ARIZONA DEPARTMENT OF WATER RESOURCES

Technical Memorandum

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

Groundwater Modeling Section
Hydrology Division

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List of Acronyms

%	percent
AAC	Arizona Administrative Code
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
AWS	Assured Water Supply
CAGRD	Central Arizona Groundwater Replenishment District
ft	feet
GSF	Groundwater Savings Facility
LTSC	Long-term Storage Credit
MNW2	Multi-Node Well (package)
NWT	Newtonian (solver)
RCH	Recharge (package)
USF	Underground Storage Facility
WEL	Well (package)
WSRV	West Salt River Valley

Executive Summary

The Groundwater Management Act (GMA or the Act) 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 Active Management Areas (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 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 due to depth to water either reaching bedrock or exceeding 1,000 feet below ground surface during the 100-year projection period.

This technical memorandum summarizes the results from a 100-year (2017 to 2116) model projection for the Lower Hassayampa Sub-basin in the Phoenix AMA. The 100-year projection and corresponding results presented in this report were conducted using the updated groundwater flow model for the Lower Hassayampa Sub-basin by ADWR (ADWR, 2022). This 100-year projection includes issued AWS demands for analyses and certificates. Demands for pending Assured Water Supply applications were not included in this projection. This projection aimed to evaluate existing and projected future groundwater use

[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)

and recharge, quantify any unmet demands, and provide the groundwater depth 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:

- One area north of the White Tank Mountains and one south of the Vulture Mountains have depths to water exceeding 1,000 feet below land surface.
- One area east of the Belmont Mountains and one area southeast of the Vulture Mountains next to the Hassayampa River have groundwater level declines below the top of bedrock.
- Existing wells (consisting of municipal, agricultural, industrial, other non-exempt uses, and portions of Certificates that were constructed as of November 2018) may experience unmet demand ranging from 943 acre-feet in 2017 to 29,749 acre-feet in 2116, with a cumulative unmet demand of 871,355 acre-feet from 2017 to 2116.
- AWS Analysis wells (demand associated with approved Analyses as of November 2018) may experience unmet demand ranging from 8,658 acre-feet in 2017 to 36,973 acre-feet in 2116, with a cumulative unmet demand of 2,155,838 acre-feet from 2017 to 2116.
- AWS Certificate wells (demand associated with issued-but-unbuilt Certificates as of November 2018) may experience unmet demand ranging from 5,993 acre-feet in 2017 to 17,831 acre-feet in 2116, with a cumulative unmet demand of 1,273,215 acre-feet from 2017 to 2116.
- The LTSC demands at the Hieroglyphic Mountains Recharge Project Underground Storage Facility (USF) may not be sustained starting from about 2029. The unmet LTSC demand could reach 1,800 acre-feet in 2116, with a cumulative unmet demand of 117,710 acre-feet by the end of 2116.

- The total unmet demand for the existing demand, AWS, and LTSC categories is simulated as 4,418,118 acre-feet from 2017 to 2116. The total assigned demand in the projection period is 29,336,080 acre-feet, which means that the unmet demand represents approximately 15% of the total demand.

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

The 100-year projection simulation for the Lower Hassayampa Sub-basin is derived from the calibrated historical model by ADWR (ADWR, 2022), which covers the period from 1930 to 2016. This technical memorandum discusses the process of extending the historical simulation by 100 years to simulate the period from 2017 to 2116.

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

The remaining MODFLOW-NWT packages from the calibrated model were revised to reflect the changes from the historical period (1930 to 2016) to the projection period (2017 to 2116). 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 2017 and 2116 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 (1930), 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 2016 from the calibrated model are used as the initial head and are defined in the MODFLOW-NWT basic (BAS) package.

1.3 Well Package for Existing Demands

The MODFLOW-NWT well (WEL) package from the calibrated model contains the existing groundwater demands at wells and the underflows from the Lower Hassayampa Sub-basin to the surrounding sub-basins. In the projection simulation, the underflows remain the same as in the calibrated model, but the well demand pumping is modified.

Existing demand consists of existing municipal, agricultural, industrial, and other non-exempt wells, and the portions of Certificates that were built out as of November 2018. Existing wells are simulated in the model using reported screen intervals. Wells for agricultural irrigation that fall in the footprints of AWS development areas were removed from the projection. The pumping rates for the retained wells are based on the 5-year average between 2012 and 2016 from the calibrated model. Demand associated with partially-built-out AWS determinations in these 5 years are part of the existing demand. The resulting total existing demand is roughly 123,000 acre-feet per year and is applied as a constant annual rate for the whole projection period. The existing well locations in the projection model are presented in **Figure 1-1,** and the assigned pumping rate at each location is summarized in **Table A1** of **Appendix A**.

As in the historical period, the WEL package included the automatic pumping reduction function in the projection period. The reduction began when the saturated thickness of the WEL cell was less than 20% of the cell's total thickness. When the cell goes dry (i.e., the simulated water level falls below the bottom elevation of the cell), pumping from that layer ceases. The magnitude of the reduced and/or foregone pumping in the WEL package is the unmet demand for the existing wells.

1.4 Multi-Node Well Package for AWS and LTSC Demands

The multi-node well (MNW2) package is used to simulate groundwater withdrawal for Analyses of AWS, issued-but-unbuilt Certificates of AWS, and Long-Term Storage Credits (LTSCs) at underground storage facilities (USFs) and groundwater savings facilities (GSFs) in the Lower Hassayampa Sub-basin; this is an entirely new package from the calibrated model. This package offers more flexibility and realistic pumping for wells penetrating multiple model layers with high heterogeneity, which is important for the 100-year projection where cells may become dewatered. However, pumping is still possible from lower layers.

All the wells in the MNW2 package are assumed to fully penetrate the alluvial aquifer, and the assigned pumping rates remain constant for the projection period. However, the model reduces the pumping when the aquifer cannot support the assigned pumping rate. The magnitude of the reduced pumping in the MNW2 package is the unmet demands for the Analyses, issued-but-unbuilt Certificates, and LTSCs.

1.4.1 Assured Water Supply Demands

The issued-but-unbuilt AWS demands include the demands associated with all issued-but-unbuilt subdivisions within AWS determinations based on ADWR's records as of November 2018. The data underwent a screening process to remove demands duplicated in the database due to changes of ownership of Certificates of Assured Water Supply or renewals of issued Analyses of Assured Water Supply. The built-out certificates were subtracted from the total demands in the projection simulation using aerial photography based on a count of visible existing dwellings within the subdivision footprints and included in the existing demands in the WEL package, as described above. Finally, for the subdivisions enrolled as "member lands" with the Central Arizona Groundwater Replenishment District (CAGRD), demands were adjusted using a per-parcel water use report provided by the CAGRD 2015 Plan of Operation (CAGRD, 2015).

The resulting total demand associated with each unbuilt AWS determination was divided evenly among model grid cells occupied by the development with a well spacing of one mile. All wells were assumed to fully penetrate the alluvial aquifer. The total projected demand is about 123,000 acre-feet per year for the Analysis pumping and 39,000 acre-feet per year for the unbuilt Certificate pumping, with a total of about 162,000 acre-feet per year. The demands are applied at a constant rate for the entire projection period. The well locations in the projection model are presented in **Figure 1-2,** and the assigned pumping rate at each location is summarized in **Table A2** of **Appendix A**.

1.4.2 Long-Term Storage Credits

At the end of the historical model period in 2016, four USFs and two GSFs were operating in the Lower Hassayampa Sub-basin, with a combined volume of LTSCs of about 1,158,000 acre-feet. Of this balance, credits amounting to 203,000 acre-feet were held by CAGRD and are not subject to removal from the model. Per standard AWS program assumptions and statute, the rest is subject to removal from the 100-year projection simulation.

1). Underground Storage Facilities

The LTSCs at the Hieroglyphic Mountains Recharge Project USF (65,244 acre-feet) and the Tonopah Desert Recharge Project USF (14,097 acre-feet) owned by the CAGRD are not subject to removal during the projection period. The remaining credits, 193,397 acre-feet at the Hieroglyphic Mountains Recharge Project USF and 661,569 acre-feet at the Tonopah Desert Recharge Project USF, were removed by one percent (1%) of the values every year over the 100-year projection period.

During the historical period (1930-2016), the Buckeye Tartesso Water Reclamation Facility and the Hassayampa Managed Recharge Facility accumulated LTSCs of about 980 acre-feet and 31,534 acre-feet, respectively. The credits were removed over the 100-year period by removing 1% of the sum from the aquifer each year. Future projected recharge was assumed to be removed within the same year it will be recharged, and as the projection period is simulated at an annual time scale, the net impact of projected future recharge would be null. Thus, no future recharge is applied at the facilities in the projective model.

The LTSCs at the USFs in the Lower Hassayampa Sub-basin by the end of 2016, subject to the removal during the 100-year projection period, are listed in **Table B1** of **Appendix B.**

2). Groundwater Saving Facilities

The LTSCs at the Roosevelt Irrigation District GSF and the Tonopah Irrigation District GSF that do not belong to CAGRD were based on the balance at the end of 2016 and removed at a rate of 1% percent of the sum per year over the course of 100 years (2017 to 2116). The projection scenario assumes entities with GSF storage credits will recover their credits at the same location where the water was initially delivered and applied. The volumes of LTSCs at the GSFs in the Lower Hassayampa Sub-basin by the end of 2016, subject to the removal during the 100-year projection period, are listed in **Table B2** of **Appendix B**.

The location of wells used to remove the LTSCs in the projection model is shown in **Figure 1-3**.

1.5 Recharge Package

The MODFLOW-NWT recharge (RCH) package simulates the mountain front recharge, the underflows from the adjacent sub-basins to the Lower Hassayampa Sub-basin, the impulsive recharge due to flooding events along the Gila River and the Hassayampa River, and the incidental agricultural recharge in the projection. Artificial recharge that occurred during the calibration period is removed for the projection.

1.5.1 Mountain Front Recharge, Underflows, and Impulsive Recharge

In the projection simulation, the mountain front recharge, the underflows from the West Salt River Valley (WSRV) Sub-basin at Buckeye Gap and the Harquahala Sub-basin at Mullen's Cut between the Palo Verde Hills and the Gila Bend Mountains, and the impulsive recharge along the Gila River and the Hassayampa River are based on the average between 2012 and 2016 from the calibrated model. These recharge rates remain constant in the projection period.

1.5.2 Incidental Agricultural Recharge

Incidental agricultural recharge that was active in the calibrated model was removed from the projection model in areas where there is an overlap with the footprints of issued AWS determinations (**Figure 1-4**). The retirement of agricultural acreage overlapping issued AWS footprints was simulated to occur on day 1 of the 100-year projection period. In non-overlap areas, the average incidental agricultural recharge between 2012 and 2016 was applied at a constant rate in the 100-year projection simulation.

1.6 Summary of Changes

The constant rates of recharge in the projection period are shown in **Table 1-1**. The average annual volume is shown because, although the rate is constant, the annual volume varies slightly depending on whether the stress period represents a leap year or not.

Table 1-1 Summary of Recharge in the Projection Model.

Recharge Component	Average Annual Volume (acre-feet per year)
Agricultural return flow	52,851
Groundwater underflow from WSRV through Buckeye Gap	12,802
Seepage from the Gila River	6,535
Ephemeral flows in the Hassayampa River	19,313
Mountain-front recharge	3,005
Groundwater underflow from Harquahala through Mullen's Cut	423

Assigned existing and future demands are shown in **Figure 1-5**. The projected demands include existing demands, AWS analyses, AWS certificates, and LTSC. One notable feature of the projection is that the total demands in the projection period exceed the total demands in the historical period at all times.

2.0 100-Year Assured Water Supply Projection Model Results

ADWR constructed the projection period as described in the previous section and ran the model. Under the AWS program, physical availability of groundwater must be demonstrated using a groundwater model. 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 land surface or bedrock, and 2) demands from existing wells and previously issued AWS determinations must be satisfied. 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 (2116). 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 in a given cell to use in the depth-to-water calculation. This is a reasonable assumption because there are no known significant vertical gradients or confining beds in the Lower Hassayampa Sub-basin.

At the end of 2016, no location in the active model domain had a water level deeper than 1,000 feet below ground surface or below the top of bedrock. This means that the entire model domain was active in the 100-year projection simulation. 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, and the comparison result is shown in **Figure 2-2**, which indicates that the simulated water depth in the Lower Hassayampa Sub-basin by the end of 2116 exceeds the depth to static water level requirement in the following four areas:

- North of the White Tank Mountains (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)
- East of the Belmont Mountains (simulated water level below the top of bedrock)
- Southeast of the Vulture Mountains next to the Hassayampa River (simulated water level below the top of bedrock)

Figure 2-3 shows the water level decline in the 100-year projection period and provides a better idea of which areas are declining in response to local pumping demands and which could be responding to regional-scale water level declines. **Figure 2-3** shows that the areas with the greatest water level declines are typically co-located with the projected AWS wells (**Figure 1-2**). The other notable area is the Tonopah Desert Recharge Project USF, which experiences a decline between 2017 and 2116 because artificial recharge is not simulated in the projection period.

The remaining saturated thickness above the 1,000 ft requirement by the end of 2116 is shown in **Figure 2-4**, ranging from zero (0) feet at the four areas described above to more than 800 feet between the Gila River and Interstate Highway 10. **Figure 2-5** shows the projected saturated thickness above bedrock by the end of 2116. Since the bedrock is deeper between the Belmont Mountains and the Palo Verde Hills, northeast of the Belmont Mountains, and between the Hieroglyphic Mountains and the White Tank Mountains, much of the alluvial aquifer is expected to remain saturated (2,000 to 3,000 feet thick) in these areas. In comparison, about half of the Lower Hassayampa Sub-basin has a saturated thickness less than 1,000 feet above the bedrock by the end of 2116.

From 2017 to 2116, the saturated thickness of the alluvial aquifer above bedrock is expected to predominantly decrease across the whole sub-basin, except a small area near the Palo Verde Hills (**Figure 2-6**). The average water level change across the sub-basin is a decline of about 231 feet.

2.2 Unmet Demand

Unmet demand is calculated in the model by taking the difference between the assigned demand and the simulated demand. Assigned demand is a model input developed as described in Sections 1.3 and 1.4 for existing and AWS/LTSC demands, respectively. Simulated demand is a model output and can be less than assigned demand if the water level in the model cell falls below a given level, triggering the 20% threshold for automated pumping reduction (for existing wells) or a reduction in pumping through the MNW2 package (for AWS/LTSC wells). **Figure 2-7** illustrates the assigned pumping versus the simulated pumping in both the historical (1930 to 2016) and projection (2017 to 2116) periods. For every stress period in the 100-year projection period, simulated pumping is less than assigned pumping, resulting in unmet demand. The difference between the assigned pumping and the simulated pumping between 2017 and 2116 is the unmet demand for the projection period. This annual unmet demand for the existing demand, AWS analyses, AWS certificates, and LTSC demand categories is shown in **Figure 2-8**. The cumulative unmet demands for the projection period are presented in **Figure 2-9**. A summary of assigned, simulated, and unmet demands is included in **Table C1** of **Appendix C**.

Figures 2-7 through **2-9** and **Table C1** indicate:

- The assigned existing pumping was sustainable from 1930 to 2016. Existing pumping continues to be more or less sustainable until about 2070. After that, the unmet demand in the existing wells increases rapidly to about 29,750 acre-feet in 2116 (**Figures 2-7** and **2-8**).

- The assigned pumping at the simulated AWS wells cannot be fully supported from the onset of the projection (**Figure 2-7**). The unmet demand ranges from approximately 14,650 (8,660 for Analyses and 5,990 for issued-but-unbuilt Certificates) acre-feet in 2017 to 54,800 (36,987 for Analyses and 17,830 for issued-but-unbuilt Certificates) acre-feet in 2116 (**Figure 2-8**).

- The LTSC pumping, which has a relatively minor demand of 9,500 acre-feet per year, is also not sustainable for the duration of the projection (**Figure 2-7**). Unmet demand in this category ranges from about zero acre-feet in 2017 to 1,850 acre-feet in 2116 (**Figure 2-8**).

- The total annual unmet demand for all categories (existing, AWS Analyses and issued-but-unbuilt Certificates, and LTSCs) is simulated by the model to be approximately 15,600 acre-feet per year in 2017. It gradually increases to about 86,400 acre-feet per year in 2116 (**Figure 2-8**).

- 100 out of 357 existing wells and 94 out of 458 simulated AWS wells are modeled as going dry by the end of 2116 (**Table C1**). LTSC wells do not go dry in the model during the projection period.

- The cumulative unmet demand from 2017 to 2116 is 4,418,120 acre-feet total for all categories. This breaks down to 871,400 acre-feet for the existing demand, 2,155,830 acre-feet for AWS Analyses, 1,273,220 acre-feet for AWS issued-but-unbuilt Certificates, and 117,710 acre-feet for the LTSC demand (**Figure 2-9**).

The cumulative unmet demand at existing wells from 2017 to 2116 is shown in **Figures 2-10**, **2-11**, and **2-12** for Layer 1, Layer 2, and Layer 3, respectively. These figures indicate that the cumulative unmet demand at most existing wells is less than 10,000 acre-feet, with several exceptions ranging from 20,000 to 70,000 acre-feet.

Figure 2-13 shows the cumulative unmet demand at AWS Analysis locations, which ranges from less than 10,000 acre-feet to more than 110,000 acre-feet for the 100-year projection period. The cumulative unmet demand at the AWS issued-but-unbuilt Certificate locations ranges from less than 10,000 acre-feet to about 40,000 acre-feet (**Figure 2-14**). The cumulative unmet demand for LTCS locations is shown in **Figure 2-15**. This occurs only at the Hieroglyphic Mountains USF, which is simulated to experience unmet demand of approximately 117,710 acre-feet between 2017 and 2116.

2.3 Comparison of Water Budgets between Historical and Projection Periods

The simulated water budget for the historical (steady state and 1931 to 2016) and projection (2017 to 2116) periods are presented in **Table D1** of **Appendix D**, which indicates:

- The Lower Hassayampa Sub-basin is expected to receive less underflow from adjacent sub-basins during the projection period (2017 to 2116) than the historical period (1931 to 2016). The average annual underflow from the adjacent sub-basins to the Lower Hassayampa Sub-basin at Buckeye Gap and Mullen's Cut decreases from 28,327 at the steady state, 23,050 in the historical period (1931 to 2016), to 13,225 acre-feet per year at the projection period (2017 to 2116).

- The Lower Hassayampa Sub-basin is expected to receive less total and average groundwater recharge during the projection than the historical periods, mainly due to decreasing agricultural recharge and artificial recharge.

- Groundwater pumping during the projection period may cause the Gila River to become a completely losing stream.

- Pumping during the projection period is expected to lower the water table and significantly reduce the evapotranspiration along the Gila River riparian zone, eventually bringing it to zero around the year 2050.

3.0 Summary

ADWR constructed a projection (predictive) simulation to evaluate the future conditions of the alluvial aquifer in the Lower Hassayampa Sub-basin. The projection simulation was based on the calibrated groundwater flow model developed by ADWR (2022). The projection simulation covers the period 2017 to 2116, with several assumptions:

- The groundwater recharge, the existing pumping, and the underflows between the Lower Hassayampa Sub-basin and adjacent sub-basins during the projection are the same as the average conditions between 2012 and 2016 from the calibrated model (i.e., historical period).
- Agricultural recharge that falls within AWS Program development footprints is discontinued during the projection.
- Long-term underground storage credits and groundwater savings facility credits not belonging to the CAGRD are removed at a rate of 1% of the credit per year between 2017 and 2116.
- The hydraulic conditions of the Gila River and the vegetation along the Gila River riparian zone (i.e., the evapotranspiration potential) remain the same as the last stress period (2016) of the calibrated model.
- Artificial recharge is completely shut off during the projection period.
- The Assured Water Supply demand from each development (Analyses and issued-but-unbuilt Certificates) is evenly distributed at the associated development area with a well spacing of one mile and fully penetrating the alluvial aquifer. The issued-and-built demand is included in the calibrated model and is carried over to the projection period as existing demand.

The projection includes groundwater demands totaling 122,957 acre-feet per year for existing users, 161,518 acre-feet per year for AWS determinations (Analyses and issued-but-unbuilt Certificates), and 9,508 acre-feet per year for long-term storage credits.

For the Phoenix AMA, ADWR's AWS rules require that groundwater depth must not exceed 1,000 feet below the land surface, or top of bedrock, whichever is shallower, after 100 years of simulated groundwater pumping. In comparison with the AWS rules, the projection simulation indicates:

- Two areas (north of the White Tank Mountains and south of the Vulture Mountains) may have a water level depth exceeding 1,000 feet below the land surface.
- Two areas (east of the Belmont Mountains and southeast of the Vulture Mountains next to the Hassayampa River) may experience water level decline below the top of bedrock.
- Existing wells may experience unmet demand ranging from 943 acre-feet in 2017 to 29,749 acre-feet in 2116, with a cumulative unmet demand of 871,355 acre-feet from 2017 to 2116.
- AWS Analysis wells may experience unmet demand ranging from 8,658 acre-feet in 2017 to 36,973 acre-feet in 2116, with a cumulative unmet demand of 2,155,838 acre-feet from 2017 to 2116.
- AWS issued-but-unbuilt Certificate wells may experience unmet demand ranging from 5,993 acre-feet in 2017 to 17,831 acre-feet in 2116, with a cumulative unmet demand of 1,273,215 acre-feet from 2017 to 2116.
- The LTSC demands at the Hieroglyphic Mountains Recharge Project USF may not be sustained starting from about 2029. The unmet demand could reach 1,800 acre-feet in 2116, with a cumulative unmet demand of 117,710 acre-feet by the end of 2116.
- The total unmet demand for the existing demand, AWS, and LTSC categories is simulated as 4,418,118 acre-feet from 2017 to 2116. The total assigned demand in the projection period is 29,336,080 acre-feet, which means that the unmet demand represents approximately 15% of the total demand.

- Groundwater pumping increases from the historical period (24,149 acre-feet per year in 1930 to 144,905 acre-feet per year between 1931 to 2016) to the projection period (249,995 acre-feet per year from 2017 to 2116). The cumulative pumping doubles from 12,461,852 acre-feet between 1931 and 2016 to 24,999,503 acre-feet between 2017 and 2116.

- The groundwater level is expected to drop noticeably across the Lower Hassayampa Sub-basin, with an average decline of about 231 feet from the end of 2016 to the end of 2116. As a result, aquifer storage loss is projected to be 14,137,661 acre-feet. In comparison, the alluvial aquifer experienced an average water level drop of about 16 feet from 1930 to 2016, with an aquifer storage loss of 2,059,956 acre-feet.

- 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 lower the water table below the plant roots and result in no evapotranspiration along the Gila River riparian zone around 2050.

- The groundwater level decline is expected to make the Gila River a completely losing stream during the projection period. In comparison, the calibrated model indicated that the Gila River was mainly a gaining stream prior to 1940.

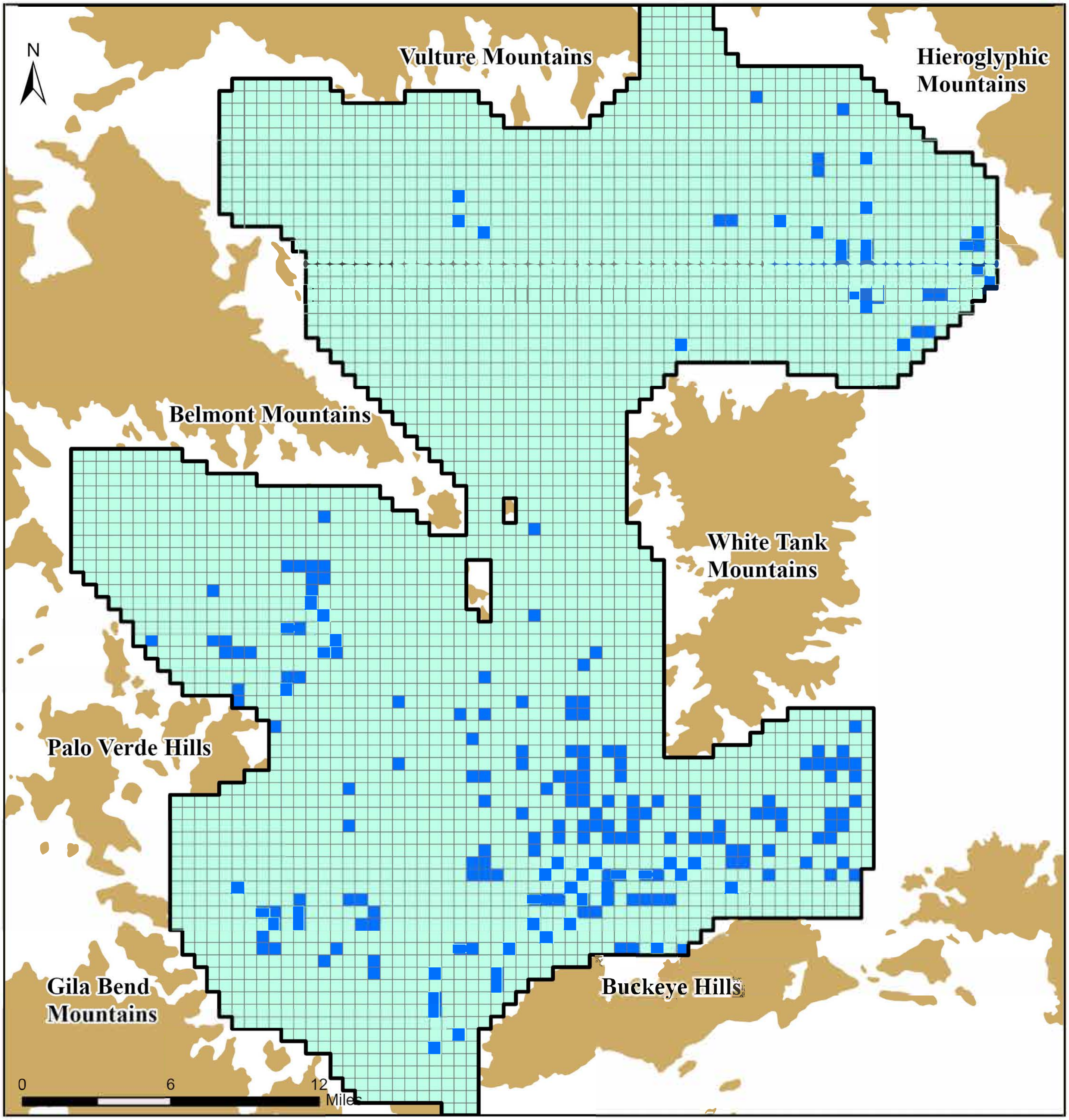
As with any groundwater modeling projection, if the future hydrologic conditions differ from the assumptions made in the projection simulation, the groundwater levels in the future may be significantly different from those presented herein.

4.0 References

ADWR, 2022. Groundwater Flow Model of the Lower Hassayampa Sub-basin in the Phoenix Active Management Area, Arizona. Modeling Report No. 27.

CAGRD, 2015. Plan of Operation. https://library.cap-az.com/cagrd/documents/2015-CAGRD-Plan-of-Operation.pdf

Figures



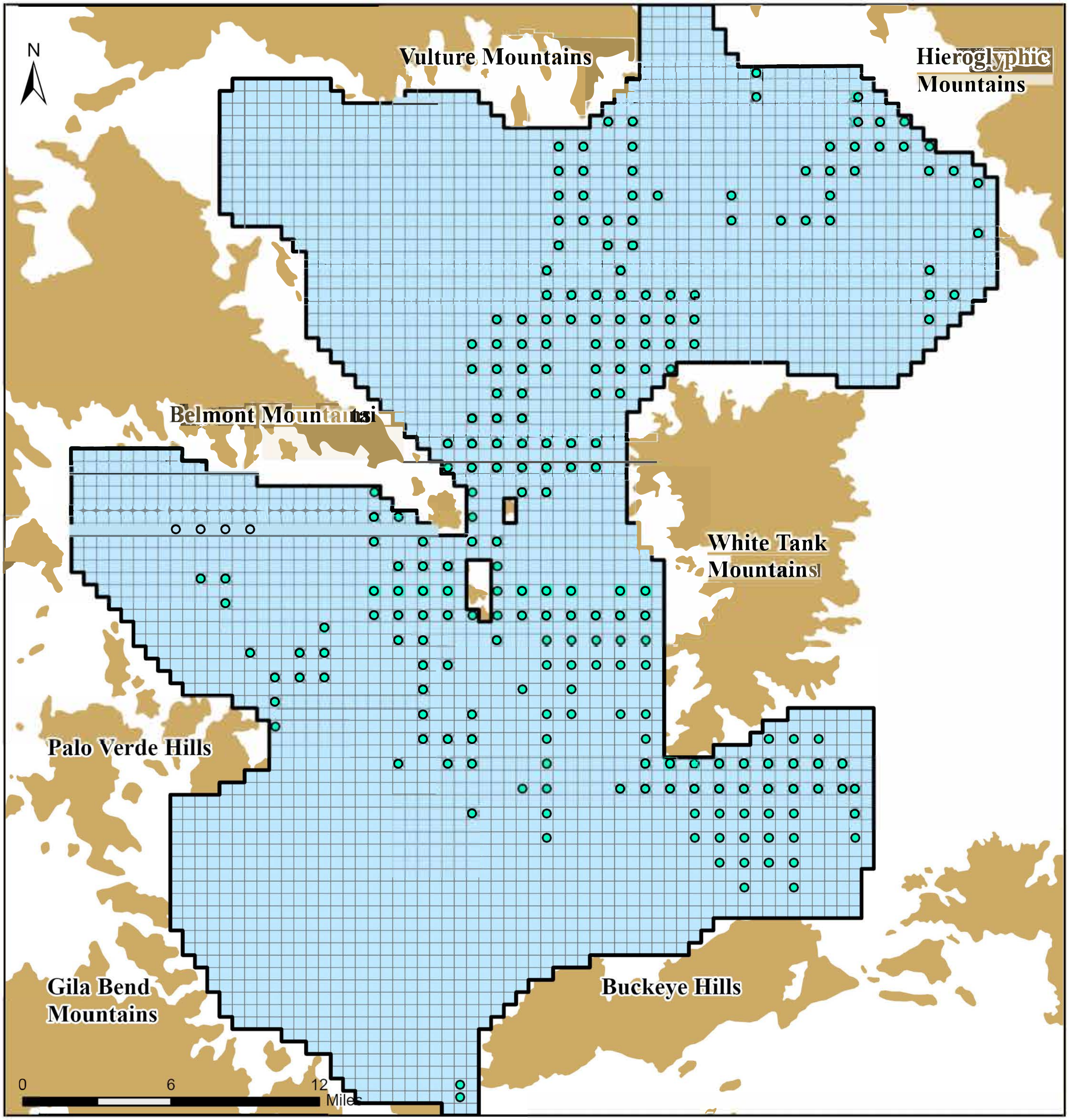
Active Model Domain
Existing Wells
Active Model Grid
Bedrock Outcrops

Figure 1-1

Location of Existing Wells

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023



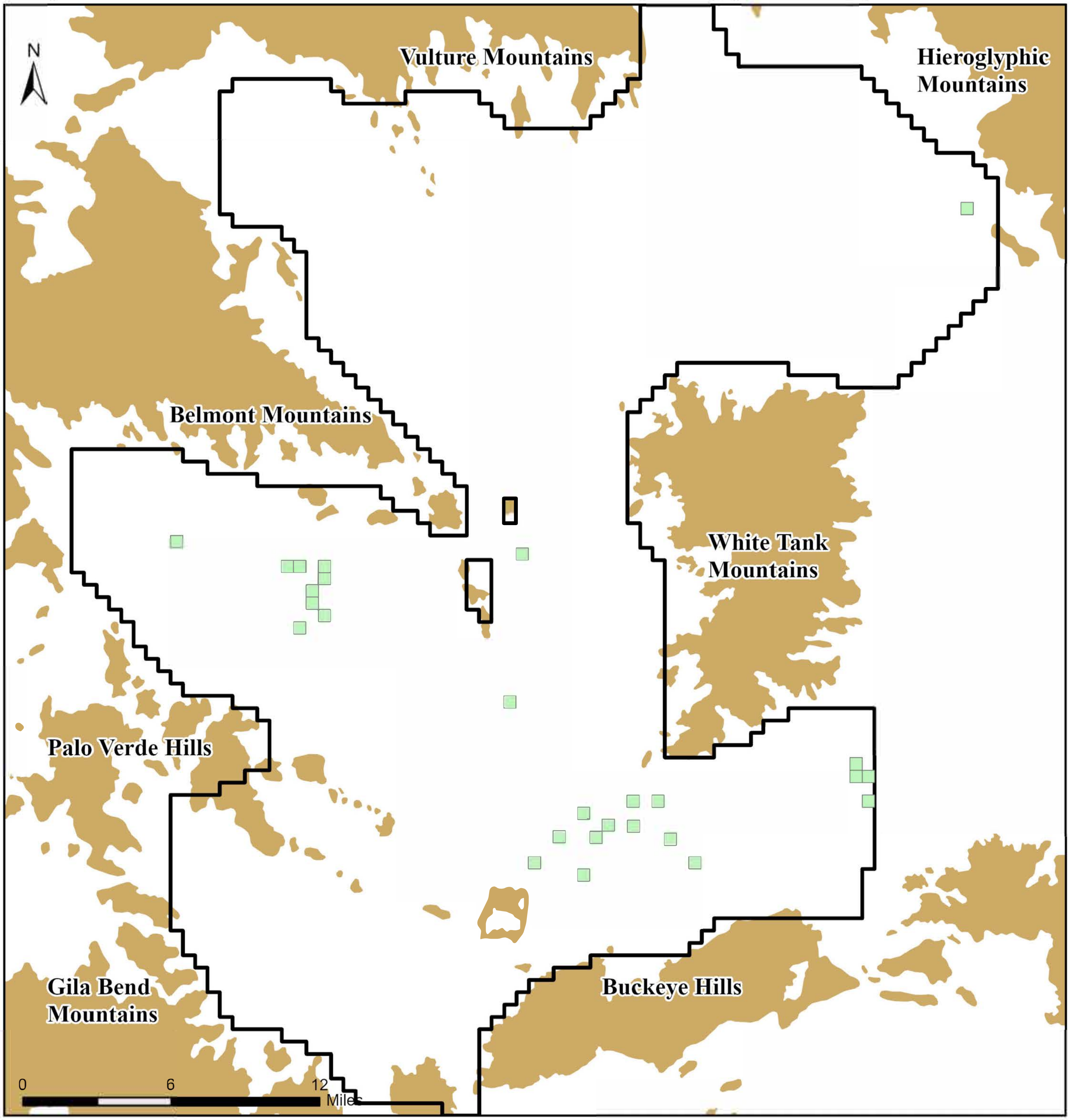
- Simulated AWS Well
- Active Model Domain
- Active Model Grid
- Bedrock Outcrops

Figure 1-2

Location of Simulated AWS Wells

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023



Long Term Storage Credit Well

Active Model Domain

Bedrock Outcrops

Figure 1-3

Location of Wells Removing LTSCs

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023

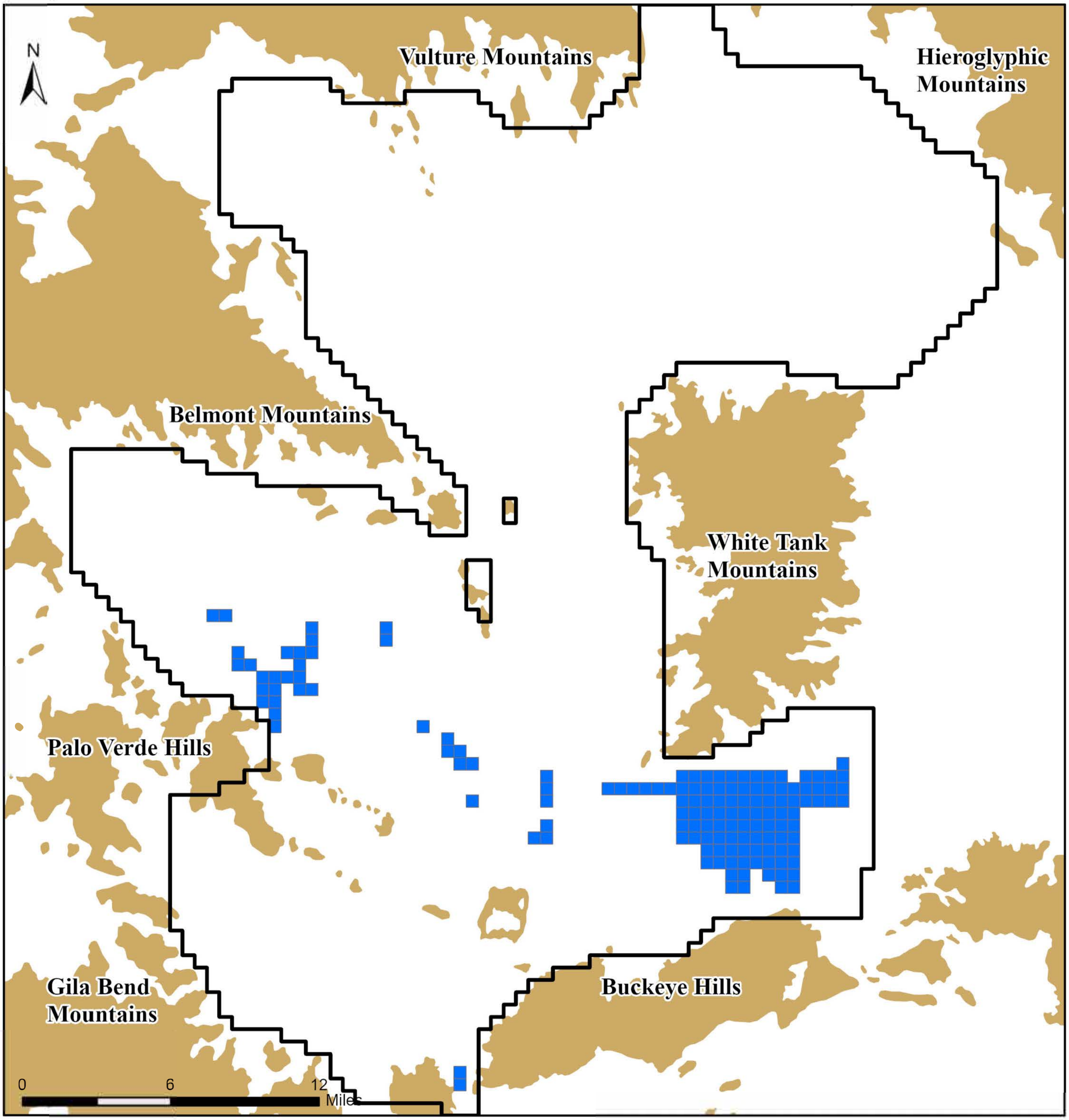


Figure 1-4
Location of Agricultural Cells Removed during Projection Simulation

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023

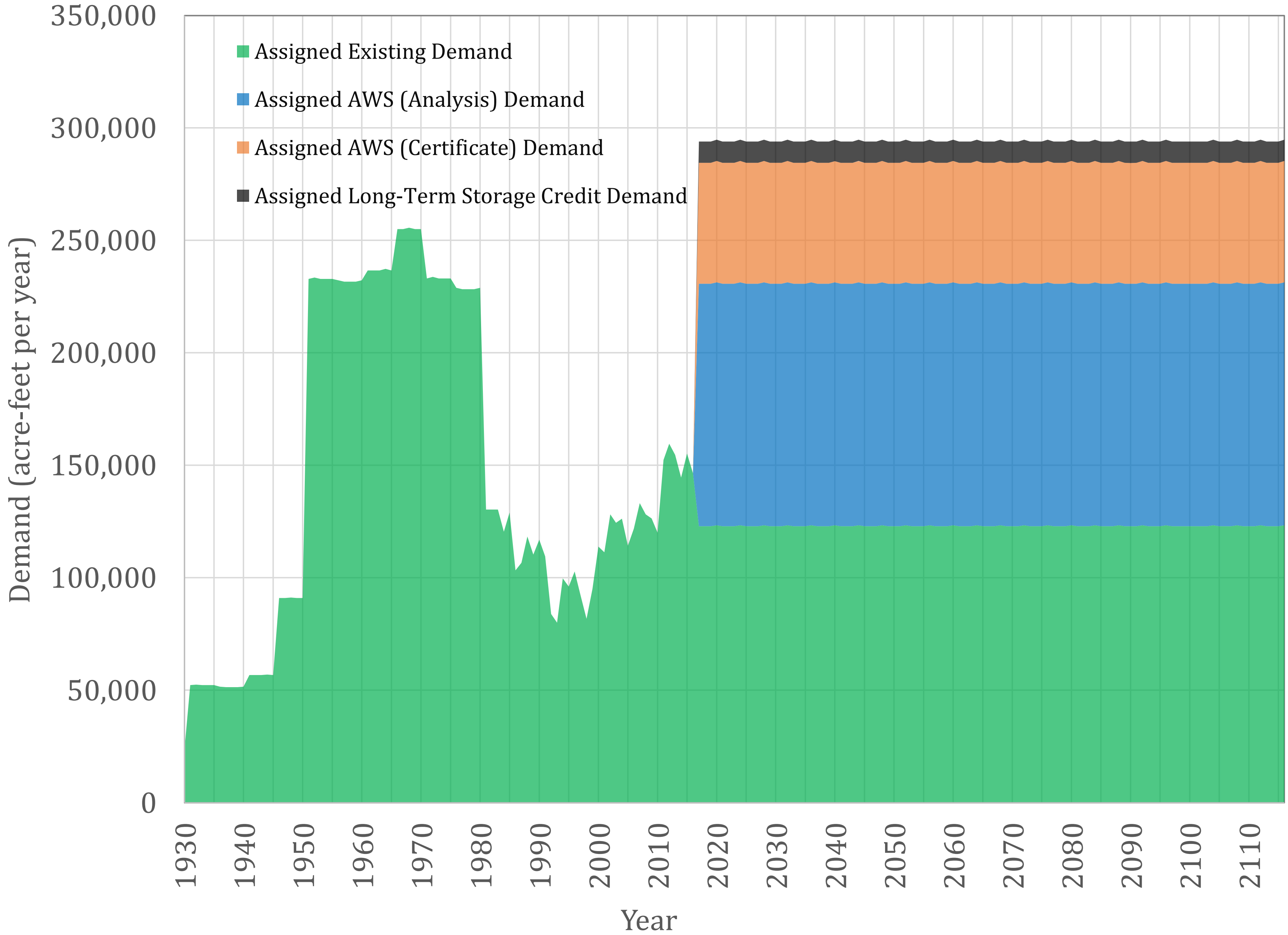


Figure 1-5
Stacked Graph of Assigned Demand in Historical and Projection Periods

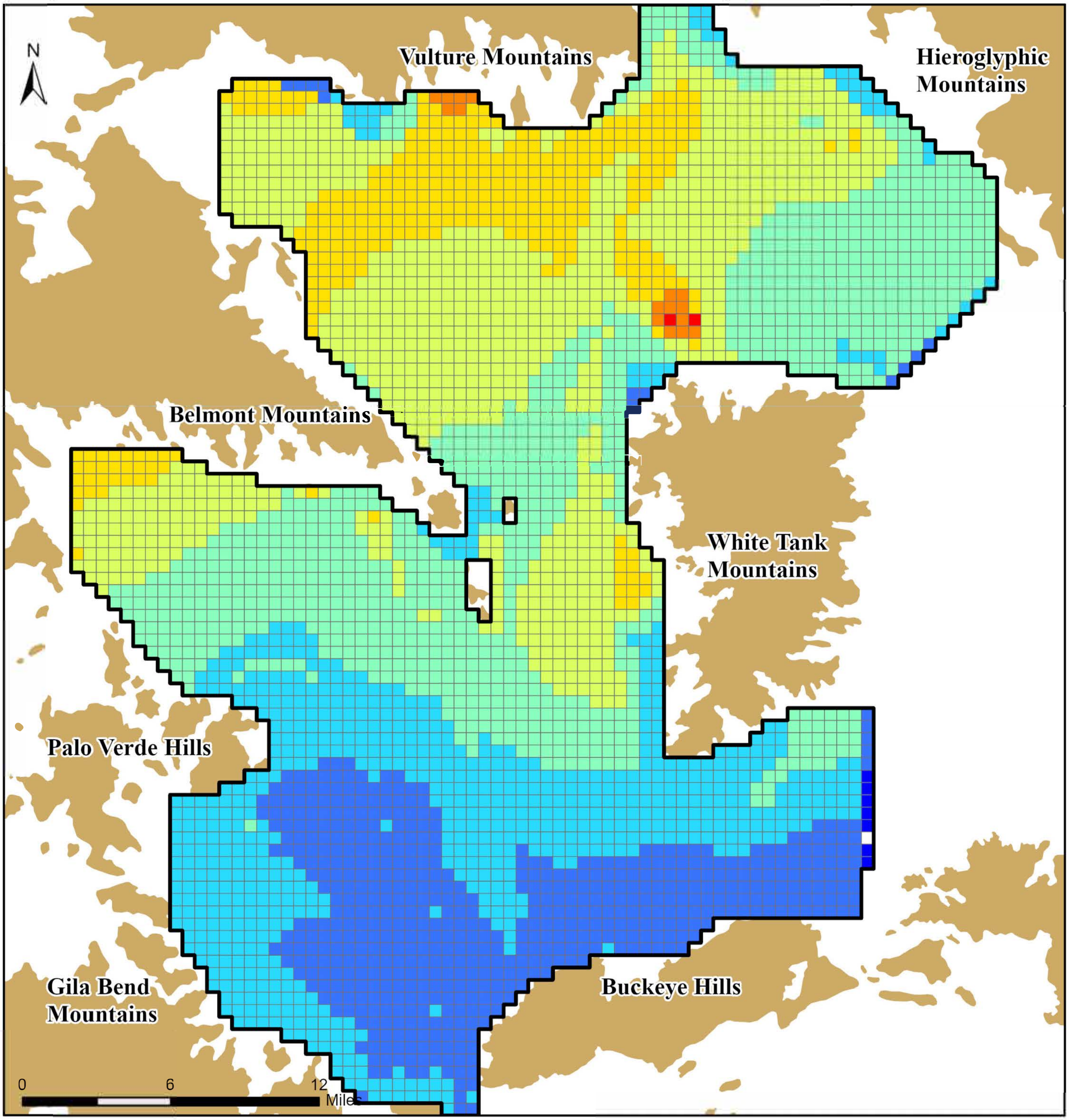
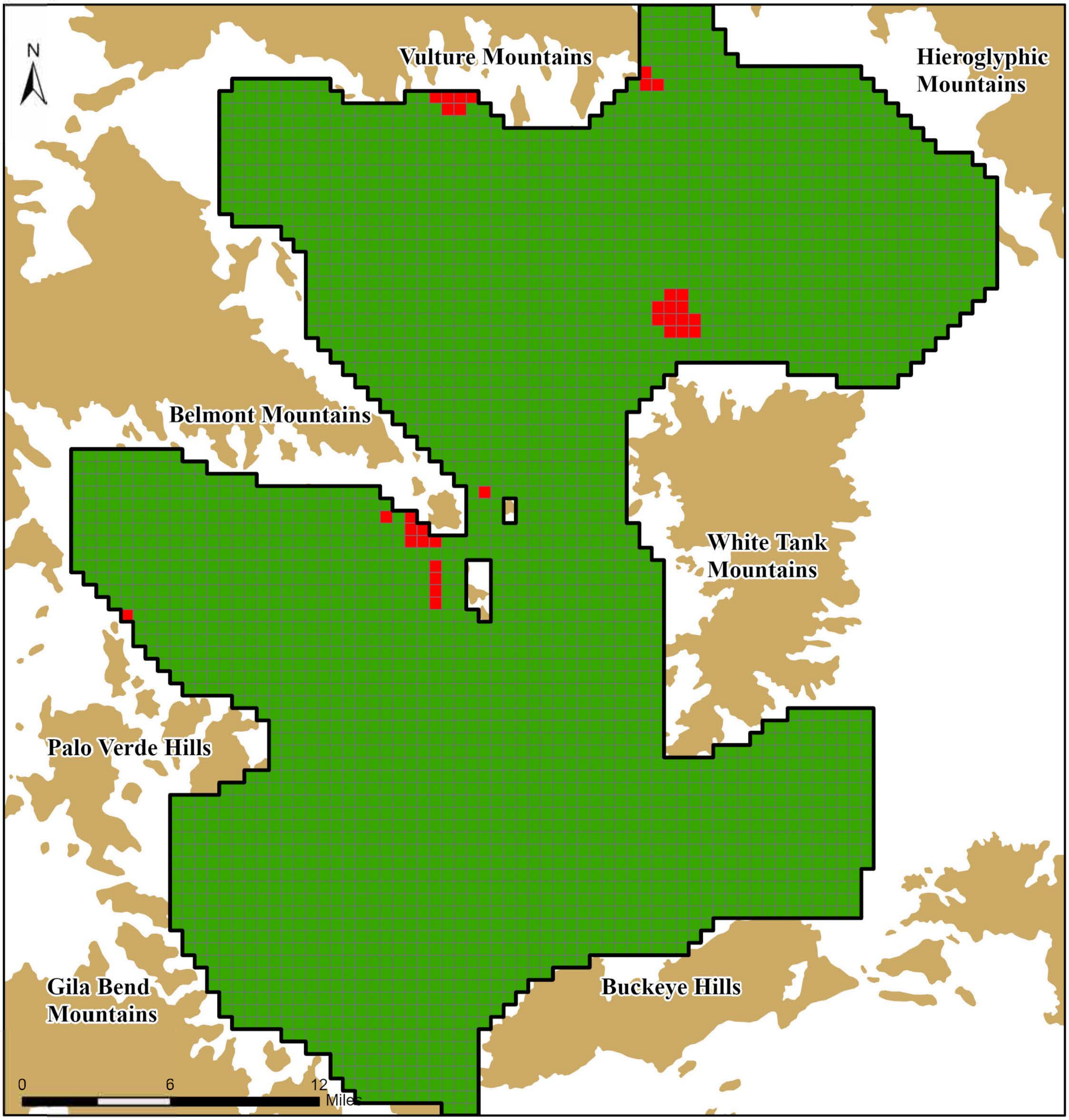


Figure 2-1

Simulated Depth to Water

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain
Bedrock Outcrops
Simulated AWS Violation
Not Violated
Violated

Figure 2-2
Location of Simulated Depth to Water below 1,000 ft or at Bedrock

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023

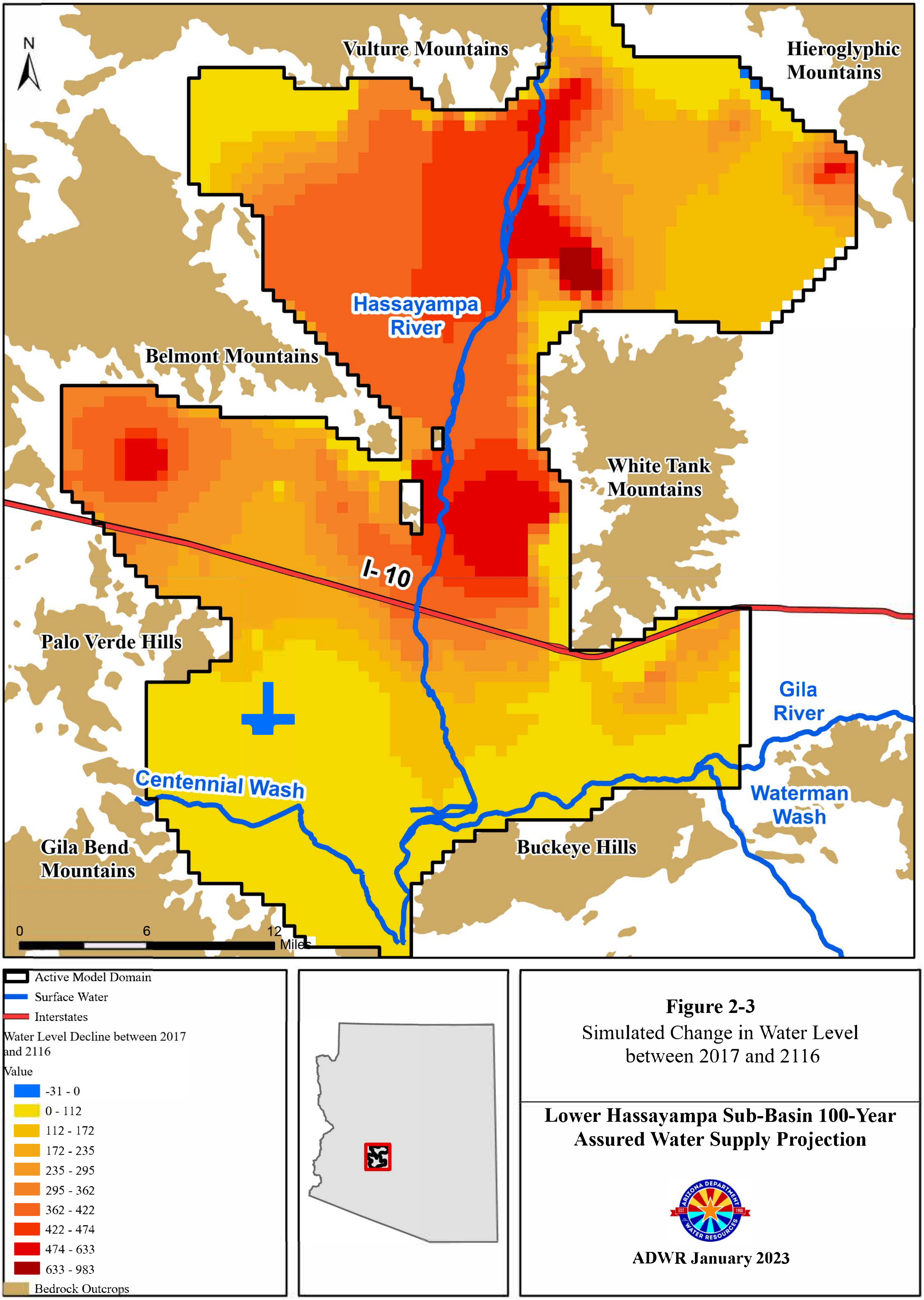
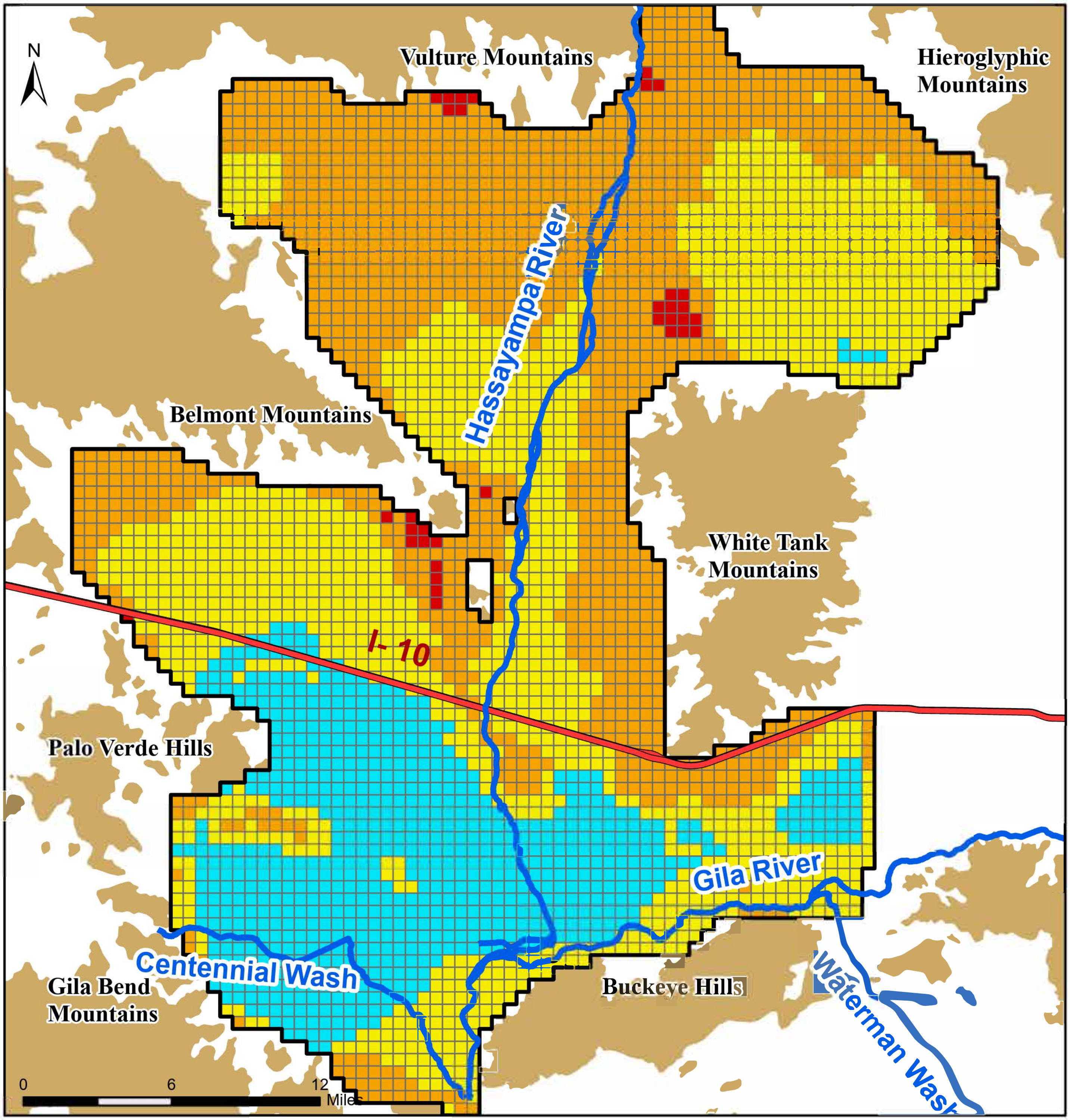


Figure 2-3
Simulated Change in Water Level between 2017 and 2116

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023



Surface Water
Interstate Highway
Active Model Domain
Bedrock Outcrops

Saturated Thickness above 1,000 ft bgs or Bedrock

Sat_Thick

- 0
- 0 - 300
- 300 - 600
- 600 - 900

Figure 2-4
Saturated Thickness of Alluvial Aquifer above 1,000 ft bgs or Bedrock by the end of 2116

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023

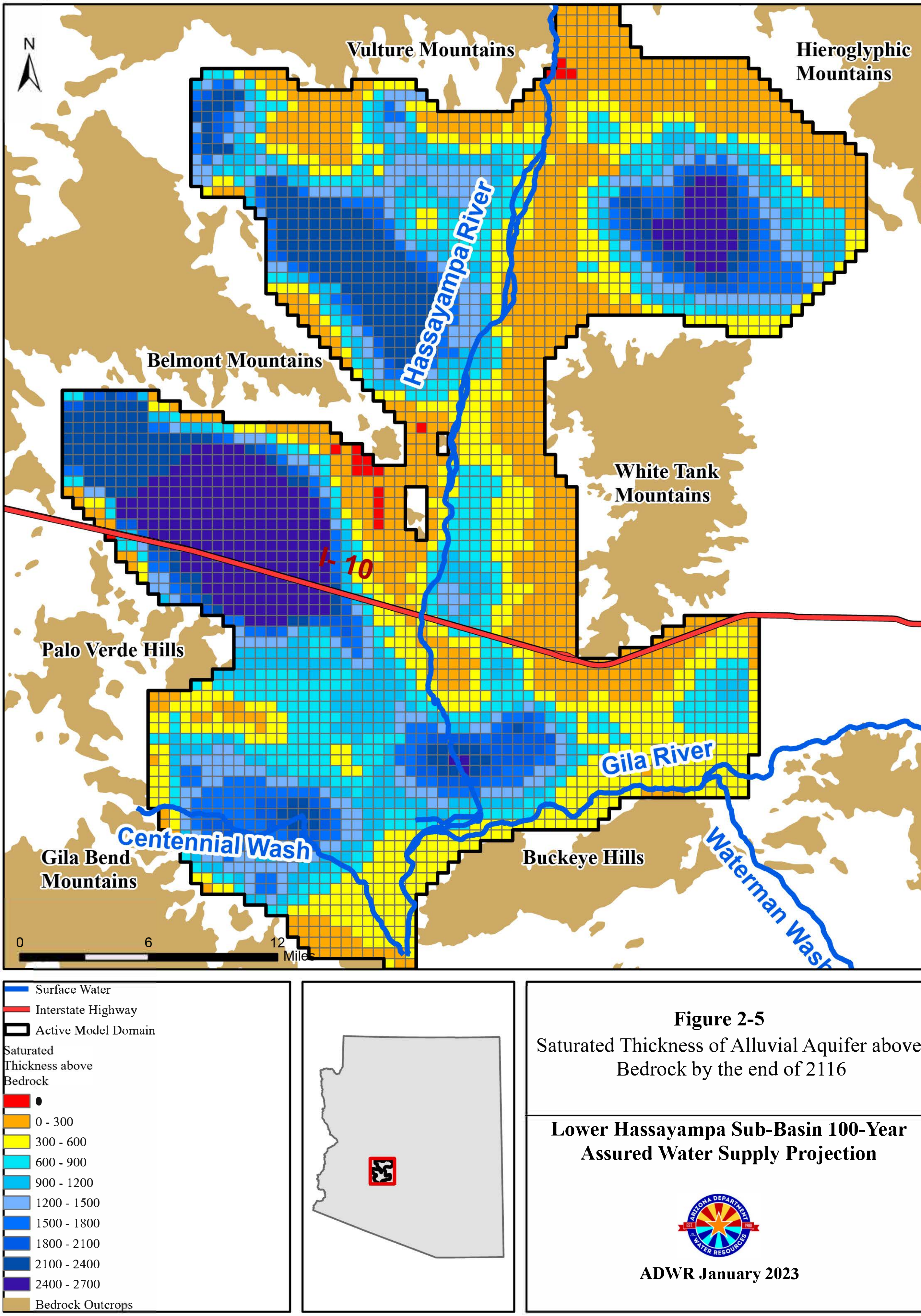
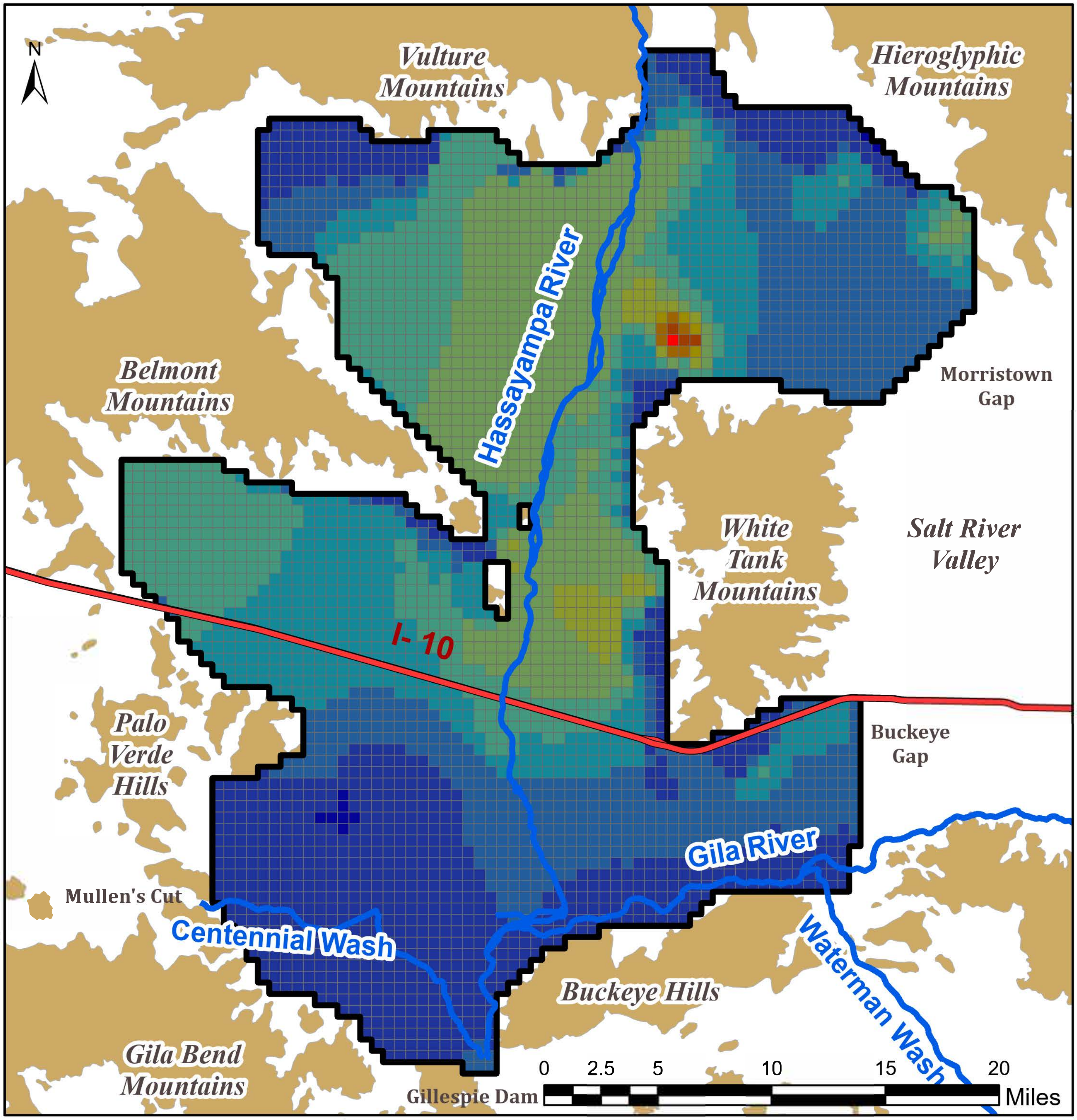


Figure 2-5

Saturated Thickness of Alluvial Aquifer above Bedrock by the end of 2116

Lower Hassayampa Sub-Basin 100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain

Bedrock Outcrops

Saturated Thickness Change from 2016 to 2116 (feet)

0 to 20
-100 to 0
-200 to -100
-300 to -200
-400 to -300
-500 to -400
-600 to -500
-700 to -600
-800 to -700
-900 to -800
-976 to -900

Figure 2-6

Change in Alluvial Aquifer Saturated Thickness above Bedrock from 2017 to 2116

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

ADWR January 2023

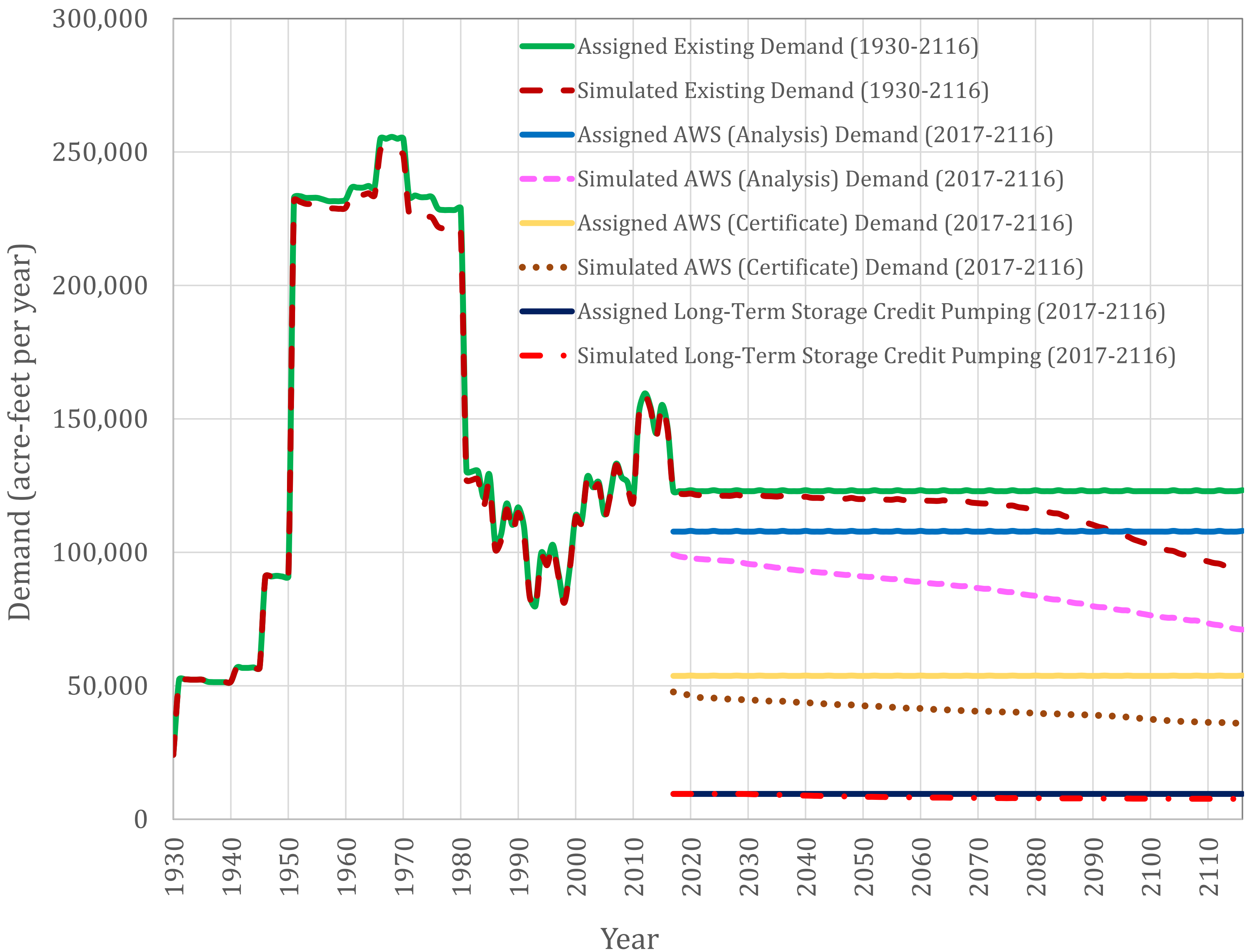


Figure 2-7
Assigned and Simulated Pumping

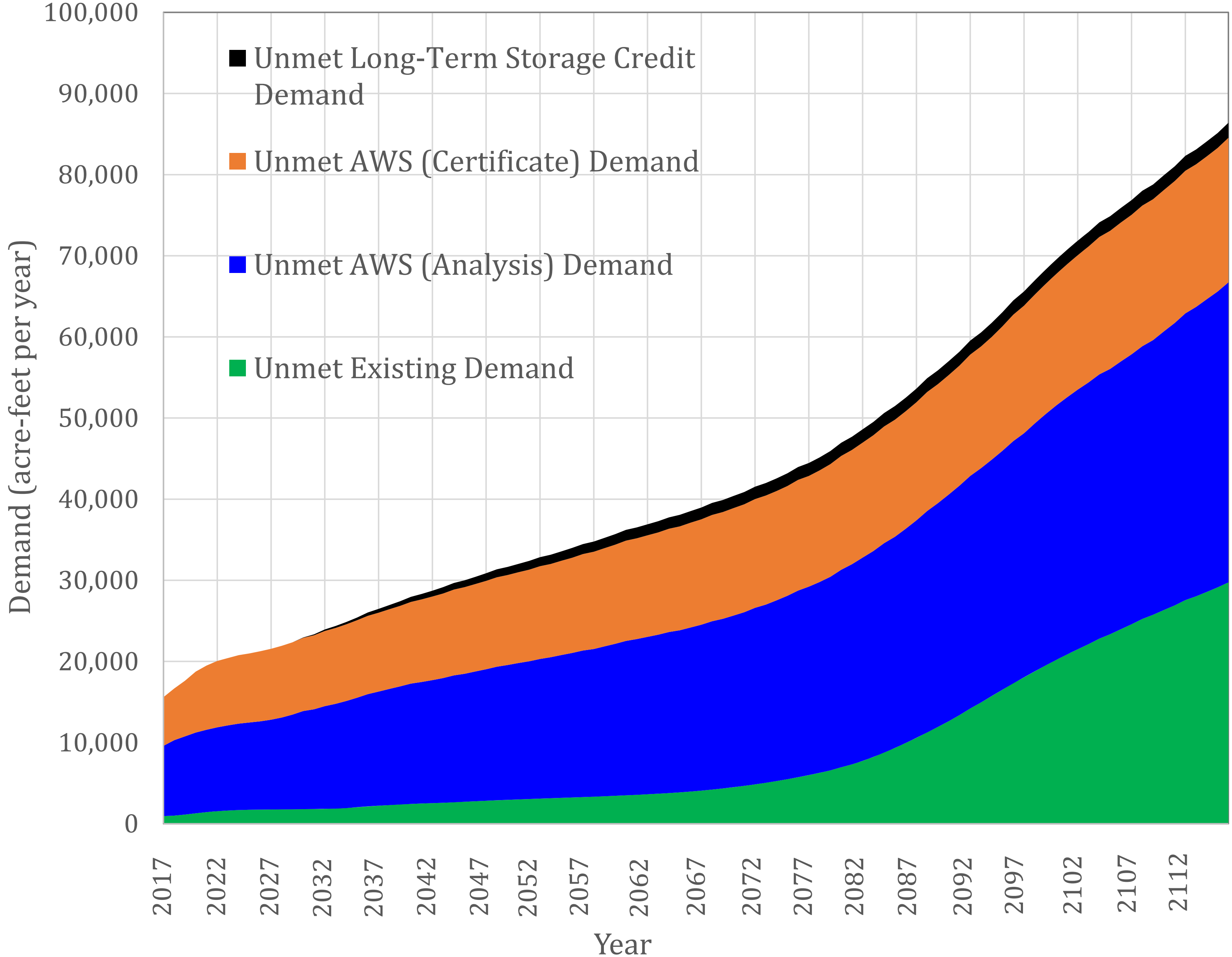


Figure 2-8
Annual Unmet Demand for Existing, AWS, and LTSC Wells

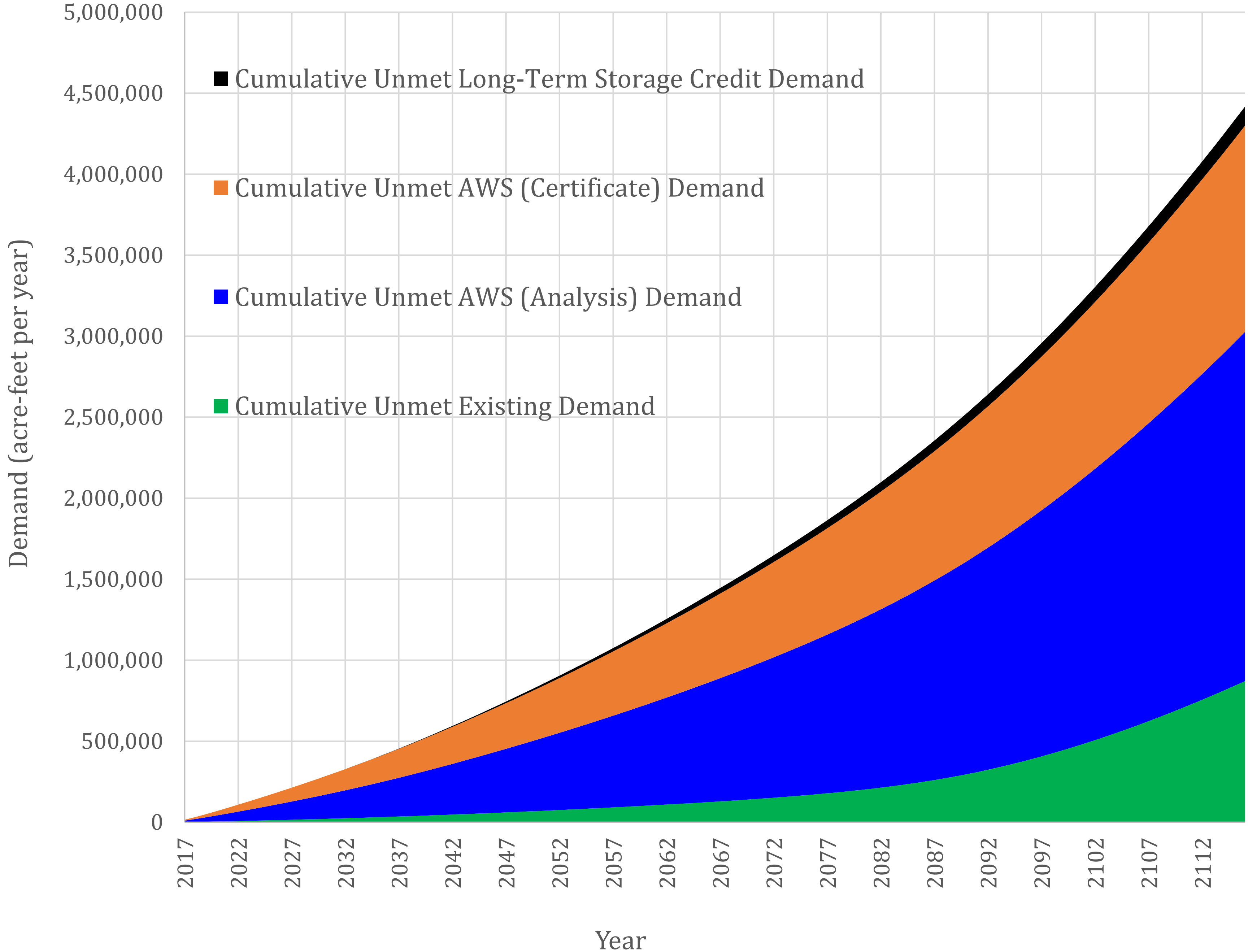
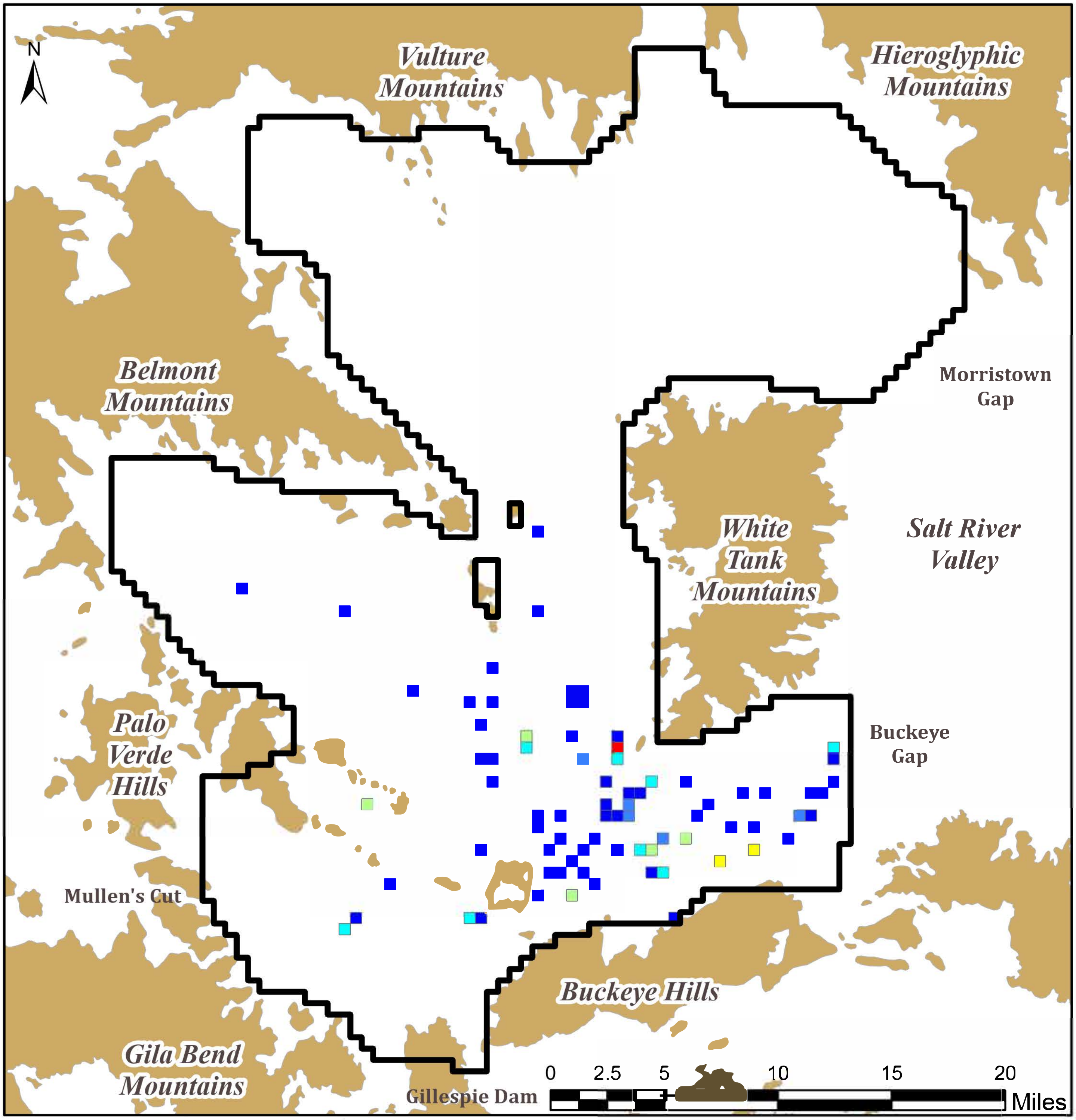


Figure 2-9
Cumulative Unmet Demand for Existing, AWS, and LTSC Wells



Active Model Domain

Bedrock Outcrops

Cumulative Unmet Demand at Existing Wells in Layer 1 (2017-2116) (acre-feet)

- Less Than 10,000
- 10,000 to 20,000
- 20,000 to 30,000
- 30,000 to 40,000
- 40,000 to 50,000
- 50,000 to 60,000
- 60,000 to 70,000

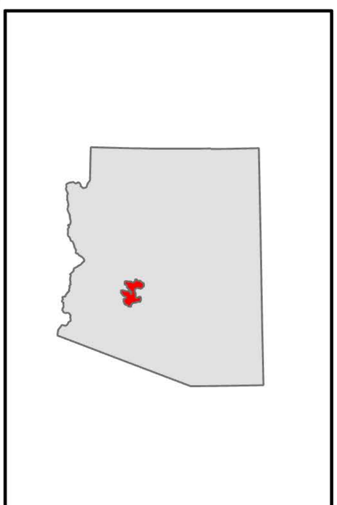
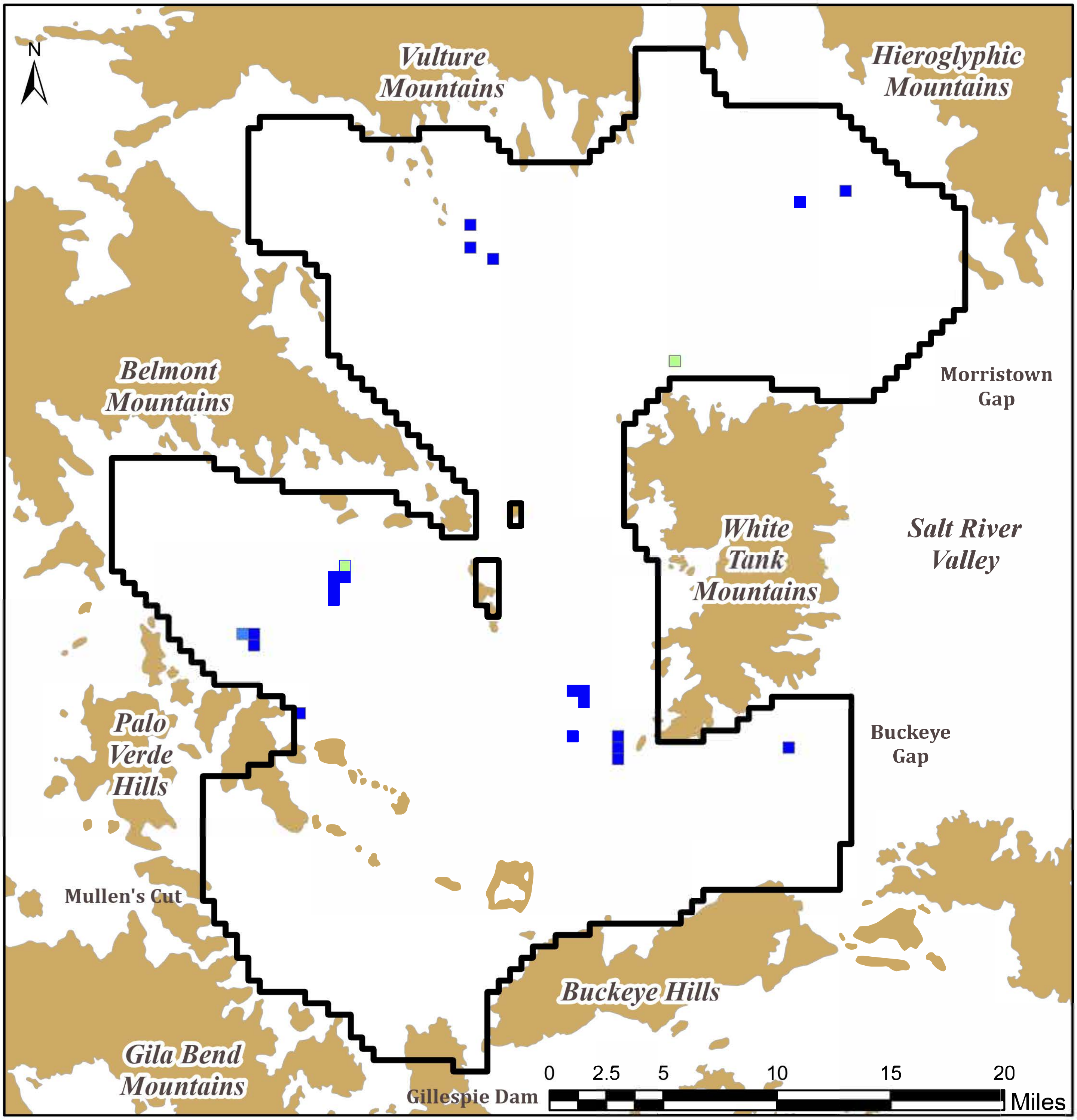


Figure 2-10

Cumulative Unmet Demand at Existing Wells in Layer 1

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain
Bedrock Outcrops

Cumulative Unmet Demand at Existing Wells in Layer 2 (2017-2116) (acre-feet)

Less Than 10,000
10,000 to 20,000
20,000 to 30,000
30,000 to 40,000

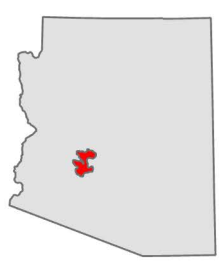
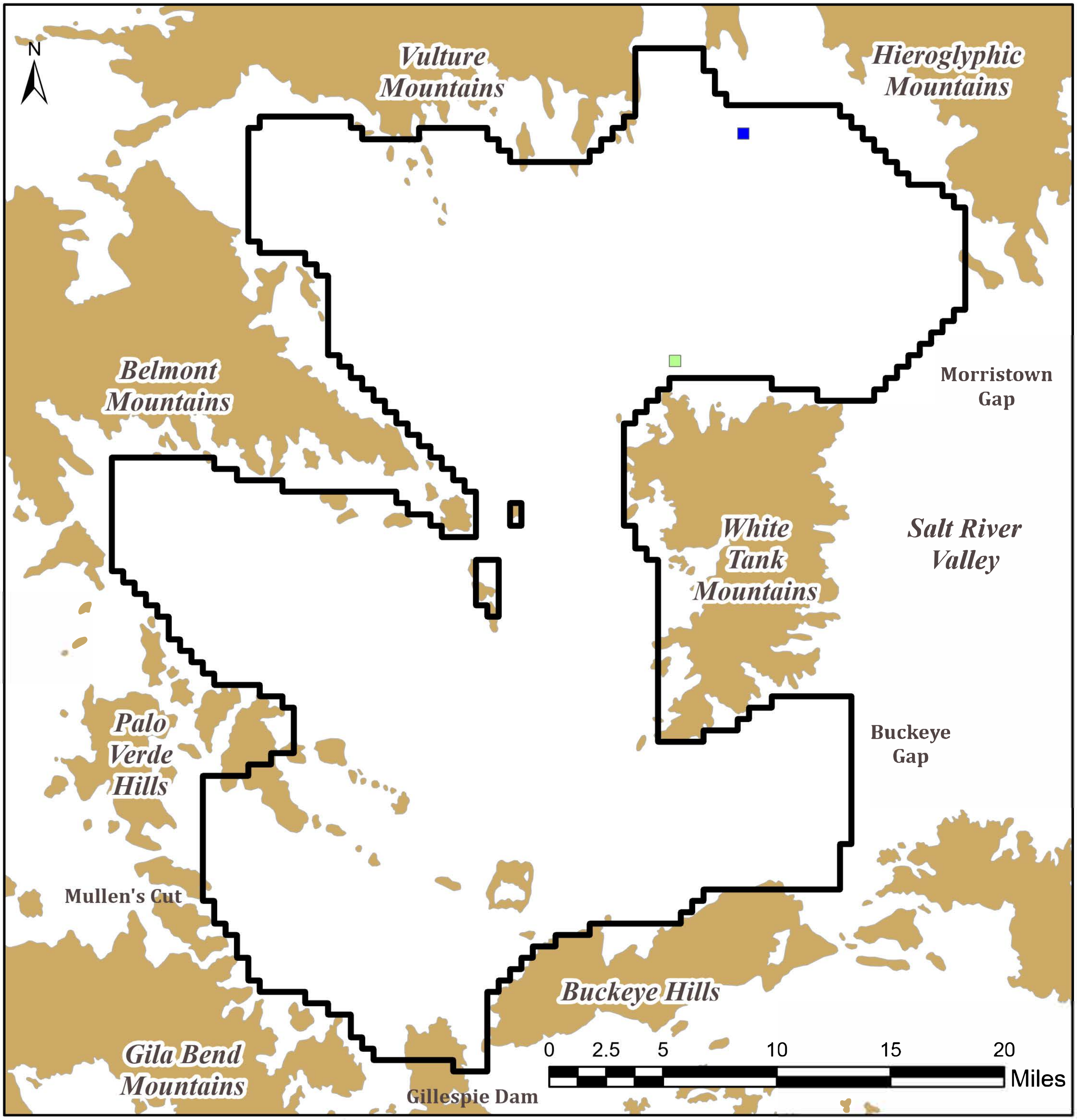


Figure 2-11

Cumulative Unmet Demand at Existing Wells in Layer 2

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain

Bedrock Outcrops

Cumulative Unmet Demand at Existing Wells in Layer 3 (2017-2116) (acre-feet)

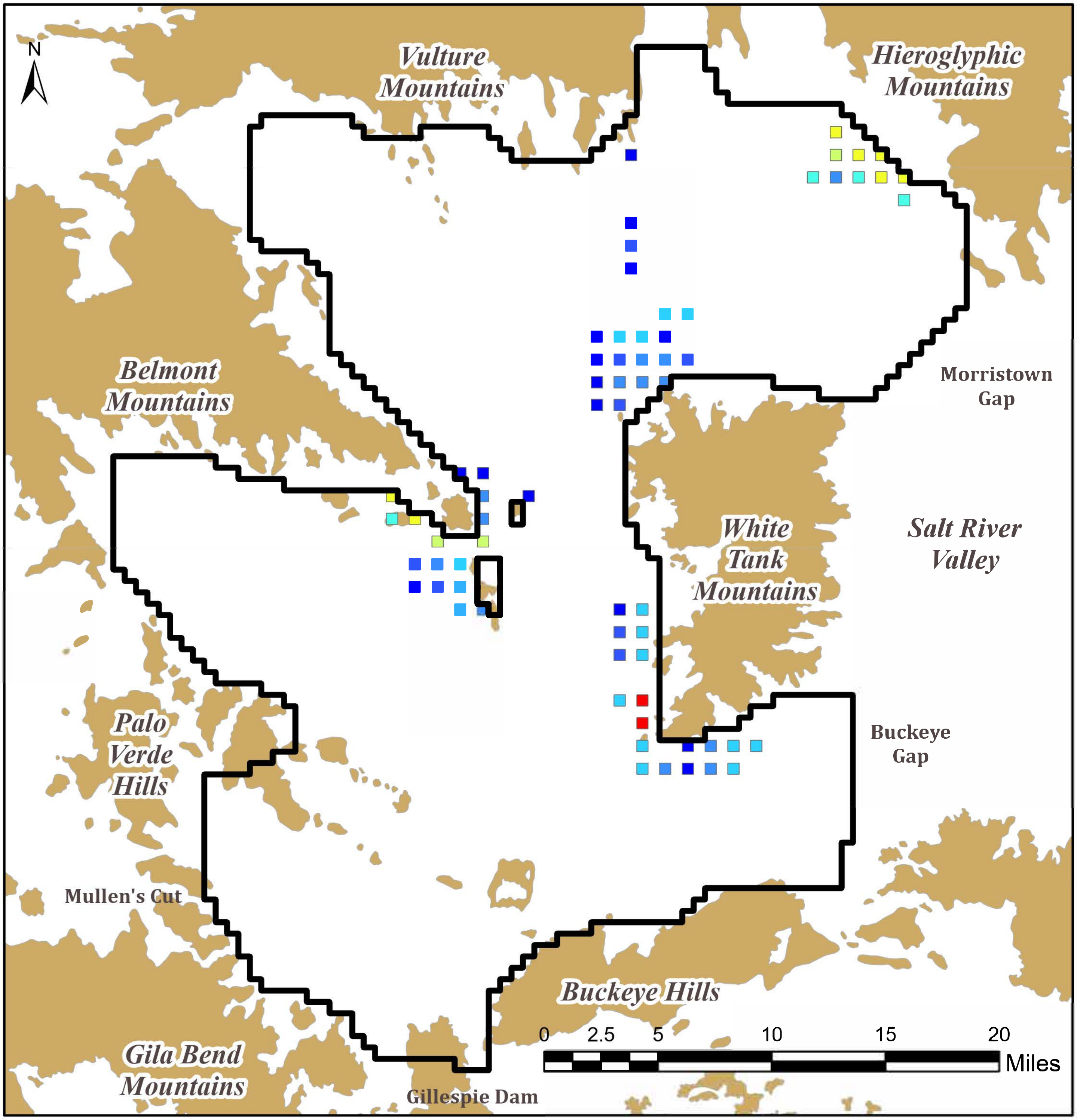
- Less Than 10,000
- 10,000 to 20,000
- 20,000 to 30,000
- 30,000 to 40,000

Figure 2-12

Cumulative Unmet Demand at Existing Wells in Layer 3

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain
Bedrock Outcrops

Cumulative Unmet Demand at Assured Water Supply (Analyses) (2017-2116) (acre-feet)

Less Than 10,000
10,000 to 20,000
20,000 to 30,000
30,000 to 40,000
40,000 to 50,000
50,000 to 60,000
60,000 to 70,000
70,000 to 80,000
80,000 to 90,000
90,000 to 100,000
100,000 to 110,000
110,000 to 120,000

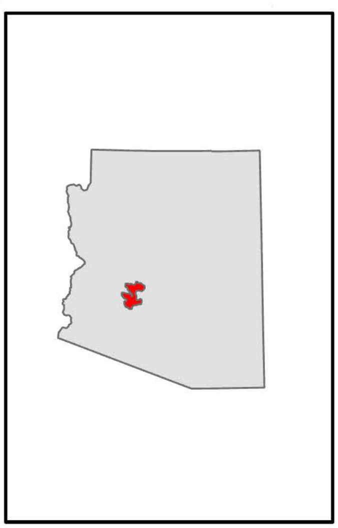
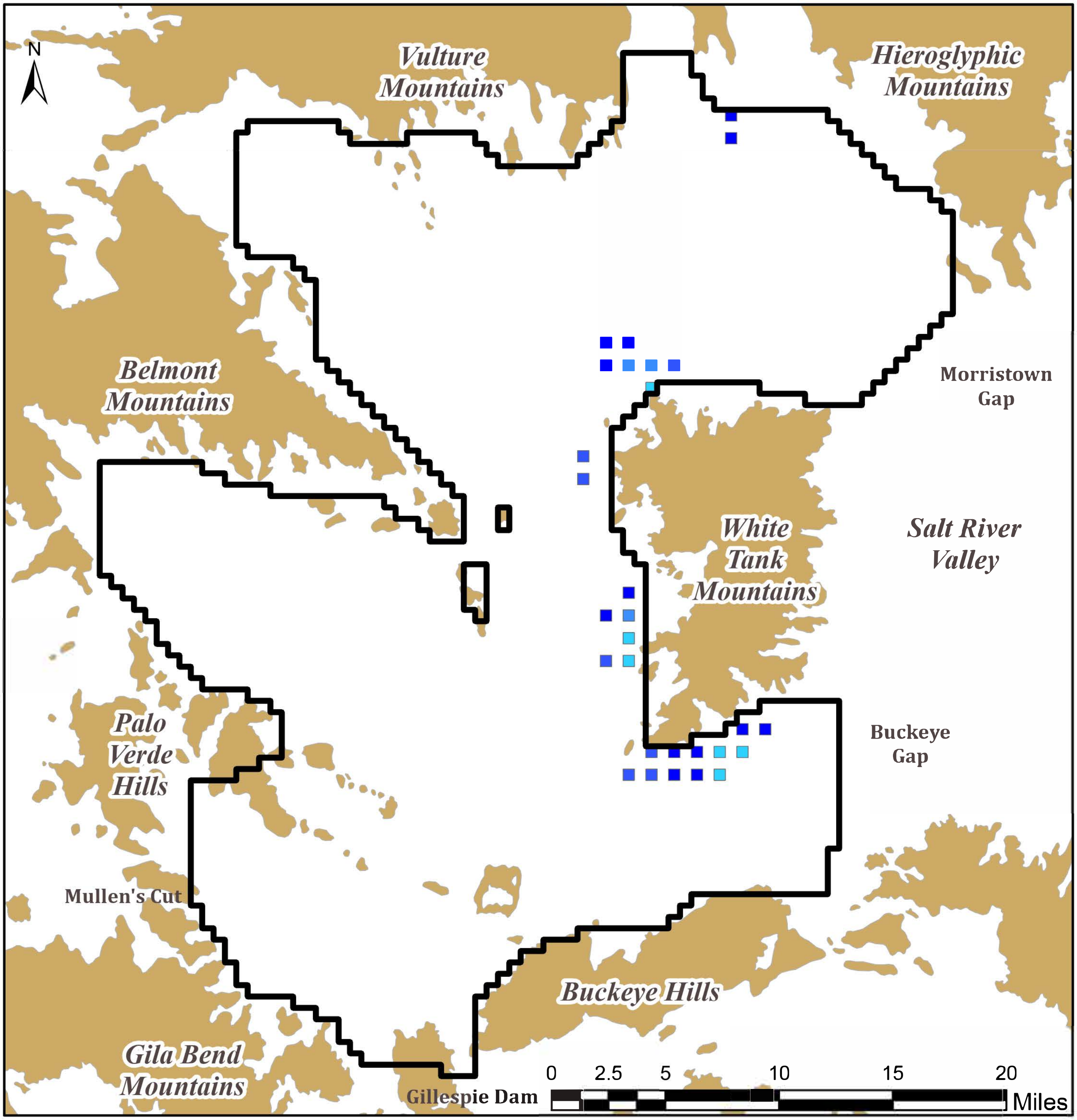


Figure 2-13

Cumulative Unmet Demand at AWS Analysis Location

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain

Bedrock Outcrops

Cumulative Unmet Demand at Assured Water Supply (Certificate) (2017-2116) (acre-feet)

- Less Than 10,000
- 10,000 to 20,000
- 20,000 to 30,000
- 30,000 to 40,000
- 40,000 to 50,000
- 50,000 to 60,000
- 60,000 to 70,000
- 70,000 to 80,000
- 80,000 to 90,000
- 90,000 to 100,000
- 100,000 to 110,000
- 110,000 to 120,000

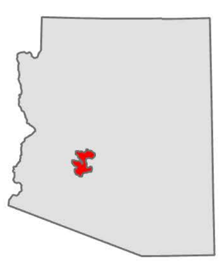
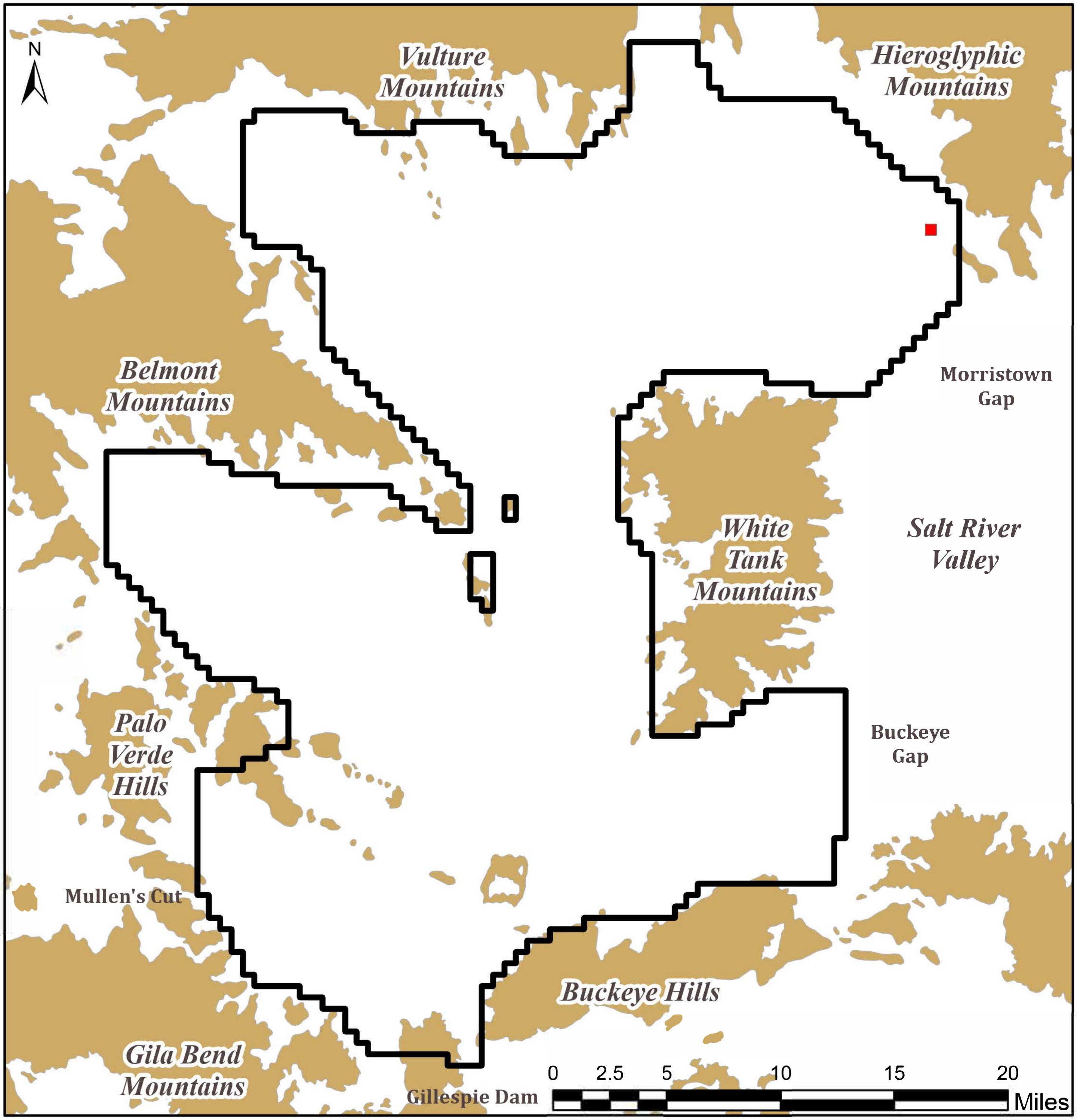


Figure 2-14

Cumulative Unmet Demand
at AWS Certification Locations

Lower Hassayampa Sub-basin
100-Year Assured Water Supply Projection

ADWR January 2023



Active Model Domain

Bedrock Outcrops

Cumulative Unmet Demand at LTSC Locations (2017-2116) (acre-feet)

- Less Than 10,000
- 10,000 to 20,000
- 20,000 to 30,000
- 30,000 to 40,000
- 40,000 to 50,000
- 50,000 to 60,000
- 60,000 to 70,000
- 70,000 to 80,000
- 80,000 to 90,000
- 90,000 to 100,000
- 100,000 to 110,000
- 110,000 to 120,000

Figure 2-15

Cumulative Unmet Demand at LTSC Locations

Lower Hassayampa Sub-basin 100-Year Assured Water Supply Projection

ADWR January 2023

Appendices

Appendix A: Summary of Assigned Pumping at Existing and Assured Water Supply Wells

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
2	20	79	2.827939E-01
3	20	79	1.974437E-01
1	68	55	1.023837E+02
2	68	55	1.409882E+00
3	68	55	2.786348E+02
3	68	56	1.260971E+02
3	68	58	7.780478E+00
2	35	64	4.103704E+02
3	35	64	4.986847E+02
3	61	56	1.507445E+02
2	72	71	3.833005E+02
3	72	71	6.064090E+02
1	73	72	1.121978E-01
3	74	72	6.775492E+02
1	75	66	4.334987E-02
2	75	66	4.794672E-06
3	75	67	8.721493E+01
2	25	68	4.384127E+01
1	72	78	6.275135E+01
2	72	78	3.983207E-02
1	74	77	4.479871E+02
2	74	77	3.401978E-01
1	73	70	2.054742E+01
2	73	70	1.033267E+02
3	73	70	1.722099E+02
2	73	51	5.909435E+00
3	73	51	1.100946E+02
1	57	52	6.049847E+00
2	68	75	2.462533E+02
2	74	57	7.384708E+00
3	74	57	6.177868E+02
3	75	65	1.905396E+01
2	31	84	1.091876E+02
3	31	84	1.152539E+01
1	76	69	6.847580E+01
3	76	69	2.766939E+00
2	74	56	4.460560E+00
3	74	56	2.257281E+02
1	69	51	6.986744E+02
2	66	78	8.710385E+01

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
3	66	78	4.219207E+02
2	34	83	1.747755E+00
3	34	83	5.027736E-02
2	34	84	6.392560E-01
1	74	58	8.625073E+00
2	74	58	8.625073E+00
3	74	58	1.652675E+01
2	31	78	6.799391E+00
2	78	48	7.068467E+01
2	77	48	2.194538E+01
2	75	56	7.562279E+00
3	75	56	2.808423E+02
1	74	37	3.518574E+02
2	74	37	1.623476E+03
3	74	37	9.930263E+01
2	35	82	2.243618E+00
3	35	82	9.093522E+01
3	49	35	1.039829E+00
1	79	68	1.285223E+03
1	72	65	4.748826E+01
3	72	65	2.273939E+01
2	85	39	1.297580E+01
2	86	39	1.681171E+01
3	85	39	5.026621E+01
3	86	39	7.061564E+01
1	55	26	7.040151E+00
3	72	55	4.023976E+02
3	76	48	4.808228E+01
2	81	56	7.294414E+02
2	60	36	4.583449E+00
3	60	36	2.807879E+01
2	26	88	2.586631E+01
2	27	88	1.344519E+01
2	60	35	1.484325E-01
3	60	35	4.635034E-03
3	69	56	5.023139E+00
1	77	74	4.410747E+03
2	32	79	2.769765E+01
2	86	49	1.575697E+03
2	87	49	1.802054E+01

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
2	26	48	4.862442E+00
3	26	48	1.210334E+01
1	73	76	6.096533E+01
2	73	76	9.488679E-02
3	73	76	7.604548E+01
1	65	46	2.235611E+00
2	65	46	1.718743E+00
3	65	46	2.471720E+01
1	81	57	2.249763E+03
3	77	68	2.197647E-01
2	23	46	4.392262E-01
3	23	46	8.811345E-01
1	65	56	4.899118E+01
2	65	56	2.084639E+00
3	65	56	2.489666E+00
2	69	77	2.589968E+01
3	69	77	9.093462E+01
2	74	76	9.706577E+00
3	74	76	1.461407E+01
2	25	46	4.502255E+00
3	25	46	8.297472E+00
1	62	48	3.958522E+00
2	28	79	1.639732E+01
1	70	47	8.002024E-01
1	73	77	2.996116E+02
2	78	49	3.304729E+02
1	72	58	1.441969E+02
2	72	58	2.324251E+00
3	72	58	6.069499E+02
2	26	75	3.020797E+00
2	70	76	1.121855E+02
3	70	76	6.283577E+01
2	21	75	3.968196E+01
3	20	75	2.604024E+01
3	21	75	4.005785E+01
3	72	56	2.405309E+02
3	81	33	1.443548E+03
3	80	33	4.399673E-01
2	82	31	2.818432E+01
3	82	31	7.615124E+02

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
3	83	30	1.053909E+03
3	84	30	6.268780E+02
3	84	31	7.555153E+02
2	81	30	6.517436E+01
2	81	31	3.604758E+01
3	81	30	7.900065E+01
3	81	31	6.220399E+02
2	69	76	1.472459E+02
3	69	76	2.981137E+02
2	69	75	5.025932E+02
2	82	38	1.803439E-01
3	82	38	8.797517E-01
2	25	67	3.937907E+01
2	76	68	1.985878E+01
2	29	88	4.870261E+02
2	30	89	1.490440E+01
2	25	72	3.671683E+01
2	73	71	3.980326E+01
3	73	71	4.409163E+02
2	68	77	3.214443E+02
3	68	77	3.027208E+02
3	60	57	4.088982E+02
3	64	51	1.988031E+01
1	68	51	9.878761E+02
2	68	51	1.010713E+00
2	54	35	1.738776E+02
3	54	35	9.017893E+01
3	59	21	1.079804E+00
1	70	56	6.022839E+02
2	71	55	1.010018E+02
2	72	60	3.200061E+02
1	73	60	3.547229E+01
2	73	60	1.486290E-01
1	84	46	1.897112E+03
1	84	47	7.420966E+01
2	84	46	1.305841E+01
2	84	47	2.218684E+02
3	78	58	1.727484E+02
3	27	87	3.539997E+01
2	78	64	3.999984E+00

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
1	69	78	3.906839E+02
2	69	78	4.250582E-01
1	72	62	3.282635E+02
2	72	62	2.842024E+00
3	72	62	8.547124E-01
1	70	78	4.844243E+01
2	70	78	9.899057E+00
3	70	78	3.943929E+00
2	75	63	1.958801E+02
3	75	63	2.297882E+02
1	75	60	7.369201E+02
2	75	60	2.646575E+01
3	75	60	2.218940E+02
1	74	60	5.171544E+02
1	75	58	2.626026E+02
2	75	58	5.002421E+01
3	75	58	3.148835E+02
1	64	56	7.133604E-01
2	64	56	6.312980E+00
3	64	56	2.824498E+02
1	75	54	5.138211E+02
2	74	54	1.837230E-03
2	75	54	8.605088E+00
3	74	54	9.469774E-02
3	75	54	9.028698E+01
2	71	37	1.799925E+00
2	79	58	7.353980E+02
2	80	37	2.799083E+00
2	80	38	1.309748E+01
3	80	38	1.072101E+02
1	80	61	8.524740E+02
1	73	61	3.239219E+01
2	73	61	7.256687E-02
2	59	36	5.933376E+00
3	59	36	4.607847E+00
2	60	27	1.042151E+03
3	60	27	2.719618E+02
1	84	36	2.029414E+02
2	84	36	6.786303E+01
3	84	36	8.583084E+02

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
1	85	35	9.847738E+02
2	85	35	4.138856E+02
1	50	52	1.108835E+01
2	80	52	1.432822E+02
1	82	52	9.715912E+01
1	80	53	3.557538E+02
2	80	53	6.342627E-01
1	80	54	1.816102E+02
1	75	59	1.053468E+02
2	75	59	7.091979E-01
1	68	59	4.964315E+01
2	68	59	7.531696E-01
3	68	59	5.612500E+02
1	69	59	6.639952E+02
2	69	59	1.081363E+02
3	69	59	1.210268E+03
1	70	59	2.751164E+02
2	70	59	6.446938E+00
3	70	59	2.172885E+02
1	65	48	1.272078E+02
3	64	28	2.102925E+03
2	63	28	6.978984E+01
3	63	28	5.178356E+02
3	16	77	4.558278E+00
1	78	71	3.337676E+03
1	57	35	8.990421E-01
2	57	35	2.191078E+01
3	57	35	1.310434E+00
2	58	32	3.397801E+01
3	58	32	1.629439E+02
2	58	33	3.589185E+01
3	58	33	2.912709E+02
1	67	47	9.176377E+00
2	53	35	5.882071E+02
3	53	35	9.991854E+01
2	54	34	6.931478E+01
3	54	34	4.748603E+02
2	55	34	1.607223E+02
3	55	34	1.161098E+03
2	56	34	2.255605E+02

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
3	56	34	7.329305E+01
2	69	74	6.060760E+01
3	69	74	1.800223E+00
2	31	85	1.161347E+00
2	92	44	9.805778E+02
3	92	44	6.841198E+01
2	28	77	6.773382E+01
2	27	79	5.391719E+01
2	27	77	1.440603E+00
3	60	28	2.640886E+00
1	75	76	3.044321E+03
1	75	75	2.158993E+03
2	75	75	7.656224E+01
1	79	55	6.741169E+02
2	79	55	1.986053E+00
1	78	53	1.044873E+02
2	78	53	2.623195E-01
1	77	77	1.724765E+03
2	77	77	1.499871E+02
3	77	77	6.393050E+01
1	78	76	5.722220E+02
1	77	65	1.245285E+03
2	77	65	7.890256E-01
1	77	63	1.699381E+03
2	77	63	6.602386E-01
1	78	62	2.399779E+03
1	78	61	2.545355E+03
2	78	61	9.751302E+00
1	78	59	1.977984E+02
2	78	59	1.894916E+01
3	78	59	2.065199E+02
1	78	56	1.356478E+03
1	80	60	3.275101E+03
2	80	60	3.616028E+01
3	80	60	7.205901E+00
1	80	58	1.365778E+02
1	80	56	2.920253E+02
2	80	56	2.113750E-01
1	80	63	3.473589E+03
1	80	62	4.066161E+03

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
2	80	63	2.927493E-01
1	82	55	1.984050E+03
1	75	52	1.512844E+02
2	75	52	5.876159E+00
1	76	52	8.479659E+01
2	76	52	1.845732E+02
2	73	57	1.395422E+02
2	71	56	4.538434E+02
2	79	28	5.578860E-02
3	79	28	5.623769E+00
3	70	55	3.314399E+02
2	71	53	1.465286E-01
3	70	54	4.827674E+02
1	81	39	1.586969E+01
2	81	39	7.217408E+01
3	81	39	1.566991E+02
2	82	39	2.530698E-01
3	82	39	5.721316E+00
1	77	57	4.008655E+02
2	77	57	5.106799E+01
3	77	57	3.035036E+02
3	73	65	1.120474E+00
3	15	70	4.825274E+01
2	24	79	5.199374E+00
1	74	67	9.999793E-01
2	66	31	5.182959E-02
3	66	31	3.547494E+00
2	91	46	1.122421E+02
3	91	46	1.212563E+01
2	84	62	6.863591E+01
2	84	60	1.308057E+02
2	84	59	1.551994E+01
1	84	64	2.689116E+00
2	84	64	1.971045E+01
3	53	32	1.007714E+03
3	53	33	8.573629E+02
3	53	34	8.582596E+02
2	86	44	2.277794E+03
1	89	44	6.575892E+02
2	89	44	6.007978E+03

Table A1 Assigned pumping at existing wells.

Layer	Row	Column	Rate (acre-feet per year)
3	89	44	2.676479E+02
2	88	44	2.068701E+03
3	88	44	1.302995E+03
2	77	47	3.186651E+03
2	84	50	2.612070E+03
3	84	50	4.168680E+03
3	83	53	9.063710E+02
1	76	71	1.648037E+01
2	59	27	4.435611E+00
1	77	54	6.618852E+01
1	70	48	6.000566E+00
1	72	48	1.183973E+01
3	60	29	1.381927E+01
3	77	69	1.616368E+01
3	78	78	3.622591E+00
1	64	55	6.177503E-01
1	65	55	3.523216E+00
2	64	55	7.448920E+00
2	65	55	4.015382E-02
3	64	55	1.544610E+02
3	65	55	1.444906E+00
2	59	26	4.532740E+02
3	59	26	2.355910E+02
1	78	47	5.731897E+00
2	78	47	5.460395E+01
2	62	32	2.732211E-02
2	62	33	2.774184E-01
3	62	32	2.173180E-01
3	62	33	1.699393E+00
3	63	32	6.959896E-01
2	69	41	2.220091E+01
3	69	41	1.906041E+01
1	64	41	1.024020E+00
2	64	41	7.428272E+00
3	64	41	2.663631E+00
2	82	33	9.801824E-01
3	82	33	1.619489E+02
Total			**122,957**

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
Analyses					
42-400513.0002_A	992.66	584	71	65	2.815069E+02
42-400513.0002_B	1054.6	789	69	67	2.815069E+02
42-400513.0002_C	1008.9	591	71	63	2.815069E+02
42-400513.0002_D	1047.2	593	69	65	2.815069E+02
42-400513.0002_E	998.29	705	71	67	2.815069E+02
42-400903.0002_A	1329.1	896	47	39	7.407378E+02
42-400903.0002_AA	1204	204	55	41	7.407378E+02
42-400903.0002_B	1097	0	63	43	7.407378E+02
42-400903.0002_C	1243.7	700	53	43	7.407378E+02
42-400903.0002_D	1593.2	546	49	39	7.407378E+02
42-400903.0002_E	1141.7	150	59	43	7.407378E+02
42-400903.0002_F	1264.5	850	51	43	7.407378E+02
42-400903.0002_G	1312.4	890	49	41	7.407378E+02
42-400903.0002_H	1212.5	684	55	45	7.407378E+02
42-400903.0002_I	1279.6	891	49	47	7.407378E+02
42-400903.0002_J	1305.4	919	47	47	7.407378E+02
42-400903.0002_K	1114.4	200	61	43	7.407378E+02
42-400903.0002_L	1179.9	395	57	43	7.407378E+02
42-400903.0002_M	1246.5	976	51	47	7.407378E+02
42-400903.0002_N	1183.1	354	55	49	7.407378E+02
42-400903.0002_O	1206.3	404	53	49	7.407378E+02
42-400903.0002_P	1194.2	-1415	55	39	7.407378E+02
42-400903.0002_Q	1175.5	-343	57	41	7.407378E+02
42-400903.0002_R	1239	463	53	41	7.407378E+02
42-400903.0002_S	1206.7	650	55	43	7.407378E+02
42-400903.0002_T	1127.3	325	61	45	7.407378E+02
42-400903.0002_U	1363.7	721	45	45	7.407378E+02
42-400903.0002_V	1263.1	404	51	49	7.407378E+02
42-400903.0002_W	1259.4	-239	51	39	7.407378E+02
42-400903.0002_X	1150.9	-498	59	41	7.407378E+02
42-400903.0002_Y	1235.5	727	53	45	7.407378E+02
42-400903.0002_Z	1164.6	-1809	57	39	7.407378E+02
42-400947.0002_A	1223.8	-157	55	53	1.182307E+03
42-400947.0002_B	1113.5	-846	63	51	1.182307E+03

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
42-400947.0002_C	1241.2	195	59	57	1.182307E+03
42-400947.0002_D	1173.1	-289	61	55	1.182307E+03
42-400947.0002_E	1102.4	789	67	61	1.182307E+03
42-400947.0002_F	1141.5	-140	57	51	1.182307E+03
42-400947.0002_G	1143.2	-497	61	53	1.182307E+03
42-400947.0002_H	1200.6	-195	57	53	1.182307E+03
42-400947.0002_I	1169.5	-335	59	53	1.182307E+03
42-400947.0002_J	1131.3	-185	63	55	1.182307E+03
42-400947.0002_K	1205.3	-94	59	55	1.182307E+03
42-400947.0002_L	1158.1	-76	55	51	1.182307E+03
42-400947.0002_M	1202.3	180	61	57	1.182307E+03
42-400947.0002_N	1133.6	625	65	59	1.182307E+03
42-400947.0002_O	1152.9	800	65	61	1.182307E+03
42-401037.0002_A	1397.6	-293	43	45	8.449256E+02
42-401037.0002_AA	1454.5	-444	35	53	8.449256E+02
42-401037.0002_AB	1580.2	-14	31	53	8.449256E+02
42-401037.0002_B	1345.5	721	45	47	8.449256E+02
42-401037.0002_C	1342.4	276	45	49	8.449256E+02
42-401037.0002_D	1530.3	-744	33	51	8.449256E+02
42-401037.0002_E	1479.7	-1329	37	49	8.449256E+02
42-401037.0002_F	1399.1	-239	41	51	8.449256E+02
42-401037.0002_G	1492	-1499	35	47	8.449256E+02
42-401037.0002_H	1426.5	-1125	39	49	8.449256E+02
42-401037.0002_I	1447.8	313	33	55	8.449256E+02
42-401037.0002_J	1461.9	-1526	37	47	8.449256E+02
42-401037.0002_K	1237.5	705	47	51	8.449256E+02
42-401037.0002_L	1405.1	-502	37	53	8.449256E+02
42-401037.0002_M	1620	106	29	53	8.449256E+02
42-401037.0002_N	1501.6	-864	35	51	8.449256E+02
42-401037.0002_O	1520.1	336	31	55	8.449256E+02
42-401037.0002_P	1406.1	-809	41	49	8.449256E+02
42-401037.0002_Q	1330.1	106	43	51	8.449256E+02
42-401037.0002_R	1538.6	-291	33	53	8.449256E+02
42-401037.0002_S	1410	-1259	41	47	8.449256E+02
42-401037.0002_T	1362	-76	43	49	8.449256E+02

Table A2 **Assigned pumping at Assured Water Supply wells.**

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
42-401037.0002_U	1501.5	-1374	35	49	8.449256E+02
42-401037.0002_V	1530.5	-1233	33	49	8.449256E+02
42-401037.0002_W	1283.7	342	45	51	8.449256E+02
42-401037.0002_X	1475	-719	37	51	8.449256E+02
42-401037.0002_Y	1382.2	-163	43	47	8.449256E+02
42-401037.0002_Z	1444.1	-672	39	51	8.449256E+02
42-401061.0002_A	1503.1	1100	37	59	2.837123E+02
42-401061.0002_B	1532.6	1231	37	61	2.837123E+02
42-401061.0002_C	1586.4	1349	37	63	2.837123E+02
42-401061.0002_D	1503.7	847	37	57	2.837123E+02
42-401061.0002_E	1603.7	556	35	65	2.837123E+02
42-401061.0002_F	1453.8	841	35	57	2.837123E+02
42-401061.0002_G	1563.1	800	35	63	2.837123E+02
42-401061.0002_H	1466.3	863	39	57	2.837123E+02
42-401061.0002_I	1503.7	1063	39	59	2.837123E+02
42-401061.0002_J	1538.6	1050	35	59	2.837123E+02
42-401061.0002_K	1537.7	1010	35	61	2.837123E+02
42-401061.0002_L	1580.9	24	33	65	2.837123E+02
42-401120.0002_A	1143.2	-497	61	53	4.400783E+02
42-401120.0002_B	1223.8	-157	55	53	4.400783E+02
42-401120.0002_C	1205.3	-94	59	55	4.400783E+02
42-401120.0002_D	1113.5	-846	63	51	4.400783E+02
42-401120.0002_E	1169.5	-335	59	53	4.400783E+02
42-401120.0002_F	1131.3	-185	63	55	4.400783E+02
42-401120.0002_G	1173.1	-289	61	55	4.400783E+02
42-401120.0002_H	1241.2	195	59	57	4.400783E+02
42-401120.0002_I	1102.4	789	67	61	4.400783E+02
42-401120.0002_J	1152.9	800	65	61	4.400783E+02
42-401120.0002_K	1202.3	180	61	57	4.400783E+02
42-401120.0002_L	1200.6	-195	57	53	4.400783E+02
42-401120.0002_M	1158.1	-76	55	51	4.400783E+02
42-401120.0002_N	1141.5	-140	57	51	4.400783E+02
42-401120.0002_O	1133.6	625	65	59	4.400783E+02
42-401222.0001_A	1239.6	-19	57	55	3.706886E+02
42-401222.0001_B	1281.2	121	57	57	3.706886E+02

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
42-401222.0001_C	1285.7	775	59	59	3.706886E+02
42-401222.0001_D	1281.7	962	61	61	3.706886E+02
42-401222.0001_E	1403.8	950	57	61	3.706886E+02
42-401222.0001_F	1240.5	710	61	59	3.706886E+02
42-401222.0001_G	1333.6	650	57	59	3.706886E+02
42-401222.0001_H	1343	1000	59	61	3.706886E+02
42-401346.0001_A	1103.1	-1908	62	35	7.232784E+02
42-401346.0001_B	1021.4	-663	66	31	7.232784E+02
42-401346.0001_C	1065.2	-1932	62	31	7.232784E+02
42-401346.0001_D	1071.3	-1915	62	33	7.232784E+02
42-401346.0001_E	1109.4	-1886	60	35	7.232784E+02
42-401346.0001_F	1043.1	-1956	64	31	7.232784E+02
42-401346.0001_G	1092.5	-1893	60	33	7.232784E+02
42-401346.0001_H	1131.2	-1858	58	35	7.232784E+02
42-401585.0001_A	1181.8	674	57	45	9.354960E+02
42-401585.0001_B	1162.7	674	57	47	9.354960E+02
42-401585.0001_C	1161.1	311	57	49	9.354960E+02
42-401585.0001_D	1109.8	-86	59	49	9.354960E+02
42-401647.0002_A	1799.9	1347	17	80	7.199972E+02
42-401647.0002_B	1725.1	824	19	80	7.199972E+02
42-401647.0002_C	1802.8	1361	17	82	7.199972E+02
42-401647.0002_D	1742.1	751	19	76	7.199972E+02
42-401647.0002_E	1733.4	605	19	78	7.199972E+02
42-401647.0002_F	1793.6	920	17	78	7.199972E+02
42-401647.0002_G	1642.5	1050	21	84	7.199972E+02
42-401647.0002_H	1721.9	1108	19	82	7.199972E+02
42-401647.0002_I	1872.7	1507	15	78	7.199972E+02
42-401647.0002_J	1714	1420	19	84	7.199972E+02
42-401738.0001_A	999.67	503	71	59	4.088884E+02
42-401738.0001_B	1016.9	669	71	61	4.088884E+02
42-401738.0001_C	1061.2	768	69	61	4.088884E+02
42-401796.0001_A	998.45	761	71	69	3.261687E+02
42-401796.0001_B	1053.5	810	69	69	3.261687E+02
42-401796.0001_C	998.29	705	71	67	3.261687E+02
42-401796.0001_D	992.3	285	71	71	3.261687E+02

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
42-401796.0001_E	1041	773	69	71	3.261687E+02
42-401866.0001_A	978.84	385	71	51	6.619363E+02
42-401866.0001_B	948.4	126	73	53	6.619363E+02
42-401866.0001_C	1173.1	-289	61	55	6.619363E+02
42-401866.0001_D	990.2	257	71	53	6.619363E+02
42-401866.0001_E	1131.3	-185	63	55	6.619363E+02
42-401866.0001_F	1239.6	-19	57	55	6.619363E+02
42-401866.0001_G	917.48	-537	75	53	6.619363E+02
42-401866.0001_H	1020.7	475	69	53	6.619363E+02
42-401866.0001_I	1043.2	16	67	53	6.619363E+02
42-401970.0001_A	890.17	73	75	73	2.372740E+02
42-401970.0001_B	933.39	-64	73	73	2.372740E+02
42-402022.0002_A	1526.4	669	31	59	5.667723E+02
42-402022.0002_B	1626.8	805	27	60	5.667723E+02
42-402022.0002_C	1574.7	971	33	61	5.667723E+02
42-402022.0002_D	1661.8	656	19	60	5.667723E+02
42-402022.0002_E	1453.8	841	35	57	5.667723E+02
42-402022.0002_F	1460.9	569	31	57	5.667723E+02
42-402022.0002_G	1537.7	1010	35	61	5.667723E+02
42-402022.0002_H	1429.8	776	33	57	5.667723E+02
42-402022.0002_I	1538.6	1050	35	59	5.667723E+02
42-402022.0002_J	1585.4	475	29	59	5.667723E+02
42-402022.0002_K	1667.4	886	25	60	5.667723E+02
42-402022.0002_L	1703.1	765	23	60	5.667723E+02
42-402022.0002_M	1549.6	330	27	58	5.667723E+02
42-402022.0002_N	1581.4	982	33	59	5.667723E+02
42-402022.0002_O	1561.7	262	25	58	5.667723E+02
42-402022.0002_P	1597.2	580	31	61	5.667723E+02
42-402022.0002_Q	1643.4	593	21	60	5.667723E+02
42-402022.0002_R	1686.9	827	17	60	5.667723E+02
42-402022.0002_S	1579.1	-19	33	63	5.667723E+02
42-402022.0002_T	1580.9	24	33	65	5.667723E+02
42-402023.0002_A	1597.2	580	31	61	1.588161E+03
42-402023.0002_B	1574.7	971	33	61	1.588161E+03
42-402023.0002_C	1599.1	60	31	63	1.588161E+03

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
42-402023.0002_D	1579.1	-19	33	63	1.588161E+03
42-402023.0002_E	1603.3	272	31	65	1.588161E+03
42-402023.0002_F	1580.9	24	33	65	1.588161E+03
42-402052.0001	1101.8	-1883	60	29	8.283967E+01
42-402079.0001	1109.4	-1886	60	35	7.559975E+01
Subtotal of Analyses					**122,812**
Certificates					
27-200008.0000_A	1352.9	-1661	50	23	4.650482E+01
27-200008.0000_B	1304.1	-1724	50	27	4.650482E+01
27-200008.0000_C	1282.8	-1745	50	29	4.650482E+01
27-200008.0000_D	1330.6	-1675	50	25	4.650482E+01
27-200055.0000	1889.4	1267	15	70	2.800009E+00
27-200104.0000	951.5	-413	73	47	2.605694E+00
27-200211.0000	998.29	705	71	67	2.259992E+01
27-200227.0000_A	1066.6	-281	65	43	1.294657E+02
27-200227.0000_B	1028	-600	67	43	1.294657E+02
27-200227.0000_C	1037	300	65	47	1.294657E+02
27-200367.0000_A	800	395	96	46	1.745397E+01
27-200367.0000_B	753	325	95	46	1.745397E+01
27-200395.0000_A	1211	-1813	54	27	5.547229E+00
27-200395.0000_B	1235	-1769	54	25	5.547229E+00
27-200395.0000_C	1181.6	-1847	56	27	5.547229E+00
27-200396.0000	1087.2	10	65	55	3.870542E+01
27-200401.0000_A	1684	-64	23	56	7.749966E-01
27-200401.0000_B	1709	72	21	56	7.749966E-01
27-200401.0000_C	1802	541	19	56	7.749966E-01
27-200401.0000_D	1641	44	25	56	7.749966E-01
27-200401.0000_E	1682	-410	25	54	7.749966E-01
27-200401.0000_F	1762	268	21	54	7.749966E-01
27-200401.0000_G	1715	-488	23	54	7.749966E-01
27-200401.0000_H	1642	-125	27	54	7.749966E-01
27-200402.0000_A	1641	44	25	56	1.937533E+00
27-200402.0000_B	1684	-64	23	56	1.937533E+00
27-200402.0000_C	1709	72	21	56	1.937533E+00

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-200402.0000_D	1802	541	19	56	1.937533E+00
27-200403.0000_A	1762	268	21	54	4.339612E-01
27-200403.0000_B	1709	72	21	56	4.339612E-01
27-200403.0000_C	1752	910	23	62	4.339612E-01
27-200403.0000_D	1642	-125	27	54	4.339612E-01
27-200403.0000_E	1684	-64	23	56	4.339612E-01
27-200404.0000_A	1642.4	-125	27	54	1.214572E+00
27-200404.0000_B	1682.7	-410	25	54	1.214572E+00
27-200404.0000_C	1804.7	878	17	58	1.214572E+00
27-200404.0000_D	1820.5	911	19	54	1.214572E+00
27-300015.0000	1422.4	-294	31	84	1.422796E+01
27-300150.0000_A	1030	275	67	47	2.727529E+00
27-300150.0000_B	1021.8	-265	69	45	2.727529E+00
27-300150.0000_C	1041.4	150	67	45	2.727529E+00
27-300150.0000_D	1012	120	69	47	2.727529E+00
27-300223.0000	1593.2	-1424	25	76	5.420979E+01
27-300290.0000	1011.7	-421	69	41	3.892981E+01
27-400265.0000	904.34	89	75	69	3.962295E+01
27-400374.0000	907.22	67	75	67	1.336995E+02
27-400421.0000_A	907.22	67	75	67	9.697965E+01
27-400421.0000_B	904.34	89	75	69	9.697965E+01
27-400423.0000	949.28	230	73	69	1.733163E+02
27-400465.0000	872.61	157	77	67	1.705009E+02
27-400570.0000	1026.7	45	69	75	1.255069E+01
27-400585.0000	1037.4	279	69	73	4.348444E+01
27-400586.0000	1105.8	550	67	73	1.928702E+01
27-400588.0000	1105.8	550	67	73	2.803688E+01
27-400589.0000	1105.8	550	67	73	3.085121E+01
27-400590.0000	1105.8	550	67	73	2.127357E+01
27-400591.0000	1665.9	-918	25	68	2.711208E+02
27-400602.0000_A	1037.4	279	69	73	1.233450E+01
27-400602.0000_B	1110	762	67	71	1.233450E+01
27-400688.0000	872.61	157	77	67	1.046065E+02
27-400719.0000	1084.6	237	67	75	3.414702E+01
27-400720.0000	1084.6	237	67	75	2.003260E+01

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-400721.0000	1084.6	237	67	75	1.410646E+01
27-400733.0000	1624.1	-1051	25	72	2.614344E+02
27-400742.0000	1110	762	67	71	7.242409E+01
27-400747.0000	1105.8	550	67	73	3.591345E+01
27-400749.0000	1105.8	550	67	73	3.213986E+01
27-400750.0000	1105.8	550	67	73	5.762712E+02
27-400752.0000	998.45	761	71	69	3.331253E+02
27-400806.0000	1037.4	279	69	73	8.222404E+01
27-400855.0000	1084.6	237	67	75	5.824180E+01
27-400856.0000	1084.6	237	67	75	4.468233E+00
27-400864.0000	944.63	82	73	71	1.447515E+02
27-400867.0000	1665.9	-918	25	68	8.081315E+01
27-400874.0000	944.63	82	73	71	2.467160E+02
27-400893.0000	1084.6	237	67	75	2.038570E+01
27-400894.0000	1084.6	237	67	75	4.388237E+01
27-400895.0000	1084.6	237	67	75	4.412788E+01
27-400916.0000	1026.7	45	69	75	2.462686E+01
27-400917.0000	1026.7	45	69	75	4.120981E+01
27-400923.0001	949.28	230	73	69	5.415507E+01
27-400940.0000	1665.9	-918	25	68	1.345230E+02
27-400942.0000	1037.4	279	69	73	2.505998E+01
27-400943.0000	1037.4	279	69	73	3.349361E+01
27-400974.0000	907.22	67	75	67	9.777383E+01
27-400997.0000	944.63	82	73	71	3.228356E+02
27-401008.0000	1084.6	237	67	75	1.638925E+02
27-401017.0000	1037.4	279	69	73	1.043132E+02
27-401034.0000	1110	762	67	71	3.835341E+01
27-401041.0000	1665.9	-918	25	68	1.534659E+02
27-401042.0000	858.51	318	77	71	4.807409E+01
27-401127.0000	907.22	67	75	67	8.693251E+01
27-401140.0000_A	1586.4	1349	37	63	3.133419E+02
27-401140.0000_B	1563.1	800	35	63	3.133419E+02
27-401140.0000_C	1603.7	556	35	65	3.133419E+02
27-401140.0000_D	1537.7	1010	35	61	3.133419E+02
27-401140.0000_E	1580.9	24	33	65	3.133419E+02

Table A2 **Assigned pumping at Assured Water Supply wells.**

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-401161.0000	1026.7	45	69	75	3.201484E+01
27-401162.0000	1037.4	279	69	73	1.899701E+01
27-401163.0000	1202.3	180	61	57	2.490388E+01
27-401164.0000	1202.3	180	61	57	3.803466E+01
27-401165.0000	1202.3	180	61	57	3.609989E+01
27-401166.0000	1202.3	180	61	57	4.691172E+01
27-401167.0000	1202.3	180	61	57	3.246397E+01
27-401168.0000_A	1363.5	275	55	59	3.982070E+00
27-401168.0000_B	1241.2	195	59	57	3.982070E+00
27-401169.0000	1202.3	180	61	57	7.347678E+01
27-401170.0000	1202.3	180	61	57	3.843242E+01
27-401192.0000	998.29	705	71	67	2.105629E+01
27-401193.0000	998.29	705	71	67	1.392329E+01
27-401194.0000	998.29	705	71	67	1.493425E+01
27-401195.0000	998.29	705	71	67	2.429504E+01
27-401196.0000	998.29	705	71	67	3.261337E+01
27-401197.0000	998.29	705	71	67	2.875280E+01
27-401198.0000	998.29	705	71	67	2.452756E+01
27-401199.0000	998.29	705	71	67	3.934165E+01
27-401200.0000	998.29	705	71	67	3.016001E+01
27-401220.0000	998.45	761	71	69	2.127910E+02
27-401237.0000	1026.7	45	69	75	5.490041E+01
27-401273.0000	1054.6	789	69	67	4.677312E+01
27-401274.0000	1054.6	789	69	67	2.261450E+01
27-401275.0000	1054.6	789	69	67	2.307167E+01
27-401276.0000	1054.6	789	69	67	4.798602E+01
27-401279.0000	1105.8	550	67	73	2.450092E+01
27-401282.0000	1105.8	550	67	73	5.759635E+01
27-401283.0000	1084.6	237	67	75	8.799885E-01
27-401285.0000	949.28	230	73	69	8.336513E+01
27-401290.0000	1105.8	550	67	73	2.047980E+01
27-401359.0000	1084.6	237	67	75	1.030999E+01
27-401442.0000	1173.1	-289	61	55	7.448765E+01
27-401443.0000	1173.1	-289	61	55	5.225768E+01
27-401444.0000	1173.1	-289	61	55	6.033058E+01

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-401445.0000	1173.1	-289	61	55	4.262305E+01
27-401446.0000	1173.1	-289	61	55	2.147400E+01
27-401447.0000	1173.1	-289	61	55	8.129680E+01
27-401448.0000	1173.1	-289	61	55	4.413592E+01
27-401449.0000	1173.1	-289	61	55	3.413127E+01
27-401450.0000	1173.1	-289	61	55	3.657114E+01
27-401451.0000_A	1143.2	-497	61	53	2.381173E+01
27-401451.0000_B	1173.1	-289	61	55	2.381173E+01
27-401452.0000_A	1205.3	-94	59	55	1.733599E+01
27-401452.0000_B	1173.1	-289	61	55	1.733599E+01
27-401453.0000	1173.1	-289	61	55	5.592309E+01
27-401454.0000_A	1143.2	-497	61	53	2.260545E+01
27-401454.0000_B	1173.1	-289	61	55	2.260545E+01
27-401455.0000_A	1143.2	-497	61	53	2.094326E+01
27-401455.0000_B	1173.1	-289	61	55	2.094326E+01
27-401456.0000	1143.2	-497	61	53	5.839497E+01
27-401457.0000_A	1143.2	-497	61	53	2.028616E+01
27-401457.0000_B	1173.1	-289	61	55	2.028616E+01
27-401458.0000_A	1143.2	-497	61	53	2.774737E+01
27-401458.0000_B	1173.1	-289	61	55	2.774737E+01
27-401459.0000_A	1143.2	-497	61	53	4.095156E+01
27-401459.0000_B	1173.1	-289	61	55	4.095156E+01
27-401460.0000_A	1143.2	-497	61	53	2.586707E+01
27-401460.0000_B	1169.5	-335	59	53	2.586707E+01
27-401461.0000	1143.2	-497	61	53	6.630481E+01
27-401462.0000	1143.2	-497	61	53	6.921694E+01
27-401463.0000	1143.2	-497	61	53	6.199646E+01
27-401464.0000	1143.2	-497	61	53	8.336739E+01
27-401482.0000_A	1001.1	-131	69	77	1.803281E+01
27-401482.0000_B	1026.7	45	69	75	1.803281E+01
27-401485.0000	1026.7	45	69	75	9.554855E+00
27-401497.0000	1037.4	279	69	73	4.131572E+01
27-401503.0000	1084.6	237	67	75	2.658986E+01
27-401504.0000	1084.6	237	67	75	4.119984E+01
27-401505.0000	1084.6	237	67	75	2.919992E+01

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-401522.0000	867.53	241	77	69	8.271155E+01
27-401532.0000	1110	762	67	71	5.973724E+01
27-401536.0000	872.61	157	77	67	1.109944E+02
27-401549.0000	1624.1	-1051	25	72	1.284120E+02
27-401550.0000_A	1665.9	-918	25	68	2.366718E+02
27-401550.0000_B	1693.6	105	23	68	2.366718E+02
27-401601.0000	872.61	157	77	67	1.362113E+02
27-401626.0000_A	998.29	705	71	67	4.934539E+01
27-401626.0000_B	992.66	584	71	65	4.934539E+01
27-401634.0000	842.09	429	79	69	8.265289E+01
27-401679.0000	1001.1	-131	69	77	1.720670E+01
27-401680.0000	1001.1	-131	69	77	1.434334E+01
27-401681.0000	1001.1	-131	69	77	3.808334E+01
27-401682.0000	1001.1	-131	69	77	3.947463E+01
27-401717.0000	1606	-1415	25	74	1.499801E+02
27-401762.0000_A	1452	234	29	84	1.489663E+02
27-401762.0000_B	1422.4	-294	31	84	1.489663E+02
27-401788.0000	1041	773	69	71	3.214345E+02
27-401793.0000	1484.9	900	26	88	9.150138E+00
27-401795.0000	992.66	584	71	65	1.207868E+02
27-401808.0000	1001.1	-131	69	77	1.095030E+02
27-401860.0000	909.81	-26	75	65	5.164130E+02
27-401886.0000	1041	773	69	71	1.329368E+02
27-401888.0000	850.53	397	79	73	2.012316E+02
27-401914.0000	992.3	285	71	71	1.566165E+02
27-401933.0000	992.3	285	71	71	1.708026E+02
27-401938.0000	986.95	40	71	73	7.004213E+01
27-401943.0000_A	1240.5	710	61	59	3.233551E+02
27-401943.0000_B	1343	1000	59	61	3.233551E+02
27-401943.0000_C	1281.7	962	61	61	3.233551E+02
27-401945.0000	907.22	67	75	67	6.647307E+01
27-401959.0000	1603.7	556	35	65	3.726883E+02
27-401960.0000	1105.8	550	67	73	7.317596E+01
27-401977.0000_A	1281.2	121	57	57	9.252197E+02
27-401977.0000_B	1239.6	-19	57	55	9.252197E+02

Table A2 **Assigned pumping at Assured Water Supply wells.**

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-401981.0000_A	944.63	82	73	71	2.624799E+02
27-401981.0000_B	897.18	88	75	71	2.624799E+02
27-401993.0000	1053.5	810	69	69	3.131492E+02
27-401994.0000_A	859.74	361	77	73	2.615917E+02
27-401994.0000_B	858.51	318	77	71	2.615917E+02
27-402013.0000	1026.7	45	69	75	1.498209E+02
27-402029.0000	999.67	503	71	59	1.231498E+02
27-402043.0000	948.95	283	73	67	3.934308E+02
27-402051.0000	867.53	241	77	69	2.786100E+01
27-402056.0000	1041	773	69	71	4.093514E+02
27-402069.0000	949.28	230	73	69	1.713231E+02
27-402078.0000	992.3	285	71	71	2.923854E+02
27-402083.0000	949.07	231	73	65	3.509731E+02
27-402087.0000	1078	-310	65	53	8.907978E+01
27-402095.0000_A	1364.7	536	45	55	5.984626E+02
27-402095.0000_B	1446.4	878	45	57	5.984626E+02
27-402095.0000_C	1380.9	400	43	55	5.984626E+02
27-402095.0000_D	1455.2	850	43	57	5.984626E+02
27-402112.0000	999.67	503	71	59	2.530197E+02
27-402121.0000	1391	-591	33	84	6.945893E+02
27-402138.0000_A	992.66	584	71	65	1.066259E+02
27-402138.0000_B	1047.2	593	69	65	1.066259E+02
27-402143.0000	933.39	-64	73	73	5.242057E+02
27-402160.0000	907.22	67	75	67	1.737018E+02
27-402196.0000	975.64	-158	71	75	3.247964E+02
27-402229.0000_A	1403.8	950	57	61	2.306053E+02
27-402229.0000_B	1438.7	465	55	61	2.306053E+02
27-402230.0000_A	1438.7	465	55	61	2.918743E+02
27-402230.0000_B	1363.5	275	55	59	2.918743E+02
27-402261.0000	949.28	230	73	69	3.089345E+02
27-500016.0000	1016.9	669	71	61	1.968620E+02
27-500017.0000	1016.9	669	71	61	2.967594E+02
27-500028.0000	998.29	705	71	67	2.196201E+02
27-500049.0000_A	1345.1	300	43	53	3.669105E+02
27-500049.0000_B	1364.7	536	45	55	3.669105E+02

Table A2 Assigned pumping at Assured Water Supply wells.

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
27-500049.0000_C	1324.6	357	45	53	3.669105E+02
27-500049.0000_D	1301.8	362	47	53	3.669105E+02
27-500049.0000_E	1380.9	400	43	55	3.669105E+02
27-500087.0000	944.63	82	73	71	1.804555E+02
27-500101.0000_A	1438.7	465	55	61	1.830949E+02
27-500101.0000_B	1363.5	275	55	59	1.830949E+02
27-500101.0000_C	1333.6	650	57	59	1.830949E+02
27-700310.0000	1689.3	-131	21	74	2.160505E+02
27-700392.0000	1959.5	1440	13	70	3.064291E+01
27-700412.0000_A	1593.2	-1424	25	76	5.239459E+02
27-700412.0000_B	1635.6	-989	23	76	5.239459E+02
27-700504.0000	1266.5	35	55	55	3.767561E+02
27-700511.0000_A	912.9	-168	73	78	8.446113E+02
27-700511.0000_B	875.98	12	75	78	8.446113E+02
27-700527.0000_A	1581.4	982	33	59	9.947004E+01
27-700527.0000_B	1574.7	971	33	61	9.947004E+01
27-700527.0000_C	1538.6	1050	35	59	9.947004E+01
27-700527.0000_D	1537.7	1010	35	61	9.947004E+01
27-700535.0000_A	1537.7	1010	35	61	1.567449E+02
27-700535.0000_B	1563.1	800	35	63	1.567449E+02
27-700535.0000_C	1580.9	24	33	65	1.567449E+02
27-700535.0000_D	1603.7	556	35	65	1.567449E+02
27-700572.0000_A	998.29	705	71	67	1.158263E+02
27-700572.0000_B	1041	773	69	71	1.158263E+02
27-700572.0000_C	998.45	761	71	69	1.158263E+02
27-700642.0000	1105.8	550	67	73	1.248215E+01
27-700934.0000_A	1631.6	1121	21	86	8.918033E-01
27-700934.0000_B	1601.4	1050	22	88	8.918033E-01
27-700961.0000	1586.4	1349	37	63	8.365086E+02
27-700974.0000_A	1603.7	556	35	65	8.771396E+01
27-700974.0000_B	1580.9	24	33	65	8.771396E+01
28-700445.0000_A	956.74	-253	71	78	3.252054E+02
28-700445.0000_B	963.29	-253	71	77	3.252054E+02
28-700445.0000_C	1001.1	-131	69	77	3.252054E+02
28-700644.0000_A	1674	161	21	78	5.156230E+02

Table A2 **Assigned pumping at Assured Water Supply wells.**

Well ID	Screen Top (feet above sea level)	Screen Bottom (feet above sea level)	Row	Column	Rate (acre-feet per year)
28-700644.0000_B	1681.3	-48	21	76	5.156230E+02
28-700663.0000_A	1063.6	593	69	63	2.575350E+02
28-700663.0000_B	1008.9	591	71	63	2.575350E+02
28-700765.0000	1484.9	900	26	88	3.308279E+02
28-700960.0000_A	1391	-591	33	84	3.155454E+02
28-700960.0000_B	1422.4	-294	31	84	3.155454E+02
28-700960.0000_C	1402.6	-125	31	86	3.155454E+02
Subtotal of Certificates					**38,717**
Grand Total					**161,529**

Appendix B: Summary of Long-Term Storage Credits to Be Removed in Projection

Table B1 Long-term storage credits at underground storage facilities (USFs) to be removed during projection in the Lower Hassayampa Sub-basin.

Facility Number	Facility Name	Long-Term Credit (acre-feet)
71-584466	Hieroglyphic Mountains Recharge Project USF	193,397
71-593305	Tonopah Desert Recharge Project USF	661,569
71-216387	Hassayampa (Managed) Recharge Facility USF	31,534
71-205381	Buckeye Tartesso Water Reclamation Facility USF	980
Total		**887,480**

Table B2 Long-term storage credits at groundwater savings facilities (GSFs) to be removed during projection in the Lower Hassayampa Sub-basin.

Well Registry	Owner	Facility Name	Long-Term Credit (acre-feet)
619816	Buckeye Water Conservation & Drainage District	Roosevelt Irrigation District GSF	3,652
607181	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	1,373
607185	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	2,211
607190	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	2,779
619804	Buckeye Water Conservation & Drainage District.	Roosevelt Irrigation District GSF	464
619823	Buckeye Water Conservation & Drainage District.	Roosevelt Irrigation District GSF	5,044
612562	Wayne A Tr Smith	Roosevelt Irrigation District GSF	1,015
607183	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	1,359
607152	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	1,769
607171	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	495
607169	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	734
604634	Gingg Farms	Roosevelt Irrigation District GSF	1,273
607155	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	1,849
202889	Ernest M. Linsenmeyer	Roosevelt Irrigation District GSF	3,871
620367	Gingg Farms	Roosevelt Irrigation District GSF	575
607184	Roosevelt Irrigation District	Roosevelt Irrigation District GSF	1,394
Subtotal			**29,856**
629182	Daniel W. Boschma & Jahna R. Boschma	Tonopah Irrigation District GSF	6,122
629183	Daniel W. Boschma & Jahna R. Boschma	Tonopah Irrigation District GSF	6,013
617567	Gingg Farms/General Agriculture	Tonopah Irrigation District GSF	1,593
600203	Daniel W. Boschma & Jahna R. Boschma	Tonopah Irrigation District GSF	1,296

Table B2 Long-term storage credits at groundwater savings facilities (GSFs) to be removed during projection in the Lower Hassayampa Sub-basin.

Well Registry	Owner	Facility Name	Long-Term Credit (acre-feet)
617315	Tonopah Farms	Tonopah Irrigation District GSF	757
617571	Gingg Farms/General Agriculture	Tonopah Irrigation District GSF	11,320
617320	Tonopah Farms	Tonopah Irrigation District GSF	10,265
617572	Gingg Farms/General Agriculture	Tonopah Irrigation District GSF	408
Subtotal			**37,773**
Grand Total			**67,629**

Appendix C: Summary of Assigned, Simulated, and Unmet Demands

Table C1 Assigned, simulated, and unmet demands at existing, Assured Water Supply Program, and long-term storage credit wells during projection in the Lower Hassayampa Sub-basin.

Type of Demand	Number of Wells	Number of Wells with Pumping Reduced	Number of Wells with Pumping Reduced to Zero at 2116	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 2017 to 2116 (acre-feet)
					Minimum	Maximum	Average	Minimum	Maximum	Average	
Existing	357	254	100	123,038	93,545	122,013	114,324	943	29,749	8,714	871,355
Assured Water Supply (Analyses)	179	80	42	107,854	71,106	99,125	86,296	8,658	36,973	21,558	2,155,838
Assured Water Supply (Certificates)	279	77	52	53,770	36,038	47,742	41,038	5,993	17,831	12,732	1,273,215
Assured Water Supply (Analyses and Certificates)	458	157	94	161,624	107,144	146,867	127,334	14,651	54,803	34,291	3,429,054
Long-Term Storage Credit	28	1	0	9,514	7,671	9,534	8,337	0	1,846	1,177	117,710
Total	**843**	**412**	**194**	**294,176**	**208,359**	**278,415**	**249,995**	**15,595**	**86,398**	**44,181**	**4,418,118**

Appendix D: Simulated Water Budget

Table D1 Summary of simulated groundwater budget for the historical (1930 to 2016) and projection (2017 to 2116) periods.

Budget Term	Accumulative (acre-feet)			Average (acre-feet per year)			Note
	Steady State	1931 - 2016	2017 - 2116	Steady State	1931 - 2016	2017 - 2116	
Inflow							
Underflow	28,327	1,982,328	1,322,487	28,327	23,050	13,225	Underflow from adjacent sub-basins to Hassayampa Sub-basin at Buckeye Gap and Mullen's Cut
Recharge	52,406	10,108,356	8,170,400	52,406	117,539	81,704	Agricultural, mountains front, and artificial recharges
Stream Leakage	0	1,581,336	3,622,215	0	23,960	36,222	Leakage from Gila River to alluvial aquifer
General Head	0	0	31,589	0	0	316	Flow from WSRV Sub-basin to Lower Hassayampa Sub-basin (head dependent)
Total Inflow	**80,733**	**13,672,020**	**13,146,692**	**80,733**	**164,549**	**131,467**	
Outflow							
Underflow	13,282	1,325,694	2,198,417	13,282	15,415	21,984	Underflow from Hassayampa Sub-basin to adjacent sub-basins at Morristown Gap, south of Belmont Mountains, and Gillespie Dam
Stream Leakage	21,615	416,880	0	21,615	20,844	0	Leakage from alluvial aquifer to Gila River

Budget Term	Accumulative (acre-feet)			Average (acre-feet per year)			Note
	Steady State	1931 - 2016	2017 - 2116	Steady State	1931 - 2016	2017 - 2116	
General Head	538	137,273	0	538	1,596	0	Flow from Lower Hassayampa Sub-basin to WSRV Sub-basin (head dependent)
Evapotranspiration	21,149	1,390,277	100,756	21,149	16,166	1,008	Evapotranspiration along Gila River riparian zone
Pumping	24,149	12,461,852	24,999,503	24,149	144,905	249,995	Groundwater withdrawal by pumping
Total Outflow	**80,733**	**15,731,976**	**27,298,676**	**80,733**	**198,927**	**272,987**	
Aquifer Storage Loss	**0**	**2,059,956**	**14,137,661**	**0**	**34,378**	**141,520**	