ARIZONA DEPARTMENT OF WATER RESOURCES

Technical Memorandum

Phoenix AMA

100-Year Assured Water Supply Projection

Groundwater Modeling Section
Hydrology Division

June 2023

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List of Acronyms

%	percent
AAC	Arizona Administrative Code
ADWR	Arizona Department of Water Resources
AMA	AMA
AWS	Assured Water Supply
BAS	Basic (package)
bgs	below ground surface
CAGRD	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
DIS	Discretization (package)
EVT	Evapotranspiration (package)
ft	feet
GHB	General head boundary (package)
GMA	Groundwater Management Act
LTSC	Long-term Storage Credit
MNW2	Multi-Node Well (package)
NWT	Newton-Raphson (solver)

RCH	Recharge (package)
RGR	Registry of Grandfathered Rights
SCIP	San Carlos Irrigation Project
SFR	Streamflow-routing (package)
SRP	Salt River Project
SRV	Salt River Valley
UPW	Upstream weighting flow (package)
USF	Underground Storage Facility
WEL	Well (package)
WSRV	West Salt River Valley

Executive Summary

The Groundwater Management Act (GMA) passed by Arizona State Legislature in 1980 requires that developers of new subdivisions within Active Management Areas (AMAs) demonstrate a 100-year Assured Water Supply (AWS). The Arizona Department of Water Resources (ADWR) operates this legislative directive through the AWS Program, which is, at its core, a groundwater management and consumer-protection program applicable within Arizona's six AMAs. The primary AWS groundwater modeling requirements in the Phoenix AMA are:

1) The water level decline due to groundwater withdrawal by AWS determinations must not exceed 1,000 feet below ground surface (bgs) or bedrock, whichever is shallower, and

2) Simulated groundwater pumping associated with AWS determinations must not result in unmet AWS groundwater demands over the 100-year projection period.[1]

Unmet groundwater demand occurs when the model cannot simulate pumping of all demands included, creating a pumping shortfall or deficit. This pumping shortfall or deficit occurs when there is insufficient saturated aquifer to satisfy the pumping demand during the 100-year projection period.

This technical memorandum summarizes the results from a 100-year (2022 to 2121) model projection for the Phoenix AMA. The 100-year projection and corresponding results presented in this report were conducted using the updated groundwater flow model for the Phoenix AMA by ADWR (ADWR, 2023a). This 100-year projection includes existing groundwater demands and issued AWS demands for analyses, certificates, and designations. Artificial recharge and recovery of long-term storage credits (LTSCs) are included in the projection at the rates and volumes indicated by the Designation and Orders of the designated entities and per the 2015 Central Arizona Groundwater Replenishment District

[1] A.A.C. R12-15-716(B) and ADWR Substantive Policy Statement *Hydrologic Studies Demonstrating Physical Availability of Groundwater for Assured and Adequate Water Supply Applications* (AWS7)

(CAGRD) Plan of Operations. Demands for pending AWS applications were not included in this projection. This projection aimed to evaluate existing and projected future groundwater use and recharge, quantify any unmet demands, and simulate the depth to groundwater after 100 years of pumping.

The projection simulation indicates that, at the end of the 100-year projection period, the following conditions are present in the aquifer:

- Southwest of the Superstition Mountains, south of Carefree, and south of the Vulture Mountains may have a water level depth exceeding 1,000 feet bgs.

- Several areas close to mountain ranges where the aquifer is relatively thin such as south and northwest of the White Tank Mountains, south of the Belmont Mountains, south of the Hieroglyphic Mountains, around the Palo Verde Hills, north of the Gila Bend Mountains, around the Phoenix Mountains, and east of the San Tan Mountains may experience water level decline below the top of bedrock.

- Agricultural wells may experience unmet demand ranging from 191 acre-feet per year in 2032 to 55,260 acre-feet per year in 2121, with a cumulative unmet demand of 2,727,020 acre-feet from 2022 to 2121.

- Analysis of AWS wells may experience unmet demand ranging from 2,411 acre-feet per year in 2022 to 20,424 acre-feet per year in 2121, with a cumulative unmet demand of 1,292,209 acre-feet from 2022 to 2121.

- Certificates of AWS wells may experience unmet demand ranging from 1,564 acre-feet per year in 2022 to 12,034 acre-feet per year in 2121, with a cumulative unmet demand of 679,649 acre-feet from 2022 to 2121.

- Designations of AWS wells may experience unmet demand ranging from 75 acre-feet per year in 2022 to 1,337 acre-feet per year in 2121, with a cumulative unmet demand of 108,528 acre-feet from 2022 to 2121.

- Industrial wells may experience unmet demand starting in 2074 and then gradually increasing to 1,214 acre-feet per year in 2121, with a cumulative unmet demand of 25,265 acre-feet from 2022 to 2121.

- Some simulated LTSC wells may experience minor cumulative unmet demand. The cumulative unmet demand for all LTSC wells is simulated as 11,775 acre-feet by the end of 2121.

- Some existing municipal wells not associated with designated providers may experience minor unmet demand with a cumulative unmet demand of 6,732 acre-feet from 2022 to 2121

- The projection simulation shows some minor unmet demand at other wells not belonging to the sectors described above, with a cumulative unmet demand of 10,906 by the end of 2121.

- Agricultural/municipal mixed-use wells (mainly within the Salt River Project service area) are not expected to have noticeable unmet demand.

- The total unmet demand for all sectors (excluding dewatering/drainage) is simulated as 4,862,214 acre-feet from 2022 to 2121. The total cumulative assigned demand in the projection period is 134,850,711 acre-feet (excluding dewatering/drainage), meaning the unmet demand represents approximately 4% of the total demand.

- Groundwater pumping (including dewatering/drainage) has fluctuated around 850,000 acre-feet per year from the early 1980s to 2021 but increases to 1,367,405 acre-feet per year for the projection period. The cumulative pumping also increases from 117,409,946 acre-feet between 1900 and 2021 (122 years) to 136,740,534 acre-feet between 2022 and 2121 (100 years).

- The groundwater level is expected to drop noticeably across the Phoenix AMA, with an average decline of about 185 feet from the end of 2021 to the end of 2121. Aquifer storage loss is projected to be 38,671,748 acre-feet. In comparison, the same alluvial aquifer experienced an average water level decrease of about 92 feet from pre-1900 to 2021, with an aquifer storage loss of 20,550,349 acre-feet. As of 2022, there was an estimated 128,000,000 acre-feet of groundwater in storage above 1,000 ft bgs or bedrock, whichever is shallower.

- The alluvial aquifer is expected to receive less groundwater recharge during the projection period than the historical period, mainly due to decreasing agricultural and artificial recharge.

- Continuous water level decline during the projection period will reduce evapotranspiration along the Gila River riparian zone and the Salt River riparian zone from about 50,000 acre-feet per year in 2022 to less than 7,000 acre-feet per year in 2121.

- The decline in groundwater level is expected to change the Gila River from an overall gaining reach (groundwater discharge to rivers) in the historical period to an overall losing reach (river leakage to groundwater) in the projection period.

- Underflow from the Lower Hassayampa to the Gila Bend sub-basin is expected to decrease noticeably from the historical period to the projection period if groundwater levels in the adjacent Gila Bend Sub-basin remain static during the projection period.

- The estimated overdraft (aquifer storage loss) from the alluvial aquifer in the historical period averages 168,445 acre-feet per year. In the projection period, the overdraft averages 386,717 acre-feet per year. The greater annual storage loss in the projection period is due to increased pumping demand, decreased agricultural recharge, and reduced artificial recharge.

1.0 One-Hundred-Year Assured Water Supply Projection Model Assumptions

The 100-year projection simulation for the Phoenix AMA is derived from the calibrated historical model by ADWR (ADWR, 2023a), which covers the period from pre-1900 to 2021. This technical memorandum discusses the process of extending the historical simulation by 100 years to simulate the period from 2022 to 2121.

The following MODFLOW-NWT packages from the calibrated model remain unchanged: the solver (NWT) package, the upstream weighting flow (UPW) package, and the evapotranspiration (EVT) package.

The remaining MODFLOW-NWT packages from the calibrated model were revised to reflect the changes from the historical period to the projection period. These changes and the associated assumptions are described in the following sections.

1.1 Discretization Package

The model spatial discretization or layer structure remains the same as the calibrated model. However, the projection simulation represents the period between 2022 and 2121 and includes 100 annual transient stress periods; each stress period is either 365 days for non-leap years or 366 days for leap years. This temporal discretization is defined in the MODFLOW-NWT discretization (DIS) package.

1.2 Basic Package

The calibrated model starts with a steady-state period (pre-1900), providing initial head conditions for the transient simulation. However, the projection simulation contains transient periods only. Therefore, a well-defined initial head condition is essential for the projection model to simulate future conditions successfully. In this projection simulation, the head values at the end of 2021 from the calibrated model are used as the initial head values and are defined in the MODFLOW-NWT basic (BAS) package.

1.3 Well Package

The calibrated model's well (WEL) package contains the mountain-front recharge and the underflows between the Phoenix AMA and surrounding sub-basins. In the projection simulation, the mountain-front recharge and the underflows from the last stress period (2021) of the calibrated model are extended throughout the projection period.

1.4 General Head Boundary Package

The MODFLOW-NWT general head boundary (GHB) package from the calibrated model was used to simulate the underflow from the Lower Hassayampa sub-basin to the Gila Bend sub-basin underneath the Gillespie Dam. In the projection simulation, the last stress period of this general head boundary (2021) is extended throughout the projection period.

1.5 Recharge Package

The MODFLOW-NWT recharge (RCH) package from the Phoenix AMA calibrated model simulates the following recharge components:

- Incidental agricultural recharge
- Leakage from the Central Arizona Project (CAP) Canal
- Leakage along ephemeral washes
- Leakage from flooding events along streams
- Leakage from the Indian Bend Wash in Scottsdale
- Leakage from canals operated by the Salt River Project (SRP), irrigation districts, the San Carlos Irrigation Project (SCIP), and other entities
- Leakage from urban turf and artificial lakes
- Recharge at underground storage facilities (USFs)

The incidental agricultural recharge active in the calibrated model was removed from the projection model in areas overlapping with the footprints of issued AWS determinations (**Figure 1-1**). The remaining incidental recharge was combined with recharges along canals, streams, ephemeral washes, and urban areas. The 5-year average (2017 to 2021) of this combined recharge was used for the projection.

Artificial recharge at USFs was treated differently depending on the ownership of the water. First, the total amount of artificial recharge added to the model in the historical period was removed using wells at or near the respective facility at a rate of 1/100th the volume per year. This was done to clear out the historical accounts and ensure that only the owner of the stored water can rely on that water for an assured water supply. Second, the amount of recharge listed in the Designation & Order for the designated cities was added to the model at USFs where the respective city has historically recharged water. These USFs were identified using data from Hipke (2010). ADWR retained these recharge volumes in the 100-year projection because the volumes are derived from the Designation & Orders.

Artificial recharge conducted by the Central Arizona Groundwater Replenishment District (CAGRD) is included in the projection (**Figure 1-2**). CAGRD recharges water to the aquifer to meet replenishment obligations incurred by its members. Every 10 years, CAGRD is required to submit a plan of operation for approval by ADWR. The latest approved plan (CAGRD, 2015) formed the basis of ADWR's assumptions regarding the volume of artificial recharge from CAGRD. To maintain consistency with assumptions in the Pinal AMA 100-year projection (ADWR, 2019), the replenishment was limited to what the Plan of Operation indicated might be available. ADWR also assumed that the existing volume in CAGRD's master account and replenishment reserve would be extinguished prior to actively adding recharge. This volume was 881,162.84 acre-feet as of December 31, 2021. At the obligation volumes listed in the 2015 Plan of Operations, this volume is extinguished in 2036, at which point replenishment recharge is activated in the model. Unlike nearly all other stresses in the 100-year projection, CAGRD recharge is not constant from Year 1. Annual CAGRD recharge volumes are tabulated in **Table 1-1**.

1.6 Multi-Node Well Package

The multi-node well (MNW2) package simulates groundwater withdrawal at the existing and future pumping locations. Three sources are used to construct the 100-year projection MNW2 package:

- The well (WEL) package from the Salt River Valley (SRV) groundwater flow model 100-year projection (Hipke, 2010); this well package contains the most recent groundwater demand from an application for an analysis of assured water supply approved by ADWR in December 2022. This well package includes the existing demand, the AWS demand, the Long-Term Storage Credits (LTSCs) demands, and the underflow between the Salt River Valley and surrounding sub-basins. As discussed above, the underflow for the Phoenix AMA 100-year projection is included in the WEL package. As a result, it is removed from the SRV groundwater flow model 100-year projection WEL package when merging with the other two pumping packages associated with the Lower Hassayampa sub-basin.

- The WEL package from the Lower Hassayampa sub-basin groundwater flow model 100-year projection (ADWR, 2023b); this well package contains the existing demand in the Lower Hassayampa sub-basin.

- The MNW2 package from Lower Hassayampa sub-basin groundwater flow model 100-year projection (ADWR, 2023b); this multi-node well package contains the AWS demand and the LTSCs in the Lower Hassayampa sub-basin.

Before merging, ADWR reviewed the well locations from the SRV groundwater flow model 100-year projection WEL package and the Lower Hassayampa sub-basin groundwater flow model 100-year projection WEL package so that these wells (no identification available in the WEL packages) were connected to unique well identifications from the ADWR well database if possible, as required by the MNW2 package. This review also corrected some pumping rates, such as double counting and well screen intervals. The WEL package split a single well penetrating more than one model layer to multiple wells, each with a manually adjusted pumping rate. ADWR combined the separate wells into a single well using the

MNW2 package with a single total pumping rate. This approach produces more realistic simulated pumping and aquifer response to the pumping.

AWS (analysis, certificate, and designation) wells were assumed to penetrate the alluvial aquifer fully. Existing wells were simulated in the model using reported construction information. Wherever the Lower Hassayampa model active area overlaps the SRV model active area, the pumping data from the Lower Hassayampa model are used for the Phoenix AMA 100-year projection. Finally, for the combined MNW2 package, the issued demands were reviewed, and expired demands were removed.

The groundwater withdrawal during the projection period was divided into 11 sectors:

- Agricultural
- Agricultural/Municipal Mixed Use
- Drainage
- Industrial
- Municipal
- Designation
- Certificate
- Analysis
- Water Report
- LTSC
- Other

Some of the pumping locations may involve multiple sectors. The location of the simulated wells by sector in the projection model is shown in **Figure 1-3a** (LTSCs wells)**, Figure 1-3b** (AWS wells)**, and Figure 1-3c** (existing wells). **Figure 1-4** shows the assigned pumping for the projection and calibrated periods.

ADWR assigned sectors to wells using the following methodology:

- For wells in the Lower Hassayampa model domain, sector assignment was based on the well registry number and the associated water right type reported by the well owner to the Registry of Grandfathered Rights (RGR) database.

- For wells in the SRV model domain, sector assignment was also based on the well registry number and the associated water right type reported to RGR. However, because the SRV model has been used for the last decade by applicants to the AWS program, the location of wells in relation to municipal service area boundaries and data compiled by program applicants was also referenced in the process of assigning a water use sector.

- As mentioned above, assignments from the Lower Hassayampa sub-basin model were used preferentially for wells within the model overlap area.

- Wells supplying water to unbuilt developments, also referred to as "hypothetical" wells, were included in the model. Within the Lower Hassayampa sub-basin, hypothetical wells were distributed uniformly throughout the footprints of the developments associated with the issued analyses or certificates. These wells are identified using the file number of the analysis or certificate. Within the SRV model domain, hypothetical wells have been placed in the model by applicants using the SRV model to prove the physical availability of groundwater. These wells are identified with "AWS" as part of the well name.

- Most municipal pumping is reflected in the Designations and Certificates sectors. However, a small portion of municipal use falls outside these sectors and is typically associated with existing wells outside of provider service areas. These wells comprise a small portion of the total demand and may be associated with provider well networks, private water companies, built-out certificates not included in the AWS sector wells, or additional municipal demands that pre-date the program.

- Many wells in the central part of the model domain have agricultural and municipal uses, and developing a percentage split per well was beyond the scope of this projection. Therefore, these wells were classified as "Agricultural/Municipal Mixed Use."

- Drainage (dewatering) wells are existing wells that reduce the shallow water table in the Buckeye Waterlogged Area. The drainage wells were set to stop pumping when the simulated water level at the wells reached 20 feet bgs.

- Water reports are types of wells that pre-date the 1980 GMA and account for a negligible portion of pumping in the model domain. The locations of these wells were retained from Hipke (2010).

During the projection, the model reduces the pumping when the aquifer cannot support the assigned pumping rate. The unmet demand is the magnitude of the reduced pumping in the MNW2 package. The drainage wells are an exception. In this case, the pumping reduction is due to artificial control and, thus, is not counted as unmet demand.

The sector assignments in the MNW2 package are considered appropriate for the 100-year AWS regional-scale projection. As with any planning scenario, results within individual categories may shift in the future as refinements to sector assignments are made.

1.7 Streamflow-Routing Package

The streamflow-routing (SFR) package simulates surface water flow and surface water/groundwater interaction along the Gila River, the Salt River, the Hassayampa River, the Santa Cruz River, and the Buckeye Irrigation Canal. This package remains the same as the calibrated model for the projection simulation except for the discharge from the 23rd Avenue and 91st Avenue wastewater treatment plants and releases from reservoirs to these surface water bodies, as presented in **Table 1-2**.

2.0 100-Year Assured Water Supply Projection Model Results

ADWR constructed the projection period described in the previous section and ran the model. Under the AWS program, the physical availability of groundwater must be demonstrated using a groundwater model. Arizona Administrative Code (A.A.C.) R12-15-716. Physical availability consists of two primary components:

1) Depth to static water level must not go below 1,000 ft below ground surface (bgs) or bedrock, whichever is shallower, and
2) Simulated groundwater pumping associated with AWS determinations must not result in unmet AWS groundwater demands over the 100-year projection period.

This section discusses the results of the projection model simulation in the context of the physical availability requirements.

2.1 Depth to Water Level

Depth to water is calculated by taking the difference between the land surface elevation and the simulated water level elevation at the end of 100 years (2121). Because the model has three layers, and each layer can return a different water level depending on the amount of pumping and vertical anisotropy at that particular location, ADWR conservatively chose the minimum water level at a location to calculate the depth-to-water.

The simulated water depth from the 100-year projection simulation is presented in **Figure 2-1**. This depth is then compared with the AWS physical availability requirement. When ADWR evaluates if the simulated water depth exceeds the AWS physical availability requirement by the end of the 100-year projection, both of the following conditions must be met:

- The initial water depth at a model cell at the beginning of 2022 must be above the AWS physical availability requirement. Model cells with AWS violations at the beginning of 2022 are excluded when evaluating AWS violations at the end of 2121.

- The water depth at the same model cell by the end of 2121 must be lower than the AWS physical availability requirement.

The comparison result is shown in **Figure 2-2**, which indicates that the simulated water depth in the Phoenix AMA by the end of 2121 exceeds the depth to static water level requirement in the following areas:

- Southwest of the Superstition Mountains (simulated water level is deeper than 1,000 feet below the ground surface)
- South of Carefree (simulated water level is deeper than 1,000 feet below the ground surface)
- South of the Vulture Mountains (simulated water level is deeper than 1,000 feet below the ground surface)
- South and northwest of the White Tank Mountains (simulated water level below the top of bedrock)
- South of Belmont Mountains (simulated water level below the top of bedrock)
- South of the Hieroglyphic Mountains (simulated water level below the top of bedrock)
- Around the Palo Verde Hills (simulated water level below the top of bedrock)
- North of the Gila Bend Mountains (simulated water level below the top of bedrock)
- Around the Phoenix Mountains (simulated water level below the top of bedrock)
- East of the San Tan Mountain (simulated water level below the top of bedrock)

The projection simulation also indicates that, at the beginning of 2022, the simulated water level was below the AWS physical availability requirement at some model cells located south of the Hieroglyphic Mountains, south of Carefree, and south of the Superstition Mountains.

As mentioned above, these model cells were not considered AWS violations at the end of 2121 but were presented in **Figure 2-2** for reference purposes.

Figure 2-3 shows the water level decline in the 100-year projection period (between the end of 2021 and the end of 2121) and provides a better idea of which areas are declining in response to local pumping demand and which could be responding to regional-scale water level declines. **Figure 2-3** indicates that the areas with the greatest water level declines are typically co-located with the projected AWS wells (**Figure 1-3b**).

The remaining saturated thickness above the 1,000 ft bgs requirement or the bedrock by the end of 2121 is shown in **Figure 2-4**, ranging from zero (0) feet at the areas described above to more than 900 feet south of South Mountain. **Figure 2-5** shows the projected saturated thickness above bedrock by the end of 2121, which is mainly controlled by the bedrock depth.

From 2022 to 2121, the saturated thickness of the alluvial aquifer above bedrock is expected to decrease across the whole study area, with the most significant decline over several hundred feet in the areas south of the Superstition Mountains, west of the Salt River Valley, and the Lower Hassayampa sub-basin (**Figure 2-6**). The average water level decline across the study area is projected to be about 185 feet between 2022 and 2121. In comparison, the average water level decline was observed to be about 92 feet between 1900 and 2021.

2.2 Unmet Demand

Unmet demand is calculated by taking the difference between the assigned and simulated demands. Assigned demand is a model input developed as described in Section 1.6 (**Figures 1-3a, b,** and **c)**. Simulated demand is a model output and can be less than the assigned demand if the aquifer cannot support the assigned pumping volumes throughout the projection period. The annual unmet demand for 10 sectors (excluding drainage demand) is shown in **Figure 2-7**. The cumulative unmet demands for 10 sectors during the projection period are presented in **Figure 2-8**. A summary of assigned, simulated, and unmet demands is included in **Table 2-1**.

Figure 2-7, **Figure 2-8,** and **Table 2-1** indicate:

- The agricultural, analysis, and certificate pumping dominate the unmet demand. Analysis and certificate pumping cannot be fully supported from the onset of the projection, while the unmet demand for agricultural pumping starts around 2032 (**Figure 2-7)**.
- The total annualized unmet demand for all sectors (excluding the drainage) is simulated by the model to be 4,070 acre-feet per year in 2022. It gradually increases to 91,165 acre-feet per year in 2121 (**Figure 2-7**).
- The cumulative unmet demand from 2022 to 2121 is 4,862,214 acre-feet for all sectors. This breaks down to 2,727,020 acre-feet from agricultural pumping, 1,292,209 from Analysis of AWS pumping, 679,649 acre-feet from Certificate of AWS pumping, 108,528 acre-feet from Designation of AWS pumping, 25,265 acre-feet from industrial pumping, 11,775 acre-feet from LTSC pumping, 10,906 acre-feet from other sector pumping, 6,732 acre-feet from municipal pumping, 129 acre-feet from agricultural/municipal mixed pumping, and about one acre-foot from water report pumping (**Figure 2-8** and **Table 2-1**).
- The agricultural, analysis, and certificate pumping produces about 97 percent of the cumulative unmet demand (**Table 2-1**).
- 31 out of 622 agricultural wells, 47 out of 240 simulated Analysis of AWS locations, 54 out of simulated 557 Certificate of AWS locations, 16 out of 460 simulated Designation of AWS locations, 7 out of 324 industrial wells, 40 out of 1,164 simulated LTSC wells, 5 out of 143 municipal wells, 33 out of 295 agricultural/municipal mixed wells, and 1 out of 24 other wells are simulated with a cumulative unmet demand equal to or more than one (1) acre-foot between 2022 and 2121 (**Table 2-1**).
- 8 agricultural wells, 3 Analysis of AWS locations, 1 Designation of AWS location, 7 industrial wells, and 5 municipal wells are modeled as going dry by the end of 2121 (**Table 2-1**).

The cumulative unmet demand at 31 Agricultural wells from 2022 to 2121 is shown in **Figure 2-9**. Most of the agricultural wells with high unmet demand are located between the White Tank Mountains and the Buckeye Hills and east of the San Tan Mountains (San Tan Valley).

Minor cumulative unmet demand (1 to 2 acre-feet) is simulated at 33 agricultural/municipal mixed wells (**Figure 2-10**). All of these wells are located within the City of Mesa. This is likely an artifact of well construction elevations in the MNW2 package and not an indication of excessive depth to water, as the projected depth to water in that area is between 200 and 600 feet bgs after 100 years.

Figure 2-11 shows the cumulative unmet demand at 47 Analysis of AWS locations, which ranges from less than 10 acre-feet to about 114,210 acre-feet for the 100-year projection period. Most unmet demand is in the Lower Hassayampa sub-basin and the West Salt River Valley (WSRV) between the Hieroglyphic Mountains and the Aqua Fria River.

The cumulative unmet demand for 54 Certificate of AWS locations is shown in **Figure 2-12**. Most unmet demand is simulated around the White Tank Mountains in the Lower Hassayampa sub-basin, the West Salt River Valley (WSRV) between the Hieroglyphic Mountains and the Aqua Fria River, and south of the Superstition Mountains.

The cumulative unmet demand for 16 Designation of AWS locations is shown in **Figure 2-13**. Two locations with cumulative unmet demand exceeding 10,000 acre-feet are located east of the San Tan Mountains and between the Hieroglyphic Mountains and the Aqua Fria River.

Seven industrial wells show cumulative unmet demand ranging from 41 to 11,264 acre-feet in the Lower Hassayampa sub-basin and near the Gila River in the WSRV (**Figure 2-14**).

The cumulative unmet demand at 40 LTSC recovery locations is shown in **Figure 2-15**, ranging from about one (1) to 4,922 acre-feet. These locations are in several concentrated areas: south and southeast of the Hieroglyphic Mountains, west of Fountain Hills, west of the Superstition Mountains, and east of the San Tan Mountains.

Figure 2-16 shows the cumulative unmet demand at five municipal wells in the Lower Hassayampa sub-basin, ranging from 15 to 3,656 acre-feet. One well belonging to the "other" sector located next to the Gila River in the WSRV is simulated with a cumulative unmet demand of 10,896 acre-feet (**Figure 2-17**). No water report wells are simulated with cumulative unmet demand equal to or more than one acre-foot.

2.3 Comparison of Water Budgets between Historical and Projection Periods

The simulated water budget for the historical (steady state and 1900 to 2021) and projection (2022 to 2121) periods are presented in **Table 2-2**, which indicates:

- The Phoenix AMA is expected to receive less underflow from adjacent sub-basins during the projection period than the historical period. The reduction in underflow may cause less combined mountain-front recharge and underflow from the projection period (2022 to 2121: average 51,255 acre-feet per year or cumulative 5,125,472 acre-feet) than the historical period (1900 to 2021: average 63,153 acre-feet per year or cumulative 7,704,690 acre-feet).

- The Phoenix AMA is expected to receive less groundwater recharge from agricultural and artificial recharge during the projection because of ag-to-urban land conversion and because of how artificial recharge is treated during the projection period (credits belong to a specific entity, which means the recharge is not available for others to rely upon). This results in an average recharge volume of 702,593 acre-feet per year or cumulative 70,259,325 acre-feet in the projection period, which is lower than the historical period (average 917,353 acre-feet per year or cumulative 111,917,067 acre-feet).

- Groundwater pumping during the projection period may result in the gaining reach of the Gila River near the Buckeye Waterlogged Area becoming a losing reach, flipping the water budget for stream leakage from overall gaining in the historical period to overall losing in the projection period.

- Underflow from the Lower Hassayampa sub-basin to the Gila Bend sub-basin is expected to decrease noticeably to about 1,500 acre-feet per year in 2121, provided the water levels in the adjacent Gila Bend sub-basin remain static during the projection period.

- Pumping during the projection period is expected to lower the water table and significantly reduce evapotranspiration along the Gila and Salt River riparian areas from the historical average of 136,793 acre-feet per year (or cumulative 16,688,774 acre-feet) to the projection period average of 16,229 acre-feet per year (or cumulative 1,622,940 acre-feet), eventually bringing riparian evapotranspiration to less than 7,000 acre-feet per year around 2121.

3.0 Summary

ADWR constructed a projection (predictive) simulation to evaluate the future conditions of the alluvial aquifer system in the Phoenix AMA. The projection simulation was based on the calibrated groundwater flow model developed by ADWR (2023a) and incorporated the AWS program requirements. The projection simulation covers the period 2022 to 2121, with several assumptions:

- The groundwater recharge rate is the average of the last five years (2017 to 2121) of the calibrated model (i.e., historical period), but the agricultural recharge within the AWS Program development footprints and the artificial recharge at the underground storage facilities (except for recharge listed in Decision & Orders belonging to designated cities and the replenishment recharge belonging to the CAGRD) are removed during the projection period.

- The mountain-front recharge, the underflows between the Phoenix AMA and adjacent sub-basins, and the vegetation along the Gila River riparian zone and the Salt River riparian zone (i.e., the evapotranspiration potential) remain the same as the last stress period (2021) of the calibrated model.

- The historical pumping within AWS Program development footprints is removed.

- The hydraulic conditions (i.e., river configuration and riverbed conductivity) of the Gila River, the Salt River, the Hassayampa River, the Santa Cruz River, and the Buckeye Irrigation Canal remain unchanged, but the discharge from wastewater treatment plants and releases from reservoirs are revised to represent a short- or long-term average, as appropriate.

- Long-term underground storage credits and groundwater savings facility credits accumulated during the historical calibration period are removed at a rate of 1% of the credit per year between 2022 and 2121.

- The AWS demand from each development in the Lower Hassayampa sub-basin is evenly distributed at the associated development area with a well spacing of one mile.

- The distribution of AWS demand for the rest of the study area has been retained from an application for an analysis of assured water supply approved by ADWR in December 2022.

- All AWS wells are assumed to fully penetrate the alluvial aquifer. The issued-and-built demand is an existing demand included in the calibrated model and is carried over to the projection period.

The projection includes assigned groundwater demands totaling 346,500 acre-feet per year for agricultural, 295,131 acre-feet per year for Designation of AWS, 194,697 acre-feet per year for Certificate of AWS, 143,871 acre-feet per year for agricultural/municipal mixed-use, 134,518 acre-feet per year for Analysis of AWS, 74,825 acre-feet per year for industrial, 74,209 acre-feet per year for LTSC, 38,631 acre-feet per year for municipal, 4,168 acre-feet per year for water reports, and 41,957 acre-feet per year for other sectors, with an annual total of 1,348,507 acre-feet per year. The projection model also includes assigned demand of 18,898 acre-feet per year for dewatering/drainage, but this quantity is not included in the unmet demand calculation as described in Section 1.6.

For the Phoenix AMA, the AWS rules require that static groundwater depth at existing or issued municipal and AWS wells must not exceed 1,000 feet bgs or top of bedrock, whichever is shallower, after 100 years of simulated groundwater pumping. In comparison with the AWS rules, the projection simulation indicates:

- Southwest of the Superstition Mountains, south of Carefree, and south of the Vulture Mountains may have a depth to groundwater exceeding 1,000 feet bgs.

- Several areas close to mountain ranges where the aquifer is relatively thin such as south and northwest of the White Tank Mountains, south of the Belmont Mountains, south of the Hieroglyphic Mountains, around the Palo Verde Hills, north of the Gila

Bend Mountains, around the Phoenix Mountains, and east of the San Tan Mountains may experience water level decline below the top of bedrock.

- Agricultural wells may experience unmet demand ranging from 191 acre-feet per year in 2032 to 55,261 acre-feet per year in 2121, with a cumulative unmet demand of 2,727,020 acre-feet from 2022 to 2121.

- Analysis of AWS wells may experience unmet demand ranging from 2,411 acre-feet per year in 2022 to 20,424 acre-feet per year in 2121, with a cumulative unmet demand of 1,292,209 acre-feet from 2022 to 2121.

- Certificate of AWS wells may experience unmet demand ranging from 1,564 acre-feet per year in 2022 to 12,034 acre-feet per year in 2121, with a cumulative unmet demand of 679,649 acre-feet from 2022 to 2121.

- Designation of AWS wells may experience unmet demand ranging from 75 acre-feet per year in 2022 to 1,337 acre-feet per year in 2121, with a cumulative unmet demand of 108,528 acre-feet from 2022 to 2121.

- Industrial wells may experience unmet demand in 2074, gradually increasing to 1,214 in 2121, with a cumulative unmet demand of 25,265 acre-feet from 2022 to 2121.

- Some simulated LTSC wells may experience minor cumulative unmet demand except for three locations where the simulated cumulative unmet demand could reach over 1,000 acre-feet. The cumulative unmet demand for all LTSC wells is simulated as 11,775 acre-feet by the end of 2121.

- Some municipal wells may experience minor unmet demand with a cumulative unmet demand of 6,732 acre-feet from 2022 to 2121

- The projection simulation does not indicate any unmet demand at the water report wells but shows some minor unmet demand at other wells not belonging to the sectors described above, with a cumulative unmet demand of 10,906 by the end of 2121.

- The unmet demand at the agricultural/municipal mixed-use wells (mainly in the SRP boundary) is minor.

- The total unmet demand for all sectors (excluding dewatering/drainage) is simulated as 4,862,214 acre-feet from 2022 to 2121. The total cumulative assigned demand in the projection period is 134,850,711 acre-feet (excluding dewatering/drainage), meaning the unmet demand represents approximately 4% of the total demand.

- Groundwater pumping has fluctuated around 850,000 acre-feet per year from the early 1980s to 2021 but increases to about 1,367,405 acre-feet per year for the projection period. The cumulative pumping also increases from 117,409,946 acre-feet between 1900 and 2021 (122 years) to 136,740,534 acre-feet between 2022 and 2121 (100 years).

- The groundwater level is expected to drop noticeably across the Phoenix AMA, with an average decline of about 185 feet from the end of 2021 to the end of 2121. As a result, the total aquifer storage loss is projected to be 38,671,748 acre-feet. In comparison, the alluvial aquifer experienced an average water level drop of about 92 feet from pre-1900 to 2021, with an aquifer storage loss of 20,550,349 acre-feet. As of 2022, there was an estimated 128,000,000 acre-feet of groundwater in storage above 1,000 ft bgs or bedrock, whichever is shallower.

- The alluvial aquifer is expected to receive less groundwater recharge during the projection period when compared to the historical period, mainly due to decreasing agricultural and artificial recharge.

- Continuous water level decline during the projection period will reduce evapotranspiration along the Gila and Salt River riparian zones to less than 7,000 acre-feet per year in 2121.

- The groundwater level decline is expected to change the Gila River from overall gaining (groundwater discharge to rivers) in the historical period to overall losing (river leakage to groundwater) in the projection period.

- Underflow from the Lower Hassayampa to the Gila Bend sub-basin is expected to decrease noticeably from the historical period to the projection period.

As with any groundwater modeling projection, if the future hydrologic conditions differ from the assumptions made in the projection simulation, the groundwater levels and flows may significantly differ from those presented herein.

4.0 References

ADWR, 2019. 2019 Pinal Model and 100-Year Assured Water Supply Projection Technical Memorandum. October 2019. https://infoshare.azwater.gov/docushare/dsweb/Get/Document-11793/2019_Pinal_Model_and_100-Year_AWS_Projection-Technical_Memorandum.pdf

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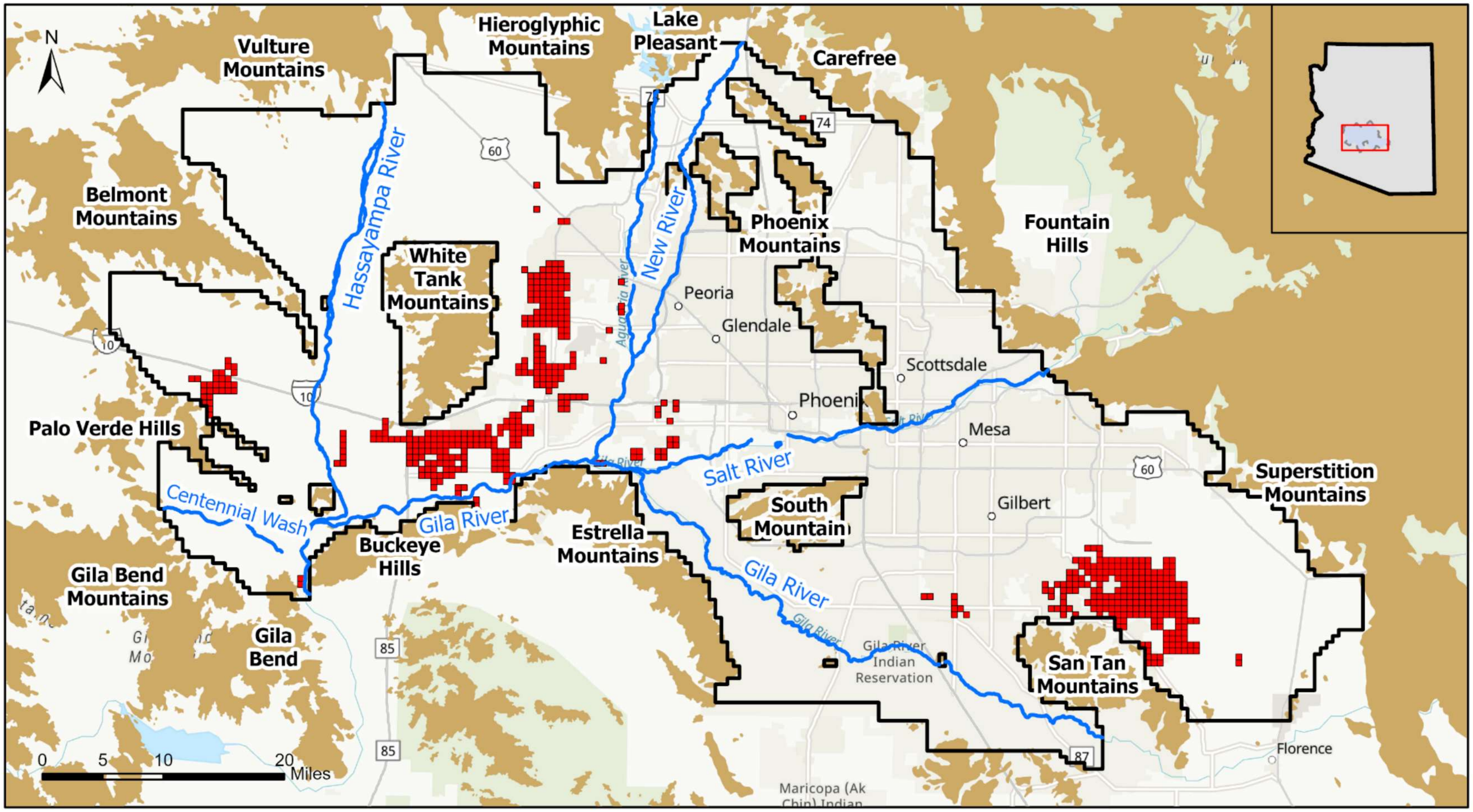
CAGRD, 2015. Plan of Operation. https://cagrd.com/operations/plan-of-operation-and-mid-plan-reviews/

Hipke, W. 2010. 100-Year Predictive Scenarios Used for the Determination of Physical Availability in the Phoenix Active Management Area. Modeling Report No. 22. https://new.azwater.gov/sites/default/files/Modeling_Report_22_0.pdf

FIGURES



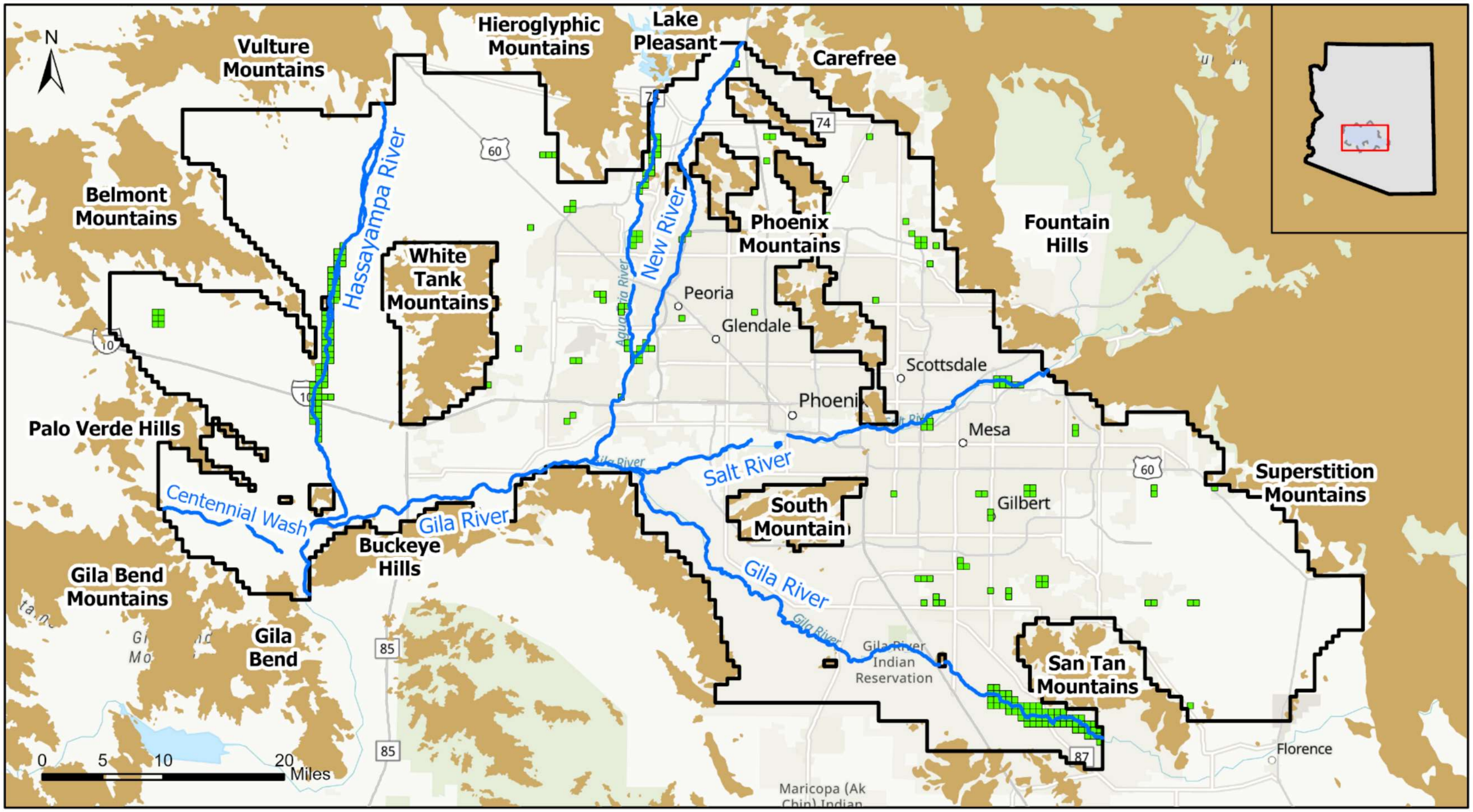
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 1-1

Location of
Incidental Agricultural Recharge
Removed during Projection Simulation

Phoenix AMA Grid Boundary
Bedrock
Removed Agricultural Recharge



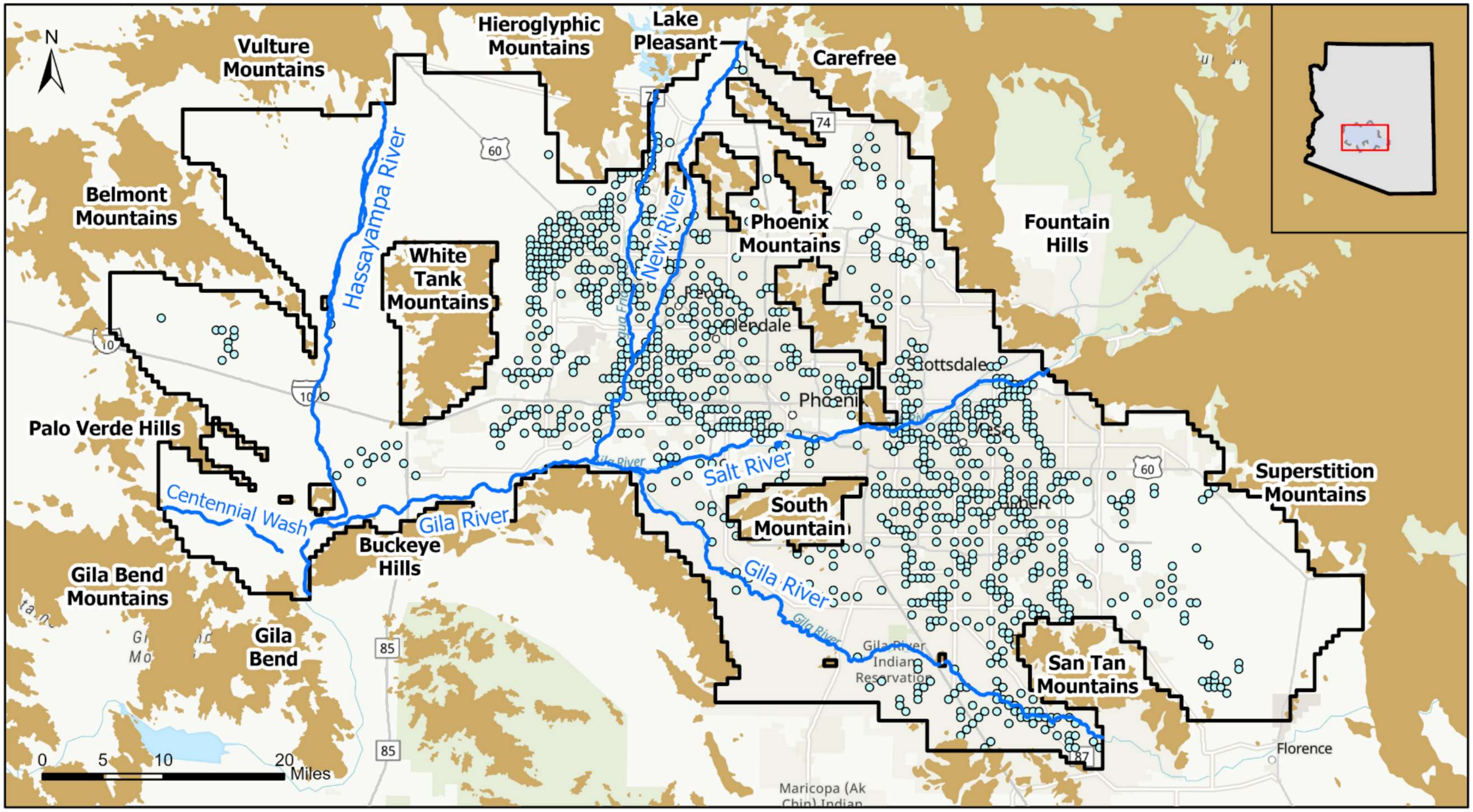
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 1-2

Location of
Artificial Recharge
during Projection Simulation

Phoenix AMA Grid Boundary
Bedrock
Simulated Artificial Recharge



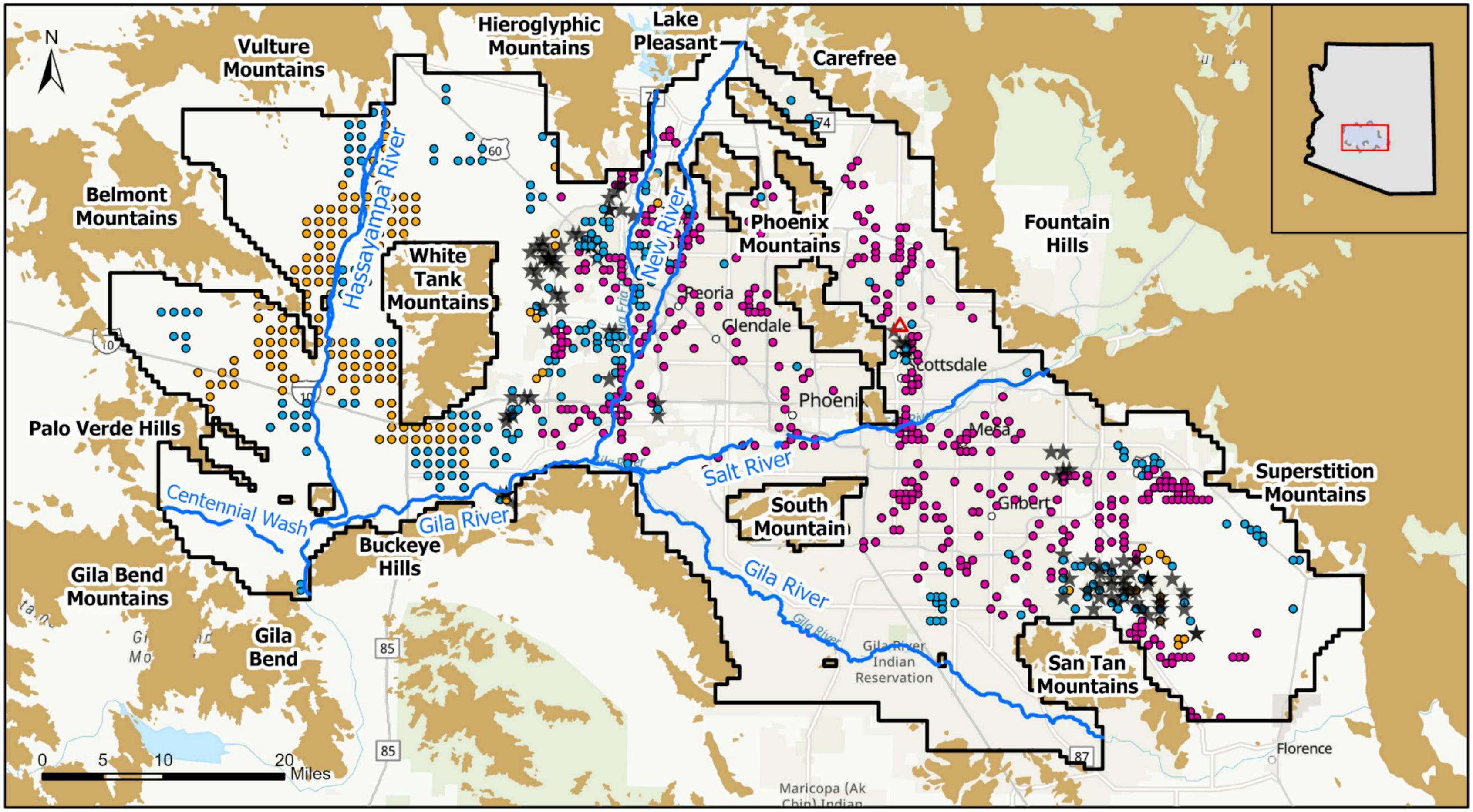
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 1-3a

Location of
Long-Term Storage Credit
Removal Wells

Phoenix AMA Grid Boundary
Bedrock
Sector
Long-Term Storage Credit (LTSC) Wells



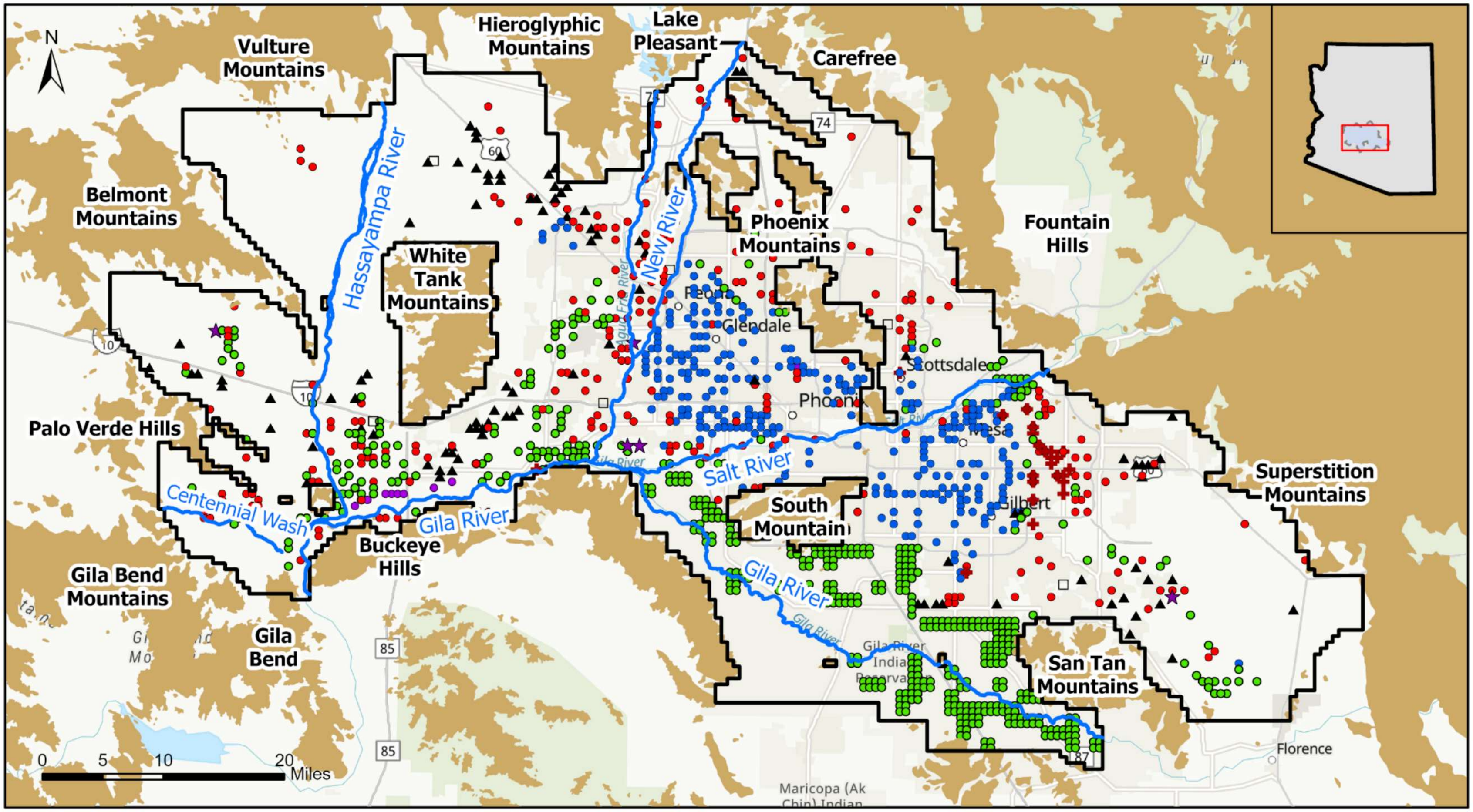
Phoenix Active Management Area (AMA) 100-Year Assured Water Supply Projection

ADWR 2023

Figure 1-3b

Location of Assured Water Supply Sector Wells

Phoenix AMA Grid Boundary
Bedrock
AWS MNW Wells Sector
Analysis
Certificate
Designation
Water Report
Split (Multiple AWS Sectors)



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 1-3c

Location of
Existing Sector Wells

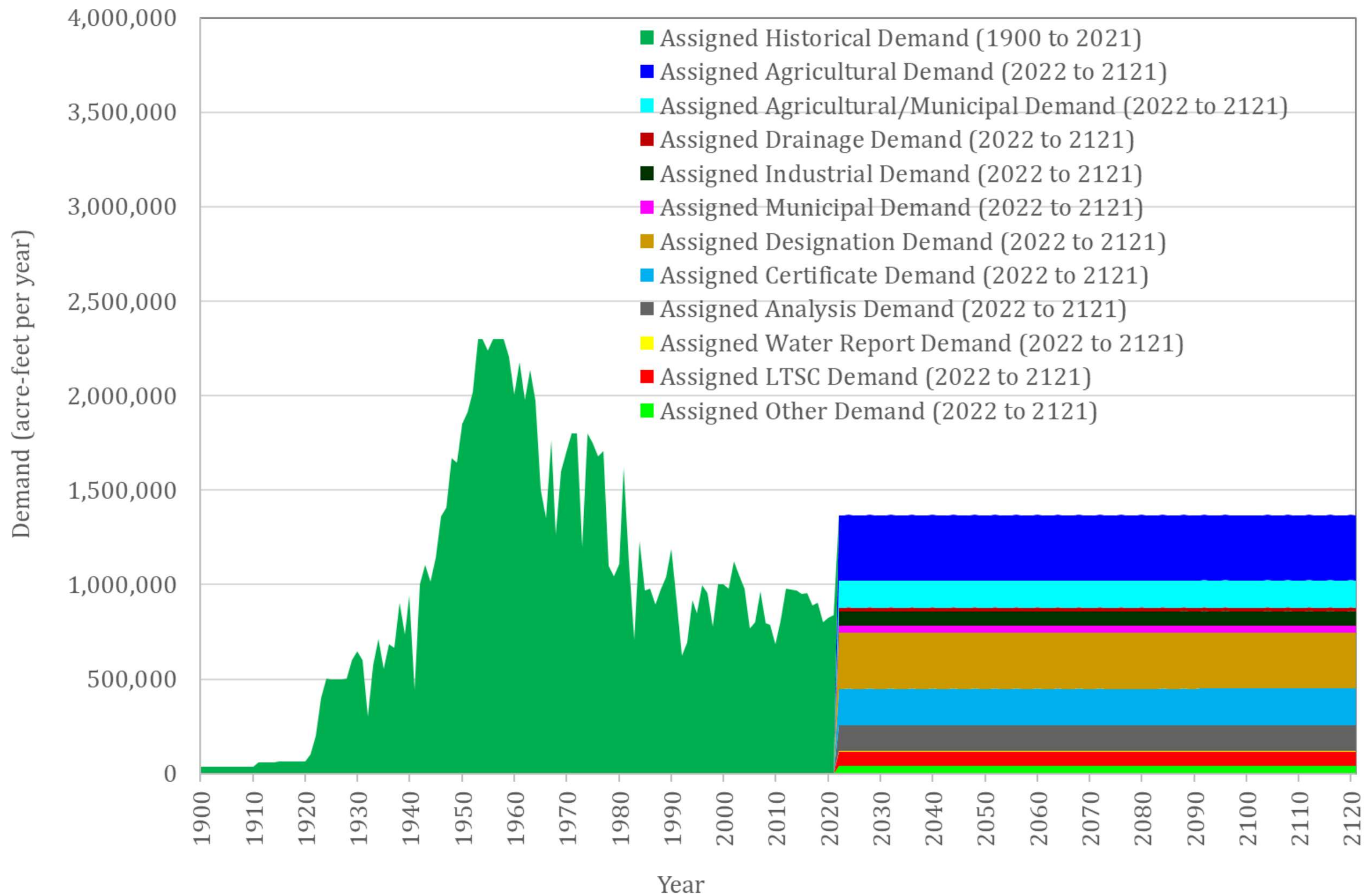
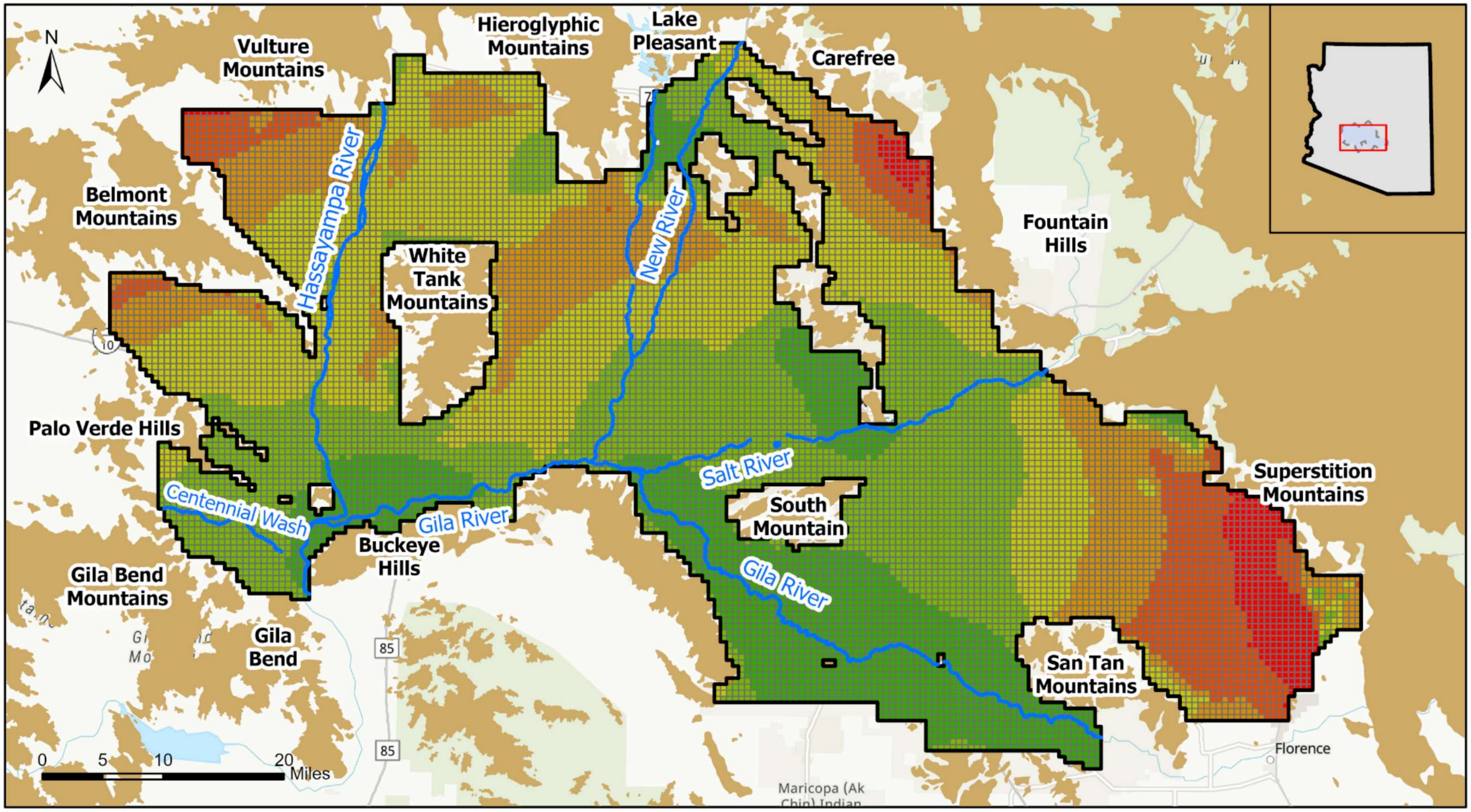


Figure 1-4

Stacked Graph of Assigned Demand in Historical and Projection Periods



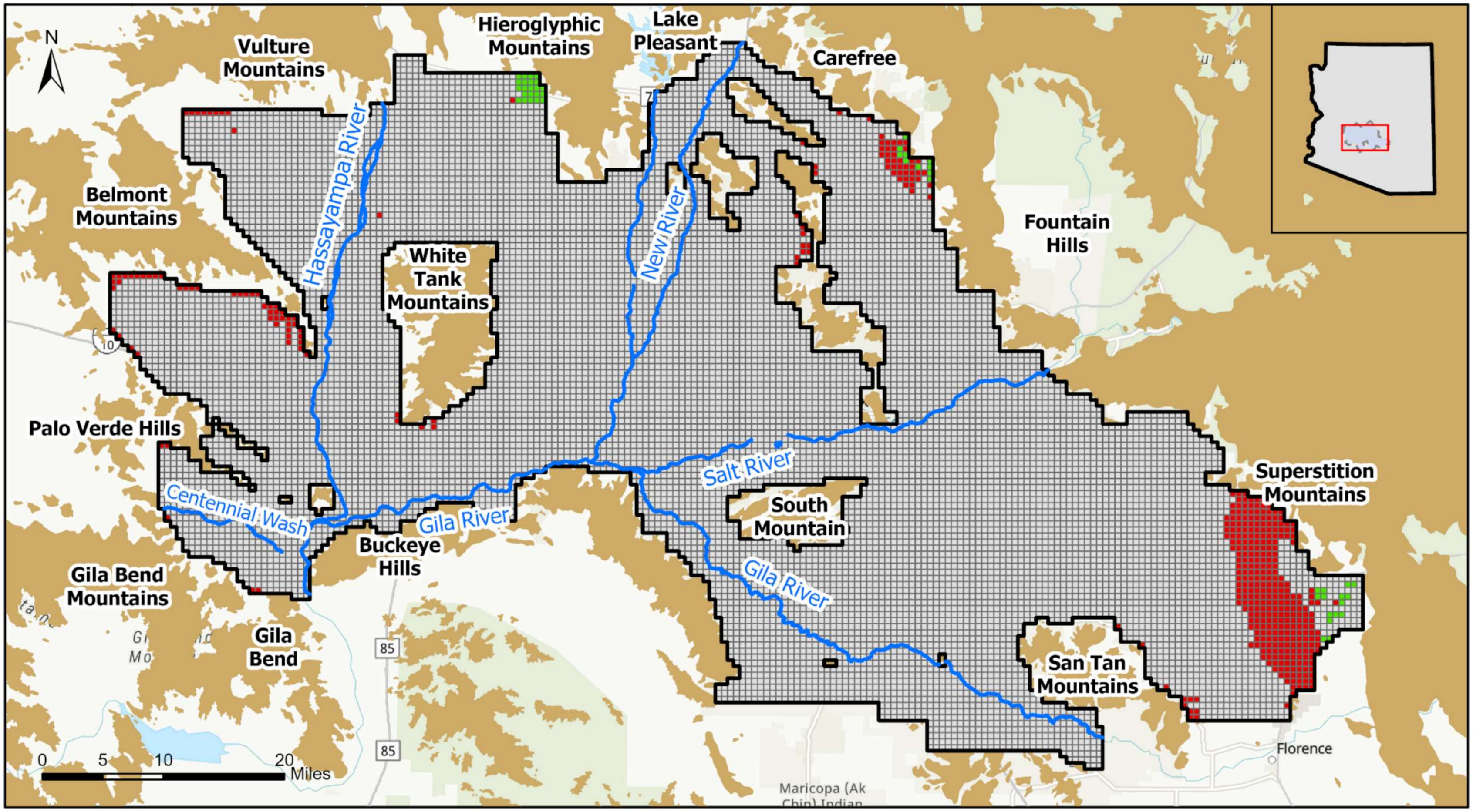
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-1

Simulated Depth to Water
at End of 2121

Phoenix AMA Grid Boundary
Bedrock
Depth to Water (feet below land surface)
<200
200 to 400
400 to 600
600 to 800
800 to 1,000
1,000 to 1,158



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

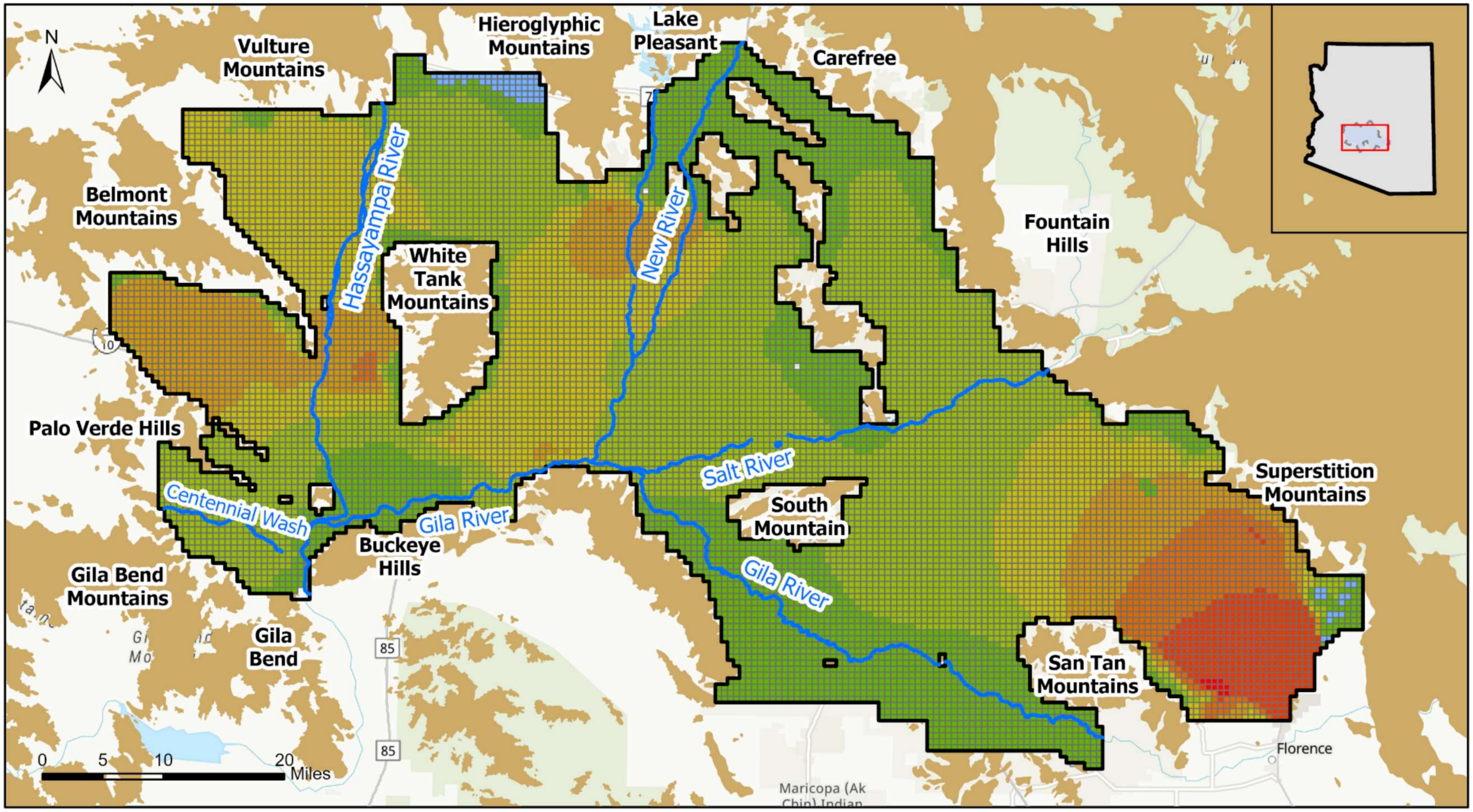
Figure 2-2

Location of
Simulated Depth to Water
below 1,000 ft or at Bedrock

- Phoenix AMA Grid Boundary
- Bedrock

Simulated AWS Violation

- Not Violated
- Violated at Beginning of 2022
- Violated at End of 2121



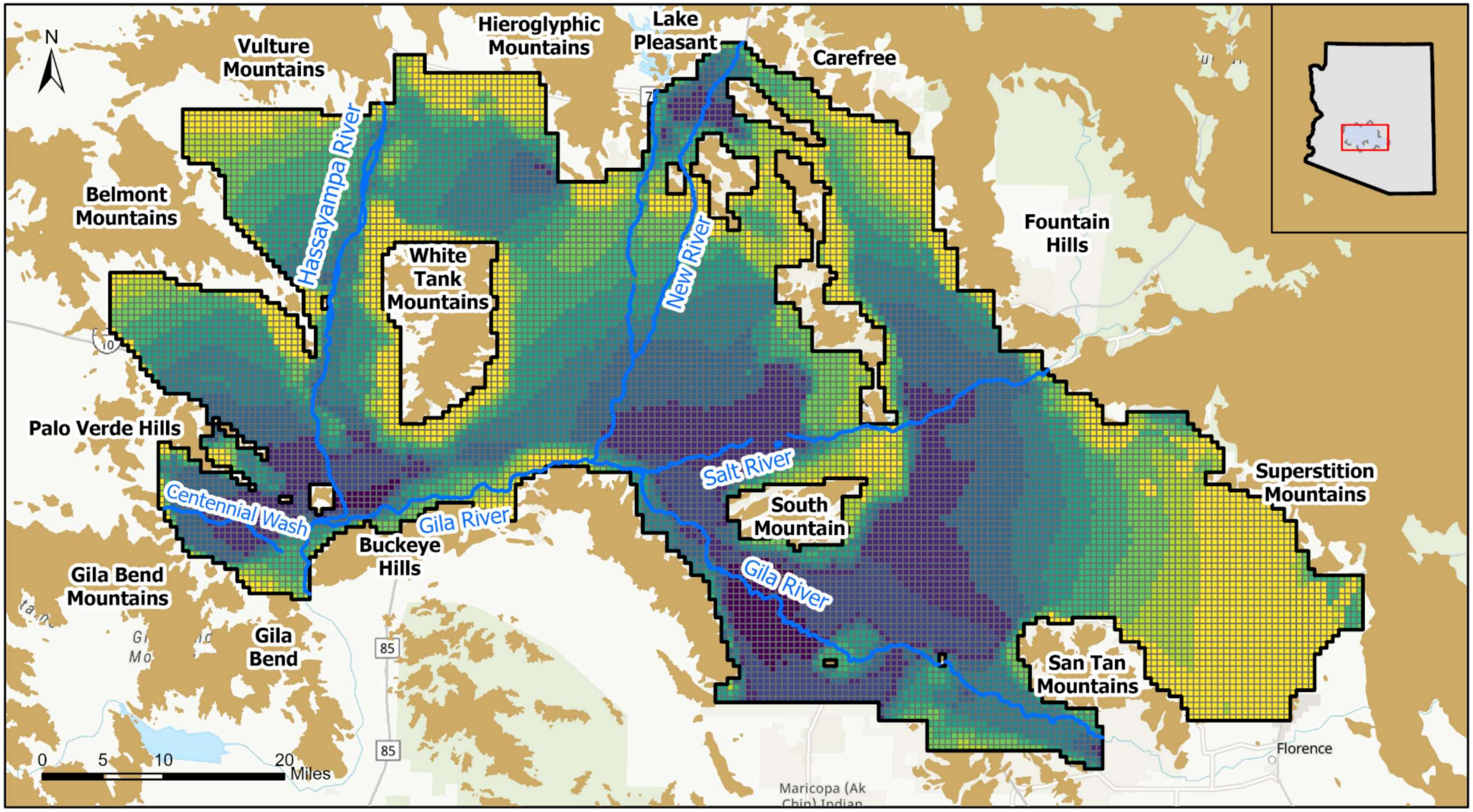
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-3

Simulated Change in Water Level between 2021 and 2121

Phoenix AMA Grid Boundary
Bedrock
Drawdown (feet)
-78 to 0
0 to 100
100 to 200
200 to 300
300 to 400
400 to 500
500 to 600
600 to 630



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

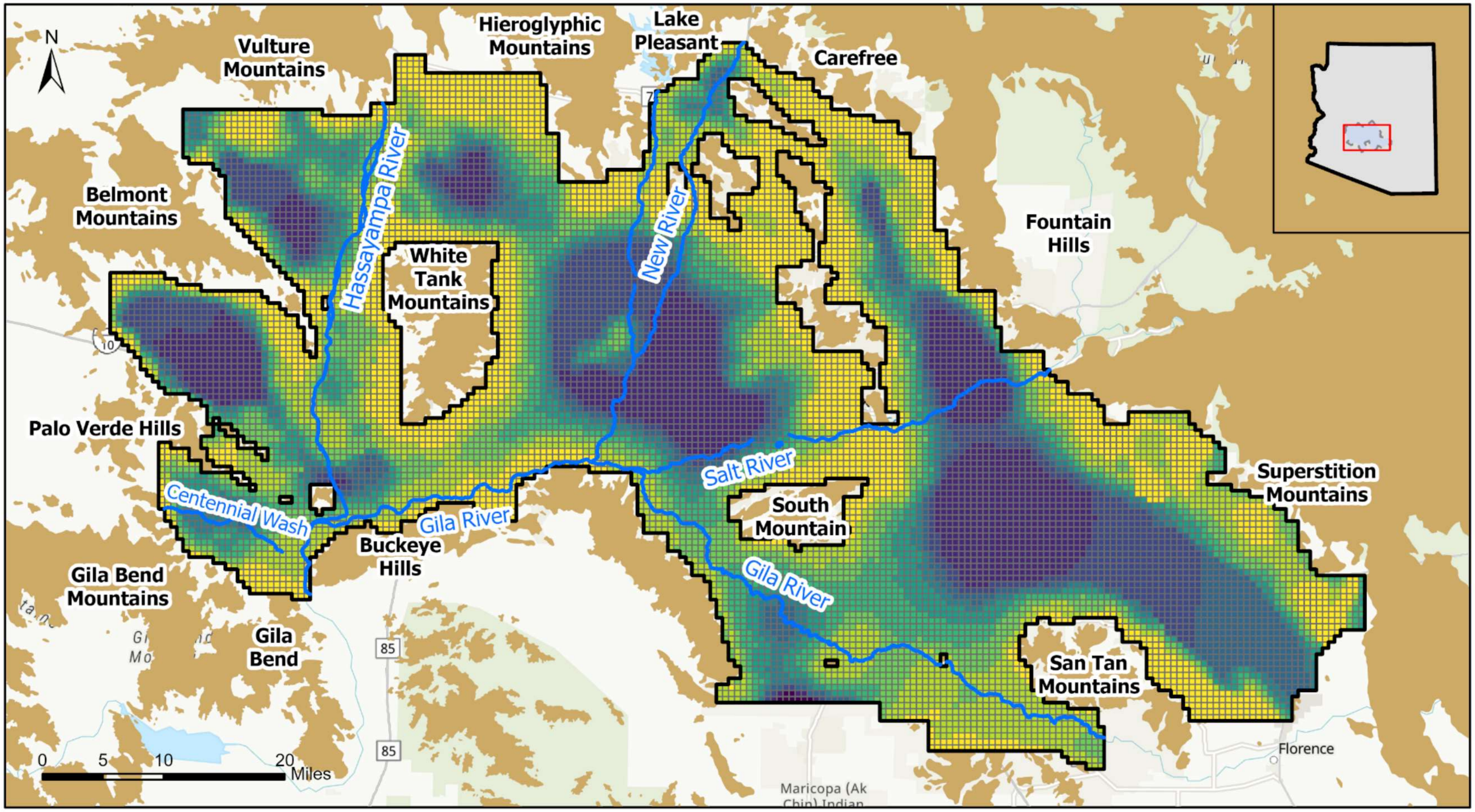
Figure 2-4

Simulated Thickness of Alluvial Aquifer above 1,000 Feet below Ground Surface or Bedrock by the End of 2121

- Phoenix AMA Grid Boundary
- Bedrock

Simulated Thickness above 1,000 ft below Land Surface or Bedrcok (feet)

- 0 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- 600 to 700
- 700 to 800
- 800 to 900
- 900 to 950



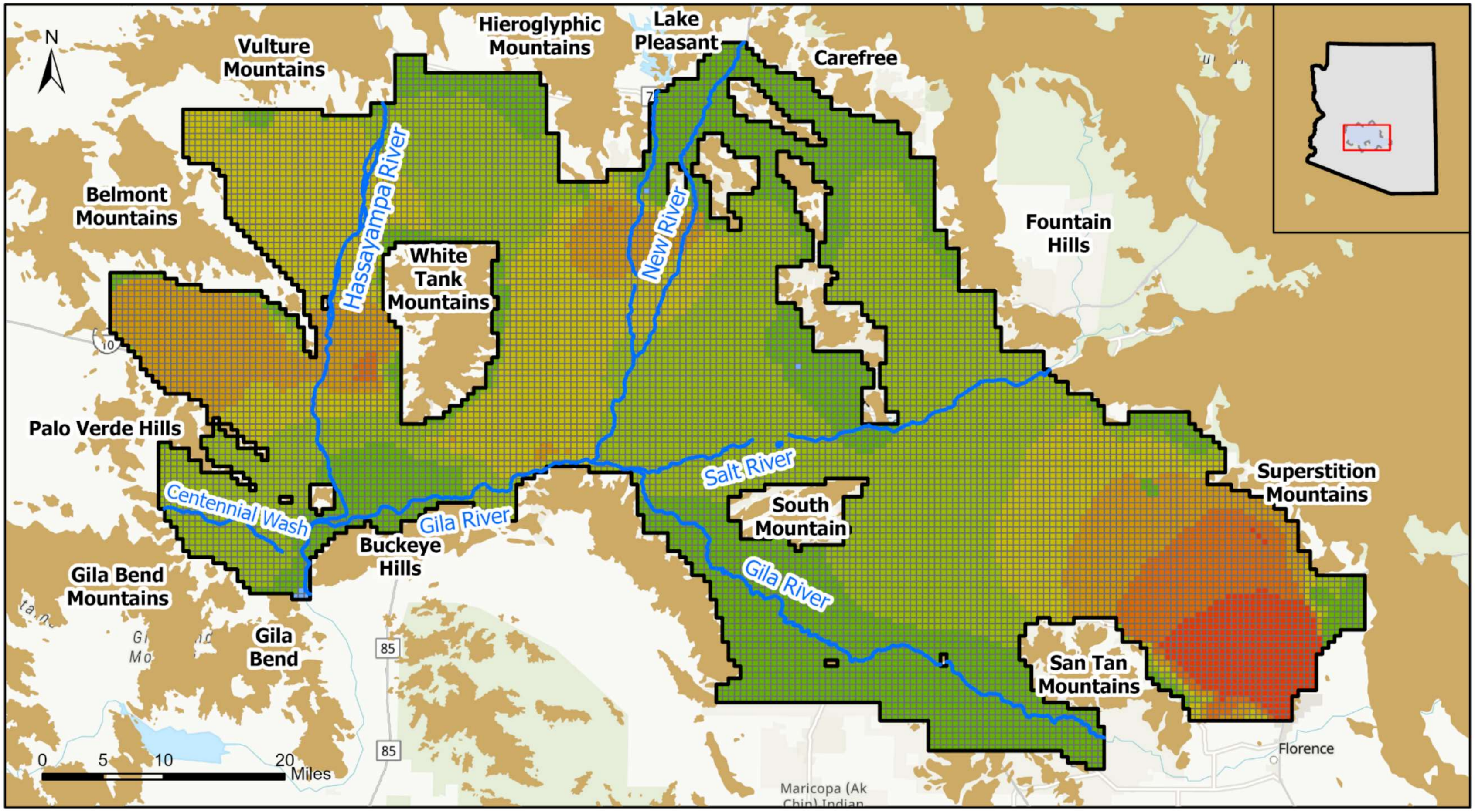
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-5

Saturated Thickness of Alluvial Aquifer above Bedrock by the End of 2121

Phoenix AMA Grid Boundary
Bedrock
Saturated Thickness above Bedrock (feet)
0 to 300
300 to 600
600 to 900
900 to 1,200
1,200 to 1,500
1,500 to 1,800
1,800 to 2,100
2,100 to 2,400
2,400 to 2,700
2,700 to 2,858



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-6

Change in Alluvial Aquifer Saturated Thickness above Bedrock from 2021 to 2121

Phoenix AMA Grid Boundary	
Bedrock	
Thickness Change (feet)	
78 to 0	-200 to -300
0 to -100	-300 to -400
-100 to -200	-400 to -500
	-500 to -600
	-600 to -626

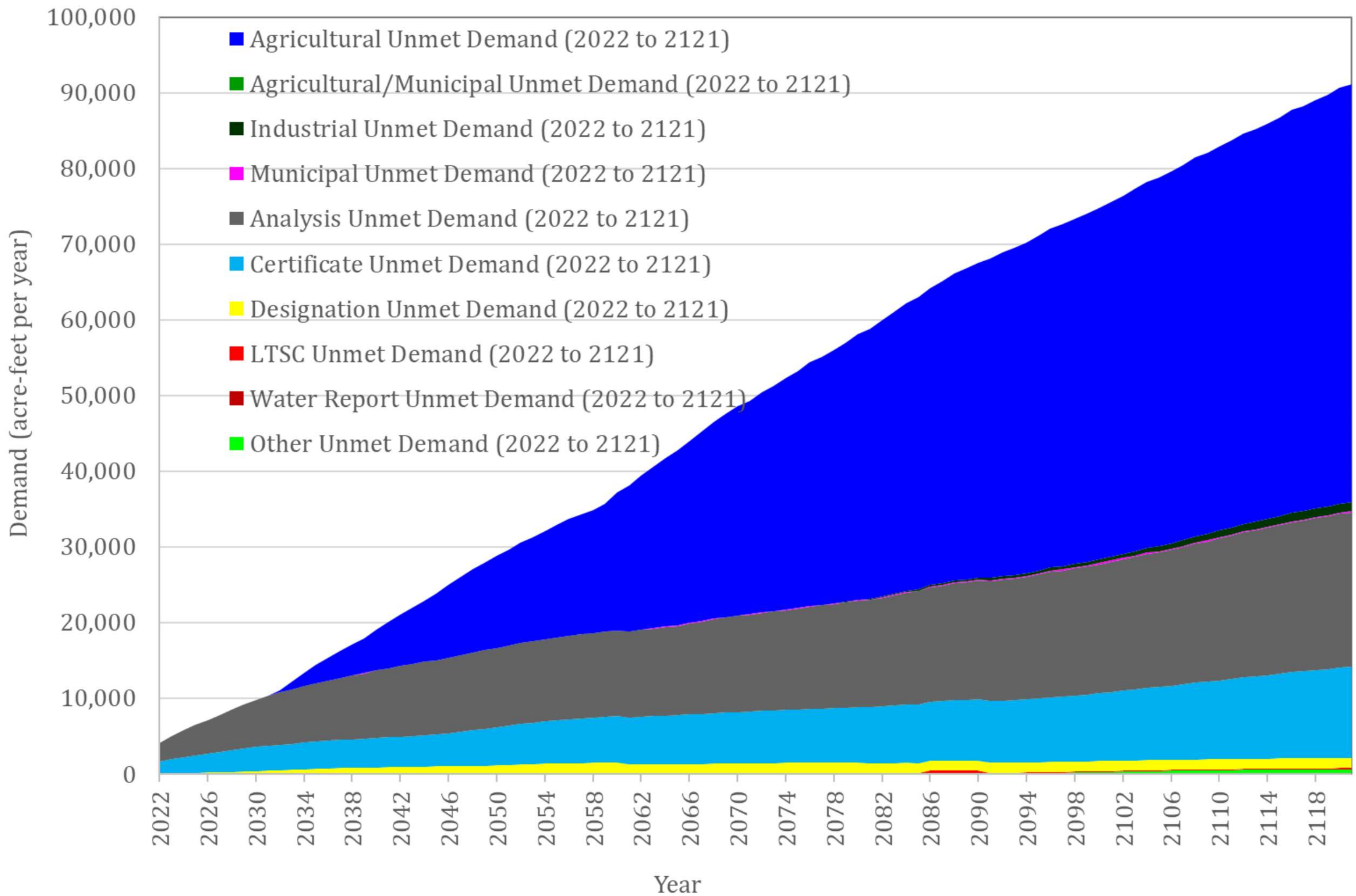


Figure 2-7

Simulated Annual Unmet Demand by Sector

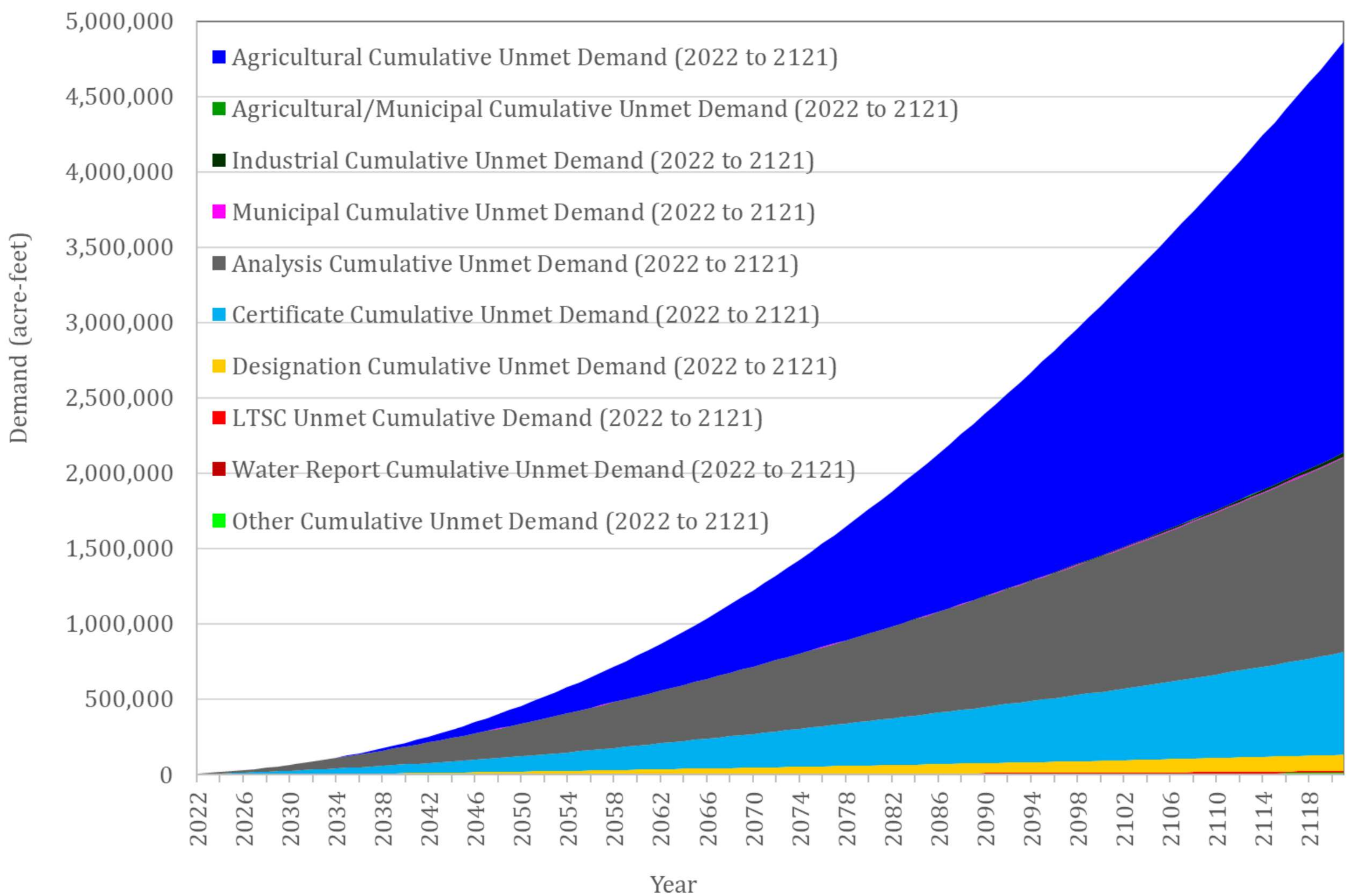
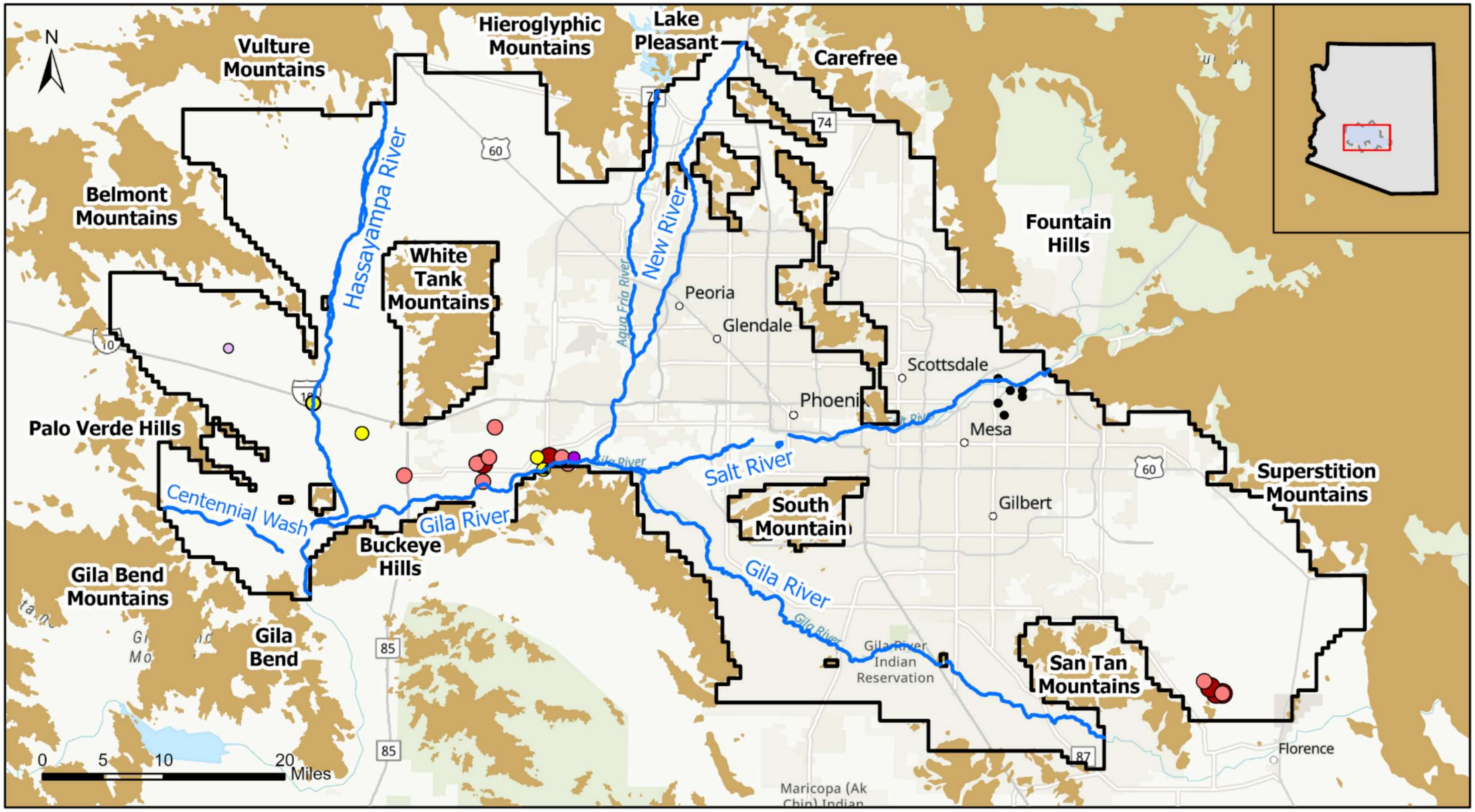


Figure 2-8

Simulated Cumulative Unmet Demand by Sector

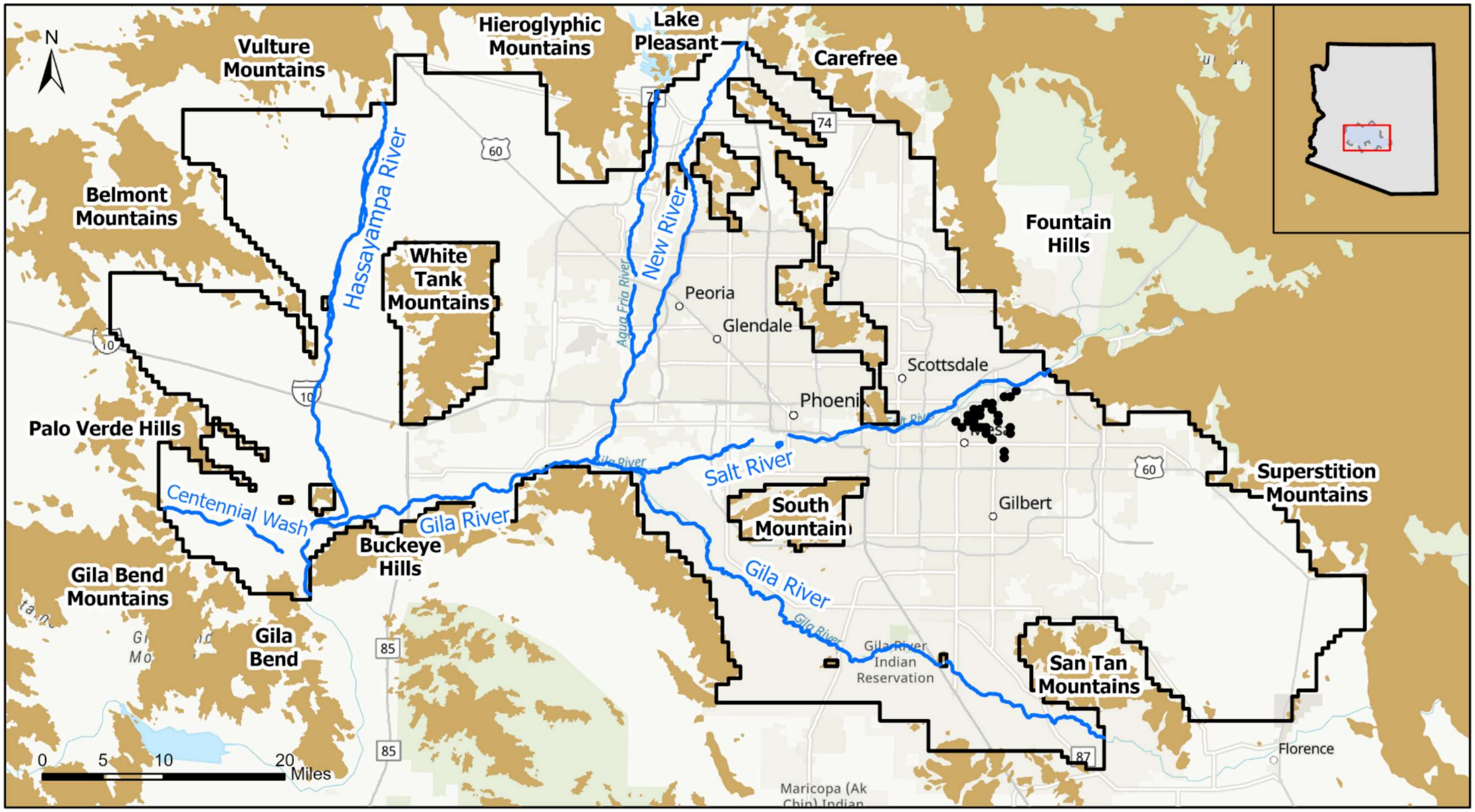


Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-9

Cumulative Unmet Demand
at Agricultural Wells (2022 - 2121)



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-10

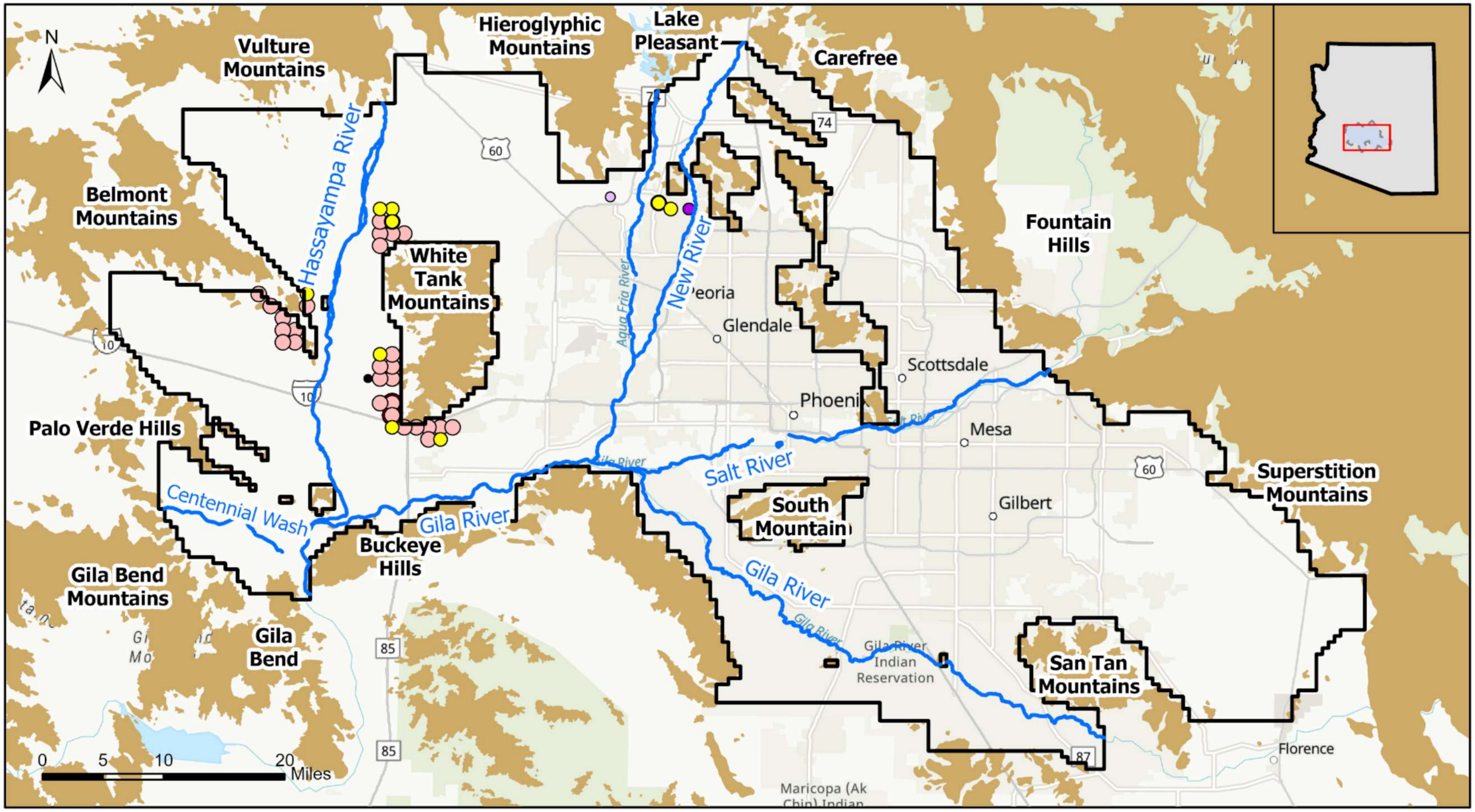
Cumulative Unmet Demand
at Agricultural/Municipal
Mixed Wells (2022 - 2121)

Phoenix AMA Grid Boundary

Bedrock

Cumulative Unmet Demand (acre-feet)

- 1 to 2



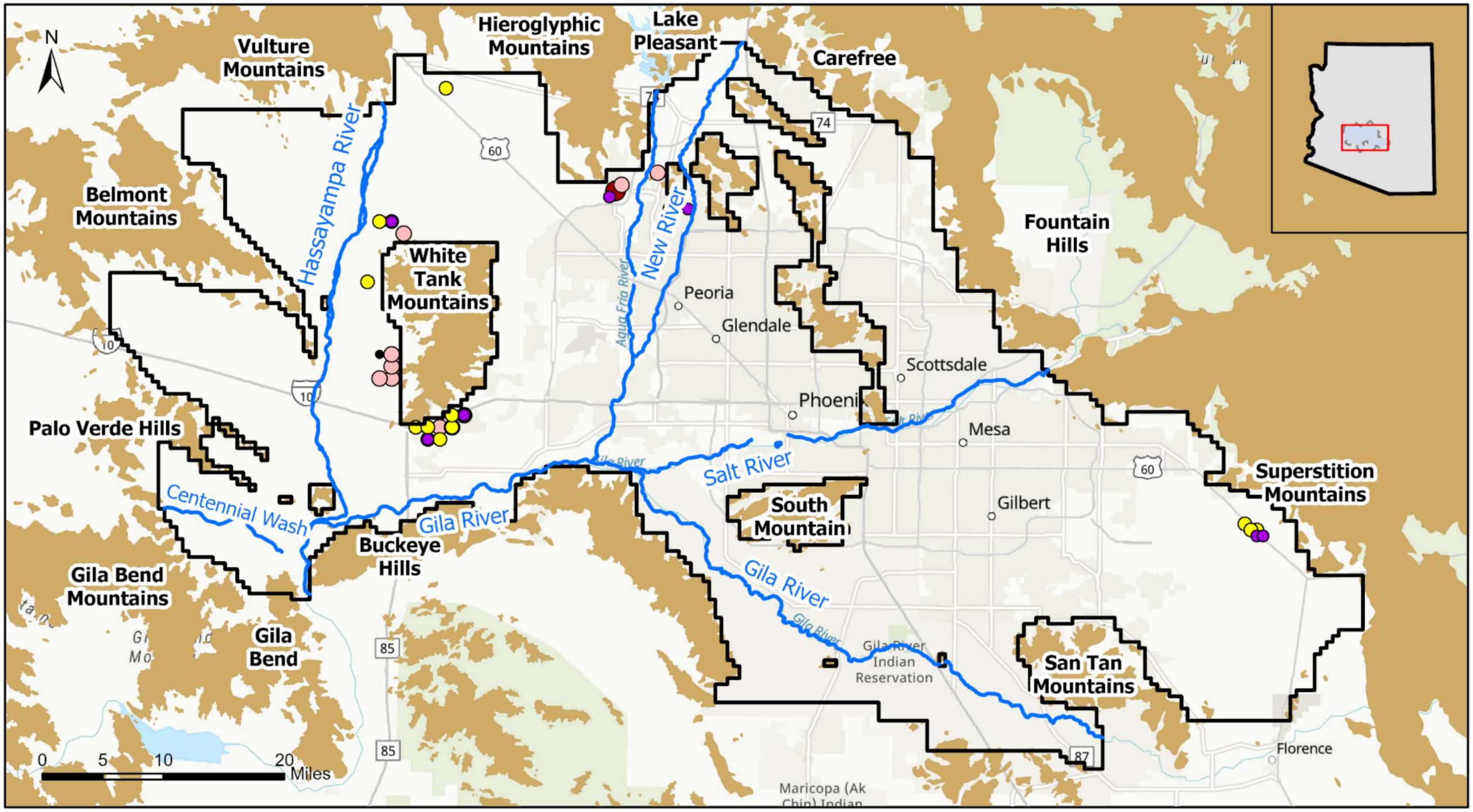
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-11

Cumulative Unmet Demand
at Analysis of AWS Locations
(2022 - 2121)

Phoenix AMA Grid Boundary
Bedrock
Cumulative Unmet Demand (acre-feet)
- 6 to 10
- 10 to 100
- 100 to 1,000
- 1,000 to 10,000
- 10,000 to 100,000
- 100,000 to 114,209



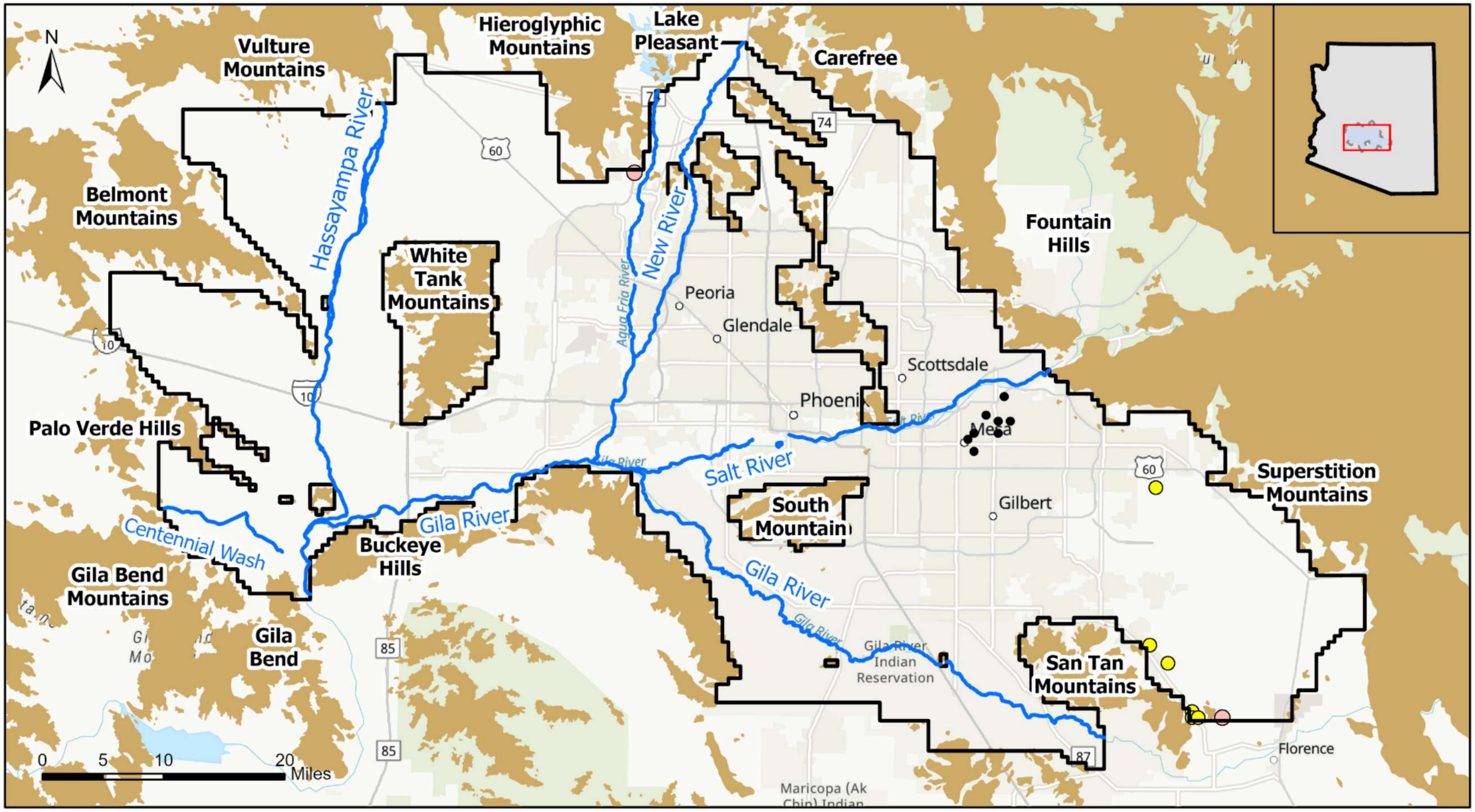
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-12

Cumulative Unmet Demand
at Certificate of AWS Locations
(2022 -2121)

Phoenix AMA Grid Boundary
Bedrock
Cumulative Unmet Demand (acre-feet)
- 8 to 10
- 10 to 100
- 100 to 1,000
- 1,000 to 10,000
- 10,000 to 100,000
- 100,000 to 147,287

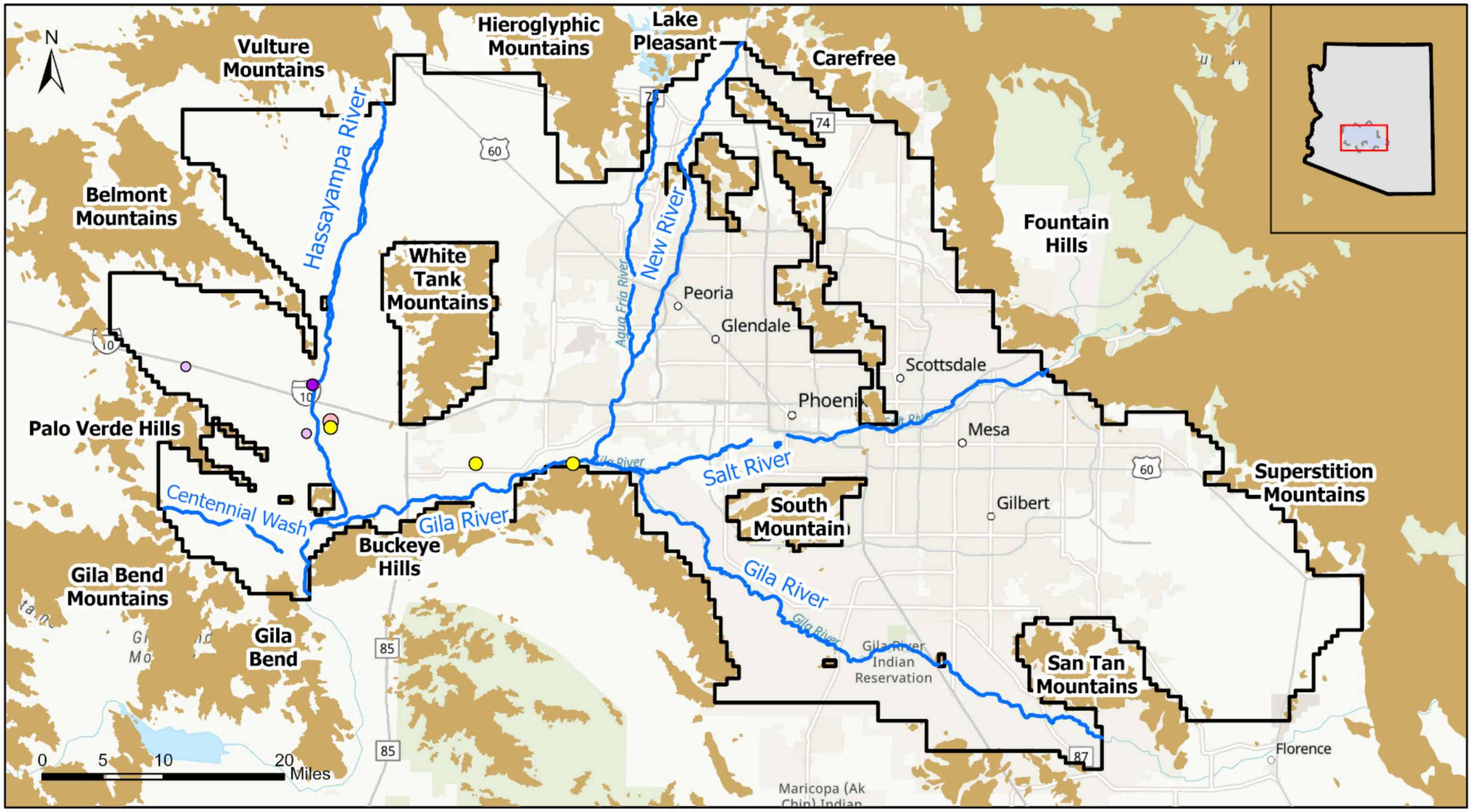


Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-13

Cumulative Unmet Demand
at Designation of AWS Locations
(2022 - 2121)



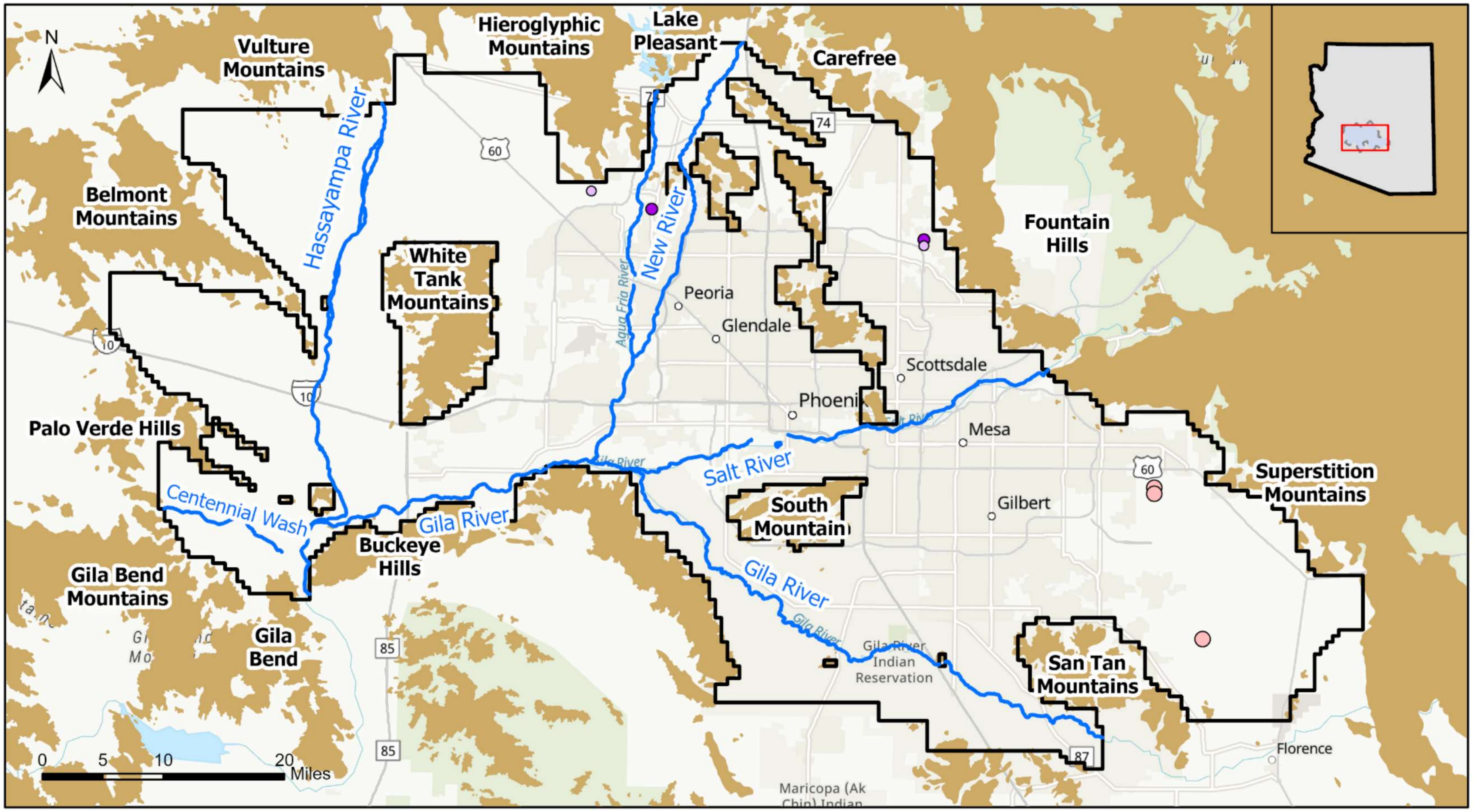
Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-14

Cumulative Unmet Demand
at Industrial Wells (2022 - 2121)

Phoenix AMA Grid Boundary
Bedrock
Cumulative Unmet Demand (acre-feet)
41 to 100
100 to 1,000
1,000 to 10,000
10,000 to 11,264

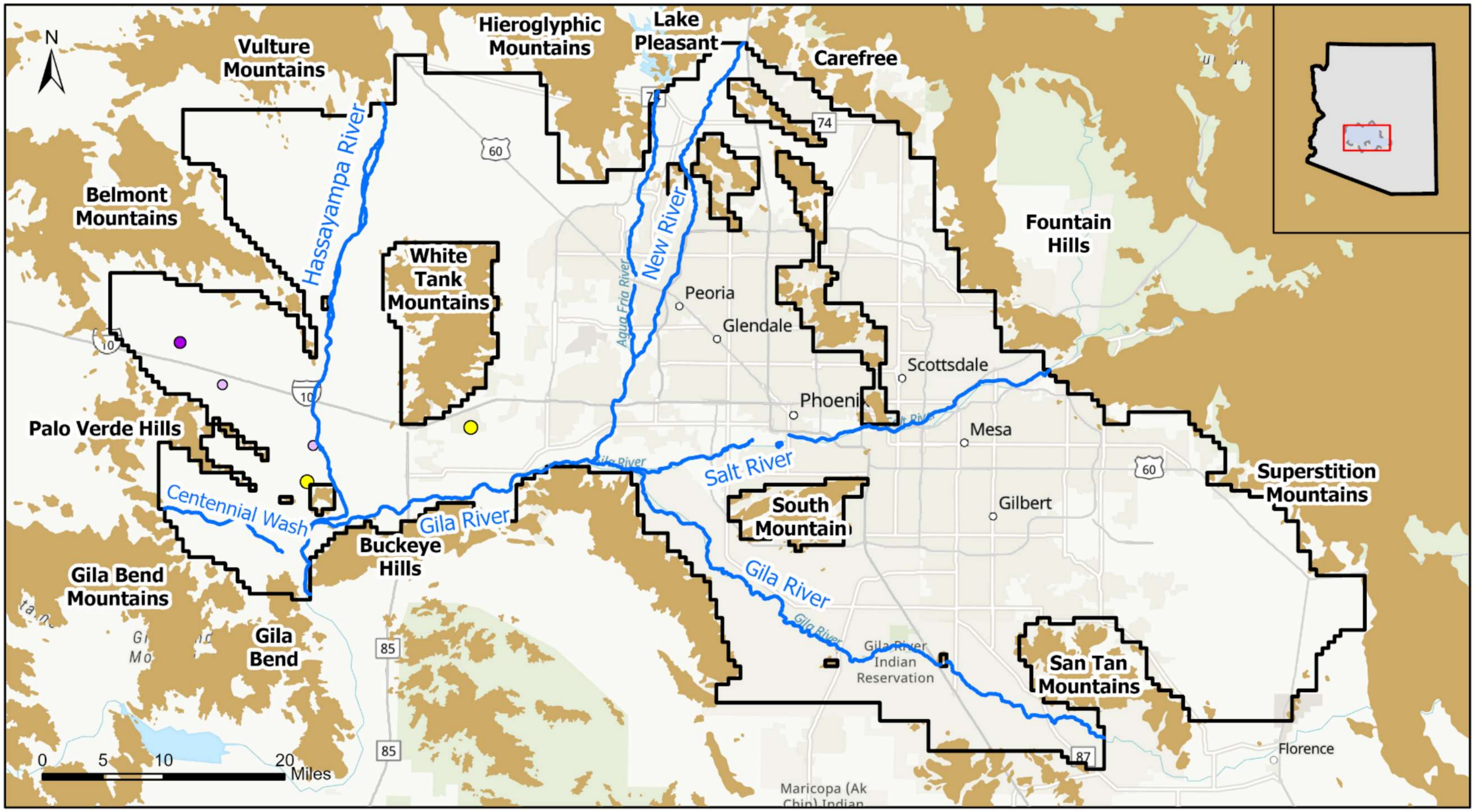


Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-15

Cumulative Unmet Demand
at LTSC Wells (2022 - 2121)



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-16

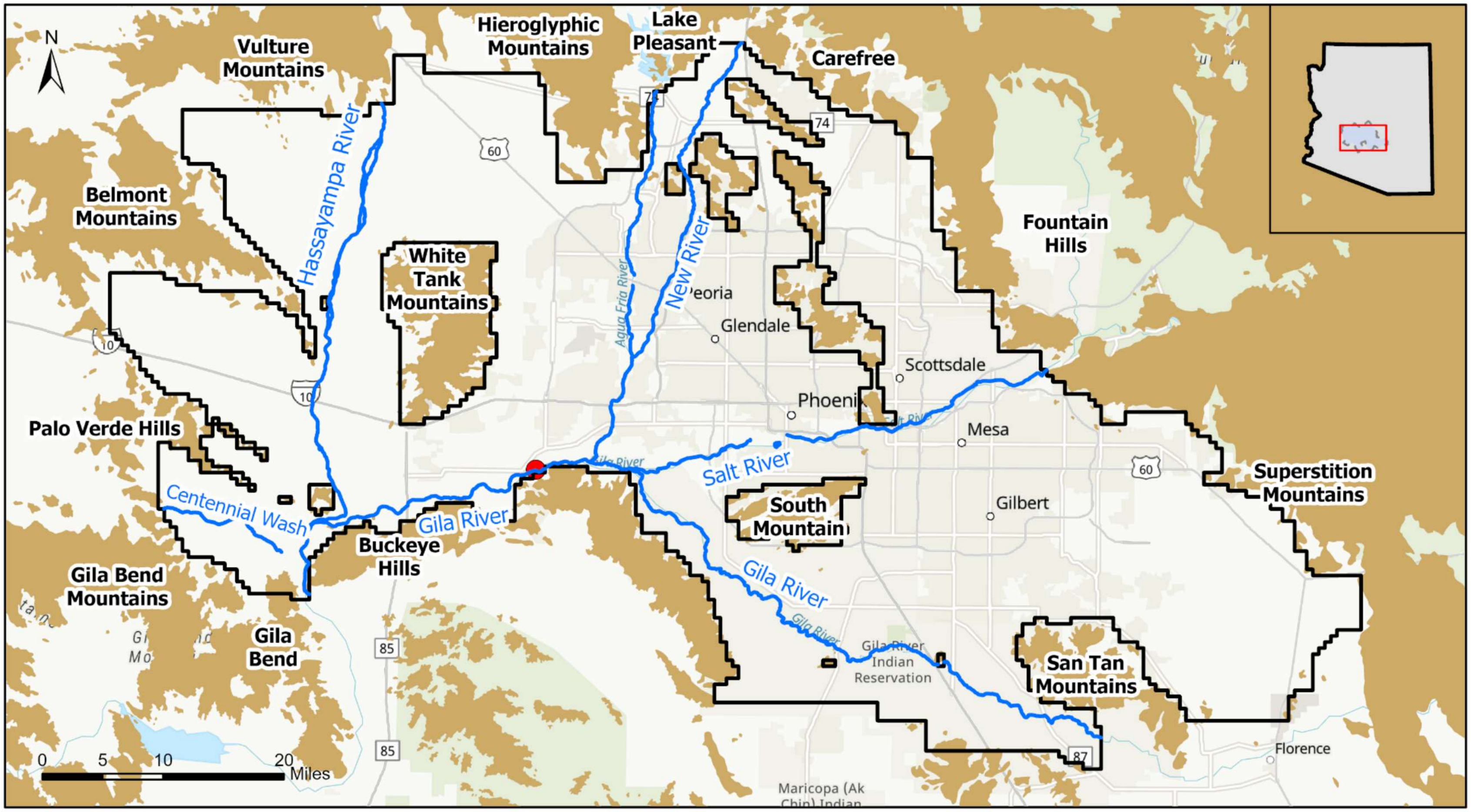
Cumulative Unmet Demand
at Municipal Wells (2022 - 2121)

Phoenix AMA Grid Boundary

Bedrock

Cumulative Unmet Demand (acre-feet)

- 15 to 100
- 100 to 1,000
- 1,000 to 3,656



Phoenix Active Management Area (AMA)
100-Year Assured Water Supply Projection

ADWR 2023

Figure 2-17

Cumulative Unmet Demand
at Other Wells (2022 - 2121)

Phoenix AMA Grid Boundary

Bedrock

Cumulative Unmet Demand (acre-feet)

10,896

TABLES

Table 1-1 Summary of Annual CAGRD Replenishment.

Year	Estimated Obligation from 2015 Plan of Operations (Acre-Feet)	Water in Master Account (Acre-Feet)	Water in Reserve Account (Cannot Access Until 2030) (Acre-Feet)	Replenishment Recharge to Add to Model (Acre-Feet)
2015	34,300	N/A	N/A	0
2020	37,700	N/A	N/A	0
2021	40,820	N/A	N/A	0
2022	43,940	586,838	250,385	0
2023	47,060	539,778	250,385	0
2024	50,180	489,598	250,385	0
2025	53,300	436,298	250,385	0
2026	55,140	381,158	250,385	0
2027	56,980	324,178	250,385	0
2028	58,820	265,358	250,385	0
2029	60,660	204,698	250,385	0
2030	62,500	142,198	250,385	0
2031	64,025	78,173	250,385	0
2032	65,550	12,623	250,385	0
2033	67,075	0	195,933	0
2034	68,600	0	127,333	0
2035	68,795	0	58,537.84	0
2036	68,990	0	0	10,452.16
2037	69,185	0	0	69,185
2038	69,380	0	0	69,380
2039	69,575	0	0	69,575
2040	69,770	0	0	69,770
2041	69,965	0	0	69,965
2042	70,160	0	0	70,160
2043	70,355	0	0	70,355
2044	70,550	0	0	70,550
2045	70,745	0	0	70,745
2046	70,940	0	0	70,940
2047	71,135	0	0	71,135
2048	71,330	0	0	71,330
2049	71,525	0	0	71,525
2050	71,720	0	0	71,720
2051	71,915	0	0	71,915
2052	72,110	0	0	72,110
2053	72,305	0	0	72,305
2054	72,500	0	0	72,500

Year	Estimated Obligation from 2015 Plan of Operations (Acre-Feet)	Water in Master Account (Acre-Feet)	Water in Reserve Account (Cannot Access Until 2030) (Acre-Feet)	Replenishment Recharge to Add to Model (Acre-Feet)
2055	72,695	0	0	72,695
2056	72,890	0	0	72,890
2057	73,085	0	0	73,085
2058	73,280	0	0	73,280
2059	73,475	0	0	73,475
2060	73,670	0	0	73,670
2061	73,865	0	0	73,865
2062	74,060	0	0	74,060
2063	74,255	0	0	74,255
2064	74,450	0	0	74,450
2065	74,645	0	0	74,645
2066	74,840	0	0	74,840
2067	75,035	0	0	75,035
2068	75,230	0	0	75,230
2069	75,425	0	0	75,425
2070	75,620	0	0	75,620
2071	75,815	0	0	75,815
2072	76,010	0	0	76,010
2073	76,205	0	0	76,205
2074	76,400	0	0	76,400
2075	76,595	0	0	76,595
2076	76,790	0	0	76,790
2077	76,985	0	0	76,985
2078	77,180	0	0	77,180
2079	77,375	0	0	77,375
2080	77,570	0	0	77,570
2081	77,765	0	0	77,765
2082	77,960	0	0	77,960
2083	78,155	0	0	78,155
2084	78,350	0	0	78,350
2085	78,545	0	0	78,545
2086	78,740	0	0	78,740
2087	78,935	0	0	78,935
2088	79,130	0	0	79,130
2089	79,325	0	0	79,325
2090	79,520	0	0	79,520
2091	79,715	0	0	79,715
2092	79,910	0	0	79,910
2093	80,105	0	0	80,105

Year	Estimated Obligation from 2015 Plan of Operations (Acre-Feet)	Water in Master Account (Acre-Feet)	Water in Reserve Account (Cannot Access Until 2030) (Acre-Feet)	Replenishment Recharge to Add to Model (Acre-Feet)
2094	80,300	0	0	80,300
2095	80,495	0	0	80,495
2096	80,690	0	0	80,690
2097	80,885	0	0	80,885
2098	81,080	0	0	81,080
2099	81,275	0	0	81,275
2100	81,470	0	0	81,470
2101	81,665	0	0	81,665
2102	81,860	0	0	81,860
2103	82,055	0	0	82,055
2104	82,250	0	0	82,250
2105	82,445	0	0	82,445
2106	82,640	0	0	82,640
2107	82,835	0	0	82,835
2108	83,030	0	0	83,030
2109	83,225	0	0	83,225
2110	83,420	0	0	83,420
2111	83,615	0	0	83,615
2112	83,810	0	0	83,810
2113	84,005	0	0	84,005
2114 to 2121	84,200	0	0	84,200

Table 1-2 Summary of estimated discharge from wastewater treatment plants and release from reservoir to surface water bodies during projection.

Surface Water	Discharge, Release, or Diversion		Note
	(cubic feet per day)	(acre-feet per year)	
Gila River	3.12E+06	26,143	Average of calibrated period (1900-2021)
Salt River	2.36E+07	197,750	Average of calibrated period (1900-2021)
Hassayampa River	1.60E+06	13,407	Average of calibrated period (1900-2021)
Buckeye Irrigation Canal	1.11E+07	93,010	Average of calibrated period (1900-2021)
Aqua Fria River	4.13E+05	3,461	Average of calibrated period (1992-2021) after dam expansion in 1991
23rd Avenue Wastewater Treatment Plant	0	0	No discharge during projection
91st Avenue Wastewater Treatment Plant	8.55E+06	71,643	Average of last 5 years of calibrated period (2017-2021) due to discharge reduction in comparison with previous years

Table 2-1 Assigned, simulated, and unmet demands by sector for the 100-year projection (2022 to 2121).

Sector of Demand	Number of Wells	Number of Wells with Pumping Reduced*	Number of Wells with Pumping Reduced to Zero at 2121	Assigned Total Annual Demand (acre-feet per year)	Simulated Total Annual Demand (acre-feet per year)			Unmet Total Annual Demand (acre-feet per year)			Cumulative Unmet Demand from 2022 to 2121 (acre-feet)
					Minimum	Maximum	Average	Minimum	Maximum	Average	
Agricultural	622	31	8	346,500	291,013	347,220	319,230	1	55,260	27,270	2,727,020
Analysis	240	47	3	134,518	113,971	132,020	121,596	2,411	20,424	12,922	1,292,209
Certificate	557	54	0	194,697	183,427	192,843	187,901	1,564	12,034	6,796	679,649
Designation	460	16	1	295,131	292,943	295,949	294,046	75	1,387	1,085	108,528
Industrial	324	7	7	74,825	73,562	74,980	74,572	0	1,214	253	25,265
LTSC	1,164	40	0	74,209	73,763	74,360	74,092	4	399	118	11,775
Other	24	1	0	41,957	41,326	42,044	41,848	0	604	109	10,906
Municipal	143	5	5	38,631	38,455	38,704	38,564	8	150	67	6,732
Agricultural/ Municipal	295	33	0	143,871	143,775	144,170	143,870	1	2	1	129
Water Report	23	0	0	4,168	4,162	4,181	4,168	0	0	0	1
Total	**3,852**	**234**	**24**	**1,348,507**	**1,256,397**	**1,346,471**	**1,299,887**	**4,064**	**91,474**	**48,621**	**4,862,214**

* Pumping is considered to be reduced when cumulative unmet demand is 1 acre-foot or more from 2022 to 2121.

Table 2-2 Summary of simulated groundwater budget for the historical (pre-1900 to 2021) and projection (2022 to 2121) periods.

Budget Term	Accumulative (acre-feet)			Average (acre-feet per year)			Note
	Steady State	1900 - 2021	2022 - 2121	Steady State	1900 - 2021	2022 - 2121	
Inflow							
Mountain-Front Recharge and Underflow	80,327	7,704,690	5,125,472	80,327	63,153	51,255	Underflow represents net flow from adjacent sub-basins
Recharge	197,577	111,917,067	70,259,325	197,577	917,353	702,593	Agricultural recharge, leakage from canals, artificial recharge, recharge during flooding, recharge along ephemeral streams and washes, and recharge from urban turf and artificial lakes
Stream Leakage	0	0	16,985,179	0	0	169,852	Net stream leakage from rivers and Buckeye Canal to the alluvial aquifer
Total Inflow	**277,904**	**119,621,757**	**92,369,976**	**277,904**	**980,506**	**923,700**	
Outflow							
Pumping	0	115,738,473	128,853,375	0	948,676	1,288,534	Groundwater withdrawal by pumping
Stream Leakage	91,257	5,959,981	0	91,257	48,852	0	Net stream gain from alluvial aquifer
General Head	13,930	1,867,786	581,278	13,930	15,310	5,813	Underflow from Lower Hassayampa Sub-basin to Gila Bend Sub-basin at Gillespie Dam
Evapotranspiration	172,718	16,688,774	1,622,940	172,718	136,793	16,229	Evapotranspiration along Gila and Salt River riparian zones
Total Outflow	**277,905**	**140,255,014**	**131,057,593**	**277,905**	**1,149,631**	**1,310,576**	
Aquifer Storage Loss	**0**	**20,550,349**	**38,671,748**	**0**	**168,445**	**386,717**	