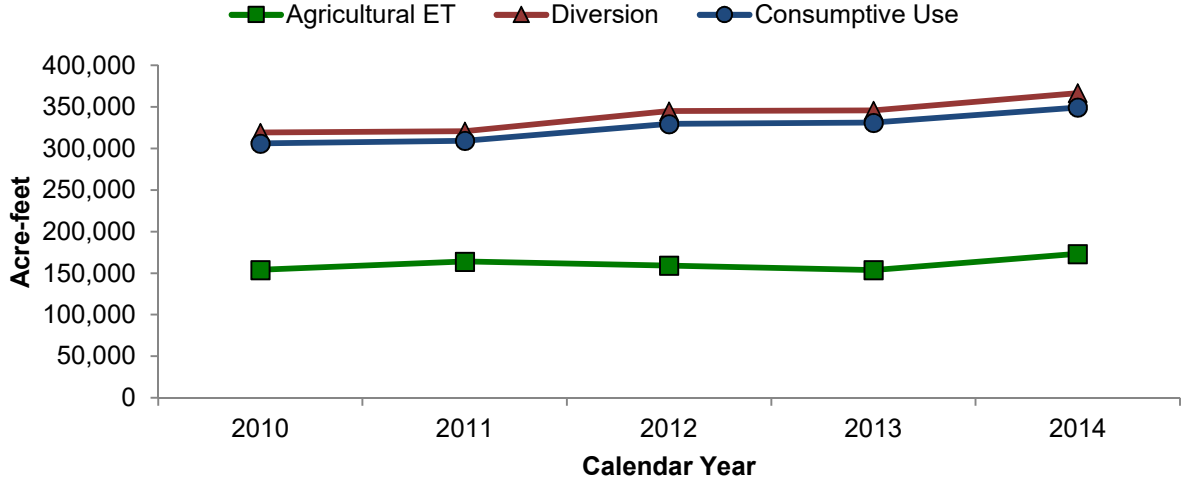
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Coachella Valley Water District - CA

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	755	1	3,780	2
Aloe	1	<1	3	<1
Bermuda/Grass	2,035	3	9,082	5
Citrus	7,194	11	24,091	14
Crucifers	2,899	5	1,722	1
Dates	8,620	14	49,660	29
Deciduous Orchards	545	1	2,491	1
Field Grain	1,305	2	3,812	2
Grapes	8,050	13	24,854	14
Legume/Solanum Veg.	7,562	12	18,255	11
Lettuce	6,923	11	4,621	3
Melons	2,697	4	4,540	3
Miscellaneous herbs	1,213	2	2,711	2
Moist Soil Unit	87	<1	442	<1
Nursery/Greenhouse	1,675	3	3,645	2
Perennial Vegetables	1,946	3	9,042	5
Small Grains	28	<1	57	<1
Small Vegetables	8,743	14	8,532	5
Sudan	285	<1	882	1
Tomatoes	470	1	1,050	1
Total*	**63,030**	**100%**	**173,273**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

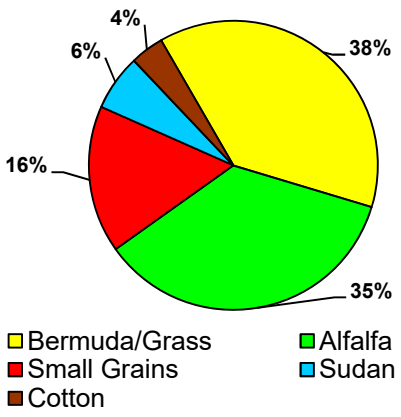
Fort Mojave Indian Reservation - CA

2014

River Reach:	Davis Dam to Parker Dam
Agriculture	
Irrigable Acres:	3,233
Gross Cropped Acres:	3,068
Net Cropped Acres:	3,000
Fallowed/Idle Acres:	233
Agricultural Evapotranspiration (acre-feet):	10,124
Riparian	
Riparian Vegetation Acres:	919
Riparian Evapotranspiration (acre-feet):	2,648
Open Water	
Open Water Acres:	1
Open Water Evaporation (acre-feet):	4

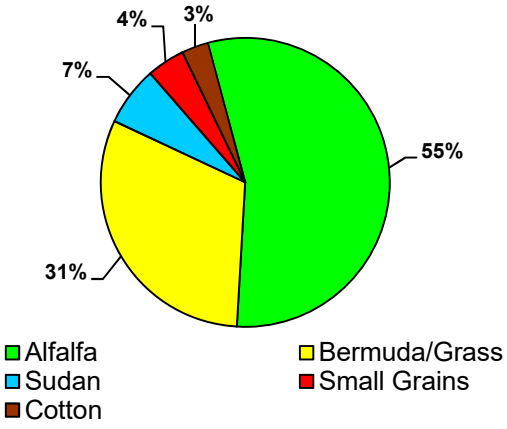
Major Crop Types

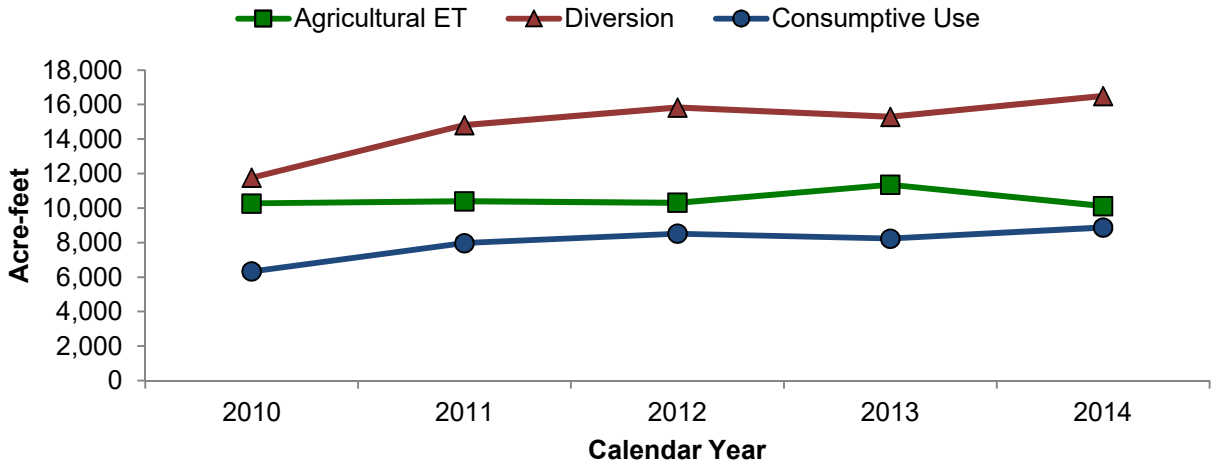
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Fort Mojave Indian Reservation - CA

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	1,089	35	5,580	55
Bermuda/Grass	1,166	38	3,142	31
Cotton	115	4	304	3
Small Grains	506	16	431	4
Sudan	193	6	668	7
Total*	**3,068**	**100%**	**10,124**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

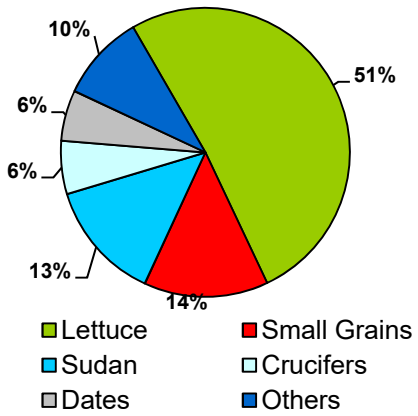
Yuma Project Reservation Division, Bard Unit - CA

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	6,301
Gross Cropped Acres:	14,803
Net Cropped Acres:	6,283
Fallowed/Idle Acres:	18
Agricultural Evapotranspiration (acre-feet):	24,924
Riparian	
Riparian Vegetation Acres:	236
Riparian Evapotranspiration (acre-feet):	784
Open Water	
Open Water Acres:	29
Open Water Evaporation (acre-feet):	175

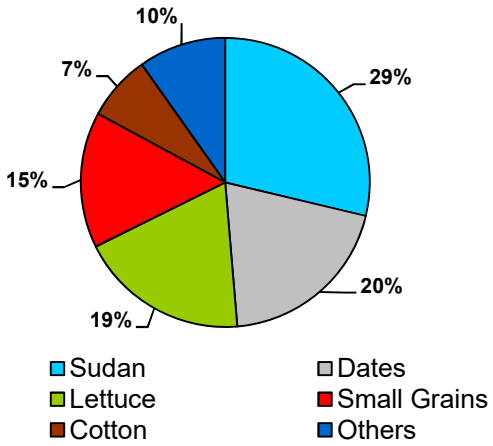
Major Crop Types

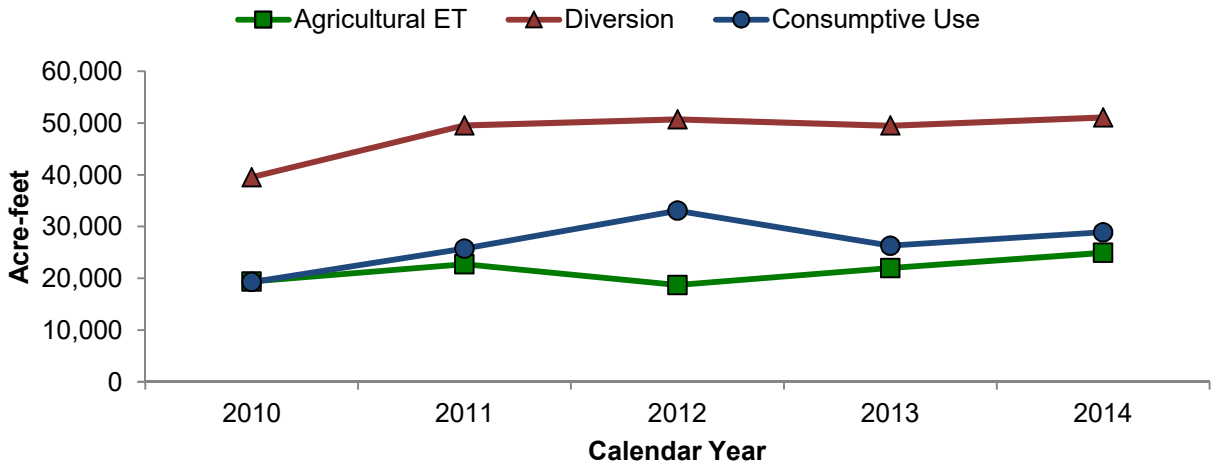
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Yuma Project Reservation Division, Bard Unit - CA

2014

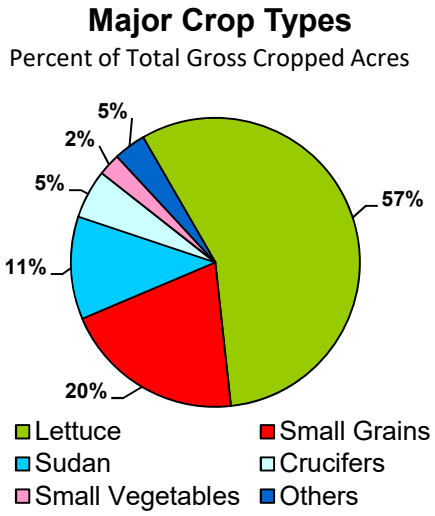
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	104	1	588	2
Bermuda/Grass	13	<1	43	<1
Citrus	115	1	428	2
Cotton	534	4	1,824	7
Crucifers	882	6	450	2
Dates	840	6	4,970	20
Deciduous Orchards	7	<1	31	<1
Lettuce	7,593	51	4,737	19
Melons	252	2	468	2
Moist Soil Unit	8	<1	43	<1
Root Vegetables	13	<1	13	<1
Small Grains	2,062	14	3,790	15
Small Vegetables	388	3	379	2
Sudan	1,992	13	7,160	29
Total*	**14,803**	**100%**	**24,924**	**100%**

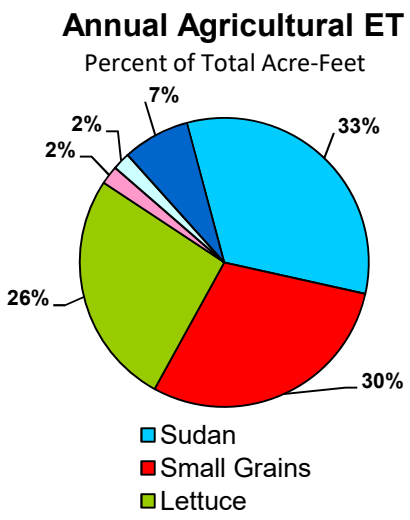
*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

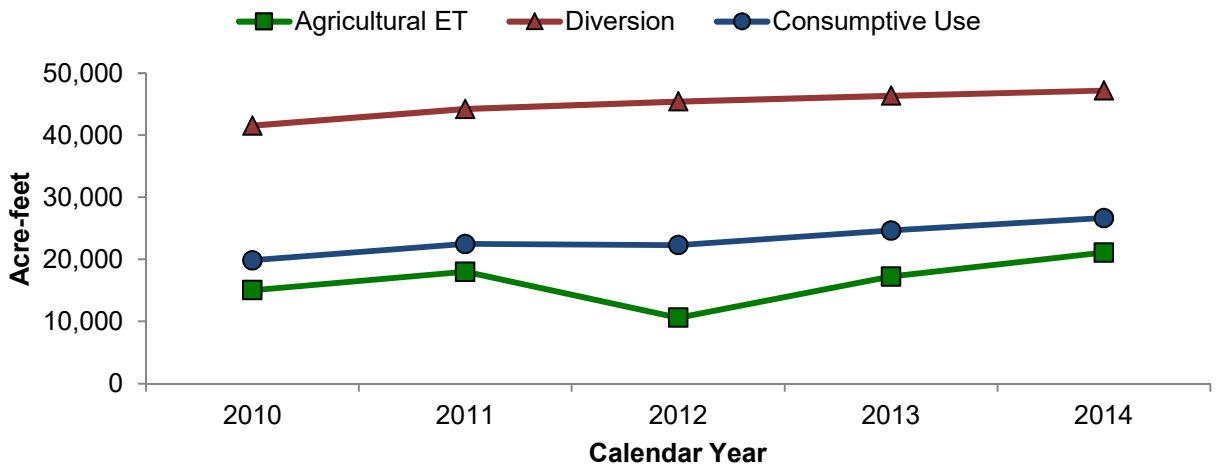
Yuma Project Reservation Division, Indian Unit - CA

2014

River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	6,215
Gross Cropped Acres:	16,680
Net Cropped Acres:	6,187
Fallowed/Idle Acres:	28
Agricultural Evapotranspiration (acre-feet):	21,112
Riparian	
Riparian Vegetation Acres:	252
Riparian Evapotranspiration (acre-feet):	716
Open Water	
Open Water Acres:	21
Open Water Evaporation (acre-feet):	125







Yuma Project Reservation Division, Indian Unit - CA

2014

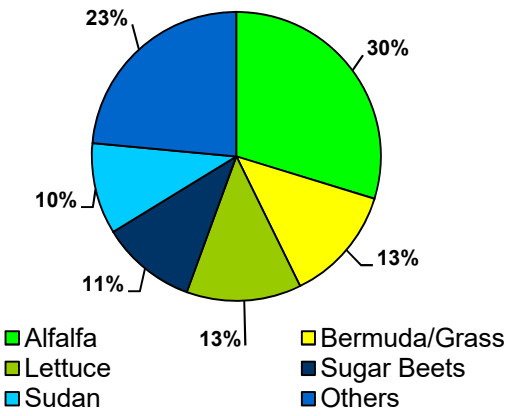
Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	65	<1	289	1
Bermuda/Grass	123	1	214	1
Cotton	109	1	371	2
Crucifers	914	5	414	2
Dates	9	<1	56	<1
Legume/Solanum Veg.	123	1	313	1
Lettuce	9,445	57	5,549	26
Melons	76	<1	129	1
Miscellaneous herbs	19	<1	57	<1
Root Vegetables	13	<1	13	<1
Small Grains	3,392	20	6,234	30
Small Vegetables	414	2	440	2
Sudan	1,918	11	6,893	33
Tomatoes	59	<1	140	1
Total*	**16,680**	**100%**	**21,112**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

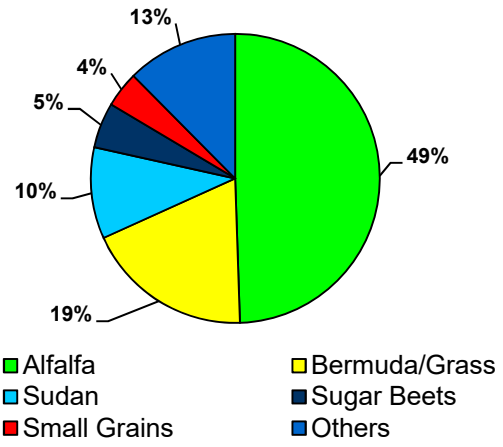
Imperial Irrigation District - CA
2014

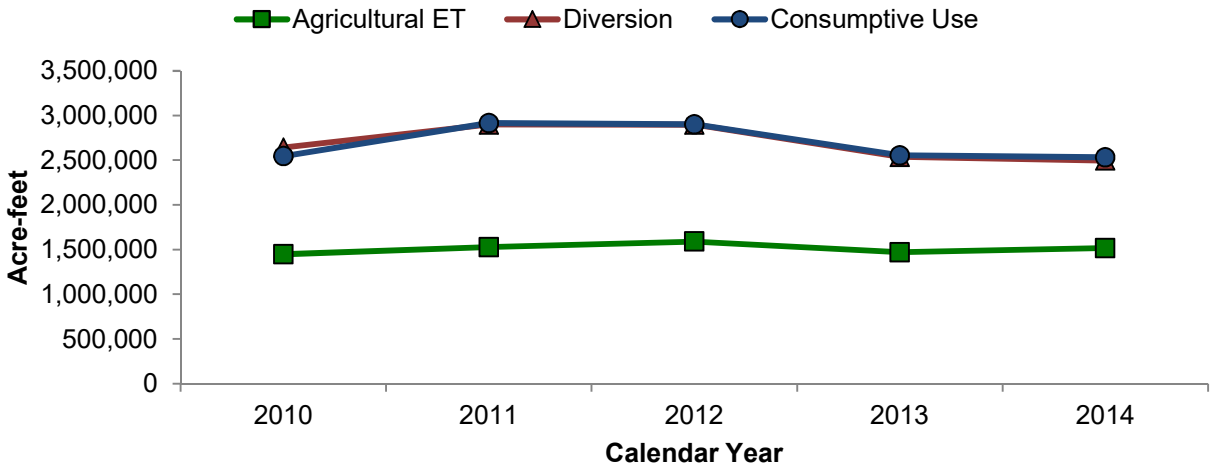
River Reach:	Imperial Dam to Mexico
Agriculture	
Irrigable Acres:	431,101
Gross Cropped Acres:	489,229
Net Cropped Acres:	386,943
Fallowed/Idle Acres:	44,158
Agricultural Evapotranspiration (acre-feet):	1,515,621
Riparian	
Riparian Vegetation Acres:	0
Riparian Evapotranspiration (acre-feet):	0
Open Water	
Open Water Acres:	2,057
Open Water Evaporation (acre-feet):	12,939

Major Crop Types
Percent of Total Gross Cropped Acres



Annual Agricultural ET
Percent of Total Acre-Feet





Imperial Irrigation District - CA

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	145,480	30	749,824	49
Aloe	23	<1	51	<1
Bermuda/Grass	63,499	13	284,502	19
Cane/Bamboo	561	<1	3,130	<1
Citrus	6,444	1	20,578	1
Crucifers	21,976	4	19,618	1
Dates	1,090	<1	6,275	<1
Deciduous Orchards	540	<1	2,416	<1
Field Grain	5,589	1	16,331	1
Legume/Solanum Veg.	453	<1	517	<1
Lettuce	62,849	13	44,495	3
Marsh Maintained	303	<1	1,773	<1
Melons	9,636	2	16,819	1
Moist Soil Unit	1,214	<1	6,181	<1
Nursery/Greenhouse	505	<1	1,093	<1
Perennial Vegetables	627	<1	2,913	<1
Small Grains	30,421	6	60,363	4
Small Vegetables	34,705	7	44,171	3
Sudan	49,945	10	154,856	10
Sugar Beets	52,272	11	77,379	5
Wildlife Forage Maintained	1,095	<1	2,336	<1
Total*	**489,229**	**100%**	**1,515,621**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

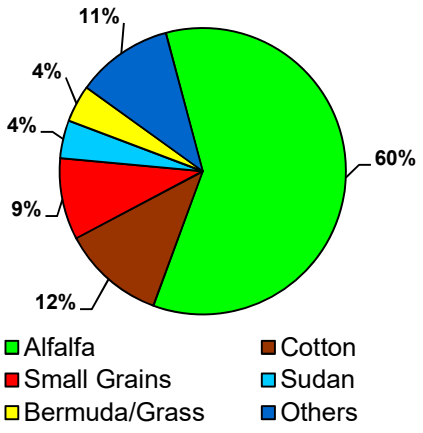
Palo Verde Irrigation District - CA

2014

River Reach:	Parker Dam to Imperial Dam
Agriculture	
Irrigable Acres:	89,279
Gross Cropped Acres:	86,002
Net Cropped Acres:	83,348
Fallowed/Idle Acres:	5,931
Agricultural Evapotranspiration (acre-feet):	366,091
Riparian	
Riparian Vegetation Acres:	2,927
Riparian Evapotranspiration (acre-feet):	8,502
Open Water	
Open Water Acres:	232
Open Water Evaporation (acre-feet):	1,208

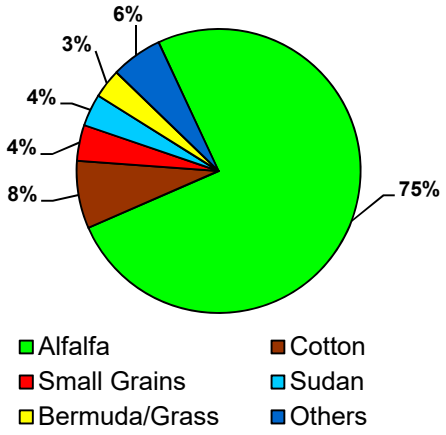
Major Crop Types

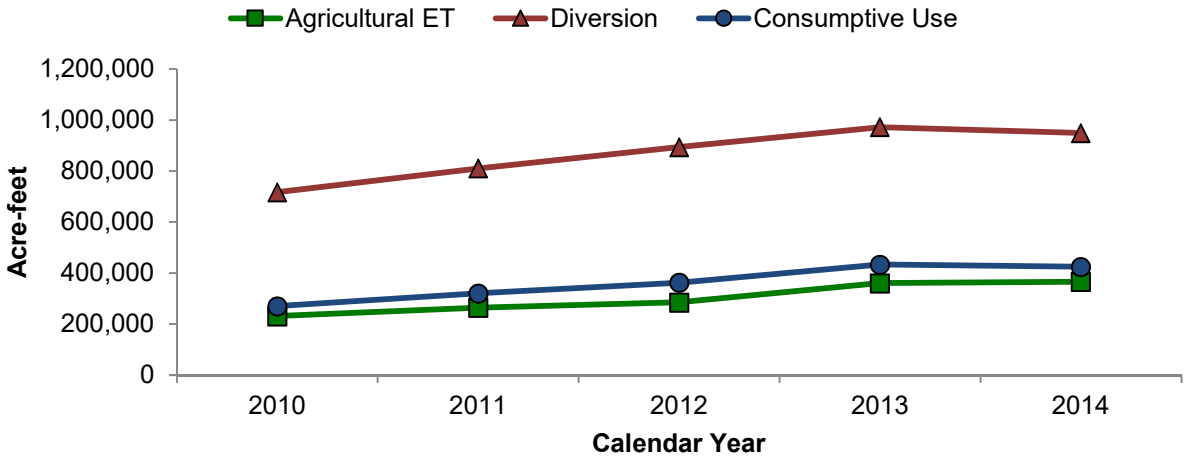
Percent of Total Gross Cropped Acres



Annual Agricultural ET

Percent of Total Acre-Feet





Palo Verde Irrigation District - CA

2014

Crop Type	Acres	Acres % Total	Annual ET (acre-feet)	Annual ET % Total
Alfalfa	51,400	60	276,042	75
Bermuda/Grass	3,610	4	12,136	3
Citrus	1,573	2	5,961	2
Cotton	10,020	12	28,221	8
Crucifers	1,528	2	733	<1
Dates	257	<1	1,492	<1
Deciduous Orchards	17	<1	87	<1
Field Grain	1,903	2	4,974	1
Legume/Solanum Veg.	644	1	295	<1
Lettuce	824	1	502	<1
Melons	1,305	2	2,790	1
Moist Soil Unit	41	<1	207	<1
Nursery/Greenhouse	9	<1	19	<1
Restoration Area	935	1	4,075	1
Small Grains	7,915	9	14,911	4
Small Vegetables	339	<1	200	<1
Sudan	3,683	4	13,446	4
Total*	**86,002**	**100%**	**366,091**	**100%**

*Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.

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Other Water Users Not Reported on Individual Fact Sheets
2014

		Agricultural Acreage				Agriculture			Riparian Vegetation		Open Water	
Water User	River Reach	Irrigable Acres	Gross Cropped Acres	Net Cropped Acres	Fallowed/Idle Acres	Crop Type	Acres	Annual ET (acre-feet)	Acres	Annual ET (acre-feet)	Acres	Annual Evaporation (acre-feet)
Note: Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.												
Arizona												
Beattie Farms Southwest	Imperial Dam To Mexico	214	190	182	32	Alfalfa	76	391				
						Small Vegetables	114	126				
						Total	**190**	**517**	**87**	**243**	**0**	**0**
Bill Williams National Wildlife Refuge	Davis Dam To Parker Dam	0	0	0	0							
						Total	**0**	**0**	**2,140**	**7,538**	**45**	**217**
Bill Williams National Wildlife Refuge (NCR)	Bill Williams River, NCR	0	0	0	0							
						Total	**0**	**0**	**457**	**1,602**	**10**	**49**
BLM	Imperial Dam To Mexico	78	55	55	23	Bermuda/Grass	40	135				
						Restoration Area	15	77				
						Total	**55**	**212**	**23**	**135**	**0**	**0**
BLM (Monty Lee)	Imperial Dam To Mexico	51	101	51	0	Cotton	51	173				
						Lettuce	51	21				
						Total	**101**	**194**	**0**	**0**	**0**	**0**
BLM (Pratt)	Imperial Dam To Mexico	61	54	61	0	Alfalfa	48	260				
						Restoration Area	6	30				
						Total	**54**	**290**	**0**	**0**	**0**	**0**
Cha Cha, LLC	Imperial Dam To Mexico	514	512	514	0	Citrus	451	1,482				
						Dates	62	366				
						Total	**512**	**1,848**	**10**	**28**	**2**	**11**
City of Yuma (Yuma East Wetlands)	Imperial Dam to Mexico	0	0	0	0							
						Total	**0**	**0**	**97**	**403**	**17**	**102**
Cocopah Indian Tribe, Fee Lands	Imperial Dam To Mexico	110	310	110	0	Cotton	18	63				
						Lettuce	108	62				
						Small Vegetables	92	79				
						Sudan	91	327				
						Total	**310**	**532**	**18**	**53**	**0**	**0**
Cocopah Indian Tribe - West Reservation (NCR)	Imperial Dam to Mexico	701	193	161	540	Alfalfa	32	67				
						Crucifers	10	2				
						Lettuce	151	110				
						Total	**193**	**180**	**1,678**	**4,833**	**0**	**0**
Curtis, Armon	Imperial Dam To Mexico	44	132	44	0	Cotton	44	151				
						Lettuce	88	33				
						Total	**132**	**184**	**5**	**18**	**0**	**0**
Fort Yuma Indian Reservation	Imperial Dam To Mexico	31	40	0	31	Deciduous Orchards	40	186				
						Total	**40**	**186**	**1,358**	**4,494**	**44**	**268**
Fort Yuma Indian Reservation, Ranch 5	Imperial Dam To Mexico	182	191	82	100	Alfalfa	37	153				
						Crucifers	31	6				
						Legume/Solanum Veg.	11	27				
						Lettuce	82	57				
						Miscellaneous herbs	10	31				
						Sudan	21	74				
						Total	**191**	**348**	**1**	**2**	**0**	**0**
Fort Yuma Indian Reservation, Yuma East Wetlands	Imperial Dam To Mexico	0	0	0	0							
						Total	**0**	**0**	**189**	**639**	**<1**	**2**
Griffin, R.	Imperial Dam To Mexico	13	40	13	0	Lettuce	13	10				
						Small Vegetables	13	20				
						Sudan	13	48				
						Total	**40**	**78**	**0**	**0**	**0**	**0**
Griffin Ranches	Imperial Dam To Mexico	37	110	37	0	Crucifers	16	8				
						Lettuce	40	23				
						Small Vegetables	16	24				
						Sudan	37	131				
						Total	**110**	**187**	**<1**	**1**	**0**	**0**

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Other Water Users Not Reported on Individual Fact Sheets
2014

		Agricultural Acreage				Agriculture			Riparian Vegetation		Open Water	
Water User	River Reach	Irrigable Acres	Gross Cropped Acres	Net Cropped Acres	Fallowed/Idle Acres	Crop Type	Acres	Annual ET (acre-feet)	Acres	Annual ET (acre-feet)	Acres	Annual Evaporation (acre-feet)
Note: Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.												
Arizona (continued)												
GSC Farm, LLC	Parker Dam To Imperial Dam	389	407	376	13	Alfalfa	31	21				
						Cotton	376	1,059				
						Total	**407**	**1,080**	**0**	**0**	**0**	**0**
Havasu National Wildlife Refuge	Davis Dam To Parker Dam	0	0	0	0							
						Total	**0**	**0**	**10,934**	**43,145**	**3,161**	**15,248**
Hillander C (NCR)	Imperial Dam To Mexico NCR	2,334	1,082	709	1,625	Alfalfa	248	1,433				
						Legume/Solanum Veg.	417	1,061				
						Sudan	417	1,500				
						Total	**1,082**	**3,994**	**0**	**0**	**0**	**0**
Imperial National Wildlife Refuge	Parker Dam To Imperial Dam	70	70	70	0	Bermuda/Grass	70	229				
						Total	**70**	**229**	**4,814**	**21,242**	**662**	**3,450**
JRJ Partners, LLC	Imperial Dam To Mexico	200	278	200	0	Crucifers	18	9				
						Dates	111	656				
						Lettuce	134	69				
						Small Grains	12	22				
						Small Vegetables	4	7				
						Total	**278**	**763**	**4**	**11**	**0**	**0**
Lake Havasu State Park	Davis Dam To Parker Dam	0	0	0	0							
						Total	**0**	**0**	**405**	**1,305**	**50**	**243**
Lake Mead National Recreation Area (Davis Dam to Parker Dam)	Davis Dam To Parker Dam	0	0	0	0							
						Total	**0**	**0**	**27**	**101**	**1**	**5**
Lake Mead National Recreation Area (Hoover Dam to Davis Dam)	Hoover dam to Davis Dam	0	0	0	0							
						Total	**0**	**0**	**666**	**2,067**	**7**	**33**
Mittry Lake Management Area	Imperial Dam To Mexico	0	0	0	0							
						Total	**0**	**0**	**3,256**	**15,134**	**505**	**3,067**
North Baja Pipeline, LLC	Parker Dam To Imperial Dam	46	46	46	0	Cotton	46	130				
						Total	**46**	**130**	**1**	**2**	**0**	**0**
Ogram Boys Enterprises Inc.	Imperial Dam To Mexico	169	279	169	0	Alfalfa	39	213				
						Lettuce	91	28				
						Small Grains	103	189				
						Small Vegetables	21	9				
						Sudan	25	90				
						Total	**279**	**530**	**2**	**11**	**0**	**0**
Ogram, George	Imperial Dam To Mexico	74	74	74	0	Alfalfa	74	336				
						Total	**74**	**336**	**0**	**0**	**0**	**0**
Pasquinelli, Gary and Barbara	Imperial Dam To Mexico	76	229	76	0	Crucifers	71	37				
						Lettuce	49	41				
						Small Grains	43	79				
						Small Vegetables	33	15				
						Sudan	33	119				
						Total	**229**	**291**	**0**	**0**	**0**	**0**
Peach, John	Imperial Dam To Mexico	74	74	74	0	Cotton	74	255				
						Total	**74**	**255**	**0**	**0**	**0**	**0**
Phillips, Milton	Imperial Dam To Mexico	19	57	19	0	Lettuce	19	2				
						Small Vegetables	19	28				
						Sudan	19	68				
						Total	**57**	**98**	**0**	**0**	**0**	**0**
Power	Imperial Dam To Mexico	45	135	45	0	Lettuce	67	40				
						Small Vegetables	23	10				
						Sudan	45	162				
						Total	**135**	**211**	**0**	**0**	**0**	**0**

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Other Water Users Not Reported on Individual Fact Sheets
2014

		Agricultural Acreage				Agriculture			Riparian Vegetation		Open Water	
Water User	River Reach	Irrigable Acres	Gross Cropped Acres	Net Cropped Acres	Fallowed/Idle Acres	Crop Type	Acres	Annual ET (acre-feet)	Acres	Annual ET (acre-feet)	Acres	Annual Evaporation (acre-feet)
Note: Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.												
Arizona (continued)												
Power, Victor	Imperial Dam To Mexico	8	25	8	0	Crucifers	8	4				
						Small Vegetables	8	13				
						Sudan	8	30				
						Total	**25**	**47**	**1**	**2**	**0**	**0**
Rayner Ranches	Parker Dam To Imperial Dam	679	688	679	0	Alfalfa	242	1,401				
						Cotton	345	972				
						Melons	31	67				
						Small Grains	11	22				
						Sudan	59	215				
						Total	**688**	**2,676**	**2**	**2**	**0**	**0**
State of Arizona (Davis Dam to Parker Dam)	Davis Dam To Parker Dam	0	0	0	0							
						Total	**0**	**0**	**895**	**2,131**	**72**	**346**
State of Arizona (Parker Dam to Imperial Dam)	Parker Dam To Imperial Dam	131	131	131	0	Alfalfa	131	711				
						Total	**131**	**711**	**6,225**	**21,960**	**724**	**3,776**
State of Arizona (Imperial Dam to Mexico)	Imperial Dam To Mexico	644	737	518	126	Alfalfa	70	388				
						Bermuda/Grass	18	59				
						Citrus	2	6				
						Cotton	86	294				
						Crucifers	51	32				
						Dates	36	214				
						Lettuce	208	143				
						Moist Soil Unit	88	448				
						Small Grains	151	277				
						Sudan	27	98				
						Total	**737**	**1,959**	**2,369**	**8,372**	**98**	**598**
State of Arizona (Imperial Dam to Mexico) (NCR)	Imperial Dam to Mexico	176	176	176	0	Dates	176	1,039				
						Total	**176**	**1,039**	**0**	**0**	**0**	**0**
State of Arizona, Alamo Dam to Bill Williams River NWR (NCR)	Bill Williams River, NCR	410	396	410	0	Alfalfa	396	1,796				
						Total	**396**	**1,796**	**6,349**	**15,425**	**110**	**533**
State of Arizona, Down Gradient of YMIDD (NCR)	Imperial Dam To Mexico	7,496	7,133	6,743	753	Alfalfa	2,545	13,539				
						Bermuda/Grass	3	9				
						Citrus	576	1,995				
						Cotton	123	420				
						Dates	1,937	11,442				
						Deciduous Orchards	38	179				
						Field Grain	487	1,175				
						Small Grains	979	1,799				
						Sudan	444	1,597				
						Total	**7,133**	**32,156**	**0**	**0**	**0**	**0**
State of Arizona, Gila River Valley (NCR)	Gila River Valley, NCR	2,866	814	814	2,052	Dates	357	1,979				
						Jojoba Beans	220	1,074				
						Small Grains	237	401				
						Total	**814**	**3,453**	**0**	**0**	**7**	**41**
State of Arizona, Limitrophe (NCR)	Imperial Dam To Mexico	793	1,249	793	0	Alfalfa	121	659				
						Bermuda/Grass	270	904				
						Crucifers	269	141				
						Dates	31	181				
						Lettuce	127	84				
						Melons	1	1				
						Small Grains	118	217				
						Small Vegetables	34	15				
						Sudan	243	872				
						Tomatoes	35	83				
						Total	**1,249**	**3,158**	**1,447**	**4,141**	**0**	**0**

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Other Water Users Not Reported on Individual Fact Sheets
2014

		Agricultural Acreage				Agriculture			Riparian Vegetation		Open Water	
Water User	River Reach	Irrigable Acres	Gross Cropped Acres	Net Cropped Acres	Fallowed/Idle Acres	Crop Type	Acres	Annual ET (acre-feet)	Acres	Annual ET (acre-feet)	Acres	Annual Evaporation (acre-feet)
Note: Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.												
Arizona (continued)												
University of Arizona	Imperial Dam To Mexico	85	56	58	27	Citrus	44	147				
						Dates	2	11				
						Deciduous Orchards	9	41				
						Nursery/Greenhouse	1	3				
						Total	**56**	**202**	**0**	**0**	**0**	**0**
Yuma Mesa Irrigation and Drainage District, AZ (NCR)	Imperial Dam to Mexico	2,364	2,759	1,958	406	Alfalfa	470	2,596				
						Citrus	155	579				
						Dates	628	3,713				
						Small Grains	561	816				
						Sudan	946	3,401				
						Total	**2,759**	**11,103**	**0**	**0**	**0**	**0**
Yuma Proving Ground	Imperial Dam to Mexico	0	0	0	0							
						Total	**0**	**0**	**84**	**266**	**0**	**0**
California												
Chemehuevi Indian Reservation	Davis Dam To Parker Dam	58	0	0	58		0	0				
						Total	**0**	**0**	**560**	**2,175**	**7**	**34**
Cibola National Wildlife Refuge	Davis Dam To Parker Dam	0	0	0	0							
						Total	**0**	**0**	**3,946**	**12,983**	**118**	**613**
Colorado River Indian Reservation	Parker Dam To Imperial Dam	949	671	671	278	Alfalfa	670	3,624				
						Bermuda/Grass	1	2				
						Total	**671**	**3,626**	**11,107**	**33,349**	**166**	**864**
Fort Yuma Indian Reservation	Imperial Dam To Mexico	123	245	85	38	Lettuce	163	104				
						Small Grains	31	57				
						Sudan	51	183				
						Total	**245**	**343**	**3,492**	**10,786**	**59**	**358**
Fort Yuma Indian Reservation, Ranch 1	Imperial Dam To Mexico	86	269	86	0	Cotton	90	306				
						Crucifers	62	31				
						Lettuce	117	64				
						Total	**269**	**400**	**0**	**0**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 2, Parcel 1	Imperial Dam To Mexico	10	21	10	0	Lettuce	21	16				
						Total	**21**	**16**	**0**	**0**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 2, Parcel 2	Imperial Dam To Mexico	15	46	15	0	Alfalfa	15	14				
						Lettuce	15	2				
						Sudan	15	55				
						Total	**46**	**71**	**0**	**0**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 2, Parcel 3	Imperial Dam To Mexico	55	164	55	0	Cotton	55	186				
						Crucifers	33	11				
						Lettuce	76	16				
						Total	**164**	**214**	**0**	**0**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 3	Imperial Dam To Mexico	80	2	2	78	Dates	2	10				
						Total	**2**	**10**	**5**	**14**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 4	Imperial Dam To Mexico	329	463	309	20	Alfalfa	35	149				
						Crucifers	22	16				
						Lettuce	312	183				
						Small Grains	12	22				
						Small Vegetables	73	129				
						Sudan	9	33				
						Total	**463**	**532**	**0**	**0**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 5	Imperial Dam To Mexico	311	408	186	125	Alfalfa	52	305				
						Lettuce	218	160				
						Small Grains	31	57				
						Small Vegetables	16	7				
						Sudan	91	328				
						Total	**408**	**857**	**0**	**0**	**0**	**0**

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Other Water Users Not Reported on Individual Fact Sheets
2014

		Agricultural Acreage				Agriculture			Riparian Vegetation		Open Water	
Water User	River Reach	Irrigable Acres	Gross Cropped Acres	Net Cropped Acres	Fallowed/Idle Acres	Crop Type	Acres	Annual ET (acre-feet)	Acres	Annual ET (acre-feet)	Acres	Annual Evaporation (acre-feet)
Note: Due to displaying values to the nearest whole number, totals may differ from the sum of the individual values.												
California (continued)												
Fort Yuma Indian Reservation, Ranch 7	Imperial Dam To Mexico	120	205	102	18	Alfalfa	102	87				
						Crucifers	30	10				
						Lettuce	20	17				
						Sudan	52	186				
						Total	**205**	**300**	**0**	**0**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 15	Imperial Dam To Mexico	127	333	127	0	Crucifers	9	2				
						Lettuce	197	146				
						Sudan	127	457				
						Total	**333**	**604**	**2**	**11**	**0**	**0**
Fort Yuma Indian Reservation, Ranch 17	Imperial Dam To Mexico	58	0	0	58	**Total**	**0**	**0**	**0**	**0**	**0**	**0**
Havasu National Wildlife Refuge	Davis Dam To Parker Dam	0	0	0	0	**Total**	**0**	**0**	**755**	**3,697**	**85**	**412**
Imperial National Wildlife Refuge	Parker Dam To Imperial Dam	0	0	0	0	**Total**	**0**	**0**	**2,536**	**10,506**	**213**	**1,112**
Lake Enterprises of California, LLC	Parker Dam To Imperial Dam	0	0	0	0	**Total**	**0**	**0**	**131**	**663**	**9**	**49**
State of California (Davis Dam to Parker Dam)	Davis Dam To Parker Dam	362	0	0	362	**Total**	**0**	**0**	**3,267**	**9,286**	**88**	**423**
State of California (Parker Dam to Imperial Dam)	Parker Dam To Imperial Dam	1,434	374	386	1,048	Citrus	161	418				
						Dates	212	1,238				
						Total	**374**	**1,656**	**4,541**	**18,983**	**1,041**	**5,427**
State of California (Imperial Dam to Mexico)	Imperial Dam to Mexico	0	0	0	0	**Total**	**0**	**0**	**2,432**	**8,545**	**70**	**422**
Nevada												
Fort Mojave Indian Reservation	Davis Dam To Parker Dam	412	360	406	6	Alfalfa	278	1,580				
						Bermuda/Grass	82	253				
						Total	**360**	**1,832**	**2,256**	**5,251**	**11**	**54**
Lake Mead National Recreation Area (Hoover Dam to Davis Dam)	Hoover Dam to Davis Dam	0	0	0	0	**Total**	**0**	**0**	**690**	**2,034**	**2**	**11**
State of Nevada (Davis Dam to Parker Dam)	Davis Dam To Parker Dam	0	0	0	0	**Total**	**0**	**0**	**3,287**	**9,241**	**59**	**284**

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Appendix 2: Monthly Reference Values for Reference ET, Precipitation, and Crop/Riparian Vegetation ET Rates

This appendix contains area-specific data used by Reclamation to calculate the ET and evaporation estimates provided in this report. Each table displays monthly reference ET and precipitation values, monthly ET rates for crop and riparian groups, and monthly evaporation rates for open water areas.

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Mohave Area ET Rate Table
(Inches)
2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reference ET	3.77	3.20	5.94	7.13	9.03	9.21	8.42	7.45	9.25	5.13	3.54	2.00	74.07
Precipitation	0.01	0.07	0.11	0.01	0.00	0.00	1.08	0.97	0.46	0.01	0.00	0.57	3.29

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Alfalfa	2.66	3.25	4.73	6.66	8.29	8.07	7.53	7	6.56	3.85	2.85	2.18	63.63
Bermuda	0	0	0	3.01	7.38	7.84	7.17	6.23	5.07	0.41	0	0	37.11
Bermuda Overseeded with Rye in Winter	3.36	2.72	4.56	3.01	7.38	7.84	7.17	6.23	5.07	2.41	3.09	1.79	54.63
Citrus - Declining	1.83	1.5	2.67	3.06	3.71	3.67	3.36	2.97	2.55	2.23	1.65	1	30.19
Citrus - Mature	2.62	2.14	3.81	4.37	5.29	5.25	4.8	4.25	3.64	3.19	2.36	1.42	43.13
Citrus - Young	1.57	1.28	2.28	2.62	3.18	3.15	2.88	2.55	2.18	1.91	1.41	0.85	25.88
Cotton	0	0	0	1.04	2.29	5.27	7.75	8.33	6.14	0.92	0	0	31.73
Crucifers Fall Early	0	0	0	0	0	0	0	0	0	2.31	2.05	1.87	6.23
Crucifers Fall Late	0	0	0	0	0	0	0	0	0	0.19	1.6	1.26	3.05
Crucifers Spring Early	3.78	3.1	0.4	0	0	0	0	0	0	0	0	0	7.28
Crucifers Spring Late	3.63	3.21	5.69	0	0	0	0	0	0	0	0	0	12.53
Dates	3.3	2.91	5.87	7.17	9.03	9.11	8.24	7.2	5.98	4.85	3.31	1.85	68.81
Deciduous Orchards	1.7	1.45	3.37	5.24	7.75	7.98	7.29	6.45	5.41	4.44	2.98	1.22	55.28
Fall Melons	0	0	0	0	0	0	0	1.26	3.75	4.99	3.53	0.97	14.5
Farm Pond	3.36	2.75	5.17	6.77	8.4	7.83	6.82	5.66	4.56	4	3.12	1.62	60.06
Field Grain	0	0	2.02	6.49	10.83	9.66	1.34	0	0	0	0	0	30.34
Grapes	0	0.22	1.73	4.62	7.62	7.82	6.8	4.73	1.67	0	0	0	35.2
Irrigated Restoration - Cottonwood/Willow	1.25	1.06	2.83	5.38	8.91	9.37	8.56	7.58	6.36	4.7	1.97	0.47	58.44
Irrigated Restoration - Mixed Veg Low	0.77	0.68	1.91	3.31	5.03	5.16	4.72	4.08	2.84	1.78	0.84	0.41	31.51
Irrigated Restoration - Mixed Veg Medium	1.13	0.97	2.21	3.32	4.79	4.92	4.47	3.54	2.51	1.69	1.06	0.6	31.22
Klein Grass	0	0	0	3.01	7.38	7.84	7.17	6.23	5.07	0.41	0	0	37.11
Legume/Solanum Vegetables Fall	0	0	0	0	0	0	0	0	0	1.47	2.51	2	5.99
Legume/Solanum Vegetables Spring	3.97	3.32	2.05	0	0	0	0	0	0	0	0	0	9.34
Lettuce Fall Early	0	0	0	0	0	0	0	0	0	3.12	3.12	0	6.24
Lettuce Spring Late	3.44	3.21	2.24	0	0	0	0	0	0	0	0	0	8.89
Miscellaneous herbs	0	1.23	4.51	8.42	11.17	10.22	1.67	0	0	0	0	0	37.22
Moist Soil Unit	3.77	3.2	5.84	7.02	5.22	2.99	8.98	8.4	4.22	5.13	3.54	2	60.31
Nursery/Greenhouse	1.57	1.28	2.28	2.62	3.18	3.15	2.88	2.55	2.18	1.91	1.41	0.85	25.88
Oil Crops	0	1.23	4.51	8.42	11.17	10.22	1.67	0	0	0	0	0	37.22
Perennial Vegetables	1.64	1.4	2.74	5.27	8.41	8.59	7.86	6.94	5.13	3.32	1.59	0.87	53.74
Root Vegetables	0	0	0	0	0	0	0	0	2.19	3.74	3.71	1.81	11.45
Small Grains Fall	0	0	0	0	0	0	0	0	0	0	0.33	0.78	1.1
Small Grains Spring	3.23	3.61	6.7	7.79	3.07	0	0	0	0	0	0	0	24.41
Small Vegetables Fall	0	0	0	0	0	0	0	0	1.1	2.03	2.65	1.99	7.78
Small Vegetables Spring	3.75	3.19	5	0	0	0	0	0	0	0	0	0	11.94
Spring Melons	0	0.31	3.89	7.06	9.02	5.19	0	0	0	0	0	0	25.48
Sudan	0	0	3.03	7.3	10.29	10.5	9.3	1.19	0	0	0	0	41.62
Sugar Beets (Summer)	4.04	3.43	6.37	7.37	6.7	0.17	0	0	0	0	0	0	28.08
Sugar Beets Fall	0	0	0	0	0	0	0	0	0.72	1.84	2.23	1.97	6.76
Tomatoes	0	1.97	5.1	8.38	10.13	3.78	0	0	0	0	0	0	29.36
Wildlife Forage Maintained	3.74	3.79	7.04	7.4	3.77	0.31	0	0	0	0	0.06	0.94	27.06

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Open Water	3.36	2.75	5.17	6.77	8.4	7.83	6.82	5.66	4.56	4	3.12	1.62	60.06

Riparian Types	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Barren	0.75	0.57	0.83	0.97	1.23	1.25	1.15	1.01	0.85	0.73	0.63	0.4	10.37
Cottonwood/Willow	1.25	1.06	2.83	5.38	8.91	9.37	8.56	7.58	6.36	4.7	1.97	0.47	58.44
Marsh	0.98	0.83	4.65	8.48	10.74	10.95	10.01	8.86	7.38	3.18	0.89	0.5	67.44
Mixed Veg Low	0.77	0.68	1.91	3.31	5.03	5.16	4.72	4.08	2.84	1.78	0.84	0.41	31.51
Mixed Veg Medium	1.13	0.97	2.21	3.32	4.79	4.92	4.47	3.54	2.51	1.69	1.06	0.6	31.22
Salt Cedar Dense	0.84	0.72	1.69	3.63	6.46	6.97	6.37	5.64	4.71	3.09	1.25	0.45	41.81

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Parker Area ET Rate Table
(Inches)
2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reference ET	3.14	3.50	5.84	7.38	9.14	9.84	9.45	7.94	6.59	4.49	3.20	1.91	72.42
Precipitation	0.00	0.20	0.13	0.01	0.01	0.00	0.33	1.79	0.69	0.07	0.00	0.36	3.59

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Alfalfa	2.33	3.55	4.65	6.82	8.38	8.59	8.36	7.41	6.91	3.5	2.58	2.08	65.18
Bermuda	0	0	0	3.12	7.46	8.37	8.04	6.64	5.35	0.31	0	0	39.3
Bermuda Overseeded with Rye in Winter	2.8	2.98	4.46	3.12	7.46	8.37	8.04	6.64	5.35	2.15	2.79	1.71	55.87
Citrus - Declining	1.53	1.64	2.62	3.17	3.75	3.93	3.77	3.17	2.69	1.96	1.49	0.95	30.65
Citrus - Mature	2.18	2.34	3.74	4.53	5.36	5.61	5.39	4.53	3.84	2.8	2.13	1.36	43.79
Citrus - Young	1.31	1.4	2.25	2.72	3.21	3.37	3.23	2.72	2.3	1.68	1.28	0.82	26.27
Cotton	0	0	0	1.07	2.32	5.64	8.71	8.88	6.5	0.67	0	0	33.8
Crucifers Fall Early	0	0	0	0	0	0	0	0	0	2.02	1.86	1.8	5.68
Crucifers Fall Late	0	0	0	0	0	0	0	0	0	0.17	1.44	1.22	2.83
Crucifers Spring Early	3.15	3.39	0.39	0	0	0	0	0	0	0	0	0	6.93
Crucifers Spring Late	3.02	3.51	5.59	0	0	0	0	0	0	0	0	0	12.11
Dates	2.75	3.18	5.77	7.42	9.14	9.73	9.24	7.68	6.3	4.24	2.99	1.77	70.22
Deciduous Orchards	1.42	1.59	3.32	5.43	7.84	8.52	8.18	6.88	5.71	3.89	2.69	1.15	56.61
Fall Melons	0	0	0	0	0	0	0	1.36	3.93	4.39	3.19	0.86	13.72
Farm Pond	2.79	3.01	5.08	7.01	8.5	8.36	7.65	6.03	4.81	3.5	2.82	1.55	61.13
Field Grain	0	0	2	6.72	10.96	10.3	1.42	0	0	0	0	0	31.39
Grapes	0	0.24	1.71	4.78	7.71	8.35	7.64	5.02	1.78	0	0	0	37.24
Irrigated Restoration - Cottonwood/Willow	1.04	1.16	2.79	5.57	9.01	10.01	9.61	8.07	6.7	4.07	1.78	0.44	60.26
Irrigated Restoration - Mixed Veg Low	0.64	0.74	1.88	3.42	5.09	5.51	5.29	4.35	3	1.54	0.76	0.39	32.62
Irrigated Restoration - Mixed Veg Medium	0.94	1.06	2.18	3.43	4.85	5.25	5.02	3.77	2.65	1.47	0.96	0.57	32.16
Klein Grass	0	0	0	3.12	7.46	8.37	8.04	6.64	5.35	0.31	0	0	39.3
Legume/Solanum Vegetables Fall	0	0	0	0	0	0	0	0	0	1.45	2.27	1.92	5.65
Legume/Solanum Vegetables Spring	3.3	3.63	2	0	0	0	0	0	0	0	0	0	8.93
Lettuce Fall Early	0	0	0	0	0	0	0	0	0	2.74	2.81	0	5.55
Lettuce Spring Late	2.86	3.51	2.17	0	0	0	0	0	0	0	0	0	8.54
Miscellaneous herbs	0	1.35	4.45	8.71	11.31	10.9	1.79	0	0	0	0	0	38.51
Moist Soil Unit	3.14	3.5	5.74	7.28	5.3	3.22	10.13	8.95	4.5	4.49	3.2	1.91	61.36
Nursery/Greenhouse	1.31	1.4	2.25	2.72	3.21	3.37	3.23	2.72	2.3	1.68	1.28	0.82	26.27
Oil Crops	0	1.35	4.45	8.71	11.31	10.9	1.79	0	0	0	0	0	38.51
Perennial Vegetables	1.37	1.53	2.7	5.45	8.51	9.18	8.82	7.39	5.42	2.88	1.44	0.83	55.51
Root Vegetables	0	0	0	0	0	0	0	0	2.31	3.36	3.35	1.75	10.78
Small Grains Fall	0	0	0	0	0	0	0	0	0	0	0.31	0.75	1.06
Small Grains Spring	2.7	3.95	6.59	8.06	3.11	0	0	0	0	0	0	0	24.41
Small Vegetables Fall	0	0	0	0	0	0	0	0	1.13	1.8	2.4	1.9	7.23
Small Vegetables Spring	3.13	3.49	4.88	0	0	0	0	0	0	0	0	0	11.49
Spring Melons	0	0.36	3.85	7.3	9.13	5.49	0	0	0	0	0	0	26.13
Sudan	0	0	2.99	7.55	10.42	11.22	10.44	1.22	0	0	0	0	43.84
Sugar Beets (Summer)	3.37	3.75	6.26	7.63	6.79	0.17	0	0	0	0	0	0	27.96
Sugar Beets Fall	0	0	0	0	0	0	0	0	0.74	1.61	2.02	1.89	6.27
Tomatoes	0	2.16	5.03	8.67	10.25	4.01	0	0	0	0	0	0	30.11
Wildlife Forage Maintained	3.11	4.15	6.92	7.65	3.82	0.32	0	0	0	0	0.06	0.9	26.92

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Open Water	2.14	2.52	4.85	6.86	8.32	9.15	8.69	7.3	6.13	4.36	3.14	1.47	64.92

Riparian Types	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Barren	0.63	0.62	0.82	1	1.24	1.34	1.29	1.08	0.9	0.64	0.57	0.38	10.51
Cottonwood/Willow	1.04	1.16	2.79	5.57	9.01	10.01	9.61	8.07	6.7	4.07	1.78	0.44	60.26
Marsh	0.82	0.91	4.61	8.77	10.87	11.7	11.24	9.44	7.78	2.64	0.8	0.48	70.06
Mixed Veg Low	0.64	0.74	1.88	3.42	5.09	5.51	5.29	4.35	3	1.54	0.76	0.39	32.62
Mixed Veg Medium	0.94	1.06	2.18	3.43	4.85	5.25	5.02	3.77	2.65	1.47	0.96	0.57	32.16
Salt Cedar Dense	0.7	0.78	1.67	3.75	6.54	7.45	7.15	6.01	4.97	2.67	1.12	0.43	43.25

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Wellton-Mohawk Area ET Rate Table
(Inches)
2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reference ET	2.49	3.15	5.16	6.65	8.38	9.07	9.35	8.16	7.04	4.59	3.2	2.28	69.52
Precipitation	0	0	0.27	0	0	0	0.22	1.61	0.3	0.7	0	0.45	3.55

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Alfalfa	1.83	3.2	4.42	5.35	6.93	8	8.27	7.22	5.92	4.87	2.66	2.44	61.1
Bermuda	0	0	0	2.81	6.81	7.67	7.91	6.8	5.73	0.29	0	0	38.03
Bermuda Overseeded with Rye in Winter	2.21	2.69	3.99	2.81	6.81	7.67	7.91	6.8	5.73	2.15	2.79	2.03	53.61
Citrus - Declining	1.21	1.47	2.31	2.86	3.44	3.62	3.73	3.26	2.87	2	1.49	1.13	29.39
Citrus - Mature	1.73	2.1	3.31	4.08	4.91	5.17	5.33	4.65	4.1	2.86	2.13	1.62	41.99
Citrus - Young	1.04	1.26	1.98	2.45	2.95	3.1	3.2	2.79	2.46	1.72	1.28	0.97	25.19
Cotton	0	0	0.81	1.74	3.26	6.15	9.07	9.16	6.9	1.52	0	0	38.6
Crucifers Fall Early	0	0	0	0	0	0	0	0	0.25	1.62	1.76	2.15	5.78
Crucifers Fall Late	0	0	0	0	0	0	0	0	0	0	1.13	1.24	2.36
Crucifers Spring Early	2.48	0.73	0	0	0	0	0	0	0	0	0	0	3.2
Crucifers Spring Late	2.28	3.15	2.31	0	0	0	0	0	0	0	0	0	7.73
Dates	2.04	2.72	4.97	6.54	8.23	8.86	9.09	7.89	6.77	4.39	3.05	2.16	66.71
Deciduous Orchards	0.96	1.22	2.66	4.68	7.05	7.71	7.95	6.94	5.98	3.9	2.65	1.39	53.08
Fall Melons	0	0	0	0	0	0	0	0	3.46	4.04	3.19	2.04	12.73
Farm Pond	2.22	2.71	4.49	6.32	7.79	7.71	7.57	6.2	5.14	3.58	2.82	1.85	58.39
Field Grain	0	0.58	2.99	7.46	9.96	6.97	0	0	0	0	0	0	27.96
Gila Gravity Main Canal	2.12	3.02	5.31	6.92	8.63	9.34	9.72	8.49	7.18	4.54	2.78	1.71	69.77
Grapes	0	0.21	1.51	4.31	7.07	7.7	7.55	5.14	1.93	0	0	0	35.42
Irrigated Restoration - Cottonwood/Willow	0.82	1.04	2.47	5.02	8.27	9.22	9.51	8.3	7.16	4.17	1.79	0.53	58.3
Irrigated Restoration - Mixed Veg Low	0.51	0.67	1.66	3.08	4.67	5.08	5.24	4.46	3.21	1.58	0.76	0.47	31.38
Irrigated Restoration - Mixed Veg Medium	0.75	0.96	1.93	3.09	4.45	4.84	4.97	3.87	2.83	1.5	0.96	0.68	30.82
Jojoba Beans	2.74	3.31	3.11	0.2	3.97	7.54	10.27	8.98	7.74	5.05	3.52	2.51	58.95
Klein Grass	0	0	0	2.81	6.81	7.67	7.91	6.8	5.73	0.29	0	0	38.03
Legume/Solanum Veg.	0	0	0	1.85	5.22	8.86	9.71	3.1	0	0	0	0	28.74
Legume/Solanum Vegetables Fall	0	0	0	0	0	0	0	0	0	1.2	1.98	2.26	5.43
Legume/Solanum Vegetables Spring	2.61	3.26	1.78	0	0	0	0	0	0	0	0	0	7.66
Lettuce Fall Early	0	0	0	0	0	0	0	0	1.8	3.39	2.97	0	8.16
Lettuce Fall Late	0	0	0	0	0	0	0	0	0	0	0	1.63	1.63
Lettuce Spring Early	2.4	1.73	0	0	0	0	0	0	0	0	0	0	4.13
Lettuce Spring Late	1.06	2.77	5.06	0.19	0	0	0	0	0	0	0	0	9.07
Miscellaneous herbs	0	1.15	3.85	7.78	10.29	10	1.71	0	0	0	0	0	34.78
Moist Soil Unit	2.49	3.15	5.07	6.55	4.78	2.95	10.07	9.22	4.83	4.59	3.2	2.28	59.17
Nursery/Greenhouse	1.04	1.26	1.98	2.45	2.95	3.1	3.2	2.79	2.46	1.72	1.28	0.97	25.19
Oil Crops	0	1.15	3.85	7.78	10.29	10	1.71	0	0	0	0	0	34.78
Perennial Vegetables	1.02	1.29	2.25	4.79	7.71	8.36	8.62	7.51	5.75	2.96	1.49	0.93	52.67
Root Vegetables	0	0	0	0	0	0	0	0	2.6	3.48	3.35	2.12	11.56
Small Grains Fall	0	0	0	0	0	0	0	0	0	0	0	0.78	0.78
Small Grains Spring	2.32	3.52	5.76	6.29	2.49	0	0	0	0	0	0	0	20.37
Small Vegetables Fall	0	0	0	0	0	0	0	0	0	1.3	1.93	1.95	5.19
Small Vegetables Spring	2.48	3.14	5.08	5.44	0	0	0	0	0	0	0	0	16.15
Small Vegetables Spring Late	1.89	2.45	4.77	5.86	3.78	0.89	0	0	0	0	0	0	19.64
Spring Melons	0	2.31	4.59	6.71	7.9	0	0	0	0	0	0	0	21.51
Sudan	0	0	0	2.84	8.22	10.26	10.57	8.9	0	0	0	0	40.79
Sugar Beets (Summer)	2.64	3.35	5.48	6.8	6.15	0.16	0	0	0	0	0	0	24.57
Sugar Beets Fall	0	0	0	0	0	0	0	0	0.79	1.68	2.01	2.23	6.72
Tomatoes	0	1.94	4.44	7.79	9.38	3.77	0	0	0	0	0	0	27.32
Wildlife Forage Maintained	2.49	3.73	6.11	6.89	3.47	0.3	0	0	0	0	0.05	1.06	24.11

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Open Water	2.12	3.02	5.31	6.92	8.63	9.34	9.72	8.49	7.18	4.54	2.78	1.71	69.77

Riparian Types	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Barren	0.5	0.56	0.72	0.9	1.14	1.23	1.27	1.11	0.96	0.66	0.57	0.46	10.08
Cottonwood/Willow	0.82	1.04	2.47	5.02	8.27	9.22	9.51	8.3	7.16	4.17	1.79	0.53	58.3
Marsh	0.65	0.82	4.07	7.91	9.96	10.78	11.12	9.7	8.31	2.7	0.8	0.57	67.39
Mixed Veg Low	0.51	0.67	1.66	3.08	4.67	5.08	5.24	4.46	3.21	1.58	0.76	0.47	31.38
Mixed Veg Medium	0.75	0.96	1.93	3.09	4.45	4.84	4.97	3.87	2.83	1.5	0.96	0.68	30.82
Salt Cedar Dense	0.56	0.71	1.48	3.38	6	6.87	7.08	6.18	5.31	2.73	1.13	0.51	41.92

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Yuma Area ET Rate Table
(Inches)
2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reference ET	3.31	3.36	5.72	6.77	8.37	9.88	10.07	8.70	7.45	7.79	3.56	2.23	77.21
Precipitation	0.01	0	0.04	0	0	0	0.21	0.69	0.66	0.03	0.01	0.36	2.01

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Alfalfa	2.45	3.42	4.94	5.49	6.97	8.72	8.98	7.71	6.23	5.06	2.92	2.38	65.27
All American Canal	2.81	3.23	5.89	7.04	8.62	10.18	10.47	9.05	7.6	4.74	3.1	1.67	74.4
Bermuda	0	0	0	2.85	6.81	8.36	8.52	7.25	6.06	0.36	0	0	40.21
Bermuda Overseeded with Rye in Winter	2.94	2.87	4.42	2.85	6.81	8.36	8.52	7.25	6.06	2.26	3.1	1.99	57.43
Citrus - Declining	1.61	1.57	2.57	2.91	3.43	3.94	4.02	3.47	3.04	2.09	1.66	1.11	31.41
Citrus - Mature	2.3	2.24	3.67	4.15	4.9	5.63	5.74	4.96	4.34	2.98	2.37	1.59	44.88
Citrus - Young	1.38	1.35	2.2	2.49	2.94	3.38	3.44	2.98	2.6	1.79	1.42	0.95	26.93
Cotton	0	0	0.87	1.77	3.26	6.72	9.73	9.76	7.29	1.63	0	0	41.02
Crucifers Fall Early	0	0	0	0	0	0	0	0	0.29	1.69	1.97	2.1	6.04
Crucifers Fall Late	0	0	0	0	0	0	0	0	0	0	1.25	1.21	2.46
Crucifers Spring Early	3.29	0.75	0	0	0	0	0	0	0	0	0	0	4.04
Crucifers Spring Late	3.01	3.36	2.66	0	0	0	0	0	0	0	0	0	9.02
Dates	2.72	2.9	5.5	6.66	8.22	9.65	9.79	8.41	7.17	4.59	3.39	2.11	71.1
Deciduous Orchards	1.27	1.3	2.93	4.75	7.04	8.4	8.56	7.4	6.33	4.07	2.94	1.36	56.35
Fall Melons	0	0	0	0	0	0	0	0	3.67	4.19	3.55	1.99	13.4
Farm Pond	2.95	2.89	4.98	6.43	7.78	8.4	8.16	6.61	5.44	3.74	3.13	1.81	62.31
Field Grain	0	0.61	3.27	7.58	9.94	7.55	0	0	0	0	0	0	28.96
Gila Gravity Main Canal	2.81	3.23	5.89	7.04	8.62	10.18	10.47	9.05	7.6	4.74	3.1	1.67	74.4
Grapes	0	0.23	1.65	4.36	7.07	8.39	8.14	5.48	2.02	0	0	0	37.35
Irrigated Restoration - Cottonwood/Willow	1.1	1.11	2.71	5.09	8.26	10.05	10.24	8.85	7.58	4.36	1.98	0.51	61.85
Irrigated Restoration - Mixed Veg Low	0.68	0.71	1.83	3.13	4.66	5.53	5.64	4.76	3.39	1.65	0.84	0.46	33.29
Irrigated Restoration - Mixed Veg Medium	0.99	1.02	2.13	3.14	4.44	5.28	5.35	4.12	2.99	1.57	1.07	0.67	32.78
Klein Grass	0	0	0	2.85	6.81	8.36	8.52	7.25	6.06	0.36	0	0	40.21
Legume/Solanum Veg.	0	0	0	1.83	5.22	9.65	10.46	3.35	0	0	0	0	30.51
Legume/Solanum Vegetables Fall	0	0	0	0	0	0	0	0	0	1.22	2.21	2.21	5.64
Legume/Solanum Vegetables Spring	3.48	3.48	2.1	0	0	0	0	0	0	0	0	0	9.06
Lettuce Fall Early	0	0	0	0	0	0	0	0	1.95	3.51	3.33	0	8.79
Lettuce Fall Late	0	0	0	0	0	0	0	0	0	0	0	1.61	1.61
Lettuce Spring Early	3.18	1.84	0	0	0	0	0	0	0	0	0	0	5.02
Lettuce Spring Late	1.29	2.96	5.62	0.2	0	0	0	0	0	0	0	0	10.06
Miscellaneous herbs	0	1.23	4.23	7.91	10.28	10.85	1.99	0	0	0	0	0	36.49
Moist Soil Unit	3.31	3.36	5.62	6.68	4.79	3.28	10.78	9.83	5.09	4.79	3.56	2.23	63.32
Nursery/Greenhouse	1.38	1.35	2.2	2.49	2.94	3.38	3.44	2.98	2.6	1.79	1.42	0.95	26.93
Oil Crops	0	1.23	4.23	7.91	10.28	10.85	1.99	0	0	0	0	0	36.49
Perennial Vegetables	1.35	1.37	2.48	4.86	7.7	9.11	9.28	8	6.08	3.09	1.66	0.91	55.9
Root Vegetables	0	0	0	0	0	0	0	0	2.75	3.6	3.73	2.07	12.16
Small Grains Fall	0	0	0	0	0	0	0	0	0	0	0	0.76	0.76
Small Grains Spring	3.03	3.75	6.38	6.44	2.46	0	0	0	0	0	0	0	22.06
Small Vegetables Fall	0	0	0	0	0	0	0	0	0	1.32	2.15	1.91	5.39
Small Vegetables Spring	3.3	3.35	5.64	5.56	0	0	0	0	0	0	0	0	17.86
Small Vegetables Spring Late	2.51	2.61	5.28	6	3.77	0.96	0	0	0	0	0	0	21.12
Spring Melons	0	2.46	5.07	6.83	7.89	0	0	0	0	0	0	0	22.25
Sudan	0	0	0	2.87	8.21	11.17	11.39	9.49	0	0	0	0	43.14
Sugar Beets (Summer)	3.52	3.57	6.07	6.94	6.14	0.16	0	0	0	0	0	0	26.39
Sugar Beets Fall	0	0	0	0	0	0	0	0	0.86	1.75	2.25	2.18	7.04
Tomatoes	0	2.07	4.88	7.93	9.37	4.03	0	0	0	0	0	0	28.28
Wildlife Forage Maintained	3.25	3.98	6.78	7.04	3.46	0.33	0	0	0	0	0.06	1.04	25.95

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Open Water	2.81	3.23	5.89	7.04	8.62	10.18	10.47	9.05	7.6	4.74	3.1	1.67	74.4

Riparian Types	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Barren	0.66	0.59	0.8	0.92	1.14	1.34	1.37	1.18	1.01	0.69	0.64	0.45	10.79
Cottonwood/Willow	1.1	1.11	2.71	5.09	8.26	10.05	10.24	8.85	7.58	4.36	1.98	0.51	61.85
Marsh	0.86	0.87	4.44	8.05	9.95	11.75	11.97	10.34	8.8	2.86	0.89	0.56	71.35
Mixed Veg Low	0.68	0.71	1.83	3.13	4.66	5.53	5.64	4.76	3.39	1.65	0.84	0.46	33.29
Mixed Veg Medium	0.99	1.02	2.13	3.14	4.44	5.28	5.35	4.12	2.99	1.57	1.07	0.67	32.78
Salt Cedar Dense	0.74	0.75	1.62	3.43	6	7.48	7.62	6.59	5.62	2.86	1.25	0.5	44.45

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IID and Coachella Area ET Rate Table
(Inches)
2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Reference ET	2.77	3.30	5.76	7.06	8.74	9.67	9.12	8.76	7.15	4.73	3.30	1.76	72.12
Precipitation	0.00	0.02	0.01	0.00	0.01	0.00	0.02	0.30	0.13	0.00	0.02	0.25	0.76

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Alfalfa	2.22	3.84	4.54	5.67	7.04	7.78	7.43	7.1	5.95	5.48	2.76	2.04	61.86
Aloe	1.15	1.32	2.21	2.6	3.07	3.31	3.12	3	2.5	1.77	1.32	0.75	26.12
Bermuda	0	0.08	5.12	6.78	8.39	9.28	8.76	8.41	6.37	0.6	0	0	53.78
Bermuda Overseeded with Rye in Winter	2.45	3.17	5.53	6.78	8.39	9.28	8.76	8.41	6.37	0.6	0	0.1	59.83
Cane/Bamboo	0.72	0.86	4.57	8.39	10.39	11.5	10.84	10.42	8.44	2.8	0.82	0.44	70.19
Citrus - Declining	1.35	1.54	2.58	3.03	3.59	3.86	3.64	3.5	2.91	2.06	1.54	0.88	30.48
Citrus - Mature	1.92	2.2	3.69	4.33	5.12	5.51	5.2	4.99	4.16	2.95	2.2	1.25	43.53
Citrus - Young	1.15	1.32	2.21	2.6	3.07	3.31	3.12	3	2.5	1.77	1.32	0.75	26.12
Cotton	0	0.06	1.67	1.95	4.25	7.88	10.3	8.58	4.06	0.51	0	0	39.27
Cottonwood/Willow	0.92	1.09	2.76	5.31	8.63	9.83	9.28	8.91	7.27	4.3	1.84	0.39	60.54
Crucifers Fall Early	0	0	0	0	0	0	0	3.45	2.94	4.68	3.96	1.64	16.67
Crucifers Fall Late	0	0	0	0	0	0	0	0	2.58	1.68	2.95	2.11	9.32
Crucifers Spring Early	0.77	0.03	0	0	0	0	0	0	0	0	0	0	0.8
Crucifers Spring Late	2.83	1.25	0.16	0	0	0	0	0	0	0	0	0	4.24
Dates	2.27	2.84	5.55	6.95	8.58	9.44	8.86	8.47	6.88	4.53	3.14	1.67	69.19
Deciduous Orchards	1.06	1.28	2.97	4.95	7.35	8.22	7.75	7.45	6.08	4.02	2.73	1.06	54.92
Fall Melons	0	0	0	0	0	0	0.54	4.08	4.08	4.94	3.4	1.16	18.19
Farm Pond	2.96	3.53	6.16	7.55	9.35	10.35	9.76	9.37	7.65	5.06	3.53	1.88	77.17
Field Grain	0	0.84	2.74	7.01	10.45	10.16	3.6	0.27	0	0	0	0	35.07
Grapes	0	0.22	1.7	4.55	7.38	8.21	7.38	5.49	1.96	0	0	0	36.89
Irrigated Restoration - Cottonwood/Willow	0.92	1.09	2.76	5.31	8.63	9.83	9.28	8.91	7.27	4.3	1.84	0.39	60.54
Irrigated Restoration - Mixed Veg Low	0.57	0.7	1.86	3.27	4.87	5.42	5.11	4.78	3.26	1.63	0.78	0.36	32.59
Irrigated Restoration - Mixed Veg Medium	0.83	1	2.15	3.28	4.64	5.16	4.85	4.14	2.87	1.55	0.99	0.53	32
Jojoba Beans	3.05	3.47	3.44	0.2	4.18	8.02	10.02	9.64	7.87	5.2	3.63	1.94	60.65
Klein Grass	0	0.08	5.12	6.78	8.39	9.28	8.76	8.41	6.37	0.6	0	0	53.78
Legume/Solanum Veg.	0	0	2.51	4.59	10.26	9.16	3.92	0.12	0	0	0	0	30.56
Legume/Solanum Vegetables Fal	0	0	0	0	0	0	0	0	0	1.1	1.55	1.8	4.46
Legume/Solanum Vegetables Spring	3.03	3.23	5.47	1.98	0	0	0	0	0	0	0	0	13.71
Lettuce Fall Early	0	0	0	0	0	0	0	0	0	3.47	3.53	1.88	8.87
Lettuce Fall Late	0	0	0	0	0	0	0	0	0	0.25	2.78	1.88	4.92
Lettuce Spring Early	2.96	1.15	0.01	0	0	0	0	0	0	0	0	0	4.12
Lettuce Spring Late	2.96	3.52	5.78	0.81	0	0	0	0	0	0	0	0	13.07
Marsh Maintained	0.72	0.86	4.57	8.39	10.39	11.5	10.84	10.42	8.44	2.8	0.82	0.44	70.19
Miscellaneous herbs	0.2	1.58	4.02	8.33	8.17	4.18	0.34	0	0	0	0	0	26.84
Moist Soil Unit	2.77	3.3	5.66	6.98	5.03	3.13	9.77	9.85	4.91	4.73	3.3	1.76	61.19
Nursery/Greenhouse	1.15	1.32	2.21	2.6	3.07	3.31	3.12	3	2.5	1.77	1.32	0.75	26.12
Oil Crops	0.2	1.58	4.02	8.33	8.17	4.18	2.11	0	0	0	0	0	28.61
Perennial Vegetables	0.53	0.01	1.69	3.54	8.06	9.19	8.66	8.32	6.79	4.49	3.13	1.44	55.85
Root Vegetables	0.54	0.01	0	0	0	0	0	0	0.74	1.73	3	1.81	7.83
Small Grains Fall	0	0	0	0	0	0	0	0	0	0	0.06	0.84	0.89
Small Grains Spring	2.74	3.91	6.83	7.34	3.61	0.33	0	0	0	0	0	0	24.76
Small Vegetables Fall	0	0	0	0	0	0	0	0	0.12	1.75	2.11	1.75	5.73
Small Vegetables Spring	2.93	3.36	5.23	5.42	0.95	0	0	0	0	0	0	0	17.91
Small Vegetables Spring Late	2.09	2.56	5.33	6.25	3.93	0.96	0	0	0	0	0	0	21.13
Spring Melons	0.13	1.55	5.86	7.06	5.73	1.03	0	0	0	0	0	0	21.35
Sudan	0	0	0.28	2.99	8.72	11.52	9.28	4.14	0.28	0	0	0	37.21
Sugar Beets (Summer)	3.16	3.76	6.25	6.84	5.73	2.58	0.3	0	0	0	0	0	28.61
Sugar Beets Fall	0	0	0	0	0	0	0	0	0.2	1.75	1.89	1.77	5.61
Tomatoes	0.2	1.58	4.02	8.33	8.17	4.18	0.34	0	0	0	0	0	26.84
Wildlife Forage Maintained	2.74	3.91	6.83	7.34	3.61	0.33	0	0	0	0	0.06	0.84	25.66

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Open Water	2.96	3.53	6.16	7.55	9.35	10.35	9.76	9.37	7.65	5.06	3.53	1.88	77.17
All American Canal*	2.35	3.17	5.93	7.34	9	9.96	9.48	9.11	7.29	4.68	2.87	1.32	72.52

*Imperial to Morelos Kc data and Yuma area weather data used for these calculations

Riparian Types	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Barren	0.55	0.59	0.81	0.96	1.19	1.32	1.24	1.19	0.97	0.68	0.59	0.35	10.43
Marsh	0.72	0.86	4.57	8.39	10.39	11.5	10.84	10.42	8.44	2.8	0.82	0.44	70.19
Mixed Veg Low	0.57	0.7	1.86	3.27	4.87	5.42	5.11	4.78	3.26	1.63	0.78	0.36	32.59
Mixed Veg Medium	0.83	1	2.15	3.28	4.64	5.16	4.85	4.14	2.87	1.55	0.99	0.53	32
Salt Cedar Dense	0.62	0.74	1.65	3.58	6.26	7.32	6.9	6.63	5.39	2.81	1.16	0.39	43.47

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Appendix 3: Maps of the Program Area

This appendix contains the following maps:

1. Map 1. Program area, reach boundaries.
2. Map 2. Program area, Hoover Dam to Davis Dam.
3. Map 3. Program area, Davis Dam to Parker Dam.
4. Map 4. Program area, Parker Dam to Imperial Dam.
5. Map 5. Program area, Imperial Dam to Mexico.

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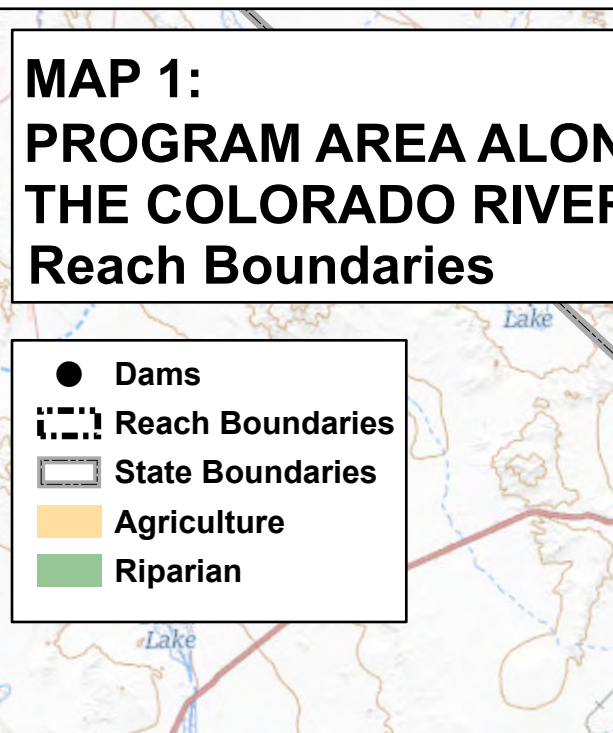
MAP 1:
PROGRAM AREA ALONG THE COLORADO RIVER
Reach Boundaries

- Dams
- Reach Boundaries
- State Boundaries
- Agriculture
- Riparian



HOOVER DAM

NEVADA

Hoover Dam to Davis Dam

DAVIS DAM

Davis Dam to Parker Dam

ARIZONA

CALIFORNIA

Bill Williams River (NCR)

PARKER DAM

ALAMO DAM

PALO VERDE DIVERSION DAM

Parker Dam to Imperial Dam

* NCR (Non-Colorado River). The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

Salton

IMPERIAL DIVERSION DAM

Gila River Valley

MEXICO

Imperial Dam to Mexico (NCR)

Imperial Dam to Mexico

Gila River Valley (NCR)

N

0 5 10 20 30 40 Miles

RECLAMATION
Managing Water in the West

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MAP 2: PROGRAM AREA ALONG THE COLORADO RIVER

Hoover Dam to Davis Dam

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

HOOVER DAM

DAVIS DAM

Dams
Reach Boundary
State Boundaries
1) Lake Mead National Recreation Area, NV (Hoover Dam to Davis Dam)
2) Lake Mead National Recreation Area, AZ (Hoover Dam to Davis Dam)

1

2

NEVADA

ARIZONA

Lake Mead
Lake Mohave
Boulder City
Boulder City Municipal Airport
Quail Wash
S BOULDER HWY
ELDORADO MOUNTAINS
RIVER MOUNTAINS
WHITE HILLS
Mount Perkins
BLACK MOUNTAINS
Detrital Wash
Lost Cabin Wash
Turo Wash
Sacramento Wash
Searchlight Airport
Laughlin/Bullhead International Airport
NEW[illegible] MOUNTAINS
CHIQUITA [illegible]LS
Golde

N

0 2 4 8 12 Miles

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MAP 3: PROGRAM AREA ALONG THE COLORADO RIVER

Davis Dam to Parker Dam

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DAVIS DAM

NEVADA

ARIZONA

CALIFORNIA

PARKER DAM

- Dams
- Reach Boundary
- State Boundaries
- 1) Lake Mead National Recreation Area, NV (Davis Dam to Parker Dam)
- 2) Lake Mead National Recreation Area, AZ (Davis Dam to Parker Dam)
- 3) State of Nevada (Davis Dam to Parker Dam)
- 4) State of Arizona (Davis Dam to Parker Dam)
- 5) Ft Mojave Indian Reservation, NV
- 6) Ft Mojave Indian Reservation, AZ
- 7) Mohave Valley Irrigation and Drainage District, AZ
- 8) State of California (Davis Dam to Parker Dam)
- 9) Ft Mojave Indian Reservation, CA
- 10) Havasu National Wildlife Refuge, AZ
- 11) Havasu National Wildlife Refuge, CA
- 12) Chemehuevi Indian Reservation, CA
- 13) Lake Havasu State Park, AZ
- 14) Bill Williams River National Wildlife Refuge, AZ

Laughlin
Bullhead City
Laughlin/Bullhead International Airport
Fort Mohave
Fort Mojave Reservation
Mohave Valley
Needles
Needles Airport
Lost Lake
Golden Valley
Kingman
Lake Havasu City
Lake Havasu City Airport
Chemehuevi Valley Airport
Chemehuevi Reservation
Lake Havasu
Silver Creek Wash
Warm Springs Wash
Sacramento Wash
Standard Wash
Mohave Wash
Wesz Wash
Mountain Wash
DEAD MOUNTAINS
UTE MOUNTAINS
SACRAMENTO MOUNTAINS
CHEMEHUEVI MOUNTAINS
MOHAVE MOUNTAINS
BUCK MOUNTAINS
SAWTOOTH RANGE
WHIPPLE MOUNTAINS
MOPAH RANGE
BILL WILLIAMS MOUNTAINS
SAN BERNARDINO COUNTY
MOHAVE COUNTY
OATMAN-TOPOCK HWY
BULLHEAD PKWY
NEEDLES HWY

N

0 3 6 9 12 Miles

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MAP 4: PROGRAM AREA ALONG THE COLORADO RIVER

Parker Dam to Imperial Dam

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PARKER DAM

ALAMO DAM

Bill Williams River (NCR)

CALIFORNIA

ARIZONA

PALO VERDE DIVERSION DAM

IMPERIAL DAM

Colorado River Indian Reservation

Parker

Blythe

Quartzite

Alamo Lake

Bill Williams River

Colorado River

- Dams
- Reach Boundaries
- State Boundaries
- 1) State of California (Parker Dam to Imperial Dam)
- 2) State of Arizona (Parker Dam to Imperial Dam)
- 3) Colorado River Indian Reservation, CA
- 4) Colorado River Indian Reservation, AZ
- 5) Palo Verde Irrigation District, CA
- 6) Rayner Ranches, AZ
- 7) North Baja Pipeline, LLC (TransCanada)
- 8) Arizona State Land Department, AZ (Parker Dam to Imperial Dam)
- 9) Cibola Valley Irrigation and Drainage District, AZ
- 10) Arizona Game and Fish Commission/Mohave County Water Authority
- 11) Hopi Tribe
- 12) GSC Farm, LLC
- 13) Cibola National Wildlife Refuge, CA
- 14) Cibola National Wildlife Refuge, AZ
- 15) Imperial National Wildlife Refuge, CA
- 16) Imperial National Wildlife Refuge, AZ
- 17) Lake Enterprises of California, LLC, CA
- 18) Yuma Proving Ground, AZ
- 19) Bill Williams River National Wildlife Refuge, AZ (NCR)
- 20) State of Arizona, Alamo Dam to Bill Williams River NWR (NCR)

* NCR (Non-Colorado River) - The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

N

0 5 10 15 20 Miles

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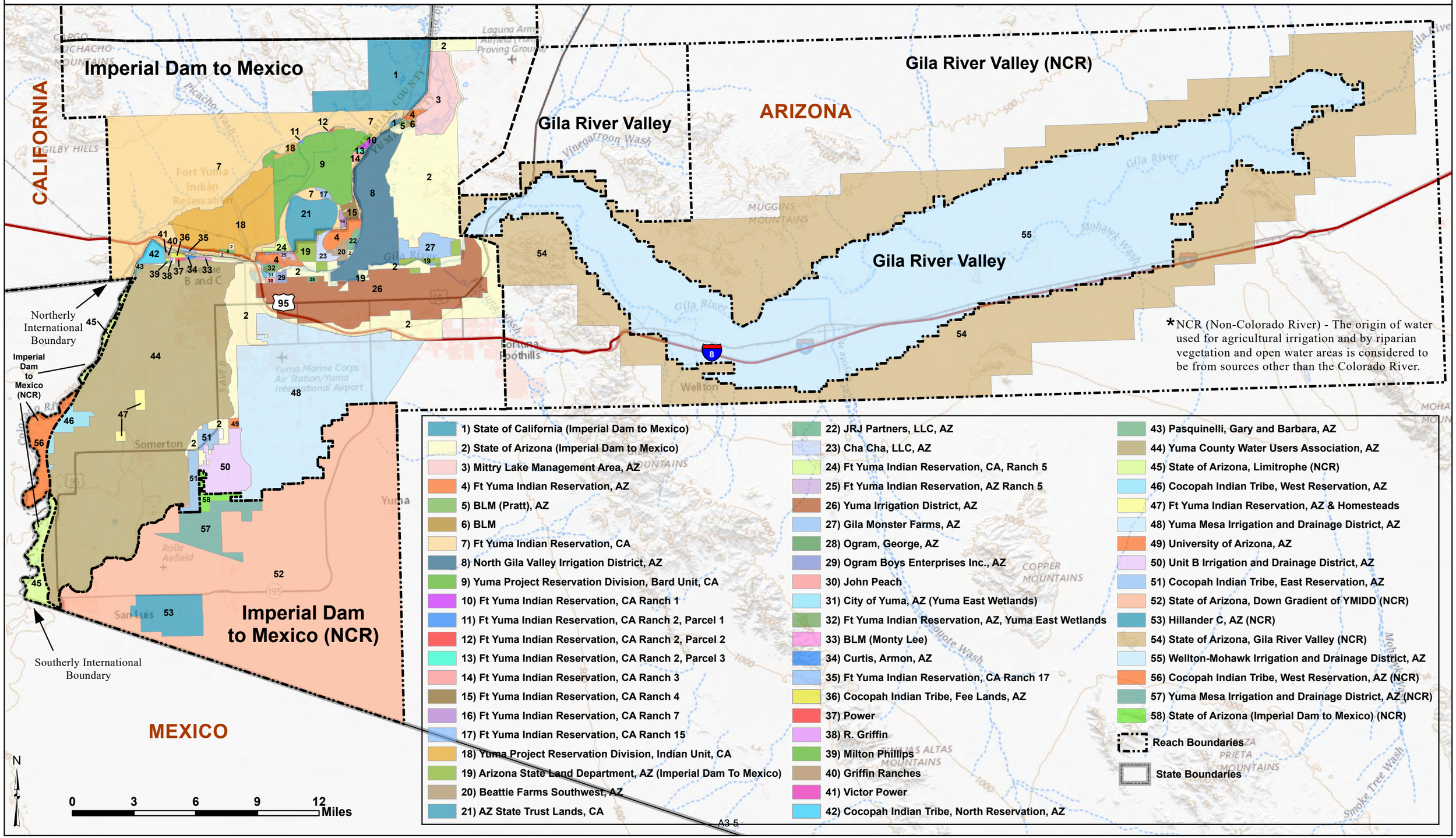
MAP 5: PROGRAM AREA ALONG THE COLORADO RIVER
Imperial Dam to Mexico



*NCR (Non-Colorado River) - The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

1) State of California (Imperial Dam to Mexico)
2) State of Arizona (Imperial Dam to Mexico)
3) Mittry Lake Management Area, AZ
4) Ft Yuma Indian Reservation, AZ
5) BLM (Pratt), AZ
6) BLM
7) Ft Yuma Indian Reservation, CA
8) North Gila Valley Irrigation District, AZ
9) Yuma Project Reservation Division, Bard Unit, CA
10) Ft Yuma Indian Reservation, CA Ranch 1
11) Ft Yuma Indian Reservation, CA Ranch 2, Parcel 1
12) Ft Yuma Indian Reservation, CA Ranch 2, Parcel 2
13) Ft Yuma Indian Reservation, CA Ranch 2, Parcel 3
14) Ft Yuma Indian Reservation, CA Ranch 3
15) Ft Yuma Indian Reservation, CA Ranch 4
16) Ft Yuma Indian Reservation, CA Ranch 7
17) Ft Yuma Indian Reservation, CA Ranch 15
18) Yuma Project Reservation Division, Indian Unit, CA
19) Arizona State Land Department, AZ (Imperial Dam To Mexico)
20) Beattie Farms Southwest, AZ
21) AZ State Trust Lands, CA
22) JRJ Partners, LLC, AZ
23) Cha Cha, LLC, AZ
24) Ft Yuma Indian Reservation, CA, Ranch 5
25) Ft Yuma Indian Reservation, AZ Ranch 5
26) Yuma Irrigation District, AZ
27) Gila Monster Farms, AZ
28) Ogram, George, AZ
29) Ogram Boys Enterprises Inc., AZ
30) John Peach
31) City of Yuma, AZ (Yuma East Wetlands)
32) Ft Yuma Indian Reservation, AZ, Yuma East Wetlands
33) BLM (Monty Lee)
34) Curtis, Armon, AZ
35) Ft Yuma Indian Reservation, CA Ranch 17
36) Cocopah Indian Tribe, Fee Lands, AZ
37) Power
38) R. Griffin
39) Milton Phillips
40) Griffin Ranches
41) Victor Power
42) Cocopah Indian Tribe, North Reservation, AZ
43) Pasquinelli, Gary and Barbara, AZ
44) Yuma County Water Users Association, AZ
45) State of Arizona, Limitrophe (NCR)
46) Cocopah Indian Tribe, West Reservation, AZ
47) Ft Yuma Indian Reservation, AZ & Homesteads
48) Yuma Mesa Irrigation and Drainage District, AZ
49) University of Arizona, AZ
50) Unit B Irrigation and Drainage District, AZ
51) Cocopah Indian Tribe, East Reservation, AZ
52) State of Arizona, Down Gradient of YMIDD (NCR)
53) Hillander C, AZ (NCR)
54) State of Arizona, Gila River Valley (NCR)
55) Wellton-Mohawk Irrigation and Drainage District, AZ
56) Cocopah Indian Tribe, West Reservation, AZ (NCR)
57) Yuma Mesa Irrigation and Drainage District, AZ (NCR)
58) State of Arizona (Imperial Dam to Mexico) (NCR)

Reach Boundaries
State Boundaries