FARR WEST ENGINEERING

Character | Stewardship | Excellence

5510 Longley Lane • Reno, Nevada 89511 • (775) 851-4788

Water Resource Plan

Storey County

January 2023

EXECUTIVE SUMMARY

This Water Resource Plan (Plan) is intended to provide Storey County (County) a document to guide future decisions related to the County's water supply, transmission and distribution system, and its ability to meet customer water demands into the future. This Plan also addresses the requirements of Nevada Revised Statute (NRS) Chapter 287.0228 as amended by Senate Bill (SB) No. 150, as part of the 2019 legislative session, to require governing bodies to develop and maintain a water resource plan. Per NRS 278.0228, the plan shall be in place by 2029 and then updated every 10 years. This executive summary provides a snapshot of the key findings from each chapter of the Plan. In total, the Plan is comprised of an Introduction and three topic-focused chapters.

INTRODUCTION

This WRP will focus on the populated areas of Virginia City, Gold Hill, American Flat, Virginia City Highlands, Highland Ranches[1], and Mark Twain Estates in the southern portion of the County (Plan Area). A map of the Plan Area is provided in Figure 2. The major water supply for this portion of the County is supplied by the Marlette Lake Water System (Marlette System). The Marlette System is owned and operated by the State of Nevada (State). The Marlette System provides water to the County Water System for customers in Virginia City, Gold Hill, and American Flat. The County also delivers water to residents of Silver City which is located in Lyon County. The remaining populated areas within the Plan Area are supplied by domestic wells.

Because the County does not provide water service in other portions of the County, those areas are outside the scope of this Plan. In the future, it is anticipated that the Canyon General Improvement District (Canyon GID) and the Tahoe Reno Industrial GID (TRI GID) will complete similar water resource plans which can be considered for potential incorporation into this Plan as Appendices.

CHAPTER 1: WATER DEMANDS, SOURCES, AND MANAGEMENT

Chapter 1 summarizes current County Water System water demands, water sources and water management strategies within the Plan Area. This Chapter presents an analysis of current water uses and demands to establish estimates and assumptions which will form the basis for the Plan.

The County Water System currently serves approximately 803 metered customers. The majority of customers (666) are within Virginia City, 51 within Gold Hill, and 86 are within Silver City. The County serves approximately 207 commercial customers and the remaining 596 are residential. For the period between 2018 through 2021 the County Water System consumed an average of 221 AF of water per year and a maximum of 234 AF in 2017 from the Marlette System.

Deliveries to the majority of customers in the County's systems are metered, however some unmetered connections still exist. For this reason, Farr West utilized the Water Treatment Plant (WTP) flow meter data as the basis for estimating system demands. Analysis of WTP water meter records from 2016 to 2019 yielded the following:

- Average Annual Demand (AAD) 210 AF
- Average Day Demand (ADD) 131 gpm
- Maximum Day Demand (MDD) 262 gpm
- Peak Hour Demand (PHD) 524 gpm

Considering the County System serves 803 customers, the average water use per connection is 0.26 AF per year which is equivalent to approximately 0.16 gpm per connection. This average connection demand was

[1] Virginia Ranches are excluded from the Plan Area.

used to set existing water demands but was adjusted to 0.3 AF per new residential connection to estimate future water demands.

The County does not own the water rights to what is currently its only water supply. However, each of the water rights owned by the State defines the place of use as Virginia City, Gold Hill, Silver City, and Carson City. Prior to the State being able to deliver water to locations not currently included as the place of use, a temporary or permanent change to the water right would have to be approved by the Nevada State Engineer (NSE). Finally, the contract between the County and the State for continued delivery of water from the Marlette System is currently being negotiated for renewal.

Historically, the State has implemented 10-year contracts with the County for delivery of Marlette System water according to the limits shown in Table ES-1.

Table ES-1: County Delivery Limits per 2002 Contract (Supply Contract, 2002)

Year	June, July, Aug., & Sept. Daily Peak Limit (gallons per day)	Remaining Month Daily Peak Limit (gallons per day)	Annual Use Limit (acre-feet)
2015	833,500	533,500	448.2
2016	846,500	546,500	456.1
2017	859,500	559,500	464.0
2018	872,500	572,500	471.9
2019	885,500	585,500	479.8
2020	898,500	598,500	487.7
2021	911,500	611,500	495.6

Water for the County Water System is delivered through a seven-mile inverted siphon which transitions to a pipeline. The County's ownership of the system begins at the location where the siphon crosses under Interstate 580 at Lakeview, north of Carson City. The transmission line discharges to the Five-Mile Reservoir and/or the Five-Mile Tank prior to filling the Bullion Tank next to the 1.2 MGD Water Treatment Plant where water is treated to potable standards and placed into the County Water System distribution system.

Key findings of this chapter include a review of water right ownership, water demand calculations, an estimate of unaccounted for water, a summary of water storage facilities, and domestic well pumpage estimates.

CHAPTER 2: SOURCE WATER RELIABILITY AND SYSTEM CAPACITY

Chapter 2 discusses the water system's current capacity, the quality and quantity of all water sources, a water source risk analysis, and drought mitigation strategies available to the County. Recent water use in the Plan Area is estimated to be 1,157 AF per year. Of this volume, 221 AF is raw water from the Marlette System used to serve Virginia City, Gold Hill, and Silver City. The remainder is unmetered groundwater pumped at domestic wells. Utilizing a consumption rate of 1 AF per domestic well it is estimated that 588 AF is pumped in the Highlands, 333 AF in Mark Twain, and 15 AF in the American Flat area.

The only water source currently available to the County Water System is the surface water provided by the Marlette Water System. This source is very reliable and of high quality, however the volume of water available from the Marlette Water System is primarily influenced or restricted by transmission pipeline capacity, although annual snowpack, fishery management at Marlette Lake, and operating agreement limits also have a potential to limit the amount of water available form this source. The annual volume of water available under the Franktown Decree to NPWD is approximately 7,200 AFA. Per the previous operating agreement, the County has reserved up to approximately 500 AF of that annual total.

Water resources within the Plan Areas are less than current demand. Annual recharge of area aquifers is limited due to inadequate elevation of the Plan Area and adjoining areas for significant recharge. The primary source of recharge occurs within the upslope mountain block and is attributed to snowpack melt and infiltration from winter storms. Recharge from drainages can provide an additional source of recharge depending on the slope and soil permeability. The Highlands is dependent on local recharge within the mountain block without significant impact from adjoining areas. The Mark Twain area water resources are impacted by mountain block ("upslope") recharge, recharge conveyed by drainages and the Carson River watershed.

The populated areas of the Highlands and Mark Twain also lie within the Plan Area but are not provided water by the County Water System. Residences in these areas utilize individual wells to provide domestic water supplies. Even though each area sits in a separate hydrographic basin, both areas have experience water availability problems during extended dry periods. Per the Plan, it is not feasible to develop a single, groundwater well to serve the local community in either of these areas due to aquifer performance concerns.

For the County to provide a reliable water supply to its customers, it must actively manage its water sources and system infrastructure. Some key recommendations made in this chapter include:

- Negotiate a long-term delivery agreement and contract with the Marlette Water System,
- Maintain an up-to-date Water Resource Plan,
- Complete a Water Conservation Plan,
- Develop a water right dedication rate schedule and maintain a water right ledger, and
- Develop policy which requires future development utilizing groundwater as its only water source to provide substantial analysis and study of the groundwater aquifer and prove that the proposed uses will have limited and mitigatable effect on existing users or uses.

This chapter also reviewed existing system infrastructure and provided estimates of how much water the system can supply on a regular and maximum day basis. Considering the conveyance capacity of the siphon transmission main, the surface water treatment plant, and the storage tanks throughout the system it is estimated that up to 864 additional residential connections can be added to the system without creating additional infrastructure investment. Additionally, each portion of the system was analyzed separately from one another, and it is estimated that up to 768 units could be added to Virginia City and/or 710 units could be added in Gold Hill. It should be noted that even though these estimates are provided in the unit of single-family residences (SFR), other land uses (e.g., commercial, industrial) can be added to the system. Projected water demands for these uses should be divided by the SFR water demand factor of 0.3 AF per unit to account for the number of "units" the proposed development represents in overall system capacity accounting.

CHAPTER 3: FUTURE DEMANDS AND WATER MANAGEMENT

The purpose of Chapter 3 is to estimate potential buildout demands resulting from future land development within the Plan Area. This chapter also identifies the impacts to the Storey County Water System at the buildout condition which includes improvements to existing infrastructure and water right holdings. Future utility and water resource planning efforts is also discussed.

Future water demands for the Plan Area were generated from applying water demand factors against parcel size (i.e., acreage) or unit counts using designated land uses as of December 2020. The areas analyzed were:

- The Comstock,
- VC Highlands,
- Mark Twain, and
- American Flat.

Table ES-2 provides an accounting of the projected number of units or acres which can be developed in each sub-area.

Table ES-2: Vacant Parcel Land Use

	Comstock	Highlands	Mark Twain	American Flat	Total
Single-Family Residential (ERUs)	293	607	74	-	**974**
Multi-Family Residential (ERUs)	21	-	-	-	**21**
Commercial (Acres)	132	-	-	-	**132**
Industrial (Acres)	19	-	4,327	252	**4,598**
Forestry (ERUs)	11	-	23	31	**65**
Special Planning Zone (parcels)	74	-	-	-	**74**

Utilizing water demand factors based on the existing system or similar areas in the region, estimated water demands were estimated at the buildout condition for each sub-area. A summary of these estimates is shown below in Table ES-3.

Table ES-3: Plan Area Water Demands

Area	Existing Demand (AFA)	Additional Demand (AFA)	Buildout Demand (AFA)
Comstock	221	456[i]	677[i]
Highlands	176	182	358
Mark Twain[2]	100	4,875	4,975
American Flat	4.5	291	296
Total	502	5,804	6,306

i - Includes 105.3 AFA for Silver City

To supply the volume of water that will be required to meet maximum day demands of the entire Plan Area at buildout, the County will need to have sufficient conveyance capacity in their water system infrastructure as well as have the water rights needed to provide almost 7,000 acre-feet of water on an annual basis. Farr

[2] This table is based on the land use maps identified in 2016 Master Plan for Storey County. Storey County is currently developing a Housing Study for the county and the results of the Study may suggest modifications to housing considerations within the different areas of the county. Future Master Plan amendments may be considered as a result of the Housing Study. Significant changes to Master Plan land use elements may require additional analysis and amendments to this Water Resource Plan.

West developed improvement project(s) for each water system need in the future to provide a scenario for what the integration or development of specific areas will have on the current system. Per the findings of this chapter, the County will need to invest between $5.7 and $127 million dollars in water system improvement projects in order to maintain system compliance and supply water to new areas (e.g., Highlands, American Flat, Mark Twain).

Table ES-4: Water System Projects

Project	Probable Cost[i]
Existing System Deficiencies	$6.0 M
Comstock Service Area Buildout	$12.4 M
Comstock Service Area Buildout + American Flat Buildout	$27.7 M
Comstock Service Area Buildout + Mark Twain Ex. Residents Only	$53.4 M
Comstock Service Area Buildout + Highlands Ex. Residents Only	$95 M
Comstock Service Area Buildout + Highlands Buildout	$126 M

i – All costs are presented in 2021 dollars and are Class 5 per AACEI (Association for the Advancement of Cost Estimating International)

In addition to constructing the infrastructure necessary to provide water service at buildout, the County will need to maintain or acquire a sufficient water rights to be able to serve the number of connections projected at buildout. At the most extreme condition where the County Water System is expanded to provide service to meet the buildout demands of the Highlands, Mark Twain, and American Flat in addition to the buildout demands of the Comstock, the volume of water rights needed would be 6,911 AF. If the County were to only provide water service to the existing Comstock area, this total is reduced to 2,178 AF.

This chapter also evaluated additional water sources which may be available to the County in the future. While the new external sources are unlikely to be connected in the near term (i.e., 10 years) it is important to document every option in the case that economic, political, or system conditions change, and the viability of these sources is altered. Additionally, by implementing a proactive approach to water management planning, Storey County will ensure a reliable and resilient water utility well into the future to meet the needs of its residents and businesses.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i
Table of Contents vi
Table of Tables viii
Table of Figures viii

INTRODUCTION 4
1.0 Purpose 5
2.0 Background 5
3.0 Scope of Water Resource Plan 5
3.1 Plan Area 5
3.2 Need for a Water Resource Plan 5

CHAPTER 1: WATER DEMANDS, SOURCES, AND MANAGEMENT 1
1.0 Purpose 1
2.0 Summary of Communities 1
2.1 Storey County Water Customers 1
2.2 Estimated Population within Plan Area 1
3.0 Water Resources 2
4.0 Water Rights in Nevada 2
4.1 Water Right Priority and Appropriation Statutes and Regulation 2
4.2 Nevada State Engineer Regulatory Actions 3
4.3 Water Right Ownership 3
5.0 Marlette Water System 3
5.1 Franktown Creek Decree 3
5.2 Marlette Lake Water Rights 3
5.3 Marlette System Surface Water Rights 4
5.4 Contract Between State of Nevada and Storey County 6
6.0 Water Rights within Storey County 6
6.1 Tracey Segment Water Rights 6
6.2 Dayton Valley Lake Water Rights 7
6.3 Domestic Groundwater Use 7
7.0 Water Production and Facilities 8
7.1 Storey County Water System Facilities 8
7.2 Storey County System Demands 8
7.2.1 Raw Water Delivery 8
7.2.2 Water Treatment Plant Production 9
7.2.3 Customer Meter Records 9
7.3 Water Demand Factors 10
7.4 Unaccounted For Water 10
7.5 Water Storage Facilities 11

CHAPTER 2: SOURCE WATER RELIABILITY 13
1.0 Purpose 13
2.0 Water Resource Availability and Management 13
2.1 Estimated Use Within Plan Area 13
2.2 Surface Water 13
2.3 Groundwater 13
3.0 Threats to Existing and Future Water Resources 15
3.1 Drought and Climate Change 16
3.2 Regulatory Actions 17

3.3 Contamination 18
3.3.1 Surface Water 18
3.3.2 Groundwater 18
3.3.3 Distribution System 18
3.4 Conveyance Interruptions 18
4.0 Remaining Capacity Analysis 19
4.1 Remaining Storage Capacity 19
4.2 Remaining Supply Capacity 19
4.3 Remaining System Capacity 20
5.0 Long-Term Strategies 22
5.1 Water Rights 22
5.1.1 Surface Water 22
5.1.2 Groundwater 22
5.1.3 Best Management Practices 24
5.2 Resource Management 24
5.3 Dedication Rates 24
5.4 Water Conservation Plan 25
5.5 Water Resource Planning 25

CHAPTER 3: MANAGEMENT OF WATER RESOURCES 26
1.0 Purpose 26
2.0 Future Demands 26
2.1 Vacant Parcels and Land Use 26
2.2 Demand Factors and Total Buildout Demands 32
3.0 Buildout Impacts 33
3.1 Infrastructure Improvements 33
3.1.1 County Water System 33
3.1.2 American Flat 34
3.1.3 Mark Twain 34
3.1.4 VC Highlands 35
3.1.5 Siphon Upgrades 37
3.1.6 Water Treatment Plant Upgrades 37
3.1.7 Project Summary 37
3.2 Water Rights 38
4.0 Future Management 39
4.1 Future Water Resources 39
4.2 Regionalization 39
5.0 Future Water Management Planning 39
6.0 Conclusion 40

Bibliography 41

Appendix A ..... Storey County 2016 Master Plan
Appendix B ..... Storage and Supply Calculations
Appendix C ..... Opinions of Probable Cost

LIST OF TABLES

Table ES-1: County Delivery Limits per 2002 Contract (Supply Contract, 2002) ii
Table ES-2: Vacant Parcel Land Use iv
Table ES-3: Plan Area Water Demands iv
Table ES-4: Water System Projects v
Table 5: Current Population and Household Size 2
Table 6: Marlette System Water Rights 5
Table 7: County Delivery Limits per 2002 Contract (Supply Contract, 2002) 6
Table 8: Domestic Pumpage Estimates 7
Table 9: Monthly Raw Water Deliveries (Acre-Feet) 9
Table 10: Residential Customer Demand 10
Table 11: Commercial Customer Demand 10
Table 12: Total Customer Demand 10
Table 13: System Demands 11
Table 14: Water Storage Facilities 12
Table 15: Existing Customer Base System Capacity Analysis 20
Table 16: Existing System Maximum Capacity Analysis (864 Additional Connections) 21
Table 17: Storage + Supply Calculations Summary for Storey County Systems 21
Table 18: Water Demand Factors 27
Table 19: Vacant Parcel Land Use 33
Table 20: Plan Area Water Demands 33
Table 21: Water Treatment Plant Capacity Upgrade Needs 38
Table 22: Water System Projects 38
Table 23: Water System Planning 41

LIST OF FIGURES

Figure 1: Storey County 2016 Master Plan Planning Areas x
Figure 2: Plan Area xi
Figure 3: Monthly Average Water Treatment Plan Production (2016 – 2019) 9
Figure 4: Annual Percentage of Revenue Water 12
Figure 5: Comstock Vacant Parcels 29
Figure 6: Highlands Vacant Parcels 30
Figure 7: Mark Twain Vacant Parcels 31
Figure 8: American Flat Land Use 32
Figure 9: Highlands Water System Improvements 37

INTRODUCTION

1.0 PURPOSE

The Water Resource Plan (Plan) provides Storey County (County) with a documented plan and policy related to the County's ability to provide a sustainable water supply to its customers even during periods of extended drought. This Plan also addresses the requirements of Nevada Revised Statute (NRS) Chapter 287 as amended by Senate Bill (SB) No. 150 (2019) to require governing bodies to develop and maintain a water resource plan by 2029.

2.0 BACKGROUND

On January 21, 2020, the Storey County Board of County Commissioners awarded a contract to Farr West Engineering to prepare a Water Resource Plan. This Plan is separated into three chapters, with each addressing a specific component of the Plan as follows:

- Chapter 1 – Water Demands, Sources, and Management
- Chapter 2 – Source Water Reliability and System Capacity
- Chapter 3 – Future Demand and Water Management

3.0 SCOPE OF WATER RESOURCE PLAN

Storey County is located in the Western portion of Northern Nevada. The County is bordered by Washoe County to the west and north and Lyon County to the east and south. The County is a mountainous area which sits above the Reno metropolitan area and is bounded by the Truckee River to the north. There are eight distinct land use areas in the County including Comstock (Virginia City, Gold Hill, and American Flat), Highlands (Virginia City Highlands and Highland Ranches), Lagomarsino, Lockwood-Mustang, McCarran, Painted Rock, Northeast, and Mark Twain. The County is considered rural but includes areas with high-tech industry.

3.1 PLAN AREA

This Plan will focus on the populated areas of Virginia City, Gold Hill, American Flat, Virginia City Highlands, Highland Ranches, and Mark Twain Estates in the southern portion of the County (Plan Area). A map of the Plan Area is provided in Figure 2.

The major water supply for this portion of the County is supplied by the Marlette Lake Water System (Marlette System). The Marlette System is owned and operated by the State of Nevada (State). Pursuant to Nevada Revised Statute (NRS) 331.160, the Public Works Division (NPWD) is responsible for the supervision and administration of the system which includes transmission and storage of water in Carson City, Washoe County, and Storey County. The Marlette System provides water to the County for customers in Virginia City, Gold Hill, and American Flat. The County also delivers water to residents of Silver City which is in Lyon County. The remaining populated areas within the Plan Area are supplied by domestic wells.

Because the County does not provide water service in other portions of the County, those areas are outside the scope of this Plan. In the future, it is anticipated that the Canyon General Improvement District (GID) and the Tahoe Reno Industrial GID (TRI GID) will complete similar water resource plans which can be considered for potential incorporation into this Plan as Appendices.

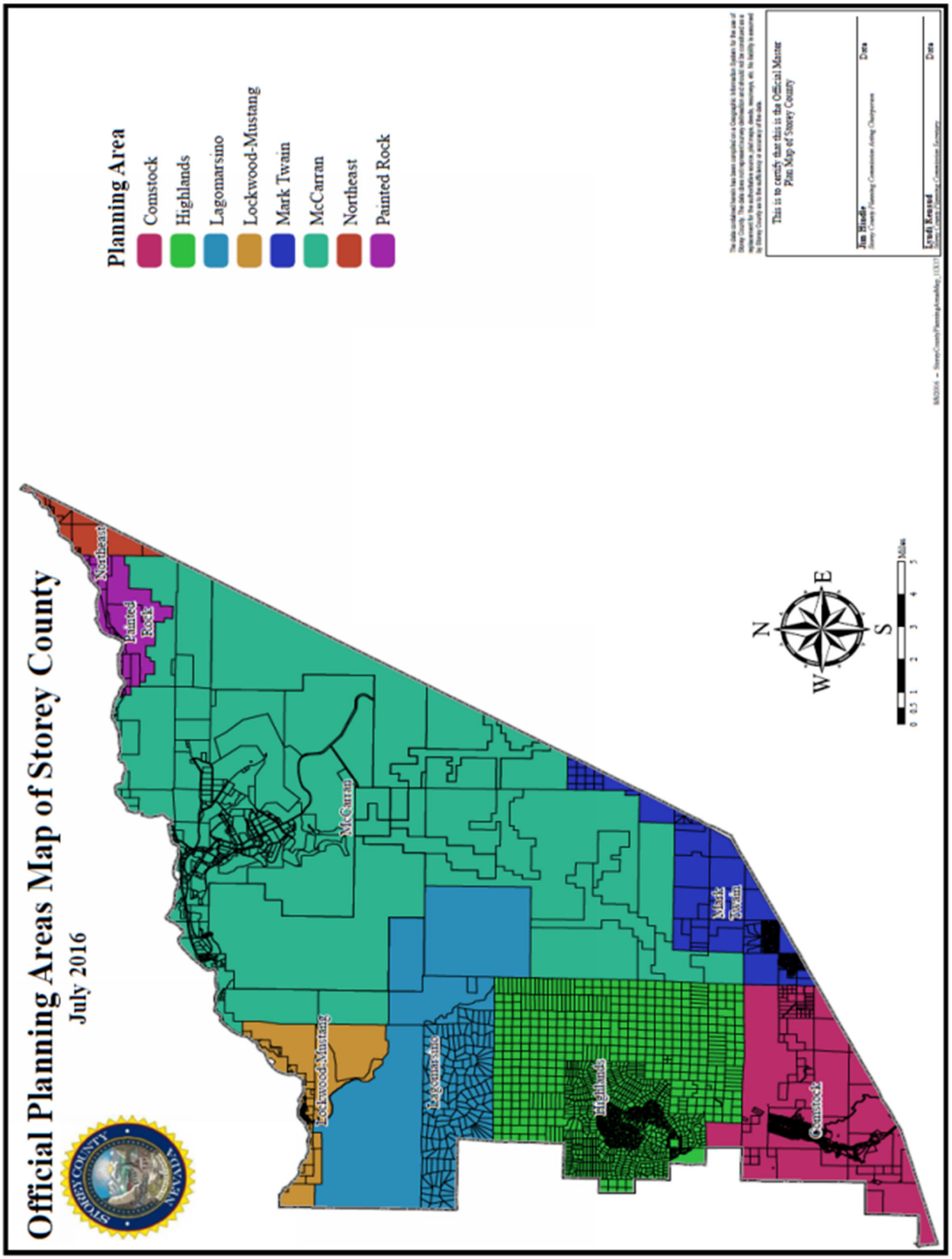
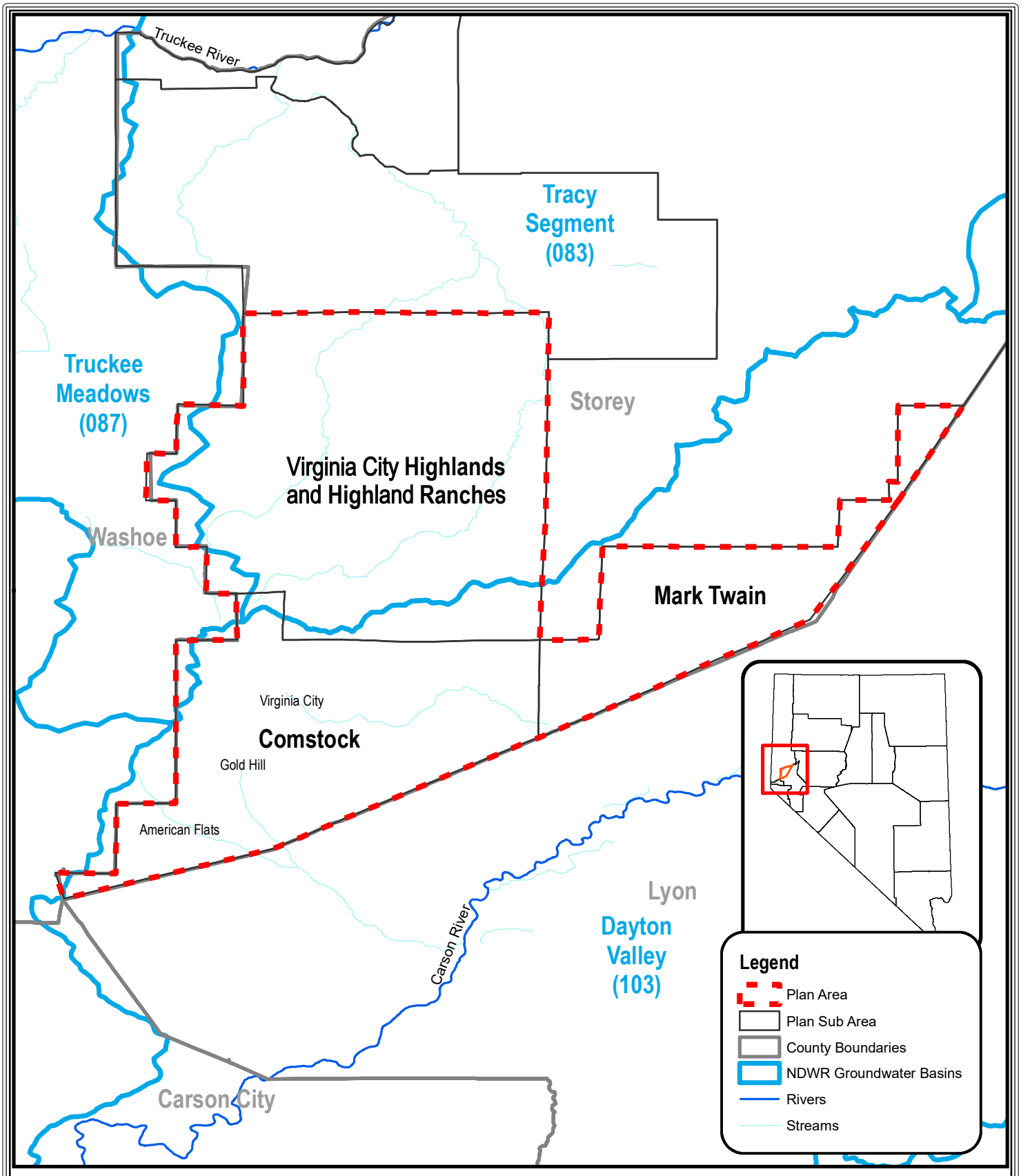


Figure 1: Storey County 2016 Master Plan Planning Areas



The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

N

1 " = 15,000 '

Figure 2: Plan Area With Select Water Features

FARR WEST ENGINEERING
5510 Longley Lane
Reno, NV 89511
(775) 851-4788
www.farrwestengineering.com

P:\Client Projects\Storey County 092\1797 Water Resource Plan\3.0 Studies_Reports\3.4 Dwg_Figs\MAPS\Figure2.mxd, Editor: tbrashler, Printed: 8/25/2021

3.2 NEED FOR A WATER RESOURCE PLAN

The County does not own the water rights to what is currently its only water supply. In addition, the contract between the County and the State for continued delivery of water from the Marlette System is currently being negotiated for renewal. This Plan will review current water demands within the Plan Area and project water demands into the future based on buildout scenarios. This analysis will assist the County in determining the amount of water which may be needed to serve customers in the future and ensure that there are adequate supplies.

This Plan is the County's first water resource plan, and it is recommended that this Plan be updated every five to ten years to address issues due to potential changes in Nevada water law, economic growth, land use planning, water quality, and water quantity. Additionally, NRS 278.0228 requires that governing bodies update their water resource plan no less than every ten years. This Plan will provide the basis for future updates and help guide the County in decisions related to water resources including future investments in the water system and water sources.

The County completed its Master Plan in 2016. The 2016 Master Plan states, "Nearly every community in the county is faced with water supply challenges." Water resource planning is tied directly to master planning efforts, and these two planning efforts are intended to complement each other. Information from the 2016 Master Plan was used in this Plan.

CHAPTER 1: WATER DEMANDS, SOURCES, AND MANAGEMENT

1.0 PURPOSE

The purpose of this chapter is to summarize current water demands, water sources and water management strategies within the Plan Area. As described in the Introduction, the Plan Area consists of the populated areas in the southern portion of the County including Virginia City, Gold Hill, American Flat, Virginia City Highlands, Highland Ranches and Mark Twain Estates and is shown on Figure 2. The Storey County Water System currently serves customers in Virginia City and Gold Hill and delivers water to Silver City in Lyon County. Other communities within the Plan Area rely on individual wells to meet demands. This chapter presents an analysis of current water uses and demands to establish estimates and assumptions which will form the basis for the Plan.

2.0 SUMMARY OF COMMUNITIES

The Comstock Area, located at the southern end of the County, includes Virginia City, the Divide, Gold Hill and American Flat. This area was originally developed in the late 1800s and considerable measures are employed to maintain the rich historical character while promoting business, tourism, and the rural Nevada lifestyle. The Highlands Area, located north of the Comstock, is a residential estate community surrounded by undeveloped lands. This is a rural community which is relatively close to the conveniences of the Reno metropolitan area. There are no commercial uses within the Highlands. The Mark Twain Area is also a residential estate community surrounded by undeveloped lands and is at the southern border of the County. Mark Twain abuts Lyon County and is near the growing suburban area of Dayton.

2.1 STOREY COUNTY WATER CUSTOMERS

The County currently serves approximately 803 metered customers. The majority of customers (666) are within Virginia City, 51 within Gold Hill, and 86 are within Silver City. The County serves approximately 207 commercial customers and the remaining 596 are residential.

2.2 ESTIMATED POPULATION WITHIN PLAN AREA

The County's 2016 Master Plan includes a population summary based on data from 2014. This information is reproduced in Table 5 below along with an estimate of current population provided by the State Demographer. The population estimate for Storey County for 2019 was 4,258. The Demographer also provides estimates for Gold Hill and Virginia City. The 2019 population of the other areas in Table 5 were estimated based on the Demographer's information and 2014 population estimates from the 2016 Master Plan. The estimated population of the Plan Area is 3,346 persons.

Table 5: Current Population and Household Size

Area	2014	2019
Storey County	3,974	4,258
Gold Hill	201	206
Virginia City	832	904
Highlands	1,398	1,498
Mark Twain	689	738
Lockwood/River	979	1,049
Household Size	2.1	2.1

[i] Sources: (Storey County, 2016); (Demographer, 2020)

3.0 WATER RESOURCES

The major water supply within the Plan Area is the Marlette Lake Water System (Marlette System). The Marlette System is owned and operated by the State of Nevada (State). Pursuant to Nevada Revised Statute (NRS) 331.160, the Public Works Division (NPWD) is responsible for the supervision and administration of the system which includes transmission and storage of water in Storey County, Carson City, and Washoe County. Currently, Carson City and Storey County are the only two customers of the Marlette System.

The Marlette System provides water to the County to supply customers in Virginia City and Gold Hill. The County also delivers water to Silver City located in Lyon County. The remaining populated areas are supplied by domestic wells.

4.0 WATER RIGHTS IN NEVADA

The Nevada Division of Water Resources (NDWR) is the regulatory authority for water rights in the State of Nevada. The Nevada State Engineer (NSE), as head of this division, approves or denies water right applications, establishes limitations to water usage and manages dam safety operations within the State.

4.1 WATER RIGHT PRIORITY AND APPROPRIATION STATUTES AND REGULATION

The legal process to acquire water rights and transfer those rights to the subject property is defined by Nevada Revised Statutes (NRS) Chapters 533 and 534, Nevada Administrative Code (NAC), and internal office policy. All water, whether surface or groundwater is owned by the citizens of the State. Nevada water right law is based on the prior appropriation doctrine, otherwise known as "first in time, first in right." By filing an application to appropriate through the office of the Nevada State Engineer (NSE), surface water resources have been appropriated since 1905 and groundwater resources in Nevada have been appropriated for use since 1939. The priority date assigned to each water right establishes what water rights can be exercised from a source depending on available water at a given time.

Another pillar of Nevada water right law is the concept of beneficial use. Beneficial use is the basis, measure, and limit to the water right. This means that only the portion of the water right that can be used beneficially is established as the perfected, or certificated water right. To allow water right owners flexibility to place their rights to beneficial use, there is a process to change or move the permitted location of these water rights to meet project demands. Furthermore, if the beneficial use of the right was initiated prior to the 1905 or 1939 appropriation dates for surface water and groundwater, respectively, those rights are deemed vested[3] water rights and are thus more senior than rights appropriated after 1905 or 1939.

[3] Vested water rights are limited to existing places of use and manner of use until an adjudication of the basin of origin is completed.

Historically, the management of groundwater rights and surface water rights by the state engineer adhered to a clear distinction, treating each source as distinct and separate. However, recognizing the evident hydrologic interconnection between ground and surface water resources, recent legislative measures, found under NRS 533.024, have directed the state engineer to adopt conjunctive management principles concerning the available surface and underground sources of water in Nevada.

In light of the complex nature of this issue, the Nevada Division of Water Resources continues to classify ground and surface water rights within separate administrative frameworks. Nevertheless, it is prudent for forward-looking water rights management to encompass an understanding of potential future consequences stemming from the implementation of conjunctive use strategies.

4.2 NEVADA STATE ENGINEER REGULATORY ACTIONS

Dayton Valley and the Tracey Segment Hydrographic Basins are within the Plan Area. The NSE has designated both groundwater basins under Orders 471 and 688 in Dayton Valley and Order 705 in the Tracey Segment. These designation Orders provide the NSE additional regulatory tools to manage groundwater appropriation such as designation of preferred/non-preferred uses and processing applications out of filing order.

The Dayton Valley Hydrographic Basin is considered over-appropriated. NSE Ruling 5823 established the perennial yield between 8,000 and 20,000 acre-feet annually (AFA) and approximately 24,495 AFA are currently appropriated. The Tracey Segment Hydrographic Basin is nearing the perennial yield of 11,500 AFA according to NSE Ruling 5747, with approximately 11,230 AFA appropriated. For planning purposes, the ability to obtain new appropriations for groundwater in either hydrographic basin is considered limited.

4.3 WATER RIGHT OWNERSHIP

Water rights in the Marlette System have been held by different parties over the years. Reports of Conveyance which update water right ownership must be submitted to NDWR, and deeds that transfer ownership are recorded in the respective County Recorder's office. Water right ownership processes are important to understand especially as the County does not own the water rights to the Marlette System. Currently, the State owns all water rights associated with Marlette System approved for use within the County which are described below. Each of the water rights owned by the State defines the place of use as Virginia City, Gold Hill, Silver City, and Carson City. Prior to the State being able to deliver water to locations not currently included as the place of use, an application to expand the place of use would have to be submitted and approved by the NSE.

5.0 MARLETTE WATER SYSTEM

The Marlette System dates back to the 1870's and includes several water sources. The following is a summary of the Marlette System sources and water rights.

5.1 FRANKTOWN CREEK DECREE

The Franktown Creek Decree defines the water rights to streams on the eastern slope of the Sierra Nevada Mountains which are associated with the Marlette System. The decree is the result of a 1951 petition by the Franktown Creek Irrigation District to the State Engineer to determine the relative rights of claimants to the waters of Franktown Creek. At the time of the decree, the water rights to the Marlette System were held by Marlette Lake Company. The decree states that the water source for Marlette Lake Company is, "Hobart Creek (tributary to Franktown Creek) and certain waters in the Franktown Creek Watershed proper having sources in the eastern slopes of the Sierra Nevada Mountains at and above Red House" (Franktown Creek Decree, 1961). The decree also states that the Marlette Lake Company had the right to store water in the 110-acre foot Hobart Reservoir. Water stored in Hobart Reservoir is released to supplement flows in the natural channel. The amount of the Claim was limited to 10 cubic feet per second (cfs) based on the capacity

of the flumes downstream from Red House (Affirmation, 1963). This water right is described as Franktown Decree Claim V-02419 and is deemed "vested" since the beneficial use of this water right was initiated prior to March 1, 1905. The specific priority and volume for these rights will be determined in the future should Franktown Creek undergo an adjudication.

5.2 MARLETTE LAKE WATER RIGHTS

Marlette Lake was originally constructed in 1873. A tunnel was constructed through Herlan Peak to connect Marlette Lake to Franktown Creek and Hobart Reservoir. Marlette Lake had an initial capacity of about 3,400 acre-feet (AF) when it was constructed in 1873. The dam was subsequently raised to its current height in 1959 to bring the capacity to approximately 11,500 AF. Prior to purchase by the State, discussed further below, there were no documented water rights associated with Marlette Lake as the original construction pre-dated the statutory requirements to file an application. Marlette Lake water rights are currently subject to an agreement between the State's Building and Grounds Department and Nevada Department of Wildlife. The agreement limits annual diversions to maintain a minimum water surface elevation necessary for spawning of the for the Lahontan Cutthroat Trout and could impact water resource availability should the County require water from Marlette Lake in any given year.

5.3 MARLETTE SYSTEM SURFACE WATER RIGHTS

In 1963, Marlette Lake Company sold all property, water rights, easements and improvements associated with the Marlette System to the State. This included Marlette Lake, all water rights included in the Franktown Creek Decree (i.e., waters above Red House Diversion Dam and Hobart Lake), Five Mile Reservoir and waters of Mill Creek, Tunnel Creek and others draining into the North Flume. Following the purchase of these rights, the State filed additional water right applications. A summary of these water rights is provided in Table 6.

Table 6: Marlette System Water Rights

Owner of Record	App	Cert	Priority Date	App Status	Source	Source Description	Type of Use	Div. Rate (cfs)	Duty (AFA/S)	AF Storage
Marlette Drainage										
Nevada Building and Grounds Division	24877	8855	1/22/1969	Certificate	Stream	Marlette Creek and Lake	Municipal	0.000	90.79	3,000
Nevada Building and Grounds Division	30896	--	12/8/1976	Permit	Stream	Marlette Creek and Lake and Tributary	Municipal	0.000	3,000.00	0
Hobart Drainage										
Nevada Building and Grounds Division	24876	8801	1/22/1969	Certificate	Underground	Tunnel	Municipal	0.710	514.00	0
Nevada Building and Grounds Division	30895	10786	12/8/1976	Certificate	Underground	Tunnel	Municipal	0.836	631.89	0
Nevada State Lands Division	V02419	--	1/8/1871	Decree	Stream	Hobart Creek	Municipal	10.000	7,240.14[i]	-

i – Not to exceed. Volume not specified in Franktown Decree.

5.4 CONTRACT BETWEEN STATE OF NEVADA AND STOREY COUNTY

As described in this section, all water rights for the Marlette System are owned by the State and administered by NPWD. The State has provided water to Storey County since 1963. Historically, the State has entered into 10-year contracts with the County for delivery of Marlette System water. This is currently the only supply available to County water customers located in Virginia City, Gold Hill, and Silver City. Currently, the County and the State are negotiating a new contract. While this occurs, the entities have agreed to operate under the terms of the prior contract dated October 23, 2002 (2002 Contract).

The 2002 Contract includes a table summarizing the maximum amount of raw water to be supplied to the County each year through 2021. A portion of this information is reproduced in Table 7. It is important to note that this is for illustrative purposes only and does not represent any indication of current negotiations between the State and County.

Table 7: County Delivery Limits per 2002 Contract (Supply Contract, 2002)

Year	June, July, Aug., & Sept. Daily Peak Limit (gallons per day)	Remaining Month Daily Peak Limit (gallons per day)	Annual Use Limit (acre-feet)
2015	833,500	533,500	448.2
2016	846,500	546,500	456.1
2017	859,500	559,500	464.0
2018	872,500	572,500	471.9
2019	885,500	585,500	479.8
2020	898,500	598,500	487.7
2021	911,500	611,500	495.6

6.0 WATER RIGHTS WITHIN STOREY COUNTY

There are other water users within the southern portion of Storey County which rely on water rights to groundwater, springs, and small streams. These water rights are currently not permitted for municipal purposes and are instead for use by individuals or companies for mining and milling, stock water, irrigation, environmental, domestic, and quasi-municipal purposes. A more specific study or analysis is needed to determine if these rights may be available to the County for M&I uses in the future.

6.1 TRACEY SEGMENT WATER RIGHTS

The County is listed as the owner of two groundwater rights within the Tracey Segment Hydrographic Basin. These water rights are permitted for use in the Canyon General Improvement District (GID)[4] water system, although the GID maintains a separate holding of rights which are used to provide service to its non-County facility customers. Permit No. 80870, and Permit 50553, Certificate No. 18224 are for quasi-municipal and domestic uses to support County facilities and uses within the GID service area. These water rights represent approximately 48.5 AF in two production wells. For planning purposes, the balance[5] of water rights above what is being used to support County facilities in the GID service area could be transferred to another location within the Tracey Segment Hydrographic Basin. A more specific study or analysis is needed to determine the exact balance of these rights that may be available to the County for use in the basin.

[4] The canyon GID is outside of the Water Resource Plan study area.
[5] The volume of water which could be transferred is currently unknown and requires additional analysis to determine.

6.2 DAYTON VALLEY WATER RIGHTS

A review of water rights appropriated by Storey County in the Dayton Valley Hydrographic Basin indicates four previous applications, which have been cancelled or denied, that sought water rights to support fire protection and storage for treated effluent. The applications and permits contain limited information as to the nature of the cancellation or denial, but several attempts to appropriate water since the 1980s may indicate a need for this water.

Currently, Storey County operates two wastewater facilities in the basin, the Virginia City WWTP and the Gold Hill WWTP. Both facilities discharge category D effluent to Six Mile Creek and Gold Creek, respectively. Approved uses for category D effluent can be found in NAC 445A.2768.

6.3 DOMESTIC GROUNDWATER USE

A water right is not required for a domestic well to serve a single-family dwelling. Groundwater use for domestic purposes is not to exceed 2 AF per year. Domestic wells exist in portions of three hydrographic basins within the Plan area including Tracy Segment, Dayton Valley and a small portion of the Truckee Meadows as shown in Figure 2. NDWR documents the number of domestic wells within each groundwater basin and then estimates domestic use at 1 AF per year for each domestic well. Based on current County GIS data, the number of single-family residences with a domestic well within the Plan area was determined, and the same assumption of 1 AF per year for each domestic well was applied. Table 8 summarizes the volume of committed groundwater resources associated with domestic wells[6] (i.e., 2 AF per domestic well) and the estimated volume pumped for the entire basin and for the portions within the Plan area.

Table 8: Domestic Pumpage Estimates

Basin	NDWR Values for Basin[i]		Plan Area Estimates[ii]	
	Committed Volume (AF)	Estimated Annual Use (AF)	Committed Volume (AF)	Estimated Annual Use (AF)
Dayton Valley	3,012	1,506	744	372
Tracy Segment	1,460	730	1,064	532
Truckee Meadows	3,498	1,749	80	40

[i] This information is based on the Water Year 2017 Pumpage Inventories for the Dayton Valley, Tracy Segment and Truckee Meadows Hydrographic Basins.

[ii] The Plan Area estimates are based on a query of the NDWR Well Log Database dated November 15, 2019 and downloaded from the NDWR website on February 26, 2020 along with Storey County assessor parcel data.

[6] Domestic wells are exempt from water right permitting requirements in the State of Nevada unless the maximum demand of the user exceeds 2 acre-feet annually.

7.0 WATER PRODUCTION AND FACILITIES

As described above, the County's primary water source is surface water which originates from the Marlette System which consists of two reservoirs, several catchment basins, and a diversion dam on Hobart Creek at Red House. The current capacity of the flumed pipe diverting water at Red House water control facility is about 7 cubic feet per second (cfs) or 3,142 gallons per minute (gpm). From the Red House facility, the pipe discharges to the Lakeview Tank. At this location, water can be directed towards Carson City or Storey County.

7.1 STOREY COUNTY WATER SYSTEM FACILITIES

Water for the County is delivered through a seven-mile inverted siphon which transitions to a pipeline. The County's ownership of the system begins at the location where the siphon crosses under Interstate 580 at Lakeview, north of Carson City. The transmission line discharges to the Five-Mile Reservoir and/or the Five-Mile Tank. The transmission main from the Lakeview Tank to Five-Mile is currently operated at a flow rate up to 320 gallons per minute[7] (gpm). During normal operations, the transmission line discharges directly to Five-Mile Reservoir which fills the tank or continues northeast to the Bullion Tank then through the water treatment plant at the south end of Virginia City.

The water treatment plant is a filtration plant used to meet surface water treatment requirements and has a capacity of 1.2 MGD[8]. The treated water is then pumped into the Hillside storage tanks. From the Hillside tanks, the water flows directly into the distribution system and can also fill the Taylor Tank and Divide Tank. Water from the Divide Tank is used to supply Gold Hill and also fills the Silver City Tank to supply the community of Silver City.

7.2 STOREY COUNTY SYSTEM DEMANDS

Within the County's system, water flows are metered at numerous locations that can be considered when analyzing the system demands. For the purpose of this Plan, water meter data for deliveries to the County's system at the Lakeview Tank (source), water treatment plant and customer service connections (end user) were reviewed and analyzed.

7.2.1 Raw Water Delivery

Raw water from the Marlette System is measured by a flow meter at the Lakeview Tank. The County is billed for raw water provided by the State based on readings at this meter. Table 9 summarizes raw water deliveries to the County during 2016 through 2019. During this time, the County used an average of approximately 221 AF per year.

[7] If 320 gpm were to be delivered continuously, this would be equal to approximately 516 AFA. The maximum capacity of the siphon is estimated at 738 gpm (1,190 afa) but the flows are throttled down with valves below the Lakeview Tank.
[8] Based on design capacity flow rate of 875 gpm.

Table 9: Monthly Raw Water Deliveries (Acre-Feet)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2016	12.3	11.2	13.3	14.3	16.8	26.7	34.5	30.9	27.3	16.9	11.6	12.0	**227.7**
2017	11.9	11.1	13.0	11.3	18.0	30.5	33.1	31.4	25.3	16.8	13.2	18.4	**234.0**
2018	11.7	7.5	13.0	14.4	19.4	27.7	31.8	34.2	25.8	18.6	11.4	9.6	**225.1**
2019	9.0	9.4	9.9	10.6	18.9	23.6	28.1	27.0	23.1	16.5	11.8	9.1	**196.9**
Avg.	11.2	9.8	12.3	12.6	18.2	27.1	31.8	30.9	25.4	17.2	12.0	12.3	**220.9**

7.2.2 Water Treatment Plant Production

The water treatment plant was constructed in 1997 and consists of three filters. Figure 3 shows the monthly average flow rate through the water treatment plant during 2016 through 2019. The average production at the treatment plant during this time period was 210 AF per year which equals an average flow rate of 131 gpm. The monthly average treatment plant flows also provide the seasonal demand curve. This seasonal demand curve is typical and shows increased system demand during warmer months when yard irrigation occurs and tourist activity increases. Reduced demand occurs during the cooler, non-irrigation months when tourism slows off its summer and fall peak. Maximum summer production is 2.9 times greater than minimum wintertime production.

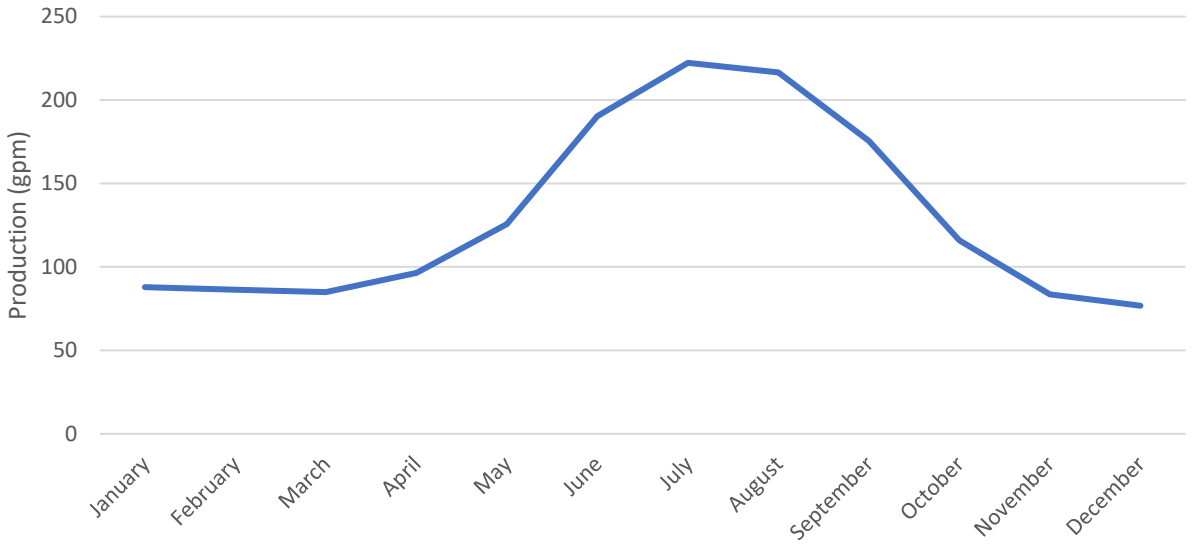


Figure 3: Monthly Average Water Treatment Plan Production (2016 – 2019)

7.2.3 Customer Meter Records

Deliveries to the majority of customers in the County's systems are metered. Currently, the County Public Works shop and the sewer treatment plant are not metered. Table 10 through Table 12 summarizes the daily average and maximum water use, in addition to the flow rate, based on monthly customer records provided by the County for 2018 through 2021. The average demand during this time period was approximately 153,100 gallons per day, or 106.3 gpm. Residential customers accounted for 60 percent of this demand, at 92,800 gallons, or 64.5 gpm, on average. Commercial customers accounted for the other 40 percent at 60,300 gallons, or 41.8 gpm, on average. This average demand is approximately 25 percent of the non-peak daily flow limit from the Marlette System, in 2020.

Between 2018 and 2021, the average maximum day demand was 284,110 gallons per day, or 197.3 gpm. This was approximately 30 percent of the summertime daily flow limit from the Marlette System, in 2020. Residential customers used 167,600 gallons of maximum day demand, on average, or 116.4 gpm. Commercial customers used 116,500 gallons of maximum day demand, equating to 80.9 gpm, on average.

Table 10: Residential Customer Demand

Year	Daily Average		Maximum	
	Delivery (kgal)	Flow Rate (gpm)	Delivery (kgal)	Flow Rate (gpm)
2018	88.0	61.1	177.5	123.3
2019	84.1	58.4	158.6	110.1
2020	95.4	66.2	154.4	107.2
2021	103.8	72.1	179.9	124.9
Average	88.0	61.1	177.5	123.3

Table 11: Commercial Customer Demand

Year	Daily Average		Maximum	
	Delivery (kgal)	Flow Rate (gpm)	Delivery (kgal)	Flow Rate (gpm)
2018	55.6	38.6	102.6	71.3
2019	53.1	36.9	96.3	66.9
2020	62.1	43.1	122.4	85.0
2021	70.2	48.8	144.6	100.4
Average	55.6	38.6	102.6	71.3

Table 12: Total Customer Demand

Year	Daily Average		Maximum	
	Delivery (kgal)	Flow Rate (gpm)	Delivery (kgal)	Flow Rate (gpm)
2018	143.7	99.8	280.2	194.6
2019	137.2	95.3	254.9	177.0
2020	157.5	109.4	276.8	192.2
2021	174.0	120.9	324.5	225.3
Average	143.7	99.8	280.2	194.6

7.3 WATER DEMAND FACTORS

Water demands for a system are typically presented in four ways:

- Average Annual Demand (AAD),
- Average Day Demand (ADD),
- Maximum Day Demand (MDD), and

- Peak Hour Demand (PHD).

For the purposes of this Plan, system water demand factors are based on the WTP flow meter data. As stated above, the average production at the WTP, or AAD, was 210 AF per year. Therefore, the average flow rate (ADD) during the study period of 2016 through 2019 was 131 gpm. Based on the monthly flow data provided, the daily flow during the maximum month was 1.75 times greater than the average day flow. Because daily data are not available, a more conservative peaking factor of 2.0 is used for this Plan. PHD is also based on an assumed PHD peaking factor of 4.0 x ADD. Table 13 summarizes the system demands which will be used in this Plan.

Table 13: System Demands

System Demand	Demand Volume or Flow	Peaking Factor
AAD	210 AF per year	N/A
ADD	131 gpm	N/A
MDD	262 gpm	2.0 x ADD
PHD	524 gpm	4.0 x ADD

Based on the customer meter analysis presented in Section 7.2.3, the average water consumption for residential customers is 0.17 AF per year while commercial customers average 0.33 AF per year. An average connection demand of 0.30 AF (0.19 gpm or 268 gpd) per residential connection and 0.50 AF (0.31 gpm or 446 gpd) per commercial connection will be used in this Plan to estimate future water demands.

7.4 UNACCOUNTED FOR WATER

Unaccounted for water (UAFW) is the difference between the quantity of water purchased/produced and the quantity of water delivered to customers or billed. UAFW is not the same as water loss, as losses are only a component of UAFW. Figure 4 shows the percentage of revenue water which is the counterpart to UAFW and is calculated by dividing the customer meter volume by raw water deliveries. From 2016 through 2019, revenue water fluctuated between 65 and 75 percent on an annual basis, with a non-weighted average of 70 percent.

There are numerous factors that can contribute to UFAW or non-revenue water including waterline leaks, evaporative losses at Five-Mile Reservoir[9], process losses at the water treatment plant, system flushing, unmetered connections, fire hydrants and unmetered construction water usage. The Divide Reservoir[1], which holds 1.5 million gallons of treated water and is used for fire protection, is another connection which is not metered. The Divide Reservoir is located in Virginia City and is on an automatic fill which regularly offsets evaporation, and larger refills occur following use for fire protection. In addition, during the period of 2016 through 2019, several large construction projects took place including a sewer system improvement project, a water main extension/replacement project and construction of the courthouse parking lot with retaining walls. All of these would contribute to the volume of unmetered or unbilled water. It is recommended that the County pursue a comprehensive water loss analysis or audit to confirm the primary contributor(s) to system non-revenue water and reduce this volume below 15 percent of all water purchased from the Marlette Water System.

[9] Average annual evaporative losses at the Five-Mile and Divide Reservoirs are estimated at 1.24 and 0.74 acre-feet, respectively. Combined, these losses make up less than one percent of average annual raw water deliveries.

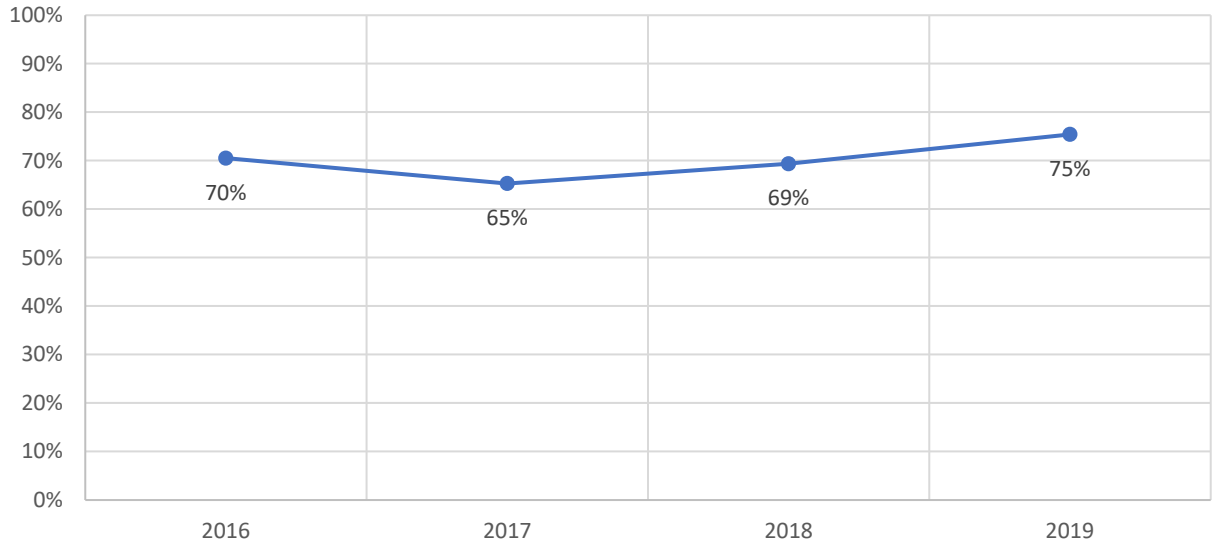


Figure 4: Annual Percentage of Revenue Water

7.5 WATER STORAGE FACILITIES

The County uses non-potable and potable water storage facilities to operate the water system. Table 14 summarizes the capacity of each of the tanks and reservoirs in the County's System. The potable water tanks are designed to provide operational, emergency and fire storage (see NAC 445A.6674 through 6675); however, the Divide Reservoir is used to store water for wildland fire protection purposes only. Additional information and analysis regarding the benefit of water storage is provided in Chapter 2.

Table 14: Water Storage Facilities

Tank	Raw/Potable	Operational Capacity (gal)
Five Mile Reservoir	Raw	5,600,000
Five Mile Tank	Raw	500,000
Bullion Tank	Raw	1,400,000
Total Raw Water Storage =		**7,500,000**
Hillside Tank No. 1	Potable	500,000
Hillside Tank No. 2	Potable	500,000
Taylor Tank	Potable	200,000
Divide Tank	Potable	115,000
Silver City Tank	Potable	160,000
Total Potable Water Storage =		**1,475,000**
Divide Reservoir [i]	Potable	1,552,000

[i] The Divide Reservoir is located at the south end of Virginia City. The reservoir is filled with potable water; however, it is currently only used for wildland fire protection purposes only and does not contribute to system storage volumes.

CHAPTER 2: SOURCE WATER RELIABILITY

1.0 PURPOSE

The purpose of this chapter is to assess the availability, capacity and quality of each water source used within the Plan Area as shown on Figure 2. Additionally, this chapter identifies risks associated with each source and provides strategies to mitigate those potential threats. This chapter also includes an analysis of remaining capacity of Storey County Water System facilities.

2.0 WATER RESOURCE AVAILABILITY AND MANAGEMENT

Water resources within the Plan Area are less than current demand. The County lies in the rain shadows created by the Sierra Nevada Mountains and the Virginia Range. Average annual precipitation in the Plan Area is approximately 12.5 inches per year based on a Western Regional Climate Center station located in Virginia City (WRCC, 2020). Annual recharge of area aquifers is limited due to inadequate elevation of the Plan Area and adjoining areas for significant recharge. The primary source of recharge occurs within the upslope mountain block and is attributed to snowpack melt and infiltration from winter storms. Recharge from drainages can provide an additional source of recharge depending on the slope and soil permeability. The Highlands is dependent on local recharge within the mountain block without significant impact from adjoining areas. The Mark Twain area water resources are impacted by mountain block ("upslope") recharge, recharge conveyed by drainages and the Carson River watershed.

As a result of significant mining activities in the second half of the 19th century, an external water source was brought in to supply domestic and mining uses. This source of water is surface water, supplied by the Marlette Water System from the eastern slope of the Sierra in the Tahoe Basin and is conveyed through a reverse siphon pipeline for approximately 7 miles. This section of the Plan will address the availability of water and current management practices for these existing resources.

2.1 ESTIMATED USE WITHIN PLAN AREA

Recent water use in the Plan Area is estimated to be 1,157 AF per year. Of this volume, 221 AF is raw water from the Marlette System used to serve Virginia City, Gold Hill, and Silver City. The remainder is unmetered groundwater used by domestic wells. Utilizing a consumption rate of 1 AF per domestic well it is estimated that 588 AF is pumped in the Highlands, 333 AF in Mark Twain, and 15 AF in the American Flat area.

2.2 SURFACE WATER

The annual volume of water available under the Franktown Decree to NPWD is approximately 7,200 AFA. Based on the information in Chapter 1, the County can use up to 487.7 AF during 2020. This is more than double the County Water System's current demand. Because water from the Franktown Decree can also be supplemented by water stored in Marlette Lake, the Marlette Water System is a very reliable water source for Virginia City, Gold Hill, and Silver City. However, the maximum volume of water available from the Marlette Water System is restricted by transmission pipeline capacity and impacted by annual snowpack, fishery management at Marlette Lake, and operating agreement limits.

Future water demands, including a buildout scenario, will be analyzed as part of this Plan in chapter 3. This analysis will assist the County in determining the future needs within the Plan Area. Due to groundwater limitations described in Section 2.3, the County must pursue amending its Contract with the State to allow delivery of water to American Flat, the Highlands and Mark Twain.

2.3 GROUNDWATER

In total, Storey County overlies portions of six groundwater basins with the Plan Area overlying portions of four basins. Most of the Highlands area lies within the Tracy Segment Basin (083) and the majority of the Comstock and Mark Twain areas lie within the Dayton Valley (103) Basin. Because of limited recharge and water right appropriations exceeding perennial yields, groundwater development within the Plan Area is limited to predominantly domestic wells. Groundwater availability for the wells varies annually depending on annual recharge, pumping, and corresponding water in groundwater storage. As identified in the chapter 1, future groundwater development will be discussed for the Plan Area and not the entire County.

The Highlands area currently has approximately 588 domestic wells ranging in screen depths from about 53 to 1,500 feet below ground surface. A significant portion of the wells in the area have been deepened over time as the more wells that are added to the area require a greater amount of groundwater from the aquifer, thus resulting in a lowering of the water table. Extended dry periods including between the period between 2013 through 2015 also generally resulted in less water availability. More specifically, Highlands area residents have experienced drawdown ranging upwards of 240-feet in the past requiring wells to be deepened or replaced.

The United States Geologic Survey (USGS) has been contracted to conduct a study of this area and has presented preliminary data in 2019 and 2020. Initial data indicates that groundwater levels have declined approximately 50 to 165 feet within the past two decades (Smith, 2020) in some areas. The study will also evaluate water level trends in the Highlands, develop water table and water level change maps, characterize the fractured volcanic rock aquifer(s)[10] hydraulic properties and estimate recharge rates. The resulting 5-year study, expected in 2022, will provide valuable data that will assist the County in water resource planning. The current groundwater availability in the Highlands is inadequate to support current demands and will not be able to support the buildout condition of the existing lots with cost effective wells. Some residents are currently relying on trucked water and private storage tanks. Although the upper elevations of the Highlands watershed may allow for natural recharge, capturing or diverting precipitation from surface water runoff for local recharge is either not allowed[11] or is already included in determining the perennial yield of the basin and would not result in any additional appropriative right(s). A comprehensive study of the water quality in the Highlands area has not been completed to date, although data which has been made available indicates groundwater in the Highlands can have high concentrations of constituents including, but not limited to total dissolved solids and iron. In fact, most Highlands residents employ some form of filtration treatment technology in their homes for the removal of iron from their domestic well.

The Mark Twain area currently has approximately 333 domestic wells ranging in depths from about 80 to 700 feet below ground surface. The area is proximal to Dayton, Nevada which relies on municipal and domestic wells that produce groundwater from the same alluvial aquifer. Some wells in the Mark Twain area north of the alluvial basin require wells completed in fractured rock aquifers that are typically more limited in capacity than wells in the alluvial aquifer. Like the Highlands, extensive water quality data does not exist for this area, although wells adjacent to this area have not meet water quality standards required for community water systems in the past. Residents in this area have experienced wells going dry when the total depth of the well is 170-feet or less.

The Comstock area includes an area commonly referred to as American Flat, which presently supports approximately 15 domestic wells. Currently, a mine and heap-leach facility is located in American Flat. A

[10] Volcanic rock aquifers are known to offer reduced water storage capacity and provide very limited recharge as compared to aquifers in other geologic units.

[11] A single surface water permit was found for Long Valley Creek for industrial purposes. Any additional appropriation would need to ensure that this senior right would not be negatively impacted by the proposed use. No surface water rights associated with Lagomarsino Creek were found on the NDWR database.

company purchased residences in the area to house mine workers and guests. Originally, American Flat was part of the County water system and received treated surface water from the Marlette System. In 1964, American Flat was excised from the County water services and is now supported by groundwater through two domestic wells. With a total of 44 domestic wells lying within the Comstock area the amount of groundwater being used is small. Also, hydrogeology characteristics indicate that the costs associated with drilling higher capacity production wells will exceed the benefits that would be realized by developing groundwater resources in this area. Additionally, water quality in the Comstock is suspected to generally not meet drinking water maximum contaminant levels due to hydrothermal mineralization and historic (i.e., 19th century) anthropogenic contamination from mining processes. A current liability for the Storey County Water System is the absence of any formal agreement for providing water service to the community of Silver City (Lyon County). It is strongly recommended that Storey County and Lyon County work together to enter into an agreement which clearly defines Storey County's responsibility(s) to provide water service to future development in Silver City.

Because all existing wells in the Plan Area are domestic wells, which are owned and operated by private residents, the County's ability to have influence on the ongoing management of groundwater use may be limited. In the 2016 Master Plan, the County developed many objectives and policies regarding groundwater use within the Plan Area and it is recommended that the County enforce and build on these policies to protect the sustainability of current groundwater resources. The County shall provide education and guidance to private landowners that production from existing domestic wells in the Virginia Highlands is not sustainable and deepening of domestic wells is a cyclic, never-ending process. The County should also demonstrate a commitment to monitoring water quality throughout the Plan Area to the best of its ability, within reason.

The County could also consider adopting policy which improves or promotes the sustainability of local aquifers and provides valuable data for the long-term understanding of aquifer conditions. An example of the proposed policy is:

> Policy: Any new domestic well created through a land use change or parcel map process will be equipped with a meter to measure all water produced by the well. The meter must comply with County specifications and provide electronic direct read transfer of data to County Public Works equipment. The meters are to be used for quantifying the capacity of the limited aquifers in the County. The County may also use the meter data to enforce state limitations for the production of groundwater (i.e., 2 acre-feet annually maximum) or any future restrictions to domestic groundwater production.

Per Chapter 16 of the Storey County Code, land subdivision applications must also demonstrate that a sufficient volume of uncommitted water exists to serve the needs of the development as well as evidence that the use of water for the development will not adversely impact existing surrounding residents, properties and uses. Procurement of the necessary water is not required until filing for final map at which point the sufficiency of the water rights will be reviewed by the County and NDWR. This policy is beneficial to future groundwater sustainability. It is also recommended that the County continue to develop their groundwater management plan, through studies like this plan and by participating in more specific studies, to guide groundwater use in these areas. See appendix A for supporting information.

3.0 THREATS TO EXISTING AND FUTURE WATER RESOURCES

For the County to provide a reliable water supply to its Storey County Water System customers, it must consider any potential changes which may affect its water source and supply. Additionally, residents outside of the Water System's service area must also be aware of potential risks. The risks and threats presented in this section are typically out of a water supplier's and private well owner's control; however, proper management and planning can mitigate their impacts. This section identifies potential threats to water

supplies within the Plan Area. Recommendations as to how the County and residents can mitigate these threats are discussed in this chapter and in chapter 3.

3.1 DROUGHT AND CLIMATE CHANGE

The Storey County Water System's only source of water is from the Sierra Nevada Mountains. The amount of water available to the County system through the Marlette Water System is directly dependent on seasonal storms and the snowpack on the East Slope of the Tahoe Basin and in the Marlette/Hobart Lake watershed and existing pipeline capacity at the siphon. Extended periods of below average precipitation are known to occur in the Tahoe Basin and on the eastern side of the Sierra Nevada which have the potential to reduce the amount of water available in any given year. However, this condition is mitigated by the upstream Marlette and Hobart storage reservoirs.

Extended periods of dry weather are especially known to affect the availability of groundwater within the Plan Area. As mentioned previously, the drought which occurred from 2013 through 2015 resulted in declining groundwater levels within the Virginia Highlands. Some homeowners had to deepen their wells to be able to pump the groundwater in this area. Drought also affects the Mark Twain area and the Dayton Valley. Groundwater in this area is affected by flows in the Carson River which has limited upstream storage. Below average precipitation in the Carson River Watershed results in decreased surface and subsurface flows through the Dayton Valley which can impact groundwater levels.

In addition to droughts, which are temporary, climate change is expected to have lasting effects on the availability of future water supplies. Climate is used in reference to prevailing weather conditions in an area over a long period of time. No climate study[12] or evaluation was undertaken for the purpose of this Plan; however, sources were reviewed and referenced regarding climate change and climate predictions. The California Department of Water Resources (CDWR) released a report entitled *California Climate Science and Data for Water Resources Management*. Although this report does not include Nevada, it does include the Tahoe and Carson Basins as part of the North Lahontan hydrologic region[13]. CDWR summarized the key climate vulnerabilities for the North Lahontan region as:

- Increased air and water temperatures would place additional stress on sensitive ecosystems and species;
- Loss of snowpack storage may reduce reliability of surface water supplies and result in greater demand on groundwater resources;
- Magnitude and frequency of extreme precipitation events may increase, resulting in greater flood risk; and
- High temperature and longer dry seasons would increase wildfire risk.

Many of these vulnerabilities not only apply to the region of surface water supply in the Sierra Nevada Mountains but are also potential vulnerabilities in and around the Plan Area. CDWR provides a list of Resource Management Strategies that water suppliers can consider as tools to adapt to climate change. The following are CDWR recommended Resource Management Strategies for the climate vulnerabilities identified which are applicable to the County and Plan Area.

- Urban Water Use Efficiency: Practices that maximize use of available water supplies by reducing waste and increasing efficiency.
- Conveyance – Regional/Local: Improvement and maintenance of water conveyance systems to improve system reliability, protect water quality, increase available water supplies, and provide operational flexibility.

[12] The Truckee Meadows Water Authority has several climatic models which could be used for further study.
[13] The Marlette Water System is directly adjacent to the North Lahontan hydrologic region which is bounded by the eastern border of the State of California.

- Conjunctive Management and Groundwater Storage: Coordinated and planned use and management of surface water and groundwater resources to maximize the availability and reliability of water supplies.
- Surface Storage – Regional/Local: Human made, above-ground reservoirs to collect water for later release when needed. Surface storage has played a key role where the quantity, timing and location of water demand does not match the natural water supply availability.
- Drinking Water Treatment and Distribution: Development and maintenance of public water treatment and distribution facilities. Reliability, quality, and safety of the raw water supplies are critical to achieving this goal.

Although timing and magnitude of warming and other climate change factors are unknown, resource management strategies such those limited above will be useful considerations for climate change adaption. Through the County's planning efforts, it will be critical to continue assessing potential climate change strategies and implement them as feasible and needed.

3.2 REGULATORY ACTIONS

As discussed throughout this chapter, the County's water source(s) is governed by State and quality related Federal regulatory guidelines, Nevada water rights law, the Franktown Decree and through agreements with the Marlette Water System. The water available to the County from the Marlette Water System is also utilized by other entities (e.g., Carson City, private irrigation companies) according to their appropriation and priority. Additional parties, agreements and decrees could also influence the quantity and availability of water resources should the County pursue groundwater development within the Plan Area in the future.

The NSE possesses the authority to oversee groundwater usage within a hydrographic basin by imposing restrictions on water rights based on the chronology of appropriations. When the NSE deems a hydrographic basin to be excessively appropriated and experiencing over-extraction, the NSE holds the power to issue a curtailment order. Such an order delineates which water rights are permissible for exercise and which must be curtailed, thereby safeguarding the long-term well-being of the aquifer.

Given the County's existing constraints on groundwater rights, any potential future appropriations would hold a relatively junior priority. Consequently, these rights would be more susceptible to curtailment. This vulnerability can be mitigated if the County opts to secure senior groundwater rights through acquisition instead of pursuing new appropriations. This strategic choice would enhance the County's resilience against the risk of curtailment and ensure more secure access to groundwater resources. However, NRS 534.037 dictates that if an area is going through a curtailment process, it would have previously been declared a critical management area and be granted ten years to develop a plan to address the groundwater decline.

More importantly, the County should monitor the development of new regulations and determine whether they directly impact the County's current water supply or not. Conjunctive use regulations are currently being developed in the Humboldt Regional Hydrographic Basin which could have an impact to future water resources the County may or may not pursue. While previous legislative sessions have resulted in conjunctive use management statements, there are currently no regulations to guide how groundwater and surface water interaction or conflict will work through the existing permitting process. If new conjunctive use management regulations are developed, it may impact the County's ability to acquire, change and exercise permitted and certificated groundwater rights.

Other potential regulatory actions that the County should consider include:

- Modification to activities and uses which impact basin inflows and outflows.
- Future reduction in water quality maximum contaminant limits.

3.3 CONTAMINATION

The County is committed to providing a high level of service with its potable water system and is dedicated to ensuring that level of service in the future. This section focuses on protection of source water quality, which is also of importance to private well owners, and ensuring that negative impacts to water quality from anthropogenic and natural sources are minimized to the greatest extent possible.

3.3.1 Surface Water

Due to the location of the surface water source, which is above any major roads or railways, the source is less vulnerable to contamination. However, the County should still be aware of possible contamination events including, but not limited to, turbidity events and algal blooms as opposed to toxic spills. The water treatment plant is designed to treat surface water but understanding and maintain the highest quality of water possible arriving at the plant is important.

3.3.2 Groundwater

Changes to water quality of the groundwater sources in the Plan Area can occur in two ways:

1. The concentrations of naturally occurring constituents could change over time, or
2. Groundwater sources could become contaminated as a result of human activities, particularly in areas of high septic system densities.

Although the County does not currently utilize groundwater as a water source, constituents which could pose threats to the quality of groundwater are Arsenic, Gross Alpha, Uranium, Nitrate, Iron and Manganese. The County should encourage private well owners to send the County any water quality data to develop a database and monitor trends.

3.3.3 Distribution System

The County relies upon certified water treatment and distribution system operators who continually monitor water quality in the treatment and distribution systems. All testing and monitoring are done in conformance with established health and safety standards and under an operating permit with the Nevada Division of Environmental Protection – Bureau of Safe Drinking Water. The County prepares an annual water quality Consumer Confidence Report which provides an overview of the previous year's drinking water quality data for the Storey County Water System.

3.4 CONVEYANCE INTERRUPTIONS

The materials which make up the siphon and transmission main which delivers water from the Marlette Water System to the Plan Area are approximately 150 years old and known to have vulnerabilities. In 2018, a portion of the line experienced a leak which required emergency repair to ensure continued delivery of water to Virginia City, Gold Hill, and Silver City. Although the County has 20 to 50 days[14] of raw and potable water storage within its system, this event and others like it show the importance of regular monitoring and maintenance. Due to the age of the transmission main most parts or repairs must be completed with custom fittings which are not only costly but require longer lead times. In order to increase system reliability and conveyance capacity it may become necessary to replace large portion of the siphon in the future.

[14] Range in values is dependent on average or max day water use

4.0 REMAINING CAPACITY ANALYSIS

A remaining capacity assessment of the System is a critical resource for the County to use to make future development determinations. The System's capacity to convey and provide water to its customers and to future users is based on two primary factors:

1. A System's ability to operate within the parameters of Nevada Administrative Code (NAC) regulations; and,
2. Proper allocation of water rights by the NSE.

This section will focus on the existing System capacity and will convert remaining capacity estimates into residential connection counts. Remaining capacity evaluations will be made on a combined supply and storage basis as described further below. Key assumptions used for this analysis include:

- Water supply is based on 100% utilization of the siphon transmission main for a 24-hour period.
  - The theoretical flow capacity of the siphon transmission main is 738[15] gpm.
- Maximum fire demand is assumed to be 3,600 gpm for 2 hours for Virginia City and 1,500 gpm for 2 hours each for Silver City and Gold Hill. The largest fire demand, 3,600 gpm for 2 hours, will be used for the combined system analysis.
- Operating Storage is equal to the Average Day Demand (ADD) for 24 hours.
- Emergency Storage is 75% of the Operating Storage.
- The available potable storage within the system is assumed to be 1.475 Mgal[16].

4.1 REMAINING STORAGE CAPACITY

Typical capacity calculations use a combination of storage and supply to determine if a system meets NAC requirements. However, it is informative to analyze storage and supply capacity separately to better understand which of the two is the limiting factor in capacity. Current storage requirements are 762,000 gallons out of the existing 1,475,000 gallons of storage capacity. Based on the Maximum Day Demand (MDD) and operations and emergency supply requirements, the remaining storage capacity can support an additional 1,519 connections. This assumes that no water is being supplied via the siphon over a 24-hour period.

The individual systems comprising the larger County system, vary in their storage capacities. The Virginia City system has ample storage, while both Gold Hill and Silver City have sufficient storage to meet demands as they are currently. This leads to the Virginia City storage providing the bulk capacity for the larger County system.

4.2 REMAINING SUPPLY CAPACITY

Currently, the siphon that provides water to the County System is only metered with a totalizing meter. The siphon that provides water to the County System is primarily 10-inch threaded steel pipe. The majority of the pipeline was installed around 1875, with portions of the siphon replaced over the years. Due to the age and massive pressures experienced by the siphon in places, the siphon is never operated at its full capacity. The siphon begins at the Lakeview Tank, which controls the water diversions to both Carson City and Virginia City. Flow to the County Systems is controlled by an actuated flow control valve. This valve is never fully opened. Anecdotal evidence shows that the average flow seen in the siphon is approximately 320 gpm. The theoretical, calculated capacity of the pipeline is 738 gpm.

Raw water is conveyed from the 5-Mile Reservoir to the Bullion tank in Virginia City by a 3-mile pipeline that is made up of a combination of newer 12-inch high-density polyethylene (HDPE) pipe and older 12-

[15] Value listed is the theoretical capacity of the siphon. See Section 4.2 for further information.
[16] For this analysis, the capacities of the Hillside Tanks are assumed to be their future capacity of 500,000 gal each.

inch ductile iron pipe. This pipeline is capable of conveying over 2,000 gpm of raw water to the water treatment plant. The water treatment plant serving the system is rated at 1.26 MGD. This equates to a flow rate of 875 gpm. Therefore, the limiting factor in the overall transmission of raw water to the system is the siphon at 738 gpm. A 738 gpm flow rate equates to 4,528 connections in the County system. Removing the existing connections, leaves us with a system capacity of 3,862 possible connections.

Potable water is also transmitted from Virginia City to Gold Hill and then to Silver City. The Gold Hill system is fed by the Divide Tank off a separate 12-inch main. This pipe can convey up to 2,800 gpm if required. Silver City is fed by a single 4-inch main. This presents capacity issues in the system, as the main can only convey up to 315 gpm. Per the system hydraulic model, this flow rate is achieved when filling the Silver City Tank.

4.3 REMAINING SYSTEM CAPACITY

Minimum water system capacity requirements are established in NAC 445A sections 6672 through 66755. NAC 445A.6672(3) establishes specific water system capacity requirements for systems relying upon groundwater production wells to meet the following scenarios:

(a) Maximum day demand + fire demand with all water sources functioning, or
(b) Average day demand + fire demand with the most productive well out of service

NAC 445A allows for a combination of water supply wells and storage to satisfy the requirements. Since Storey County does not rely on wells for supply, scenario (b) was excluded from this analysis, and it is assumed that scenario (a) provides the appropriate assessment of system capacity for the County. Table 15 provides a summary of the available system capacity, storage requirements and excess storage capacity for the potable storage tanks in the County System. The analysis is based on a 24-hour period and considers the design ADD of 131 gpm as summarized in Table 15. It is assumed that each potable water tank is filled to its operational capacity at the beginning of the 24-hour analysis period.

Table 15: Existing Customer Base System Capacity Analysis

	MDD + Fire with All Sources	
Storage Type	**Capacity Requirement (kgal)**	**Capacity Balance (kgal)**
Potable Tank Storage		1,475
Siphon Supply in Excess of Demand[17]		686
Available System Capacity		**2,161**
Fire Storage	432	1,729
Operating Storage	189	1,540
Emergency Storage	141	**1,399**

Based on this analysis, the system has the source and storage capacity to meet the requirements of NAC 445A.6672 and shows that there is a remaining system capacity of 1,399 kgal. Table 16 provides the capacity analysis considering the maximum number of additional connections based on the excess capacity shown in Table 16.

[17] Siphon flowrate of 738 gpm used for capacity calculations.

Table 16: Existing System Maximum Capacity Analysis (864 Additional Connections)

	MDD + Fire with All Sources	
Storage Type	**Capacity Requirement (kgal)**	**Capacity Balance (kgal)**
Potable Tank Storage		1,475
Siphon Supply in Excess of Demand[7]		-60
Available System Capacity		**1,415**
Fire Storage	432	983
Operating Storage	562	421
Emergency Storage	421	**0**

As shown, when the number of connections and resulting demands increase, the operating storage and emergency storage requirements increase correspondingly. Under the "MDD + Fire with All Sources" the existing supply infrastructure and potable storage tank system could support an additional 864 connections, assuming an average annual usage of 0.3 gpm per connection, without system expansion or improvement. This is the number of additional connections which results in a capacity balance of zero. For complete calculations, refer to Appendix B.

Additional analysis was performed on the individual systems comprising the larger Storey County Water System. Separate storage and supply calculations for Virginia City, Gold Hill and Silver City were completed to better understand where specific capacity issues may arise, as well as understand the hydraulic relationship between the three systems. A summary of the results can be found below in Table 17. The complete calculations can be found in Appendix B.

Table 17: Storage + Supply Calculations Summary for Storey County Systems

System	Total Storage (kgal)	Supply in Excess of Demand (kgal)	Total Required Storage (kgal)	Capacity Balance (kgal)	Capacity Remaining (EDUs)
Virginia City	1,200	750	706	1,244	**768**
Gold Hill	115	1,236	201	1,150	**710**
Silver City	160	412	215	357	**220**
Combined	1,475	686	761	1,398	**864**

As shown, two of the three individual systems have similar remaining capacities. However, the Silver City system is limited by its small storage and supply in comparison to its total required storage. The primary limiting factor being the small amount of storage in the area and is also exacerbated by the fact that the system is supplied via a 4-inch water main from Gold Hill. This restriction in combination with the small storage greatly reduces the ability to serve future connections in the area. However, in practice the three systems are operated as a single system. This allows upstream storage in Virginia City and Gold Hill to help alleviate the supply and storage issues in Silver City.

While the capacity remaining is represented in equivalent dwelling units (EDU), it does not require that all future development be comprised of residential uses. Rather, an EDU is a commonly used utility planning unit which is equal to the water demand of one single-family residence. If a proposed commercial or industrial development is projected to use ten times the amount of water as a single-family residence than that development would be allocated 10 EDUs of the remaining system capacity listed. It is recommended that the County require a proposed fixture unit count for all non-residential developments be provided at

the time of parcel map approval and/or building permit in order to convert projected water demands back to an EDU basis and evaluate available system capacity.

5.0 LONG-TERM STRATEGIES

Protection of existing and future water resources should be of upmost importance for the County and its residents. However, the strategic management of the County's resources becomes complicated due to the variety of water resource type (i.e., groundwater and surface water), the geographic distance between the communities in the Plan Area and the evolving regulatory environment, including Nevada water rights law. This section will review management approaches the County should consider both currently and in the future.

5.1 WATER RIGHTS

5.1.1 Surface Water

Storey County utilizes water from the Marlette Water System as its only source for providing water service to customers of the Storey County Water System. The Marlette Water System exercises water rights owned by the State of Nevada, under the Franktown Creek Decree which are contracted and delivered to the County. Because the County does not own any Decreed water rights, the delivery agreement and contract become especially important for dependable long-term water delivery. Furthermore, because the Marlette Water System is the sole source of water for the County system, the contract with the water system should allow for full utilization of the conveyance capacity of water system infrastructure and all for expansion to cover potential "growth" in the water system, especially in areas like the Highlands or Mark Twain where groundwater resources are limited.

While improbable, the Carson River is another source of surface water which could provide water service should the County intertie their water system with Lyon County Dayton Utilities. The County does not currently own any surface water rights associated with the Carson River system and it is not recommended for the County to purchase or accept dedication of Carson River rights at this time. The benefits and challenges of utilizing the Carson River as a future water source will be detailed in chapter 3.

5.1.2 Groundwater

The Plan Area overlies two primary hydrographic areas or basins from a water resource regulatory standpoint in the Tracy Segment and the Dayton Valley basin. Each of these areas has separate Orders and Rulings by the Nevada State Engineer that shape the regulatory options and environment the County must work within regarding groundwater resource development and use. For example, the Dayton Valley Hydrographic area has the benefit of a Domestic Well Credit Order (see page 23), whereas the Tracy Segment does not currently have that provision under the designation Order. Additionally, the County only owns less than 50 AF in the Tracey Segment with the point of diversion and place of use currently tied to the Canyon General Improvement District.

Also discussed in Section 2.3, the availability of groundwater resources in both the Highlands and Mark Twain areas is extremely restricted and their ability to continuously meet domestic use demands has become more and more limited over the last 20 years. The following information is meant to provide a planning level summary of short and long-term alternatives which the County may consider when evaluating providing future groundwater resources to its residents.

Change in Point of Diversion/Place of Use

Storey County owns approximately 48.58 acre-feet within the Tracey Segment Hydrographic Basin under Permit No. 50533, Certificate 18224, and 80870. These water rights currently support an elementary school, park, and the Lockwood Fire Station. The amount of water needed to support these facilities in the

Lockwood area should be identified and allocated appropriately with the Canyon General Improvement District. Any remainder in right could then be utilized within the Tracey Segment to support other County purposes. The balance of any right which could be moved is not expected to be large enough to support new development or a new public water system in the Highlands.

A concept that this change supports would be to provide a single point of service within the Highlands community which residents whose wells had failed could access potable water. This alternative may also require the construction of a new well, installation of water treatment equipment, construction of storage facilities, water system and water right permitting activities which are expected to range between 1.2 and 5 million dollars[18] and span 12 to 36 months.

This alternative is not currently an option for the Mark Twain area due to the lack of existing rights owned by the County in the Dayton Valley basin.

Appropriate New Rights

An alternative to moving existing rights from one location to another is to file an application to appropriate new rights in either the Tracey Segment or Dayton Valley Basins. Review of the hydrographic basin summaries prepared by the NDWR show both the Tracey Segment and Dayton Valley as over-appropriated, with mining and milling identified as the preferred use in the Dayton Valley Basin. For these reasons, new appropriations for new municipal purposes should be considered unlikely. In the event a new appropriation is approved, it would be junior in priority date and would face additional challenges to be used to support to new development. Additionally, the infrastructure requirements (i.e., well, tank, distribution piping) proposed by the first alternative would still be required by this option as well.

Purchase Water Rights

Since new appropriations for groundwater are assumed to be limited based on total appropriation in each hydrographic basin, purchasing existing water rights becomes the remaining option. Based on the cost associated with researching, confirming, purchasing, and developing these water rights, Farr West only recommends that the County pursue a water rights purchase for small quantities of rights to support existing development which may require a community water supply for an indefinite period of time. While this option may be the quickest to implement, it may also be the costliest with an approximate price tag of $1.5 to $8 million dollars[19] and take anywhere from 12 to 18 months to implement.

In the case of new development being served by an existing system or the formation of a new water system, operated by Storey County or General Improvement District, Farr West recommends the County require developers to dedicate the necessary rights to support the proposed uses.

Domestic Well Credit Program

The Domestic Well Credit Order in Dayton Valley provides the ability for the owner of a Domestic Well on a lot that was created prior to July 1, 1993, to plug and abandon the domestic well and be provided water service from a water purveyor by issuing a water right credit to the purveyor. The Order could be used to allow the County to develop a community water system in the Mark Twain area, but these credits cannot be transferred or sold like a water right after they have been issued. The benefit to this alternative is that new water rights would not be required and the overall impact to the water resource would be the same as the current condition. To provide a new water system in this area, a production well would still need to be permitted and constructed, storage tanks and distribution piping would be required to provide water service

[18] Opinions of probable costs are planning level in nature (-50% to +100%) and are for a single point of use alternative. Costs associated with installing a distribution system are not included.

[19] Cost of water rights are planning level estimates which projects a range of $400,000 to $3,000,000 depending on which basin (Tracey Segment, Dayton Valley, or both) the rights are purchased in. Estimates are based on a volume of 100 AF.

to the residents who forfeited their right to a domestic well. However, these types of conversion projects are rare due to the significant costs associated with the infrastructure improvements.

This alternative is not currently an option for the Highlands area due to the lack of existing Order in the Tracy Segment basin issued by the NSE. The County could apply to the NSE for an Order; however, the significant cost of associated infrastructure may still be prohibitive.

5.1.3 Best Management Practices

Farr West recommends Storey County allocate annual budget and staff time to continue to participate in regional planning groups, like the Carson River Subconservancy District and Truckee Meadows Water Authority Advisory Committee meetings or planning sessions. Involvement with these groups will allow the County to stay informed on regional policy changes and potentially provide insight into other water resource management strategies. Additionally, staying engaged with water right permit changes in basins which contribute to the Marlette Water System and inside of and adjacent to the Tracey Segment and Dayton Valley Hydrographic Basins will assist the County in maintaining their current and future water right interests.

Storey County owns two water right permits that are currently managed by Canyon General Improvement District. Farr West recommends that the County allocate budget and staff time to monitor due dates and water usage for these rights to maintain their good standing. In the event additional water rights are acquired or dedicated to the County, due dates for Proof of Completion of Work and/or Proof of Beneficia Use should be pursued and maintained.

5.2 RESOURCE MANAGEMENT

Some of the water right strategies, particularly the Domestic Well Credit Order in Dayton Valley, have long term impacts to Storey County residents. Domestic wells are the only source of water for many parcels in the County and while this land was originally developed with the understanding that these residents were to be responsible for their own water supply, it has become common for governing bodies to be forced into with providing water service or mitigating groundwater impacts in areas which groundwater conditions have changed significantly over time. To mitigate the potential for this outcome it is recommended that the County encourage local, private groups to be proactive in protecting the aquifer which supplies their groundwater wells. Examples of action that benefits aquifer sustainability has been provided throughout this chapter and Plan.

As shown in this chapter, the surface water from the Marlette Water System is the most available, highest quality source which the County has access. Water from the Marlette Water System is critical for long-term sustainability in Storey County because it is the only source that is currently permitted with the NSE and is capable of regular deliveries. The County should place upmost importance on renewing the contractual agreement with the Marlette Water System and should pursue the contractual ability to transmit quantities of water that are commensurate with the investment the County has placed in its water system infrastructure and meets the long-term demands of the Comstock and surrounding areas far into the future.

5.3 DEDICATION RATES

Outside of the provisions for the division of lands within Chapter 16 of the Storey County Code, the County does not maintain a minimum water rights dedication for single unit residential development served by the County Water System. Farr West recommends a water right budget or allocation be applied to each existing connection or lot within the service area and for these values to be maintained on a digital ledger kept by either the Public Works or Planning Department. This will allow the County to accurately budget and manage water rights contracted from the Marlette Water System and provide the County the ability to justify water use factors and rates in future planning studies and communication with the NSE. Developing a dedication rate would allow the County to include factors such as drought protection, unanticipated public

uses, and system loss into allocations per connection. Benefits from representative dedication rates include maximizing volumes put to beneficial use, a correct assessment of water right needs related to future development, better land use planning and more accurate utility planning resulting in properly phased and sized infrastructure improvement projects.

5.4 WATER CONSERVATION PLAN

Water conservation planning is an important component to improving system sustainability well into the future. In fact, per chapter 540.121 of the NRS, each supplier of water must adopt a plan of water conservation which is in accordance with the requirements of NRS 540.141 and these plans should be updated at least every five years. These plans are typically geared to increase public awareness of the limited water resources which supply their region, and the impact conservation can have on the quality and quantity of water which is available long term. Additionally, these plans typically set near and long-term water use goals, present contingency plans for when water supplies are compromised and recommend water efficiency standards for new development. Another component of these plans is the evaluation of installing meters on all connections and the development of a tiered rate structure which encourages conservation. It is important to note that any modification to the rate structure should be included as part of a formal rate study which evaluates how changes to the rate structure impacts future water system revenues and expenses, including estimating a reduction in water use. The County is currently in the process of updating their Water Conservation Plan in 2021.

5.5 WATER SYSTEM FACILITY PLAN

The purpose of a water utility facility plan is to assess current and future system deficiencies and develop a capital improvement program to identify the projects needed to keep the system operating and in compliance. Once this program is defined the utility can identify future funding sources and associate the costs of the improvements to capacity replacement and capacity expansion. The most recent facility plan was completed in 2011 and it is recommended that the County pursue completing a plan by 2024.

5.6 WATER SYSTEM RATE AND CONNECTION FEE STUDY

Over the past 10 years, Storey County has evaluated the water utility user rates multiple times in the form of a formal rate study or as a rate analysis. One item which has not been updated as part of these studies is the connection fee for the County Water System. Currently, the County collects a hook-up fee based on the cost of providing the water meter and the physical connection to the water system, however this fee does not include any consideration for "buying in" to the available capacity of the system nor does it include a "water availability" charge. It is recommended that once the capital improvement program is defined as part of the facility plan that a formal rate and connection fee study be performed to recommend a representative fee for all future development.

5.7 WATER RESOURCE PLANNING

Per chapter 278.0228 of the NRS, all governing bodies shall develop and maintain a Water Resource Plan which:

- Evaluates all known sources of water,
- Quantifies current and future water demands,
- Analyzes the sufficiency of water sources in terms of quality and quantity, and
- Provides a plan for obtaining additional water of sufficient quality and quantity.

This plan must be updated at least once every ten years and shall be submitted to NDWR to be kept on file. Upon completion, this plan will satisfy this requirement and should be formally adopted by the Storey County Board of County Commissioners prior to being submitted to the NDWR. It is also recommended that the County update this plan at least once every seven years as conditions can change over time and the

information presented in a WRP is critical to ensuring the sustainability of a water utility. As a comparison the Truckee Meadows Water Authority updates its WRP on a five-year cycle.

CHAPTER 3: MANAGEMENT OF WATER RESOURCES

1.0 PURPOSE

This chapter is based on the findings from the third technical memorandum in a series of three which documented the analysis and findings of the 2021 Storey County Water Resource Plan (Plan). The specific purpose of this chapter is to estimate potential buildout demands as a result of future development within the Plan Area. This chapter will also identify the impacts to the Storey County Water System at the buildout condition which includes improvements to existing infrastructure and water right holdings. Future utility and water resource planning efforts will also be discussed.

2.0 FUTURE DEMANDS

Future demands for the Plan Area were generated from applying water demand factors against parcel size (i.e., acreage) or unit count. This analysis used the designated land use[20], as of December 2020, for vacant parcels and applied a water demand factor as listed in Table 18. The Plan Area was broken up into the same four separate areas as used in Chapters 1 and 2 and shown on Figure 2. These areas are referred to as:

- The Comstock,
- VC Highlands,
- Mark Twain, and
- American Flat.

Additionally, Farr West held a workshop with Storey County staff on December 9, 2020, which detailed the methodology used for generating these future demands and presented preliminary results for future connect ions and improvement project alternatives.

Table 18: Water Demand Factors

Land Use	Demand Factor	Notes
Single-Family Residential	0.3 AFA/connection	Includes rural residential and forestry connections
Multi-Family Residential	0.9 AFA/connection	Assumes 3 units per parcel
Commercial	1.50 AFA/acre	Assumes 3 commercial connections per acre
Industrial	1.12 AFA/acre	Based on 1,000 gallons per day
Special Planning Zone	0.3 AFA/connection	Average connection demand determined from Chapter1

.

2.1 VACANT PARCELS AND LAND USE

Vacant parcel land use determinations were primarily pulled from County GIS data, however land use determinations for all areas were updated per the 2016 Storey County Master Plan. Due to the rural nature of the County, there were a large number of vacant parcels outside of the Plan Area that were not considered as a part of this analysis due to their distance from current water system infrastructure and a high barrier of cost to reach these areas through additional infrastructure. It should be noted that a vacant parcel analysis was not performed for Silver City, as it lies in Lyon County and future land uses are not under the

[20] Vacant parcel land use determinations were primarily pulled from County GIS data, however land use determinations for all areas were updated per the 2016 Storey County Master Plan.

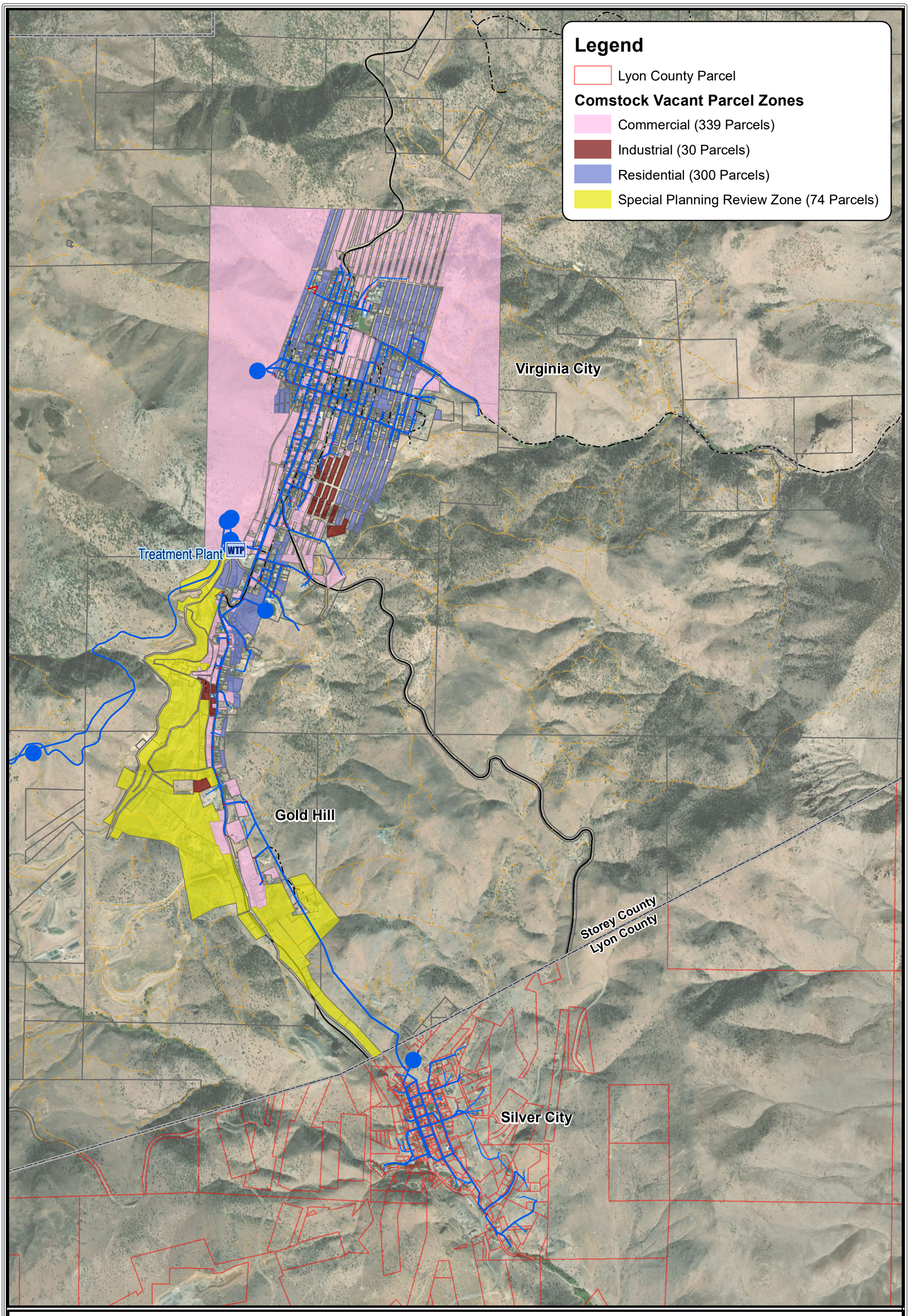
responsibility of Storey County. Future demands for Silver City were limited to the remaining system capacity of 105.3 acre-feet per annum (AFA) determined in chapter 2 of this Plan.

The vacant parcels in the Comstock area can be found in Figure 5. Vacant land uses within the Comstock include single-family residential, multi-family residential, commercial, industrial, forestry, and special planning zones. The special planning zone parcels are limited to railroad and mining uses. However, both designations were considered as potential future water users and assigned a single EDU per parcel as a worst-case scenario for buildout demands.

The vacant parcels in VC Highlands are comprised of entirely residential parcels, ranging in area from 1 acre to 40 acres. No matter the parcel size, all vacant parcels within the loop consisting of HWY 341, Lousetown Road, and Cartwright Road were included in this analysis and were counted as one EDU per parcel. There are 269, 10-acre parcels surrounding this looped area that are reasonable to include in future planning efforts but were excluded from this plan due to the diminishing cost-benefit relationship in adding this small number of connections. Figure 6 shows the parcels considered for the analysis as well as surrounding parcels.

The analysis of the Mark Twain area included land uses which reflect future changes as outlined in the 2016 Master Plan (see Appendix A). The area consists of single-family residential, rural residential, forestry, and industrial. Figure 7 shows the vacant parcels and zoning in the study area that was considered for this analysis.

The American Flat area southwest of Gold Hill currently has no existing development beyond a mining operation and two single family residences. However, future development potential was identified in the 2016 Master Plan. The land uses identified in the 2016 Master Plan were used for this area as shown in Figure 8. The area is primarily forestry with 252 acres of industrial. Similar to the Mark Twain area, the 240 acres of BLM forestry lands were removed from this analysis. For residential and special planning zone parcels, individual parcels were counted as possible future water service connections for this analysis. For rural residential parcels, a factor of 40 acres per future connection was used. Commercial and industrial parcels were counted as total acreage for the analysis and a water usage per acre demand factor listed in Table 18 was applied to the parcel area. Forestry parcel connections were assigned the same EDU value as rural residential parcel connections.



The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

N

1 " = 2,000 '

Figure 5: Comstock Vacant Parcels

FARR WEST ENGINEERING
5510 Longley Lane
Reno, NV 89511
(775) 851-4788
www.farrwestengineering.com

P:\Client Projects\Storey County 092\1797 Water Resource Plan\3.0 Studies_Reports\3.4 Dwg_Figs\MAPS\Figure5.mxd, Editor: tbrashler, Printed: 8/25/2021

Washoe County

Storey County

Legend

Highlands Study Area

Highlands Vacant Parcel Zones

Residential (607 Parcels)

The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

N

1 " = 2,000 '

Figure 6: Highlands Vacant Parcels

FARR WEST ENGINEERING
5510 Longley Lane
Reno, NV 89511
(775) 851-4788
www.farrwestengineering.com

P:\Client Projects\Storey County 092\1797 Water Resource Plan\3.0 Studies_Reports\3.4 Dwg_Figs\MAPS\Figure6.mxd, Editor: tbrashler, Printed: 8/25/2021

FARR WEST
ENGINEERING
5510 Longley Lane
Reno, NV 89511
(775) 851-4788
www.farrwestengineering.com

Figure 7: Mark Twain Vacant Parcels

Storey County
Lyon County

Legend

- Mark Twain Study Area

Mark Twain Vacant Parcel Zones

- Residential (45 Parcels)
- Industrial (22 Parcels)
- Industrial-Professional (5 Parcels)
- Public Facilities (1 Parcels)
- Resource (16 Parcels)
- Rural Residential (9 Parcels)

N

1 " = 4,000 '

The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FARR WEST
ENGINEERING
5510 Longley Lane
Reno, NV 89511
(775) 851-4788
www.farrwestengineering.com

Figure 8: American Flat Vacant Parcels

Gold Hill

Washoe County
Storey County

Storey County
Lyon County

Legend

American Flat Study Area

American Flat Vacant Parcel Zones

Industrial (1 Parcels)

Resource (6 Parcels)

N

1 " = 1,500 '

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

Table 19: Vacant Parcel Land Use

	Comstock	Highlands	Mark Twain	American Flat	Total
Single-Family Residential (ERUs)	293	607	74	-	**974**
Multi-Family Residential (ERUs)	21	-	-	-	**21**
Commercial (Acres)	132	-	-	-	**132**
Industrial (Acres)	19	-	4,327	252	**4,598**
Forestry (ERUs)	11	-	23	31	**65**
Special Planning Zone (parcels)	74	-	-	-	**74**

2.2 DEMAND FACTORS AND TOTAL BUILDOUT DEMANDS

Demand[21] factors were applied to the vacant parcels in each area according to their land use. Although the average water usage per residential customer was determined to be 0.17 AFA per connection in Chapter 1, the projected unit water demand for residential uses or EDUs was adjusted to 0.3 AFA for this Plan. Multi-family residential assumes three units per parcel. Customer meter data also showed that commercial customers used 0.33 AFA on average. This volume was scaled up to 0.5 AF per commercial connection or 1.5 AF per acre for all vacant parcels zoned commercial for future water demand projections.

Industrial water usage was calculated on a per acre basis. The industrial demand factor was selected based on an analysis of Tahoe Reno Industrial Center, south Washoe County, and Douglas County water usages. Demand factors were then applied to all vacant parcels within the plan area. Table 20 below shows the existing demand, additional demand based on land use, and buildout demand.

Table 20: Plan Area Water Demands

Area	Existing Demand (AFA)	Additional Demand (AFA)	Buildout Demand (AFA)
Comstock	221	456[i]	677[i]
Highlands	176[ii]	182	358
Mark Twain	100[ii]	4,875	4,975
American Flat	4.5	291	296
Total	502	5,804	6,306

i - Includes 105.3 AFA for Silver City
ii – Existing demand was calculated by allocating 0.3 AF per existing residential connection.

[21] All demands or demand factors in this chapter are average day demands unless noted otherwise.

3.0 BUILDOUT IMPACTS

To supply the volume of water that will be required to meet maximum day demands of the entire Plan Area at buildout, the County will need to have sufficient conveyance capacity in their water system infrastructure as well as have the volume of water rights needed to provide over 6,000 acre-feet of water on an annual basis. For further context, this volume of water corelates to a maximum day demand flow rate of 7,802 gpm or require transmission (i.e., siphon) and water treatment facilities (WTP) designed to deliver more than 11 million gallons per day (MGD). Due to the large disparity between the makeup of the current system and a system capable of providing more than 11 MGD to its customers, this Plan will only propose future improvement projects which eliminate current system deficiencies or will interconnect no more than one satellite area per any given development scenario or alternative.

3.1 INFRASTRUCTURE IMPROVEMENTS

Farr West developed improvement project(s) for each water system need in the future to provide a picture for what the connection or development of specific areas will have on the current system. These project alternatives were discussed and workshopped with County staff on December 9, 2020. All project cost estimates were prepared according to Class 5 methodology according to AACE International using conceptual or planning level engineering criteria to size significant project components.

3.1.1 County Water System

The County Water System consists of the water treatment plant, five storage tanks and distribution mains throughout Virginia City, Gold Hill, and Silver City. Overall, the system has aging infrastructure, areas with inadequate fire flow and static pressures in excess of 190 psi. Through previous master planning and recent hydraulic modeling analysis four projects were identified which would resolve current deficiencies[22]. These projects are:

- B St. & Union St. Water Main Replacement Project
- Divide Water Main Upsizing Project
- Silver City Transmission Main Replacement Project

After all these projects are completed, the County Water System will be able to meet or exceed all standard performance criteria/requirements as set forth by the Nevada Administrative Code 445A (NAC 445A) and enforced by the Nevada Division of Environmental Protection – Bureau of Safe Drinking Water (BSDW). Complete opinions of probable cost totaling approximately $6.0 million dollars can be found in Appendix C.

If the Comstock area were to buildout per the current land use designations, Average Day Demand (ADD) and Maximum Day Demand (MDD) would increase to 413 and 825 gpm, respectively. System demands on this order would exceed current siphon capacity and would reduce WTP excess capacity to only four percent of total rated capacity. For this reason, the two additional recommended improvement projects would be:

- 12-inch diameter Parallel Siphon (from US 580 to Top of Siphon)
- WTP Capacity Improvement Project (1.26 MGD to 1.5 MGD)

The estimated total cost of all improvements required to meet the buildout condition for the existing Comstock service area is just more than $18 million dollars with $12.4 million being attributed to the Siphon and WTP projects.

[22] The Silver City distribution system has been previously identified as deficient and in need of replacement in the 2011 Master Plan. An engineering design has been completed for these improvements and the Lyon County Utilities Department has assumed the role as sponsor for the construction of this project.

3.1.2 American Flat

The proposed development of the American Flat area as shown on Figure 8 would increase system demands by approximately 291 acre-feet annually or an additional 367 gpm during MDD. Water service would be supplied to the area via 3,100 linear feet (lf) of 12-inch diameter transmission main in addition to 750,000 gallons in above ground storage. In total these supply and storage improvements would cost approximately $3.9 million dollars[23].

This area would be supplied water through the Gold Hill pressure zone from the County Water System and would require the following additional improvements:

- 12-inch diameter Siphon replacement (from Lakeview Tanks to Top of Siphon)
- WTP Capacity Improvement Project (1.26 MGD to 2.2 MGD)

The estimated total cost of these additional County Water System improvements is approximately $27.7 million dollars with $6.3 million being associated with the pipeline installed between Lakeview Tanks and US 580 (i.e., Marlette Water System ROW).

3.1.3 Mark Twain

As stated in chapter 1, there are 333 existing connections in the Mark Twain area which would increase system demands by 100 acre-feet annually or an additional 124 gpm (0.2 MGD) during MDD. In order to supply water to serve the existing residential uses in the Mark Twain area via the existing County Water System, a 5.2-mile, 12-inch diameter transmission main would need to be constructed in 6-Mile Canyon Dr. along with a 500,000-gallon terminal tank. Additionally, an 8-inch diameter distribution system would also need to be installed to provide water service to the existing residences. The estimated cost of the improvements needed to supply potable water to the 333 connections is approximately $30 million dollars.

Upgrades to the transmission siphon and WTP would also be required to meet NRS supply capacity requirements. These improvements would be:

- 12-inch diameter Siphon replacement (from Lakeview Tanks to Top of Siphon)
- WTP Capacity Improvement Project (1.26 MGD to 2.2 MGD)

The estimated cost of these additional County Water System improvements is just more than $53 million dollars with $6.3 million being installed between Lakeview Tanks and US 580 (i.e., Marlette Water System ROW).

3.1.4 VC Highlands

The area known as VC Highlands is home to approximately 588 residential structures which receive potable water service from domestic wells. If these existing residences were to be connected to the County Water System, it is estimated that system demands would increase by 176 acre-feet annually or an additional 219 gpm (0.3 MGD) during MDD. The infrastructure needed to supply water to the existing residents of the Highlands is:

- 5.5 mile, 12-inch diameter transmission main between Virginia City and the top of Geiger Grade
- A 100 hp booster pump station located at the north end of the current County Water System
- 30 miles of 8 and 12-inch distribution main as shown on Figure 9
- 588 water meters and service lines
- 650,000-gallon water storage tank

[23] The cost to install the distribution system in the American Flat area is not included in this total. It is assumed that the cost of these improvements would be borne by the developer/development.

In total, it is estimated that the cost of these improvements would exceed $70 million dollars, with the transmission and storage portion totaling $15.8 million. Due to the increase in system demands, upgrades to the transmission siphon and WTP would also be required to meet NRS supply capacity requirements. These improvements would be:

- 14-inch diameter Siphon replacement (from Lakeview Tanks to Top of Siphon)
- WTP Capacity Improvement Project (1.26 MGD to 1.6 MGD)

These additional water supply improvements would increase total project costs by $25 million dollars and bring project totals to approximately $95 million dollars. If the County were to size all infrastructure detailed in this section to accommodate complete buildout of the Highlands area the total cost of improvements increases from $95 million to $126 million dollars.

COMSTOCK HWY

CARTWRIGHT RD

GEIGER GRADE RD

LOUSETOWN RD

341

Maxar

Legend

Nonvacant Parcels

Pipe Diameter (in)

8

12

FARR WEST ENGINEERING

5510 Longley Lane
Reno, NV 89511
(775) 851-4788
www.farrwestengineering.com

N

1" = 2,000'

Figure 9: Highlands Future Water System

The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

C:\Users\tbrashler\Models_InfowaterPro\StoreyCounty_WRP\StoreyCounty_WRP.aprx, Layout: Highlands_11X17. Editor: tbrashler. Printed: 8/25/2021

3.1.5 Siphon Upgrades

In review, the transmission siphon between Lakeview Tanks and the Top of Siphon does not have the conveyance capacity to supply enough water to meet the buildout condition for any of the scenarios evaluated in this Plan. At a minimum, a new 12-inch pipeline would need to be installed parallel to the existing main between US 580 and the Top of Siphon in order to meet buildout demands for the current service area. For all other scenarios, the entire line would need to be replaced between the Lakeview Tanks and the Top of Siphon with a 12, 14, or 16-inch diameter pipeline. Since different portions of the pipeline are owned and maintained by different parties (i.e., Marlette Water System and Storey County), it is reasonable to assume that each party would contribute funding for their portion of the improvements. The approximate split of ownership based on pipeline length is 61 percent for Storey County and 39 percent for the Marlette Water System.

3.1.6 Water Treatment Plant Upgrades

Like the upgrades to the siphon transmission main, the 1.26 MGD Water Treatment Plant will also need to be expanded to supply the volume of water needed at buildout for all development scenarios or alternatives studied in this Plan. Table 21 below details the additional capacity needed at the Water Treatment Plant to meet each development scenario.

Table 21: Water Treatment Plant Capacity Upgrade Needs

Development Scenario	Increase in Treatment Capacity (MGD)
Comstock Service Area Buildout	0.3
Comstock Service Area Buildout + American Flat Buildout	1.0
Comstock Service Area Buildout + Mark Twain (Ex.)	1.0
Comstock Service Area Buildout + Highlands (Ex.)	0.6
Comstock Service Area Buildout + Highlands Buildout	1.0

3.1.7 Project Summary

Per the findings of this Plan, the County will need to invest between $6.0 and $126 million dollars in water system improvement projects to maintain system compliance and supply water to new areas (e.g., Highlands, American Flat, Mark Twain). Table ES-4 lists a probable cost for each project that the County can reference for future long-term capital planning applications. These opinions of probable cost were developed using conceptual designs and cost data and should be refined as part of a preliminary engineering process prior to securing financing or allocating funds for their design and construction.

Table 22: Water System Projects

Project	Probable Cost[i]
Existing System Deficiencies	$6.0 M
Comstock Service Area Buildout	$12.4 M
Comstock Service Area Buildout + American Flat Buildout	$27.7 M
Comstock Service Area Buildout + Mark Twain Ex. Residents Only	$53.4 M
Comstock Service Area Buildout + Highlands Ex. Residents Only	$95 M
Comstock Service Area Buildout + Highlands Buildout	$126 M

i – All costs are presented in 2022 dollars and are Class 5 per AACEI

3.2 WATER RIGHTS

In addition to constructing the infrastructure necessary to provide water service at buildout, the County will need to maintain or acquire a sufficient volume of water rights to be able to serve the number of connections projected at buildout. The calculations provided below estimate what the minimum volume of water rights will need to be held in the interest of the County according to the land uses studied in Section 2.0.

Existing number of Residential Connections (County Water System)	596
Existing number of Commercial Connections (County Water System)	207
Existing number of EDUs	998
Volume of water rights dedicated for existing development (assumes 1.12 ac-ft per EDU)	1,118 AF
Future EDUs (Highlands Ex. Domestic Wells)	588
Future EDUs (Mark Twain Domestic Wells)	333
Future EDUs (American Flat Domestic Wells)	15
Future EDUs (Vacant - Single and Multi-Family Residential)	995
Future EDUs (Vacant - Commercial + Industrial)[24]	10,694
Future EDUs (Vacant - Other: Forestry + Special Planning)[2]	139
Total Future EDUs	12,764
Water rights needed for all future development + conversion of existing domestic well owners to County Water System (assessed at 1.12 ac-ft per EDU)	8,783 AF
Estimated Domestic Well Credits (assessed at 2 acre-ft per DW)	(1,872 AF)
Total Water Rights Needed	**6,911 AF**

Per the 2002 contract, Storey County has reserved up to 495.6 acre-feet of water from the Marlette Water System in 2021[25]. This total is only slightly more than half of the volume that would typically be dedicated to support the existing 803 connections of the Storey County Water System. Considering the conversion of existing domestic well owners to the Storey County Water System and the absolute development of all vacant parcels according to approved land uses, Storey County may need to acquire right to upwards of 6,911 acre-feet of water to support permitting of the proposed developments.

Since Storey County does not maintain a ledger tracking historic water right dedications, this study assumes a dedication rate of 1.12 acre-feet per EDU[26] for all calculations being presented in this section. This value has been commonly used across the state in the past to support the permitting of one residential unit with

[24] EDU counts for non-residential uses were calculated by dividing the projected average annual demand from Section 2 by a value of 0.3 AF/EDU.

[25] Projecting out the annual increases in water made available to Storey County for the next 20 years results in an estimate of 653.6 acre-feet from the Marlette Water System in 2041.

[26] This is a high estimate. Dedication rates of 1.12 AF/EDU have created large volumes of unexercised commitments of water rights throughout the state and the NSE's office has supported reduced dedication requirements over the past 10-20 years when there is adequate data to support a reduced rate.

the Nevada State Engineer's (NSE) office. If the County would like to have this unit volume reduced for future dedications it is recommended that the County prepare a more specific document summarizing their water use profile and proposed dedication rates and engage the NSE's office prior to passing new ordinance.

4.0 FUTURE MANAGEMENT

As shown in Section 3.2, the County will need to acquire or be dedicated almost 14 times the amount of water they have currently secured via contract with the Marlette Water System to meet buildout demands in all four areas studied as part of this Plan. If the County were to only provide water service to the Comstock area this volume gets reduced to approximately 4 times the currently contracted volume for a total of 2,178 acre-feet. In either scenario it will be necessary for the County to secure additional water in addition to modifying how the system is operated based on the number of customers and size of the service area in the future.

4.1 FUTURE WATER SOURCES

Chapter 2 found that the only viable water source for the County Water System is the Marlette Water System, and all future volumes of water should be acquired from this source. Additionally, chapter 2 also found that the current conveyance capacity of the siphon transmission main was limited to 738 gallons per minute (gpm) or 1,190 acre-feet annually. This stated capacity will be able to provide nearly all the future water needs of the Comstock area, however the addition of either the Highlands or Mark Twain areas will present the need for additional transmission mains to be constructed.

Another water source potentially available to the County could be the Carson River or groundwater rights in hydrographic basins 103, 104 or 105. To receive water supplies from these sources the County Water System would need to be interconnected with the Dayton and/or Mound House Water System(s), owned and operated by the Lyon County Utilities Department (LCUD). The connection to these systems can occur via a transmission main along 6-Mile Canyon Road and/or State Highway 341. Depending on the volume of water which will be supplied by these new connections, additional infrastructure in the LCUD or Carson City water systems may need to be installed prior to entering into any operating agreement with the associated utilities. An array of future utility management and operational strategies exist depending on how the new water source would be used and should be studied further prior to pursuing and water rights acquisitions or construction of any infrastructure improvements related to these water sources. These strategies include, but are not limited to: emergency backup supply, primary water supply for portion of water system, seasonal supply for greater water system, and an active wholesale connection between utilities.

Chapter 2 also found that the ability for existing groundwater sources to meet existing domestic uses has become more and more limited over the past 20 years and are not viable to support proposed development in the future. However, if the County were to pursue the interconnection of the County Water System to the Highlands or Mark Twain areas there is some merit to constructing a new community well which can be used seasonally (as conditions allow) and in emergencies. Additional water rights for this proposed water source should also not necessary since the conversion of domestic wells to the County Water System should provide domestic well credits which could be used to support permitting of the new community well.

4.2 REGIONALIZATION

If Storey County were to pursue interconnection of the County Water System with the Dayton/Mound House System, it would present the significant benefit of regionalizing water supplies for both the Comstock and surrounding areas. Regionalization of water supplies provides redundancy during periods of severe drought, during water system infrastructure failure, or when the quality or quantity of a water supply has diminished.

5.0 FUTURE WATER MANAGEMENT PLANNING

By implementing a proactive approach to water management planning, Storey County will ensure a reliable and resilient water utility well into the future. To do this the County needs to complete and update a variety of different planning efforts over a five to seven fiscal year (FY) cycle. While the intent and findings of each study is different, proper planning builds off the information developed in one plan to another and provides recommendations which improve the overall sustainability of the water system. An example of this would be developing a representative capital improvement program (CIP) as part of a water system master plan update. This CIP would subsequently ensure that accurate user and connection fees were being collected so that future capital funding needs were being met. Additionally, the rate study would also develop a user fee structure which promotes conservation and improves source water sustainability. This section summarizes key planning efforts required in the future and offers a recommendation for when these documents should be completed.

Table 23: Water System Planning

Plan	Year Completed	Recommended Update
County Strategic Plan	2020	2030
Water Resource Plan	2022	2027
Water System Master Plan	2011	2023
Rate Study	2011, 2020	2025
Water Conservation Plan	-	2022

6.0 CONCLUSION

This chapter has found that the development of all vacant parcels according to current land uses within the current service area boundary will nearly triple current average water use and require significant improvements to County Water System infrastructure. Beyond a projected cost of $18.4M for these improvements, the County will also need to secure approximately 2,000 acre-feet of water from the Marlette Water System (or other) to support permitting of the proposed development(s). Additionally, if the County was to pursue connecting additional areas into the current service area improvement project costs may exceed $100M and the need for additional water triples to more than 6,500 acre-feet beyond the volume the County has currently reserved with the Marlette Water System.

Completion of this Water Resource Plan is a significant step for the County towards improving water system sustainability. The findings of this Plan can be used to:

- support the acquisition of additional water resources,
- properly evaluate future land development proposals,
- improve capital planning exercises including the identification of future funding sources, and
- maintain regulatory compliance with NDEP the Nevada State Engineer's Office.

BIBLIOGRAPHY

Affirmation of the Second Judicial District's Franktown Creek Decree, 4386 (Nevada Supreme Court April 24, 1963).

Demographer, N. S. (2020). Certified Population Estimates of Nevada's Counties, Cities and Towns 2000 to 2019. Nevada: Nevada Department of Taxation.

Franktown Creek Irrigation Company v. Marlette Lake Company, 4386 (Supreme Court of Nevada September 27, 1961).

Smith, D. W. (2020, April 14). *Evaluation of water-level decline and aquifer properties in the Virginia City Highlands and Highland Ranches Volcanic Rock aquifer system, Storey County, Nevada*. Retrieved from USGS: https://www.usgs.gov/centers/nv-water/science/evaluation-water-level-decline-and-aquifer-properties-virginia-city?qt-science_center_objects=0#qt-science_center_objects

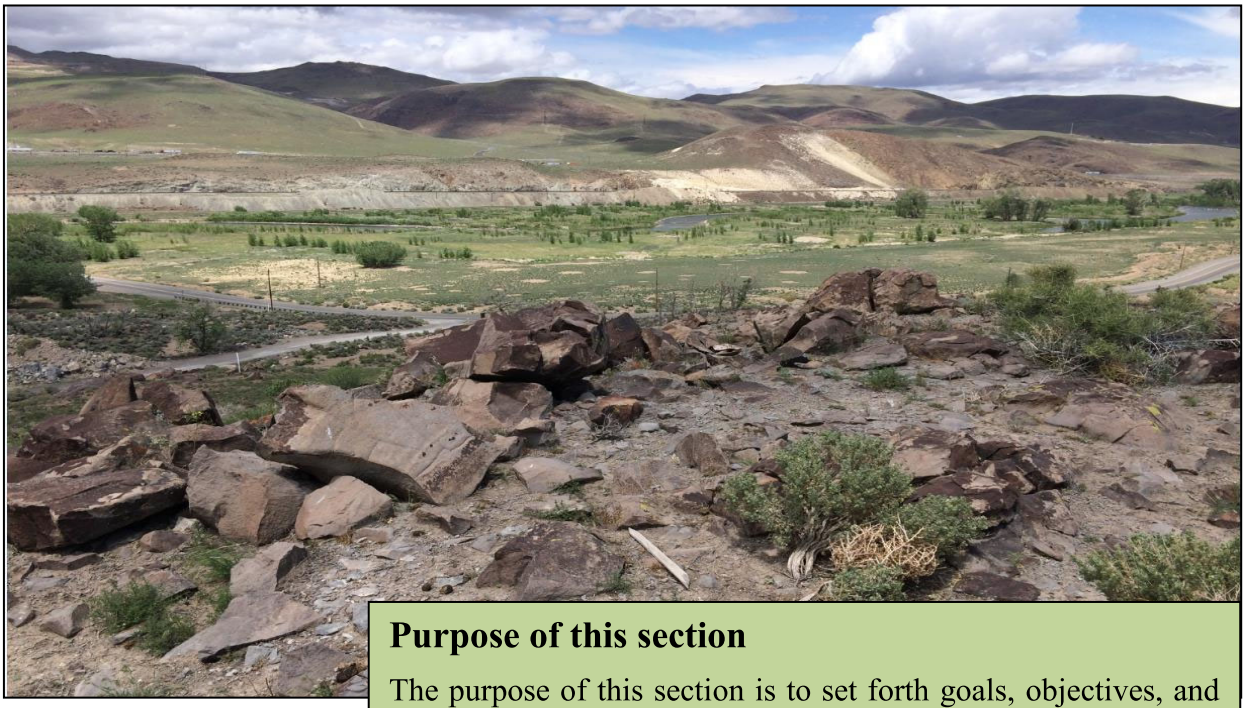
Storey County. (2016). *Storey County Master Plan.* Storey County.

Supply Contract. (2002, October 23). *Contract bewtween the State of Nevada and Storey County to Supply Raw Water from the Marlette Lake Water System*. Carson, Nevada.

WRCC. (2020, April 14). *Virginia City, Nevada (268761)*. Retrieved from Western Regional Climate Center: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nv8761

APPENDIX A

3.5 Goals, Objectives, and Policies



Purpose of this section

The purpose of this section is to set forth goals, objectives, and policies for carrying out this master plan. This section is divided into the respective planning areas of the county, as well as the county as a whole.

3.5.1 General Countywide

The following goals, objectives, and policies apply across the county as described thereby. Each planning area and subarea contains goals, objectives, and policies which are specific to those areas.

Goal 1	**Direct and manage orderly, efficient, and sustainable development**
Objective 1	**To use this master plan to graphically depict desired land use patterns**
Policy 1	By defining the master plan land use maps as the official maps depicting potential future land uses in the county
Objective 2	**To maintain an up-to-date master plan**
Policy 1	By periodically updating this master plan and master plan maps
Policy 2	By maintaining zoning maps in conformance with this master plan
Policy 3	By regularly communicating with residents, land owners, and businesses to identify needs and respond appropriately and expediently
Policy 4	By continually communicating with the Nevada State Demographer's Office to determine accurate growth trends and forecasts in the county and region, and using the findings as the basis for updating this master plan
Objective 3	**To involve community stakeholders in the administration and updating of this master plan**
Policy 1	By making master plan information and maps easily accessible to the public
Policy 2	By reaching out to community stakeholders and leaders about the provisions of this master plan and general land use trends in the county and in each community
Policy 3	By holding planning commission public meetings in the areas most likely affected by proposed master plan and zoning amendments
Goal 2	**Create and maintain livable and sustainable communities**
Objective 1	**To maintaining compact communities**
Policy 1	By concentrating commercial development in defined and planned mixed-use centers
Policy 2	By encouraging new commercial development as integrated centers, or compatible infill within existing developed communities, rather than as individual or periphery development centers
Policy 3	By encouraging infill residential development within existing population centers in the county, and as part of an integrated planned community at Painted Rock
Policy 4	By exploring density trades and other means to encourage and provide for compact nodal development
Policy 5	By revising development codes to reflect performance-based standards

Objective 2 **To create and maintain complete communities**

Policy 1 By facilitating enterprise areas in each community except the Highlands

Policy 2 By requiring planned unit developments to include commercial, residential-commercial, and other uses concentrated into one or more established town enterprise centers, or to be strategically integrated with existing such centers

Policy 3 By incorporating open space wildlife migration corridors throughout planned unit developments, and aligning these corridors with existing exterior agriculture, equestrian, common open-space, public lands, wildlife corridors of adjacent planned unit developments, and known natural wildlife migratory pattern

Objective 3 **To facilitate pedestrian-friendly communities**

Policy 1 By situating new residential developments so that enterprise areas, schools, and public gathering places are in close-proximity and easily accessible to area residents

Policy 2 By implementing walkable systems that connect residential areas with enterprise areas, schools, public gathering areas, and other uses outside of the development

Policy 3 By aligning and designing walkways, roads, and other transportation ways to encourage local trips by foot and bicycle, and as appropriate for the development (e.g., developments with equestrian uses) by horseback

Policy 4 By separating walkways, pathways, and access roads from collector, arterial, and other high-speed traffic route

Policy 5 By avoiding grid-pattern roadways, except in Virginia City, and instead configuring local roads into loops, cul-de-sacs, and circuitous patterns in order to reduce and slow traffic

Policy 6 By designing streets around parks, schools, and other public gathering places to be essentially pedestrian, approximately 20 to 30 feet wide, and with activity areas situated mostly away from vehicle ways

Policy 7 By locating high-speed, collector, and arterial routes toward the edges of the development, or along existing arterial and collector routes, where possible

Policy 8 By situating roads to be circuitous and by implementing traffic calming design and devices to slow traffic where close connection between vehicle and non-motorized ways exist

Objective 4 **To facilitate existing and future automobile-alternative transportation systems**

Policy 1 By reserving necessary property, right-of-way, and easements in new planned unit developments to support existing and future pedestrian, bicycle, bus, rail, and other transportation systems

Policy 2 By aligning right-of-ways and easements for transit systems with existing transit system right-of-ways, easements, and planned corridors

Policy 3 By connecting bicycle ways in Mustang, McCarran, and Painted Rock to the Tahoe-Pyramid Bikeway alignment

Policy 4 By collaborating with the Union Pacific Railroad, Regional Transportation Commission, the Tahoe-Reno Industrial Center, and other agencies and entities to

assess and consider the feasibility of light-rail commuter systems utilizing new and existing infrastructure along the Truckee River/Interstate 80 corridor

Objective 5 **To ensure safe and sustainable water resources for each community and natural ecosystem in the county**

Policy 1 By requiring permit applicants to provide Storey County with documentation showing well water meets minimum quality and quantity standards before building permits are issued

Policy 2 By requiring land subdivision applications to include valid documentation showing that underground water resources supporting the development will not adversely impact the availability of quality drinking water for existing and future residents and uses in the area

Policy 3 By researching and considering alternative water sources, such as the importation of water from other jurisdictions, for the Highlands and Mark Twain Estates and other places where needed

Policy 4 By requesting services from the Nevada State Engineer's Office and the Unites States Geological Survey to study current and future water availability and quality in the Highlands and Mark Twain Estates and to determine potential alternative sources

Policy 5 By requesting service from the Nevada State Engineer's Office and the United States Geological Survey to determine the interrelation, or lack thereof, between declining groundwater levels in the Mark Twain Estates and the rate of residential growth in the nearby Dayton Valley, Lyon County

Policy 6 By encouraging the Virginia City Highlands and Highland Ranches, and Mark Twain Estates, and all planned unit developments to form general improvement districts that will secure sufficient quantities and quality of water and distribute it to local residents

Policy 7 By lobbying and working with the state legislature to develop legal means preventing water and water rights exportation from the county

Objective 6 **To design communities which attract diverse people and workforce**

Policy 1 By providing accessible quality K-12 schools and related facilities to students in northern Storey County

Policy 2 By requiring developers of planned unit developments to dedicate to the county and/or school district land necessary for the construction of public schools and public services facilities. The location and quality of land must meet the standards of this master plan and not cause undue strain on county/school district resources.

Policy 3 By requiring developers of planned unit developments to build and dedicate to the county school district, as agreed between the developer and the school district, K-12 school facilities adequate to serve area populations, as well as other needs determined appropriate by the school district for the subject area

Policy 4 By working collaboratively with the school district and its board of trustees during review of proposed subdivisions, housing projects, and planned unit developments in order to consider what level and type of education and supporting facilities may be required

Policy 5	By creating a physical environment in planned unit developments that facilitates education facilities and curriculum possibilities as directed by the school board
Policy 6	By creating a physical environment in planned unit developments that facilitates education facilities and curriculum beyond K-12 education, including for instance, pre-kindergarten, vocational, and post-secondary education, which is aligned with the needs of area employers
Policy 7	By creating a physical environment in planned unit developments in which schools may relate to the surrounding community functionally, culturally, and visually, and where schools may incorporate the greater community into the education process
Policy 8	By forming an advisory group between the county and the school district, consisting of a broad representation of well-respected people in their fields of expertise and who are recognized for their leadership and commitment to improving schools, to ensure that the location, placement, and design of school facilities meets the goals of this master plan, and the school district's needs which extend beyond the jurisdiction of this master plan
Objective 7	**To facilitate phasing of planned unit developments that ensures project completion and sustainability during phasing**
Policy 1	By meeting changing market conditions while ensuring that improvements meet demands for infrastructure and service
Policy 2	By entering into development agreements with large planned unit developments
Policy 3	By phasing planned development projects so that they function effectively and independently at each phase
Policy 4	By ensuring that the development agreement is consistent with tentative and final maps and the provisions of this master plan
Policy 5	By requiring terms and plans for potential abandonment or termination of developments prior to their completion
Goal 3	**Create and maintain a diversified economy**
Objective 1	To support a wide-range of industries across the county including agriculture, commercial, tourism, manufacturing, mining distribution, and technology
Policy 1	By working with regional and local economic development agencies and community groups to identify economic assets and development opportunities
Policy 2	By communicating with regional partners to improve local and regional industrial databases to improve vertical integration and production efficiencies
Policy 3	By encouraging and identifying opportunities for co-location and close proximity placement of complementary businesses
Policy 4	By establishing zoning districts that support commercial and other economic uses
Policy 5	By promoting mixed-use developments that support live-work environments and community diversity
Policy 6	By preserving water rights for agriculture use and encouraging alternative agriculture practices and water use

Objective 2	**To maintain streamlined and efficient application and approval processes**
Policy 1	By maintaining simple and streamlined development applications
Policy 2	By maintaining and improving "one-stop-shop" permitting and development review as feasible
Policy 3	By considering performance zoning regulations that facilitate mixed-uses and reduce the need for special use permitting
Policy 4	By encouraging development agreements between the county and certain land developers
Goal 4	**Create integrated public facilities**
Objective 1	To provide efficient and reliable public services by combining fire and emergency services, law enforcement, library and social services, public works, general local government, and possibly non-profits as applicable, into a unified public facility located toward the center of the subject community
Policy 1	By including representatives from fire and emergency services, law enforcement, library and social services, public works, general local government, and possibility non-profits, as applicable, to an advisory group during the planned unit development process, to ensure that combined facilities and services, including those combined with public schools, are designed and placed properly and meet the needs of the community
Policy 2	By coordinating efforts with federal and state agencies such as the U.S. Department of Housing and Urban Development, U.S. Department of Agriculture Rural Development, and the Nevada Rural Housing Authority to help fund rehabilitation of abandoned and substandard dwellings
Goal 5	**Maintain distinct communities in the county**
Objective 1	**To create and maintain distinct land use patterns and characteristics for each community in the county**
Policy 1	By using this master plan to pattern uses which are consistent with the distinct character of each existing and new community in the county
Policy 2	By conforming to the goals, objectives, and policies for each planning area and sub-area in this master plan
Policy 3	By only approving land uses which are compatible with the community in which they are proposed and their surrounding communities
Goal 6	**Maintain compatibility between uses**
Objective 1	**To implement design and performance standards that minimizes use conflicts**
Policy 1	By designating in planned unit developments specific areas where mixed-use residential-commercial uses are appropriate in relation to the new development and the existing surrounding community
Policy 2	By establishing design and performance standards for commercial, industrial, residential, and other uses located within or adjacent to existing communities, and new communities, to ensure that future development is high in quality, desirable for

	occupants, and compatible with existing surrounding uses. The design standards should address lot size and density; building scale, bulk, height, and setbacks; building materials and exterior aesthetics; buffering to abutting uses (including, but not limited to, density transitions); outdoor lighting and noise; vehicle loading, parking, and circulation; pedestrian circulation; landscaping (and xeriscaping); screening and fencing; accessibility to people with disabilities; and other elements.
Policy 3	By preventing the overconcentration of multi-family residential uses in any given area and encouraging multi-family residential uses as part of mixed-use communities
Policy 4	By reviewing proposed infrastructure improvements including roads and transportation connections, potential unintended impacts to adjacent communities, and weighing them against the potential benefits of the infrastructure improvements
Policy 5	By actively engaging with the Bureau of Land Management and the local property owners and their associations to maintain public access to public lands within and adjacent to the Highlands
Policy 6	By engaging in cooperative agency status with the Bureau of Land Management in all environmental assessments and other actions potentially affecting communities in the county
Goal 7	**Reduce and prevent blight**
Objective 1	**To develop and enforce codes preventing and addressing nuisances and blight**
Policy 1	By enforcing nuisance and blight regulations consistently and fairly
Policy 2	By educating residents about available assistance and programs aimed at cleaning properties and abating nuisances and related hazards
Policy 3	By coordinating efforts with area resources, including Waste Management, Inc., to provide annual programs for no-cost refuse disposal and other such assistance
Policy 4	By coordinating efforts with federal and state agencies such as the U.S. Department of Housing and Urban Development, United State Department of Agriculture Rural Development, and Nevada Rural Housing Authority to help fund rehabilitation of abandoned and substandard dwellings
Goal 8	**Balance renewable energy systems with other uses**
Objective 1	**To support the development of certain renewable energy systems while preserving quality of life in residential areas**
Policy 1	By allowing small-scale domestic renewable energy systems, including solar and wind, when they are found to be scaled, placed, and designed as to not substantially detract from the existing character of each community
Policy 2	By prohibiting commercial-scale renewable energy systems, including solar and wind, in and adjacent to residential areas
Policy 3	By requiring planning commission and board review and action pertaining to all commercial-scale renewable energy systems

Goal 9	**Balance mining and non-mining uses**
Objective 1	**To support the development of mineral resources while mitigating negative impacts to non-mining uses**
Policy 1	By adopting standards and policies concerning mineral development in all parts of the county
Policy 2	By adopting standards that substantially limit surface mining, but provide for small operations phased surface mining, and encourage underground mining in sensitive areas of the county
Policy 3	By requiring board approval with action by the planning commission for all large scale surface and underground mining applications
Policy 4	By refraining from duplicating permit applications requirements and fees which have been established by state and federal agencies
Policy 5	By maintaining proactive and collaborative relationships between county officials, mining interests, residents, and local stakeholders in mining permits and mine ordinance developments to assure compliance with local, state, and federal requirements pertaining to active and proposed mining operations

(Source: Storey County, 2014)

3.5.2 Comstock Area

Goal 1	**Enhance and diversify the local economy**
Objective 1	**To promote commercial business in Gold Hill, Virginia City, and the Divide that serves the specific interests and needs of tourists and local residents**
Policy 1	By accessing grants and other resources through collaboration with state and regional economic development agencies such as the Northern Nevada Development Authority and the U.S. Department of Agricultural Rural Development
Policy 2	By assessing needs and interests of residents, businesses, and stakeholders through formal and informal communication and assisting local businesses
Policy 3	By coordinating the master plan, zoning ordinances, and county codes with the regulations and programs of the local tourism commission
Policy 4	By designing the master plan, zoning ordinances, and county codes to reduce barriers toward expansion of needed businesses and services
Policy 5	By assessing the benefits and limitations of establishing a downtown revitalization redevelopment district that increases eligibility for grants, other funding sources, and programs to improve the downtown business district
Policy 6	By working with the Virginia City Tourism Commission to enhance the image and significance of the south and north gateway areas of Virginia City and Gold Hill

Objective 2 **To secure local control from the Nevada Department of Transportation portions of State Route 341 ("C" Street) within Virginia City's downtown area**

Policy 1 By working with the Nevada Department of Transportation to convey to Storey County State Route 341 right-of-way between north and south intersecting "B" Street

Policy 2 By not accepting conveyance of portions of State Route 341 to Storey County until curbs, gutters, drainages, and pavement are improved to Storey County standards

Objective 3 **To develop a fairgrounds facility in Virginia City that is permanent and sufficient in area and design to facilitate existing and future events**

Policy 1 By securing sufficient land in Virginia City to support fairgrounds and ancillary uses including parking, vehicle and trailer staging, domestic animal stables, and other related uses

Policy 2 To develop a single permanent fairground facility in phases as resources allow

Policy 3 To improve road and pedestrian ways, and other infrastructure around the fairgrounds facility, and between it and downtown Virginia City

Goal 2 **Maintain historic use patterns on the Comstock**

Objective 1 **To implement zoning, regulations, and practices and to maintain conformance with historic use patterns**

Policy 1 By implementing Form-Based-Codes in the Virginia City downtown area requiring building location, placement, configuration, height, and scale which is consistent with adjacent conditions

Policy 2 By coordinating with the Comstock Historic District Commission in the development of Form-Based-Codes applicable within the Comstock

Policy 3 By encouraging commercial, residential-commercial, single-family residential, multi-family residential, and mixed-uses in the core areas of Gold Hill, Virginia City, and the Divide

Policy 4 By maintaining single-family residential uses in areas of Virginia City, Gold Hill, and the Divide currently and historically used principally with such uses

Policy 5 By preventing residential sprawl into outlying areas of the Comstock, particularly in the surrounding hillsides which are directly visible from the Virginia City downtown area, that were not historically developed with residential uses

Policy 6 By allowing reduced setback distances for single-family and multi-family residential uses in the Virginia City downtown area that are consistent with commercial uses

Policy 7 By preserving the natural and historic scenic corridor along State Route 341 and State Route 342 between the Washoe and Lyon county lines

Policy 8 By preserving to the extent feasible historic landforms including mine tailings and mine dumps

Policy 9 By replacing conventional "cobra-head" overhead streetlights with decorative and historically appropriate street lamps, such as those currently found along "C" Street in Virginia City. First priority should be given to the length of "B" Street between

Taylor Street and the north side of the Eagles Hall.

Policy 10 By requiring sidewalks along "C" Street in downtown Virginia City to be constructed of wood except where motor vehicle access is provided to street-abutting driveways and parking areas. Decorative pavers and/or other materials as permitted by the Comstock Historic District Commission should be considered where existing non-wood materials (e.g., concrete and asphalt) are being replaced.

Goal 3 Provide for certain renewable energy that is compatible with other uses in the Comstock Historic District

Objective 1 To support the development of certain renewable energy systems while preserving the integrity of the historic district, including its feeling of place and authenticity within the context of the nineteenth century

Policy 1 By allowing small-scale domestic renewable energy systems, including solar and wind, when they are found to be scaled, placed, and designed as to not aesthetically detract from abutting uses and the overall historic environment of the Comstock Historic District

Policy 2 By prohibiting commercial/utility-scale renewable energy systems, including solar and wind, within the boundaries of the Comstock Historic District

Policy 3 By requiring planning commission and board review and action pertaining to all proposed domestic renewable energy systems, including solar and wind, within the Comstock Historic District, and all commercial/utility-scale systems outside of the historic district

Policy 4 By coordinating with the Comstock Historic District Commission in the review of all renewable energy systems, including solar and wind, proposed within the Comstock Historic District

Goal 4 Balance mining and non-mining uses

Objective 1 To support the development of mineral resources while mitigating negative impacts to non-mining land uses and historic resources

Policy 1 By adopting standards and policies concerning mineral development in and near the Comstock Historic District which are distinct from development standards in other areas of the county

Policy 2 By adopting standards that substantially limit surface mining, but provide for small operations phased surface mining, and encourage underground mining in Gold Hill, Virginia City, and the Divide, and their immediate surrounding areas

Policy 3 By considering southern Gold Hill (approximately south of Sky Lane) for appropriately regulated large-scale surface and other types of mining when substantial impacts to area residents and the integrity of the Comstock Historic District are not found

Policy 4 By requiring board approval with action by the planning commission for all large scale surface and underground mining applications

Policy 5 By refraining from duplicating permit applications requirements and fees which have been established by state and federal agencies

Policy 6	By maintaining proactive and collaborative relationships between county officials, mining interests, residents, and local stakeholders in mining applications and ordinance development to assure compliance with local, state, and federal requirements pertaining to active and proposed mining operations
Goal 5	**Enhance and diversify vehicular and multi-modal transportation**
Objective 1	**To continue development patterns that provide for a walkable community**
Policy 1	By encouraging historically dense mixed-use commercial and residential development in the core areas of Gold Hill, Virginia City, and the Divide
Objective 2	**To acquire necessary property, right-of-way, and easements to develop vehicular parking and multi-modal transportation systems**
Policy 1	By inventorying vacant land adjacent to the Virginia City downtown area that may facilitate centralized vehicular parking and transit systems
Policy 2	By considering opportunities to purchase appropriate vacant land to facilitate centralized vehicular parking and transit systems
Policy 3	By seeking grants and other funding sources to purchase the historic Virginia City Freight Depot and the southern parcels between it and Union Street
Objective 3	**To improve identified properties to facilitate vehicular parking and multi-modal transportation systems**
Policy 1	By repurposing the historic Virginia City Freight Depot to facilitate train boarding and disembarking
Policy 2	By repurposing the parcels between the Virginia City Freight Depot and Union Street to facilitate vehicular parking, rail service, bus service, and multi-modal transportation support systems
Policy 3	By widening and improving “B”, “D”, and “E” Streets to increase vehicular parking and circulation capacity
Objective 4	**To develop alternative transit systems between centralized transit hubs and the downtown area of Virginia City**
Policy 1	By developing appropriate transit stops to facilitate transit to and from “C” Street
Policy 2	By developing inclinators between “C” Street and the Virginia City Freight Depot and other centralized transit staging areas
Goal 6	**Facilitate a safe pedestrian-friendly downtown**
Objective 1	**To improve pedestrian corridors including sidewalks and street crossings**
Policy 1	By relocating a substantial portion of vehicular parking away from “C” Street and toward centralized parking areas
Policy 2	By enhancing vehicle and pedestrian visibility at key road crossings on “C” Street
Policy 3	By developing walkways and stairways, and developing visual and other separation between pedestrian and vehicle ways on east-west orientated streets near “C” Street
Policy 4	By considering revisions to the intersections of Taylor, Union and “C” Streets for safer pedestrian and vehicle crossing

Objective 2	**To provide rest areas in key places around pedestrian corridors and parking areas**
Policy 1	By adding sitting benches and tables along the "C" Street boardwalk
Policy 2	By adding sitting benches between remote vehicle parking areas and "C" Street, and in parking lots
Policy 3	By securing funds to develop "pocket-parks" on vacant parcels along "C" Street in downtown Virginia City
Policy 4	By assessing the feasibility of converting several "C" Street parking spaces into "parklets" after sufficient vehicular parking and downtown transportation is completed at the Virginia City Freight Depot multi-model transit center

(Source: Storey County Planning Department, 2015)

3.5.3 Highlands Area

Goal 1 **Preserve the rural residential character of the Highlands area**

Objective 1 **To implement zoning and other regulations in and around the Highlands planning area that conforms to historic use patterns**

Policy 1 By maintaining estate and rural single-family residential uses and zoning in the Highlands and rural residential uses and zoning in surrounding areas where residential uses may be considered

Policy 2 By preventing retail and other commercial uses in the Highlands and its immediate surrounding areas with exception of home-based enterprises as appropriate to maintaining existing area character

Objective 2 **To ensure use consistency between the Highlands and its surrounding lands**

Policy 1 By assessing adverse impacts, including traffic, safety, noise, light pollution, wildland fire risk, and attraction of other undesirable development that a north-south transportation interconnection may have on the Highlands community before such a project is considered

Policy 2 By maintaining minimum required parcel size of one acre for the Virginia City Highlands; ten acres for the Highland Ranches; and 40 acres for the Virginia Ranches

Policy 3 By maintaining minimum parcel size of 40 acres for parcels surrounding the Highlands including, but not limited to, the Sunny Hills Ranchos

Policy 4 By assessing adverse impacts, including traffic, safety, noise, light pollution,

wildland fire risk, and attraction of undesired development that a north-south and east-west transportation interconnection in the Lagomarsino planning area may have on the Highlands community before such a project is considered

Goal 2 **Preserve and enhance the natural beauty of the Highlands and surrounding areas**

Objective 1 **To provide for land uses which are compatible with the Highlands area**

Policy 1 By adopting development codes that mitigate visual and adverse impacts of developments on moderate to steep slopes (slopes greater than ten percent) and along the top of prominent ridgelines

Policy 2 By coordinating with private property to implement fire fuels reduction programs

Policy 3 By coordinating with local property owners associations in the development of standards for special use permits, zone changes, and other planning applications potentially affecting the Highlands

(Source: Storey County Planning Department, 2015)

3.5.4 Mark Twain Area

Goal 1 **Preserve rural character of the Mark Twain Estates area**

Objective 1 **To make land use decisions that maintain the existing character of the community**

Policy 1 By maintaining estate and rural single-family residential use in the Mark Twain Estates, and rural residential uses and industrial professional uses in the surrounding area as allowed in this master plan

Policy 2 By preventing encroachment of suburban residential sprawl into Mark Twain

Policy 3 By adopting codes and zoning regulations and making decisions on land use applications that protect the existing character, environmental conditions, security and safety, aesthetic conditions, and efficient services of the Mark Twain Estates

Policy 4 By implementing zoning and codes that maintain estate and rural single-family residential uses patterns where residential uses are allowed

Objective 2 **To facilitate complementary interface between adjacent residential and non-residential uses allowed by this master plan**

Policy 1 By adopting zoning and development standards that lessen impacts between residential and professional industrial uses through:

a. Distances and buffering;

b. Landscaping, screening, noise abatement, and outdoor lighting standards;

c. Vehicle access, egress, parking, and on-site circulation;

d. Property management through owners associations, Covenants, Conditions, and Restrictions, etc.; and

e. Placement of buildings and structures such as to reduce direct visual impacts to area residences, and cause blending with the surrounding natural environment, including backdrop mountain vistas.

Goal 2 **To prevent land use conflicts with existing mining**

Objective 1 **To develop and implement land use allowances and regulations that maintain separation between existing mining and future residential and other incompatible uses**

Policy 1 By maintaining significant separation between the Basalite mine and residential and other uses which are incompatible with mining activities

Policy 2 By encouraging rezoning of land around existing mining activities from residential to commercial, industrial, or resource type designations

Goal 3 **Minimize flooding and flood damage in the Mark Twain Estates**

Objective 1 **To implement improvements to lessen property damage caused by flash flooding**

Policy 1 By collaborating and negotiating with private property owners for the establishment drainage and stormwater detention basin easements

Policy 2 By collaborating and negotiating with private property owners immediately north of the Mark Twain Estates to establish easements or acquire property for regional stormwater detention improvements

Policy 3 By designing stormwater drainage systems capacities in accordance with upstream stormwater detention systems

Policy 4 By requiring regional flood mitigation for any development that occurs to the north and west of the Mark Twain Estates

Objective 2 **To prevent development in known floodways**

Policy 1 By developing and implementing building codes restricting buildings within known floodways

Policy 2 By educating residents about the impacts and dangers of building in floodways and floodplains

Objective 3 **To consider the benefit of reginal flood planning**

Policy 1 By considering participation in the Carson Water Subconservancy District Carson River Watershed regional floodplain management study and planning process

Goal 4 **Enhance local and regional economic opportunity**

Objective 1 **By promoting commercial and industrial uses in the eastern portions of Mark Twain**

Policy 1 By collaborating and coordinating with state and regional economic development agencies such as the Northern Nevada Development Authority and the United States Department of Agricultural Rural Development Authority

Policy 2 By assessing needs and interests of residents, businesses, and stakeholders in the area, including in adjacent Lyon County, through formal and informal communication

Policy 3 By coordinating the master plan, zoning ordinances, and county codes with the regulations and programs of the local tourism commission

Policy 4 By designing the master plan, zoning ordinances, and county codes so that they support expansion of all needed businesses and services for the region

(Source: Rainbow Bend Homeowners Association, 2012)

3.5.5 Lockwood-Mustang Area

Goal 1 **Maintain a community with a diversity of uses**

Objective 1 **To implement zoning, regulations, and practices that that diversify uses**

Policy 1 By encouraging commercial and residential uses which are compatible with existing uses and community character and scale

Policy 2 By promoting and directing commercial activity along Canyon Way, Avenue of the Colors, and within the eastern portions former Peri Ranch

Goal 2 **Reduce and prevent use compatibility conflicts**

Objective 1 **To promote uses and performance measures which mitigate known and potential conflicts between existing and new uses**

Policy 1 By actively engaging county leaders and officials with commercial interests, residents, and local stakeholders in order to assure conformance with local regulations and this master plan

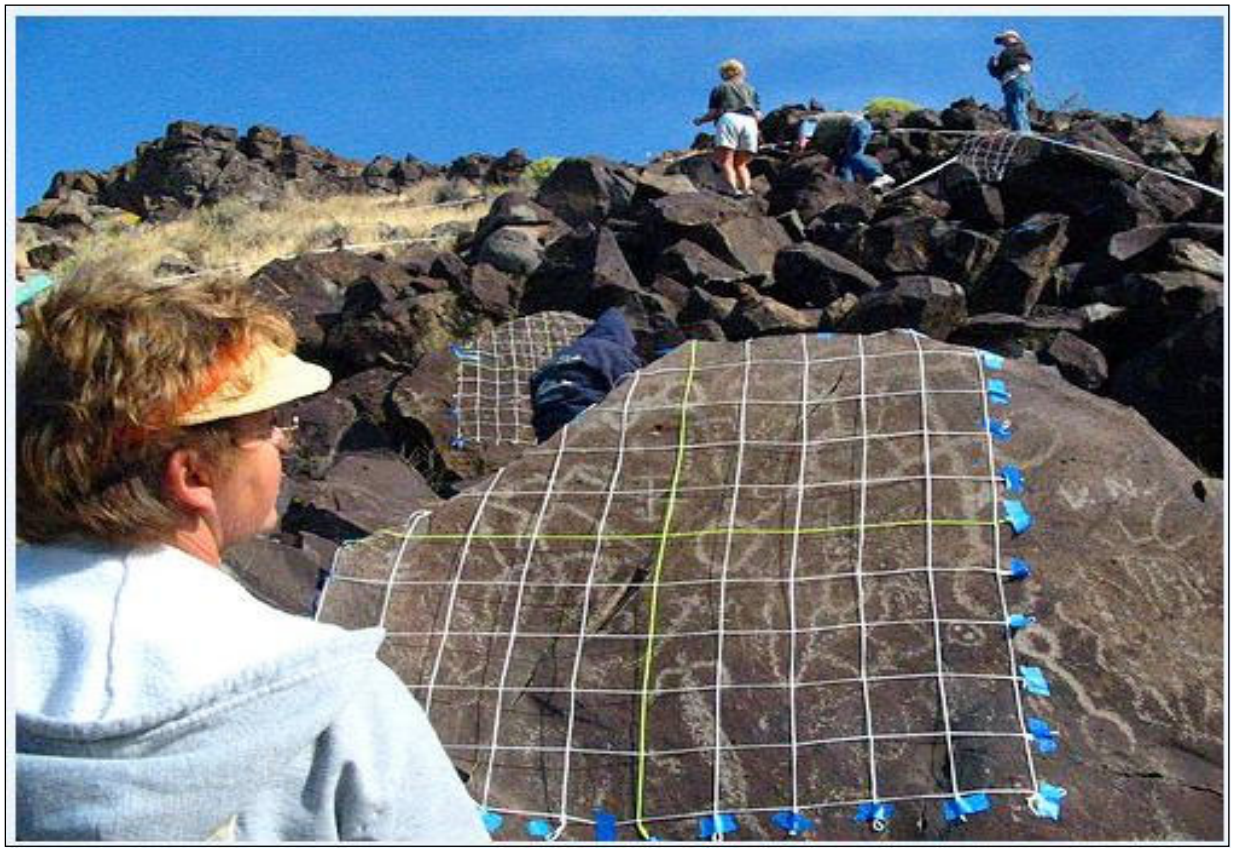
Policy 2 By supporting proposals for zone changes that lessen or mitigate known conflicts

Policy 3 By maintaining buffering between residential and non-residential uses

Policy 4 By applying density transitions and compatible uses between existing residential uses and new uses, including new residential and non-residential uses

Policy 5 By directing heavy industrial activity away from Lockwood and east toward Mustang Road, south toward the Lockwood Regional Landfill, and west toward

	Avenue of the Colors and its existing heavy industrial uses and zones
Policy 6	By encouraging zone changes in transition areas that are consistent with the master plan maps
Objective 2	**To prevent and mitigate inconsistent uses on vacant land located across the Truckee River immediately north of Lockwood**
Policy 1	By participating in the public process for master planning, zoning, special uses, variances, or other land use actions involving the subject land
Policy 2	By requesting to the State Land Use Planning Advisory Council to review neighboring county master plan inconsistencies involving the subject land
Policy 3	By collaborating with the subject property owner and neighboring jurisdictions to determine the possibility of annexing the land into Storey County, and any terms that may come with such an annexation
Policy 4	By following the legislative process for transfer of land from Washoe County to Storey County
Policy 5	If annexation occurs, applying zoning that is compatible with Lockwood and the adjacent Rainbow Bend community
Objective 3	**To prohibit brothels and adult entertainment uses**
Policy 1	By prohibiting brothels, adult entertainment, and adult retail, and other adult uses in Mustang and Lockwood
Goal 3	**Better integrate the Truckee River into Lockwood and Mustang**
Objective 1	**To enhance the river environment for local residents**
Policy 1	By improving access to the Truckee River for local residents
Policy 2	By improving recreation opportunity along the Truckee River for local residents
Policy 3	By preserving and enhancing natural river alignment and riparian alignment
Policy 4	By requiring new land developments abutting the Truckee River to integrate the river environment into the design of new land developments through the application of parks and recreation spaces that enable accessibility to the river for occupants of the development and the public



Source: Nevada Rock Art Foundation, 2015

3.5.6 Lagomarsino Area

Goal 1 **Diversify uses and reduce conflicts**

Objective 1 **Implement zoning, regulations, and practices that maintain a diversity of uses and reduce conflicts**

Policy 1 By ensuring that uses in the area are compatible with heavy and high-intensity industrial uses

Policy 2 By preventing residential development in the Lagomarsino area, except for the area immediately south and abutting the Highlands (known as the Sunny Hills Ranchos) where rural residential (40 acre minimum) uses are allowed

Policy 3 By requiring 40 acre parcel size throughout the Sunny Hills Ranchos

Policy 4 By concentrating heavy and high-intensity industrial uses in areas already designated for such uses

Policy 5 By maintaining extensive buffer areas for uses on lands zoned for high-intensity industrial uses

Policy 6 By communicating with the Highlands property owners associations and residents when considering master plan amendment, zone change applications, special use permits, other planning applications, and road infrastructure improvements, in the Lagomarsino area where the Highlands may be potentially impacted by the use

Objective 2 **To ensure that regional transportation improvements do not adversely impact the Highlands and Lockwood-Mustang areas**

Policy 1 By assessing adverse impacts, including traffic, safety, noise, light pollution, wildland fire risk, and undesirable uses that a north-south and east-west transportation interconnection may have on the Highlands community before such a project is considered

Policy 3	By utilizing the McCarran Government Complex to expand public services including, but not limited to, administrative, court, and emergency services, proportional to growth in the northern parts of the county

Goal 2 **Increase the capacity and efficiency of the Storey County Courthouse**

Policy 1	By preserving the historic layout, design, and integrity of the Storey County Courthouse in any decisions affecting its use
Policy 2	By repurposing spaces in the courthouse to increase office space and efficiency
Policy 3	By considering adding an administrative office extension to the courthouse building or constructing a separate building adjacent to the courthouse for this purpose
Policy 4	By considering use of properties adjacent to the courthouse to accommodate needed expansions

Goal 3 **Consider alternative location(s) for certain county administrative offices**

Policy 1	By considering expansions to the county jail facility at 911 State Route 341 and relocating certain administrative offices to that facility
Policy 2	By considering other county-owned buildings in Virginia City to be repurposed for county administrative offices
Policy 3	By collaborating with the Storey County School District to co-locate use of existing and future county and school district facilities

Goal 4 **Maintain the Storey County Courthouse in its existing functional capacity**

Policy 1	By maintaining the Storey County Courthouse for the purpose of court, statutory administrative offices, and other key county administrative functions

9.3.8 County-owned historic structures

Goal 1 **Preserve the historic integrity of county-owned historic structures for the enjoyment of residents, visitors, and scholars**

Policy 1	By conforming to Nevada Revised Statute 384 Comstock Historic District requirements in decisions affecting architecture, materials, colors, and design elements of county-owned historic structures
Policy 2	By establishing and maintaining inter-local agreements with non-profit and other organizations for the preservation and enhancement of county-owned historic structures

9.3.9 Water and wastewater management

Goal 1 **Protect public health by complying with all state and federal water regulations**

Policy 1	By creating incentives to encourage existing development to connect into existing municipal water systems

Policy 2	By requiring new planned unit developments and land subdivisions to connect into municipal water systems or have densities which cause no adverse impact on area underground water resources
Goal 2	**Minimize high-water demand on public and private landscaping areas**
Policy 1	By encouraging low-water-consumption vegetation and efficient irrigation systems in all new developments
Policy 2	By serving as a role-model in the community by applying xeriscaping to all public buildings landscaping where feasible
Policy 3	By educating residents, businesses, and school-age children the principles, practices, and benefits of xeriscaping
Policy 4	By requiring xeriscaping provisions in all planned unit developments and private-public development agreements
Policy 5	By providing economic and other incentives by adjusting the water rights dedication requirements to reflect the reduced water demand of water conservation landscaping and fixtures
Goal 3	**Reduce non-point water pollution sources and improve groundwater recharge through Low-Impact-Development processes**
Policy 1	By requiring comprehensive Low Impact Development practices in all planned unit development approvals
Policy 2	By providing economic or other incentives for Low Impact Development retrofits to existing developed properties and small-scale developments
Policy 3	By education residents, businesses, and school-aged children the principles, practices, and benefits of Low Impact Development practices
Goal 4	**Reduce water consumption for new buildings and developments**
Policy 1	By adopting new building standards for water conservation devices in the county code
Policy 2	By encouraging and promoting gray-water conservation systems
Policy 3	By requiring installation of water conservation devices in occupied units of all planned unit development and subdivision approvals
Goal 5	**Improve the quality and quantity of water in the Highlands and Mark Twain**
Policy 1	Provide education and other assistance that helps each community develop its own general improvement districts
Policy 2	Consider inter-local cooperation with adjacent jurisdictions to provide access to their municipal water systems where needed

Goal 6 **Provide adequate community wastewater facilities**

Policy 1 By completing the Gold Hill and Virginia City wastewater rehabilitation project within the timeframes allowed by the awarded 2015 U.S. Department of Agriculture grant

Policy 2 By encouraging the reuse and repurposing of effluent wastewater at the Tahoe-Reno Industrial Center for industrial and other non-potable uses

Policy 3 By monitoring Nevada Division of Environmental Protection groundwater quality data for the Highlands and Mark Twain in order to provide needed time to help the communities plan for wastewater treatment needs if they arise

Policy 4 By requiring all golf courses to be irrigated exclusively with secondary effluent

Policy 5 By remaining vigilant in reporting to the State suspected domestic well withdraws exceeding two acre-feet per year

Goal 7 **Prevent individual sewage disposal systems in rural areas from degrading groundwater quality**

Policy 1 By requiring new planned unit developments and land subdivisions to connect into municipal wastewater systems or have densities which cause no adverse impact on underground water resources

Policy 2 By allowing rural areas to be served by individual septic systems if groundwater quality will conform to with federal, state, and county standards

Policy 3 By utilizing state standards to evaluate new septic systems on the basis of site susceptibility to groundwater pollution by septic effluent

Policy 4 By ensuring that location, design, construction, and inspection of on-site sewage disposal systems (i.e. septic systems and engineer systems) comply with county codes and Nevada Administrative Code 444, "Regulation Governing Individual Sewage Disposal Systems"

Policy 5 By continuing to monitor areas with high septic system densities for signs of groundwater contamination

Policy 6 By requiring abandonment of failed septic systems and corrective action that conforms to federal, state, and county standards

9.3.10 Flood and stormwater management

Goal 1 **Minimize flooding and flood damage**

Objective 1 **To evaluate existing infrastructure and flooding conditions and making improvements based on those factors**

Policy 1 By developing a comprehensive flood and drainage study for the Lockwood area, and by developing a list of solutions based on the findings of the study

Policy 2 By participating in regional cooperative efforts for floodplain management and planning in the Lockwood

10.10.1 Goals and objectives

Goal 1	**Retain existing water resources which exist for the benefits of Mark Twain residents**
Objective 1	Request the legislation, both at county and state level, to allow restriction or to prevent water or water rights exportation to areas outside Mark Twain
Objective 2	Request Nevada State Engineer to commence hydraulic study of water basin in Mark Twain to determine quantity and quality of aquifers to assure aquifers are not being depleted beyond their recharging capabilities
Policy 1	Discourage exporting or selling off water rights form Story County
Objective 3	Cooperate with and encourage area mining operations, residences and other land uses to implement water conservation practices.
Goal 2	**Retain existing water resources for the River District**
Objective 1	Require new development to obtain water rights before land use permits are approved
Objective 2	With local residents and development firms, investigate the feasibility of developing a unified water and sewer district for the River District
Policy 1	Discourage exporting or selling off water rights form Story County
Goal 3	**Preserve existing agricultural areas**
Objective 1	Direct non-agricultural development to non-agricultural areas through zoning regulations
Policy 1	Discourage exporting or selling off water rights form Story County
Objective 2	Encourage conservation farming such as low water use crops and techniques to minimize evaporation
Goal 4	**Maintain an environment which is healthy, safe, and desirable for residents throughout the county**
Policy 1	Preserve open space within the county
Objective 1	Work with conservation groups to minimize invasive weeds
Goal 5	**Ensure that present and future county residents have an adequate water supply meeting safe drinking standards**

Objective 1 Require all proposed planned unit developments to furnish proof of owned rights to adequate water meeting safe drinking standards before necessary land use or building permit applications are considered

Objective 2 Actively participate on regional governmental water agencies to ensure the water rights of all owners and residents are protected. In addition, actively protest the granting of water rights or land development proposals which will have a negative impact on the quantity and/or quality of Storey County residents' water supply

Objective 3 Continue to encourage and require, when feasible, the use of recycled, treated effluent water for agrarian and recreational uses. Establish the county's priority of right to the use of this water

Policy 1 Encourage landscaping to minimize erosion, and increase infiltration

Objective 4 Request the Nevada State Engineer to undertake a hydrologic study of water resources in the undeveloped northerly and easterly portion of the county and the stability of the water aquifer in the Highlands

Objective 5 Continue to maintain, replace, and upgrade segments of the Marlette Water System pipeline, as necessary.

Objective 6 Maintain the primacy of the Virginia City/Gold Hill water allotment allocated in the Franktown Water Decree

Objective 7 Enhance local water conservation awareness and investigate ordinance changes to require conservation

Objective 8 Redefine by County Ordinance the geographic boundaries of the town site of Gold Hill as originally written

Objective 9 Discourage landscaping which requires large amounts of water. Encourage xeriscaping techniques on landscaped public right-of-way areas, around public building and other public areas and other landscaping to slow run off from county.

Goal 6 Protect the quality of present and future water resources

Objective 1 Refuse special use permitting of industries which cannot guarantee the quality of effluent produced by their activity. Require users of toxic or hazardous materials to provide monitoring capabilities to assure protection from surface and groundwater contamination

Objective 2 Engage in collaborative efforts with surrounding water quality and land conservation entities to implement watershed improvement programs within Long Valley Creek, and Six Mile and Seven Mile Canyons

Objective 3 Actively protest the granting of water rights or land development proposals which will have a negative impact on the quantity and/or quality of Storey County residents' water supply

Objective 4 Slow the runoff of precipitation to limit erosion damage, minimize flooding impacts, and encourage greater recharge of county aquifers

Objective 5 Encourage new developments to design with native animal and plant interests in mind to encourage their growth, and leverage their benefits

Goal 7 Regulate use of open-range and watershed areas to minimize fire danger and prevent degradation

Objective 1 Assist property owners and interested groups in controlling grazing and public use of critical watershed and riparian areas

Objective 2 Cooperate with ranchers, property owners and interested groups in the county in managing wild horses and other grazing animals, in numbers which will not exceed capacity of the land

APPENDIX B

Storey County Storage & Supply Calculations
Water Resource Plan

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	131	262	524
Additional Demands at Buildout	864	259	518	1,036
Totals	**1,667**	**390**	**780**	**1,560**

Supply Data

Source	Production Capacity (gpm)
Marlette Water System	738
Total Supply	**738**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
Total Storage	**1,475,000**

Table 1. Storey County System Existing Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		1,475,000		1,475,000
Total Supply (Production - Demand)		685,760		-188,480
Total Capacity (Daily)		2,160,760		1,286,520
Fire Storage	432,000	1,728,760	432,000	854,520
Operating Storage	188,480	1,540,280	188,480	666,040
Emergency Storage	141,360	1,398,919	141,360	524,680

Table 2. Storey County System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		1,475,000		1,475,000
Total Supply (Production - Demand)		-60,331		-561,525
Total Capacity (Daily)		1,414,669		913,475
Fire Storage	432,000	982,669	432,000	481,475
Operating Storage	561,525	421,144	561,525	-80,051
Emergency Storage	421,144	0	421,144	-501,195

*Tank Values, Pump Capacity, and Unit Demands taken from Storey County Water System Master Plan

Comstock Only

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	137	274	548
Additional Demands at Buildout - Comstock	750	283	566	1,132
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands at Buildout - Highlands	0	0	0	0
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**1,553**	**420**	**840**	**1,680**

Supply Data

Source	Production Capacity (gpm)		
Water Treatment Plant	1,050	1.51	MGD
Marlette Water System - Ex. Siphon	738		
Marlette Water System - Add. Siphon	320	<- 12" transmission main from I-580 to top of siphon	
Total Supply	**1,050**		
Total w/ largest well out of service	**1,050**		

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
Total Storage	**1,475,000**

Table 1. Comstock System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		1,475,000		1,475,000
Total Supply (Production - Demand)		302,441		-1,209,559
Total Capacity (Daily)		1,777,441		265,441
Fire Storage	432,000	1,345,441	0	265,441
Operating Storage	604,779	740,662	0	265,441
Emergency Storage	453,585	287,077	0	265,441

Comstock + American Flat

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

0.394 AFA per EDU
0.245 EDU ADD (gpm)

Demand Data

	No. EDUs	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	137	274	548
Additional Demands at Buildout - Comstock	750	283	566	1,132
Additional Demands at Buildout - American Flat	46	190	380	760
Additional Demands at Buildout - Highlands	0	0	0	0
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**1,599**	**610**	**1,220**	**2,439**

Supply Data

Source	Production Capacity (gpm)	
Water Treatment Plant	1,500	2.2 MGD
Marlette Water System - Ex. Siphon	0	
Marlette Water System - Add. Siphon	1,500	<- 12" transmission main from Lakeview Tanks to top of siphon
Total Supply	**1,500**	
Total w/ largest well out of service	**1,500**	

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
American Flat Tank	750,000
Total Storage	**2,225,000**

Table 1. Comstock + American Flat System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage**	**Storage Balance**	**Storage**	**Storage Balance**
Total Storage		2,225,000		
Total Supply (Production - Demand)		403,598		
Total Capacity (Daily)		2,628,598		
Fire Storage	432,000	2,196,598		
Operating Storage	878,201	1,318,398		
Emergency Storage	658,651	659,747		

Comstock + Highlands

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

0.394 AFA per EDU
0.245 EDU ADD (gpm)

Demand Data

	No. EDUs	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	137	274	548
Additional Demands at Buildout - Comstock	750	283	566	1,132
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands at Buildout - Highlands	1,195	477	955	1,910
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**2,748**	**897**	**1,795**	**3,590**

Supply Data

Source	Production Capacity (gpm)	
Water Treatment Plant	2,250	3.2 MGD
Marlette Water System - Ex. Siphon	0	
Marlette Water System - Add. Siphon	2,250	<- 16" transmission main from Lakeview Tanks to Top of Siphon
Total Supply	**2,250**	
Total w/ largest well out of service	**2,250**	

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
Highlands Tank	1,000,000
Total Storage	**2,475,000**

Table 1. Comstock + Higlands System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage**	**Storage Balance**	**Storage**	**Storage Balance**
Total Storage		2,475,000		
Total Supply (Production - Demand)		655,439		
Total Capacity (Daily)		3,130,439		
Fire Storage	432,000	2,698,439		
Operating Storage	1,292,280	1,406,159		
Emergency Storage	969,210	436,948		

Comstock + Highlands (Ex)

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

0.394 AFA per EDU
0.245 EDU ADD (gpm)

Demand Data

	No. EDUs	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	137	274	548
Additional Demands at Buildout - Comstock	750	283	566	1,132
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands Highlands (Ex)	588	365	729	1,458
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**2,141**	**785**	**1,569**	**3,138**

Supply Data

Source	Production Capacity (gpm)	
Water Treatment Plant	1,950	2.8 MGD
Marlette Water System - Ex. Siphon	0	
Marlette Water System - Add. Siphon	1,950	<- 14" transmission main from Lakeview Tanks to Top of Siphon
Total Supply	**1,950**	
Total w/ largest well out of service	**1,950**	

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
Highlands Tank	1,000,000
Total Storage	**2,475,000**

Table 1. Comstock + American Flat System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage**	**Storage Balance**	**Storage**	**Storage Balance**
Total Storage		2,475,000		
Total Supply (Production - Demand)		548,576		
Total Capacity (Daily)		3,023,576		
Fire Storage	432,000	2,591,576		
Operating Storage	1,129,712	1,461,864		
Emergency Storage	847,284	614,580		

Comstock + Mark Twain (Ex)

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

0.394 AFA per EDU
0.245 EDU ADD (gpm)

Demand Data

	No. EDUs	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	137	274	548
Additional Demands at Buildout - Comstock	750	283	566	1,132
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands Highlands (Ex)	0	0	0	0
Additional Demands Mark Twain (Ex)	333	206	413	826
Totals	**1,886**	**626**	**1,253**	**2,506**

Supply Data

Source	Production Capacity (gpm)	
Water Treatment Plant	1,550	2.2 MGD
Marlette Water System - Ex. Siphon	0	
Marlette Water System - Add. Siphon	1,550	<- 12" transmission main from Lakeview Tanks to Top of Siphon
Total Supply	**1,550**	
Total w/ largest well out of service	**1,550**	

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
Mark Twain Tank	500,000
Total Storage	**1,975,000**

Table 1. Comstock + American Flat System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage**	**Storage Balance**	**Storage**	**Storage Balance**
Total Storage		1,975,000		
Total Supply (Production - Demand)		427,875		
Total Capacity (Daily)		2,402,875		
Fire Storage	432,000	1,970,875		
Operating Storage	902,063	1,068,812		
Emergency Storage	676,547	392,265		

American Flat Only

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. MDD w/o supply
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	0	0	0	0
Additional Demands at Buildout - Comstock	0	0	0	0
Additional Demands at Buildout - American Flat	46	190	380	760
Additional Demands at Buildout - Highlands	0	0	0	0
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**46**	**190**	**380**	**760**

Supply Data

Source	Production Capacity (gpm)
3,100 lf of 12" Transmission Main (23' headloss)	1,750
Total Supply	**1,750**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	2,000	2	240,000

Existing Storage Data

Tank	Storage Capacity (gal)
American Flat Tank	750,000
Total Storage	**750,000**

Table 1. American Flat System Buildout Conditions

	MDD + Fire w/all sources		MDD (No Supply)	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		750,000		750,000
Total Supply (Production - Demand)		1,973,157		-546,843
Total Capacity (Daily)		2,723,157		203,157
Fire Storage	240,000	2,483,157	240,000	-36,843
Operating Storage	273,421	2,209,736	273,421	-310,264
Emergency Storage	205,066	2,004,670	205,066	-515,330

Highlands Only - Buildout

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. MDD w/o supply
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	0	0	0	0
Additional Demands at Buildout - Comstock	0	0	0	0
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands at Buildout - Highlands	1,195	477	955	1,910
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**1,195**	**477**	**955**	**1,910**

Supply Data

Source	Production Capacity (gpm)
20,250 lf of 12" Transmission Main (100' headloss)	1,500
Total Supply	**1,500**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	1,000	2	120,000

Existing Storage Data

Tank	Storage Capacity (gal)
Highlands Tank	1,000,000
Total Storage	**1,000,000**

Table 1. Highlands System Buildout Conditions

	MDD + Fire w/all sources		MDD (No Supply)	
Storage Type	**Storage Requirement (gal)**	**Storage Balance (gal)**	**Storage Requirement (gal)**	**Storage Balance (gal)**
Total Storage		1,000,000		1,000,000
Total Supply (Production - Demand)		784,998		-687,501
Total Capacity (Daily)		1,784,998		312,499
Fire Storage	120,000	1,664,998	120,000	192,499
Operating Storage	687,501	977,497	687,501	-495,002
Emergency Storage	515,626	461,871	515,626	-1,010,628

Mark Twain Only - Buildout

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. MDD w/o supply
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	0	0	0	0
Additional Demands at Buildout - Comstock	0	0	0	0
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands at Buildout - Highlands	0	0	0	0
Additional Demands at Buildout - Mark Twain	430	3,229	6,457	12,914
Totals	**430**	**3,229**	**6,457**	**12,914**

Supply Data

Source	Production Capacity (gpm)
27,500 lf of 14" Transmission Main (705 ft headloss)	6,000
Total Supply	**6,000**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	2,000	2	240,000

Existing Storage Data

Tank	Storage Capacity (gal)
Mark Twain Tank(s)	9,100,000
Total Storage	**9,100,000**

Table 1. American Flat System Buildout Conditions

	MDD + Fire w/all sources		MDD (No Supply)	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		9,100,000		9,100,000
Total Supply (Production - Demand)		-658,433		-9,298,433
Total Capacity (Daily)		8,441,567		-198,433
Fire Storage	240,000	8,201,567	240,000	-438,433
Operating Storage	4,649,216	3,552,351	4,649,216	-5,087,649
Emergency Storage	3,486,912	65,439	3,486,912	-8,574,561

Highlands Only - Existing

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. MDD w/o supply
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	588	365	730	1,460
Totals	**588**	**365**	**730**	**1,460**

Supply Data

Source	Production Capacity (gpm)
20,250 lf of 12" Transmission Main (100' headloss)	1,500
Total Supply	**1,500**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	1,000	2	120,000

Existing Storage Data

Tank	Storage Capacity (gal)
Highlands Tank 1	650,000
Total Storage	**650,000**

Table 1. Highlands Ex System Buildout Conditions

	MDD + Fire w/all sources		MDD (No Supply)	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		650,000		650,000
Total Supply (Production - Demand)		1,108,800		-525,600
Total Capacity (Daily)		1,758,800		124,400
Fire Storage	120,000	1,638,800	120,000	4,400
Operating Storage	525,600	1,113,200	525,600	-521,200
Emergency Storage	394,200	719,000	394,200	-915,400

Mark Twain Only - Existing

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. MDD w/o supply
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	333	206	413	826
Totals	**333**	**206**	**413**	**826**

Supply Data

Source	Production Capacity (gpm)
27,500 lf of 12" Transmission Main	1,500
Total Supply	**1,500**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	1,000	2	120,000

Existing Storage Data

Tank	Storage Capacity (gal)
Mark Twain Tank(s)	500,000
Total Storage	**500,000**

Table 1. Mark Twain System Buildout Conditions

	MDD + Fire w/all sources		ADD (No Supply)	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		500,000		500,000
Total Supply (Production - Demand)		1,565,434		-297,283
Total Capacity (Daily)		2,065,434		202,717
Fire Storage	120,000	1,945,434	120,000	82,717
Operating Storage	297,283	1,648,150	297,283	-214,566
Emergency Storage	222,962	1,425,188	222,962	-437,529

Comstock Ex Only

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	803	137	274	548
Additional Demands at Buildout - Comstock	0	0	0	0
Additional Demands at Buildout - American Flat	0	0	0	0
Additional Demands at Buildout - Highlands	0	0	0	0
Additional Demands at Buildout - Mark Twain	0	0	0	0
Totals	**803**	**137**	**274**	**548**

Supply Data

Source	Production Capacity (gpm)	
Water Treatment Plant	1,050	1.26 MGD
Marlette Water System - Ex. Siphon	738	
Marlette Water System - Add. Siphon	0	<- 12" transmission main from I-580 to top of siphon
Total Supply	**738**	
Total w/ largest well out of service	**738**	

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Divide Tank	115,000
Silver City Tank	160,000
Total Storage	**1,475,000**

Table 1. Comstock System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		1,475,000		1,475,000
Total Supply (Production - Demand)		668,128		-394,592
Total Capacity (Daily)		2,143,128		1,080,408
Fire Storage	432,000	1,711,128	0	1,080,408
Operating Storage	197,296	1,513,832	0	1,080,408
Emergency Storage	147,972	1,365,860	0	1,080,408

Storey County Storage Calculations (Gold Hill System)
Water Resource Plan

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	51	8	17	33
Additional Demands at Buildout	710	213	426	852
Totals	**761**	**221**	**443**	**885**

Supply Data

Source	Production Capacity (gpm)
Supply from VC	875
Total Supply	**875**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	1,500	2	180,000

Existing Storage Data

Tank	Storage Capacity (gal)
Divide Tank	115,000
Total Storage	**115,000**

Table 1. Gold Hill System Existing Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		115,000		115,000
Total Supply (Production - Demand)		1,236,059		-11,971
Total Capacity (Daily)		1,351,059		103,029
Fire Storage	180,000	1,171,059	180,000	-76,971
Operating Storage	11,971	1,159,088	11,971	-88,941

Emergency Storage	8,978	1,150,110	8,978	-97,919

Table 2. Gold Hill System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage Requirement (gal)**	**Storage Balance (gal)**	**Storage Requirement (gal)**	**Storage Balance (gal)**
Total Storage		115,000		115,000
Total Supply (Production - Demand)		622,667		-318,667
Total Capacity (Daily)		737,667		-203,667
Fire Storage	180,000	557,667	180,000	-383,667
Operating Storage	318,667	239,000	318,667	-702,333
Emergency Storage	239,000	0	239,000	-941,333

*Tank Values, Pump Capacity, and Unit Demands taken from Storey County Water System Master Plan

Storey County Storage Calculations (Silver City System)
Water Resource Plan

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	86	14	28	56
Additional Demands at Buildout	220	66	132	264
Totals	**306**	**80**	**160**	**320**

Supply Data

Source	Production Capacity (gpm)
Supply from GH	314
Total Supply	**314**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	1,500	2	180,000

Existing Storage Data

Tank	Storage Capacity (gal)
Silver City Tank	160,000
Total Storage	**160,000**

Table 1. Silver City System Existing Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		160,000		160,000
Total Supply (Production - Demand)		411,788		-20,186
Total Capacity (Daily)		571,788		139,814
Fire Storage	180,000	391,788	180,000	-40,186
Operating Storage	20,186	371,602	20,186	-60,372

Emergency Storage	15,139	356,463	15,139	-75,511

Table 2. Silver City System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage Requirement (gal)**	**Storage Balance (gal)**	**Storage Requirement (gal)**	**Storage Balance (gal)**
Total Storage		160,000		160,000
Total Supply (Production - Demand)		221,675		-115,243
Total Capacity (Daily)		381,675		44,757
Fire Storage	180,000	201,675	180,000	-135,243
Operating Storage	115,243	86,432	115,243	-250,485
Emergency Storage	86,432	0	86,432	-336,917

*Tank Values, Pump Capacity, and Unit Demands taken from Storey County Water System Master Plan

Storey County Storage Calculations (Virginia City System)
Water Resource Plan

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage
2. ADD + Fire Flow with largest supply out of service
   a. Operating Storage = 100% of Average Day Demand
   b. Emergency Storage = 75% Operating Storage

Demand Data

	No. Connections	Demands (gpm)		
		ADD	MDD	PHD
Existing Demands	666	109	217	434
Additional Demands at Buildout	768	230	461	922
Totals	**1,434**	**339**	**678**	**1,356**

Supply Data

Source	Production Capacity (gpm)
Marlette Water System	738
Total Supply	**738**
Total w/ largest well out of service	**0**

Fire Flow Demand

Demand	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Flow Demand	3,600	2	432,000

Existing Storage Data

Tank	Storage Capacity (gal)
Hillside Tank #1	500,000
Hillside Tank #2	500,000
Taylor Tank	200,000
Total Storage	**1,200,000**

Table 1. Virginia City System Existing Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	Storage Requirement (gal)	Storage Balance (gal)	Storage Requirement (gal)	Storage Balance (gal)
Total Storage		1,200,000		1,200,000
Total Supply (Production - Demand)		750,073		-156,324
Total Capacity (Daily)		1,950,073		1,043,676

Fire Storage	432,000	1,518,073	432,000	611,676
Operating Storage	156,324	1,361,749	156,324	455,353
Emergency Storage	117,243	1,244,507	117,243	338,110

Table 2. Virginia City System Buildout Conditions

	MDD + Fire w/all sources		ADD + Fire w/o largest source	
Storage Type	**Storage Requirement (gal)**	**Storage Balance (gal)**	**Storage Requirement (gal)**	**Storage Balance (gal)**
Total Storage		1,200,000		1,200,000
Total Supply (Production - Demand)		86,336		-488,192
Total Capacity (Daily)		1,286,336		711,808
Fire Storage	432,000	854,336	432,000	279,808
Operating Storage	488,192	366,144	488,192	-208,384
Emergency Storage	366,144	0	366,144	-574,528

*Tank Values, Pump Capacity, and Unit Demands taken from Storey County Water System Master Plan

APPENDIX C

Storey County
Water Resource Plan
Project Alternative Cost Estimate - B St. & Union St. Water Mains

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/13/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	10-inch C900 PVC Water Main	1,500	LF	$200.00	$300,000.00
2	8-inch C900 PVC Water Main	4,600	LF	$160.00	$736,000.00
3	Meters and Services	53	EA	$10,000.00	$530,000.00
4	Traffic Control	1	LS	$75,000.00	$75,000.00
				Subtotal:	$1,641,000.00
				25% Contingency:	$410,250.00
				25% Engineering & Inspection:	$410,250.00
				Project Total:	$2,461,500.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Hillside to Divide Transmission

Estimate by: Alex Stodtmeister

Project No. 1797
Date: 11/30/20

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	12-inch C900 PVC Water Main	2,900	LF	$240.00	$696,000.00
				Subtotal:	$696,000.00
				25% Contingency:	$174,000.00
				25% Engineering & Inspection:	$174,000.00
				Project Total:	$1,044,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Silver City Transmission Main

Estimate by: Alex Stodtmeister

Project No. 1797
Date: 11/30/20

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	8-inch C900 PVC Water Main	8,200	LF	$160.00	$1,312,000.00
2	8-inch PRV	1	EA	$150,000.00	$150,000.00
				Subtotal:	$1,462,000.00
				25% Contingency:	$365,500.00
				25% Engineering & Inspection:	$365,500.00
				Project Total:	$2,193,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Parallel Siphon (Comstock Buildout Only | 1,086 gpm capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/14/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	12-inch Transmission Main	25,700	LF	$240.00	$6,168,000.00
2	6" Air Release Valve Assembly	10	EA	$14,000.00	$140,000.00
				Subtotal:	$6,308,000.00
				25% Contingency:	$1,577,000.00
				25% Engineering & Inspection:	$1,577,000.00
				Project Total:	$9,462,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - WTP Capacity Upgrade (Comstock Buildout Only | 1.5 MGD capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/14/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	0.3 MGD Capacity Upgrade	1	LS	$1,450,000.00	$1,450,000.00
				Subtotal:	$1,450,000.00
				25% Contingency:	$362,500.00
				25% Engineering & Inspection:	$362,500.00
				Project Total:	$2,175,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Replace Siphon (Comstock + AF Buildout | 1,500 gpm capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/28/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	12-inch Transmission Main - Storey County ROW	25,700	LF	$240.00	$6,170,000.00
2	6" Air Release Valve Assembly - Storey County ROW	10	EA	$14,000.00	$140,000.00
3	12-inch Transmission Main - MWS ROW	16,100	LF	$240.00	$3,870,000.00
4	6" Air Release Valve Assembly - MWS ROW	0	EA	$14,000.00	$0.00

Subtotal:	$10,180,000.00
25% Contingency:	$2,545,000.00
25% Engineering & Inspection:	$2,545,000.00
Project Total:	$15,270,000.00
Storey Co. Total:	$9,465,000.00
Marlette Water System Total:	$5,805,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - WTP Capacity Upgrade (Comstock + American Flat Buildout | 2.2 MGD capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/14/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	1.0 MGD Capacity Upgrade	1	LS	$4,830,000.00	$4,830,000.00

Subtotal:	$4,830,000.00
25% Contingency:	$1,207,500.00
25% Engineering & Inspection:	$1,207,500.00
Project Total:	$7,245,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - American Flat Infrastructure

Estimate by: Alex Stodtmeister

Project No. 1797
Date: 11/30/20

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	12-inch Transmission Main	3,100	LF	$160.00	$496,000.00
2	750,000-Gallon Storage Tank	1	EA	$1,620,000.00	$1,620,000.00
3	Land Acquisition and Easements	1	LS	$200,000.00	$200,000.00

Subtotal:	$2,316,000.00
25% Contingency:	$579,000.00
25% Engineering & Inspection:	$579,000.00
Project Total:	$3,474,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Replace Siphon (Comstock + Mark Twain Buildout Only | 1,550 gpm capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 05/20/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	12-inch Transmission Main - Storey County ROW	25,700	LF	$240.00	$6,170,000.00
2	6" Air Release Valve Assembly - Storey County ROW	10	EA	$14,000.00	$140,000.00
3	12-inch Transmission Main - MWS ROW	16,100	LF	$240.00	$3,870,000.00
4	6" Air Release Valve Assembly - MWS ROW	0	EA	$14,000.00	$0.00
				Subtotal:	$10,180,000.00
	0.614832536			25% Contingency:	$2,545,000.00
				25% Engineering & Inspection:	$2,545,000.00
				Project Total:	$15,270,000.00
				Storey Co. Total:	$9,465,000.00
				Marlette Water System Total:	$5,805,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - WTP Capacity Upgrade (Comstock + Mark Twain Ex. Residents | 2.2 MGD capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 05/20/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	1.0 MGD Capacity Upgrade	1	LS	$4,830,000.00	$4,830,000.00
				Subtotal:	$4,830,000.00
				25% Contingency:	$1,207,500.00
				25% Engineering & Inspection:	$1,207,500.00
				Project Total:	$7,245,000.00

Storey County
Water Resource Plan
Project Alternative Opinion of Cost - Mark Twain Water System (Ex. Residents Only)

Estimate by: Alex Stodtmeister

Project No. 1797
Date: 04/28/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	12-inch Transmission Main	27,500	LF	$240.00	$6,600,000.00
2	8-inch Distribution Main	46,000	LF	$160.00	$7,360,000.00
3	Pressure Sustaining Valve	1	EA	$150,000.00	$150,000.00
4	Meters and Services	333	EA	$10,000.00	$3,330,000.00
5	500,000-Gallon Storage Tank	1	EA	$1,080,000.00	$1,080,000.00
6	Land Acquisition and Easements	1	LS	$200,000.00	$200,000.00
				Subtotal:	$18,720,000.00
				25% Contingency:	$4,680,000.00
				25% Engineering & Inspection:	$4,680,000.00
				Project Total:	$28,080,000.00
				Transmission Only Total:	$11,945,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Replace Siphon (Comstock + Highlands Buildout Only | 2,000 gpm capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 07/14/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	14-inch Transmission Main - Storey County ROW	25,700	LF	$280.00	$7,200,000.00
2	6" Air Release Valve Assembly - Storey County ROW	10	EA	$14,000.00	$140,000.00
3	14-inch Transmission Main - MWS ROW	16,100	LF	$280.00	$4,510,000.00
4	6" Air Release Valve Assembly - MWS ROW	0	EA	$14,000.00	$0.00
				Subtotal:	$11,850,000.00
				25% Contingency:	$2,962,500.00
				25% Engineering & Inspection:	$2,962,500.00
				Project Total:	$17,775,000.00
				Storey Co. Total:	$11,010,000.00
				Marlette Water System Total:	$6,765,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - WTP Capacity Upgrade (Comstock + Highlands Ex. Residents | 2.8 MGD capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 07/14/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	1.6 MGD Capacity Upgrade	1	LS	$7,720,000.00	$7,720,000.00
				Subtotal:	$7,720,000.00
				25% Contingency:	$1,930,000.00
				25% Engineering & Inspection:	$1,930,000.00
				Project Total:	$11,580,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Highlands Buildout Infrastructure

Estimate by: Lucas Tipton

Project No. 1797
Date: 11/10/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	10-inch Transmission Main	20,500	LF	$200.00	$4,100,000.00
2	8-inch Distribution Main	100,000	LF	$160.00	$16,000,000.00
3	10-inch Distribution Main	51,600	LF	$200.00	$10,319,904.00
4	8-inch PRV	14	EA	$150,000.00	$2,100,000.00
5	10-inch PRV	10	EA	$175,000.00	$1,750,000.00
6	Meters and Services	588	EA	$10,000.00	$5,880,000.00
7	120 hp Booster Pump Station	1	EA	$4,600,000.00	$4,600,000.00
8	650,000-Gallon Storage Tank	1	EA	$1,400,000.00	$1,400,000.00
9	Land Acquisition and Easements	1	LS	$200,000.00	$200,000.00
				Subtotal:	$46,349,904.00
				25% Contingency:	$11,587,476.00
				25% Engineering & Inspection:	$11,587,476.00
				Project Total:	$69,524,856.00
				Transmission Only Total:	$15,350,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Replace Siphon (Comstock + Highlands Buildout Only | 2,250 gpm capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/28/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	16-inch Transmission Main - Storey County ROW	25,700	LF	$330.00	$8,490,000.00
2	6" Air Release Valve Assembly - Storey County ROW	10	EA	$14,000.00	$140,000.00
3	16-inch Transmission Main - MWS ROW	16,100	LF	$330.00	$5,320,000.00
4	6" Air Release Valve Assembly - MWS ROW	0	EA	$14,000.00	$0.00

Subtotal:	$13,950,000.00
25% Contingency:	$3,487,500.00
25% Engineering & Inspection:	$3,487,500.00
Project Total:	$20,925,000.00
Storey Co. Total:	$12,945,000.00
Marlette Water System Total:	$7,980,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - WTP Capacity Upgrade (Comstock + Highlands Buildout Only | 3.2 MGD capacity)

Estimate by: Lucas Tipton

Project No. 1797
Date: 04/28/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	2.0 MGD Capacity Upgrade	1	LS	$9,650,000.00	$9,650,000.00

Subtotal:	$9,650,000.00
25% Contingency:	$2,412,500.00
25% Engineering & Inspection:	$2,412,500.00
Project Total:	$14,475,000.00

Storey County
Water Resource Plan
Project Alternative Cost Estimate - Highlands Buildout Infrastructure

Estimate by: Lucas Tipton

Project No. 1797
Date: 11/10/21

QC Check by:
Date:

BID SCHEDULE - BASE BID

Bid Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	10-inch Transmission Main	20,500	LF	$240.00	$4,920,000.00
2	8-inch Distribution Main	150,000	LF	$160.00	$24,000,000.00
3	10-inch Distribution Main	51,600	LF	$240.00	$12,383,884.80
4	8-inch PRV	14	EA	$150,000.00	$2,100,000.00
5	10-inch PRV	10	EA	$200,000.00	$2,000,000.00
6	Meters and Services	1,195	EA	$10,000.00	$11,950,000.00
7	220 hp Booster Pump Station	1	EA	$5,400,000.00	$5,400,000.00
8	650,000-Gallon Storage Tank	1	EA	$1,400,000.00	$1,400,000.00
9	350,000-Gallon Storage Tank	1	EA	$800,000.00	$800,000.00
10	Land Acquisition and Easements	1	LS	$200,000.00	$200,000.00

Subtotal:	$65,153,884.80
25% Contingency:	$16,288,471.20
25% Engineering & Inspection:	$16,288,471.20
Project Total:	$97,730,827.20
Transmission Only Total:	$18,980,000.00