# TOWN OF MINDEN, NEVADA

## WATER SYSTEM ANALYSIS

## Amendment #1

## DECEMBER 2018

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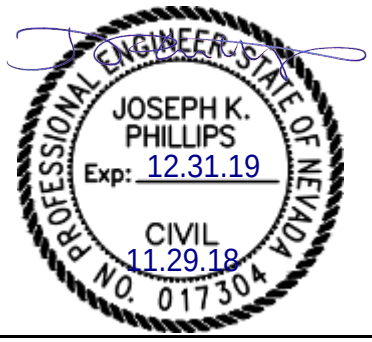
Minden NEVADA

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*Section 3 of the Town of Minden, Nevada Water System Analysis shall be replaced with the following revised Section 3.*

# 3 WATER RIGHTS ANALYSIS

The Town of Minden provided a worksheet that shows the water rights information for the wells owned by the Town. The worksheet shows the water permits for each well. The extent of this report will be to summarize the information shown in the worksheet and to compare it to existing and projected required water usage.

## 3.1 Water Rights Portfolio

Table 3-1 shows all active water rights that are held in the possession of the Town per the information provided by the Town.

**Table 3-1: Water Rights – Town of Minden**

| Town of Minden Culinary Water Rights | | Flow | | Duty |
|---|---|---|---|---|
| App. No. | Point of Diversion | gpm | cfs | ac-ft |
| 85979 | Well #1 | 13.5 | 0.030 | 22.0 |
| 60636 | Well #2 | 763.9 | 1.702 | 1,232.3 |
| 60637 | Well #3 | 1,616.6 | 3.602 | 2,607.9 |
| 60638 | Well #4 | 1,723.4 | 3.840 | 2,780.2 |
| 60639 | Well #5 | 1,907.4 | 4.250 | 414.1 |
| 60640 | Well #6 | 67.3 | 0.150 | 20.0 |
| 82284 | Well #6 | 74.5 | 0.166 | 120.0 |
| 69593 | Well #8 | 673.2 | 1.500 | 1,086.0 |
| 60635 | Well #11 | 1,490.0 | 3.320 | 2,403.3 |
| **Total Town of Minden Water Rights** | | **8,329.8** | **18.560** | **10,685.7** |

In addition to the water rights owned by the Town of Minden, additional water rights have points of diversion being wells operated by the Town of Minden. These water rights aid in providing wholesale water. The amount of water rights and the associated wells is provided in Table 3-2.

**Table 3-2. Water Rights by Well (Ac-Ft)**

| Well # | Town of Minden | Carson City | Douglas County | Indian Hills GID | Combined |
|---|---|---|---|---|---|
| 1 | 22.00 | 0 | 0 | 0 | 22.00 |
| 2 | 1,232.33 | 700.00 | 0 | 0 | 1,932.33 |
| 3 | 2,607.87 | 650.00 | 0 | 0 | 3,257.87 |
| 4 | 2,780.16 | 0 | 0 | 0 | 2,780.16 |
| 5 | 414.06 | 640.00 | 82.72 | 0 | 1,136.78 |
| 6 | 140.01 | 0 | 4.04 | 0 | 144.05 |
| 7 | 0 | 250.00 | 531.46 | 0 | 781.46 |
| 8 | 1,085.96 | 0 | 127.43 | 0 | 1,213.39 |
| 9 | 0 | 500.00 | 1,127.33 | 0 | 1,627.33 |
| 10 | 0 | 0 | 860.59 | 1,454.60 | 2,315.19 |
| 11 | 2,403.31 | 0 | 0 | 0 | 2,403.31 |
| **Total** | **10,685.70** | **2,740.00** | **2,733.57** | **1,454.60** | **17,613.87** |

## 3.2 Existing Required Water Right

Water rights are generally evaluated based on an "average day" demand basis. As mentioned previously, the average daily usage for residential connections was determined using the Town of Minden's historical usage data and determined to be 656 gallons per day as shown in Table 2-7.

The existing required water right was calculated by multiplying the average daily water use per ERU by the total number of ERUs in the system. The results of the analysis are presented in acre-feet annually and gallons per minute. When compared with the Town's total available water rights summarized in Table 3-1, it becomes apparent that the Town has sufficient rights under existing growth conditions.

In addition to the water rights required of the Town, additional water rights are required due to wholesale use. These water rights have been calculated based on the average wholesale use from available historical data. The required amount was converted to acre feet and compared with the water rights belonging to Carson City, Douglas County, and Indian Hills GID. Based on the data shown in Table 3-3 below, there exists adequate water right to provide the wholesale water under current conditions.

**Table 3-3: Required Water Right (Existing Conditions)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | | |
| 1,387 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 632 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Commercial** | | | | | | | | | | |
| 757 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 345 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Other** | | | | | | | | | | |
| 85 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 39 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| | | | | | **Total Required Retail Water Right** | = | **1,015** | **gpm** | **1,637.8** | **Acft** |
| | | | | | **Existing Minden Water Right** | | | | **10,685.7** | **Acft** |
| | | | | | **Total Retail Water Right Available** | | | | **9,047.9** | **Acft** |
| **Wholesale (Average Usage)** | | | | | | = | **2,526** | **gpm** | | |
| | | | | | **Required Wholesale Water Right** | | | | **4,075.1** | **Acft** |
| | | | | | **Existing Wholesale Water Right** | | | | **6,928.2** | **Acft** |
| | | | | | **Total Water Right Available** | | | | **2,853.1** | **Acft** |

## 3.3 Projected Required Water Right

Projecting growth to the 5-year planning horizon and using the same method of calculating water rights demand as for the required existing water rights reveals that the Town will have sufficient water rights in the 5-year planning horizon, as shown in Table 3-4.

The projections also show that existing wholesale water rights will be sufficient through the 5-year planning horizon as shown in Table 3-4. The projected wholesale usage was assumed to have a 1% growth similar to the projected growth in the Town of Minden.

### Table 3-4: Required Water Right (5-Year Planning Horizon)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | | |
| 1,458 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 664 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Commercial** | | | | | | | | | | |
| 796 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 363 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Other** | | | | | | | | | | |
| 89 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 40 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| | | | | | **Total Required Retail Water Right** | = | **1,067** | **gpm** | **1,721.3** | **Acft** |
| | | | | | **Existing Minden Water Right** | | | | **10,685.7** | **Acft** |
| | | | | | **Total Retail Water Right Available** | | | | **8,964.4** | **Acft** |
| **Wholesale (Average Usage)** | | | | | | = | **2,655** | **gpm** | | |
| | | | | | **Required Wholesale Water Right** | | | | **4,282.9** | **Acft** |
| | | | | | **Existing Wholesale Water Right** | | | | **6,928.2** | **Acft** |
| | | | | | **Total Water Right Available** | | | | **2,645.2** | **Acft** |

Similarly, projecting growth to the 20-year planning horizon and using the same method of calculating water rights demand reveals that the Town will have sufficient water rights in the 20-year planning horizon, as shown in Table 3-5.

The projections also show that existing wholesale water rights will be sufficient through the 20-year planning horizon as shown in Table 3-5. The projected wholesale usage was assumed to have a 1% growth similar to the projected growth in the Town of Minden.

### Table 3-5: Required Water Right (20-Year Planning Horizon)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | | |
| 1,693 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 771 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Commercial** | | | | | | | | | | |
| 924 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 421 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Other** | | | | | | | | | | |
| 103 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 47 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| | | | | | **Total Required Retail Water Right** | = | **1,239** | **gpm** | **1,998.4** | **Acft** |
| | | | | | **Existing Minden Water Right** | | | | **10,685.7** | **Acft** |
| | | | | | **Total Retail Water Right Available** | | | | **8,687.3** | **Acft** |
| **Wholesale (Average Usage)** | | | | | | = | **3,082** | **gpm** | | |
| | | | | | **Required Wholesale Water Right** | | | | **4,972.4** | **Acft** |
| | | | | | **Existing Wholesale Water Right** | | | | **6,928.2** | **Acft** |
| | | | | | **Total Water Right Available** | | | | **1,955.8** | **Acft** |

Finally, projecting growth to the vested connections planning horizon and using the same method of calculating water rights demand reveals that the Town will have sufficient water rights even after providing water to all connections which are currently vested in the system (see Table 3-6).

The projections also show that existing wholesale water rights will be sufficient through the 20-year planning horizon as shown in Table 3-6. The projected wholesale usage was assumed to have a 1% growth similar to the projected growth in the Town of Minden.

**Table 3-6: Required Water Right (Vested Connections Planning Horizon)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | |
| 2,213 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 1008 | gpm | |
| | | | ERU | 24 hr | 60 min. | | | | |
| **Commercial** | | | | | | | | | |
| 1,216 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 554 | gpm | |
| | | | ERU | 24 hr | 60 min. | | | | |
| **Other** | | | | | | | | | |
| 136 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 62 | gpm | |
| | | | ERU | 24 hr | 60 min. | | | | |
| | | | | | **Total Required Retail Water Right** | = | **1,624** | **gpm** | **2,619.3** **Acft** |
| | | | | | **Existing Minden Water Right** | | | | **10,685.7** **Acft** |
| | | | | | **Total Retail Water Right Available** | | | | **8,066.4** **Acft** |
| **Wholesale (Average Usage)** | | | | | | = | **4,073** | **gpm** | |
| | | | | | **Required Wholesale Water Right** | | | | **6,569.9** **Acft** |
| | | | | | **Existing Wholesale Water Right** | | | | **6,928.2** **Acft** |
| | | | | | **Total Water Right Available** | | | | **358.2** **Acft** |

Figure 3-1 for the required retail water right and Figure 3-2 for the required wholesale water right illustrate the information given in the tables graphically; namely, it demonstrates that the Town has sufficient water rights through the vested connections planning period.

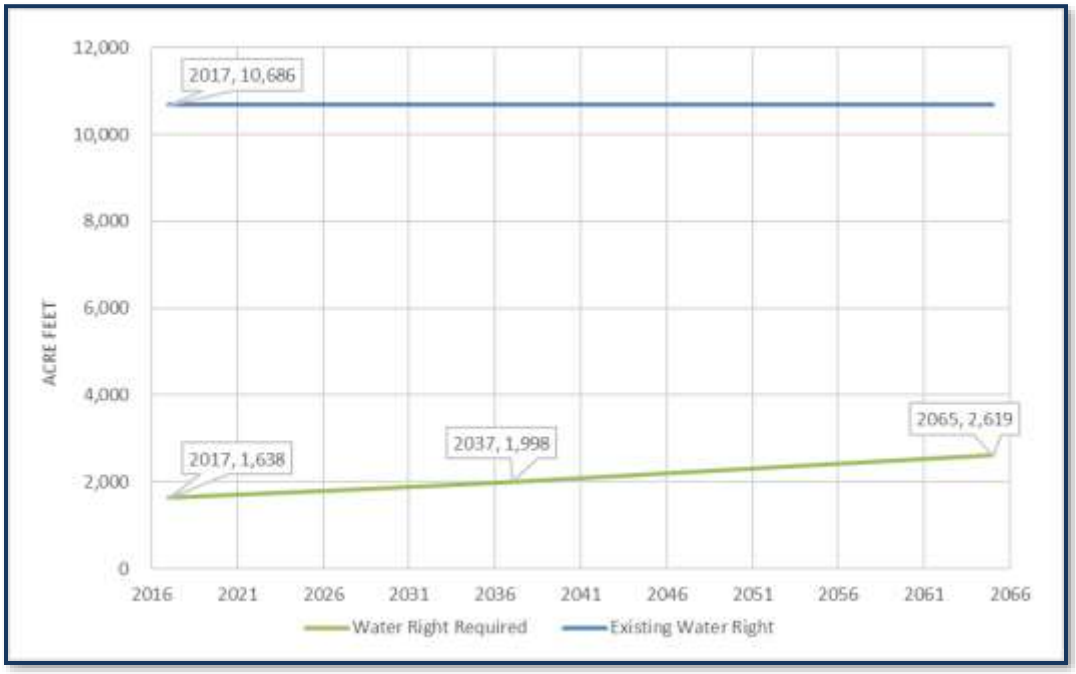



**Figure 3-1: Water Right Demand vs. Availability - Retail**

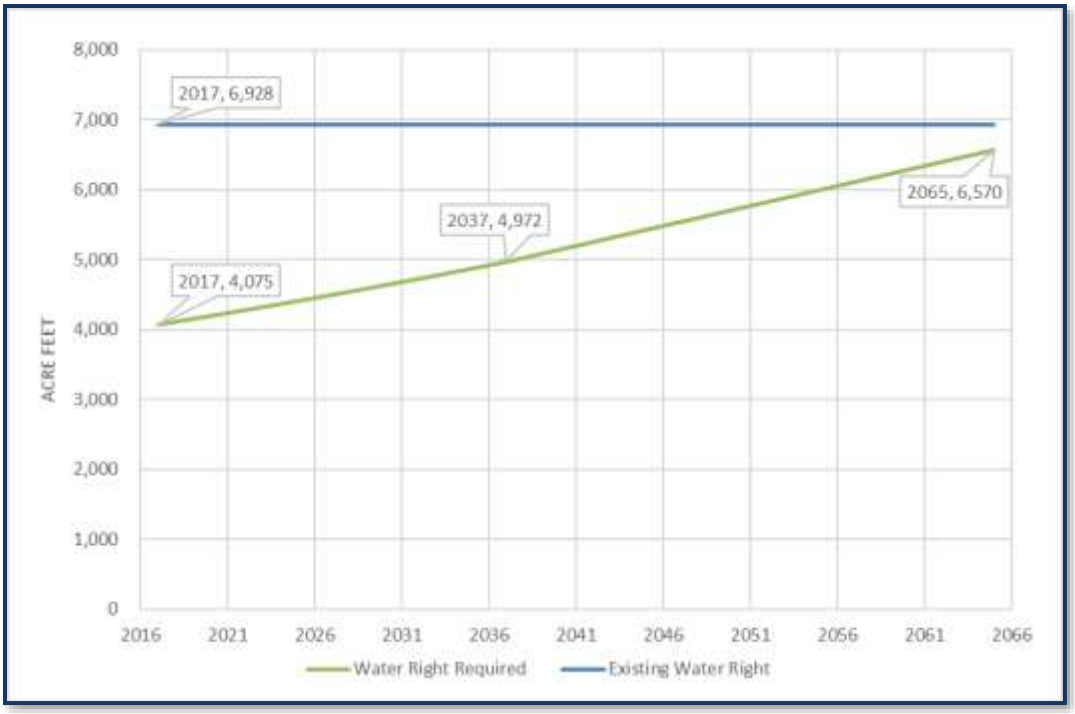



**Figure 3-2: Water Right Demand vs. Availability - Wholesale**

## 3.4 Projected Required Water Right at Buildout

Although Section 3.3 indicates the Town is anticipated to have adequate water rights throughout the planning period, the anticipated water rights required at buildout was also calculated. "Buildout" in this section is considered the projected Town boundary based primarily on the existing Town boundary and future service areas identified in the Town's "Plan for Prosperity" that the Town is adopting. Appendix D shows the anticipated future Town boundary and service area.

Multiple buildout scenarios were considered. The first buildout analysis was completed using existing zoning designations for the areas shown in Appendix D. The land use categories were broken into two types, residential and non-residential, based on the zoning definitions.

The number of residential dwelling units was calculated as shown in Table 3-7. The area is based on the land use categories as shown in the map in Appendix D. The dwelling units per acre were determined based on the zoning classification, and the number of dwelling units were calculated by multiplying the area and the dwelling units per acre. The number of residential dwelling units equals the number of residential ERUs at buildout.

**Table 3-7: Residential Dwelling Units at Buildout – Existing Zoning**

| Land Use Category | Area (acre) | DU/Acre | No. DU |
|---|---|---|---|
| Agriculture, 19 Acres | 4,801.53 | 0.05 | 253 |
| Forest Range, 19 Acres | 0.40 | 0.05 | 1 |
| Multi-Family Residence 6.01-16 Dwelling Units/Ac | 48.74 | 6.01 | 293 |
| Rural Agriculture, 10 Acres | 10.79 | 0.10 | 2 |
| Rural Agriculture, 5 Acres | 63.64 | 0.20 | 13 |
| Single Family Residence, 1 Acre | 16.83 | 1.00 | 17 |
| Single Family Residence, 1/2 Acre | 1.75 | 0.50 | 1 |
| Single Family Residence, 12,000 SF | 429.21 | 3.63 | 1,559 |
| Single Family Residence, 8,000 SF | 374.77 | 5.45 | 2,043 |
| | 5,747.66 | | 4,182 |

The number of non-residential ERUs was calculated based on the areas shown in Table 3-8. These areas are based on the land use categories as shown in the map in Appendix D.

**Table 3-8: Non-Residential Area at Buildout – Existing Zoning**

| Land Use Category | Area (acre) |
|---|---|
| General Commercial | 31.49 |
| Light Industrial | 466.03 |
| Mixed Used Commercial | 42.69 |
| Neighborhood Commercial | 83.73 |
| Office Commercial | 16.18 |
| Public Facility | 202.27 |
| Service Industrial | 15.41 |
| Tourist Commercial | 25.94 |
| | 883.74 |

Assumptions were required to obtain the number of non-residential ERUs from the area shown in Table 3-8. One assumption is that the existing users have the same composition of residential and non-residential users as the water system footprint would have if at maximum density. Another assumption is that the existing non-residential usage per acre is the same as the buildout non-residential usage per acre.

Implementing these assumptions, an estimated percent of maximum density for the existing system footprint was calculated to be 47.21%. The estimated non-residential ERU density was also determined to be 5.20 ERUs/acre. Multiplying this density with the number of non-residential acreage at buildout gives the estimated total non-residential ERUs at buildout:

$$5.20\ \frac{ERUs}{Acre} \times 883.74\ acres = 4{,}596\ Non - Residential\ ERUs$$

The total required water right was calculated based on the estimated number of residential ERUs at buildout (4,182) and the estimated number of non-residential ERUs at buildout (4,596) as shown in Table 3-9.

### Table 3-9: Required Water Right (Buildout) – Existing Zoning

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | | |
| 4,182 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 1905 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Non-Residential** | | | | | | | | | | |
| 4,596 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 2094 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| | | | | | **Total Required Retail Water Right** | = | **3,999** | **gpm** | **6,450.6** | **Acft** |
| | | | | | **Existing Minden Water Right** | | | | **10,685.7** | **Acft** |
| | | | | | **Total Retail Water Right Available** | | | | **4,235.1** | **Acft** |

The above calculations show that the Town would have adequate water rights through buildout under the scenario analyzed. However, these calculations are based on the current zoning. As can be seen on the map in Appendix D, a large portion of the area in the anticipated future service area is zoned agricultural. If this area were to be re-zoned to single family residential, the required water rights would presumably increase. The second buildout scenario, instead of relying on existing zoning, assumes the anticipated future service areas will be zoned similar to the existing Town area and at the current density of the existing Town area. The number of ERUs for this buildout scenario were calaculated based on a ratio of existing acreage to total buildout acreage. The equation below multplies the number of existing ERUs (2,229) by the ratio of the total buildout area (6,631 acres) to the existing water system footprint area (1,054 acres).

$$2{,}229\ Ex.ERUs \times \frac{6{,}631\ acres}{1054\ acres} = 14{,}024\ Buildout\ ERUs$$

Maintaining the same proportion of residential and non-residential ERUs as the existing ERUs results in 8,726 buildout residential buildout ERUs and 5,297 non-residential buildout ERUs. The total buildout water right requirement was calculated based on these ERU values as shown in Table 3-10.

### Table 3-10: Required Water Right (Buildout) – Zoning/Densities Matching Existing

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | | |
| 8,726 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 3975 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| **Non-Residential** | | | | | | | | | | |
| 5,297 | ERU's X | 656 | gpd X | 1 day X | 1 hr | = | 2413 | gpm | | |
| | | | ERU | 24 hr | 60 min. | | | | | |
| | | | | | **Total Required Retail Water Right** | = | **6,388** | **gpm** | **10,305.0** | **Acft** |
| | | | | | **Existing Minden Water Right** | | | | **10,685.7** | **Acft** |
| | | | | | **Total Retail Water Right Available** | | | | **380.7** | **Acft** |

The above calculations shows that **if the water rights required for the existing water system footprint were extended to the entire anticipated future service area, the total water right required would be 10,305 ac-ft** with a small amount of water rights available. This scenario is a reasonable scenario, although it is still likely conservative.

The previous buildout scenario assumes that all areas are at the 47.21% of maximum density as calculated previously and that the composition of the anticipated future service area is the same

as the existing system footprint. A third buildout scenario was analyzed based on an extension of similar zoning for the future service areas (as in the previous scenario); however, this scenario assumes all buildout areas are built to their maximum allowable densities. This scenario gives a possible upper bound to the water rights required at buildout. To determine the number of ERUs for this scenario, the total buildout ERUs from the previous scenario (14,024) were divided by the 47.21% maximum density to achieve the assumed maximum density at buildout.

$$\frac{14{,}024\ ERUs}{47.21\%} = 29{,}705\ Buildout\ ERUs$$

Maintaining the same proportion of residential and non-residential as the existing ERUs results in 18,484 buildout residential ERUs and 11,221 non-residential ERUs. The total buildout water right requirement was calculated based on the above mentioned ERU values as shown in Table 3-11.

**Table 3-11: Required Water Right (Buildout) – Zoning Matching Existing, Max. Densities**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Residential** | | | | | | | | | |
| 18,484 | ERU's X | 656 | gpd / ERU X | 1 day / 24 hr X | 1 hr / 60 min. | = | 8420 | gpm | |
| **Non-Residential** | | | | | | | | | |
| 11,221 | ERU's X | 656 | gpd / ERU X | 1 day / 24 hr X | 1 hr / 60 min. | = | 5112 | gpm | |
| | | | | **Total Required Retail Water Right** | | = | **13,532** | **gpm** | **21,829.1 Acft** |
| | | | | **Existing Minden Water Right** | | | | | **10,685.7 Acft** |
| | | | | **Total Retail Water Right Deficit** | | | | | **(11,143.4) Acft** |

The above calculations show that **If all the existing system footprint were built to maximum density and then extended to the entire anticipated future service area, the total water right required would be 21,829 ac-ft** with a water rights shortage prior to buildout.

The three buildout scenarios are summarized below in Table 3-12. The first buildout scenario considered is not a probable scenario as the majority of the additional service area is agricultural that would presumably be developed over time. This scenario could be considered a lower bound scenario. The second scenario is a reasonable scenario although it may still be somewhat conservative depending on actual densities at buildout. The third buildout scenario could be considered an upper bound as it is unlikely the maximum densities would be achieved.

**Table 3-12: Summary of Buildout Scenarios**

| Scenario | Water Right Required (Ac-Ft) | Water Right Available/(Deficit) (Ac-Ft) |
|---|---|---|
| Buildout with existing zoning | 6,450.6 | 4,235.1 |
| Buildout with zoning and densities matching existing system footprints | 10,305.0 | 380.7 |
| Buildout with zoning matching existing system footprints, with max. densities | 21,829.1 | (11,143.4) |

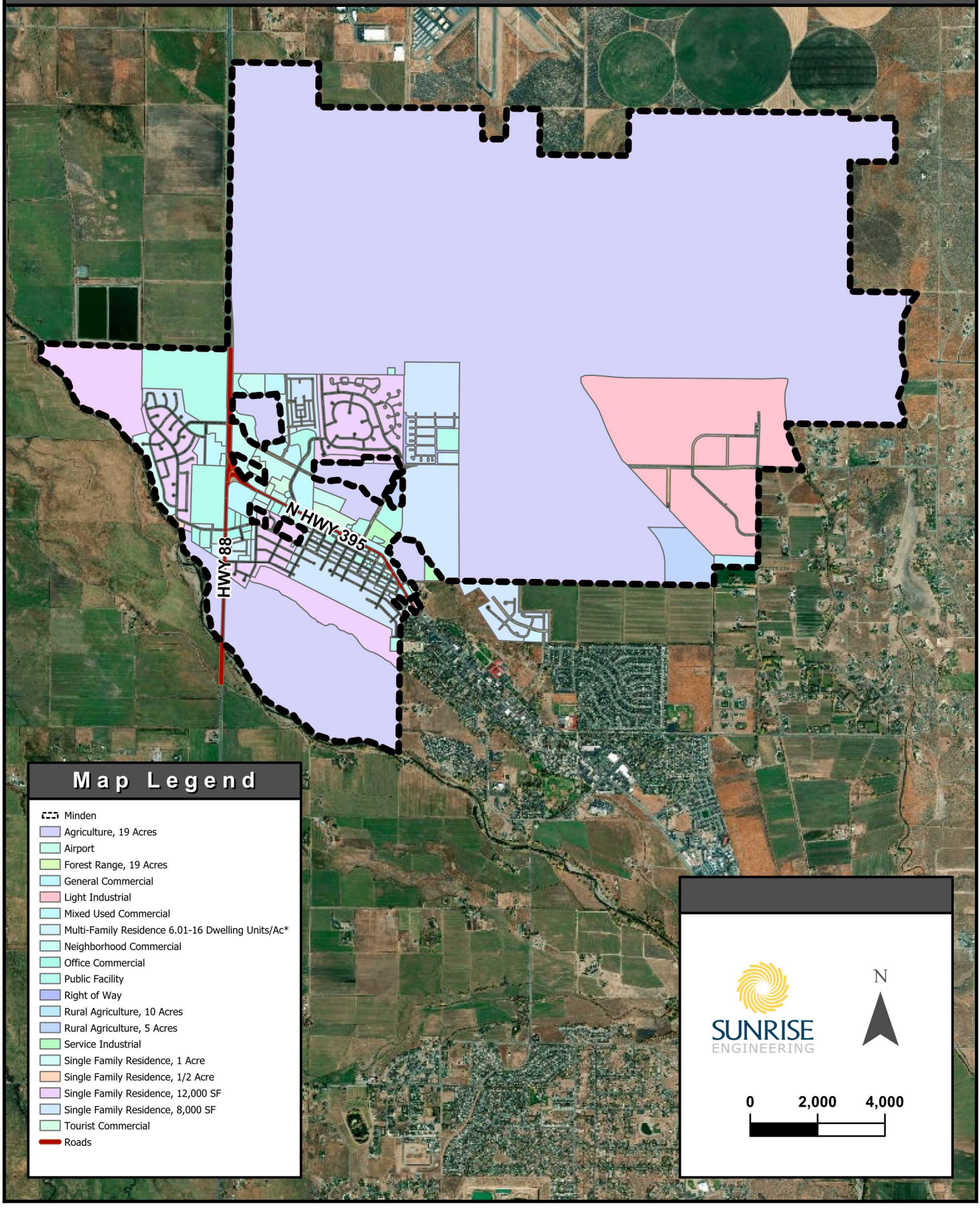
## 3.5 Recommended Water Right Improvements

Water rights recommendations are not in the scope of this report. For these recommendations, please refer to previous water rights studies.

# APPENDIX D

# ANTICIPATED FUTURE BUILDOUT AREA

# Minden Water System Analysis




## Map Legend

- Minden
- Agriculture, 19 Acres
- Airport
- Forest Range, 19 Acres
- General Commercial
- Light Industrial
- Mixed Used Commercial
- Multi-Family Residence 6.01-16 Dwelling Units/Ac*
- Neighborhood Commercial
- Office Commercial
- Public Facility
- Right of Way
- Rural Agriculture, 10 Acres
- Rural Agriculture, 5 Acres
- Service Industrial
- Single Family Residence, 1 Acre
- Single Family Residence, 1/2 Acre
- Single Family Residence, 12,000 SF
- Single Family Residence, 8,000 SF
- Tourist Commercial
- Roads

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