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.

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# 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

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[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 Outside System |
| Export Within System | Export Within System |
| Agriculture | Irrigated Agriculture |
| Municipal and Industrial | Stockpond Evaporation |
| Thermal Electric Power | Livestock |
| Mainstream Reservoir Evaporation | 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.

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[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.

[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**<br>HUC8s: Middle Gila, Lower Salt, Agua Fria (15050100, 15060106, 15070102) | 143 | 143 | 131 | 124 | 124 |
| **Southern Arizona Coefficients**<br>HUC8s: Upper Santa Cruz, Rillito, Brawley Wash (15050301, 15050302, 15050304) | 127 | 127 | 112 | 105 | 105 |
| **Southwest Utah Coefficients**<br>HUC8s: Upper Virgin, Fort Pierce Wash, Lower Virgin (15010008, 15010009, 15010010) | 328 | 328 | 264 | 256 | 256 |
| **Rural Coefficients**<br>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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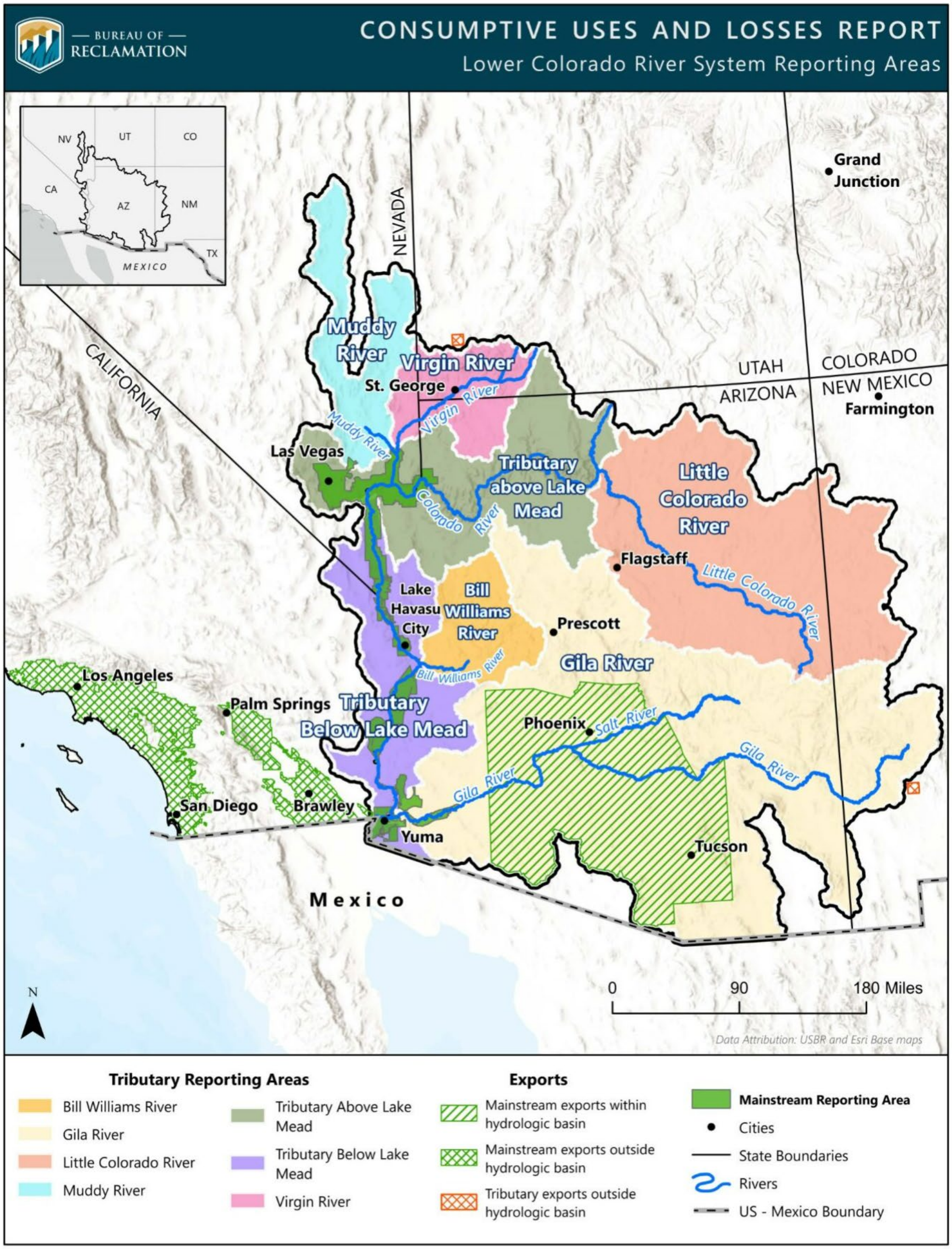
**Map 1: Subbasins (HUC8s)**

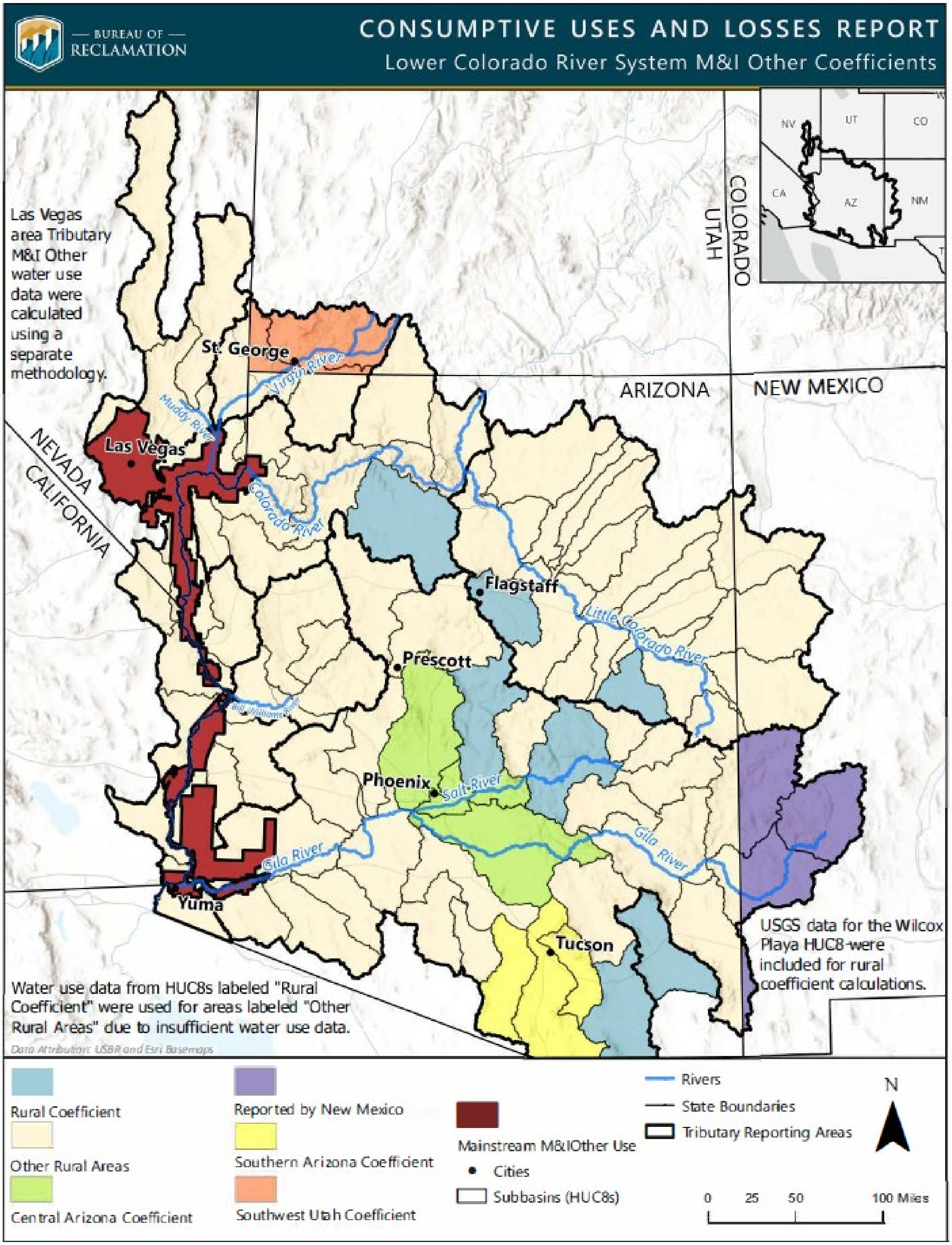



**Map 2: Lower Colorado River System Reporting Areas[43]**

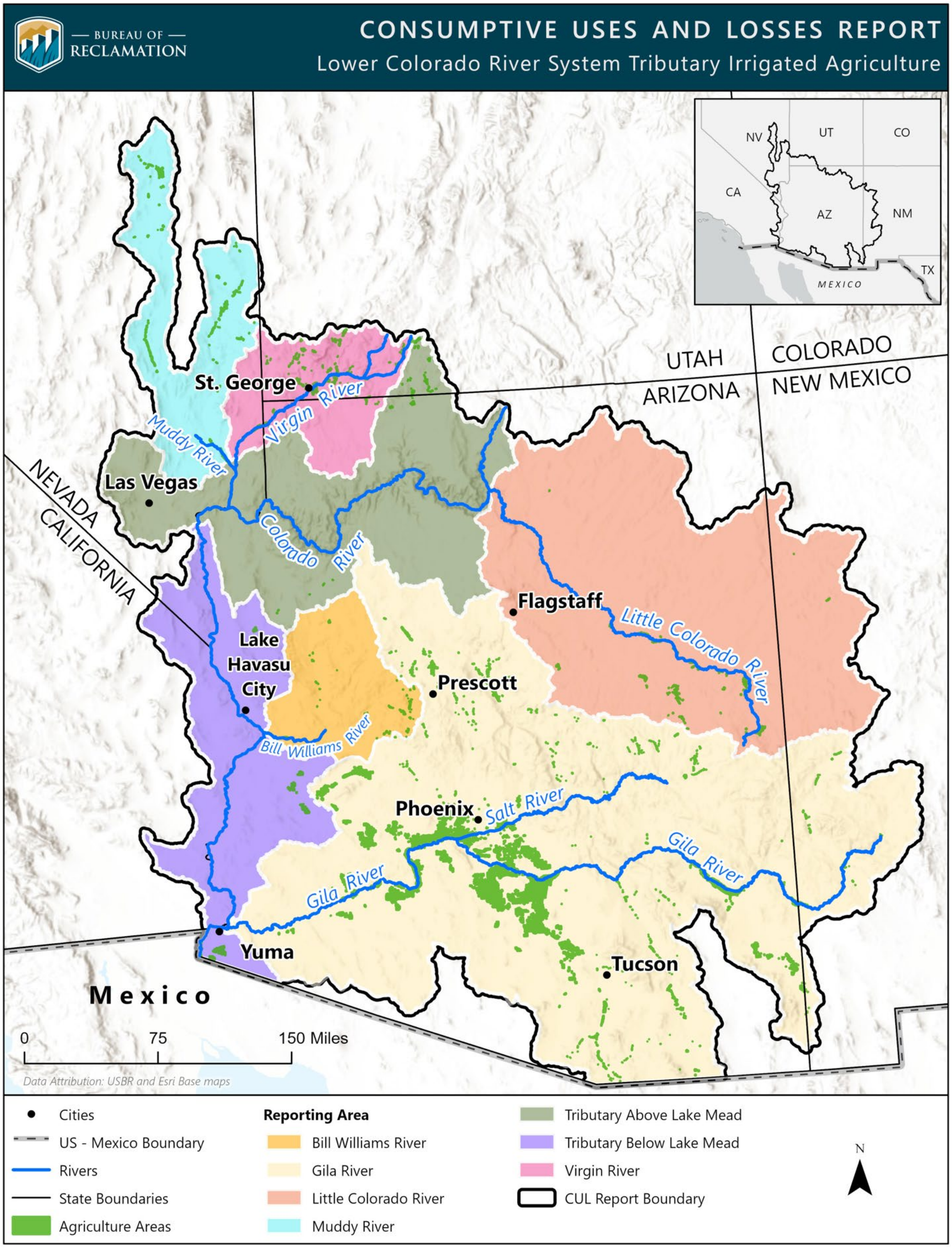
[43] Mainstream Reporting Area is indicative of users sourcing mainstream water for agricultural purposes. Slight modifications to this boundary were made for users sourcing mainstream water for M&I Other purposes.


**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 |