2020-2040

WATER SYSTEM FACILITY PLAN

UPDATE

OCTOBER 2023

TRUCKEE MEADOWS WATER AUTHORITY

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INTRODUCTION

BACKGROUND:

The 2020-2040 Water System Facility Plan (WFP) update is the fourth WFP prepared since the inception of TMWA in June 2001. The initial facility plan (2025 WFP) was approved in 2004 at a time when the rate of new development was nearing its peak. The second facility plan (2030 WFP) was published in 2010 in the midst of a recession caused by the fallout from the subprime mortgage financial crisis which produced a virtual halt to new development activity in the Truckee Meadows. The economic slowdown; loss of jobs and subsequent increase in residential vacancies; and to a lesser extent the effects of price elasticity resulting from conversion to an essentially fully metered system combined to produce a significant reduction in peak day water use, or maximum day demand (MDD). Other factors contributing to the decrease in peak day use include conversion from a 2-day per week outdoor watering schedule to a 3-day per week irrigation schedule in 2010 and a certain amount of demand hardening (a permanent decrease in water use) when TMWA asked its customers to conserve near the end of the drought period in the summer/fall of 2014 and 2015. Water demand growth projections in the third (2035 WFP) update were adjusted upward based on increased growth occurring at the time of the update but demand hardening continued to impact demands. Comparisons of actual MDD to the projections presented in the previous three WFP's are summarized below:

2005-2022 Actual MDD vs WFP Projections

Year	2025 WFP MDD (MGD)*	2030 WFP MDD (MGD)	2035 WFP MDD (MGD)	Actual MDD (MGD)
2005	153.1			148.3
2006	154.2			140.8
2007	155.4			136.7
2008	156.6			133.2
2009	158.1			128.8
2010	159.6	136.8		123.2
2011	161.1	138.9		119.9
2012	163.9	141.0		125.6
2013	166.5	143.3		121.4
2014	168.8	145.2		119.7
2015	171.0	146.9	159.7	125.0
2016	172.9	148.6	162.7	139.6
2017	174.9	150.4	165.6	139.8
2018	176.8	152.7	168.6	145.4

2019	178.7	155.0	171.5	145.7
2020	180.5	157.2	174.5	141.6
2021	182.4	159.5	176.7	149.3
2022	184.2	161.4	178.8	147.6

* MGD = million gallons per day

Even though the Truckee Meadows entered robust building period since 2010, the growth in peak day water use currently remains subdued. Per review of existing meter data, a combination of reduced peak demands by existing and new customers and growth rates not as high as anticipated by previous WFP updates, the growth in peak demands is generally slower than previous predictions. The slight uptick in peak day demand after 2015, shown above, can be attributed to the consolidation of former Washoe County water systems (17.9 MGD added in 2015) with the TMWA system on December 31, 2014. The reduction in peak demands in 2020 was generally due to covid pandemic restrictions that are not representative of normal operating conditions and subsequent peak demands have returned to a more normal pattern in later years.

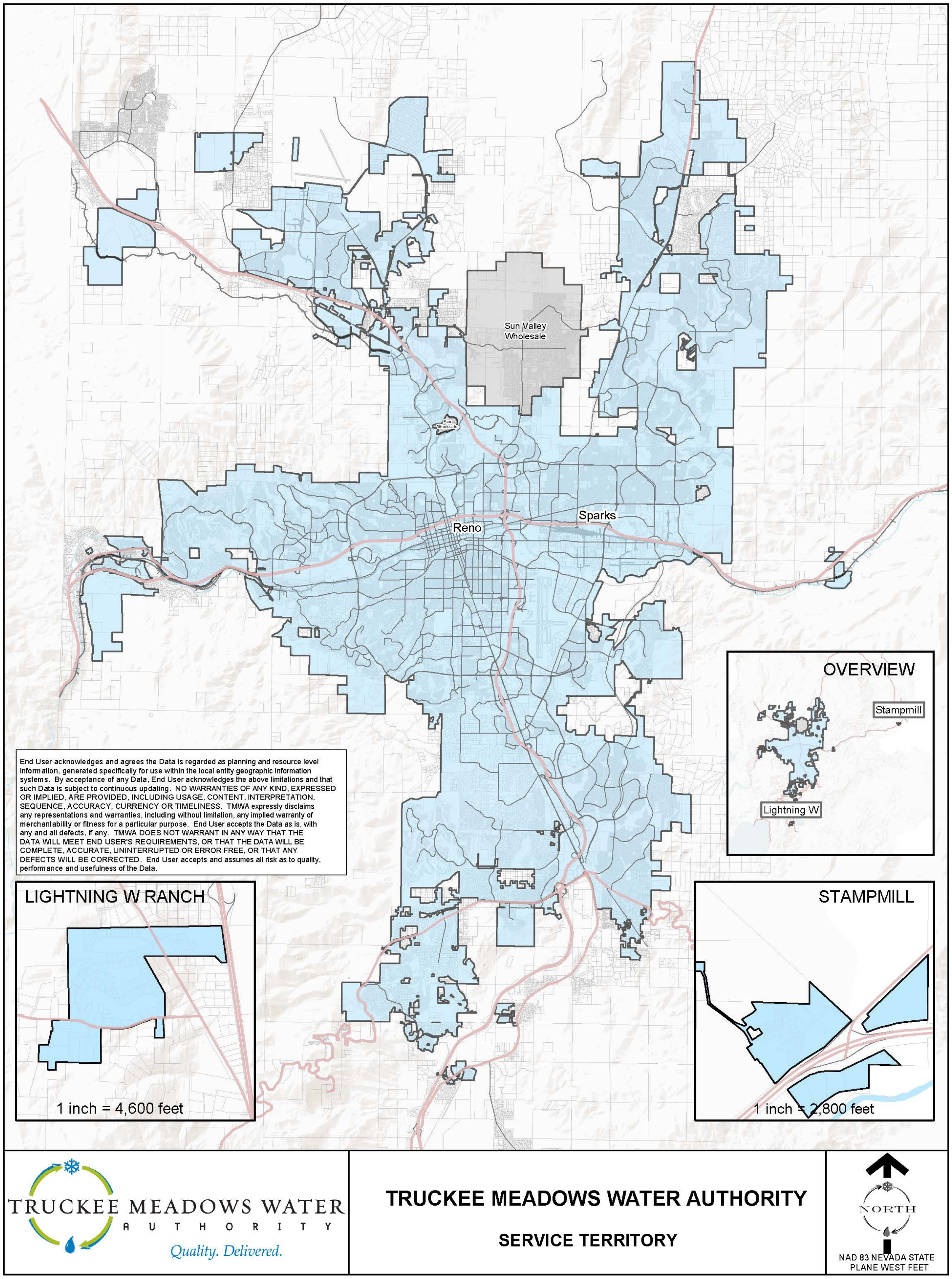
Based on current projections, the maximum day demand on TMWA's supply and distribution facilities is anticipated to increase to about 177 MGD in 2040. The current demand growth projections in this WFP update have been developed using the regional growth projection that was developed in the TMWA 2040 Water Resources Plan and applying the percentage growth per year to the 2021 maximum day demand based on historic consumption data. A comparison of the previous WFP maximum day demands and current demand projections is presented as follows:

2010-2040 MDD Projections

Year	2025 WFP MDD (MGD)	2030 WFP MDD (MGD)	2035 WFP MDD (MGD)	2040 WFP MDD (MGD)
2010	159.6	136.8		
2015	171.0	146.9	159.7	
2020	180.5	157.2	174.5	152.6
2025	189.5	166.8	185.3	160.3
2030		171.9	193.1	166.6
2035			197.3	171.9
2040				176.8

The 2035 WFP update included a comprehensive engineering analysis that thoroughly examined both the state of the legacy TMWA system and integrated (post 2015) Washoe County water system, updated unit demand and peaking factors for each rate class, and provided a blueprint for future expansion to meet a future MDD of approximately 197 MGD. Therefore, based on current demand projections that are significantly lower than previous projections and spatial allocation of growth that is not significantly different from the previous WFP update, the current WFP update focuses on verifying or modifying recommended capacities and facility sizing, re-establishing priorities and updating the timing of recommended improvements.

Figure 1 presents the current retail TMWA service territory that includes five “satellite” systems that are not connected to the core TMWA water system.


Sun Valley Wholesale
Reno
Sparks
OVERVIEW
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SERVICE TERRITORY
NORTH
NAD 83 NEVADA STATE PLANE WEST FEET

FIGURE 1

The primary objectives of the 2040 WFP are:

1. Update existing demands in TMWA hydraulic computer model for all TMWA water systems and perform model calibration. Updated hydraulic models will be used for daily operational support and identification of future improvements required to meet TMWA and NAC design requirements as additional growth demands are added to the water system.
2. Determine if modifications are necessary to facility improvement recommendations made in the previous WFP.
3. Identify revised in-service dates and update cost estimates for recommended water system facilities. This information will provide the basis for updating TMWA's funding plan and developer Water Service Facilities (WSF) charges.
4. Determine if modifications are necessary to facility improvement recommendations made in the previous WFP to meet current fire flow requirements.
5. Analyze the ability of the water system to continue operating with the loss of supply from the Truckee River.

THE WATER FACILITY PLAN IN REVIEW:

An impressive amount of water system infrastructure has been constructed in the past 18 years. Major accomplishments include:

- Replacement of the North Virginia pumping system and the Stead-Silver Lake pumping system with a $30 million combined supply system meeting the needs of growth and existing customers.
- Replacement of the rock and rubble diversion structure for the Glendale WTP with a new, modern fish and boater friendly concrete diversion structure to insure the ability to capture and treat privately owned stored water during drought conditions and to take advantage of the full treatment capacity of the Glendale facility.
- Construction of a new effluent pumping station at the Glendale WTP along with the first four phases of the NE Sparks Feeder Main to supply the growing area of Spanish Springs Valley.
- Acquisition and permitting of a site for the future Sparks GWTP which will diversify the overall water supply and provide additional drought supply.
- Completion of the Highland Ditch Improvement Plan which allows 100% of the raw water supply to the Chalk Bluff WTP to be provided via gravity-flow and significantly increases the reliability of the raw water supply to our most important treatment facility.
- Integration of the Washoe County water facilities into the TMWA system
- Integration of the Fish Springs groundwater supply into the TMWA system providing additional operational flexibility and drought protection.

- Construction of the Mt. Rose Water Treatment Plant that will be used to offset annual groundwater pumping volumes on the Mt Rose Fan when surface water is available (Up to 4 MGD capacity).
- Construction of the Disc Drive Pump Station. This pump station increases the reliable capacity of the Spanish Springs 2 Pump Station.
- Construction of the Kinglet Pump Station for expansion of the TMWA water system.
- Improved fire flow to at least a half dozen sites that had legacy low fire flows that were below current TMWA preferred design fire flows.
- Washoe Flume Reconstruction to repair storm damage and allow Washoe Hydroelectric facility to continue to operate, offsetting water system power costs.
- As part of the asset management and reliability program, TMWA has continued to replace and rehabilitate a multitude of tanks, pressure reducing stations, water mains, telemetry and data system, and other supporting infrastructure.

Major facility challenges facing TMWA in the future include expanding conjunctive surface and groundwater use in the region; potential treatment of poor quality groundwater (primarily nitrate removal) in Spanish Springs; expanding supply capacity to the South Truckee Meadows; replacement of backbone transmission mains in the gravity zones; consolidation of multiple pump systems into “super” pump stations; assisting with the development and permitting of Nevada’s first Advanced Purified Water Treatment Facility; construction of Orr Ditch Pump Station Rehabilitation and Hydroelectric Facility; and continued expansion of the water system into the Verdi area.

Based on the planning and analysis presented herein, staff is recommending improvements summarized in Appendix D. The following table presents estimated costs for projects anticipated to occur in the 2020 to 2040 planning period and it includes projects that do not have an assigned completion dates (“TBD”).

Water Facility Expenditures 2020-2040

Facility Category	Total Cost	Cost Allocated To Growth
Supply	$ 178,600,000	$ 99,100,000
Storage	$ 37,200,000	$ 18,500,000
Distribution	$201,800,000	$ 76,500,000
Totals	**$417,600,000**	**$194,100,000**

The types of project costs not allocated to growth include improvements to fire hydrants with historically low fire flows, existing system reliability improvements, replacement of existing wells, storage for existing customers, zone conversions, and major main replacements. Other supply project costs not allocated to growth include the proposed Spanish Springs Nitrate Treatment Plant that will treat existing groundwater supplies. Not included in these costs are smaller rehabilitation projects, replacement in kind activities, developer specific facility construction, nor projects that occur beyond the year 2040.

SECTION 2

WATER USE AND DEMANDS

BASE CASE DEMAND

Before future demands can be considered in the planning process, a base case condition needs to be established which accurately quantifies and distributes existing demands by geographic location. For this WFP, the billing data for 2021 has been established as the base case condition of average daily usage. Since the completion of the previous WFP, the 2021 billing data was the most recent complete data set that represented an average year that had reasonable weather and minimal post COVID-19 pandemic shutdown impacts.

To be conservative, this WFP assumes a 10 percent non-revenue water (or unaccounted for water) use factor even though previously completed mass balance analysis indicated a lower value.

Future maximum day demand projections were based on TMWA's 2020-2040 Water Resource Plan (WRP) estimated regional growth curve with an estimated cumulative growth of 14.4% by 2040. Distribution of the estimated cumulative regional growth within TMWA's service territory is not uniform since older neighborhood will grow less than newer areas. The following sources of information were used to help spatially distribute the predicted growth: (1) Truckee Meadows Regional Planning 2020 Growth Forecast; and (2) TMWA New Business Inquiries that remain unbuilt consisting of 129 projects. Using these sources of information, and engineering judgement, the estimated maximum day demand growth in each planning period was spatially allocated within TMWA's service territory. Additional details of the maximum day demand projections and methodology used for the 20-year planning period of the 2020-2040 WFP is included in Appendix A.

UNIT DEMANDS & PEAKING FACTORS

With system-wide billing data linked to the Geographic Information System (GIS) mapping system it is possible to establish average unit demand factors for each service/parcel and to compile the average monthly demand for each rate class within specific pressure zones. In the past, daily meter reads obtained during the peak summer months provided data for establishing average day to maximum day peaking factors; however, daily meter read studies have not been performed in recent years. As a result, water production data and changes in storage volumes acquired by the Supervisory Control and Data Acquisition (SCADA) system for the South Truckee Meadows and the pre-merger TMWA system were analyzed to establish peak day consumption values. These peak day values and average monthly metered use data were then utilized to generate a peak day to maximum month peaking factor. The average value produced by this analysis was a peaking factor of 1.15. Application of this peaking factor to average day of max month metered use data allows the establishment of the maximum day demand. The average day to maximum day peaking factor for each rate class as shown in Table 1 below.

TABLE 1

AVERAGE USE & PEAKING FACTORS BY RATE CLASS

Rate Code	Description	Avg Day Demand (gpm)	Max Day Demand (gpm)	Max Day Peaking Factor
GMWS	Commercial	1.42	2.24	1.58
MIS	Metered Irrigation	2.16	5.48	2.54
MMWS	Metered Multi-Unit Residential	0.10	0.14	1.37
RMWS	Metered Residential	0.38	0.74	2.13

Notes:

1. Average Day Demands are 2012 metered use data plus 10% non-revenue loss factor.
2. Max Day Demands are Average Day of Max Month x 1.15 Peaking Factor.
3. Max Day to Average Day peaking factors are the average for 2010-2013.
4. Residential demands are based on the system wide median value. Residential MDD is calculated on a lot-size basis to account for domestic + irrigation.

Historically, the system wide maximum to average day peaking factor has been in the range of 1.9-2.0, but in recent years there appears to be a trend that is slightly reducing this peaking factor. The system wide usage data has indicated increased annual average usage that would correlate with continued regional development and water service growth, but system maximum day demands have generally shown slower growth than what would be expected. Table 2 shows the maximum day of water production for the last 18 years.

TABLE 2 - HISTORICAL PEAK DAYS

Year	Peak Day	Demand (MGD)
2005	Wednesday, July 20	148 (1)
2006	Wednesday, July 26	141
2007	Wednesday, August 1	137
2008	Wednesday, July 9	133
2009	Sunday, July 26	129
2010	Tuesday, July 20	123 (2)
2011	Tuesday, August 9	120
2012	Thursday, July 12	126
2013	Sunday, July 21	121
2014	Thursday, July 3	120 (3)
2015	Tuesday, August 18	126 (3)(4)
2016	Tuesday, August 2	140
2017	Tuesday, July 18	140
2018	Tuesday, July 17	145
2019	Tuesday, July 23	145
2020	Wednesday, Aug 5	142 (5)
2021	Tuesday, July 13	149
2022	Friday, July 28	148
2023	Tuesday, July 25	145

(1) Highest peak day demand recorded prior to adding Washoe County system (back to back 107 degree days).
(2) 3-days per week irrigation schedule implemented in 2010
(3) Drought year – water conservation requested
(4) Merger completed - County demands (17.9 MGD) included
(5) Decrease in peak demands likely due to impacts from Covid restrictions

Utilizing rate class specific peaking factors improves the accuracy of maximum day estimates by pressure zone since each zone has a specific mix of various use categories. Peak hour demands are estimated by multiplying the maximum day demand by a peaking factor. Experience has shown that the peak hour factor will range from about 1.3 to 2.0 depending upon the level of mixed use in the zone. Analysis of metered use data from zones with reasonably accurate flow metering and either mixed use or 100 percent residential use suggests that a zone with 100 percent single family residential will have a peak hour multiplier of about 1.8 to 2.0, while a 50 percent single-family residential allocation will be closer to 1.3. Without zone specific hourly demand information, it is necessary to validate the assumed hourly peaking factors by calibration of the hydraulic model against available historical SCADA data. TMWA is in the process of upgrading water customer meters with Advanced Metering Infrastructure meters that will provide hourly usage data that will allow for additional system wide verification of peaking factors. This meter upgrade process is still several years from completion.

UNACCOUNTED FOR LOSSES

Unaccounted for water is typically reported or estimated as 7-15 percent for the water utility industry, with 10 percent being a commonly reported value. Unaccounted for water includes demand from hydrant testing, unauthorized use, leakage and meter inaccuracy or failure. The selected 10 percent unaccounted for value used in this WFP is considered conservative since mass balance calculations indicate the actual losses are less. However, the mass balance method is only as good as the accuracy of metered source pumping or water production flow values as compared to metered consumption data. Water meters have a range of anticipated accuracy which can be impacted by meter age and service conditions. Compounding inaccuracies in older meters operating under predominately low flow conditions can reach a level of 10-20 percent degradation in accuracy. TMWA does have an active asset management program that includes a street repaving main replacement program and critical/prioritized main replacement program to maintain system reliability and minimize potential system leaks and failure. Also, TMWA aggressively pursues repairing leaks and sources of leakage when reported or discovered. The current smart meter replacement program should also help reduce water losses by identifying potential leaks on the customer side much more quickly.

SECTION 3

TREATED WATER STORAGE

Treated water storage serves several purposes. Storage is provided to equalize the demand on the water supply over a daily period. Storage is also relied upon to provide water to meet fire suppression requirements, provide a degree of operational flexibility when maintenance and repair of treatment and supply facilities are necessary and provide system reliability in emergency situations. Total Storage requirements consist of Operating, Emergency and Fire Storage components.

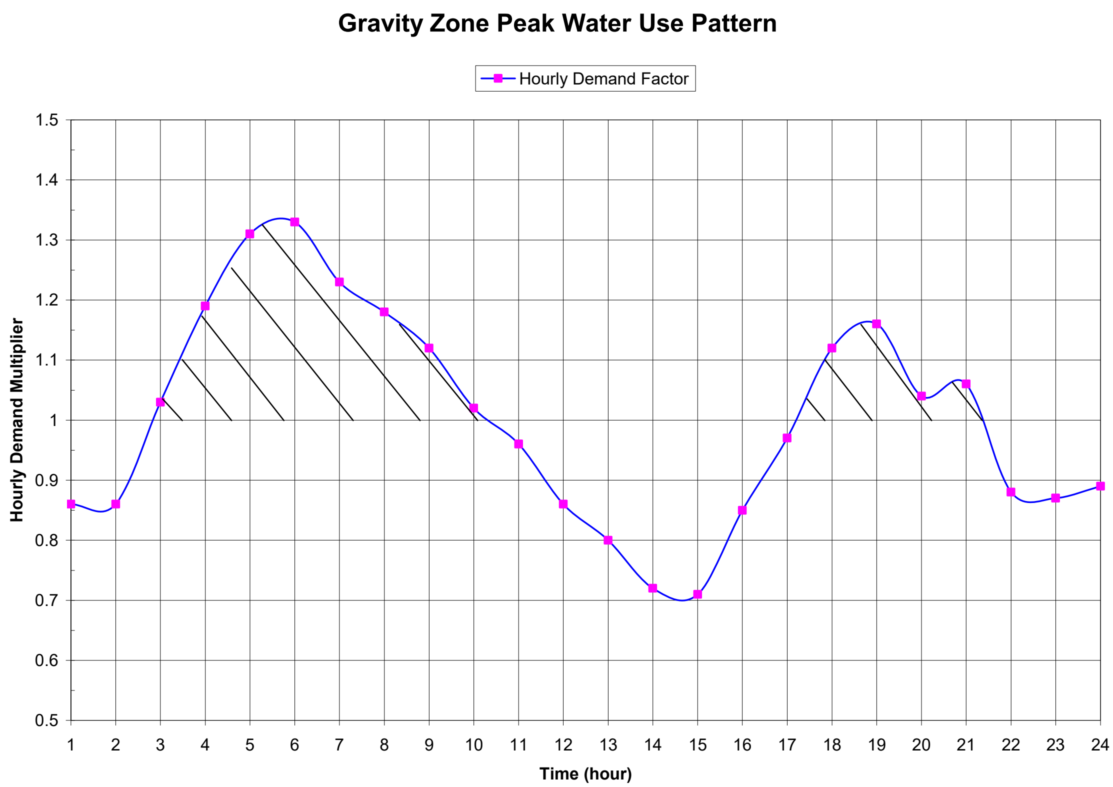
There are several sections of the NAC 445A regulations that are directly applicable to operating, fire and emergency storage components; however, there are also sections pertaining to "capacity" that include combinations of treatment, storage and pumping capacities under various demand conditions. The sections that apply to storage only will be referenced below and the general or combined capacity sections will be referenced in a later section of this WFP.

OPERATING STORAGE

NAC 445A.6672, .6674 and .66745 address operating storage. Operating storage is necessary to supply peak water demands that exceed system production capacity from treatment plants, wells and pump stations. Constructing supply and treatment facilities with sufficient capacity to meet instantaneous peak water demands is inefficient and uneconomical since a significant amount of plant capacity will remain idle for a majority of the time. In addition, most treatment processes are not amenable to rapid and constant changes in flow rate. TMWA supply, treatment and pumping facilities are designed to meet maximum day demands. Therefore, operating storage requirements are based on the volume of water needed to supply peak demands that exceed the average demand on the maximum day of use.

Selection of the desired operating storage volume is highly dependent upon production or pumping capacity, the time of pumping for pumped storage systems and the magnitude of the hourly variation in water use. With a metered supply source and accurate tank levels, a demand curve showing the hourly variation in demand over a 24-hour period can be plotted for any pressure zone as presented in Figure 2 below. For the maximum day scenario, the y-value of 1.00 (100 percent) represents the average demand on the maximum day and, for TMWA, also represents the "design" production and/or pumping rate. The area under the curve above the y-value of 1.00 (see hatched area) represents the volume of operational storage that should be provided to meet the hourly demands that exceed the available production or pumping capacity. Analysis of the diurnal demand curve for TMWA's gravity zones in 2010 (Figure 2) indicates a need for only about seven percent (7%) of the average demand as operational storage assuming a steady supply equal to the maximum day demand. It should be noted that the seven percent value is somewhat conservative since it does not reflect the areas under the y-value of 1.00 (but above the curve) where operational storage is being replenished. To provide some flexibility for equipment outages and supply disruptions, TMWA provides 15% of the maximum day demand of the tank zone as the operating storage component.

Figure 2



A decision to provide more than 15 percent of the maximum day demand as operational storage depends on several factors including the estimated peak hour demand, the physical ability to pump at rates greater than the max day, the economic benefits of employing off-peak pumping, the incremental cost of the larger tank, and whether redundant capacity is unavailable making it necessary to rely on a 100 percent equipment utilization factor during the peak use period. In any zone, if the steady supply is compressed into a 12-hour period (or less), as for off-peak pumping, the required operating storage volume can easily reach between 30 and 50 percent of the maximum daily use. The trend in electric rates over the last 15 years has been to shift more costs from the old demand charge component to a new facility charge component. The facility charge is based on connected kW load and is applicable when any of the equipment is operated during the month. If the trend continues, there will be less and less incentive to perform off-peak pumping. Since development within a new tank zone normally takes a significant period of time to reach buildout, the lower turnover rate of the large volume of stored water can create taste, odor and other water quality problems such as disinfection byproducts. Therefore, there is less motivation to provide excess storage beyond what is absolutely required to operate the system in a safe and reliable manner in compliance with regulations. The incremental first cost of additional operational storage primarily depends on excavation and grading requirements for the site, which is normally relatively small. However, due to the previously discussed factors, it is concluded that a minimum operational storage component equal to 15 percent of the max day demand is appropriate in most cases. Operational storage is provided for all demand classes, including wholesale demands, unless positive flow control can limit or cap the wholesale maximum day demand.

FIRE STORAGE

Subsection 2 of NAC 445A.6674 states that fire storage requirements must be calculated according to the requirements of the fire authority and that the health authority shall evaluate the design of a public water system based upon appropriate documentation of those requirements.

Fire storage is provided for the welfare of the general public so that water for fire suppression is available at all times. Required fire flows are assigned to new development projects by the local fire protection agency having jurisdiction in the area based on the International Fire Code (IFC). The evaluation process takes into account several factors including type of construction, flammability of construction materials and square footage of the structure. Storage for fire protection is calculated by multiplying the required fire flow by the required time necessary to control or extinguish the fire. Since water storage facilities generally serve widespread areas containing mixes of commercial and residential uses, the required fire storage volume for a particular area or pressure zone must be based on the largest fire flow demand within that area. All three local fire agencies (City of Reno, City of Sparks, Truckee Meadows Fire Protection District) have adopted a version of the International Fire Code (IFC) to set required fire flow. Typical fire flow requirements in the Reno-Sparks area are 1,500-2,750 gallons per minute (gpm) for residential, 3,000-3,750 gpm for commercial, and 4,000+ gpm for large industrial developments. These fire flow demands are inclusive of internal fire sprinkler system supply which may reduce the required hydrant flow, but usually not the overall fire flow demand. The required fire flow duration is a function of the required flow and can vary from two hours for flows up to 2,750 gpm, up to four hours for a fire flow of 4,000 gpm.

Fire storage requirements for existing pumped storage systems must be addressed on a zone-by-zone basis and are based on the largest fire flow requirement in that zone. In each of TMWA’s major gravity zones, a fire flow demand of 4,000 gpm for four hours is provided. In continuous pumping zones without storage facilities, it is assumed that fire storage is provided from the zone providing suction supply to the area, which may be a tank or a gravity zone reservoir. Fire storage for multiple simultaneous fire flow demands in the same zone are not explicitly provided or planned for; however, this level of redundancy could be accommodated through use of emergency storage reserves. In zones with multiple storage tanks, fire storage can be distributed as long as the total requirement is met and the storage is accessible. Fire storage does not necessarily have to be provided for wholesale customers that maintain their own storage facilities.

Historically, going back to the 1970's when significant growth began to occur in the region, required fire flow for residential development in the unincorporated areas was on the order of 500 gpm. Even into the early 2000's, region-wide residential fire flow was no larger than 1,200-1,500 gpm. The larger fire flow requirements for in-fill projects located in fully developed areas can be very problematic – especially when storage tanks were sized to meet much smaller fire flows and space for an additional tank is non-existent. Even if it is possible to continuously reallocate excess storage to the fire storage component, the physical limitations (hydraulic constraints, hydrant and water service elevations, etc.) of the distribution system may not provide enough capacity to deliver the higher fire flow.

EMERGENCY STORAGE

NAC 445A.6675 and NAC 445A.66755 apply to emergency storage requirements. Emergency storage provides water for domestic use when equipment fails, distribution or treatment facilities are inoperable, or when natural disasters or emergency conditions curtail normal water supplies. The magnitude of this storage component depends on the susceptibility of system components to failure, the time needed to obtain replacement parts and make repairs, the reliability and diversity of supply sources, system operational constraints which could affect the availability of alternate supplies, and the physical configuration of the system which could affect the ability to transfer supply from zone to zone.

TMWA's current design standard is to provide an emergency storage reserve equal to at least one average day of use. Based on the estimated 2040 maximum day demand and an overall 1.9:1 max day to average day peaking factor, the 2040 average day demand should be on the order of 93 MGD. As for the other storage components, it is necessary to evaluate emergency storage requirements for existing pumping zones and pumped storage systems on a zone-by-zone basis since it is necessary to determine whether there is a physical means to deliver additional supply from, or transfer surplus to, adjacent areas.

Curtailment or unavailability of surface water supplies due to a non-persistent contaminant spill in the Truckee River is a realistic, but low probability threat. TMWA is fortunate to have a diverse water supply consisting of both surface water and groundwater. The minimum water supply necessary to meet the essential sanitary and culinary needs of the community is approximately equal to the total system demand on a typical winter day (indoor use only). Based on historical records, this demand level is about 50 percent of the average day demand for the year. Given the difficulty of reducing demands during the summer to indoor water use only in a very short period of time, TMWA plans on supplying the system wide average day demand that is approximately 53% of system wide maximum day demands. Under this scenario, the 2025 groundwater production capacity of about 103 MGD (contiguous Truckee Meadows area) is adequate to supply the essential water needs of the community during an emergency situation where the surface water supply is temporarily unavailable. The 103 MGD of groundwater capacity could theoretically provide a minimum emergency supply to a system with a maximum day demand of about 194 MGD. In 2040, it is estimated that TMWA will have a groundwater production capacity on the order of 114 MGD during this operational scenario.

Another reliability concern is the ability to treat highly turbid river water. Historically, summer thunderstorms in the Gray Creek and/or Bronco Creek drainages of the Truckee River have produced extreme raw water turbidities during times of very high water use. This issue was originally addressed and evaluated during the planning phase for conversion of the Hunter Creek and Highland treatment plant sites to treated water storage facilities. The decision to implement solids handling processes at the Glendale WTP resulted in a reduction in recommended emergency storage volume at Hunter Creek and Highland, but significantly increased the reliability of the surface water treatment plants. Based on the available record, the worst turbidity event on the river occurred during the period of 7/15/92 to 7/21/92, producing average 3-, 5- and 7-day raw water turbidities of 1051, 874 and 543 Nephelometric Turbidity Units (NTU's, a measure of water clarity), respectively. Both surface water treatment facilities are capable of treating and handling an average total suspended solids (TSS) loading of about 1300 mg/L (1 TSS ≈ 1 NTU in this range) for four days. If raw water and water recovery basins are expanded (planned in conjunction with construction of Chalk Bluff Phase 4), the average solids handling capability of the Chalk Bluff WTP would be increased slightly to a level of about 1750 mg/L for the four-day design period. It is noted that during the initial 8-12 hours of a significant (i.e. magnitude and duration) turbidity event, it is anticipated that surface water production will be reduced appropriately to allow process refinement and necessary adjustments to be made. Under these assumptions, a significant amount of system wide emergency storage would be required along with all available groundwater capacity.

EVALUATING EXISTING STORAGE VOLUMES

Because storage design/sizing criteria and required fire flows change over time, TMWA's storage requirements for existing pumped storage systems must be addressed on a zone-by-zone basis. Fifty percent of TMWA's storage tanks were designed and constructed more than 28 years ago under criteria (fire flow, development projections, zone boundaries, unit demands, tank sizing philosophy, etc.) which were undoubtedly different than those in use today. For these reasons, some systems may not have the storage volume desired under <u>current</u> design criteria.

Due to the critical nature of the emergency and fire storage components, it may be reasonable to assume that the operating storage component would provide some flexibility when faced with a storage deficit. Based on the previously discussed sizing criteria, some flexibility is provided with an operating storage component equal to at least 15 percent of the average maximum day demand. For existing zones, one possible methodology to establish whether adequate storage exists consists of subtracting the required emergency storage volume and the required fire storage volume from the total storage available to yield the available operating storage component. Under this methodology, if the available operating storage volume is less than 15 percent of the maximum day demand, it may be necessary to increase alternative pumping capacity, add storage, or construct interties with adjacent zones having excess capacity. Unless the original tank site can accommodate a second tank, it is usually very difficult and sometimes impossible, to acquire suitable property (due to zoning and elevation constraints, permitting issues, etc.) to construct additional storage tanks in areas of existing development. If an accurate daily demand curve has been developed for the zone from meter and tank data, the necessary incremental volume between the max day and peak hour demands can be determined; however, this bare minimum operating volume would not provide any buffer should there be a disruption in supply.

Alternatively, if total storage required exceeds the storage provided under normal sizing criteria, the deficiency can be assigned to excess storage capacity in an adjacent tank zone, or at one of the large gravity zone reservoirs depending on whether alternative pumping capacity is provided.

CURRENT STORAGE REQUIREMENTS

As previously discussed, overall system storage values do not reflect the requirements within specific pressure zones. A storage surplus in a particular tank zone may not provide any benefit if it is not possible to transfer that surplus to areas with deficiencies. In general, TMWA pressure zones are backed up by at least one regulated intertie supplied by gravity flow from higher elevation tank zones. The following presents an analysis of 2025 storage requirements for the major gravity and pumping systems.

<u>2025 SYSTEM WIDE STORAGE</u>

From a system-wide standpoint, in 2025, approximately 136 million gallons (MG) of storage will be required and about 174 MG of storage will be provided, producing an apparent storage surplus of about 38 MG. The available storage does not include treatment plant tanks used as chlorine contact chambers. Surplus storage in one tank zone is not necessarily available to other tank zones with storage deficiencies; however, surplus storage in the Hunter Creek and Highland reservoirs is physically available to other "downstream" zones. A macro-level analysis of the 2025 storage requirements for the major gravity zones and geographical areas is summarized in Table 3.

Table 3 - 2025 SYSTEM-WIDE STORAGE REQUIREMENTS

Zone or Geographical Area	Total Storage Provided (MG)	Minimum Storage Required (MG)	Storage Surplus or (Deficit) (MG)
Hunter Creek Gravity	34.0	3.4	30.6
Highland Gravity	25.5	20.6	4.9
Sparks Gravity	6.0	20.3	(14.3) (1)
Southwest Reno	11.4	10.2	1.2
North Reno	29.3	20.9	8.4
Northwest Reno	22.1	17.2	4.9
South Truckee Meadows	23.8	24.6	(0.8) (2)
NE Sparks/Spanish Springs	21.7	18.9	2.8
TOTALS	**173.8**	**136.1**	**37.7**

Notes:
1. Surplus storage in the Hunter Creek Reservoir is readily available to the Sparks Gravity zone via gravity flow primarily through the Urban, Nixon and Prater Regulating Stations and several other smaller pressure regulating stations.
2. Alternative pumping capacity from wells and pump stations supplied from Gravity Zones with excess storage volume satisfy deficient storage volumes in this region.

2025 INDIVIDUAL TANK ZONE STORAGE

Major pumped storage systems that take suction directly or indirectly off the gravity zones were congregated into the geographical areas listed in Table 3. The 2025 storage tables in Appendix C present the results for each major pumping system located in these geographical areas. The storage tables break down the required storage volume for each system into operating, fire and emergency components. Well production, alternative pumping capacity and interties to adjacent systems are identified. Surplus storage and storage deficits are discussed below along with a high-level description of water supply to the area.

Southwest Reno

The Southwest Reno area includes Caughlin Ranch, Skyline, pumping systems south of West Plumb Lane and Lakeridge/Ridgeview. Although the Highland Gravity zone provides suction supply to the Lakeridge/Ridgeview System, the supply comes from the Hunter Creek Reservoir through the Nixon/Monroe and Urban/Plumas regulators. The remainder of the Southwest area is supplied directly from the Hunter Creek Reservoir. Due to its elevation, the 3.0 MG Caughlin Ranch Tank is capable of supplying water to the entire area under emergency conditions. Under a normal service scenario that now includes most of the old continuous pumping zones in the Southwest Reno area, the Caughlin Ranch Tank contains a small surplus. However, under an area-wide power outage, the tank is also required to supply the Daniel Webster continuous pumping system and the Markridge 2 continuous pumping zone. In addition, there is a storage deficiency in the Ridgeview/Lakeridge Tank Zone that needs to be addressed.

By 2025, the Southwest area shows an overall storage surplus of 1.2 MG. Depending on the extent of a power outage in the area, the Ridgeview/Lakeridge deficit can be greatly reduced by excess storage in the Skyline 1 & 2 tanks, but a normally closed valve on Dant would need to be manually opened. In addition, the Lakeside Well (0.9 MGD) discharges directly into the Lakeside/Plumas Zone.
There are several options available to correct or modify the future storage deficiencies in the area. One option would be to add standby power to the proposed Southwest pumping system which would ultimately deliver water to both the Lakeridge and Ridgeview tanks. Another recommended alternative is to add a 1.4 MG storage tank to the existing Caughlin 5 continuous pumping zone when the upper part of the zone develops. Another option to reduce the deficit will become available with future phases of The Ridges development above Plateau Road, which will complete an emergency intertie to the Caughlin 3 zone from The Ridges Tank.

North Reno

The North Reno area includes the area surrounding the Highland Reservoir (UNR to Keystone Ave.), Sun Valley, Valley Road, Socrates, North Virginia, Stead, Silver Lake, Horizon Hills and Lemmon Valley. There are two major pumping systems that provide redundancy and operational flexibility to the area. One is the North Virginia/Stead pumping system which takes suction from the Highland Reservoir and discharges into the Raleigh Heights storage tanks (8 MG total) through about six miles of high pressure 36" and 30" transmission main. From the hydraulic hub of the Raleigh Heights tanks, water can be delivered by gravity flow to Stead/Silver Lake, Lemmon Valley, Sun Valley, Socrates/Valley Road and the entire North Virginia corridor. The other major pumping system is the Fish Springs groundwater importation system which can currently deliver up to 8,000 acre-feet per year (AFA) to the 2.5 MG Terminal Tank located in the north end of Lemmon Valley. The Terminal Tank discharges through about ten miles of 30" and 24" high pressure transmission pipe in Lemmon Drive. This pipeline can serve the entire Lemmon Valley area via pressure regulated interties and ultimately connects to the North Virginia system via a SCADA controlled valve station at North Virginia Street and Lemon Drive. This station allows Fish Springs water to be supplied by gravity flow to Stead/Silver Lake and the entire North Virginia corridor. The intertie also allows Raleigh Heights storage to back up the Fish Springs supply and may also supply Fish Springs water to future growth in Cold Springs.

With current facilities and no new improvements, the storage deficit in the Sun Valley system will be about 0.7 MG by 2025 (existing alternative pumping capacity exceeds deficit). This deficit will be erased through construction of the proposed Sun Valley #2 tank (scheduled to be in service in 2027). An apparent deficit of 0.4 MG in the Stead/Silver Lake system is resolved by allocating a portion of the Raleigh Heights Tanks storage surplus to the deficit through a regulated intertie. In addition, the Stead/Silver Lake system has about 5 MGD of groundwater capacity backed up by standby generators and Lemmon Valley has about 2.4 MGD of groundwater capacity (dual electric circuits). Ultimately, when the Fish Springs resource is fully dedicated, about 1.5 MG of operating storage will be required at the Terminal Tank to meet peak demands on the system. A second 2.5 MG Terminal tank is proposed for 2029 depending on the rate of actual growth.

Northwest Reno

This area includes West Seventh St, Kings Row, Northgate, Somersett, Mogul, Verdi and Boomtown. The primary supply for the area comes from the Hunter Creek Reservoir and the Chalk Bluff WTP effluent pumps. The Northwest mostly consists of two pump trains providing supply to the region: (1) the west side consisting of the US 40 and Mae Anne pump train; and (2) the east side consisting of the Chalk Bluff and Mae Anne/McCarran pump train. The Northwest system is highly interconnected and has a large amount of alternative pumping capacity with standby generators at Chalk Bluff, Mae Anne/McCarran, Beaumont and Somersett pumping systems. An overall storage surplus of about 4.9 MG is anticipated for 2025 in the Northwest Reno area and all tank zones have adequate emergency supply. New storage is planned for the Verdi, Boomtown and US 40 areas when the area west of Somersett and south of Boomtown develops. The Boomtown system also has about 1.3 MGD of groundwater capacity.

South Truckee Meadows

The South Truckee Meadows (STM) area consists of a lower area that includes Hidden Valley, Longley/South Virginia, Double Diamond and STMGID East and an upper area which includes STMGID West and the Arrowcreek/Mt Rose/St James systems. From the Double Diamond area, the service area rises over 2000 feet in elevation, topping out at the Mt. Rose 3 tank which has an overflow elevation of about 6680 feet. Except for the Longley/South Virginia system, all STM water systems were formerly owned and operated by Washoe County. Historically, the Hidden Valley system was supplied with TMWA surface water; however, in 2007 a groundwater treatment plant was constructed by the County that became the primary source of supply to the area. After the merger of TMWA and County water systems in 2015, the treatment process was deactivated and the facility's effluent pumps are used to deliver surface water to Hidden Valley. Historically, the Double Diamond and STMGID East systems were supplied with TMWA wholesale surface water, but the systems located on the upper Mt. Rose fan relied 100 percent on local groundwater supply.

By 2025, the lower area shows an overall storage surplus of about 0.5 MG. An apparent storage deficit in the Zolezzi tank is satisfied with alternative pumping capacity (generator) at the South Hills pump station. The lower area also has about 6.7 MGD of groundwater capacity.

The upper area shows an overall storage surplus of about 1 MG in 2025. The upper zones are highly interconnected, but generally in a one-way direction via gravity flow through pressure regulating stations. Without considering alternative pumping capacity, there are minor storage deficits in the Arrowcreek 1 tank zone and in the Mt. Rose 1/4 tank zone depending on the fire storage requirements. A more significant storage deficit of about 0.6 MG will exist in the STMGID 4/5 zone. However, this deficit is satisfied with alternative pumping capacity from the STMGID 6 Well (with a standby generator).

Northeast Sparks & Spanish Springs Valley

Northeast Sparks (NES) is made up of D'Andrea, The Vistas, Wingfield Springs and Kiley Ranch. The Spanish Springs Valley (SSV) area consists of the Spring Creek and Desert Springs areas. The primary supply to the NES systems comes from the Glendale WTP. All NES systems have alternative pumping capacity backed up by standby generators. The SSV systems receive a baseload supply of surface water through interties at Lazy 5 and Campello. Groundwater peaking supply to both NES and SSV areas consists of about 10.1 MGD of local groundwater production wells.

In 2025, an overall storage surplus of about 2.0 MG is forecast for the NES systems. There are no single zone deficiencies to address; however, there are three continuous pumping zones in the area.

The SSV area also shows an overall storage surplus in 2025. There is a minor storage deficiency in the Spring Creek 3/4 tank zone, but there is also 3.7 MGD of alternative pumping capacity (dual circuits) from wells within the zone. Surplus storage can also be moved from the upper zones to Spring Creek 3 & 4 Tank Zone by regulated bypass.

Satellite Systems

Five satellite (non-contiguous to PWS190) water systems were acquired as a result of the merger. Three of them (Sunrise, Old Washoe Estates, Lightning W) are located in the Pleasant Valley and Washoe Valley areas south of Reno. The Truckee Canyon system is located at Mustang just east of Sparks and the Stampmill system is located near Wadsworth. There are minor storage deficiencies at Sunrise and Lightning W, but the deficiencies are mitigated by alternative pumping capacity (standby generators) at the wells.

Continuous Pumping Zones

The Wingfield Hills, Satellite Hills, Point View, Queen, Longley and Huffaker pump zones operate as continuous pumping zones. Future development in the Vistas is anticipated that will allow for a main tie between the Vista 3 Tank and the Wingfield Hills Pump Zone. The Vista 3 Tank was oversized for the Wingfield Hills demand when the tank was constructed in 2008. Currently, several check connections allow backup from the Spanish Springs 2 Tank and Pump System. The Satellite Hills Zone has several interties and emergency storage for the zone is contained in the Vista System Tanks. The Point View pump zone receives some emergency protection from a check valve intertie to the discharge side of the Pyramid Pump Station, but pressure at the top of the zone is less than 10 psi. The Queen Zone is provided backup from the Wedekind 1 Regulated Zone intertie and by a check connection to the Sparks Gravity Zone. The Longley pump station has a 288 kW standby generator and the zone is also backed up by interties to the Double Diamond system at South Meadows Parkway and at The Alexander Apartments. The Huffaker pump station is equipped with a 150 kW standby generator.

FUTURE STORAGE REQUIREMENTS

2040 SYSTEM WIDE STORAGE

From 2025 to 2040, the total maximum day demand (MDD) is anticipated to increase by 22.3 MGD. From a system-wide standpoint, in 2040, approximately 147 MG of storage will be required and about 192 MG of storage will be provided, producing an apparent storage surplus of about 45 MG. As noted in the previous section, surplus storage in one tank zone is not necessarily available to other tank zones with storage deficiencies; however, surplus storage in the Hunter Creek and Highland reservoirs is physically available to other "downstream" zones. A macro-level analysis of the 2040 storage requirements for the major gravity zones and geographical areas is summarized in Table 4.

Table 4 - 2040 SYSTEM-WIDE STORAGE REQUIREMENTS

Zone or Geographical Area	Total Storage Provided (MG)	Minimum Storage Required (MG)	Storage Surplus or (Deficit) (MG)
Hunter Creek Gravity	34.0	3.4	30.6
Highland Gravity	29.5	20.9	8.6
Sparks Gravity	6.0	21.1	(15.1) [(1)]
Southwest Reno	12.8	10.7	2.1
North Reno	34.3	24.6	9.7
Northwest Reno	22.6	18.1	4.5
South Truckee Meadows	32.1	28.7	3.4
NE Sparks/Spanish Springs	24.4	22.5	1.5
TOTALS	**195.7**	**150.0**	**45.7**

Notes:

1. Surplus storage in the Hunter Creek Reservoir is readily available to the Sparks Gravity zone via gravity flow primarily through the Urban, Nixon and Prater Regulating Stations and several other smaller pressure regulating stations.

The system-wide storage surplus forecast for 2040 is very similar to the surplus indicated in Table 4 for 2025. This is because most of the growth is anticipated to occur in the foothills surrounding the Truckee Meadows and each project will be required to construct and dedicate storage facilities. The 2040 storage table includes 14 new storage tanks in the areas where this growth is expected to occur. In addition, 4 MG of storage will be added to the Highland Gravity zone to increase reliability (Highland Reservoir maintenance outage backup).

2040 INDIVIDUAL TANK ZONE STORAGE

The 2040 storage tables in Appendix C present the results for each tank zone located in the geographical areas listed above. The storage tables break down the required storage volume for each system into operating, fire and emergency components. Well production, alternative pumping capacity and interties to adjacent systems are identified. The discussions below will not repeat the information already presented in the 2025 storage section, but will focus on changes and modifications to system storage in each area.

Southwest Reno

By 2040, without additional storage facilities or improvements, the Southwest area will have an overall storage surplus of about 0.7 MG. Storage will be increased by providing alternative pumping capacity at the proposed Southwest pump station (standby generator) and the addition of a storage tank in the Caughlin 5 pump zone. The proposed Southwest pump station is included in the current 5-year CIP with construction beginning in FY 2027 and having an in-service date of FY 2029. The proposed tank in the Caughlin 5 zone is included in the storage table and is subject to the schedule of new development in the area; however, it is very likely that this growth will have occurred by 2040. The proposed emergency intertie to the Caughlin 3 zone from The Ridges tank is also likely to be in place by 2040, but the primary purpose of the tie is to provide fire flow and emergency support.

North Reno

With the addition of the Sun Valley 2 tank and a new tank with a location to be determined (potentially in Silver Hills Development, west of Stead Airport), there will be a storage surplus of about 8 MG in the North Reno area by 2040. A second Terminal Tank will probably be added by this time, but the volume will be required as operating storage to meet peak demands on the constant baseline flow from the Fish Springs system, so it is not included in the total.

Northwest Reno

An overall storage surplus of about 4.5 MG is anticipated by 2040 in the Northwest Reno area and all tank zones will have adequate emergency supply. The storage surplus will eventually decrease as new demand is added in the Verdi area. By 2040, new storage tanks are anticipated within Santerra Quilici (south of Boomtown), Mortensen Ranch (west of Somersett), and US 40 areas.

South Truckee Meadows

By 2040, the lower area shows an overall storage surplus of about 2 MG. It is likely that additional storage will be required in the Double Diamond area to satisfy an apparent deficit there, but an intertie to a slightly oversized tank in an area above (Toll Tank) would also work. The upper area shows an overall storage surplus of about 1.2 MG in 2040. The minor storage deficits in Arrowcreek 1 tank zone and in the Mt. Rose 1/4 tank zone may require additional storage depending on the fire storage requirements. Interties to other tank zones may also eliminate the deficits.

Northeast Sparks & Spanish Springs Valley

In 2040, an overall storage surplus of about 1.58 MG is forecast for the NES/SSV systems. Additional storage is proposed for the Desert Springs 3/Spring Creek 6 zone of SSV.

Satellite Systems

Minor storage deficiencies in the Satellite Systems can be mitigated by alternative pumping capacity (standby generators) at the wells, but it may be prudent to add smaller second tanks at these locations to provide storage for extended maintenance events such as when the primary tank requires recoating.

SECTION 4

GROUNDWATER RESOURCES

TMWA utilizes groundwater as a seasonal peaking supply and as a drought reserve. Groundwater use is subject to annual withdrawal limits set by the State Engineer. Under a conjunctive use approach, the State Engineer, under Order 1161, has authorized TMWA to pump (original TMWA wells) up to 16,000 acre-feet per year (AFA) during non-drought years and up to 22,000 AFA for three consecutive years during drought periods. The allowance for 22,000 AFA during drought periods is predicated upon TMWA having “banked” sufficient volumes of water either through ASR, or by using less than 16,000 acre-feet per year during non-drought periods. These totals have since been added to with additional wells and water rights joining TMWA’s system since the issuance of Order 1161.

As a result of the 2015 merger with Washoe County, TMWA inherited an additional 34 active production wells contiguous to the original TMWA water system. The resulting groundwater rights associated with both the original TMWA wells and the Washoe County inherited wells in the contiguous main TMWA water system is on the order of 43,527 acre-feet. TMWA has consistently been able to manage its groundwater pumping to meet this requirement. In the extremely dry drought year of 2015, TMWA pumped 24,510 AFA (combined/merged system) and recharged 3,873 AFA.

A number of the County wells were the sole source of supply for systems located on the upper Mt. Rose fan (Basin 88). Due to the required continuous operation to meet system demands, water level declines in some of these wells approached 80 feet over the previous ten years. Because of the magnitude of the declines and the number of domestic wells in the area, Washoe County established a domestic well mitigation program in the area where municipal pumping was concentrated. Post-merger, TMWA inherited the mitigation program and has prioritized efforts to implement a conjunctive use management plan for the Mt. Rose fan that includes the recently completed Mt. Rose Water Treatment Facility.

Groundwater use is also subject to water quality related constraints and controls such as the running annual average (RAA) method of compliance with arsenic concentration standards; and pumping required by the groundwater remediation district to remove and control the spread of perchloroethylene (PCE), in the groundwater supply. Some production wells are also subject to water quality issues including arsenic and nitrate. A very good summary of groundwater resource issues is presented in Chapter 2 of the 2020-2040 TMWA Water Resource Plan. Issues associated with water quality and quantity that impact facility requirements are discussed in greater detail below.

GROUNDWATER QUALITY ISSUES

TMWA has directly or indirectly dealt with groundwater quality issues for a number of years. Historically TMWA attempted to locate and design its wells such that aquifer areas and water bearing strata with inferior quality water (i.e. high in iron, manganese, arsenic) were avoided. This was accomplished by implementing detailed exploration techniques and performing discrete sampling and testing of water bearing formations so that only those strata with higher water quality are screened for production. Even so, as drinking water standards became more stringent, a number of groundwater wells had to be abandoned, treated or converted to non-potable use. At the same time, it has become extremely difficult to develop new groundwater sources with sufficient productivity and water quality in the Truckee Meadows region.

TMWA's groundwater resource is extremely important to the community in terms of its value as a peaking, emergency and drought resource. To maintain the viability of the groundwater resource, TMWA's general approach relative to groundwater includes the following elements.

- Preservation of existing groundwater wells. This is being performed by closely monitoring water quality, developing and implementing a wellhead protection program, rehabilitating wells to prevent losses of capacity, and adding treatment facilities when necessary and deemed feasible.
- Development of future wells where treatment can be avoided. This is becoming increasingly difficult to accomplish as water quality regulations become more stringent and as areas of high quality groundwater become harder to find.
- Implementing treatment for new groundwater wells. Based on the need to develop additional peak and off-river capacity, it is anticipated that treatment for the removal of arsenic, iron and manganese will be required.

Arsenic

Naturally occurring arsenic is present in many groundwater supplies in northern Nevada. The original US Environmental Protection Agency (EPA) arsenic standard of 50 parts per billion (ppb) was placed into effect in 1975. Three TMWA wells (Pezzi, Poplar #1 and Terminal) were impacted by the original standard. These wells were isolated from the distribution system and piped to the Glendale Treatment Plant where arsenic could be removed utilizing conventional surface water treatment processes, or blended with treated surface water prior to discharge to the system. In 2006, the EPA reduced the arsenic standard from 50 ppb to 10 ppb. The new lower standard impacted nine additional TMWA wells. The basic elements of TMWA's arsenic compliance plan (approved by the Nevada Department of Environmental Protection, NDEP) are as follows:

- Piping of the Mill Street, Greg Street, and Corbett Wells to the Glendale Plant where the water can be treated via conventional surface water techniques, or blended with treated surface water.
- Six other wells (Keitzke, Morrill, High, Silver Lake, Poplar #2 and Sparks Avenue) are pumped seasonally, recharged and/or blended with treated surface water in the distribution system to achieve compliance.

Several former Washoe County production wells located in Spanish Springs Valley and Double Diamond have also been impacted by arsenic and have been taken out of production. Nitrate contamination from septic systems and mobilization of naturally occurring nitrates in the soil by domestic irrigation, has also impacted wells in Spanish Springs and has become a major water quality issue.

PCE

Perchloroethylene (PCE), has impacted some wells near the urban center of Reno. PCE is a volatile organic chemical that has been historically used as a solvent in industrial and dry-cleaning operations. For many years PCE waste was indiscriminately dumped and it percolated and infiltrated the groundwater aquifer. Five existing wells impacted by PCE above the drinking water standard of 5 ppb are being treated for PCE removal with an air stripping process. Three stripping towers are used: one at the Mill Street location for the Mill Street and Corbett wells; one at Kietzke Lane for the Kietzke Lane well; and one at the Morrill well location for the High Street and Morrill Avenue wells. The operation of these wells is coordinated with the PCE Remediation District (administered by Washoe County), since the treatment also serves to “clean up” the aquifer. It is expected that the treatment of these wells will continue for PCE removal.

Aquifer Storage and Recovery (Recharge)

Since the early 1990’s, TMWA has actively participated in an Aquifer Storage and Recovery (ASR) program. Approximately 2,500 to 3,000 acre-feet per year (814-977 MG) of treated surface water can be injected and stored in the aquifer during the off-peak demand months. This “stored water” can then be extracted during the peak demand months or during periods of drought. Through ASR, TMWA has recharged approximately 41,600 AF of water since the program began in 1993.

The implementation of the ASR program provides several benefits to the community. First, it has helped to mitigate minor water quality issues in selected wells. The treated surface water has been shown to provide a “bubble” of high quality water at the wellhead which significantly reduces total concentrations of regulated constituents such as iron, manganese and arsenic when the well is pumped to the distribution system. The second benefit is that withdrawals from ASR storage do not count against the annual groundwater cap as set by the State Water Engineer. This provides for some banking of groundwater which can subsequently be used during drought periods.

GROUNDWATER CAPACITY

The current TMWA well production capacity in the contiguous main water system (78 wells) is approximately 103 MGD but given water system hydraulic limitations and water quality issues, available supply capacity from these wells is on the order of 87 MGD. Satellite systems have a current well production capacity of approximately 1.4 MGD from 10 wells. See Table 5 for details on individual and area specific groundwater capacity. TMWA's goal is to increase groundwater production capacity by 2 MGD every five years. This additional well capacity will increase peak day capacity and increase off-river reliability; however, it is highly likely that development of new groundwater sources will require expensive treatment facilities. Therefore, the timing of expanding groundwater capacity will depend on when additional peak capacity is required and also on how resilient existing storage and groundwater facilities are in response to an off-river supply scenario.

Prior to implementation of TROA, groundwater played a vital part in meeting demand during drought conditions. This was due, in large part, to the need to minimize the use of Privately Owned Stored Water (POSW) in case drought conditions persisted. Under TROA, modeling efforts performed as part of the previous WFP update indicated that even during an extreme 12-year long drought occurring in 2039-2050 when peak day were estimated to exceed 190 MGD, there will be sufficient surface water available that groundwater production can be limited to 60 MGD. A summary of the analysis is included in the appendix. Therefore, there is significant excess groundwater production capacity (87–103 MGD) for the contiguous system for the foreseeable future based on current demand growth trends in this WFP. Current projections indicate that peak day demands will not exceed 190 MGD until sometime after 2055.

Of course, adequate groundwater production is a highly desirable thing, especially from a reliability perspective. One of the emergency scenarios that was previously discussed consists of the temporary loss of the Truckee River water due to a non-persistent water quality issue. During this period TMWA will need to have sufficient groundwater production capacity to be able to supply at a minimum to meet the essential sanitary and culinary needs of the community. Given the difficulty of reducing demands during the summer to indoor water use only in a very short period of time, TMWA plans on supplying the system wide average day demand that is approximately 53% of system wide peak day demands. Under this criterion, the 2025 groundwater production capacity of about 103 MGD (contiguous Truckee Meadows area) is adequate to supply the essential water needs of the community during an emergency situation where the surface water supply is temporarily unavailable. The 103 MGD of groundwater capacity could theoretically provide a minimum emergency supply to a system with a maximum day demand of about 194 MGD. In 2040, the contiguous system groundwater production capacity is planned to increase to 114 MGD. An off-river supply scenario under 2040 average day demand is discussed in the Gravity Zone report contained in this WFP. The

Gravity Zone report also identifies other water infrastructure projects needed to help meet demands in these scenarios and regional stranded groundwater production capacities.

TMWA has also identified other future supply improvements to help meet growth beyond the current 2040 planning period and improve system reliability. These proposed facilities include the construction of the Sparks Groundwater Treatment Plant (11.9 MGD), the rehabilitation of the Longley Groundwater Treatment Plant (4 MGD), and treatment/blending of poor-quality groundwater at the Glendale WTP (11.1 MGD), Spanish Springs Groundwater Treatment Plant (4 MGD) and American Flat Advance Purified Water Treatment Plant (2 MGD). It should be noted that these future facilities can continue to supply the essential community water needs during an emergency situation where the surface water supply from the Truckee River is not available.

Groundwater production can decrease with time due to chemical deposition on well screens and from mechanical wear of pumping equipment. In addition, hydrologic limitations (i.e. well interference) and drought cycles that decrease groundwater levels and thus lower pump discharge can also impact the instantaneous and daily production from the wells. TMWA constantly evaluates well production to determine if well rehabilitation or pump replacement is warranted. TMWA has an ongoing program of well maintenance/rehabilitation that requires the outage of multiple production wells every year. Due to these possible constraints, it may be necessary to develop more than the “design” well capacity to obtain the desired net groundwater production capacity.

TABLE 5 – GROUNDWATER WELL PRODUCTION CAPACITY SUMMARY
Well Capacity in Million Gallons per Day (MGD)

Gravity Zone Wells				
Name	**2021 MGD**	**2025 MGD**	**2030-2040 MGD**	**Notes/Status/Treatment/Schedule**
PEZZI	2.2	2.2	2.2	Arsenic, to Glendale, treatment/blending, drought usage
POPLAR #1	2.2	2.2	2.2	Arsenic, to Glendale, treatment/blending, drought usage
TERMINAL	2.6	2.6	2.6	Arsenic, to Glendale, treatment/blending, drought usage
MILL	2.6	2.6	2.6	PCE Treatment, Arsenic, to Glendale, treatment / blending / drought
CORBETT	1.7	1.7	1.7	PCE Treatment, Arsenic, to Glendale, treatment / blending / drought
GREG	1.5	1.5	1.5	Arsenic, blending discharge to system
HIGH	2.1	2.1	2.1	PCE Treatment, discharge to system
MORRILL	1.8	1.8	1.8	PCE Treatment, discharge to system
KIETZKE	2.9	2.9	2.9	PCE Treatment, discharge to system
DELUCCHI	0.8	0.8	0.8	
EL RANCHO	1.4	1.4	1.4	
FOURTH	1.5	1.5	1.5	
GLEN HARE	1.4	1.4	1.4	
PATRIOT	1.9	1.9	1.9	
SIERRA PLAZA	2.0	2.0	2.0	
S. VIRGINIA	1.2	1.2	1.2	
VIEW	2.5	2.5	2.5	
HUFFAKER PL.	0.9	0.9	0.9	
INNOVATION	1.2	1.2	1.2	
HUNTER LK	3.1	3.1	3.1	
RENO HIGH	3.5	3.5	3.5	
SWOPE	0.8	0.8	0.8	
21st	2.0	2.0	2.0	
GALLETTI	2.3	2.3	2.3	
POPLAR #2	2.2	2.2	2.2	
NUGGET	0.8	0.8	0.8	
	37.8	**37.8**	**37.8**	

Southwest - Reno Wells				
Name	**2021 MGD**	**2025 MGD**	**2030-2040 MGD**	**Notes/Status/Treatment/Schedule**
Lakeside	1.1	1.1	1.1	

North - Reno Wells				
Name	**2021 MGD**	**2025 MGD**	**2030-2040 MGD**	**Notes/Status/Treatment/Schedule**
Air Guard	0.0	0.0	3.6	
Silver Knolls	1.6	1.6	1.6	
Silver Lake	3.4	3.4	3.4	
Lem. Valley Well 5	1.2	1.2	1.2	
Lem. Valley Well 6	0.0	0.0	0.0	Out of Production, likely to abandon
Lem. Valley Well 7	0.6	0.6	0.6	
Lem. Valley Well 8	0.0	0.0	0.9	
Lem. Valley Well 9	0.6	0.6	0.6	
Fish Springs Well A	4.3	4.3	4.3	Fish Springs Wells combined capacity limited by BPS. Normal MDD 9.4 MGD, Emergency 12.2 MGD
Fish Springs Well B	2.9	2.9	2.9	
Fish Springs Well C	2.2	2.2	2.2	
Fish Springs Well D	2.2	2.2	2.2	
Fish Springs Well E	3.2	3.2	3.2	
Fish Springs Well F	0.0	0.0	0.0	
	16.8	**16.8**	**21.3**	

Northwest - Reno / Verdi Wells				
Name	**2021 MGD**	**2025 MGD**	**2030-2040 MGD**	**Notes/Status/Treatment/Schedule**
Boomtown 7	0.4	0.4	0.4	
Boomtown 8	0.1	0.0	0.0	
Boomtown 10	0.4	0.4	0.4	
Boomtown 12	0.4	0.4	0.4	
Boomtown 13		0.5	0.5	
	1.3	**1.7**	**1.7**	

South Truckee Meadows / Mt Rose Wells				
Name	**2021 MGD**	**2025 MGD**	**2030-2040 MGD**	**Notes/Status/Treatment/Schedule**
LONGLEY LANE	2.1	2.1	2.1	
HOLCOMB	1.0	1.0	1.0	
Dbl Diamond Well 1	0.7	0.7	0.0	
Dbl Diamond Well 3	2.6	2.6	2.6	

Dbl Diamond Well 4	0.0	0.0	1.8	Arsenic, capacity limited by blending requirement. Therefore, simultaneous operation of wells not allowed
Dbl Diamond Well 5	0.0	0.0	1.8	
Hidden Valley Well 5	0.6	0.6	0.6	
STMGID Well 1	1.1	1.1	1.1	
STMGID Well 2	0.4	0.4	0.4	
STMGID Well 3	0.6	0.6	0.6	
STMGID Well 11	0.7	0.7	0.7	
Arrowcreek Well 1	0.3	0.3	0.3	
Arrowcreek Well 2	0.6	0.6	0.6	
Arrowcreek Well 3	0.7	0.7	0.7	
Callamont South	0.0	0.0	0.9	
Callamont North	0.0	0.0	0.7	
Tessa East	0.9	0.9	0.9	Well derated due to declining groundwater levels
Tessa West	0.6	0.6	0.6	Well derated due to declining groundwater levels
Mt Rose Well 3	0.4	0.4	0.4	
Mt Rose Well 5	0.9	0.9	0.9	
Mt Rose Well 6	0.8	0.8	0.8	
St James Well 1	0.3	0.3	0.3	Well derated due to declining groundwater levels
St James Well 2	0.3	0.3	0.3	Well derated due to declining groundwater levels
STMGID Well 4	0.3	0.3	0.3	
STMGID Well 5	0.6	0.6	0.6	
STMGID Well 6	2.1	2.1	2.1	
STMGID Well 12	0.8	0.8	0.8	
STMGID Well 7	0.2	0.2	0.2	
Thomas Crk Well 1	0.0	1.2	1.2	
	19.6	**20.8**	**23.5**	

Northeast - Reno / Spanish Springs Wells

Name	2021 MGD	2025 MGD	2030-2040 MGD	Notes/Status/Treatment/Schedule
HAWKINGS	4.3	4.3	4.3	
Desert Sprgs Well 1	0.5	0.5	0.5	Blending, nit treatment in 2030
Desert Sprgs Well 2	0.6	0.6	0.6	Blending, nit treatment in 2030
Desert Sprgs Well 3	0.0	0.0	1.1	OOS WQ, nit treatment in 2030
Desert Sprgs Well 4	0.0	0.0	0.0	OOS WQ, probably never to be used, maybe recharge
Spring Crk Well 2	0.7	0.7	0.7	nit treatment in 2030
Spring Crk Well 6	0.0	2.6	2.6	
Spring Crk Well 7	2.9	2.9	2.9	
Spring Crk Well 8	1.1	1.1	1.1	
Spring Crk Well 9	0.0	0.0	2.9	

Spring Crk Well 10	0.0	0.7	0.7	
	10.1	**13.4**	**17.4**	
Contiguous System Total =	**86.7**	**91.6**	**102.8**	
Satellite Systems Wells				
Name	**2021 MGD**	**2025 MGD**	**2030-2040 MGD**	**Notes/Status/Treatment/Schedule**
Lightning W Well 1	0.2	0.2	0.2	
Lightning W Well 2	0.1	0.1	0.1	Wells 2 & 3 limited to the max treatment plant capacity of 180 gpm
Lightning W Well 3	0.3	0.3	0.3	
Sunrise Well 1	0.2	0.2	0.2	
Stampmill Well 1	0.1	0.1	0.1	
Stampmill Well 2	0.1	0.1	0.1	
Truck. Cany. Well 1	0.1	0.1	0.1	Wells 1 & 3 limited to the max treatment plant capacity of 100 gpm
Truck. Cany. Well 3	0.1	0.1	0.1	
Old Washoe Well 3	0.2	0.2	0.2	
Old Washoe Well 4	0.2	0.2	0.2	

SECTION 5

SURFACE WATER RESOURCES

The Truckee River and its tributaries provide the surface water supply for operation of TMWA's two surface water plants, the Chalk Bluff Plant in northwest Reno, and the Glendale Plant in west Sparks. During most years TMWA relies on flow from Lake Tahoe which is conveyed by the Truckee River to the raw water intakes of the plants. During extended drought periods, TMWA can call upon drought reserves at Donner Lake, Independence Lake, and "contract storage" within Stampede and Boca Reservoirs. Operation of the Truckee River system is very complex and has been extensively litigated over the years. Implementation of TROA has been shown to be a real game-changer for TMWA in regards to how resilient surface water supplies can be in response to drought conditions.

SURFACE WATER TREATMENT PLANT CAPACITIES

Chalk Bluff Water Treatment Plant

The first phase of the Chalk Bluff Water Treatment Plant (CBWTP) was placed into service in 1994. Plant capacity has since been expanded twice (1996 and 2004) to allow for the retirement of older, non-compliant plants (Highland, Hunter Creek and Idlewild) and to meet increasing demands. The CBWTP now serves as TMWA's base plant and is "first on and last off" from an operations perspective. The plant is located on a 120-acre site at the northwest corner of McCarran Boulevard and W. Fourth Street in northwest Reno. The Phase 3 expansion of the plant along with subsequent approval of increased filter loading rates, resulted in a revised net production capacity of 90 MGD. The treatment plant has been designed for an ultimate net production capacity of 120 MGD.

The CBWTP incorporates the following components and processes:

- Raw water delivery from two different systems, the Orr Ditch pump station and the Highland Canal.
- Pre-settling basins and mechanical screens for the removal of floating debris, heavy grit and sediment.
- Chemical storage and feed systems.
- Coagulation, flocculation, sedimentation and filtration systems.
- Filter backwashing and solids handling/removal systems.
- Disinfection and clearwell storage to provide contact time.
- Treated water pumping into two different major pressure zones.

There are no significant limitations on plant operation. The CBWTP is equipped with treatment systems designed to handle peak turbidity events on the Truckee River system and is capable of operating at its design rate under drought conditions.

Raw water to the plant can be delivered via two efficient diversion weirs. The first and oldest diversion weir, the Washoe Dam, diverts water into the Washoe Hydro Canal. The Highland Canal, with a diversion gate off the Washoe Canal, then transports water via gravity flow to the plant. The Highland Canal has existed since the 1880s and has undergone extensive improvements over the last 10-15 years. Up until 2010, several constrictions limited the capacity of the canal to about 55 MGD; however, the April 2008 earthquake that damaged a section of wooden flume in the Mogul area raised significant concerns regarding the vulnerability of the plant's water supply. As a result, completion of the canal master plan improvements was accelerated and the plant's treatment capacity of 90 MGD can now be supplied 100 percent by gravity flow from the Highland Canal. In addition, it is estimated that the cumulative effect of completion of the canal improvements has reduced leakage losses from the canal by several hundred acre feet annually.

From an operational perspective, canal water is considered "cheap and reliable" water as compared to the pumping required from the Chalk Bluff weir facility which is located on the river, about 1000 feet south of the CBWTP. The Orr Ditch Pump Station (ODPS), lifts the raw water diverted from the weir approximately 200 feet in elevation to the plant above the river. Limitations relative to the Chalk Bluff weir include the requirement to pass at least 20 CFS of flow downstream of the weir (only required when actually diverting from the facility), even under low flow conditions where the only water in the river may be releases from TMWA's upstream reservoir storage. Other constraints include capacity (approximately 68 MGD vs the 90 MGD plant capacity) and the cost of pumping. With the expanded gravity flow capacity of the Highland Canal, the ODPS has been relegated to backup duty yielding estimated electrical cost savings of about $360,000 per year. Modifications of the ODPS are in progress to allow it to operate as a hydroelectric generation facility when excess water is available from the Highland canal.

Glendale Water Treatment Plant

The Glendale Water Treatment Plant (GWTP) was placed into service in 1976 and initially operated as a direct filtration plant with direct pumping from the filters into the distribution system. Over the years, improvements have been made to the GWTP to incorporate the same basic treatment processes found at the CBWTP. The GWTP is currently used as a peaking plant to provide critical peak period supply to Sparks and Southeast Reno. It is normally not operated in the off-peak period (November through April), since system demands do not require its operation and because it is more efficient to consolidate off-peak operations at the CBWTP. Upon completion of the Glendale Diversion project, Phase 4 of the Sparks Feeder Main and the Effluent Pumping Improvements in 2011, the GWTP is now able to deliver approximately 42 MGD (net treatment capacity of 32 MGD plus 10 MGD of "arsenic blend wells") into the distribution system. The current distribution system facilities can convey flows up to approximately 34 MGD from GWTP. Additional distribution system improvements are needed to convey higher flows from GWTP to minimize system pressures increases near GWTP. Although the GWTP normally discharges its entire output into the Sparks Gravity Zone where the production is needed to maintain tank levels and service pressures in the peak summer months, the effluent pump station also has a bank of pumps designed to deliver water into the Highland Gravity Zone.

Mt Rose Water Treatment Plant

Construction of the Mt Rose Water Treatment Plant (MRWTP) began in 2020 and the facility went online in the early fall of 2023. The MRWTP is located at the north end of Callahan Road and will treat up to 4 MGD of surface water diverted from Whites Creek. The MRWTP will discharge into the Arrowcreek Tank 3 zone on the upper Mt Rose Fan and will provide a much needed source of peak supply and conjunctive use supply for an area where demands are anticipated to increase almost 20 percent (to about 6.1 MGD) by 2040. By not having to rely 100 percent on local groundwater to meet demands, it is hoped that aquifer water levels in the area will stabilize and possibly even recover somewhat. Several distribution system improvements will be required to firm up the maximum day yield of the creek water rights and to fully integrate the new source into the service area which consists of several tank and pressure zones.

SECTION 6

NAC 445A CAPACITY REQUIREMENTS

This section summarizes the WFP compliance with applicable section of Nevada Administrative Code 445A. The sections of the NAC 445A regulations applicable to Capacity include:

NAC 445A.6554 "Alternative pumping capacity" defined. (NRS 445A.860) "Alternative pumping capacity" means a source of water, including a well, or a facility for pumping from a source of water, which:

1. Can provide a public water system with regular or emergency supplies of water in areas that do not have an adequate storage of water that is accessible by gravity; and
2. Is equipped with an independent, reliable supply of power that is available during periods when the normal supply of power fails, which:

(a) Consists of:

(1) An emergency generator; or

(2) A standby prime mover that operates by internal combustion; or

(b) Is obtained from an electric substation or other source other than the normal supply of power.

(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.65665 "Capacity for the development and treatment of water" defined. (NRS 445A.860) "Capacity for the development and treatment of water" means the facilities and appurtenances of a public water system that provide finished water, treated if necessary, to the distribution system.

(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6588 "Emergency" defined. (NRS 445A.860) "Emergency" means a situation in which an unusual calamity, including a flood, fire, storm, earthquake, drought, civil disturbance, accidental spill of a hazardous material or similar occurrence, disrupts the provision of water by a public water system or endangers the quality of water provided by a public water system.

(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6652 "Total capacity" defined. (NRS 445A.860) "Total capacity" means the capacity of a public water system to supply the water demanded by its customers within its area of service during all conditions except emergencies.

(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.6672 Existing systems: Minimum capacities; minimum pressure and velocity of water; total capacity of groundwater system; timely completion of water projects. (NRS 445A.860) A supplier of water for an existing public water system shall:

1. Ensure that the public water system maintains a sufficient capacity for the development and treatment of water, and a storage capacity of sufficient quantity, to satisfy the requirements of all users of the public water system under the conditions of maximum day demand and peak hour demand.

2. Ensure that the residual pressure in the distribution system is:
(a) At least 20 psi during conditions of fire flow and fire demand experienced during maximum day demand;
(b) At least 30 psi during peak hour demand; and
(c) At least 40 psi during maximum day demand.
 Unless otherwise justified by an engineer and approved by the Division or the appropriate district board of health, high head losses must be avoided by maintaining normal water velocities at approximately 8 feet per second during all conditions of flow other than fire flow.
3. If the public water system relies exclusively on water wells as its source of water, ensure that the total capacity of the system is sufficient to meet:
(a) The maximum day demand, fire flow and fire demand when all the facilities of the system are functioning; or
(b) The average day demand, fire flow and fire demand when the most productive well of the system is not functioning,
 whichever is greater. When computing total capacity for this purpose, credit must be given for any storage capacity.
4. Ensure that water projects are completed in such a manner as to meet the actual maximum day demand, peak hour demand, fire flow and fire demand for developments of property in the area of service of the public water system.
(Added to NAC by Bd. of Health, eff. 2-20-97; A by Environmental Comm'n by R194-08, 10-27-2009)

NAC 445A.66725 Existing systems: Determination of total capacity preparation, maintenance and dissemination of certain information, analyses, plans and reports. (NRS 445A.860) A supplier of water for an existing public water system shall:
1. Determine the total capacity of the public water system through engineering analyses that use historical data or other guidelines or parameters accepted by the engineering profession and, upon request, submit documentation of that capacity to the Division or the appropriate district board of health. When analyzing the total capacity of the public water system with regard to requirements for maximum day demand, only the alternative pumping capacity and the storage capacity of the public water system may be considered as sources of supply.
2. When assessing the total capacity of the public water system and the need for water projects to meet future commitments, use a network hydraulic analysis of the public water system. The analysis must be prepared by an engineer.
3. Prepare a plan for the timely completion of any water projects required to meet the anticipated needs of developers of property within the area of service of the public water system and, upon request, provide a copy of the plan to the Division or the appropriate district board of health.
4. Maintain:
(a) A current list of the users of the public water system.
(b) A copy of each pending acknowledgment of water service it has issued.
5. Provide to the Division or the appropriate district board of health, upon request and at no charge, any data, technical information or engineering analyses or reports necessary to determine the acceptability of any technologies, processes, products, facilities or

materials associated with the design, construction, operation or maintenance of the public water system.

(Added to NAC by Bd. of Health, eff. 2-20-97; A by Environmental Comm'n by R194-08, 10-27-2009)

NAC 445A.6674 Storage capacity. (NRS 445A.860) Except as otherwise provided in NAC 445A.66755:

1. A supplier of water shall ensure that:

(a) An existing public water system maintains a storage capacity that, as determined by an engineer on the basis of historical data, accepted engineering judgment and a network hydraulic analysis, is sufficient to ensure that the total capacity of the public water system will meet current and anticipated demands for water while maintaining the pressures indicated in NAC 445A.6711.

(b) A new public water system maintains a storage capacity that is sufficient to provide the amount of water required for sufficient operating storage, emergency reserve and fire demand.

2. Storage requirements for fire demand must be calculated according to the requirements of the fire authority. The Division or the appropriate district board of health shall evaluate the design of a public water system based upon appropriate documentation of those requirements.

3. A supplier of water for an existing public water system shall ensure that the total storage capacity and capacity of booster pumps for each zone of pressure in the distribution system are sufficient to meet the maximum day demand within that zone. Water stored in a higher zone of pressure may be provided to serve a lower zone of pressure if:

(a) An appropriate pressure regulator is installed between the zones; and

(b) The requirements for the higher zone of pressure are not compromised.

(Added to NAC by Bd. of Health, eff. 2-20-97; A by Environmental Comm'n by R194-08, 10-27-2009)

NAC 445A.66745 Operating storage. (NRS 445A.860) Except as otherwise provided in NAC 445A.66755:

1. An existing public water system must maintain an operating storage in such an amount as an engineer determines, based upon historical data and the system's capacity for the development and treatment of water, to be sufficient for the system to meet requirements for maximum day demand.

2. A new public water system must, except as otherwise justified by an engineer and approved by the Division or the appropriate district board of health, maintain an operating storage equal to 700 gallons for each residential equivalent in the area of service of a metered system and 1,225 gallons for each residential equivalent in the area of service of an unmetered system.

(Added to NAC by Bd. of Health, eff. 2-20-97; A by Environmental Comm'n by R194-08, 10-27-2009)

NAC 445A.6675 Emergency reserve. (NRS 445A.860) Except as otherwise provided in NAC 445A.66755:

1. An existing public water system must maintain an emergency reserve in such an amount as an engineer determines appropriate on the basis of the best available local information.

2. A new public water system must maintain an emergency reserve equal to 75 percent of the amount of operating storage of the system.

(Added to NAC by Bd. of Health, eff. 2-20-97)

NAC 445A.66755 Existing systems: Exemption from storage requirements. (NRS 445A.860) An existing public water system is not required to comply with the requirements of NAC 445A.6674, 445A.66745 and 445A.6675 if the system has a sufficient alternative pumping capacity to meet requirements for maximum day demand, peak hour demand and fire flow.

(Added to NAC by Bd. of Health, eff. 2-20-97)

COMPLIANCE WITH NAC 445A CAPACITY REQUIREMENTS

NAC 445A.6672 states that an existing public water system should maintain sufficient capacity for the development and treatment of water and a storage capacity of sufficient quantity, to satisfy the requirements of all users of the public water system under the conditions of maximum day and peak hour demand. Compliance with this section is demonstrated in previous discussions concerning TMWA's pump and storage sizing criteria and how its production and pumping facilities are designed to meet maximum day demands and its operating storage component provides the incremental capacity to meet peak hour demands. In addition, previous discussions concerning surface water and groundwater production capacities show that for PWS 190, TMWA's capacity for the development and treatment of water is 213.6 MGD, which far exceeds current (154.1 MGD in 2021) and future (176.0 MGD in 2040) maximum day demands.

Existing (2025) Water Production Capacity

TMWA's 2025 capacity for the development and treatment of water is summarized in Table 6. This supply capacity will be used for meeting 2025 estimated demands for NAC compliance determination.

TABLE 6 - 2025 TREATMENT & PRODUCTION CAPACITY

Facility	Capacity (MGD)
Chalk Bluff WTP	90.0
Glendale WTP	32.0
Groundwater	91.6
TOTALS	**213.6 MGD**

Notes:

1. Groundwater capacity includes wells in PWS 190 (Truckee Meadows) and Fish Springs (booster pump capacity), but does not include satellite systems.
2. Glendale WTP capacity shown in this table is conservatively low, the WTP has the ability to supply up to 34.5 MGD during MDD.
3. The Mt Rose WTP is not included above because it may not be available on MDD. The 4 MGD Longley Groundwater Treatment Plant is not included above.

NAC 445A.66725 further states that for an existing public water system, the total capacity should be determined through engineering analyses that use historical data or other guidelines or parameters accepted by the engineering profession; and when analyzing the total capacity of the system with regard to requirements for maximum day demand, only the alternative pumping capacity and the storage capacity of the public water system may be considered as sources of supply. The definition of “total capacity” in NAC 445A.6652 references the public water system’s capacity to meet demands “within its area of service” which indicates this is a system-wide capacity requirement.

Compliance with this section is demonstrated through TMWA’s use of actual 2021 metered use data to determine the base maximum day demand, peaking factors, unit demand factors and the following discussions relating to storage and alternative pumping capacity.

<u>Existing Available Operating & Emergency Storage</u>

The diurnal demand curve (hourly demand pattern) for the gravity zones during the peak day was previously introduced in Figure 2. The demand curve shown in Figure 2 includes the effect of all demands on the gravity zones including base booster pump stations and wholesale demands. Analysis of this data indicates that with a steady source of supply equal to the maximum day demand (represented by a y-value of 1.00 on the chart), a storage volume of about seven percent of the maximum day demand is required to meet the peak hour demand.

TMWA’s current design standard is to provide an operational storage component of at least 15 percent of the maximum day demand to provide flexibility to accommodate the potential failure of mechanical equipment, or to allow avoidance of peak period electrical charges when possible. This is two times the volume indicated by the diurnal curve analysis.

The requirements of Section 1 of NAC 445A.66725 for determining peak day capacity by considering only alternative pumping capacity and storage capacity of the system does not refer to a particular storage component (operating, fire, emergency) or combination thereof. The fact that “only” alternative pumping and storage capacity should be considered (and not other capacity such as treatment capacity) would imply an issue of reliability under an emergency situation with loss of primary power and thus infers that emergency storage could be utilized to satisfy those requirements.

A detailed accounting of storage requirements is presented and discussed in the Storage sections and the appendices of this report. For the purposes of establishing the storage available to meet overall system capacity requirements, the operating and emergency storage components provided are summarized in Table 7 below.

TABLE 7 – EXISTING AVAILABLE OPERATING & EMERGENCY STORAGE

Zone	Total Storage Provided (1) (MG)	Less Required Fire Storage (MG)	Available Emergency & Operating Storage (MG)
Hunter Creek Gravity	34.00	0.96	33.04
Highland Gravity	25.50	3.00	22.50
Sparks Gravity	6.00	0.96	5.04
Southwest Reno	11.40	1.80	9.60
North Reno	29.33	8.46	20.87
Northwest Reno	22.11	5.29	16.82
South Truckee Meadows	23.82	7.70	16.12
NE Sparks/Spanish Springs	21.68	3.86	17.82
Totals	**173.84**	**32.03**	**141.81**
Less Emergency Storage (1 Average Day) (2)			**80.81**
Available Operating Storage			**61.00**

Notes:
1. Storage provided includes tanks that are scheduled to be complete and in-service by 2025, but does not include treatment plant clearwell storage.
2. Emergency storage (one average day) does not include the demand of wholesale customers who have their own storage.

Existing Alternative Pumping Capacity

The Chalk Bluff and Glendale WTP's are provided with two sources of electrical power (there are physically two separate electrical feeds into both facilities) and thus meet the reliability requirements of "alternative pumping capacity". Switching between the primary electrical circuit to the secondary circuit at Chalk Bluff is automatic should the primary circuit fail. With the additional standby generation improvement projects at Glendale (2018) and at Chalk Bluff (2019), the entire treatment and pumping processes at both locations are 100 percent covered with backup power. At Chalk Bluff, this was accomplished in part by completion of the Highland Canal improvements that allow a raw water supply equal to 100 percent of Chalk Bluff's treatment capacity to be delivered to the plant by gravity flow. On the finished water side, the 48-inch main from Chalk Bluff to the Highland zone provides a gravity flow capacity of about 22 MGD, providing additional operational flexibility during a power outage. Alternative source pumping capacity for the system as a whole is summarized in Table 8.

TABLE 8 – EXISTINIG ALTERNATIVE SOURCE PUMPING CAPACITY

Source	Pumping Capacity (MGD)	Primary Power Circuit	Secondary Power Circuit
Chalk Bluff WTP		Reno 204	NW 216
Treatment Plant	90.0		1440 kW Genset
Hunter Creek Pumps	41.0		2000 kW Genset
Highland Pumps	40.0		2000 kW Genset
Northgate Pump	8.6		2000 kW Genset
Glendale WTP		Glendale 211	Valley Rd 246
Low Lift Pumps	35.0		300 kW Genset
Treatment Plant	32.0		500 kW Genset
Highland Pumps	12.5		1600 kW Genset
Sparks Pumps	33.0		1600 kW Genset
ALT. PUMPING CAPACITY	**121.6 (1)**		

Notes:
1. Total alternative pumping capacity based on Chalk Bluff pumping to Hunter Creek, Highland and Northgate simultaneously; and Glendale WTP capacity.
2. Additional redundancy for the Chalk Bluff Highland pumps is provided by the gravity flow (approx. 22 MGD) capacity of the existing Highland pipelines.
3. Additional redundancy for both Hunter Creek and Highland pressure zones is provided by the Idlewild transfer station.
4. Additional alternative source pumping capacity from the groundwater wells are not included above.

NAC Total Capacity Compliance - Existing System with 2025 Demands

Having established the available alternative source pumping capacity and the available operating and emergency storage of the existing system, total system capacity requirements are summarized in Table 9 for NAC 445A.6672 and in Table 10 for NAC 445A.66725.

Per **NAC 445A.6674**, an existing public water system shall maintain a storage capacity that, as determined by an engineer on the basis of historical data, accepted engineering judgment and a network hydraulic analysis, is sufficient to ensure that the total capacity of the public water system will meet current and anticipated demands for water while maintaining the pressures indicated in NAC 445A.6711. Having shown compliance with the overall storage requirements, subsequent reports on specific areas and pressure zones will present compliance with the pressure requirements of NAC 445A.6711.

TABLE 9 - 2025 TOTAL DAILY CAPACITY CALCULATION PER NAC 445A.6672

Component	**Capacity (MG)**	**Demand (MG)**	**Surplus/ (Deficit)**
Surface Water Production	121.6		
Groundwater Production	91.6		
Operating Storage (1)	61.0		
Total Capacity	**274.2**		
2025 Max Day Demand (2)		**160.2**	**114.0**
Peak Hour Demand (2)		**216.3**	**57.9**

Notes:
1. Available operating storage is a system-wide value and does not indicate deficits within specific tank zones.
2. Max Day Demand determined from 2021 metered use, estimated system losses, plus growth. Peak Hour Demand estimated at 1.35xMDD per Figure 2.

TABLE 10 - 2025 TOTAL DAILY CAPACITY CALCULATION PER NAC 445A.66725

Component	**Capacity (MG)**	**Demand (MG)**	**Surplus/ (Deficit)**
Alt. Pumping Capacity (1)	121.6		
Operating Storage (2)	61.0		
Total NAC Capacity	**182.6**		
Max Day Demand		**160.2**	**22.4**

Notes:
1. Does not include groundwater production wells that meet “alternative pumping capacity” definition per NAC 445A.6554.
2. See Table 7. Available storage is a system-wide value and does not account for transfers between adjacent zones.

SECTION 7

FUTURE FACILITY REQUIREMENTS

The Truckee Meadows region is subject to periodic droughts; therefore, the water resources must be managed accordingly, and the water system must be designed to deliver water service under both drought and non-drought conditions. The primary water supply operational objectives are to maximize the use of surface water from the Truckee River to meet demands; to supplement that supply with groundwater supplies during the peak summer months; and avoid, or at least delay, the release of any Privately Owned Stored Water (POSW - storage in Donner and Independence Lakes). By maximizing the utilization of available surface water capacity in the early and/or late shoulder months, non-drought year groundwater extraction normally does not exceed 12,000 AF annually. If enough surface water is available, non-drought year groundwater extraction can be compressed into the peak irrigation months (July-September) resulting in a higher peak month yield from the resource without exceeding the normal year groundwater extraction limit, on both quantity and quality.

As discussed in the Groundwater section of this WFP, prior to implementation of TROA, groundwater played a vital part in meeting demand during drought conditions. This was due, in large part, to the need to minimize the use of Privately Owned Stored Water (POSW) in case drought conditions persisted. Under TROA, modeling efforts performed as part of the previous WFP update indicated that even during an extreme 12-year long drought occurring in 2039-2050 when peak day demands were estimated to exceed 190 MGD, there will be sufficient surface water available that groundwater production can be limited to 60 MGD. There is significant excess groundwater production capacity (87–103 MGD) for the contiguous system for the foreseeable future based on current demand growth trends in this WFP. Current projections indicate that peak day demands will not exceed 190 MGD until sometime after 2055. Therefore, additional groundwater (or surface water supplies for that matter) will technically not be required in the Truckee Meadows through the 2040 planning period. This is encouraging when considering the long-term fragile nature of groundwater supplies from both a quantity and quality perspective and with the understanding that additional groundwater supply is very difficult and costly to develop.

On a subsystem basis, it will be necessary to develop additional production wells in the South Truckee Meadows, upper Mt. Rose Fan and Spanish Springs areas to help meet peak use demands and meet system redundancy criteria included in current TMWA Design Criteria found in Appendix A. The Spanish Springs Valley Groundwater Treatment Facility is proposed to increase the reliability of existing production wells that currently require blending due to water quality issues.

The conjunctive use of ground and surface water supplies provides many benefits to the TMWA system. An adequate groundwater supply is necessary to maintain water service during periods of drought or other periods when surface supplies are temporarily curtailed. In an emergency where surface water was unavailable and mandatory conservation was imposed, groundwater could satisfy the essential indoor water needs of the community for an extended period. TMWA also utilizes its groundwater as a peaking supply to meet seasonal peak use demands that exceed surface water treatment capacity. Strategically located production wells can also reduce distribution system facility requirements by locating a supply source closer to areas of demand that may be located a great distance away from surface water production facilities. A good example is the Hawkings Court well located in Spanish Springs valley.

TMWA has expanded conjunctive use to the Mt Rose Fan area, with the addition of Mt. Rose Water Treatment Plant. TMWA will continue to expand and implement this conjunctive use operating approach throughout its service area, and especially in areas that historically relied on groundwater.

SUMMARY OF FUTURE CAPACITY IMPROVEMENTS

The results of this 2040 Water Facility Plan Update indicate that existing water demands are not increasing as quickly as the previous facility plan predicated. This is a combination of a significant number of existing customers using less water during maximum day demand periods and actual new demand growth being less than previously predicted. The current update predicts a contiguous system maximum day demand of 176.0 MGD (Year 2040) versus the 197.3 MGD (Year 2035) predicted in the 2035 update. Therefore, many of the major water supply improvements identified in the previous water facility plan can be significantly delayed beyond the 2040 planning period. Table 11 below summarizes the TMWA contiguous system demand and supply capacity for the 20-year planning period.

TABLE 11 - DEMAND vs PRODUCTION CAPACITY BY YEAR

Year	Estimated Max Day Demand (MGD)	Total Available Capacity (MGD)	Supply Surplus or (Deficit) (MGD)	Surplus or Deficit as a % of MDD
2021	154.1	204.7	50.6	32.8%
2022	155.6	204.7	49.1	31.5%
2023	157.2	204.7	47.5	30.2%
2024	158.7	204.7	46.0	29.0%
2025	160.2	209.6	49.4	30.8%

2026	161.5	209.6	48.1	29.8%
2027	162.8	209.6	46.8	28.7%
2028	164.1	209.6	45.5	27.7%
2029	165.4	209.6	44.2	26.7%
2030	166.7	220.8	54.1	32.5%
2031	167.6	220.8	53.2	31.7%
2032	168.6	220.8	52.2	31.0%
2033	169.5	220.8	51.3	30.3%
2034	170.4	220.8	50.4	29.6%
2035	171.4	220.8	49.4	28.8%
2036	172.3	220.8	48.5	28.1%
2037	173.2	220.8	47.6	27.5%
2038	174.2	220.8	46.6	26.8%
2039	175.1	220.8	45.7	26.1%
2040	176.0	220.8	44.8	25.4%

Notes:

1. In general, new/additional capacity is recommended when surplus capacity is reduced to approximately 10%.
2. The above does not reflect supply surplus or deficit within individual pressure zones or tank zones.
3. Does not include Satellite areas.

Regardless of the lower predicted demands there are a significant number of projects that will still need to be completed in the planning period. Appendix D summarizes identified facility improvements to meet future area specific peak demands, storage and reliability design criteria. This is in addition to standard annual maintenance and rehabilitation of existing water facilities. Fire flow improvements to address legacy low fire flows at existing fire hydrants will be scheduled as part of street and main rehabilitation projects and/or as annual budgets allow.

Major facility challenges facing TMWA in the future include expanding conjunctive surface and groundwater use in the region; potential treatment of poor quality groundwater (primarily nitrate removal) in Spanish Springs; expanding supply capacity and reliability to the South Truckee Meadows; replacement of backbone transmission mains in the gravity zones; assisting with the development and permitting of Nevada's first Advanced Purified Water Treatment Facility, construction of Orr Ditch Pump Station Rehabilitation and Hydroelectric Facility, and continued expansion of the water system into the Verdi area.

SECTION 8

ASSET MANAGEMENT SUMMARY

INTRODUCTION TO ASSET MANAGEMENT

As defined by American Water Works Association (AWWA), Asset Management is "the coordinated set of activities within an organization to realize the overall value from all assets through stronger governance and accountability. More specifically in the water industry it is the combination of management, financial, economic, engineering and other practices applied to all assets (infrastructure, people, processes, and systems) with the objective of providing the required Level of Service at an acceptable level of Risk at an optimal Life Cycle Cost." "Asset Management with a focus on physical infrastructure assets is the continual assessment of the condition and usefulness, projected life expectancy, criticality, and operations and maintenance history, with a long-range plan for financing asset rehabilitation or replacement. Results from these assessments prioritize infrastructure assets and are typically incorporated into the organization's annual capital improvement planning and operational budget processes." Asset Management can be realized as a full program separately run alongside the capital improvements and maintenance departments of an organization, or it can be used as a policy that multiple departments must follow.

CURRENT TMWA ASSET MANAGEMENT

TMWA currently has department specific asset management programs in varying stages of progress. Please reference Appendix F regarding some of TMWA's current asset management structure outlines that are organized by the following CIP categories:

- Groundwater Facilities
- Hydroelectric Facilities
- Pump Stations & Pressure Regulation Stations
- Raw Water Supply Facilities
- SCADA and Electrical Facilities
- Storage Facilities
- Vehicles

Each structure outline summarizes the current asset management program associated with the CIP category and is organized by asset inventory, maintenance records, conditions assessment, CIP planning/risk management, maintenance/rehabilitation program, and reporting.

The asset inventory is the centralized location that all records are saved for a particular asset. The ultimate goal is to have one source of information for all assets and avoid copies of data in the future. Currently, asset inventory is saved in Cityworks database along with many other file structures.

Maintenance records are managed and saved in the Cityworks database for most TMWA assets. There are a select number of products that are managed by third parties through the TMWA maintenance department but are subcomponents of the total asset.

Condition assessments are performed on a regular basis for TMWA assets. Schedules for condition assessments vary by asset. Some programs have a revolving schedule that is followed diligently while other programs only have the opportunity to assess the asset when an event occurs to the system such as a main break, a street & highway maintenance project uncovers a main, etc.

Capital Improvement Planning/Risk Management is tracked differently by department and depends on the level of maintenance that exists for the asset. Wells, pressure regulating stations, booster pump stations, and tanks are tracked for risk in spreadsheets and managed by the program administrator in each department.

Maintenance and rehabilitation programs exist in varying stages of development for each asset. Valve maintenance programs are in the primary stages of development while other programs are fully developed, staffed, and executed. Rehabilitation programs exist for tanks, pressure regulating stations, and booster pump stations.

Reporting is kept at the discretion of each department/ program manager. Maintenance work orders are saved in the Cityworks database, annual reporting for the Board of Directors is provided by various departments including Water Resources Department, and technical memos are published at the completion of various rehabilitation projects to name a few examples.

FUTURE TMWA ASSET MANAGEMENT

As mentioned previously TMWA does have asset management programs in place for most water facilities that is being actively managed by various groups in the organization. TMWA will continue to work on developing standardization of the information management portion of these programs and improve upon the asset management programs such that:

- TMWA continues to provide a reliable high level of service to existing and future customers
- Minimize water service risks
- Maximize value of existing and future infrastructure
- Implement process of continual improvement taking into account updated condition assessment data and changes in technology

- Coordinate with financing and rate setting to maintain the ability to properly implement the asset management program

SECTION 9

SPECIFIC AREA/PRESSURE ZONE FACILITY PLANS

The Truckee Meadows Water Authority's service area currently covers over 170 square miles and serves over 134,000 customers. The distribution system contains over 2,000 miles of water mains; 97 storage tanks; 98 wells, 118 pump stations and 380 pressure regulating stations serving 279 separate pressure zones. The system extends from a valley elevation of about 4,400 feet to almost 6,700 feet in the Mt. Rose system.

The previous sections have concentrated on system-wide demands and capacities while laying the groundwork for TMWA design and planning criteria as they apply to the NAC 445A regulations. The TMWA design and planning criteria is included in Appendix A of this WFP update. The remainder of this document will focus on specific areas of the system generally defined by the extents of pumped storage zones supplied from the major gravity zones.

The improvements that provide capacity to serve growth, or in some cases also benefit existing customers, are identified herein. The estimated cost of improvements that benefit an entire system or area are entered into Area Fee calculation sheets. Area Fees are collected from new development to insure growth pays for growth. Currently there are a total of 17 Areas where connection fees are collected. These Areas are shown on Figure 3 below. Each Area has a different Area Fee reflecting the fact that a separate and distinct set of improvements is required to provide the necessary capacity to each Area. Probably the best example of this is the Sparks Feeder Main Projects (Phases 1-8) which are primarily located in the Sparks gravity zone, but primarily benefit the extreme Northeast Sparks and Spanish Springs areas. In addition to Area Fees, TMWA also collects, where appropriate, a Supply-Treatment Fee as reimbursement for costs to construct new or expanded treatment facilities, wells and other supply-related projects and a Storage Fee for new or expanded storage project costs that provide capacity for growth.

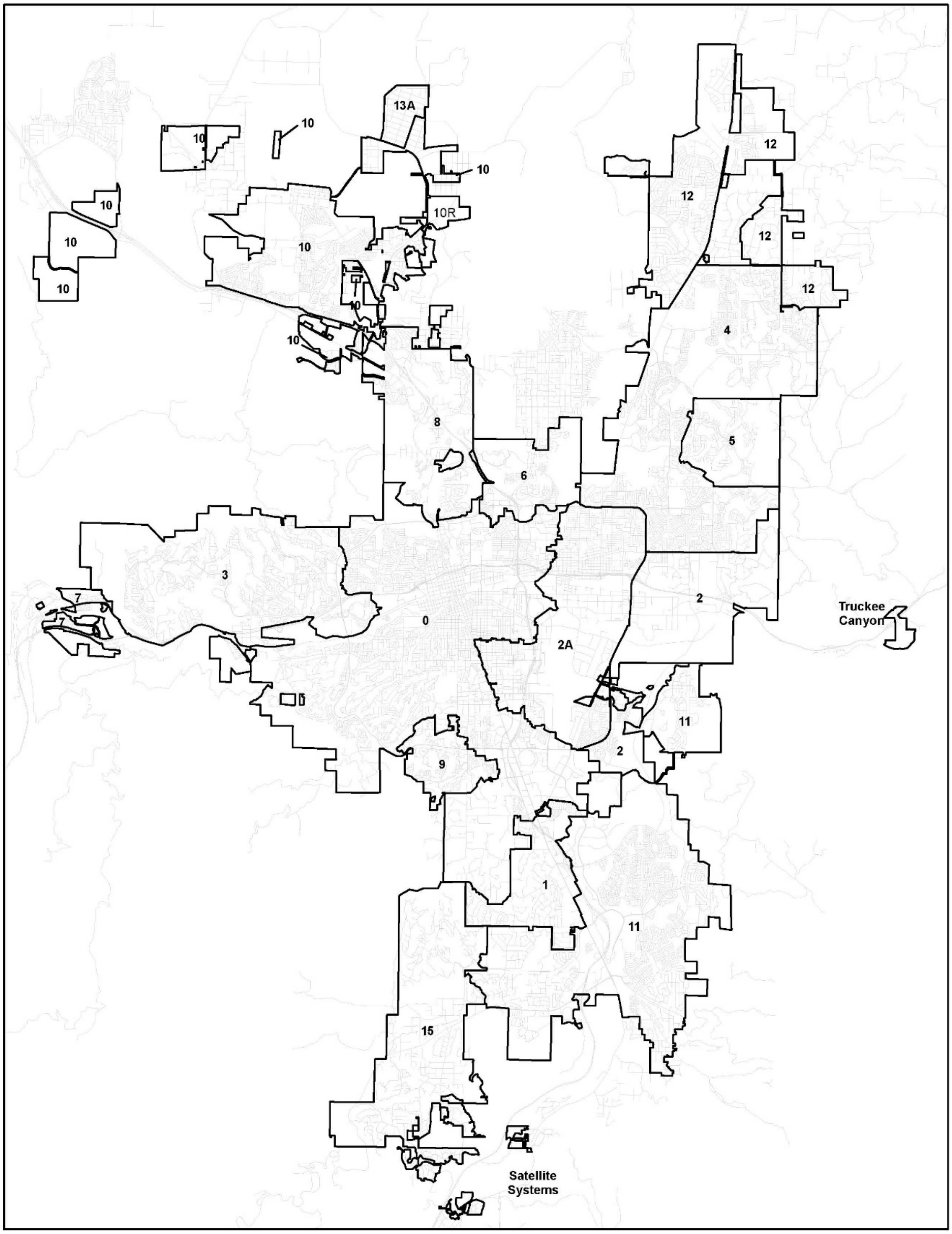


FIGURE 3 – WATER FACILITY FEE AREAS