BUREAU OF RECLAMATION

Lower Colorado River System Consumptive Uses and Losses Methods Manual 1971 – 2024

Interior Region 8: Lower Colorado Basin

U.S. Department of the Interior

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Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; 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.

Cover photo: a scenic view of the Colorado River in Grand Canyon National Park. (Reclamation)

Foreword

This manual reflects the Department of the Interior's current methods to estimate actual consumptive uses and losses within the Lower Colorado River System for the years 1971-2024. The reliability of the estimates based on these methods is affected by the availability of data and the current capabilities of data evaluation.

Summary

The methodology manual details the methods used to estimate consumptive uses and losses of water for the Lower Colorado River System for each calendar year from 1971 through 2024. This manual includes a breakdown of the methods by major types of use and explains geographical, structural, and categorical details associated with the analysis.

For additional details beyond what is described in this Methods Manual, contact the Water Accounting and Verification Group at the Lower Colorado Basin Region's Boulder Canyon Operations Office.

The methodologies described in this methods manual correspond to version 24.0 of the Lower Colorado River Basin Region's estimates of consumptive use within the Lower Colorado River System.

Contents

Maps

Definitions

Colorado River Basin: Defined in the Colorado River Compact of 1922 as all the drainage area of the Colorado River System and all other territory within the United States of America to which waters of the Colorado River System shall be beneficially applied.

Colorado River System: Defined in the Colorado River Compact of 1922 as that portion of the Colorado River and its tributaries within the United States.

Colorado River Tributaries: Major rivers and associated watersheds that naturally drain into the Colorado River. For the purpose of this report "tributary water" is water that is sourced from the Lower Colorado River System but not diverted from the mainstream of the Colorado River.

Consumptive Uses and Losses: A depletion of surface or groundwater due to human activity, including interbasin transfers. Within the report, this term is used interchangeably with 'consumptive use'.

Effective Precipitation: Precipitation that is available to meet evapotranspiration (ET) requirements of crops.

Flow Node: Bureau of Reclamation specific stream gaging locations that represent a drainage area for modeling the natural flow of the Colorado River.

Fullness Factor: A coefficient used to adjust a maximum reservoir surface area to an average annual reservoir surface area.

Incidental Use: Consumptive use resulting from phreatophytes in and along canals and laterals, and evaporation from the canals and laterals.

Lower Colorado River Basin: Defined in the Colorado River Compact of 1922 as those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System below Lee Ferry.

Lower Colorado River System: Those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry.

Mainstream: The main channel of the Colorado River downstream of Lee Ferry within the United States, including the reservoirs behind dams on the main channel, and Senator Wash Reservoir off the main channel.

Return Flow: Mainstream water that has been diverted and which flows back to the Colorado River or the Colorado River Aquifer as measured or unmeasured flow and is available for use in the United States or in satisfaction of the 1944 Water Treaty[1] obligation

DISCLAIMER:
Defined terms are provided as general information and are not intended to change, modify, or interpret the laws, rules, decrees, agreements, and treaties from which they are originally derived

[1] Referring to the *Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande Treaty between the United States of America and Mexico*, signed on February 3, 1944.

1. Introduction

The Colorado River System Consumptive Uses and Losses (CUL) Reports present estimates of the annual anthropogenic consumptive uses and losses from the Colorado River System. This manual explains the methodology that was used in the 1971-2005 Lower Colorado River System recalculation effort, and the Lower Colorado River System portion of the CUL data associated with 2006 – 2024.

1971 to 2024 Lower Basin CUL data were calculated in two separate efforts, with the first effort covering the years 1971 to 2015, and the second effort spanning from 2016 to 2024. The manual will highlight any modifications to methodologies between these two periods.
The manual will provide clear explanations on how Lower Basin CUL data were developed. Many procedures were adapted from past CUL reports and might be used for future CUL reports. The methods in this manual specifically address the Lower Colorado River System data. A separate manual is available for the Upper Colorado River System's CUL calculations.

Lower Basin CUL data are reported at the mainstream and tributary level in the CUL Report. This manual explains the process for determining mainstream consumptive use, however, mostly focuses on the methodologies of the tributary use categories. In the tributary areas of the basin, records of diversions and return flows are not complete enough to allow direct calculation of consumptive water use. As a result, the tributary data contained within this report are based almost entirely on data obtained from ongoing programs and/or historical reports and generally relied on theoretical and indirect methods of estimating consumptive use.

Categories of use within the CUL Report are listed in **Table 1: Categories of Use in the Consumptive Uses and Losses Report**. A category of use was assigned to mainstream water use based on the predominant use of diverted water. For tributary areas, each category had a specific methodology associated with estimating consumptive use for that category.

Mainstream Categories of Use (category assigned to mainstream diversion data)	**Tributary Categories of Use** (data estimated based on category specific methodology)
Export Outside System Export Within System Agriculture Municipal and Industrial Thermal Electric Power Mainstream Reservoir Evaporation	Export Outside System Export Within System Irrigated Agriculture Stockpond Evaporation Livestock Mineral Resources Municipal and Industrial Other Thermal Electric Power Reservoir Evaporation (measured and unmeasured

Table 1: Categories of Use in the Consumptive Uses and Losses Report

Consumptive use data in the New Mexico portion of the Gila River Basin were reported by the New Mexico Interstate Stream Commission and do not necessarily follow the methodologies described within this manual.

If additional details beyond what is described in this methodology manual are needed, please contact the Lower Colorado Basin's Boulder Canyon Operations Office's Water Accounting and Verification Group.

2. Geographic Boundaries

Geographic boundaries at a variety of scales were required for making CUL estimates. The largest boundary is the CUL Report boundary, followed by reporting areas, the mainstream vs tributary boundaries, states, counties, and 8-digit hydrologic unit codes[2] (HUC8, subbasin). Geographic boundary data were stored in an ESRI Geographic Information System (GIS) geodatabase using coordinate reference system NAD 1983 UTM 12N.

2.1. Consumptive Uses and Losses Report Boundary

The Lower Colorado River hydrologic basin boundary is defined by the United States Geological Survey (USGS) designated 2-digit hydrologic unit 15 (HUC2, region, Lower Colorado Region). This boundary was generally used as representative of the Lower Colorado

[2] USGS 8-digit hydrologic unit codes (HUC8), or subbasins. The USGS watershed boundaries were based on the USGS Watershed Boundary Dataset. USGS HUC boundaries are available at: https://apps.nationalmap.gov/downloader/

River System, however, given the nature of the report, there were a few revisions that were made to the HUC2 boundary.

1. The 4-digit hydrologic unit 1508 (HUC4, subregion, Sonora) was excluded because it drains directly towards the Gulf of California. This includes 7 subbasins: Tule Desert (15080103), Rio Sonoyta (15080102), San Simon Wash (15080101), Rio De La Concepción (15080200), Whitewater Draw (15080301), San Bernardino Valley (15080302), and Cloverdale (15080303).
2. For the purposes of this report, the CUL Report Boundary only includes areas in the United States. The portions of Upper Santa Cruz subbasin (15050301) and Upper Santa Pedro subbasin (15050202) in Mexico were removed from the study area, even though they drain to the Colorado River. Additionally, the portion of the Yuma Desert (15030108) in Mexico was excluded.
3. Additionally, the CUL Report Boundary does not include closed hydrologic subbasins located within the Lower Colorado Region. As a result, the Wilcox Playa (15050201) and the Animas Valley (15040003) were not included in the analysis.

The extent of the study area for the report is shown in **Map 1: Subbasins (HUC8s)**.

2.2. Reporting Areas

Tributary areas are broken up by "reporting areas" which are defined as the areas drained by the major tributaries of the Colorado River. Consistent with past reports, tributary reporting areas include: Tributary Area Above Lake Mead, Tributary Area Below Lake Mead, Little Colorado River, Virgin River, Muddy River, Bill Williams River, and the Gila River. Areas along the River that source water from the mainstream of the Colorado River are excluded from the tributary reporting areas and water use in this area is reported as mainstream water use.

2.3. Mainstream and Tributary Boundaries

Lower Basin CUL data are reported as either mainstream or tributary use. The distinction between mainstream and tributary CUL data is based on the source of water.

Two separate mainstream boundaries were developed from contract service areas[3], one for agricultural purposes and another for M&I Other purposes. Contract service boundaries can be found in the *Colorado River Accounting and Water Use Report: Arizona, California, and Nevada* (Water Accounting Report)[4]. For each mainstream boundary, contract areas using exported water (the Central Arizona Project (CAP)) were excluded because that water is

[3] As part of the Secretary of the Interior's role as water master in the lower Colorado River Basin, the United States, through the Secretary of the Interior, enters into contracts with users, granting them authorization to beneficially use Colorado River water. There are contract service areas associated with these contracts, which were used to delineate between mainstream water use and tributary water use.
[4] Annual Water Accounting Reports are available at: https://www.usbr.gov/lc/region/g4000/wtracct.html.

included in the export category. Most modifications to the contract service areas were minor, however differences of note include;

1. The boundary used for agricultural analysis and is reflected in **Map 2: Lower Colorado River System Reporting Areas** and does not include contract areas where there is no agriculture, such as the Yuma Proving Grounds.
2. The boundary used for M&I other analysis is reflected in **Map 4: Municipal and Industrial Other Water Use Coefficients**. Contractor Unit B uses mainstream water for irrigated agriculture and tributary water for municipal and industrial purposes. As a result, areas in the southern Yuma area, especially those using wells for domestic water, were removed for the M&I Other mainstream boundary. Additionally, the Southern Nevada Water Authority (SNWA) boundary was modified to cover the Las Vegas Valley as shown in the 2019 Las Vegas Valley Groundwater Pumpage Inventory Report. Tributary water use in this area was determined independent from the rest of the basin, as described in the **Las Vegas Area Tributary Municipal and Industrial Other** section.

2.4. Political and Statistical Boundaries

All political boundaries and/or statistical boundaries, including state, county, and census block were sourced from the U.S. Census 2010 Topologically Integrated Geographic Encoding and Referencing (TIGER) lines.[5] The 1990 and 2000 census data were available in a 2010 format. 2020 data did not include changes to the county lines, however there were small changes in state boundaries, but none of the population block centroids (point locations) were affected. Resultantly, the 2010 political boundaries were used for the entire period.

2.5. Spatial Unit Conversions

Due to different spatial units of source data such as reporting area, county, HUC8, census block, etc., conversion from the source data's spatial extent to the spatial units used for calculating the data in the CUL Report was required. In general, the spatial unit used in the tributary CUL calculations was State-Flow Node[6]-HUC8, referred to as "NODE CODES" in the dataset.[7] In certain cases, data was calculated at the County-Flow Node-HUC8 scale and was summed to the State-Flow Node-HUC8 scale. In general, conversion between spatial units was done on a proportional basis, with specific conversion methodologies and assumptions mentioned in the respective water use category section of this manual.

[5] U.S. Census 2010 TIGER lines available at: https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.2010.html
[6] Referring to Bureau of Reclamation (Reclamation) Flow Nodes. Flow Nodes are specific stream gaging locations that represent a drainage area for modeling the natural flow of the Colorado River. There are three areas where the flow node areas do not match HUC8 boundaries as seen in **Map 3: Flow Node Basins and Reporting Areas.**
[7] NODE CODES are formatted as "State Code-Downstream Flow Node Code-HUC8 Code" (State-Flow Node-HUC8).

3. Mainstream Consumptive Use

Mainstream consumptive use data were sourced from the annual Water Accounting Report published by Reclamation. Mainstream consumptive use data are reported in the CUL Report at the state level, except for mainstream reservoirs, which are reported as "System Water". Minor adjustments to the values published in the Water Accounting Report were made, where applicable, as discussed below.

3.1. Water Accounting Report

The CUL Report is distinct from Reclamation's annual Water Accounting Report. The Water Accounting Report contains the official record of diversions of water from the mainstream, return flow of such water to the stream as is available for consumptive use in the United States or in satisfaction of the 1944 Water Treaty[8] obligation, and consumptive use of such water for each year since 1964. The Water Accounting Report is mandated by Article V of the Consolidated Decree of the United States Supreme Court in *Arizona* v. *California* et al. 547 U.S. 150 (2006). Historical data contained within the Water Accounting Report were incorporated into the CUL dataset, with slight revisions, where applicable. It is important to note that the two reports have different legal authorities and serve different purposes. The Water Accounting Report is concerned with diversions and consumptive uses from the mainstream, and the CUL Report is concerned with all anthropogenic uses and losses of water in the entire Colorado River System, which includes areas that use mainstream water as well as tributary areas.

Within the CUL Report, water use from the mainstream of the Colorado River is reported separately from water use from tributaries to the Colorado River. Mainstream diversion data are reported by state within the Water Accounting Report, and resultantly, mainstream water use is reported by state in the CUL Report. The values from the Water Accounting Reports were reviewed for accuracy and consistency across years. Where errors were found, values were revised to reflect the most accurate data. Unmeasured return flows were included for the full period of record and values were checked to confirm consistency with the CUL Report's definition of consumptive use. Finally, each user was assigned a water use category based on their predominant use of water diverted from the mainstream.

In addition to mainstream use, data on deliveries to Mexico in satisfaction of 1944 Water Treaty requirements, on water bypassed pursuant to Minute 242[9] and on water passing to Mexico in excess of the 1944 Water Treaty were included. These data were sourced directly from the Water Accounting Report for each year and were not assigned a use category.

[8] Referring to the *Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande Treaty between the United States of America and Mexico*, signed on February 3, 1944.
[9] Referring to *Minute Number 242, Permanent and Definitive Solution to the International Problem of Salinity of the Colorado River*, signed on August 30, 1973.

3.2. Reporting Differences

Extensive review of the Water Accounting Reports was conducted to make sure the correct values were reported in the CUL Report. In some instances, values reported in the Water Accounting Report were modified for the Consumptive Uses and Losses Report.

Monthly Adjustments and Published Errors

On occasion a value reported in the Water Accounting Report would be revised in a subsequent year's report. This means that an error in a value originally published in the 2000 Water Accounting Report, for example, that was corrected in 2001, would be included in the published 2001 Water Accounting Report. These revisions result in occasional discrepancies when comparing CUL data directly to data reported in the Water Accounting Report for a given year.

There were instances where the monthly values, as reported in the Water Accounting Report, did not add up to the yearly values. Where this was due to a rounding error, and the errors were less than a few acre-feet, the monthly values were used as published. If the monthly values did not add up to annual values due to typos and errors, the state totals were compared for each month. If there was a simple solution to a typo or error, then the error was corrected using the reported totals. Some errors did not have a simple solution and an additional review specific to the error was used to improve values based on the best available information. Finally, some users only reported annual values and if monthly values were not published then the annual value was divided by 12 to estimate the monthly value.[10]

Unmeasured Return Flows

Additional modifications were made to values published in the Water Accounting Report due to the inclusion of unmeasured return flows at the user level beginning in 2003.

Unmeasured return flows are mainstream water that has been diverted and flows back to the Colorado River or the Colorado River Aquifer. Because they are not measured, user-specific factors or coefficients are used to estimate these returns. Diversions are reduced by returns (both measured and unmeasured) to determine consumptive use.

Unmeasured return flows were included at the state level prior to 2003 and resultantly, unmeasured return flows prior to 2003 were recalculated back to 1971 to keep mainstream reporting as consistent as possible.

Beginning in 2003, water users were assigned an unmeasured return flow coefficient. Where possible, the water user's coefficient was applied retroactively to estimate unmeasured return flows for all years prior to 2003. There were a few users with variable unmeasured return flow coefficients. In those situations, an average of available years was used to estimate a coefficient for years prior to 2003. There were some users who were removed prior to 2003

[10] Monthly values were generated for modeling purposes. Data in the report are reported on an annual time step.

and were therefore not assigned an unmeasured return flow coefficient. Additionally, there were some users for which an unmeasured return flow coefficient was not 'officially' assigned because their own contract was established after unmeasured return flow factors went into effect. In these cases, those users' coefficients were based on the coefficients of neighboring users.

Consumptive Use Definition

The definition of "consumptive use" in the CUL Report and "consumptive use" in the Water Accounting Report are slightly different. The CUL report is concerned with anthropogenic consumptive uses and losses from the system, and the Water Accounting Report is concerned with water diverted and returned to the Colorado River mainstream.

An example of how these differing definitions show up in the data is how Colorado River water banked in the Las Vegas Valley is reported. In any year, Nevada may store some of its Colorado River water allotment underground in the Las Vegas Valley for future use. The Water Accounting Report shows the stored water as a consumptive use in the year it was stored because it has been removed from the Colorado River mainstream. The CUL Report does not show this as a consumptive use in the year it was stored because the water remains in the system until it has been pumped out of the ground. The Water Accounting Report shows the month of storage and the month of withdrawal from storage, and this information is used to adjust the Water Accounting Report consumptive use values for Nevada to match the definition of consumptive use as defined by the CUL Report.

3.3. Mainstream Water Use Categories

The Water Accounting Report does not assign a category of use to diverted water. However, CUL data must be assigned a specific water use category for the CUL Report, see **Table 1: Categories of Use in the Consumptive Uses and Losses Report**. Resultantly, a water use category was assigned to each withdrawal point listed in the Water Accounting Report. The use category was based on the presumed primary use of water at each diversion point. Some users have multiple withdrawal points so those users have the potential for multiple use categories. If a user had multiple use categories, then the returns and consumptive use data were split to reflect the multiple categories. The split was done on a proportional basis based on the withdrawals. It was assumed that the measured returns, unmeasured returns, and consumptive use were proportionally the same as the withdrawals. The consumptive use was then summed for each category and for each state.

4. Mainstream Reservoir Evaporation

The mainstream reservoir water use category quantifies evaporative losses from reservoirs located on the mainstream. This includes the major reservoirs located in the Lower Colorado River System as well as Senator Wash reservoir and five diversion dams. This consumptive use was not assigned to a certain HUC8, reporting area, or state and is reported as "system water" in the dataset.

Reservoirs cause an artificial increase in open water available for evaporation and that increase in evaporation is considered a consumptive use. There are numerous open water evaporation categories in the CUL Report, with the largest being mainstream reservoir evaporation. For all open water evaporation categories, consumptive use for open water bodies is defined as the volume of net evaporation. Net evaporation is the gross evaporation minus precipitation. Precipitation is subtracted from gross evaporation to account for natural evapotranspiration (ET) that would have occurred if the reservoir did not exist. This concept was used for all evaporation categories in the CUL Report and is shown in **Equation 1**.

Equation 1

$$Reservoir\ ET_{net} = Reservoir\ ET_{gross} - Precipitation$$

Precipitation data was sourced from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) model produced by the PRISM Climate Group at Oregon State University.[11] This gridded model provides monthly values of precipitation at 4km grid cell resolution over the contiguous United States for the full period of record. To reduce file size, the raster files were trimmed so that only the area around the Lower Colorado River System was included. The raster files were projected into NAD 1983 12N for consistency with other GIS data. Starting with the 2016 CUL data, PRISM data was accessed using Google Earth Engine (GEE) (Gorelick et al. 2017), and raster files were not downloaded or filed.

4.1. Major Mainstream Reservoirs

Large mainstream reservoirs include Lake Mead (Hoover Dam), Lake Mohave (Davis Dam), and Lake Havasu (Parker Dam). Each of these reservoirs has gross evaporation measurements within Reclamation's Hydrologic Database (HDB). [12]

Precipitation data was gathered from the PRISM model at the location of the dam. Lake Mead has surface area measurements in HDB. Lake Mohave and Lake Havasu have elevation data in HDB and Reclamation's Lower Colorado River Operations Group provided elevation-surface area curves to calculate surface area.[13] Consumptive use for all major reservoirs was calculated by multiplying the surface area of each reservoir by the difference between gross evaporation and precipitation.

[11] PRISM data available for download from Oregon State University at: https://prism.oregonstate.edu/.
[12] Data available at: https://www.usbr.gov/lc/region/g4000/riverops/_HdbWebQuery.html using the following Site-Datatype IDs (SIDs): Lake Mead Surface Area (SID 2157), Lake Mead Evaporation (SID 1776), Lake Mohave Elevation (SID 2100), Lake Mohave Evaporation (SDI 1777), Lake Havasu Elevation (SID 2101), Lake Havasu Evaporation (SID 1778).
[13] Elevation-area curves were updated for Lakes Mohave and Havasu. The updated curves were published in 2025 and applied to the 2016-2024 data.

4.2. Senator Wash

Senator Wash is a relatively small reservoir when compared to the other reservoirs in the mainstream reservoirs category. Evaporation measurements were not available for Senator Wash. Therefore, surface area was calculated using reservoir elevations and an elevation-surface area table. The net evaporation rate was calculated using the same methods outlined in the **Unmeasured Reservoir Evaporation** section. Surface area was multiplied by the net evaporation rate to calculate monthly consumptive use.

4.3. Diversion Dams

The CUL Report includes five diversion dams along the mainstream of the Colorado River: Headgate Rock, Palo Verde, Imperial, Laguna, and Morelos. These dams are treated similar to unmeasured reservoirs, however do not use the surface area measurements from the National Inventory of Dams (see **Unmeasured Reservoir Evaporation**). Instead, these reservoirs have surface area estimates made by Reclamation which were used to calculate previously published CUL data. These surface area estimates were reevaluated using historical aerial imagery. Surface areas for Palo Verde and Imperial were modified based on the analysis. The surface areas used in the calculations were as follows: 800 acres for Headgate Rock; 110 acres for Palo Verde; 4,680 acres for Imperial; 70 acres for Laguna; and 80 acres for Morelos.

Because the CUL Report only reports anthropogenic consumptive use, the surface area of each reservoir was reduced in proportion to the surface area of the original channel. This is the same methodology that was used for the previous CUL reports. The reduction percentages used were based on the original size of the channel and the surface area of water behind the dam. Consistent with past CUL Reports, the reduction percentages were: 25% for Headgate Rock, 80% for Palo Verde, 25% for Imperial, 90% for Laguna, and 50% for Morelos.

The net evaporation for the diversion dams was calculated using the methods described in the **Unmeasured Reservoir Evaporation** section. The net evaporation was multiplied by the reduced surface areas to find consumptive use. The consumptive use for all diversion dams was summed into a "Diversion Dam" category as reported in the CUL Report and was reported as part of mainstream reservoir evaporation.

5. Tributary Reservoir Evaporation

In addition to the mainstream reservoirs, there are many tributary reservoirs in the Lower Colorado River System. While the evaporative consumptive use from all reservoirs is calculated using the same net-evaporation concept (where gross evaporation is reduced by precipitation to derive net evaporation), there were differences in the amount of data available for certain reservoirs, resulting in slightly different methodologies for determining consumptive use depending on the source data. Tributary reservoirs were grouped into two broad categories, measured reservoirs, which have daily or monthly measurements of evaporation or surface area, or unmeasured reservoirs, or reservoirs without evaporation or time-dependent surface area data.

5.1. Measured Reservoir Evaporation

There were a handful of tributary reservoirs where the operator of the reservoir provided evaporation measurements or surface area measurements that could be used to estimate evaporation. These "measured reservoirs" were all within Arizona and were generally larger than the reservoirs contained within the **Unmeasured Reservoir Evaporation** section. The reported measurements varied depending on the reservoir. Historical measurements were provided by U.S. Army Corps of Engineers (USACE), USGS, Salt River Project (SRP), or CAP, depending on the organization managing the reservoir. Reservoirs, their associated dam, the managing agency that provided data associated with the reservoir, and the HUC8 where the evaporation is reported in the CUL report are documented in **Table 2: Measured Reservoirs**.

Reservoir Name	Dam Name	Data Source	HUC8 CODE
Alamo Lake	Alamo Dam	USACE	15030204
Lake Pleasant	Old Waddell Dam /New Waddell Dam	CAP	15070102
Apache Lake	Horse Mesa Dam	SRP	15060106
Bartlett Lake	Bartlett Dam	SRP	15060203
Canyon Lake	Mormon Flat Dam	SRP	15060106
Horseshoe Lake	Horseshoe Dam	SRP	15060203
Saguaro Lake	Stewart Mountain Dam	SRP	15060106
Theodore Roosevelt Lake	Theodore Roosevelt Dam	SRP	15060105
Painted Rock	Painted Rock Dam	USACE	15070101
San Carlos	Coolidge Dam	USGS	15040005
CC Cragin (Blue Ridge)	CC Cragin (Blue Ridge)	USGS	15020008

Table 2: Measured Reservoirs

5.1.1. Reservoirs With Evaporation Measurements

Reservoir-specific evaporation data was available for eight reservoirs. This included the six SRP reservoirs, Alamo Lake, and Lake Pleasant. Of these reservoirs, only Lake Pleasant reported net evaporation for the entire study period.[14] Net evaporation data was provided for the SRP reservoirs for 2015-2024. Otherwise, all other reservoirs used precipitation data from the PRISM model to determine net evaporation. If the record was incomplete, then averages from available months were used to fill in the missing data, or values were linearly interpolated between neighboring data.

[14] Average evaporation data from Lake Pleasant were used for all years prior to 1992. New Waddell Dam replaced Old Waddell Dam in 1994, resulting in an increase in surface area. Average evaporation values decreased proportionally to the surface area prior to the New Waddell Dam being built.

5.1.2. Reservoirs Without Evaporation Measurements

There were three reservoirs where the operator did not report historical evaporation measurements. The first was Painted Rock which is managed by the USACE and had surface area measurements. The other two, the San Carlos and C.C. Cragin (formerly Blue Ridge) Reservoirs were measured by the USGS and included historical elevation measurements. Using reservoir-specific area-capacity and elevation-capacity tables, surface area for these reservoirs was calculated.

These reservoirs follow the **Unmeasured Reservoir Evaporation** process except that they have a variable surface area. The PRISM and pan evaporation model values were used to calculate the net evaporation rate. The net evaporation was multiplied by the surface area to calculate consumptive use.

5.1.3. Measured Reservoirs Final Calculation

Evaporative losses from the CAP Canal were added to the final measured tributary reservoir evaporation numbers. The CAP reports about 16,000 acre-feet of losses each year from the aqueduct.[15] This number was tapered between 1985, when water was first withdrawn by the CAP, and 1993, when the project was declared substantially complete, to reflect the ongoing construction and improvement of the aqueduct during this period. Annual values were distributed to monthly values based on the average monthly evaporation of Lake Pleasant.

All reservoirs were assigned a HUC8. The measured reservoir evaporation data were summed by State-Flow Node-HUC8. If multiple reservoirs were located within one HUC8, their evaporation volume was summed together and reported as a total for that State-Flow Node-HUC8. Theodore Roosevelt Lake covers part of two State-Flow Node-HUC8s but was included in the Tonto subbasin (15060105) for simplicity. Evaporation from the CAP Canal is recorded in the Agua Fria subbasin (15070102).

5.2. Unmeasured Reservoir Evaporation

Unmeasured reservoirs are reservoirs that have no published evaporation data or time-dependent surface area and elevation data. For these reservoirs evaporation data was calculated using free water surface (FWS) evaporation estimates and modeled precipitation data based on the point location of the dam associated with the reservoir.

Gross evaporation was sourced from a pan evaporation map created by the National Oceanic and Atmospheric Administration (NOAA).[16] The original data was digitized into a raster file by the National Weather Service (NWS).[17] There are 12 FWS evaporation rasters, one for each month. These maps were trimmed, projected into NAD 1983 12N and stored with the GIS files. Use of the pan evaporation model is consistent with past CUL reporting methodologies.

[15] Information on the CAP available at: https://www.cap-az.com/about/faq/
[16] NOAA technical report NWS; 34 available at: https://repository.library.noaa.gov/view/noaa/7050
[17] Raster data based on the NOAA technical report NWS; 34 available at: https://cida.usgs.gov/thredds/ncss/mows/pe/dataset.html

5.2.1. National Inventory of Dams

Dam point locations were sourced from the National Inventory of Dams (NID) database,[18] which is published by the USACE. The NID includes data on dams in the Lower Colorado River System and was used to identify reservoirs that were not already included in the mainstream reservoirs or tributary measured reservoirs sections. To effectively use data from the NID, certain reservoirs had to be removed, and each dam in the NID was assigned a designation of whether it was included as part of the unmeasured reservoir calculations. Measured reservoirs and mainstream reservoirs were excluded from the unmeasured reservoirs calculations. This was done one at a time by looking up the dam's name and checking the dam's locations using GIS files and satellite imagery. Additionally, dams with the purpose code for tailings were removed because it was assumed that CUL associated with those dams was accounted for in the mineral resources category. Removing other dams required a visual inspection using satellite imagery. There were some dams with poor coordinates which were removed because they could not be modeled. There were other dams that were removed because their reservoirs had been silted in or breached and no longer stored water. Dams used for thermal electric power (TEP) or a wastewater treatment plant were also removed. Some dam locations were moved based on incongruities between NID coordinates and imagery.

A detailed review of imagery was conducted between calculating the 1971-2015 and 2016-2024 dataset resulting in slight modifications to dams and dam locations. The impact on resultant consumptive use by unmeasured reservoirs is hardly noticeable.

FWS values were added at each dam location using ArcGIS Pro. Because the FWS model did not completely cover some areas of the U.S, there were a few dams that were manually moved slightly so that they were over the FWS rasters. Once every point was on the FWS rasters then the FWS values were added to each dam location. Monthly PRISM precipitation values were added using ArcGIS Pro (1971-2015) or GEE (2016-2024).

5.2.2. Unmeasured Reservoirs Final Calculation

Data from the National Hydrologic Database (NHD)[19] were included and were used to supplement and check data in the NID.

Most of the dams included in the NID have a surface area acreage for each reservoir, which was used when available. If the NID did not publish the surface area, then the NHD was referenced for the surface area of the reservoir. There were some dams which did not have a surface area provided by either the NID or the NHD. If a published surface area was not found, then the reservoir was inspected using imagery and a polygon was drawn around the surface area of the reservoir, near the high-water mark, and the surface area was calculated for that polygon.

A fullness factor was applied to each of the reservoirs to represent the average surface area of the reservoir throughout the year, as few reservoirs are maintained at capacity. Different types

[18] The NID database published in 2020 was used for the 1971-2015 analysis. A 2025 version of the NID was used for 2016-2024 analysis. NID data available at: https://nid.sec.usace.army.mil/#/
[19] NHD data available for download from the USGS at: https://apps.nationalmap.gov/downloader/

of reservoirs are operated differently, so the fullness factors listed in the NID were based on the primary use of the reservoir.

- Hydroelectric and water supply reservoirs were assigned a 0.75 fullness factor because those likely remain full for a larger portion of the year.
- Flood control and grade stabilization dams were given a 0.05 fullness factor because these are empty for most of the year.
- All other use categories were assigned 0.5 as the fullness factor.

The NID includes the first and last year of operation for each reservoir. The resultant years of operation were used to make sure a reservoir was included in the calculations only during operational years.

Net evaporation was found by subtracting the PRISM precipitation values from the gross evaporation values. The net evaporation was multiplied by the surface area to find the volume of net evaporation. The volume was then multiplied by the fullness factor for years when the reservoir was operational. These calculations resulted in the consumptive use for every reservoir. The final consumptive use values were summed by State-Flow Node-HUC8.

6. Exports

Exports are defined as water that is moved from one reporting area to another[20] (intrabasin export) or is removed from the Lower Colorado River System for eventual domestic delivery (interbasin export). For water moving between reporting areas or leaving the system, the water is reported as a consumptive use in the reporting area where it is removed. If the water is moved to another reporting area within the Colorado River system, it is reported as a negative consumptive use in the reporting area where it is delivered. Exports are reported as the total quantity that is removed or delivered and no additional details are provided.

6.1. Mainstream Exports

Mainstream exports are sourced from Reclamation's Water Accounting Reports and make up the majority of the exports category. This includes water delivered to Southern California and Central Arizona. Exports to Central Arizona are made via the CAP and are an intrabasin export. Water from the mainstream is imported to the Gila River Reporting Area via the CAP.[21] This water is considered an export from the mainstream ("positive" consumptive use) and an import to the Gila River Reporting Area ("negative" consumptive use). CAP deliveries to the Gila River Reporting Area are displayed as "Imports within Hydrologic Basin" as seen in **Map 2: Lower Colorado River System Reporting Areas**.

[20] Exports are calculated and reported in the dataset at the HUC8 scale.
[21] Water imported via the CAP is reflected in the Agua Fria subbasin (15070102) in the dataset.

Water used by Las Vegas is an exception to the exports definition. While the water crosses a HUC8 boundary as it is pumped out from Lake Mead to the Las Vegas Valley, the CUL Report does not include it as an export. Some of that water is delivered to Boulder City, which is outside of the Colorado River System. Boulder City's water use is shown as M&I Other consumptive use in the Las Vegas Valley rather than an interbasin export to Eldorado Valley (Boulder City).

6.2. Tributary Exports

Tributary exports are much smaller than the mainstream exports. There are two interbasin and three intrabasin exports included in the report.

The first interbasin tributary export is in Utah where water from a tributary to the Santa Clara River is diverted through a tunnel into Pinto Creek. This is a small diversion used as supplementary irrigation water. This diversion was measured by the USGS until they removed their gage in 1995 (USGS ID: 09408500).[22] Based on discussions with water managers in Utah, the CUL data maintains this diversion even after the gage was removed. CUL data after 1995 estimates this diversion by repeating the average monthly diversion from the available record. The other interbasin export is an export reported by New Mexico to Silver City, NM and was reported as part of the New Mexico - Gila calculations.

There were two intrabasin transfers in Arizona that have measurements from the USGS. One is on the East Verde River and the other is on Forestdale Creek. Forestdale Creek (USGS ID: 09495000) diversions ended in 2005. The East Verde River diversions were ongoing through 2024 (USGS ID: 09507580).

The report includes another intrabasin transfer which was the result of a pipeline transporting a coal slurry from the Black Mesa Coal Mine in northeastern Arizona to the Mohave Generating Station in Laughlin, Nevada. This transfer was not directly measured by the USGS, however the USGS reports groundwater withdrawal data by the mine.[23] The exported volumes were estimated by using the annual groundwater withdrawal volume by the mining company and subtracting the estimated volume of water used for mining operations onsite. The export ended in 2005, after the Mohave Generating Station shut down, which allowed for estimation of onsite water use.

7. Tributary Stockponds and Livestock

Evaporation from stockponds and water use by livestock are reported together in the CUL Report. The two categories are calculated separately and while they remain separated in the dataset, the tables of the report combine the two categories.

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[22] USGS surface water data accessed here: https://waterdata.usgs.gov/nwis
[23] U.S. Geological Survey Scientific Investigations Report 2017-1127

7.1. Stockponds

The total surface area of stockponds are based on a 1975 NRCS report which reported stockpond area by groups of counties.[24] The surface areas reported in the 1975 NRCS report were analyzed during previous CUL efforts (CUL Reports containing 2005 data and earlier) and were distributed to a total surface area for each reporting area. Total acreage, adapted from the 1975 NRCS report are included in **Table 3: Stockpond Acres Per Reporting Area**.

Reporting Area	State	Stockpond Acres
Little Colorado River	AZ	2330
Gila River	AZ	5040
Mainstream Above Lake Mead	AZ	880
Mainstream Below Lake Mead	AZ	650
Bill Williams River	AZ	160
Virgin River	AZ	40
Mainstream Above Lake Mead	NV	140
Muddy River	NV	130
Little Colorado River	NM	380
Gila River	NM	360
Virgin River	UT	180

Table 3: Stockpond Acres Per Reporting Area

These reporting area surface areas were distributed to the State- Flow Node-HUC8 level. This was estimated based on the proportion of State-Flow Node-HUC8 area to total reporting area.

Evaporation from stockponds was calculated using net evaporation, similar to the reservoir evaporation categories. To calculate stockpond evaporation, the mean precipitation for every State-Flow Node-HUC8 was calculated based on the PRISM values. Additionally, mean gross evaporation was calculated using the FWS values. Using the precipitation and gross evaporation data, the mean net evaporation for every State-Flow Node-HUC8 for the full period of record was calculated. The stockpond surface area and stockpond net evaporation rate were multiplied to find the total consumptive use for stockponds.

7.2. Livestock

Consumptive use of water by livestock is the second part of the stockpond and livestock category. Livestock consumptive use is calculated using a per-animal use coefficient (in gallons per head per day) multiplied by the number of livestock.

[24] Source file: "U.S. Soil Conservation Service, 1975, Livestock water use: 41 p."

The livestock use coefficients were slightly updated from those used in previous CUL reports. Included in the updates was the addition of horses, ponies, mules, burros, donkeys, and goats to the livestock calculation, which were not included in previous reports.

There were two coefficients for each animal type. The first was for areas where the climate is generally warmer, which included the Mainstream Below Lake Mead reporting area, the Bill Williams River reporting area, and the Yuma County and Maricopa County portions of the Gila River Reporting Area. All other areas were considered to have a generally cooler climate and were assigned the other coefficient which used slightly less water.

Livestock Water Use Coefficients	
Livestock	**Gallons per head per day** (Hotter location coefficient/Cooler location coefficient)[25]
Beef Cattle	15/12
Dairy Cattle	44/35
Sheep	3/2
Hogs	5/3
Horses, ponies, mules, burros, and donkeys	15/12
Goats	3/2

Table 4: Livestock Water Use Rates

The number of livestock came from the USDA Agriculture Census[26] which is released every five years. The USDA Agriculture Census includes the number of animals by type for each county.[27] The county scale values were fit to the same State-Flow Node-HUC8 scale used for other CUL calculations.

First, livestock values for counties with a portion of their area outside of the Lower Colorado River System had to be adapted. The portions of the counties outside of the boundary were removed on an area percentage basis. Resultantly, the percentage of county area inside the boundary was multiplied by the number of livestock in the county. This process assumed the livestock are distributed evenly across the county. **Equation 2** expresses how livestock values for counties with a portion of their area outside of the Lower Colorado River System were modified:

[25] Areas that used the hotter location coefficient: Bill Williams Reporting Area, the Trib Below Lake Mead Reporting Area, and the Maricopa and Yuma County portions of the Gila Reporting Area. All other areas used the cooler location coefficient.
[26] USDA Agricultural Census Reports and data available at: https://www.nass.usda.gov/AgCensus/
[27] The USDA Agricultural Census will not report values, on occasion, due to privacy concerns. If there was a single farmer who owned the majority of a type of livestock in the county, the census would not report the number. Between five-year or longer gaps in values a straight-line interpolation was used to estimate the missing values. Sometimes interpolation was impossible because the missing value was at the end or the beginning of the period of record. In these situations, the nearest reported value was carried over for each missing year.

Equation 2

$$USDA\ Reported\ Livestock\ in\ County\ x\ \frac{County\ acreage\ within\ the\ Lower\ Colorado\ River\ System}{Total\ County\ Acreage} = Updated\ Livestock\ \#\ in\ County$$

County values then had to be converted to County-Flow Node-HUC8 values. To accomplish this, there was an assumed correlation between the distribution of livestock and the distribution of irrigated agriculture in the basin. The assumption is that the spatial distribution of irrigated agriculture would be representative of the spatial distribution of livestock, which would allow for conversion from monthly values to State-Flow Node-HUC8 values. **Equation 3** expresses how the number of animals in the USDA Agricultural Census were adapted to the County-Flow Node-HUC8 scale:

Equation 3

$$Livestock\ in\ County\ x\ \frac{Irrigated\ Acreage\ in\ "County-Flow\ Node-HUC8"}{Total\ County\ Acreage} = Number\ of\ Livestock\ in\ "County-Flow\ Node-HUC8"$$

Number of livestock were multiplied by their respective livestock coefficients to calculate the consumptive use. This was done at the County-Flow Node-HUC8 scale due to the inclusion of county boundaries within the coefficients. The volume was converted from gallons per head per day into acre-feet per year. The acre-feet per year by County-Flow Node-HUC8 was then summed to a State-Flow Node-HUC8 scale.

Finally, a seasonality adjustment was made. A six percent increase in water use from February through August to account for the increased water use during the calving season was applied to the monthly values.

7.3. Stockponds and Livestock Final Calculation

Stockpond and livestock consumptive uses and losses data, while calculated separately, are combined and reported together as “Stockpond Evaporation and Livestock” in certain tables of the report.

8. Tributary Thermal Electric Power

The thermal electric power water use category reports the consumptive use of water for non-hydroelectric power generation. This consumptive use quantifies the water that evaporates for cooling purposes from power plants. TEP consumptive use calculations were based on data published by the Energy Information Administration (EIA) [28] and methodologies created by the USGS.

8.1. Reported Thermal Electric Power Water Use

2016-2024

Starting in 2012 the EIA reported the consumption volume of water at the power-plant scale in Section 8D-Cooling System Information of the EIA-923 form. All thermal plants (steam) with 100 megawatts or greater capacity report water lost for cooling purposes. This data was used directly from 2016 onwards. Data for 2013 to 2015 use the methodology explained in **Modeled Thermal Electric Power Water Use**.

To ensure all power plants were accounted for, the EIA-860 form for each year was reviewed and any new power plants were added to the running list of power plants within the Lower Colorado River system.

All plants were assigned a State-Flow Node-HUC8. The monthly volume of water consumed for cooling purposes, as reported in EIA-923 Form, Section-8D, was added to each plant based on the Plant ID. The volume was converted to acre-feet and summed to the State-Flow Node scale.

8.2. Modeled Thermal Electric Power Water Use

1971-2015

Prior to 2012, consumption volume was not directly reported by the EIA. Resultantly, a methodology was developed using data that was available going back to 1971. The methodology uses EIA forms for power point locations and generation data and converts that generation data to water use based on coefficients sourced either from the EIA or the USGS.

The EIA forms EIA-923 and EIA-860 were used to compile power plant details and generation records. This data has changed over time. For example, location and cooling data were included beginning in 2013, power plant ID numbers changed in 2001, and data on utility plants are available from 1970 onwards while the non-utility data are reported monthly beginning in 1999.

To develop a list of plants within the Lower Colorado River System, the location data of power plants within the states of the Lower Colorado River System from 2013-2015 were compiled from EIA-860 forms and any duplicates were removed. Using the provided latitude and longitude, the State-Flow Node-HUC8 for each plant was added to the records.

[28] EIA forms and data available at: https://www.eia.gov/electricity/data.php

The next step was to combine the generation data from 1971-2015. The records prior to 2001 were marked because of changing Plant ID numbers that could mix up records and all non-TEP records were removed. This new list of plants was then joined to the 2013-2015 list of plants on the plant ID. Plants not listed after 2000 were individually checked for a location using internet searches and satellite imagery. This new list was matched by name to the records prior to 2001 and any additional unmatched plants were checked using internet searches and satellite imagery. All records from outside of the system were removed once the list was complete.

The type of cooling system for each power plant was needed to assign the plant a coefficient. The EIA published cooling type for plants beginning in 2013. All power plants that were not published with the cooling type were manually assigned a cooling type. The process used satellite imagery and is shown in the USGS TEP publications. Sometimes satellite imagery was not available, such as when a plant was decommissioned before imagery was available. Where imagery was not available, 'recirculating tower' was used as the default cooling type.

Coefficients for each plant were used to convert between power generation and consumptive use.

To check and supplement water use coefficients in the EIA reports, two USGS thermoelectric water use specific publications were used.[29] These thermoelectric water use reports go into detail on how water is used by power plants. The reports include data on total use as well as consumptive use and were referenced for general coefficients for consumptive use which were used to check and supplement the EIA reported water use.

The 2010 USGS TEP Report included a list of power plants with generation numbers and water use values. The USGS modeled these plants to see if the reported values were reasonable. Where reasonable, these values were used for coefficients and placed on the power plant list. The USGS also provided their modeled water use for these plants. This modeled value was used for a coefficient where the EIA values were unreasonable.

There are some power plants that were not listed in the 2010 USGS TEP Report modeling effort. These power plants were assigned a use coefficient based on their cooling type and generation type. These coefficients were published in the 2015 USGS TEP Report. Priority for the coefficient values was first the EIA value, if reasonable, then the 2010 USGS TEP Report value, and finally the 2015 USGS TEP Report value if the other coefficients were not available. The consumptive use was calculated by multiplying the use coefficient by each generation record. These generation records were then summed by month and by State-Flow Node-HUC8.

[29] U.S. Geological Survey Scientific Investigations Reports 2014-5158 (2010 USGS TEP Report) and 2019-5103 (2015 USGS TEP Report)

9. Tributary Mineral Resources

The mineral resources water use category is defined as the consumptive use of water related to mining activities. The CUL Report assumes that all water used at a mine site is consumptively used. This assumption is consistent with past reports and is generally based on the understanding that mines in the Lower Colorado River System often do not release water back to the hydrologic system due to pollution controls.

9.1. Mineral Resources Source Data

The USGS publishes data on water used for mineral resources in the five-year water census reports. This includes the 1985-2010 revised report for the Colorado River Basin.[30] This also includes the 2015 National Report[31] which is done at the county level. Previously published CUL data were used for years prior to 1985.

9.2. Mineral Resources Final Calculation

2016 – 2024

The 2015 mineral resources CUL data is carried forward through 2024. This data will be updated in the future once additional source data is published by the USGS or a separate methodology for estimating use by mineral resources is developed.

Only data in the Gila River basin within New Mexico will show variation during this period, as that data is reported by New Mexico and is not based on the USGS reports.

2011-2015

The 2015 mineral resources data published by the USGS were published at the county level. These data were distributed from the county level to the State-Flow-Node-HUC8 level based on the averages within the 1985-2010 mineral resources data. The first step was to distribute the 1985-2010 average values to the County-Flow Node-HUC8 level based on area percentages. The 2015 county scale data then had to be reduced in certain cases where the county extended beyond the Lower Colorado River System Boundary. This was done on an area percentage basis, similar to the conceptual approach used in the livestock category. These adjusted 2015 values were then distributed to the HUC8 level based on the County-Flow Node-HUC8 1985-2010 values. Finally, these data at the HUC8 scale were interpolated to estimate mineral resources consumptive use from 2011-2015.

[30] U.S. Geological Survey Scientific Investigations Report 2018-5049. Data available at: https://pubs.usgs.gov/publication/sir20185049
[31] Estimated Use of Water in the United States County-Level Data for 2015 available at: https://www.sciencebase.gov/catalog/item/get/5af3311be4b0da30c1b245d8

1985-2010

The USGS numbers were used nearly as published in the 1985-2010 USGS report, however had to be reported at the State-Flow Node-HUC8 scale. There are a few HUC8 locations which were split by a Flow Node boundary. In these cases, a review of mining activity in these locations was conducted and if necessary, the data was split to reflect the mining activity in those areas. The State-Flow Node-HUC8 values were interpolated between the five-year periods.

1971-1984

Previously reported values from the CUL Reports[32] were used from 1971-1984. These values were not reported by HUC8, so they were distributed to the HUC8 scale. This distribution was simplified because the HUC8 locations could be summed to match the reporting area scale. The 1985-2010 average proportion was used to distribute the reporting area values to HUC8 values.

Final Adjustments

The mineral resources CUL values were distributed from annual values to monthly values by dividing by 12. Finally, mineral resources values in the Moenkopi Wash subbasin (15020018) were reduced due to the coal-slurry export from Arizona to Nevada as discussed in the **Exports** section.

10. Tributary Municipal and Industrial Other

The M&I Other water use category includes water used for domestic water use, commercial water use, and industrial water use (excluding water used for mineral resources and water used for TEP). The determination of M&I Other water use depends upon national level datasets and Reclamation's estimations may differ from data generated by local agencies or municipalities. Mineral resources and TEP CUL data are included as separate categories.

10.1. Per Capita Coefficients

1971 – 2015

The USGS reports consumptive use for the Colorado River Basin every fifth year.[33] As mentioned in the **Tributary Mineral Resources** section, the USGS revised their consumptive

[32] Data from previously published CUL Reports available at: https://www.usbr.gov/uc/envdocs/plans.html
[33] U.S. Geological Survey Scientific Investigations Report 2018-5021 reports on the differences between the USGS and Reclamation's water use reporting.

use estimates for the Colorado River Basin from 1985-2010. The revised report provides State-HUC8 values every fifth year for the reporting period, however for the M&I Other category, the revised values were too inconsistent to use directly due to changing methods and changing reporting accuracy over time. The USGS water use values were reviewed and were used only where they appeared most accurate. Those values which appeared most accurate were used to create per capita water use coefficients that could be used alongside population estimates to estimate M&I Other CUL data.

The per capita water use coefficients were estimated to reflect changes in use, both spatially and temporally. HUC8s near urban areas were each assigned a unique coefficient for that urban population's water use, and all other HUC8s were given a separate coefficient, deemed the "Rural Coefficient". The urban area coefficients included Central Arizona, Southern Arizona, and Southwest Utah (Las Vegas was calculated using a separate methodology, as discussed in the **Las Vegas Area Tributary Municipal and Industrial Other** section). There were three HUC8s associated with each area and only the Utah portions of the HUC8s in southwestern Utah were assigned the Southwest Utah coefficient. All remaining areas, except for areas where values were provided by New Mexico and areas that are reported as mainstream M&I Other were assigned the "Rural Coefficient". All per capita coefficients were calculated using the population values reported in the USGS revised report. **Table 5: Gallons Per Capita per Day (GPCD) Water Use Coefficients** includes the coefficients that were calculated from the USGS data. **Map 4: Municipal and Industrial Other Water Use Coefficients** highlights the HUC8s that were used to generate water use coefficients, as well as where the coefficients were applied.

Municipal and Industrial Other Water Use Coefficients in Gallons per Capita per Day (GPCD)					
Coefficient Area	**1971-1999**	**2000**	**2005**	**2010**	**2015**
Central Arizona Coefficients HUC8s: Middle Gila, Lower Salt, Agua Fria (15050100, 15060106, 15070102)	143	143	131	124	124
Southern Arizona Coefficients HUC8s: Upper Santa Cruz, Rillito, Brawley Wash (15050301, 15050302, 15050304)	127	127	112	105	105
Southwest Utah Coefficients HUC8s: Upper Virgin, Fort Pierce Wash, Lower Virgin (15010008, 15010009, 15010010)	328	328	264	256	256
Rural Coefficients HUC8s: all other areas (besides areas in the Mainstream M&I Other Boundary, areas reported by New Mexico, and mainstream HUC8s)	166	166	151	137	137

Table 5: Gallons Per Capita per Day (GPCD) Water Use Coefficients

After an analysis of the revised 1985-2010 USGS values it was determined that the USGS values were less reliable prior to the year 2000 due to missing or unreasonable wastewater values. Because of this, the consumptive use coefficients from 2000 were used for all years prior to 2000. 2010 was the final year of the revised USGS report so the coefficients from 2010 were used through 2015.

The USGS included separate TEP and mineral resources water use categories along with the Municipal, Industrial, and Commercial water use. The USGS reported more specific types of data within each of those larger categories. The data used for the CUL calculations were the withdrawal values, return values, and consumptive use values.

Withdrawals

Total withdrawals for each HUC8 were calculated from the available data. There were several categories from the USGS data that were added or subtracted to find the total withdrawals. The first category that was added was the public withdrawals which is water withdrawn for eventual delivery to the public. The withdrawals were used instead of the deliveries to account for transmission losses. The next three categories came from self-supplied water and included domestic self-supplied water, commercial self-supplied water, and industrial self-supplied water. These categories include water that is probably from a well but may include surface water diverted for private use. The last step was to subtract the thermoelectric water delivered by the public supply. This water was use was determined separately as described in the **Tributary Thermal Electric Power** Section and was removed from the M&I Other calculations.

Returns

Returns from M&I Other were found with another combination of USGS categories. The first step was to include the public returns. This is generally the treated wastewater that flows back to the hydrologic system. The next category that was added was the treated water delivered to TEP plants. An additional two subbasins, Hassayampa (15070103) and Centennial Wash (15070104), were added to this category in the Phoenix area to capture the wastewater delivered to the Palo Verde Generating Station. The last category that was added was the wastewater that was delivered to irrigate crops.

Wastewater that is delivered to irrigate golf courses was subtracted because golf courses are considered a M&I Other use of water. The USGS revised report does not distinguish between wastewater used to irrigate golf courses from wastewater used to irrigate crops. This distinction is made using additional data from the USGS about 2010 crop and golf water use. This was done by finding the proportion of crop wastewater use and proportion of golf course water use to the total wastewater used for irrigation. This proportion for 2010 was used for all other years.

Rural Estimate

The rural estimate was made using a selection of HUC8s that had the most reliable and accurate data. This approach was formulated due to the discovery of extensive errors within many of the HUC8s. Some errors were due to HUC8 boundaries, such as a public supply company near a HUC8 boundary withdrawing water from one side of a boundary and delivering the water on the other side of the boundary.

There were three criteria which were used to filter out erroneous data in the rural HUC8 locations. The first criterion excluded HUC8s that had more than 20% of the population using self-supplied water. This is because those households are more likely to use onsite sanitation systems for wastewater disposal. The next criterion was that the HUC8 could not have more wastewater returns than diversions. The final criterion was that there must be more than 30 GPCD of wastewater in the HUC8. There appeared to be a general lack of wastewater reporting in rural areas, so a minimum reasonable wastewater amount was set at 30 GPCD. A final inspection was made for drastic reporting differences between years. Any HUC8 locations with dramatic changes between years were removed.

HUC8s that remained after filtering out data based on the above criteria were used to estimate the rural coefficient, as seen **in Table 6: HUC8s Used to Generate the Rural Coefficient** and **Map 4: Municipal and Industrial Other Water Use Coefficients**. The years prior to 2000 were not included for filtering the HUC8 locations or finding a consumptive use coefficient. This consumptive use estimate used a population weighted average for each of the rural HUC8 locations.

State	HUC8 Name	HUC8 Code
Arizona	Havasu Canyon	15010004
Arizona	Silver	15020005
Arizona	Canyon Diablo	15020015
Arizona	Wilcox Playa[34]	15050201
Arizona	Upper San Pedro	15050202
Arizona	Upper Salt	15060103
Arizona	Lower Verde	15060203

Table 6: HUC8s Used to Generate the Rural Coefficient

2016-2024

Estimating consumptive use by M&I Other for tributary areas for the period from 2016-2024 built upon the 1971-2015 methodology. The USGS published water use estimates for 2000 – 2020 at the HUC12 spatial scale and the monthly and yearly temporal scale.[35] At the time of analysis the complete 2000-2020 dataset by the USGS, including public supply, domestic, and self-supplied industrial, was not available. However, the total public supply consumptive use data for 2000 – 2020 was available.[36] The trend seen in the 2010 – 2020 total public supply dataset was applied to the coefficients used to develop the 2015 CUL data. This trend was assumed to be indicative of M&I Other water use trends across the Lower Colorado River System because historically the majority of the population within the Lower Colorado River System have been served by public suppliers, as documented by the USGS for the 1985-2010 period (Maupin et al., 2018).

Public supply data were pulled from the USGS at the HUC12 scale and summed to the HUC8 scale. These volumes were converted to water use coefficients, using U.S. Census data, at two-year increments for the HUC8s used in the 1971-2015 determination of water use coefficients.

[34] The Wilcox Playa, while not included in the CUL Report data due to it being a closed basin, is included in the USGS HUC2 code 15 and was included in the USGS water use estimates for 1985-2010. Due to the limited number of HUC8s with adequate data to estimate the rural coefficient, data from the Wilcox Playa Subbasin were used in generating a rural coefficient.

[35] Available at: https://www.usgs.gov/mission-areas/water-resources/science/water-use-united-states

[36] Available at: https://www.usgs.gov/data/public-supply-water-use-reanalysis-2000-2020-period-huc12-month-and-year-conterminous-united

Entire HUC8 populations were used for the Southern Arizona, Central Arizona, and Rural coefficients, however just the Utah portions for the Southwest Utah HUC8s were used for the Southwest Utah coefficient.

A linear trend was determined for each HUC8 and the average of the slopes within each Coefficient Area was presumed to be indicative of changes in water use for each area. This average trend was then applied to the 2015 coefficient. The resultant trend (Annual Change) as well as the 2015 rate and subsequent annual coefficients are documented in **Table 7: 2016 – 2024 Estimates of GPCD Water Use Coefficients**.

	2015 Coef.	Annual Change (GPCD)	2016 Coef.	2017 Coef.	2018 Coef.	2019 Coef.	2020 Coef.	2021 Coef.	2022 Coef.	2023 Coef.	2024 Coef.
Central Arizona	124	-1.1	123	122	121	120	119	117	116	115	114
Southern Arizona	105	-2.0	103	101	99	97	95	93	91	89	87
Southwest Utah	256	-3.7	252	249	245	241	237	234	230	226	223
Rural	137	-0.1	137	137	137	137	136	136	136	136	136

Table 7: 2016 – 2024 Estimates of GPCD Water Use Coefficients (Coef.)

10.2. Population

Population values, used for calculating tributary M&I Other use, were sourced from the U.S. Census Bureau.[37] Decennial census numbers were used when possible, unless an updated estimate was provided by the Census Bureau. Between and after the decennial census, U.S. Census Bureau intercensal estimates or postcensal estimates were used.

10.2.1. Census Blocks

Because the U.S. Census Bureau reports numbers by census blocks or by county, those values had to be converted to the State-Flow Node-HUC8 scale.

Census block data were available for 1990, 2000, 2010, and 2020.[38] Census blocks, as defined by the U.S. Census Bureau, are statistical areas bounded by visible features such as streets, roads, streams, and railroad tracks as well as nonvisible features, such as selected property lines, city, township, or county limits. Census blocks in suburban or rural areas may be larger than urban areas, and in remote areas, census blocks may encompass hundreds of square miles. Census block population is the smallest scale reported by the U.S. Census Bureau. Using the

[37] U.S. Census data available at: https://www.census.gov/data/datasets.html
[38] The National Historic Geographic Information System, run by the University of Minnesota, has made historical U.S. Census data available in GIS format and can be downloaded here: https://data2.nhgis.org/main

center of each census block as a reference point, the population of each census block was assigned to a County-Flow Node-HUC8 polygon and designated as inside or outside of the M&I Other mainstream boundary. The Census blocks were then aggregated to estimate the population of each County-Flow Node-HUC8, with a distinction between M&I Other mainstream or tributary populations.

10.2.2. County Proportion

Intercensal estimates were made for each year at the county level. Additionally, the 1970 and 1980 census data were available for full coverage at the county level. Using the same process for the intercensal estimates these decadal data were estimated at the County-Flow Node-HUC8 level to match the GIS calculations of the other decades.

The decennial County-Flow Node-HUC8 population estimates (1990, 2000, 2010, and 2020), derived using GIS, were interpolated between census periods for each County-Flow Node-HUC8 area. This was done by calculating the proportion of county population by each County-Flow Node-HUC8. This proportion was interpolated between decennial census years. The resulting County-Flow Node-HUC8 proportion was multiplied by the intercensal estimates. The 1990 proportion was used for all years prior to 1990. The last step was to sum the results from County-Flow Node-HUC8 to State-Flow Node-HUC8, which resulted in the population values used for the CUL Report.

10.3. Municipal and Industrial Other Final Calculation

The final calculation involved multiplying population data by the associated coefficients. The first step was to interpolate the coefficients between years (2000 – 2010) and carry the 2000 coefficient back to 1971 and carry the 2010 coefficients to 2015. The identified linear trend was applied to the 2015 coefficient to estimate coefficients from 2016-2024. The next step was to multiply the population by the coefficients and convert the resultant consumptive use values (which were in units of gallons per day) into acre-feet per year. The annual values were distributed to a monthly timestep based on the monthly distribution of mainstream municipal and industrial water use in Yuma, AZ for 1971-2015. This approach indirectly accounted for monthly changes in population along with monthly variation in use throughout the year.

10.4. Las Vegas Area Tributary Municipal and Industrial Other

Las Vegas, NV and the surrounding areas use both mainstream water and tributary water for M&I Other purposes. Tributary water is groundwater pumped from the Las Vegas Valley and mainstream water is surface water pumped from Lake Mead. This mix of water makes it impossible to follow the same methodology used in other locations. However, the Nevada Division of Water Resources reports groundwater pumping.[39] The groundwater pumping

[39] State of Nevada, Division of Water Resources reports and data available at: https://tools.water.nv.gov/PumpageInventoryFiles.aspx

records along with the Water Accounting Report records were combined to estimate withdrawals and returns.

Stored Colorado River Water

The CUL Report accounts for water that is removed from the hydrologic system. The Water Accounting Report is concerned with water which is removed from the Colorado River mainstream. This is important to remember when thinking about groundwater banking (stored underground) in the Las Vegas Valley. The Water Accounting Report considers banked groundwater a consumptive use at the time it is stored. The CUL Report does not consider it to be a consumptive use until it is pumped back out of storage.

The Water Accounting Report and the Nevada Department of Water Resources Groundwater Pumpage Inventory report account for mainstream Colorado River water that was stored underground in the Las Vegas Valley, but they report it differently. In addition, values were gathered from Las Vegas Valley Water District and the City of North Las Vegas reports, who are both directly involved with the injections and withdrawals.

Withdrawals

Mainstream Colorado River water withdrawals for Las Vegas are recorded in the Water Accounting Report. This includes all diversions for Southern Nevada Water Authority (SNWA), the City of Henderson, and Basic Water Company. This also includes diversions for delivery to Boulder City. Boulder City is outside of the Colorado River Basin but uses water delivered by SNWA. For simplicity, Boulder City was considered part of the Las Vegas Valley for CUL calculations.

Groundwater withdrawals in the Las Vegas Valley were collected from the above-mentioned Nevada Division of Water Resources reports. The Gross Pumpage data was used because the Net Pumpage data subtracts the Nevada reported Colorado River Mainstream water which has been injected for storage. Instead, the Water Accounting Report values of Colorado River mainstream water injected for storage was subtracted from the Gross Pumpage data to equalize the withdrawal and injection data between the two reports.

Returns

Colorado River mainstream returns to Lake Mead were taken from the annual Water Accounting Reports.[40] Groundwater (tributary) returns to Lake Mead were taken directly from reports provided by the State of Nevada (Colorado River Commission) for the years 1983-2024, with a few exceptions. For the years 1977-1982 groundwater (tributary) returns were estimated based on available data for total return flows in the Las Vegas Wash (storm flow excluded) multiplied by the proportion of groundwater withdrawals relative to total withdrawals for each of those years. For the years 1971-1976, the proportion of withdrawals as groundwater returns were based on the 1977 proportion of withdrawals as groundwater returns value and used available withdrawal data for each year to estimate CUL. In all other years that

[40] Reported as Las Vegas Wash returns.

data from the State of Nevada was either not available or incomplete (1986 and 1999), a proportion of withdrawals as groundwater returns was estimated by interpolating between adjacent years. M&I Other monthly proportions from the City of Yuma were used to distribute the annual Las Vegas tributary M&I Other consumptive use values to monthly values.

11. Tributary Irrigated Agriculture and Irrigated Acreage

Irrigated agriculture is the largest tributary water use category in the Lower Colorado River System. The methodology for estimating consumptive uses and losses by irrigated agriculture underwent a revision resulting in slight differences in methodologies between the 1971-2015 data and 2016-2024 data generation effort. The general approach remains consistent between the two datasets, with differences highlighted in **Section 11.2: 2016-2024 Irrigated Agriculture Methodological Updates**.

11.1. 1971-2015 Irrigated Agriculture Methodology

Water use by irrigated agriculture was estimated using:

- GIS layer of all the agricultural fields within the region for each year
- Monthly and yearly normalized difference vegetation index (NDVI) images
- Monthly and yearly estimates of consumptive use using the Operational Simplified Surface Energy Balance (SSEBop) method.[41]

SSEBop data were delivered as images for each month where each pixel represents the amount of ET minus precipitation (net ET) in that pixel in millimeters.

11.1.1. Field Border Layer

A GIS layer of tributary agricultural field borders was created for each year as seen in **Map 5: Lower Colorado River System Tributary Irrigated Agriculture**. Fields were mapped using images of maximum yearly and monthly NDVI provided by the USGS combined with recent high-resolution imagery, when available. In the NDVI images, each pixel represents the maximum value of NDVI for the period of interest (monthly or yearly). NDVI values range from -1 to 1, with values closer to 1 indicating active, healthy vegetation. These maximum NDVI images were used to identify the location and irrigation status of each field for each year.

[41] Information on the Operational Simplified Surface Energy Balance method can be found here: https://onlinelibrary.wiley.com/doi/10.1111/jawr.12057

Agricultural fields were also classified as being flood or pivot irrigated based on shape. This classification was modified for a given year if the shape of the field in the NDVI image changed.

11.1.2. Irrigation Status

SSEBop data is calibrated for irrigated agriculture and is most accurate under those conditions. Fields which are not irrigated will show some ET using SSEBop. Therefore, fields that are not irrigated in a particular year were identified and excluded from the ET totals to make the estimates of consumptive use as accurate as possible.

To remove non-irrigated fields, data of known non-irrigated fields from the Lower Colorado River Annual Summary of Evapotranspiration and Evaporation (LCRAS) program were used to fit a logistic regression equation predicting field status (irrigated/not irrigated). That equation was then applied to the entire Lower Colorado Hydrologic Region (HUC2) field border dataset for each year to as an initial determination of which fields were irrigated in a particular year. Development of the regression equation took into consideration the following:

- LCRAS data for a given year was divided into two groups – 1) those fields that were determined to be not irrigated for the entire year, and 2) those fields that were irrigated at some point during the year. The status of the field (irrigated/not irrigated) was used as the dependent variable. Additional statistics were calculated for each field for the entire dataset including monthly NDVI, annual ET, and standard deviation of NDVI to be used as explanatory variables.
- Variables that were most predictive of irrigation status were February, June, and November NDVI, average net ET, and the standard deviation of NDVI over the 12-month period. Models for most other years were generated using the same variables. Models were examined for suitability using Akaike's Information Criterion, Variable Inflation Factors, and the R^2 values. Additionally, confusion matrices were used to help inform the subsequent manual quality assurance (QA) review.

The logistic regression model chosen for each particular year was then applied to the entire CUL field border feature class. LCRAS data that could be used to create these regressions were only available for the years 2004-2015. For years where no LCRAS data was available to create a year-specific equation, previous year's equations that performed well were used.

After an initial determination of irrigation status using the logistic regression equations, the data for each year and field was manually reviewed using the maximum annual and maximum monthly NDVI images for reference. For recent years, aerial imagery was also used. Fields where the irrigation status appeared to be incorrectly classified were corrected. Indicators of an irrigated field included:

- Distinct rectangular or circular boundaries in NDVI images
- High NDVI with low patchiness
- If a field was along a waterway, high NDVI area extends wider than what would be expected
- For recent years, obvious drill rows, canals, or irrigation equipment in imagery.

11.1.3. SSEBOP Data

Monthly SSEBop images of estimates of net actual evapotranspiration (Eta) in mm were provided by the USGS. For SSEBop data, complete coverage for all months and years depended on availability of cloud-free satellite scenes. As a result, there are locations where there is no data in a given month and year (e.g., some fields might only have data for 10 or 11 months out of the year). The months with the most chance of having clouds were also the months with the lowest ET (Oct-Feb). Evapotranspiration for areas with missing data were set to zero. This data was calculated by the USGS using GEE for 1984 – 2015 and original Landsat imagery pre-1985.

Net Eta was derived by subtracting effective precipitation from gross SSEBop ET calculations. Effective precipitation was 40% of precipitation received from October to February, 20% of precipitation in March, and 0% of precipitation in April through September. The USGS provided monthly images of Net ETa which were used to calculate consumptive use in each field.

11.1.4. Irrigated Agriculture Final Calculations

1985-2015

For fields that were classified as irrigated, ET was calculated monthly using net evapotranspiration SSEBop images and zonal statistics in ArcGIS Pro. Average monthly ET in millimeters (mm) was converted to ET in feet for each field and then multiplied by the size of the field to arrive at acre-feet of consumptive use. All fields were aggregated together for the given State-Flow Node-HUC8.

1973-1984

ET data pre-1985 were estimated by the USGS based on NDVI-ET regression curves derived from the 1985-2015 data. These data were determined to be inaccurate due to a marked decrease in total yearly ET and wide yearly fluctuations compared to successive years, therefore, average ET from 1985-2015 was applied to the 1973-1984 values. The average field ET for each month and State-Flow Node-HUC8 from 1985-2015 was multiplied by the acreage for the years 1973-1984 to determine total consumptive use for the field in that year.

For each State-Flow Node- HUC8, the following equation was applied for each year between 1973 and 1984 to determine consumptive use.

Equation 4

$$Average\ ET\ of\ irrigated\ fields_{1985-2015} \times Acreage\ of\ irrigated\ fields_{Year} = ET_{State-Flow\ Node-HUC8}$$

1971-1972

Due to the lack of satellite data in 1971 and 1972, the previously reported irrigated agriculture consumptive use trend was applied to the recalculated 1973 value for these years, thereby maintaining the previously reported trend and consistency with the recalculated dataset. In the previously reported data, 1971 and 1972 values were 89.2% and 98.7% of the 1973 value, respectively. Therefore, 1971 and 1972 data were estimated using these percentages and the recalculated 1973 value, maintaining the previous trend.

Equation 5

$$ET_{1971} = .892 * ET_{1973}$$

Equation 6

$$ET_{1972} = .987 * ET_{1973}$$

Incidental Use

Incidental use (consumptive use resulting from phreatophytes in and along canals and laterals, and evaporation from the canals and laterals) was added to the final consumptive use values. For flood irrigated fields, the incidental use value was 15% during the 1971-1990 timeframe (USBR, 1971, Table 5) and was reduced to 10% during the 1991-2024 timeframe to account for improved irrigation efficiencies and water management practices (USDA, 1976 and U.S. Interagency Task Force, 1978) created through canal lining, tailwater recovery, laser leveling, high volume turnouts, drip systems and improved irrigation scheduling. Based on the assumption that most pivot irrigated fields pump groundwater, and thus would lose less water to conveyance, a 5% incidental use value was applied to center pivot irrigated fields for the entire timeframe. Improved irrigation efficiencies – and consequently smaller incidental use - have been documented over time (DOI, 1982-1991; Yuma County Agriculture Water Coalition, 2015) which support reducing the incidental use values beginning with the 1991 year.

11.2. 2016-2024 Irrigated Agriculture Methodological Updates

The methodology for estimating tributary irrigated acreage and consumptive use by irrigated agriculture between 1971-2015 and 2016-2024 remains conceptually consistent, with several updates, as described below.

11.2.1. Field border Updates and Determination of Irrigation Status

The fields border layer used to constrain ET estimates to just irrigated agriculture underwent a substantial revision between the 2015 and 2016 layers. The revised fields border layer was used for the 2016-2024 determination of consumptive use by irrigated agriculture. The updates included:

- Fields that were not identified as in production during the 2016-2024 time frame were removed. This removed the chance these fields could be erroneously marked irrigated due to natural vegetation establishment or show high NDVI due to weeds after precipitation events.
- Many small fields (<1 acre) adjacent to homes were removed. Previously, some of these small fields that may not have been used for agriculture were included in the field border layer. While it is not always possible to determine the use of a field from high resolution imagery, Reclamation strives to be as accurate as possible.
- Pasture in high elevation areas that did not demonstrate signs of irrigation were removed.
- The field borders were updated to reflect more recent, higher resolution imagery and more accurately represent current field geometry.

The method for determining irrigation status was revised to be more consistent with the Upper Basin CUL methodology. The updated methodology used the following procedure for each year:

- For each year, an annual maximum NDVI image was created for the entire Lower Colorado River System using GEE. Each pixel of these images represent the maximum NDVI achieved by that pixel during the year as measured from all the Landsat satellite images available.
- Each pixel within each annual maximum NDVI image was classified as irrigated or not irrigated based on an NDVI threshold. Pixels that had a maximum NDVI of less than 0.6 were classified as not irrigated. Pixels that had a maximum NDVI equal to or greater than 0.6 were classified as irrigated.
- The percentage of pixels (not irrigated or irrigated) were calculated for each field in the field border layer. Fields that had a majority of pixels (>50%) classified as irrigated were designated as irrigated, while fields that had a majority of pixels classified (>50%) as not irrigated were designated as not irrigated.

11.2.2. Algorithm to Determine Consumptive Use from Satellite Imagery

Determination of consumptive use by irrigated agriculture for the 1971-2015 timeframe (Reclamation, 2024) relied upon the Operational Simplified Surface Energy Balance (SSEBop) method described by Senay et al. (2007) and later revised. At the initiation of the effort to recalculate the 1971 – 2005 CUL data and produce data through 2015, this was the only method with the capability of covering the 45-year timespan, and the large spatial extent needed for the recalculation effort. Beginning with 2016 Reclamation began using eeMETRIC (Allen et al. 2007 as revised), which is consistent with the data source the Upper Basin uses to calculate irrigated agriculture consumptive use.

11.2.3. Irrigated Agricultural Final Consumptive Use Calculations

For fields that were classified as irrigated, evapotranspiration was calculated monthly using GEE. Monthly ET for each field was derived from eeMETRIC, and monthly precipitation was derived from GRIDMET[42] (Abatzoglou, 2013) via GEE. The percentages described in section **11.1.3 SSEBOP Data** were applied to the precipitation data to arrive at effective precipitation for each field. Monthly effective precipitation was subtracted from the eeMETRIC derived ET from each field, resulting in monthly net ET for each field.

Monthly net ET in millimeters was converted to ET in feet for each field and multiplied by the size of the field to arrive at acre-feet of consumptive use. The consumptive use estimate for each field was then multiplied by the incidental use factors as described in the **1971-2015 Irrigated Agriculture Methodology** section to arrive at total consumptive use for each field. All fields were then aggregated together to derive estimates of monthly and annual consumptive use for geographic scales of interest.

12. New Mexico - Gila

Pursuant to Article VII of the Consolidated Decree of the United States Supreme Court in *Arizona* v. *California* et al. 547 U.S. 150 (2006), CUL data for areas in New Mexico that drain into the Gila River are reported annually by the state of New Mexico to Reclamation. Specifically, this is the New Mexico portion of the Gila River Basin (HUC4 1504) except for the Animas Valley Subbasin (15040003). The Animas Valley is a closed basin and was not included in the report. New Mexico reports CUL data at several different locations which can be grouped together to match the State-Flow Node-HUC8 scale.

12.1. Livestock

For each year from 1971 – 2001, the annual New Mexico report included cattle numbers, sheep numbers, and use coefficients for both animal types. These data were used by Reclamation to estimate the consumptive use by livestock for this period. Beginning in 2002 the New Mexico report included a category for livestock consumptive use and these data were directly incorporated.

12.2. Mineral Resources

Starting in 2005, CUL data for mineral resources were included as a footnote in New Mexico's annual report. Data were only reported for the Upper-Gila Mangas sub-basin. From 1971-2004 mineral resources data were estimated using data from 2005-2017. An average

[42] https://developers.google.com/earth-engine/datasets/catalog/IDAHO_EPSCOR_GRIDMET

percentage of available mineral resources CUL data (from 2005-2017) were compared to total municipal, industrial and domestic (minus exports, where applicable) for each year. That average percentage was then applied to the reported 1971-2004 data on municipal, industrial, and domestic CUL to estimate use by mineral resources.

12.3. Exports

Similar to mineral resources, exports were also only included for the Upper-Gila Mangas location. From 1982-2024 exports to Silver City, NM were reported in a footnote. The missing data had to be estimated from the available data. An average percentage of exports data from 1982-2017 was compared to total municipal, industrial and domestic (minus exports, where applicable). That average was then applied to the reported 1971-1981 data on municipal, industrial, and domestic CUL to estimate the missing exports data for that period.

12.4. Municipal and Industrial Other

Municipal, industrial, and domestic data were reported by New Mexico for the full period and were used to estimate M&I Other CUL data. M&I Other CUL data were calculated by subtracting mineral resources and exports values from the municipal, industrial, and domestic data for Upper-Gila Mangas location. For the other locations, M&I Other CUL data was estimated directly using the municipal, industrial and domestic data provided by New Mexico.

12.5. Irrigated Agriculture

Irrigated agriculture consumptive use data were reported from 2006-2024. From 1971-2005 irrigated agriculture data were calculated as the total use minus all other categories.

In addition to the irrigated agriculture data provided within New Mexico's report, additional water use in the Virden Valley was added to the reported values. This consumptive use is reported per the 1935 Globe Decree; and irrigated acreage data are available in a separate annual report. This additional agricultural consumptive use was found by multiplying the 1935 Globe Decree acreage by the acreage to consumptive use proportion from the reported numbers for the Virden Valley. The 1935 Globe Decree acreage was reported by New Mexico from 1979-2024. An average of the acreage from 1979-2017 was used as the acreage from 1971-1978.

12.6. Reservoirs and Stockponds

Reservoir evaporation and evaporation from stock ponds were directly reported by New Mexico for the entire timeframe.

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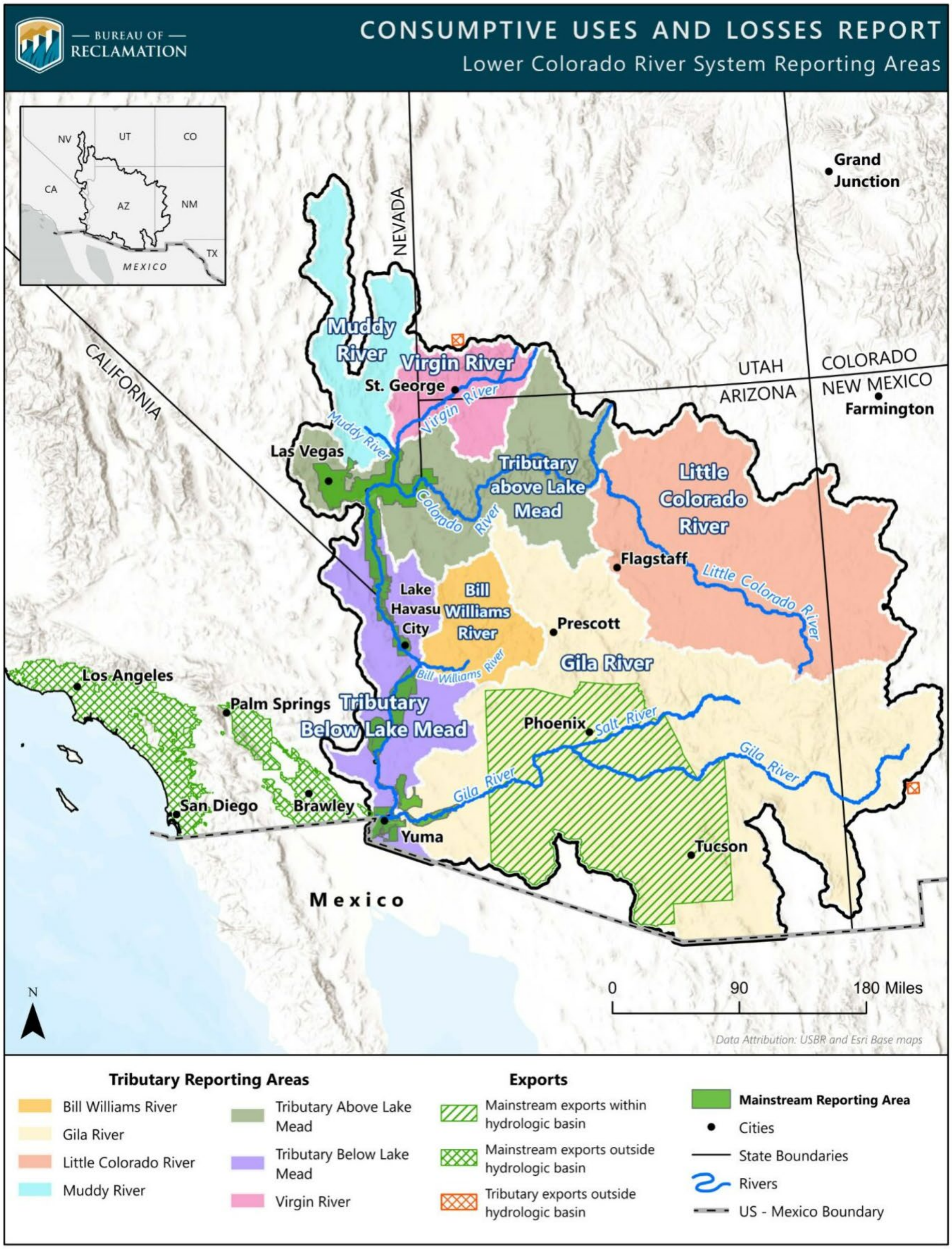
Map 1: Subbasins (HUC8s)



Map 2: Lower Colorado River System Reporting Areas[43]

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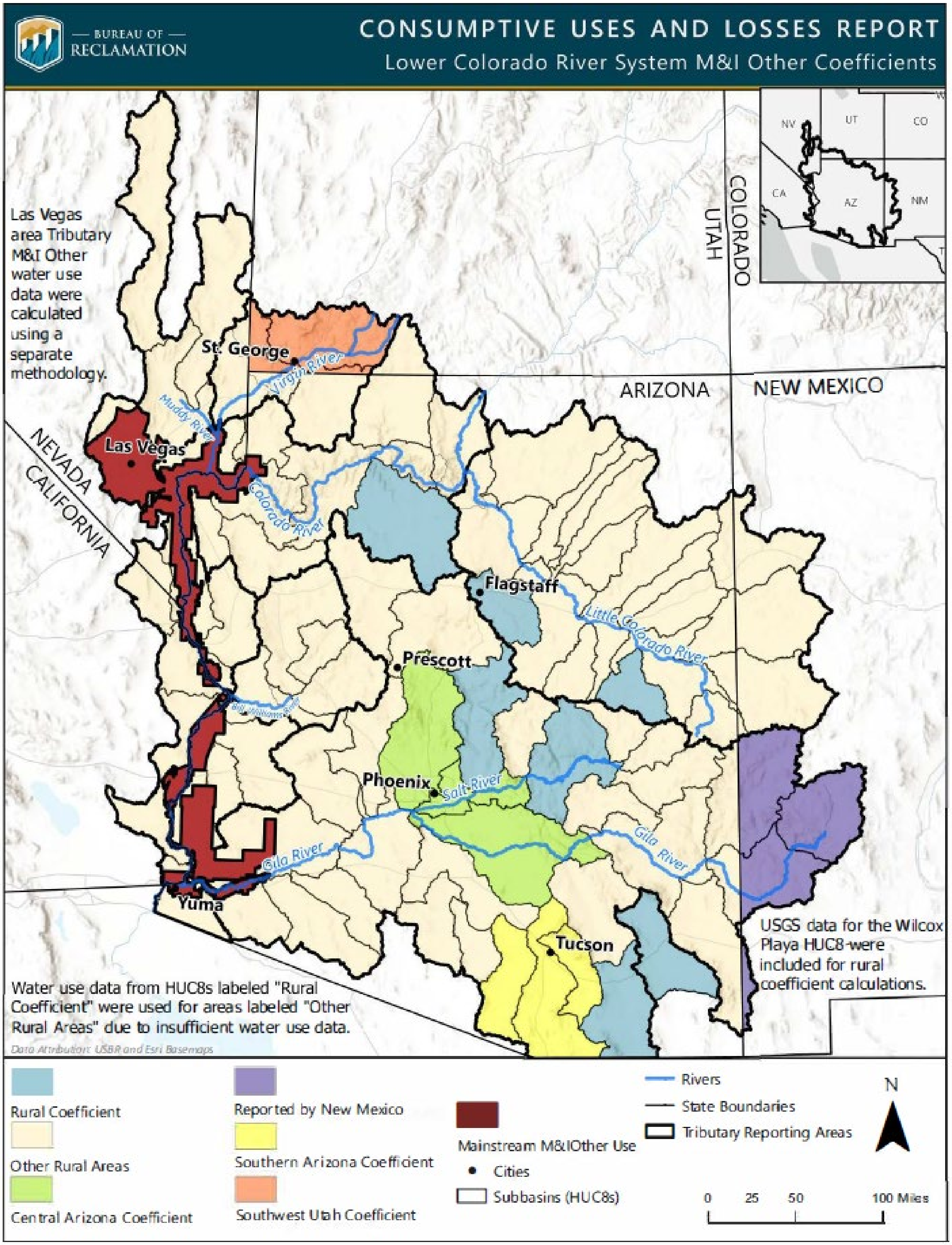
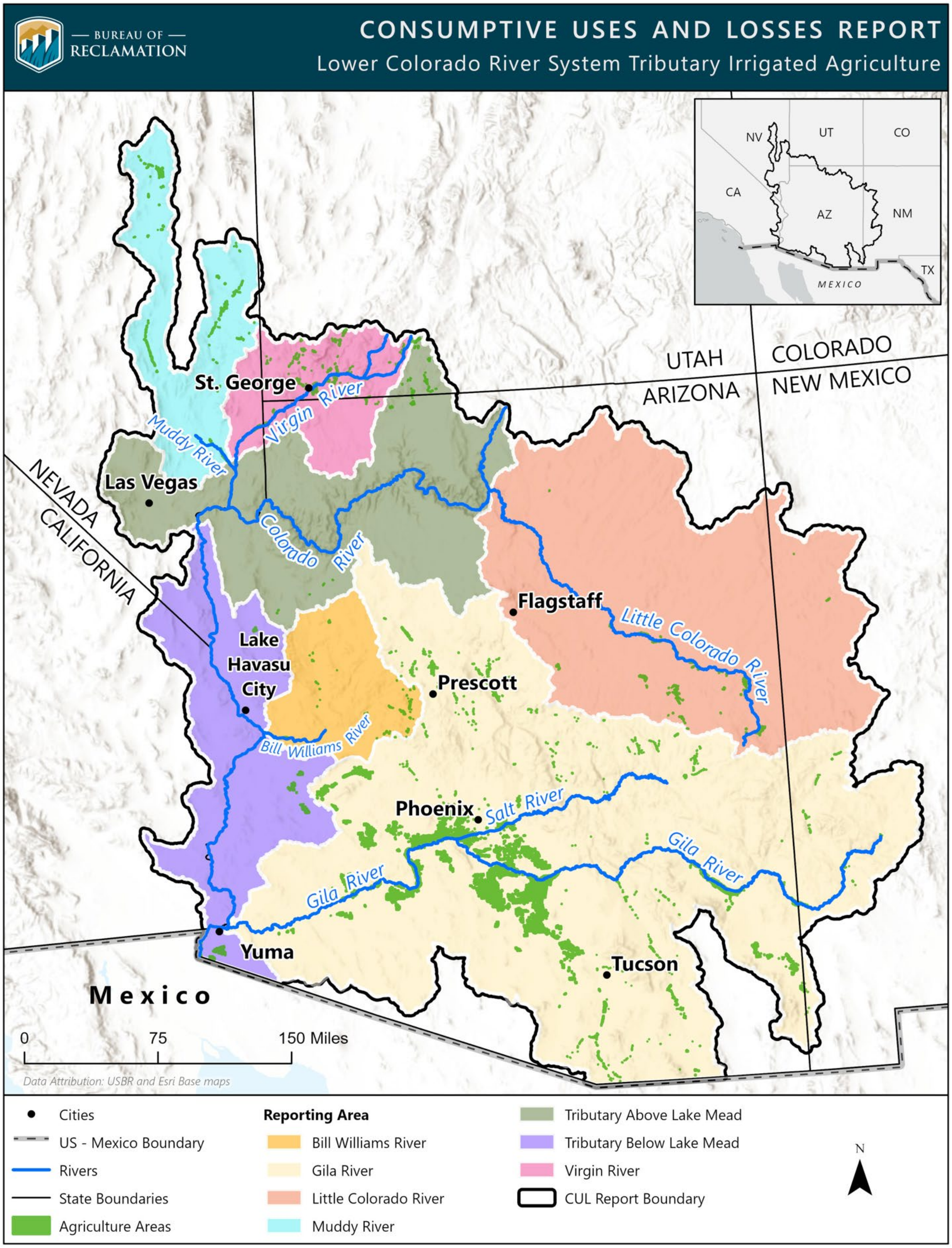
[43] Mainstream Reporting Area is indicative of users sourcing mainstream water for agricultural purposes. Slight modifications to this boundary were made for users sourcing mainstream water for M&I Other purposes.

Map 3: Flow Node Basins and Reporting Areas[44]

[44] Flow Node Basins 31 and 32 have not historically been included in Reclamation's Flow Node delineation and resultantly do not have Flow Nodes associated with the basins. Data on CUL was estimated and reported for these areas, however it has yet to be determined if that data will be used to compute natural flow values.



Map 4: Municipal and Industrial Other Water Use Coefficients



Map 5: Lower Colorado River System Tributary Irrigated Agriculture

14. Attachments

14.1. Area Reference Table

STATE NAME	HUC8 NAME	HUC8 CODE	NODE CODE	REPORTING AREA	AREA ACRES
Arizona	Little Colorado Headwaters	15020001	04_22_15020001	Little Colorado	483172
Arizona	Upper Little Colorado	15020002	04_22_15020002	Little Colorado	1034555
Arizona	Carrizo Wash	15020003	04_22_15020003	Little Colorado	211751
Arizona	Zuni	15020004	04_22_15020004	Little Colorado	445111
Arizona	Silver	15020005	04_22_15020005	Little Colorado	606713
Arizona	Upper Puerco	15020006	04_22_15020006	Little Colorado	353580
Arizona	Lower Puerco	15020007	04_22_15020007	Little Colorado	713784
Arizona	Middle Little Colorado	15020008	04_22_15020008	Little Colorado	1614681
Arizona	Leroux Wash	15020009	04_22_15020009	Little Colorado	520334
Arizona	Chevelon Canyon	15020010	04_22_15020010	Little Colorado	524357
Arizona	Cottonwood Wash	15020011	04_22_15020011	Little Colorado	1072488
Arizona	Corn-Oraibi	15020012	04_22_15020012	Little Colorado	468066
Arizona	Polacca Wash	15020013	04_22_15020013	Little Colorado	739449
Arizona	Jadito Wash	15020014	04_22_15020014	Little Colorado	600656
Arizona	Canyon Diablo	15020015	04_22_15020015	Little Colorado	767056
Arizona	Lower Little Colorado	15020016	04_22_15020016	Little Colorado	1220622
Arizona	Dinnebito Wash	15020017	04_22_15020017	Little Colorado	523850
Arizona	Moenkopi Wash	15020018	04_22_15020018	Little Colorado	1695918
Arizona	Lower Colorado-Marble Canyon	15010001	04_23_15010001	Trib Above Lake Mead	874407
Arizona	Lower Little Colorado	15020016	04_23_15020016	Little Colorado	310763
Arizona	Fort Pearce Wash	15010009	04_24_15010009	Virgin	964646
Arizona	Lower Virgin	15010010	04_24_15010010	Virgin	204617
Arizona	Lower Colorado-Marble Canyon	15010001	04_25_15010001	Trib Above Lake Mead	64694
Arizona	Grand Canyon	15010002	04_25_15010002	Trib Above Lake Mead	1632850

14.1. Area Reference Table

STATE NAME	HUC8 NAME	HUC8 CODE	NODE CODE	REPORTING AREA	AREA ACRES
Arizona	Kanab	15010003	04_25_15010003	Trib Above Lake Mead	1094155
Arizona	Havasu Canyon	15010004	04_25_15010004	Trib Above Lake Mead	1877035
Arizona	Lake Mead	15010005	04_25_15010005	Trib Above Lake Mead	1079565
Arizona	Grand Wash	15010006	04_25_15010006	Trib Above Lake Mead	535464
Arizona	Red Lake	15010007	04_25_15010007	Trib Above Lake Mead	905998
Arizona	Lower Virgin	15010010	04_25_15010010	Virgin	110584
Arizona	Detrital Wash	15010014	04_25_15010014	Trib Above Lake Mead	444393
Arizona	Havasu-Mohave Lakes	15030101	04_26_15030101	Trib Below Lake Mead	303535
Arizona	Big Sandy	15030201	04_27_15030201	Bill Williams	1378577
Arizona	Burro	15030202	04_27_15030202	Bill Williams	456495
Arizona	Santa Maria	15030203	04_27_15030203	Bill Williams	917006
Arizona	Bill Williams	15030204	04_27_15030204	Bill Williams	205932
Arizona	Havasu-Mohave Lakes	15030101	04_28_15030101	Trib Below Lake Mead	471540
Arizona	Sacramento Wash	15030103	04_28_15030103	Trib Below Lake Mead	853425
Arizona	Bill Williams	15030204	04_28_15030204	Bill Williams	482301
Arizona	Imperial Reservoir	15030104	04_29_15030104	Trib Below Lake Mead	976427
Arizona	Bouse Wash	15030105	04_29_15030105	Trib Below Lake Mead	1035134
Arizona	Tyson Wash	15030106	04_29_15030106	Trib Below Lake Mead	457874
Arizona	Upper Gila-Mangas	15040002	04_31_15040002	Gila	341491
Arizona	San Francisco	15040004	04_31_15040004	Gila	600786
Arizona	Upper Gila-San Carlos Reservoir	15040005	04_31_15040005	Gila	1771326
Arizona	San Simon	15040006	04_31_15040006	Gila	1290666
Arizona	San Carlos	15040007	04_31_15040007	Gila	688124
Arizona	Middle Gila	15050100	04_31_15050100	Gila	2100818
Arizona	Upper San Pedro	15050202	04_31_15050202	Gila	1144184
Arizona	Lower San Pedro	15050203	04_31_15050203	Gila	1267552
Arizona	Upper Santa Cruz	15050301	04_31_15050301	Gila	1425257
Arizona	Rillito	15050302	04_31_15050302	Gila	588877

14.1. Area Reference Table

STATE NAME	HUC8 NAME	HUC8 CODE	NODE CODE	REPORTING AREA	AREA ACRES
Arizona	Lower Santa Cruz	15050303	04_31_15050303	Gila	1076150
Arizona	Brawley Wash	15050304	04_31_15050304	Gila	901028
Arizona	Aguirre Valley	15050305	04_31_15050305	Gila	468926
Arizona	Santa Rosa Wash	15050306	04_31_15050306	Gila	773198
Arizona	Black	15060101	04_31_15060101	Gila	800589
Arizona	White	15060102	04_31_15060102	Gila	408259
Arizona	Upper Salt	15060103	04_31_15060103	Gila	1377581
Arizona	Carrizo	15060104	04_31_15060104	Gila	454076
Arizona	Tonto	15060105	04_31_15060105	Gila	670568
Arizona	Lower Salt	15060106	04_31_15060106	Gila	665756
Arizona	Big Chino-Williamson Valley	15060201	04_31_15060201	Gila	1378177
Arizona	Upper Verde	15060202	04_31_15060202	Gila	1604391
Arizona	Lower Verde	15060203	04_31_15060203	Gila	1257756
Arizona	Lower Gila-Painted Rock Reservoir	15070101	04_31_15070101	Gila	1289829
Arizona	Agua Fria	15070102	04_31_15070102	Gila	1757494
Arizona	Hassayampa	15070103	04_31_15070103	Gila	941367
Arizona	Centennial Wash	15070104	04_31_15070104	Gila	1236433
Arizona	Lower Gila	15070201	04_31_15070201	Gila	2685436
Arizona	Tenmile Wash	15070202	04_31_15070202	Gila	687963
Arizona	San Cristobal Wash	15070203	04_31_15070203	Gila	1053712
Arizona	Lower Colorado	15030107	04_32_15030107	Trib Below Lake Mead	46665
Arizona	Yuma Desert	15030108	04_32_15030108	Trib Below Lake Mead	404814
California	Havasu-Mohave Lakes	15030101	06_28_15030101	Trib Below Lake Mead	649911
California	Piute Wash	15030102	06_28_15030102	Trib Below Lake Mead	443873
California	Imperial Reservoir	15030104	06_29_15030104	Trib Below Lake Mead	1233077
California	Lower Colorado	15030107	06_32_15030107	Trib Below Lake Mead	128794
Nevada	Lower Virgin	15010010	32_24_15010010	Virgin	125486
Nevada	Lake Mead	15010005	32_25_15010005	Trib Above Lake Mead	775460

14.1. Area Reference Table

STATE NAME	HUC8 NAME	HUC8 CODE	NODE CODE	REPORTING AREA	AREA ACRES
Nevada	Grand Wash	15010006	32_25_15010006	Trib Above Lake Mead	62979
Nevada	Lower Virgin	15010010	32_25_15010010	Virgin	568022
Nevada	White	15010011	32_25_15010011	Muddy	1844830
Nevada	Muddy	15010012	32_25_15010012	Muddy	1161797
Nevada	Meadow Valley Wash	15010013	32_25_15010013	Muddy	1624126
Nevada	Las Vegas Wash	15010015	32_25_15010015	Trib Above Lake Mead	1205750
Nevada	Havasu-Mohave Lakes	15030101	32_26_15030101	Trib Below Lake Mead	288510
Nevada	Havasu-Mohave Lakes	15030101	32_28_15030101	Trib Below Lake Mead	70954
Nevada	Piute Wash	15030102	32_28_15030102	Trib Below Lake Mead	216234
New Mexico	Little Colorado Headwaters	15020001	35_22_15020001	Little Colorado	32073
New Mexico	Upper Little Colorado	15020002	35_22_15020002	Little Colorado	2721
New Mexico	Carrizo Wash	15020003	35_22_15020003	Little Colorado	1234779
New Mexico	Zuni	15020004	35_22_15020004	Little Colorado	1262625
New Mexico	Upper Puerco	15020006	35_22_15020006	Little Colorado	870092
New Mexico	Upper Gila	15040001	35_31_15040001	Gila	1269560
New Mexico	Upper Gila-Mangas	15040002	35_31_15040002	Gila	969810
New Mexico	San Francisco	15040004	35_31_15040004	Gila	1192781
New Mexico	San Simon	15040006	35_31_15040006	Gila	149500
Utah	Upper Virgin	15010008	49_24_15010008	Virgin	1397442
Utah	Fort Pearce Wash	15010009	49_24_15010009	Virgin	104725
Utah	Lower Virgin	15010010	49_24_15010010	Virgin	310249
Utah	Kanab	15010003	49_25_15010003	Trib Above Lake Mead	417938
Utah	Lower Virgin	15010010	49_25_15010010	Virgin	1372
Utah	Meadow Valley Wash	15010013	49_25_15010013	Muddy	1752

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
FREDONIA	36.95417	-112.51472	0.05	1973	162	AZ	Kanab	15010003
JACKSON FLAT RESERVOIR	37.01568469	-112.516806	0.5	2012	200	UT	Kanab	15010003
KANAB CITY - TOM`S CANYON FLOOD CONTROL	37.05660051	-112.5154716	0.05	2016	5	UT	Kanab	15010003
ALTON RESERVOIR	37.44908187	-112.4796671	0.5		2	UT	Kanab	15010003
GOODFELLOW, LYNN 83R21	37.02344435	-112.3760373	0.5		2	UT	Kanab	15010003
KANAB IRRIGATION DIVERSION	37.06848467	-112.535759	0.5		11	UT	Kanab	15010003
DRY HOLLOW RESERVOIR	37.46627249	-112.4392801	0.5		4	UT	Kanab	15010003
ROCKY POINT RESERVOIR	37.45071077	-112.4594037	0.5		2	UT	Kanab	15010003
ROUNDY CANYON RESERVOIR	37.44351555	-112.4343482	0.5		2	UT	Kanab	15010003
SANTA FE	35.24306	-112.18639	0.5	1892	14	AZ	Havasu Canyon	15010004
CITY	35.23361	-112.19056	0.5	1902	7	AZ	Havasu Canyon	15010004
RUSSELL TANK DAM	35.8723	-111.8794	0.5	1930	6	AZ	Havasu Canyon	15010004
DOGTOWN	35.2125	-112.12583	0.5	1934	81	AZ	Havasu Canyon	15010004
KAIBAB	35.28361	-112.16194	0.5	1934	75	AZ	Havasu Canyon	15010004
WEST CATARACT CREEK	35.25222	-112.21472	0.5	1947	46	AZ	Havasu Canyon	15010004
SWEETWOOD (K4)	35.33333	-112.275	0.5		18	AZ	Havasu Canyon	15010004
LONG POINT DAM	35.71806	-112.61056	0.5		187	AZ	Havasu Canyon	15010004
TOM TANK	35.51833	-112.22222	0.5		18	AZ	Havasu Canyon	15010004
AARON WAY DETENTION BASIN	35.9965	-114.8378	0.05	1992	2	NV	Lake Mead	15010005
HEMENWAY VALLEY FLOOD CONTROL DAMS (2)	35.99333	-114.82806	0.05	1994	3	NV	Lake Mead	15010005
TRAIL HEAD DETENTION BASIN	35.9866	-114.8435	0.05		6	NV	Lake Mead	15010005
MACDONALD LAKE	37.42682304	-112.5340981	0.5	1910	19	UT	Upper Virgin	15010008
GRASS VALLEY	37.41681945	-113.4991218	0.05	1917	8	UT	Upper Virgin	15010008
TUACAHN WASH LOWER DETENTION BASIN	37.13099643	-113.6377814	0.05	1919	4	UT	Upper Virgin	15010008
PACIFICORP - SAND COVE (LOW)	37.28514858	-113.7457975	0.75	1928	5	UT	Upper Virgin	15010008

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
PACIFICORP - SAND COVE (UP.)	37.30181607	-113.6974622	0.75	1928	13	UT	Upper Virgin	15010008
PINE VALLEY RESERVOIR	37.379297	-113.475556	0.5	1934	5	UT	Upper Virgin	15010008
IVINS BENCH	37.17855903	-113.7133461	0.5	1943	37	UT	Upper Virgin	15010008
MEADOW HOLLOW	37.50348717	-113.0941146	0.5	1948	12	UT	Upper Virgin	15010008
BAKER	37.37870212	-113.6407838	0.5	1950	48	UT	Upper Virgin	15010008
KOLOB CREEK	37.43356774	-113.0477259	0.5	1956	233	UT	Upper Virgin	15010008
BLUE SPRINGS	37.40015277	-113.0457783	0.5	1957	43	UT	Upper Virgin	15010008
ASH CREEK	37.41230116	-113.2357195	0.5	1960	243	UT	Upper Virgin	15010008
GUBLER (HARRIS)	37.51348844	-113.2141166	0.5	1960	3	UT	Upper Virgin	15010008
GUNLOCK	37.25293441	-113.7753585	0.5	1970	252	UT	Upper Virgin	15010008
STUCKI DEBRIS	37.05254914	-113.4888316	0.05	1974	29	UT	Upper Virgin	15010008
GYPSUM WASH	37.08080546	-113.489528	0.05	1975	42	UT	Upper Virgin	15010008
WARNER DRAW	37.06014755	-113.4707845	0.05	1975	164	UT	Upper Virgin	15010008
IVINS SCS-4	37.1768139	-113.6807939	0.05	1977	1	UT	Upper Virgin	15010008
IVINS SCS-5	37.17848065	-113.6724602	0.05	1977	5	UT	Upper Virgin	15010008
IVINS SCS-6	37.17848069	-113.6674599	0.05	1977	3	UT	Upper Virgin	15010008
IVINS SCS-1	37.18514731	-113.6874609	0.05	1977	2	UT	Upper Virgin	15010008
IVINS SCS-2	37.18181394	-113.6841274	0.05	1977	1	UT	Upper Virgin	15010008
IVINS SCS-3	37.17848056	-113.6824606	0.05	1977	1	UT	Upper Virgin	15010008
FROG HOLLOW	37.12113074	-113.2630378	0.05	1978	163	UT	Upper Virgin	15010008
QUAIL CREEK	37.18015031	-113.3807831	0.5	1984	616	UT	Upper Virgin	15010008
QUAIL CREEK DIVERSION	37.20114737	-113.2341663	0.5	1984	18	UT	Upper Virgin	15010008
SOUTH CREEK - WASHINGTON COUNTY	37.14900363	-112.9853889	0.5	1988	54	UT	Upper Virgin	15010008
ST. GEORGE CITY-CITY CREEK D.B.	37.13490874	-113.5858771	0.05	1989	3	UT	Upper Virgin	15010008
SAND HOLLOW NORTH DAM	37.12900979	-113.3715307	0.75	2002	1176	UT	Upper Virgin	15010008
TUACAHN WASH UPPER DETENTION BASIN	37.18829655	-113.6554308	0.05	2013	4	UT	Upper Virgin	15010008
FREHNER, GARTH E. FAMILY TRUST	37.47687746	-113.2994998	0.5		5	UT	Upper Virgin	15010008
BOWLER, JOHN M. , ET AL 84R25	37.36159238	-113.6976443	0.5		1	UT	Upper Virgin	15010008

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
STIRLING, DAVID H. 97-81-07MD	37.23173066	-113.3495943	0.5		0	UT	Upper Virgin	15010008
TOWN OF SPRINGDALE 88R161	37.20308389	-112.9974781	0.5		0	UT	Upper Virgin	15010008
ASPEN LAKE	37.53348754	-112.9057771	0.5		9	UT	Upper Virgin	15010008
CHRISTENSEN, ELLIOTT F. (LDS CHURCH)	37.43943842	-113.271911	0.5		0	UT	Upper Virgin	15010008
MCCOWAN, MILO 99-81-22	37.35677339	-112.6479613	0.5		0	UT	Upper Virgin	15010008
SUMMIT DEVELOPMENT, POND N10	37.17255377	-113.3281388	0.05		1	UT	Upper Virgin	15010008
JOSHUA CROSBY	36.4075	-113.24389	0.5	1944	13	AZ	Fort Pearce Wash	15010009
CROSBY TANK DETENTION DAM	36.45154	-113.23456	0.05	1959	139	AZ	Fort Pearce Wash	15010009
HOLE-N-WALL DETENTION DAM	36.78626	-113.49456	0.05	1960	178	AZ	Fort Pearce Wash	15010009
FLAT TOP DETENTION DAM	36.76434	-113.12291	0.05	1962	324	AZ	Mohave County	15010009
ANTELOPE VALLEY DETENTION DAM	36.59386	-112.98415	0.05	1963	37	AZ	Fort Pearce Wash	15010009
ANTELOPE DETENTION DAM	36.58749	-112.99336	0.05	1965	108	AZ	Fort Pearce Wash	15010009
SHORT CREEK SOUTHSIDE #2	36.99639	-112.96278	0.5	1970	5	AZ	Fort Pearce Wash	15010009
SHORT CREEK SOUTHSIDE #1	36.98056	-112.96889	0.5	1975	9	AZ	Fort Pearce Wash	15010009
ST. GEORGE REPLACEMENT AIPORT/ DB 2	37.03709122	-113.51273	0.05	2008	5	UT	Fort Pearce Wash	15010009
HILDALE CARLING STREET DB	37.0095854	-112.9714141	0.05		3	UT	Washington County	15010009
TOWN WASH DAM	36.82583	-114.07333	0.05	1992	10	NV	Lower Virgin	15010010
WINDMILL WASH DETENTION BASIN	36.76644	-114.12172	0.05	1999	20	NV	Lower Virgin	15010010
ST. GEORGE CITY - NAVAJO D.B.	37.05387127	-113.6230897	0.05	2002	5	UT	Lower Virgin	15010010
ABBOTT WASH DETENTION BASIN	36.825682	-114.094174	0.05	2008	21	NV	Lower Virgin	15010010
PULSIPHER WASH DETENTION BASIN	36.817577	-114.115121	0.05	2008	11	NV	Lower Virgin	15010010
SUNNYSIDE DAM	38.3597	-115.12	0.5	1915	882	NV	White	15010011
TULE FIELD DAM	38.30889	-115.19222	0.5	1930	80	NV	White	15010011
PRESTON LOWER DAM	38.94055	-115.05778	0.5	1932	24	NV	White	15010011

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
UPPER PAHRANAGAT DAM	37.28666687	-115.1200027	0.5	1937	441	NV	White	15010011
HAY MEADOW DAM	38.3297	-115.17	0.5	1967	203	NV	White	15010011
OLD PLACE DIKE #3	38.42	-115.0797	0.5	1974	43	NV	White	15010011
PAHRANAGAT UPPER CROSS DIKE	37.3024	-115.1279	0.5	1978	120	NV	White	15010011
COLD SPRINGS	38.3417	-115.1534	0.5	1980	305	NV	White	15010011
DACEY DAM	38.39	-115.1097	0.5		215	NV	White	15010011
ARROW CANYON DETENTION DAM	36.74542	-114.80149	0.05	1933	102	NV	Muddy	15010012
BOWMAN DAM	36.62106	-114.47996	0.5	1950	165	NV	Muddy	15010012
HONEYBEE DAM	36.52833	-114.42	0.5	1956	36	NV	Muddy	15010012
DAIRY POND DAM	36.5478	-114.4339	0.5	2013	1	NV	Clark County	15010012
BUFFINGTON POCKETS DAM	36.3847	-114.6907	0.05		5	NV	Muddy	15010012
COYOTE SPRINGS DETENTION BASIN 1-2	36.8043	-114.9539	0.05		85	NV	Muddy	15010012
SPEEDWAY DETENTION BASIN #2 DAM	36.2903	-115.0238	0.05		2	NV	Clark County	15010012
MATHEWS CANYON DAM	37.498329	-114.2233	0.05	1957	1	NV	Meadow Valley Wash	15010013
PINE CANYON DAM	37.47708	-114.30712	0.05	1957	1	NV	Meadow Valley Wash	15010013
HOLLINGER DEBRIS	38.105	-114.168	0.05	1962	90	NV	Meadow Valley Wash	15010013
EAGLE VALLEY RES	38.02223	-114.20058	0.5	1965	60	NV	Meadow Valley Wash	15010013
ECHO CANYON DAM LINCOLN	37.90719	-114.27153	0.5	1970	64	NV	Meadow Valley Wash	15010013
SPRING MOUNTAIN RANCH	36.06833	-115.46111	0.5	1945	3	NV	Las Vegas Wash	15010015
ANGEL PARK SOUTH DETENTION BASIN	36.17139	-115.27833	0.05	1982	24	NV	Las Vegas Wash	15010015
ANGEL PARK NORTH DETENTION BASIN	36.1820226	-115.279165	0.05	1985	52	NV	Las Vegas Wash	15010015
RED ROCK DETENTION	36.15305	-115.35468	0.05	1987	76	NV	Las Vegas Wash	15010015
MCCARRAN AIRFIELD DETENTION DAM	36.0769	-115.1194	0.05	1989	21	NV	Las Vegas Wash	15010015

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
MEADOWS DETENTION BASIN	36.17306	-115.18361	0.05	1990	22	NV	Las Vegas Wash	15010015
LAKE LAS VEGAS	36.1197	-114.9097	0.5	1991	320	NV	Las Vegas Wash	15010015
FLAMINGO WASH UPPER DETENTION BASIN	36.09	-115.2697	0.05	1992	90	NV	Las Vegas Wash	15010015
CAREY/LAKE MEAD DETENTION BASIN	36.19833	-115.18056	0.05	1993	40	NV	Las Vegas Wash	15010015
LAS VEGAS WASH UPPER DETENTION BASIN	36.32639	-115.21139	0.05	1993	165	NV	Las Vegas Wash	15010015
GOWAN DETENTION MIDDLE	36.2228	-115.2522	0.05	1993	20	NV	Las Vegas Wash	15010015
KYLE CANYON DETENTION	36.30028	-115.33833	0.05	1995	148	NV	Las Vegas Wash	15010015
CONFLUENCE DETENTION BASIN	36.2111	-115.0432	0.05	1997	157	NV	Las Vegas Wash	15010015
EQUESTRIAN DETENTION BASIN	36.0215	-114.9395	0.05	1997	10	NV	Las Vegas Wash	15010015
DUCK CREEK LOWER DETENTION DAM	36.0193	-115.1558	0.05	1999	65	NV	Las Vegas Wash	15010015
TROPICANA DETENTION BASIN	36.0817	-115.1988	0.05	1999	53	NV	Las Vegas Wash	15010015
BLACK MOUNTAIN DETENTION BASIN	35.987239	-114.99477	0.05	2000	20	NV	Las Vegas Wash	15010015
BLUE DIAMOND UPPER DETENTION DAM	36.02993	-115.31731	0.05	2000	139	NV	Las Vegas Wash	15010015
THE LAKES DETENTION BASIN	36.1278	-115.2783	0.05	2000	14	NV	Las Vegas Wash	15010015
EAST C-1 DETENTION BASIN	36.0233	-114.9065	0.05	2000	48	NV	Las Vegas Wash	15010015
DESERT INN DETENTION BASIN	36.129831	-115.24255	0.05	2002	8	NV	Las Vegas Wash	15010015
MCCULLOUGH HILLS PARK DETENTION BASIN	35.98389	-115.092222	0.05	2002	21	NV	Las Vegas Wash	15010015
RAINBOW DETENTION BASIN	36.174457	-115.243524	0.05	2002	6	NV	Las Vegas Wash	15010015
SUMMERLIN DETENTION BASIN #5	36.1731	-115.3722	0.05	2002	26	NV	Las Vegas Wash	15010015

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
PIONEER DETENTION BASIN	36.0442	-115.0203	0.05	2002	16	NV	Las Vegas Wash	15010015
PITTMAN EAST DETENTION BASIN	35.9689	-115.1291	0.05	2003	141	NV	Las Vegas Wash	15010015
RIVER MOUNTAINS IMPOUNDMENT DAM	36.02456	-114.92865	0.05	2003	13	NV	Las Vegas Wash	15010015
F-1 DETENTION BASIN	36.09772	-115.33861	0.05	2004	7	NV	Las Vegas Wash	15010015
F-2 DETENTION BASIN	36.08049	-115.32868	0.05	2004	3	NV	Las Vegas Wash	15010015
R-4 DETENTION DAM	36.11394	-115.35303	0.05	2004	36	NV	Las Vegas Wash	15010015
CHEYENNE PEAKING DETENTION BASIN	36.2196	-115.1121	0.05	2005	34	NV	Las Vegas Wash	15010015
F-4 DETENTION BASIN	36.04478	-115.29978	0.05	2005	4	NV	Las Vegas Wash	15010015
FORT APACHE DETENTION BASIN	36.28104	-115.29727	0.05	2005	5	NV	Las Vegas Wash	15010015
ANN ROAD DETENTION BASIN	36.2694	-115.3386	0.05	2007	20	NV	Las Vegas Wash	15010015
RANCHO DETENTION BASIN	36.2672	-115.2614	0.05	2008	20	NV	Las Vegas Wash	15010015
SOUTH EDGE EAST 1 HEADWORKS DETENTION BASIN	35.922	-115.118	0.05	2008	53	NV	Las Vegas Wash	15010015
DUCK CREEK RAILROAD DETENTION BASIN	36.00682	-115.23774	0.05	2010	57	NV	Las Vegas Wash	15010015
NORTHEAST C-1 DETENTION BASIN	36.052778	-114.935028	0.05	2010	14	NV	Las Vegas Wash	15010015
LEE CANYON RESERVOIR	36.3003	-115.68067	0.5	2010	1	NV	Las Vegas Wash	15010015
TROPICANA NORTH BRANCH DETENTION BASIN	36.09632	-115.19535	0.05	2011	5	NV	Las Vegas Wash	15010015
SUNRISE MOUNTAIN LANDFILL DETENTION BASIN	36.16017	-114.99032	0.05	2012	16	NV	Las Vegas Wash	15010015
LOWER BLUE DIAMOND DETENTION DAM	36.042306	-115.216778	0.05	2012	26	NV	Las Vegas Wash	15010015
F-3 DETENTION BASIN (SUMMERLIN V16A BLM DETENTION BASIN)	36.06185	-115.316597	0.05	2015	4	NV	Las Vegas Wash	15010015

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
BLUE DIAMOND BUSINESS CENTER DETENTION BASIN DAM #1	36.042102	-115.196177	0.05	2019	5	NV	Clark County	15010015
GRAND PARK DETENTION BASIN DAM	36.1932	-115.354	0.05	2023	12	NV	Las Vegas Wash	15010015
FLAMINGO WASH LOWER DETENTION BASIN	36.1024	-115.2085	0.05		29	NV	Las Vegas Wash	15010015
FLOYD LAMB PARK NORTH ENHANCEMENT EMBANKMENT	36.322	-115.256	0.05		55	NV	Las Vegas Wash	15010015
LAS VEGAS WASH LOWER DETENTION BASIN	36.255	-115.16056	0.05		40	NV	Las Vegas Wash	15010015
LONE MOUNTAIN DETENTION BASIN	36.23278	-115.30972	0.05		44	NV	Las Vegas Wash	15010015
LONE MOUNTAIN-BELTWAY DETENTION BASIN DAM	36.24684	-115.32004	0.05		32	NV	Las Vegas Wash	15010015
NORTH LAS VEGAS DETENTION BASIN	36.29306	-115.13167	0.05		75	NV	Las Vegas Wash	15010015
OAKEY DETENTION	36.150015	-115.235475	0.05		13	NV	Las Vegas Wash	15010015
ORCHARD DETENTION BASIN	36.154	-115.019	0.05		7	NV	Las Vegas Wash	15010015
PITTMAN ANTHEM DETENTION BASIN	35.94	-115.0754	0.05		9	NV	Las Vegas Wash	15010015
PITTMAN NORTH DETENTION BASIN	35.966679	-115.156301	0.05		69	NV	Las Vegas Wash	15010015
PITTMAN PARK DETENTION BASIN	36.04667	-115.05389	0.05		10	NV	Las Vegas Wash	15010015
UPPER DUCK CREEK INTERIM DETENTION BASIN	36.00815	-115.31332	0.05		171	NV	Las Vegas Wash	15010015
WEST RANGE WASH DIVERSION DIKE	36.30833	-115.11472	0.05		1	NV	Las Vegas Wash	15010015
SYKE CANYON DETENTION BASIN 1 DAM	36.310889	-115.3287	0.05		0	NV	Clark County	15010015
SYKE CANYON DETENTION BASIN 2 DAM	36.3199	-115.3314	0.05		8	NV	Clark County	15010015
FLOYD LAMB PARK SOUTH ENHANCEMENT EMBANKMENT	36.314	-115.2652	0.05		55	NV	Las Vegas Wash	15010015
GOWAN DETENTION NORTH	36.22583	-115.25333	0.05		10	NV	Las Vegas Wash	15010015
GOWAN DETENTION SOUTH	36.213823	-115.25194	0.05		10	NV	Las Vegas Wash	15010015

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
SILVERADO RANCH DETENTION BASIN DAM	36.0111	-115.2001	0.05		26	NV	Clark County	15010015
PITTMAN HORIZON RIDGE DETENTION BASIN DAM	36.014833	-115.024264	0.05		6	NV	Clark County	15010015
MISSION HILLS DETENTION BASIN	35.98725	-114.95269	0.05		29	NV	Las Vegas Wash	15010015
H-V RESERVOIR	34.04472	-109.05472	0.5	1883	51	AZ	Little Colorado Headwaters	15020001
JARVIS	33.98333	-109.20833	0.5	1886	9	AZ	Little Colorado Headwaters	15020001
CANYON	34.005	-109.33639	0.5	1886	9	AZ	Little Colorado Headwaters	15020001
NELSON	34.05972	-109.19444	0.5	1890	101	AZ	Little Colorado Headwaters	15020001
RIVER RESERVOIR #3	34.03694	-109.43667	0.5	1896	164	AZ	Little Colorado Headwaters	15020001
LEE VALLEY	33.94222	-109.49889	0.5	1899	45	AZ	Little Colorado Headwaters	15020001
HOG WALLOW	33.98111	-109.42222	0.5	1908	57	AZ	Little Colorado Headwaters	15020001
MEXICAN HAY LAKE	34.03444	-109.36417	0.5	1908	164	AZ	Little Colorado Headwaters	15020001
POOL CORRAL	33.9725	-109.40944	0.5	1908	50	AZ	Little Colorado Headwaters	15020001
ROGERS	33.94111	-109.27417	0.5	1910	13	AZ	Little Colorado Headwaters	15020001
SUNNYSIDE	34.05917	-109.53556	0.5	1912	16	AZ	Little Colorado Headwaters	15020001
ATCHISON	34.00167	-109.34306	0.5	1920	52	AZ	Little Colorado Headwaters	15020001
ST. MARYS	33.99472	-109.31806	0.5	1925	25	AZ	Little Colorado Headwaters	15020001
ELLIS WILTBANK	34.08944	-109.47028	0.5	1929	71	AZ	Little Colorado Headwaters	15020001
NORTON	34.06361	-109.52222	0.5	1929	480	AZ	Little Colorado Headwaters	15020001
TYLER RESERVOIR	34.11056	-109.52861	0.5	1929	15	AZ	Little Colorado Headwaters	15020001
WHITE MOUNTAIN	34.00889	-109.51389	0.5	1929	480	AZ	Little Colorado Headwaters	15020001

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
GLEN COE (MCKAY)	34.02444	-109.22917	0.5	1929	26	AZ	Little Colorado Headwaters	15020001
NUTRIOSO	33.951972	-109.216507	0.5	1929	31	AZ	Little Colorado Headwaters	15020001
GLEN LIVET	34.02861	-109.21861	0.5	1929	21	AZ	Little Colorado Headwaters	15020001
BUNCH RESERVOIR	34.04306	-109.44583	0.5	1929	27	AZ	Little Colorado Headwaters	15020001
EAGAR-SLADE	33.99944	-109.33278	0.5	1945	104	AZ	Little Colorado Headwaters	15020001
HULSEY LAKE DAM	33.9323	-109.1619472	0.5	1950	5	AZ	Little Colorado Headwaters	15020001
SCARLETT LAKE	34.06944	-109.08333	0.5	1950	75	AZ	Little Colorado Headwaters	15020001
SHEEP SPRINGS #1	34.05056	-109.53667	0.5	1956	43	AZ	Little Colorado Headwaters	15020001
OWENS LAKE	34.06583	-109.47222	0.5		24	AZ	Little Colorado Headwaters	15020001
UDALL	34.60917	-109.47972	0.05	1910	545	AZ	Upper Little Colorado	15020002
MALLORY TANK	34.29167	-109.50278	0.5	1918	27	AZ	Upper Little Colorado	15020002
LITTLE RESERVOIR	34.4875	-109.36139	0.5	1921	338	AZ	Upper Little Colorado	15020002
CONCHO SPRINGS	34.44889	-109.62833	0.5	1927	155	AZ	Upper Little Colorado	15020002
DAD PATTERSON	34.5375	-109.70417	0.5	1944	40	AZ	Upper Little Colorado	15020002
BOYNTON LAKE DAM	34.20324444	-109.6017694	0.5	1974	3	AZ	Upper Little Colorado	15020002
HAUMONT TANK	34.53306	-109.69278	0.5		90	AZ	Upper Little Colorado	15020002
QUEMADO LAKE DAM	34.137337	-108.497484	0.5	1971	130	NM	Carrizo Wash	15020003
CORONADO GEN. STATION	34.55778	-109.29611	0.5	1978	330	AZ	Carrizo Wash	15020003
LAYTON DET DAM NO.4	34.34245	-108.82096	0.05		2	NM	Carrizo Wash	15020003
RED HILL DETENTION DAM NO. 1	34.32982	-108.87652	0.05		2	NM	Carrizo Wash	15020003
RAMAH DAM	35.1452	-108.4897	0.5	1900	514	NM	Zuni	15020004

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
TRAPPED ROCK	35.03951	-108.854	0.5	1992	4	NM	Zuni	15020004
LAKESIDE	34.15333	-109.975	0.5	1904	118	AZ	Silver	15020005
WOODLAND	34.12722	-109.95306	0.5	1914	18	AZ	Silver	15020005
DAGGS	34.365	-110.00111	0.5	1919	379	AZ	Silver	15020005
LAKE OF THE WOODS	34.16139	-109.97806	0.5	1934	13	AZ	Silver	15020005
LONE PINE	34.35111	-110.08667	0.05	1936	357	AZ	Silver	15020005
SCOTT	34.17417	-109.96056	0.5	1945	84	AZ	Silver	15020005
JAQUES	34.19722	-110	0.5	1953	186	AZ	Silver	15020005
FOOL HOLLOW	34.27778	-110.07361	0.5	1956	152	AZ	Silver	15020005
MILLETT SWALE	34.43056	-110.04111	0.05	1958	200	AZ	Silver	15020005
TROPHY LAKE	34.36444	-110.045	0.5	1975	9	AZ	Silver	15020005
ORTEGA LAKE RETENTION	34.30111	-109.84806	0.05	1987	94	AZ	Silver	15020005
JACQUES MARSH	34.18694	-109.97694	0.5	1988	35	AZ	Silver	15020005
SCHOENS	34.41417	-110.10056	0.05	1988	900	AZ	Silver	15020005
LITTLE ORTEGA DAM	34.29472	-109.83556	0.05		30	AZ	Silver	15020005
PACE TANK DAM	34.7125	-110.02778	0.5		40	AZ	Silver	15020005
WINDOW ROCK	35.67856	-109.0455	0.05	1936	8	AZ	Upper Puerco	15020006
ASAAYI	35.97724	-108.9312	0.5	1964	35	NM	Upper Puerco	15020006
BLUE CANYON	35.78144	-109.1061	0.75	1984	2	AZ	Upper Puerco	15020006
TROUT LAKE	35.854282	-109.121336	0.5		4	AZ	Upper Puerco	15020006
BEAR CANYON	34.40694	-111.00111	0.5	1929	65	AZ	Middle Little Colorado	15020008
TREMAINE RESERVOIR	34.759995	-111.2174611	0.5	1952	265	AZ	Middle Little Colorado	15020008
KNOLL	34.43139	-111.085	0.5	1963	77	AZ	Middle Little Colorado	15020008
NORTH PONDING DAM	34.89969	-110.14971	0.05	1977	81	AZ	Navajo County	15020008
CLEAR CREEK #2	34.98028	-110.64056	0.5	1986	53	AZ	Middle Little Colorado	15020008
BROKEN TANK	34.73583	-110.80583	0.5		29	AZ	Middle Little Colorado	15020008

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
KLAGETOH	35.51719	-109.513469	0.5		47	AZ	Leroux Wash	15020009
WOODS CANYON	34.33389	-110.93583	0.5	1956	51	AZ	Chevelon Canyon	15020010
BLACK CANYON	34.33083	-110.69806	0.5	1964	78	AZ	Chevelon Canyon	15020010
CHEVELON CANYON	34.51139	-110.82389	0.5	1966	200	AZ	Chevelon Canyon	15020010
WILLOW SPRINGS	34.31667	-110.87639	0.5	1970	150	AZ	Chevelon Canyon	15020010
GANADO	35.73154	-109.521	0.5	1994	279	AZ	Cottonwood Wash	15020011
LOWER LAKE MARY	35.111455	-111.5811036	0.5	1907	910	AZ	Canyon Diablo	15020015
SOLDIER ANNEX DAM	34.78122945	-111.2282072	0.5	1935	106	AZ	Canyon Diablo	15020015
UPPER LAKE MARY	35.08083	-111.53361	0.5	1941	1058	AZ	Canyon Diablo	15020015
MORTON	34.89111	-111.29333	0.5	1943	29	AZ	Canyon Diablo	15020015
ASHURST LAKE	35.01417	-111.39222	0.5	1954	230	AZ	Canyon Diablo	15020015
COCONINO	35.005	-111.38889	0.5	1954	31	AZ	Canyon Diablo	15020015
KINNIKINICK	34.89889	-111.30333	0.5	1956	145	AZ	Canyon Diablo	15020015
CANYON DIABLO	35.2839	-110.9907	0.5	1966	284	AZ	Canyon Diablo	15020015
CONTINENTAL #1	35.19833	-111.58667	0.5	1972	5	AZ	Canyon Diablo	15020015
CONTINENTAL #2	35.18806	-111.58639	0.5	1974	38	AZ	Canyon Diablo	15020015
PASTURE CANYON	36.13643	-111.2159	0.5	1930	28	AZ	Moenkopi Wash	15020018
HIKO SPRINGS DETENTION BASIN DAM	35.1553	-114.6317	0.05	1996	41	NV	Havasu-Mohave Lakes	15030101
MINERAL PARK FLOOD CONTROL BASIN	35.37167	-114.15583	0.05	1995	3	AZ	Sacramento Wash	15030103
BOB CROWDER DETENTION DAM	33.47586	-113.71784	0.5	1963	104	AZ	Bouse Wash	15030105
FORT ROCK RANCH	35.13139	-113.32778	0.5	1963	19	AZ	Big Sandy	15030201
ORO RANCH (LAKE MARY)	34.96506	-113.10415	0.5		260	AZ	Big Sandy	15030201
SWALE TANK DAM	34.75951	-113.37242	0.05		10	AZ	Burro	15030202
RED LAKE TANK DAM	34.73297	-113.32959	0.5		30	AZ	Burro	15030202
ONEAL LAKE	34.26417	-112.95333	0.5	1894	13	AZ	Santa Maria	15030203

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
LAKE ROBERTS DAM	33.03112	-108.16502	0.5	1963	61	NM	Upper Gila	15040001
SNOW LAKE DAM	33.41716	-108.495247	0.5	1967	539	NM	Upper Gila	15040001
DAGGER DRAW DETENTION DAM 1	32.57279	-109.03095	0.05	1950	13	AZ	Upper Gila-Mangas	15040002
DAGGER DRAW DETENTION DAM 2	32.57995	-109.00937	0.05	1950	19	AZ	Upper Gila-Mangas	15040002
ANTELOPE CANYON DETENTION DAM	32.51207	-109.03392	0.05	1951	98	NM	Hidalgo County	15040002
STATE LINE DETENTION DAM	32.52985	-109.05032	0.05	1952	30	AZ	Greenlee County	15040002
OLNEY DRAW DETENTION DAM	32.52379	-109.06762	0.05	1953	25	AZ	Upper Gila-Mangas	15040002
SECHO DETENTION DAM	32.50116	-108.99151	0.05	1954	46	AZ	Upper Gila-Mangas	15040002
ROUND MOUNTAIN DETENTION DAM 1	32.52778	-109.14722	0.05	1954	29	AZ	Greenlee County	15040002
STANFORD DETENTION DAM 3	32.5368	-108.9877	0.05	1954	19	AZ	Upper Gila-Mangas	15040002
STANFORD DETENTION DAM 4	32.53244	-108.99111	0.05	1954	20	AZ	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 1 DAM	32.966801	-108.564069	0.05	1962	11	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 3 DAM	32.979925	-108.561581	0.05	1962	5	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 9 DAM	33.0176	-108.5636	0.05	1962	0	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 4 DAM	32.990804	-108.551912	0.05	1962	8	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 7 DAM	33.024942	-108.550102	0.05	1962	7	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 12 DAM	32.97918	-108.59954	0.05	1963	10	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 10 DAM	33.00953	-108.57437	0.05	1963	24	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 11 DAM	33.00724	-108.596233	0.05	1963	35	NM	Upper Gila-Mangas	15040002
UPPER GILA VALLEY SITE NO. 6 DAM	33.003917	-108.53059	0.05	1963	17	NM	Upper Gila-Mangas	15040002

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
UPPER GILA VALLEY SITE NO. 8 DAM	33.019935	-108.55843	0.05	1963	7	NM	Upper Gila-Mangas	15040002
BILL EVANS DAM	32.86473	-108.57558	0.5	1969	63	NM	Upper Gila-Mangas	15040002
LUNA	33.82806	-109.08222	0.5	1911	163	AZ	San Francisco	15040004
LYMAN DAM	34.36972222	-109.3833333	0.5	1912	1324	AZ	San Francisco	15040004
ROMERO LAKE DAM	33.91667	-109.03772	0.5		21	NM	San Francisco	15040004
ROGERS RESERVOIR	32.87972	-109.84806	0.5	1894	38	AZ	Upper Gila-San Carlos Reservoir	15040005
LEBANON RESERVOIR #1 (UPPER)	32.73528	-109.75972	0.5	1910	9	AZ	Upper Gila-San Carlos Reservoir	15040005
FRYE MESA	32.75417	-109.83361	0.75	1929	4	AZ	Upper Gila-San Carlos Reservoir	15040005
RIGGS RESERVOIR	32.78389	-109.77667	0.75	1929	3	AZ	Upper Gila-San Carlos Reservoir	15040005
DRY LAKE	33.340561	-109.825658	0.5	1935	147	AZ	Upper Gila-San Carlos Reservoir	15040005
COOK RESERVOIR	32.77528	-109.72778	0.05	1940	17	AZ	Upper Gila-San Carlos Reservoir	15040005
CENTRAL DETENTION	32.85194	-109.80111	0.05	1948	62	AZ	Upper Gila-San Carlos Reservoir	15040005
CLUFF RANCH #3	32.80694	-109.86222	0.5	1956	14	AZ	Upper Gila-San Carlos Reservoir	15040005
ROPER LAKE	32.7573	-109.70358	0.5	1961	34	AZ	Upper Gila-San Carlos Reservoir	15040005
FRYE CREEK RETARDING	32.82889	-109.75917	0.05	1962	205	AZ	Upper Gila-San Carlos Reservoir	15040005

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
GRAVEYARD WASH	32.80139	-109.71889	0.05	1962	175	AZ	Upper Gila-San Carlos Reservoir	15040005
FREEMAN WASH RETARDING	32.81417	-109.73722	0.05	1963	64	AZ	Upper Gila-San Carlos Reservoir	15040005
STOCKTON WASH RETARDING	32.79139	-109.68833	0.05	1964	558	AZ	Upper Gila-San Carlos Reservoir	15040005
POINT OF PINES	33.3665065	-109.7955357	0.5	1966	30	AZ	Upper Gila-San Carlos Reservoir	15040005
UPPER POINT OF PINES	33.3471	-109.8057	0.5	1970	7	AZ	Upper Gila-San Carlos Reservoir	15040005
CHESLEY-WAMSLEE	32.91222	-109.78833	0.05	1975	73	AZ	Upper Gila-San Carlos Reservoir	15040005
GRANT MORRIS	32.87583	-109.73361	0.05	1975	10	AZ	Upper Gila-San Carlos Reservoir	15040005
HOWARD	32.89278	-109.76389	0.05	1975	8	AZ	Upper Gila-San Carlos Reservoir	15040005
FOOTE WASH	32.79722	-109.65111	0.05	1977	188	AZ	Upper Gila-San Carlos Reservoir	15040005
NO NAME WASH	32.79806	-109.66611	0.05	1977	34	AZ	Upper Gila-San Carlos Reservoir	15040005
INDIAN FARMS	32.962222	-109.876389	0.05	1981	8	AZ	Upper Gila-San Carlos Reservoir	15040005
LEE	32.93944	-109.83278	0.05	1981	9	AZ	Upper Gila-San Carlos Reservoir	15040005
OSO LARGO DAM	32.91561	-109.91031	0.05		241	AZ	Graham County	15040005

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
BILLINGSLEY DAM	32.94742	-109.8517	0.5		2	AZ	Upper Gila-San Carlos Reservoir	15040005
HALFWAY DETENTION DAM	32.74509	-109.54581	0.05	1940	16	AZ	San Simon	15040006
OLGA DETENTION DAM	32.36092	-109.33657	0.05	1940	23	AZ	San Simon	15040006
HX DETENTION DAM	32.44491	-109.50832	0.05	1956	265	AZ	Graham County	15040006
WELL WEST CONTROL DAM	32.34874	-109.33767	0.05	1966	90	AZ	Cochise County	15040006
WEST WELL CONTROL DAM	32.34874	-109.33767	0.05	1966	90	AZ	Cochise County	15040006
RYAN DETENTION DAM	32.49546	-109.44894	0.05	1967	45	AZ	San Simon	15040006
WEST DOUBTFUL DETENTION DAM	32.30717	-109.22352	0.05	1968	126	AZ	Cochise County	15040006
ONE ELEVEN DETENTION DAM	32.71495	-109.45986	0.05	1968	42	AZ	Graham County	15040006
COVE DETENTION DAM	32.6596	-109.50911	0.05	1969	55	AZ	San Simon	15040006
SANDS DRAW BASIN DETENTION DAM	32.49285	-109.38494	0.05	1972	142	AZ	San Simon	15040006
RESERVOIR DIKE	32.71004	-109.59917	0.05	1975	12	AZ	San Simon	15040006
SAN SIMON BARRIER STRUCTURE DETENTION DAM	32.77974	-109.61141	0.05	1980	290	AZ	San Simon	15040006
CREOSOTE DETENTION DAM	32.70216	-109.57123	0.05	1981	22	AZ	San Simon	15040006
SOUTH WELL DETENTION DAM	32.70955	-109.574	0.05	1981	17	AZ	San Simon	15040006
SLICK ROCK DETENTION DAM	32.72399	-109.47577	0.05	1981	98	AZ	San Simon	15040006
PARK AVENUE DETENTION BASIN COMPLEX	32.21611	-110.94801	0.05	2008	15	AZ	San Simon	15040006
UNNAMED TANK	32.68611	-109.34333	0.5		10	AZ	San Simon	15040006
TUFA STONE	33.37353	-110.4831	0.05	1944	15	AZ	San Carlos	15040007
ELGO	33.3878	-110.4282	0.5	1979	194	AZ	San Carlos	15040007
PICACHO DAM	32.853004	-111.489917	0.05	1889	1000	AZ	Middle Gila	15050100
WHITLOW RANCH DAM	33.299451	-111.275653	0.05	1959	1	AZ	Middle Gila	15050100
MAGMA RETARDING	33.12083	-111.38806	0.05	1964	935	AZ	Middle Gila	15050100
FLORENCE RETARDING	33.03083	-111.35222	0.05	1965	700	AZ	Middle Gila	15050100
POWERLINE	33.36194	-111.54972	0.05	1967	456	AZ	Middle Gila	15050100
VINEYARD ROAD	33.31972	-111.52417	0.05	1967	840	AZ	Middle Gila	15050100

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
RITTENHOUSE	33.28083	-111.50278	0.05	1969	660	AZ	Middle Gila	15050100
APACHE JUNCTION FRS	33.44139	-111.55194	0.05	1988	174	AZ	Middle Gila	15050100
KEARNY LAKE	33.05	-110.89917	0.5	2000	10	AZ	Middle Gila	15050100
RIGGS FLAT	32.70806	-109.96611	0.5	1951	11	AZ	Willcox Playa	15050201
ANDERSON	32.65333	-110.16444	0.5		29	AZ	Lower San Pedro	15050203
PENA BLANCA	31.40917	-111.085	0.5	1958	45	AZ	Upper Santa Cruz	15050301
PARKER CANYON	31.4275	-110.45722	0.5	1962	133	AZ	Upper Santa Cruz	15050301
KINO SPRINGS	31.37694	-110.85667	0.5	1965	10	AZ	Upper Santa Cruz	15050301
LAKE PATAGONIA	31.49111	-110.86944	0.5	1968	260	AZ	Upper Santa Cruz	15050301
KENNEDY PARK	32.18021	-111.00659	0.5	1973	14	AZ	Upper Santa Cruz	15050301
CLEARWELL RESERVOIR	32.20472	-111.05167	0.75	1992	7	AZ	Upper Santa Cruz	15050301
THE LAKE	31.91222	-110.69083	0.5		3	AZ	Upper Santa Cruz	15050301
SOLDIER LAKE DAM	32.42629445	-110.7443944	0.5	1922	1	AZ	Rillito	15050302
LOWER SABINO DAM	32.31481944	-110.8112083	0.5	1935	1	AZ	Rillito	15050302
SYCAMORE DAM	32.34908333	-110.746825	0.5	1939	2	AZ	Rillito	15050302
LOWER ROSE CANYON	32.38778	-110.71111	0.5	1958	7	AZ	Rillito	15050302
MURPHY RESERVOIR	32.28111	-110.83111	0.75	1987	2	AZ	Rillito	15050302
TWIN TANKS	31.91167	-110.66667	0.5		9	AZ	Rillito	15050302
AMARILLO VALLEY ROAD	32.9369	-112.0753	0.05	1995	69	AZ	Lower Santa Cruz	15050303
MARICOPA ROAD BASIN	32.8825	-112.0497	0.05	1995	25	AZ	Lower Santa Cruz	15050303
WHITE ROAD BASIN	32.9503	-112.0919	0.05	1995	68	AZ	Lower Santa Cruz	15050303
ORO BLANCO	31.49528	-111.28139	0.5	1950	12	AZ	Brawley Wash	15050304
ARIVACA	31.53306	-111.25472	0.5	1970	89	AZ	Brawley Wash	15050304

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
TAT MOMOLIKOT	32.65188	-111.9178	0.5	1974	2000	AZ	Santa Rosa Wash	15050306
CRESCENT LAKE	33.89944	-109.42111	0.5	1934	104	AZ	Black	15060101
SIERRA BLANCA DAM	33.87768056	-109.2714778	0.5	1958	46	AZ	Black	15060101
DRIFT FENCE	33.82147	-109.5385	0.5	1963	15	AZ	Black	15060101
BIG LAKE	33.88667	-109.41722	0.5	1964	518	AZ	Black	15060101
RESERVATION	33.84053	-109.5038	0.5	1965	279	AZ	Black	15060101
PACHETA	33.77196	-109.5428	0.5	1967	60	AZ	Black	15060101
DAVIS	33.99259	-109.7582	0.5	1956	254	AZ	White	15060102
HORSESHOE CIENEGA	34.03702	-109.69	0.5	1964	115	AZ	White	15060102
CHRISTMAS TREE	33.91013	-109.7364	0.5	1965	37	AZ	White	15060102
CYCLONE	34.01551	-109.737	0.5	1965	37	AZ	White	15060102
A-1	34.02763	-109.6212	0.5	1966	19	AZ	White	15060102
SHUSH BE TOU	34.06209	-109.7353	0.5	1966	17	AZ	White	15060102
SHUSH BE ZAHZE	34.0595	-109.7246	0.5	1966	21	AZ	White	15060102
SUNRISE	34.01013	-109.5635	0.5	1967	305	AZ	White	15060102
COOLEY	34.0703	-109.9188	0.5	1963	10	AZ	Carrizo	15060104
BOOTLEG	34.07602	-109.9304	0.5	1965	8	AZ	Carrizo	15060104
GUADALUPE	33.37194	-111.97194	0.05	1975	27	AZ	Lower Salt	15060106
REACH 11 DETENTION DIKE 1	33.65412375	-111.9685366	0.5	1977	75	AZ	Lower Salt	15060106
REACH 11 DETENTION DIKE 2	33.6478	-111.9525	0.05	1977	47	AZ	Lower Salt	15060106
REACH 11 DETENTION DIKE 3	33.6377	-111.9172	0.05	1977	23	AZ	Lower Salt	15060106
REACH 11 DETENTION DIKE 4	33.628	-111.8711	0.05	1977	10	AZ	Lower Salt	15060106
SPOOK HILL	33.47306	-111.68167	0.05	1979	305	AZ	Lower Salt	15060106
SIGNAL BUTTE FRS	33.44083	-111.59556	0.05	1988	140	AZ	Lower Salt	15060106
RIO SALADO TOWN LAKE	33.43444	-111.94667	0.5	1997	214	AZ	Lower Salt	15060106
BIG SUPAI TANK	35.23528	-112.26972	0.5	1882	9	AZ	Big Chino-Williamson Valley	15060201

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
STEEL DAM	35.2254	-112.4159	0.5	1898	7	AZ	Big Chino-Williamson Valley	15060201
MCLELLAN	35.22139	-112.28306	0.5	1907	19	AZ	Big Chino-Williamson Valley	15060201
MASONRY #2	35.24361	-112.3975	0.5	1911	15	AZ	Big Chino-Williamson Valley	15060201
CANYON MOUTH	35.27194	-112.95694	0.5	1916	125	AZ	Big Chino-Williamson Valley	15060201
RAILROAD EMBANKMENT	35.33028	-112.89611	0.05	1929	98	AZ	Big Chino-Williamson Valley	15060201
MEXICAN TANK	35.12472	-112.51722	0.5	1930	10	AZ	Big Chino-Williamson Valley	15060201
GRANITE BASIN	34.6175	-112.5489	0.5	1939	7	AZ	Big Chino-Williamson Valley	15060201
NUMBER 10 TANK	35.305	-112.59139	0.5	1939	9	AZ	Big Chino-Williamson Valley	15060201
JUMBO	35.20056	-112.53833	0.5	1945	17	AZ	Big Chino-Williamson Valley	15060201
SELIGMAN	35.32278	-112.88833	0.5	1954	40	AZ	Big Chino-Williamson Valley	15060201
PAULDEN TANK #2	34.89667	-112.47056	0.5	1961	30	AZ	Big Chino-Williamson Valley	15060201
BIG ASO	35.34417	-112.51611	0.5		17	AZ	Big Chino-Williamson Valley	15060201
RAILROAD TANK DAM	35.249	-111.8878	0.05	1900	44	AZ	Upper Verde	15060202
FOXBORO LAKE DAM	34.89795194	-111.6691733	0.5	1905	8	AZ	Upper Verde	15060202

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
J. D. DAM	35.0652	-112.0277	0.5	1915	23	AZ	Upper Verde	15060202
GRANITE CREEK	34.59583	-112.41528	0.5	1920	202	AZ	Upper Verde	15060202
LOWER GOLDWATER	34.49861	-112.4575	0.75	1923	16	AZ	Upper Verde	15060202
UPPER GOLDWATER	34.49833	-112.45139	0.5	1932	23	AZ	Upper Verde	15060202
WILLOW CREEK	34.60194	-112.43139	0.5	1936	460	AZ	Upper Verde	15060202
WHITEHORSE DAM	35.1179	-112.0127	0.5	1938	42	AZ	Upper Verde	15060202
LITTLE HELL'S CANYON	35.08139	-112.40556	0.5	1951	12	AZ	Upper Verde	15060202
SCHOLZ DAM	35.1935	-112.0082	0.5	1954	73	AZ	Upper Verde	15060202
ODELL	34.93306	-111.63306	0.5	1978	32	AZ	Upper Verde	15060202
DEL RIO #1 DAM	34.82639	-112.45111	0.5		26	AZ	Upper Verde	15060202
FOUNTAIN LAKE	33.60222	-111.70944	0.5	1970	32	AZ	Lower Verde	15060203
SUNRIDGE CANYON (NO. 7)	33.60611	-111.75139	0.05	1972	9	AZ	Lower Verde	15060203
HESPERUS WASH (NO. 36)	33.63667	-111.74667	0.05	1973	28	AZ	Lower Verde	15060203
ASPEN (NO. 6)	33.62639	-111.74556	0.05	1973	17	AZ	Lower Verde	15060203
STONERIDGE (NO. 19)	33.61806	-111.73556	0.05	1973	11	AZ	Lower Verde	15060203
NORTH HEIGHTS (NO. 11)	33.62139	-111.74861	0.05	1976	14	AZ	Lower Verde	15060203
GREEN VALLEY PARK	34.23083	-111.34611	0.5	1995	10	AZ	Lower Verde	15060203
WHITE TANKS #4	33.45083	-112.48139	0.05	1956	155	AZ	Lower Gila-Painted Rock Reservoir	15070101
BUCKEYE FRS #2	33.43667	-112.58167	0.05	1975	180	AZ	Lower Gila-Painted Rock Reservoir	15070101
BUCKEYE FRS #3	33.455	-112.5325	0.05	1975	180	AZ	Lower Gila-Painted Rock Reservoir	15070101
CORTEZ TANK	32.97028	-112.79389	0.5		15	AZ	Lower Gila-Painted Rock Reservoir	15070101
CAVE CREEK	33.72583	-112.04639	0.05	1923	660	AZ	Aqua Fria	15070102
CAMP DYER DIVERSION	33.83889	-112.27111	0.5	1926	55	AZ	Aqua Fria	15070102
LYNX CREEK	34.57472	-112.35083	0.5	1927	5	AZ	Aqua Fria	15070102

14.2. List of Unmeasured Reservoirs

DAM NAME	LATITUDE	LONGITUDE	FULLNESS FACTOR	YEAR COMPLETED	SURFACE AREA	STATE	HUC8 NAME	HUC8 CODE
HORSETHIEF	34.1617	-112.299	0.5	1934	5	AZ	Aqua Fria	15070102
MESA RESERVOIR	34.57667	-112.34306	0.75	1935	10	AZ	Aqua Fria	15070102
MCMICKEN	33.6775	-112.42333	0.05	1956	2230	AZ	Aqua Fria	15070102
WHITE TANKS #3	33.53389	-112.47111	0.05	1956	294	AZ	Aqua Fria	15070102
LYNX LAKE	34.5225	-112.38639	0.5	1962	53	AZ	Aqua Fria	15070102
DREAMY DRAW	33.5625	-112.03222	0.05	1973	27	AZ	Aqua Fria	15070102
EAST PARK	33.57944	-112.0775	0.05	1974	3	AZ	Aqua Fria	15070102
WEST PARK	33.58472	-112.10889	0.05	1974	11	AZ	Aqua Fria	15070102
NORTH MOUNTAIN FLOOD DETENTION #3	33.58667	-112.04667	0.05	1975	7	AZ	Aqua Fria	15070102
PHOENIX DETENTION BASIN #7	33.60167	-112.07333	0.05	1978	18	AZ	Aqua Fria	15070102
CAVE BUTTES	33.71694	-112.04667	0.05	1980	1820	AZ	Aqua Fria	15070102
ADOBE	33.675	-112.16028	0.05	1982	1320	AZ	Aqua Fria	15070102
NEW RIVER	33.735	-112.22861	0.05	1985	1780	AZ	Aqua Fria	15070102
THUNDERBIRD PARK RESERVOIR	33.69083	-112.19833	0.75	1985	2	AZ	Aqua Fria	15070102
HASSAYAMPA CHECK	34.42889	-112.42639	0.5	1936	3	AZ	Hassayampa	15070103
BILLINGSLEY #2	34.24528	-112.85583	0.5	1946	25	AZ	Hassayampa	15070103
BILLINGSLEY #3	34.25056	-112.86472	0.5	1954	2	AZ	Hassayampa	15070103
BILLINGSLEY #4	34.24472	-112.84722	0.5	1957	1	AZ	Hassayampa	15070103
BUCKEYE FRS #1	33.43278	-112.635	0.05	1974	1145	AZ	Hassayampa	15070103
SUNNYCOVE	33.95722	-112.73972	0.05	1975	18	AZ	Hassayampa	15070103
SUNSET	33.96472	-112.74222	0.05	1977	9	AZ	Hassayampa	15070103
CASANDRO WASH	33.9675	-112.74861	0.05	1996	11	AZ	Hassayampa	15070103
UPPER CENTENNIAL CONTROL STRUCTURE	33.91836	-113.38742	0.05	1956	100	AZ	Centennial Wash	15070104
HARQUAHALA FRS	33.54889	-113.10028	0.05	1982	1180	AZ	Centennial Wash	15070104
SADDLEBACK FRS	33.47583	-113.06667	0.05	1982	1250	AZ	Centennial Wash	15070104
PAINTED ROCK DAM - SADDLE DIKE 1	33.064957	-113.021524	0.05	1960	1	AZ	Lower Gila	15070201

14.3. List of Electric Power Plants

Note: inclusion in this list only indicates presence in tributary areas of the Lower Colorado River System. Water use is based on generation records and water consumption records for the given year.

PLANT NAME	OPERATOR NAME	HUC8 NAME	HUC8 CODE	STATE NAME	PLANT CODE
IRC Generator Facility	Garkane Energy Coop, Inc	Kanab	15010003	Arizona	56899
Perrin Ranch Wind LLC	Perrin Ranch Wind LLC	Havasu Canyon	15010004	Arizona	58155
La Senita	UNS Electric, Inc	Red Lake	15010007	Arizona	57556
Jacobson 5 MW Solar	UNS Electric, Inc	Red Lake	15010007	Arizona	60603
Gray Hawk Solar	Gray Hawk Solar, LLC	Red Lake	15010007	Arizona	61272
St George Red Rock	City of St George	Upper Virgin	15010008	Utah	7080
Quail Creek Hydro Plant #1	Washington Cnty Wtr Consv Dist	Upper Virgin	15010008	Utah	52039
Millcreek Power Generation	City of St George	Upper Virgin	15010008	Utah	56253
Hurricane City Power	Hurricane City Power	Upper Virgin	15010008	Utah	57899
Washington City Electric Generation	City of Washington - (UT)	Upper Virgin	15010008	Utah	59660
Veyo Heat Recovery Project	Utah Associated Mun Power Sys	Upper Virgin	15010008	Utah	60421
Bloomington Power Plant	City of St George	Lower Virgin	15010010	Utah	7767
Reid Gardner	Nevada Power Co	Muddy	15010012	Nevada	2324
Harry Allen	Nevada Power Co	Muddy	15010012	Nevada	7082
Moapa Paiute Energy Center	Calpine Corp - Metcalf Energy Center	Muddy	15010012	Nevada	55642
Moapa Southern Paiute	First Solar Asset Management	Muddy	15010012	Nevada	57859
Playa Solar	First Solar Asset Management	Muddy	15010012	Nevada	59827
Aiya Solar Project	First Solar Project Development	Muddy	15010012	Nevada	59869
Playa Solar 2	First Solar Asset Management	Muddy	15010012	Nevada	60261
CC Landfill Energy, LLC	DCO Energy LLC	Muddy	15010012	Nevada	60792
Dolan Springs	Avangrid Renewables LLC	Detrital Wash	15010014	Arizona	57920
Western Renewable Energy	Western Renewable Energy LLC	Little Colorado Headwaters	15020001	Arizona	56358
Concord Blue Eagar, LLC	Concord Blue Eagar, LLC	Little Colorado Headwaters	15020001	Arizona	60374

14.3. List of Electric Power Plants

PLANT NAME	OPERATOR NAME	HUC8 NAME	HUC8 CODE	STATE NAME	PLANT CODE
Springerville	Tucson Electric Power Co	Upper Little Colorado	15020002	Arizona	8223
Dry Lake Wind LLC	Avangrid Renewables LLC	Upper Little Colorado	15020002	Arizona	57098
Coronado	Salt River Project	Carrizo Wash	15020003	Arizona	6177
Dry Lake Wind II LLC	Avangrid Renewables LLC	Silver	15020005	Arizona	57379
Dry Lake Solar	Avangrid Renewables LLC	Silver	15020005	Arizona	57922
Gallup Refinery	Western Refining Southwest Inc	Upper Puerco	15020006	New Mexico	50997
Cholla	Arizona Public Service Co	Middle Little Colorado	15020008	Arizona	113
Novo BioPower Plant	Novo Biopower LLC	Middle Little Colorado	15020008	Arizona	56616
Searchlight Solar	Searchlight Solar LLC	Piute Wash	15030102	Nevada	59404
Boulder Solar Power, LLC	Southern Power Co	Piute Wash	15030102	Nevada	60352
Griffith Energy LLC	Star West Gen Griffith Energy LLC	Sacramento Wash	15030103	Arizona	55124
Black Mountain Generating Station	UNS Electric, Inc	Sacramento Wash	15030103	Arizona	56482
Kingman 1	Brookfield Energy Marketing LP	Sacramento Wash	15030103	Arizona	57775
Black Mountain Solar LLC	Black Mountain Solar LLC	Sacramento Wash	15030103	Arizona	58042
La Paz Solar Tower	Enivromission, Inc	Tyson Wash	15030106	Arizona	58652
RE Bagdad Solar I LLC	RE Bagdad Solar 1 LLC	Santa Maria	15030203	Arizona	57790
Kyrene	Salt River Project	Middle Gila	15050100	Arizona	147
Santan	Salt River Project	Middle Gila	15050100	Arizona	8068
Sundance	Arizona Public Service Co	Middle Gila	15050100	Arizona	55522
Coolidge Generation Station	Coolidge Power LLC	Middle Gila	15050100	Arizona	56948
Copper Crossing Solar LLC	Avangrid Renewables LLC	Middle Gila	15050100	Arizona	57318
Queen Creek Solar Farm	Siete Solar LLC	Middle Gila	15050100	Arizona	57883
Copper Crossing Energy Center	Salt River Project	Middle Gila	15050100	Arizona	58413
Mesa Solar Array	Apple, Inc	Middle Gila	15050100	Arizona	58466
Gilbert Solar Facility I, LLC	Gilbert Solar Facility I, LLC	Middle Gila	15050100	Arizona	58543
Sandstone Solar	Sustainable Power Group, LLC	Middle Gila	15050100	Arizona	59634
Bonnybrooke PV	Apple, Inc	Middle Gila	15050100	Arizona	60413
Intel - Ocotillo Campus Solar	Tesla Inc.	Middle Gila	15050100	Arizona	60822
Red Horse 2	Red Horse 2	Upper San Pedro	15050202	Arizona	58833

14.3. List of Electric Power Plants

PLANT NAME	OPERATOR NAME	HUC8 NAME	HUC8 CODE	STATE NAME	PLANT CODE
Fort Huachuca Solar PV Project	Tucson Electric Power Co	Upper San Pedro	15050202	Arizona	58972
Red Horse III	Red Horse III	Upper San Pedro	15050202	Arizona	60285
Demoss Petrie	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	124
H Wilson Sundt Generating Station	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	126
North Loop	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	6088
Valencia	UNS Electric, Inc	Upper Santa Cruz	15050301	Arizona	6515
University of Arizona - Biosphere 2	University of Arizona - Biosphere 2	Upper Santa Cruz	15050301	Arizona	54594
Cogeneration 1	University of Arizona	Upper Santa Cruz	15050301	Arizona	56229
TAA Solar Facility	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	57391
UASTP I	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	57392
Roger Road WWTP	SunE M5C Holdings LLC	Upper Santa Cruz	15050301	Arizona	57524
UASTP II	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	57717
Amonix UASTP Solar Power Station	FRB Solar LLC	Upper Santa Cruz	15050301	Arizona	57930
Prairie Fire	Tucson Electric Power Co	Upper Santa Cruz	15050301	Arizona	58171
Actus Lend Lease DMAFB	Tesla Inc.	Upper Santa Cruz	15050301	Arizona	58632
Cogenra - TEP	Washington Gas Energy Systems	Upper Santa Cruz	15050301	Arizona	58832
Gato Montes Solar, LLC	Gato Montes Solar, LLC	Upper Santa Cruz	15050301	Arizona	58842
Rio Rico Solar	UNS Electric, Inc	Upper Santa Cruz	15050301	Arizona	59044
Avalon Solar	Avalon Solar	Upper Santa Cruz	15050301	Arizona	59168
Cogeneration 2	University of Arizona	Upper Santa Cruz	15050301	Arizona	59233
Valencia Solar	Valencia Solar, LLC	Upper Santa Cruz	15050301	Arizona	59454
Tech Park Solar	Tech Park Solar, LLC	Upper Santa Cruz	15050301	Arizona	59455
Davis Monthan AFB (AZ) West Airfield	SunE DM, LLC	Upper Santa Cruz	15050301	Arizona	59779
Avalon Solar II	Avalon Solar Partners II, LLC	Upper Santa Cruz	15050301	Arizona	60062
Amphitheater High School Solar	Constellation Solar Arizona 2, LLC	Upper Santa Cruz	15050301	Arizona	60684
Canyon Del Oro High School Solar	Constellation Solar Arizona 2, LLC	Upper Santa Cruz	15050301	Arizona	60685
Iron Horse Battery Storage	Iron Horse Battery Storage, LLC	Upper Santa Cruz	15050301	Arizona	60996
Pima Community College	Tesla Inc.	Upper Santa Cruz	15050301	Arizona	61104

14.3. List of Electric Power Plants

PLANT NAME	OPERATOR NAME	HUC8 NAME	HUC8 CODE	STATE NAME	PLANT CODE
Pima Energy Storage System	Pima Energy Storage System	Upper Santa Cruz	15050301	Arizona	61197
Saguaro	Arizona Public Service Co	Lower Santa Cruz	15050303	Arizona	118
Desert Basin	Salt River Project	Lower Santa Cruz	15050303	Arizona	55129
Walmart Casa Grande	Tesla Inc.	Lower Santa Cruz	15050303	Arizona	57939
Union HS at Casa Grande	Constellation Solar Holding, LLC	Lower Santa Cruz	15050303	Arizona	58516
Vista Grande HS at Casa Grande	Constellation Solar Holding, LLC	Lower Santa Cruz	15050303	Arizona	58517
Red Rock	Arizona Public Service Co	Lower Santa Cruz	15050303	Arizona	60467
Avra Valley Solar	NRG Solar Avra Valley	Brawley Wash	15050304	Arizona	57657
Picture Rocks Solar, LLC	NVT LICENSES, LLC	Brawley Wash	15050304	Arizona	58486
South Consolidated	Salt River Project	Lower Salt	15060106	Arizona	100
Ocotillo	Arizona Public Service Co	Lower Salt	15060106	Arizona	116
West Phoenix	Arizona Public Service Co	Lower Salt	15060106	Arizona	117
Crosscut	Salt River Project	Lower Salt	15060106	Arizona	143
Horse Mesa	Salt River Project	Lower Salt	15060106	Arizona	145
Mormon Flat	Salt River Project	Lower Salt	15060106	Arizona	148
Roosevelt	Salt River Project	Lower Salt	15060106	Arizona	149
Stewart Mountain	Salt River Project	Lower Salt	15060106	Arizona	150
Tri Cities	Salt River Project	Lower Salt	15060106	Arizona	7998
Arizona State University CHP	NRG Energy Center Phoenix LLC	Lower Salt	15060106	Arizona	58199
Jewish Community Center PV	Main Street Power	Lower Salt	15060106	Arizona	58292
Paradise Valley H.S. PV	Main Street Power	Lower Salt	15060106	Arizona	58293
Phoenix Airport East Economy Lot	Solar Star Arizona II LLC	Lower Salt	15060106	Arizona	58708
Phoenix Airport Rental Car Center	Solar Star Arizona II LLC	Lower Salt	15060106	Arizona	58709
Prescott Airport	Arizona Public Service Co	Upper Verde	15060202	Arizona	56228
Chino Solar Valley	Arizona Public Service Co	Upper Verde	15060202	Arizona	57560
Prescott Solar Plant	SunE AZ1, LLC	Upper Verde	15060202	Arizona	58147
Childs	Arizona Public Service Co	Lower Verde	15060203	Arizona	112
Irving	Arizona Public Service Co	Lower Verde	15060203	Arizona	115
Gila River Power Station	Gila River Power Station LP	Lower Gila-Painted Rock Reservoir	15070101	Arizona	55306

14.3. List of Electric Power Plants

PLANT NAME	OPERATOR NAME	HUC8 NAME	HUC8 CODE	STATE NAME	PLANT CODE
Gila Bend Power Generation Station	Gila Bend Power Partners LLC	Lower Gila-Painted Rock Reservoir	15070101	Arizona	55507
Solana Generating Station	Arizona Solar One LLC	Lower Gila-Painted Rock Reservoir	15070101	Arizona	56812
Cotton Center Solar	Arizona Public Service Co	Lower Gila-Painted Rock Reservoir	15070101	Arizona	57561
Paloma Solar	Arizona Public Service Co	Lower Gila-Painted Rock Reservoir	15070101	Arizona	57562
Buckeye Union HS District 201	Constellation Solar Arizona LLC	Lower Gila-Painted Rock Reservoir	15070101	Arizona	58037
Badger 1	Desert Sky Solar LLC	Lower Gila-Painted Rock Reservoir	15070101	Arizona	58262
Gillespie 1	X-Elio North America Inc	Lower Gila-Painted Rock Reservoir	15070101	Arizona	58501
Gila Bend	Arizona Public Service Co	Lower Gila-Painted Rock Reservoir	15070101	Arizona	59020
PB1 - Gila River	CXA Sundevil Power I	Lower Gila-Painted Rock Reservoir	15070101	Arizona	59338
SR85	Arizona Public Service Co	Lower Gila-Painted Rock Reservoir	15070101	Arizona	59444
Buckeye Generation Center, LLC	Cogentrix Development Holdings, LLC	Lower Gila-Painted Rock Reservoir	15070101	Arizona	59471
Gila River Power Block 3	Tucson Electric Power Co	Lower Gila-Painted Rock Reservoir	15070101	Arizona	59784
PB2 - Gila River	CXA Sundevil Power II	Lower Gila-Painted Rock Reservoir	15070101	Arizona	60768
Agua Fria	Salt River Project	Agua Fria	15070102	Arizona	141
Waddell	Central Arizona Water Conservation Dist	Agua Fria	15070102	Arizona	7164
Luke Solar	Arizona Public Service Co	Agua Fria	15070102	Arizona	57324
Northwest Regional	WM Renewable Energy LLC	Agua Fria	15070102	Arizona	57403
Macys Goodyear	Macys Corporate Services, Inc	Agua Fria	15070102	Arizona	57673
Glendale Energy Power Plant	Glendale Energy LLC	Agua Fria	15070102	Arizona	57829
Lake Pleasant WTP	Solar Star Arizona III LLC	Agua Fria	15070102	Arizona	58539
Maricopa County Community Colleges-Estr	Tesla Inc.	Agua Fria	15070102	Arizona	60230
T0588 Phoenix - AZ	SoCore Energy LLC	Agua Fria	15070102	Arizona	61199

14.3. List of Electric Power Plants

PLANT NAME	OPERATOR NAME	HUC8 NAME	HUC8 CODE	STATE NAME	PLANT CODE
Palo Verde	Arizona Public Service Co	Centennial Wash	15070104	Arizona	6008
Arlington Valley Energy Facility	Arlington Valley LLC	Centennial Wash	15070104	Arizona	55282
Harquahala Generating Project	New Harquahala Generating Co, LLC	Centennial Wash	15070104	Arizona	55372
Red Hawk	Arizona Public Service Co	Centennial Wash	15070104	Arizona	55455
Mesquite Generating Station Block 2	CAMS	Centennial Wash	15070104	Arizona	55481
FirstEnergy	Allegheny Energy Supply Co LLC	Centennial Wash	15070104	Arizona	55711
Arlington Valley Solar Energy I	Arlington Valley Solar Energy LLC	Centennial Wash	15070104	Arizona	57679
Arlington Valley Solar Energy II	Arlington Valley Solar Energy II LLC	Centennial Wash	15070104	Arizona	57680
Mesquite Solar 1	Mesquite Solar 1, LLC	Centennial Wash	15070104	Arizona	57707
Saddle Mountain Solar I	SunE AZ2 LLC	Centennial Wash	15070104	Arizona	58213
Mesquite Generating Station Block 1	Salt River Project	Centennial Wash	15070104	Arizona	58557
Mesquite Solar 2, LLC	Mesquite Solar 2, LLC	Centennial Wash	15070104	Arizona	60307
Mesquite Solar 3, LLC	Mesquite Solar 3, LLC	Centennial Wash	15070104	Arizona	60308
Sun Streams, LLC	First Solar Project Development	Centennial Wash	15070104	Arizona	60827
RE Ajo 1 LLC	RE Ajo 1 LLC	Tenmile Wash	15070202	Arizona	57795