

## CHAPTER 5: CONSERVATION AND NATURAL RESOURCES

### 5.0 Introduction

There are 167,680 total acres in Storey County, 39,146 acres are in the Carson basin with the remaining 128,534 in the Truckee Basin. Because the topography is generally steep, the soil permeability low, evaporation high and vegetation sparse, water runoff is hard to keep. For these reasons ground water recharge is limited to alluvial fans located at the base of various drainage networks.

Storey County is subject to summer convection storms (which deliver precipitation in large amounts over small areas). Most of that input is lost to runoff. Winter storms probably contribute more to upslope recharge, however here the soil mantle is often frozen.

Although those portions of the watershed over 6,500 feet in elevation contribute up to 7.5% of its total precipitation to ground water recharge, the recharge occurs on the alluvial fans near the bottom of the slopes, and not at higher elevations. The water destined for recharge reaches the lower slopes via runoff.

### 5.1 Topography

Storey County is mostly comprised of mountainous terrain, but some flat land does exist in the Mark Twain area and on the south bank of the Truckee River District. Although Virginia City itself was built on steep slopes, the fragility of the land makes it undesirable to follow this precedent. Only slopes of less than 10% should be developed.

#### Slope Analysis

A slope analysis has been made and a map prepared to determine topography and terrain suitable for various types of industrial development (such as manufacturing and warehousing). This information is charted on the Slope Analysis Map recorded #74667, Book 102, Page 37, which is available for reference at the Storey County Recorder's Office (see Appendix D).

Terrain with 0-5%, and 5-15% were initially considered as most probable development sites. The feasibility of these sites was further analyzed by water availability, accessibility and location within the county. Based on these factors, the following sites show potential for industrial development: Lockwood, Tracy, Painted Rock, the southern edge of Six Mile Canyon Road and the Flowery Range districts. Land use zoning decisions will be made compatible with slopes and drainage areas.

## 5.2 Climate

Virginia City and the nearby Virginia Highlands are located at an elevation of over 6,000 feet. This is considerably higher than the rest of the county's populated areas. Because of their elevation this area does not experience the extreme changes of temperature common to the rest of the county. Generally, Virginia City and the Virginia Highlands do not experience the stagnating air which normally occurs, particularly during winter, in many valley floors of Nevada. The Mark Twain and River Districts are more representative of the temperatures experienced in the Reno and Carson City areas.

The county's high mountainous location is also conducive to higher precipitation amounts which average slightly over 12 inches a year. Much of this precipitation comes in as snow during the winter. Total snow fall averages 56 inches a year but as much as three feet has fallen in one month.

Summer daytime average temperatures are in the 70's and low 80's. The nighttime temperatures drop down to the mid-50's. During the winter, daytime high temperatures average 40 to 50 degrees and nighttime temperatures range from 25 to 30 degrees F. The highest temperature recorded at Virginia City was 100 degrees in August of 1970; the lowest was -3 degrees in February 1956.

In spite of the high elevation, the growing season is relatively long, averaging 107 days. Relative humidity is slightly higher than the regional average. Humidity averages 40-50% over the year, but varies from about 70% during the winter to approximately 30% during mid-summer. Thunderstorms average about 10 to 15 a year and are usually accompanied by lightening.

Wind information is relatively sparse. The higher exposed location of Virginia City leads to higher wind velocities. The constraining influence of the Virginia Range also has an effect on the prevailing winds, which generally are from north to south. However, upslope and downslope valley winds are dominate throughout the day. Occasionally wind speed have been known to reach 100 miles per hour.

## 5.3 Geology

The geology of the county has greatly dictated its development. Among the most notable geological contributions have been a wealth of minerals and a fragmented ground water resource. The mineral deposits shaped the county's early development, while poor quality ground water throughout the county south of the Truckee River has restricted development activities.

Much of the county is underlain by relatively stable volcanic bedrock, blanketed by a very shallow surface cover. However, deposits of unstable conglomerates, sandstones, shales and diatomaceous sediments also exist. Gravel and sand deposits also occur and while relatively stable, are unsuitable for septic tank usage. The county is also affected by seismic activity and development in these areas should be restricted.

The outstanding geological feature in Storey County is the world renowned Comstock Lode. This rich vein crops out to the surface along the eastern face of Mount Davidson about 1,200 feet below the summit. For approximately five miles to the north and south to Virginia City the vein runs along the east side of other smaller mountains in the Virginia Range. Below Gold Hill the vein splits, one branch heading southwesterly into American Flat and the other branch heading in a more southerly direction to Spring Valley south of Silver City.

The face of Mount Davidson slopes to the east at an angle of about 25 degrees. The vein dips in the same direction at an average inclination of 45 degrees. At depths over 2,000 feet portions of the vein tend to become more perpendicular to the surface. The vein has been tapped at several different angles and three lines of shafts were sunk to encounter it at different depths.

For further geological information refer to the Soil Survey of Storey County Area, Nevada. Issued May, 1990.

## 5.4 Seismology

Storey County is located in seismic zone 4. Seismic zones are rated 1 through 4, with seismic zone 1 having the minimum number of seismic events and zone 4 being the most active. This becomes a major consideration for land use planning and particular construction requirements are necessary.

## 5.5 Soils

A comprehensive soil survey for Storey County has been generated by the Soil Conservation Services (SCS) and is used to describe soil characteristics which affect the county's potential.

Of critical concern to the county is its inability to capture and hold what little precipitation it receives. All but a small portion of the county has been classified by the SCS as exhibiting poor infiltration capability. Soil interpretations for both profile permeabilities and soil hydrologic grouping lead to this conclusion. Only a narrow strip of land bordering the Truckee River, and a few isolated sites in the southwestern interior of the county, diverge from the norm. However, these sites exhibit only moderate infiltration capability. Because of this condition, most of the county's runoff occurs as surface flow. Only a small portion occurs as ground water yield.

The soil surveys show that the county is well drained, there are no soils exhibiting drainage problems. Runoff leaves the county immediately. However, while drainage is no problem, the runoff does take its toll in terms of erosion. All but a fraction of the county's soils exhibit a moderate erosion hazard. The remainder is categorized as severe. Any disturbance to natural conditions will greatly increase the hazard.

Wind erosion is also a factor to consider. Again, most of the county exhibits a moderate hazard. The remaining portions are about equally divided between severe and slight. Likewise, any disturbance to natural conditions, such as blading to create roads, will greatly increase wind erosion problems.

According to the SCS land capability classification, only land along the Truckee River has irrigation capability. Even so, that land consists of Class II soils, having climatic restrictions. In terms of dry land capability, the best soil in the county is classified as Class VI. Again, this is the Truckee River strip. As a whole, the county falls into Class VII soils having such severe limitations as to make them unsuited to cultivation and which restrict their use largely to open space uses as wildlife habitat and watershed preserves. In summary, the capability classification indicates that Storey County soils are unsuited for most developmental purposes.

Further, should structures be built upon the county's soils, consideration must be made for both shrink-swell and the frost-heave potential. Over 60% of the county is classified as having very high shrink-swell characteristics. Only a small portion of the county is classified as low. To add to construction problems, over 90% of the county is classified as having moderate frost action. Thus, construction of stable foundations for any structure necessitates special design techniques or structural failure may result.

The soil survey for the upper Lousetown Creek area indicates severe limitations for septic tank activity, along with severe limitations for roads and streets as well as for dwellings. Being more detailed, this data should be referred to when considering developmental potential of the area. Both Lousetown and Long Valley Creeks are critical watersheds for surrounding areas.

## 5.6 Flora

Vegetation within the county is mainly restricted to three communities: the Pinion-Juniper, the Big Sagebrush-Grass, and the Low Sagebrush-Grass. The Pinion-Juniper, located in the upper elevations of Storey County, is accompanied with an understory of big sagebrush and antelope bitterbrush. Frequently lying above the Pinion-Juniper is the Low Sagebrush-Grass community. Associated with low sage are grasses and forbs such as needlegrass and balsamroot. Below the Pinion-Juniper lie the Big Sagebrush-Grass community. Big sagebrush is accompanied by a host of grasses, forbs and shrubs.

These vegetal communities are typical of the region, and exist in a very harsh climate. Recovery from disturbance is slow. Disturbance to vegetation leads to a host of environmental problems such as dislocation of native fauna (permanent or seasonal), increased erosional hazards and a deterioration of the local watershed.

Both Lousetown and Long Valley Creeks are critical watersheds for surrounding areas and provide valuable riparian growth in areas of natural springs which flow year long in many places. These areas should be protected from erosion by encouraging and cooperating with property owners and interested groups to control grazing and public use.

One of the key elements of maintaining a healthy environment in an area as fragile as Storey County is to insure protection of the natural vegetation. In reseeding disturbed land areas, reclamation plans are most successful when vegetation native to the area are planted.

### **5.7 Fauna**

Within the interior of Storey County exist the usual array of wildlife found in Western Nevada. Beaver, muskrat and weasel abound along the Truckee River. The river itself is important to the region's fishery. Upon completion of both the Marble Bluff Dam and Fishway at the terminus of the Truckee River and a fish by-pass around Derby Dam, the Truckee will once again provide spawning grounds for the Pyramid Lake fishery, in addition to its present fishery capacity.

Further inland, game birds such as the mountain and California valley quail, dove, and chukker partridge are abundant around the county's many springs and seeps. Sage grouse, though small in number, can also be found. Cottontail rabbits dwell close to these natural water supplies.

In terms of larger animals, the County hosts one of Nevada's larger herds of wild horses. A conservative estimate of the herd size is 300 animals throughout the County. The wild horse is the primary and preferred grazing animal in some areas, notably the Highlands area. These herds keep the fine fuel (dry grasses) from adding to the high fire danger. Consequently their presence is needed. The Virginia Range Wildlife Protection Association has formally adopted the wild horse herds in the Virginia Range to protect them from exploitation. However, the competition for available forage and water is high, and the herd will exceed the natural carrying capacity of the range unless their population is controlled. The Wildlife Protection Association works to maintain a reasonable population size and monitors the herds throughout the year.

Storey County provides a habitat for both a resident population of deer as well as a wintering ground for a portion of those deer that summer around and about the Tahoe Basin. The Flowery Range-Upper Long Valley Creek area is a key deer wintering site, as is the western face of the Virginia Mountains in Washoe County. Regular seasonal migration routes include the Five Mile Flat area as well as the canyons between Gold Hill and Silver City.

Associated with the game are the usual assortment of non- game species, ranging from chipmunks to eagles to coyotes. All the County's fauna survive within a delicate framework of available water and food. Thus the fauna are intimately associated with the county's fragile environment and are therefore equally fragile.

To protect the county's wildlife, this Master Plan agrees with the State Fish and Game Commission's recommendation to establish a wildlife management area to cover the county.

## **5.8 Water**

Storey County lies in the rain shadow created by the Sierra Nevada Mountains. Additionally, most of the county lies in a rain shadow created by a portion of the Virginia Range.

Average annual precipitation at Virginia City is 9.94 inches per year. Higher elevations of the county receive 12 to 15 inches of precipitation annually. Lower elevations receive about five inches of precipitation annually.

The county has negligible areas of snow accumulation. Lake areas are limited to a sum of ten surface acres, a figure which includes water supply reservoirs. The length of rivers and streams is limited to fourteen surface miles, including the Truckee River, which borders the county on the north.

Evaporation is high, greater than 50 inches per year. Recharge is limited to approximately 5% of total precipitation because of the high evaporation rate, depletions such as irrigation, surface water evaporation, and phreatophyte consumption. (Phreatophyte refers to plants with a deep root system that obtain water from the water table).

Annual recharge, which results from such factors as precipitation, evaporation, and other depletions, is extremely limited.

### **Implications for Future Development**

It is apparent that with the exceptions of the alluvial fans which form a perimeter around the Virginia Range, there has been little success in developing any dependable potable ground water supply within that range of mountains. As water is essential to any land uses, it follows that before a development is allowed within the Virginia Range, availability of water should be the primary consideration.

The responsibility of such considerations falls upon Storey County, whose boundaries closely follow the Virginia Range topography.

The three parameters which make scarce a potable ground water supply are low precipitation, low recharge and a soil mantle high in sulfates, iron, and numerous other chemical elements which become dissolved in what little ground water that does exist, making it unfit for consumption.

Viewing past patterns of ground water development, there have been no recorded successful wells (ones drawing potable water on a long sustained basis) in the interior of the county, at least as far as official state records are concerned. There is an artesian well located at Cottonwood Springs in the Virginia Ranches (40 acres), that is important to area wildlife. This well has been there for twenty years. Producing wells of adequate quality have been developed along the flood plain of the Truckee River and also within the Mark Twain area which lies within a declared critical ground water basin.

The patterns of success and failure of ground water development in Storey County imply that development should be treated very carefully. A cautious approach would actually benefit the County, because it would help ensure the success of new developments thereby avoiding possible county burdens in the future. Such a cautious approach would also protect the general public from what might prove to be unwise investments.

With the exception of the Truckee River flood plain, most of the county can be developed only at exceedingly low densities. The Mark Twain area should be included in the concept of low density uses, as the State Engineer has declared the area to be short of ground water.

Actual densities should be based on consideration of ground water recharge. The density of development should be based on that amount of land necessary to provide recharge equal to the needs of the proposed use.

Criteria for density zoning then becomes a situation of defining recharge rates for areas in question. At this time detailed hydrologic information has not been produced for Storey County, even on a reconnaissance level. However, the planning efforts of the USDA Nevada River Basin Planning Staff along with technical opinions by the United States Geologic Survey provide guideline data dealing with the County as a whole and with hydrologic variations within the County. As for that part of the County served by the Virginia Water Company, land uses that depend upon the company for water should be designed around the ultimate transmission capacity of the State-owned delivery system.

Presently, the most important source of domestic water for the Virginia City/Gold Hill area is the State Marlette-Hobart System. Limitations in the Marlette System and in good quality ground water pose serious constraints on the capability of the county to absorb new development.

## Ground Water Availability

In order to determine the availability of ground water in Storey County, well log records on file at the State Engineer's office have been inspected. Nevada Revised Statutes require well drillers file a log for each well drilled. This requirement dates back to the early 1940's. It should be pointed out that there had been no practical method to enforce this regulation in the past, and wells have been drilled that were never recorded. However, the State Engineer's office feels that since about 1955, 75% of all wells drilled in the State have been recorded.

The files in that office revealed that only 23 well logs have ever been filed in the county. Those that were filed were mostly in the alluvial areas to the extreme north or south of the interior, and in the Virginia Highlands area on the western edge.

It can thus be accepted that there is a lack of adequate ground water in the central portion of the County. 'Adequate', as used here, relates to both the quantity and the quality of the resource. The aspect of quality will be considered in a later section.

## The Marlette System

Presently, the only source of domestic water for the Virginia City - Gold Hill area comes from the State owned Marlette-Hobart system. The Virginia City - Gold Hill water system has a contract with the Marlette-Hobart State system. The contract, which is presently being renegotiated, limits the daily maximum amount of water to be provided to 750,000 gallons per day.

Transmission capacity of the 20 mile delivery system is relatively uncertain. Estimates from personnel in State Buildings and Grounds who operate the system range from 400 gpm (576,000 gpd) to 800 gpm (1,152,000 gpd). An opinion has been expressed by an engineer intimately associated with the pipeline that pressures at Lakeview (the low point of the inverted siphon) should not exceed 800 psi. In order to deliver 200 gpm (288,000 gpd), the gauge at Lakeview is held at 750 psi; hence it would follow that capacity of the system should not exceed 300,000 gpd for any length of time if the engineers advice is to be heeded. It is interesting to note that a century ago, 800 psi at Lakeview would theoretically deliver 700 gpm to Storey County. However, many conditions along the pipeline restrict flow and cut this theoretical capacity by over two-thirds.

Total annual rechargeable storage belonging to the state is 3,575 acre-feet. All but 100 acre-feet lies in Marlette Reservoir, and to be utilized, water must be pumped from Marlette over the ridge line to the Hobart system. At any rate, as total demands on the State-owned system (including Carson City, Lakeview, State Buildings, and Virginia City) have not exceeded 920 acre-feet, there is ample water should it be decided to draw on Marlette's total annual rechargeable supply.

In summary, the limiting resource in the system is the transmission capability, rather than the peaking or total annual water availability at the source.

### Water Quality

Analysis of ground water as a source for domestic water requires evaluation of both quality and quantity. Previously, "soft" facts implying a lack of adequate quantity were presented. Table 5.1 summarizes fairly recent findings relative to water quality as determined by analysis of twenty Storey County wells and three mine shafts. Only those twelve sites not meeting acceptable water drinking standards were individually listed in the report. Two sites in the Mustang area, one at the Orchard Exit, two at Painted Rock and three in the Mark Twain area met or exceeded water drinking standards.

The chemical parameters of sulfate and iron indicate the quantity of each compound existing within the sample. The parameter of total dissolved solids indicates the amount of dissolved inorganic and organic material within the sample and is often used as an indication of salinity.

In summary, 60% of the twenty samples submitted for quality analysis of Storey County well water were found to be below standards for domestic consumption. This figure has been determined to be three times that of the five county western Nevada regional average. The implication is that water is not only scarce in Storey County but the quality of available ground water quality is also poor.

The interior of Storey County does not produce high quality water and neither do the Truckee River benchlands. Generally, groundwater of acceptable drinking quality may only be found directly adjacent to the Truckee River as well as in the Mark Twain area.

### Summary

There are few technically reliable detailed data which can be used to determine the precipitation patterns throughout most of Storey County. Similar lack of data is found for recharge patterns. As a result, the determination of future land use densities based on water availability must rely to a great degree on (river) basin-wide inventories. Planning must be based on data which represent County conditions as a whole, an approach which may not be accurate for any specific location.

It is assumed that land should not be developed at densities which will lead to the mining of water. Population densities should not be allowed to exceed the point where more water is taken out of the ground than is naturally recharged.

Precipitation at the Virginia City rain gauge is 10 inches per year. This gauge is the only one in the county which has provided data over a sufficient length of time for analysis. Although located below Mt. Davidson in the rain shadow of the western boundary of the Virginia Range, it is observed that most of Storey County lies in the same rain shadow. The gauge is located

rather high in the watershed, and should receive more precipitation than sites of lower elevations. Based on these facts it is reasonable to use the 10 inches per year as an average precipitation figure for the county until more accurate precipitation data become available. However, it should be kept in mind that precipitation may approach 15 inches at high altitudes and as little as five inches at lower and more easterly elevations.

It is obvious that sufficient water of potable quality should be produced for residential developments. The generally accepted standard is one acre-foot available for each single family dwelling. This is a reasonable standard, as it encompasses not only the actual water use of the residents but also the numerous demands created by subdivision development (fire fighting, recreational use, water loss, etc.).

It is recommended that a ground water monitoring system be installed in sensitive areas where well water is the primary source.

# WELL WATER QUALITY ANALYSIS

## Storey County

### Table 5.1

	Sulfates	TDS (1) (Measured in parts per million)	Iron	Other
<b>Lockwood Area</b>				
Well #1	733	1,039	-	
Well #2	760	1,085	-	
Well #3	653	1,334	2.40	
Well #4	530	892	0.69	
Well #5	350	1,193	1.36	
<b>Mustang Area</b>				
Well #6	1,200	748	12.50	Very low Ph. High color value turbidity and sediment.
Well #7	-	-	2.43	
<b>Derby Dam Area</b>				
Well #10	1,200	5,452	3+	Very high in chlorides, nitrates, sodium and potassium.
<b>Highlands Area</b>				
Well #14	630-650	1,100	4.00	
Well #15	630-650	1,100	4.00	
Well #16	630-650	1,100	4.00	
<b>Mark Twain Area</b>				
Well #17	470	-	-	Very hard
<b>Various Mine Shafts</b>				
#21	860	1,667	1.04	High in calcium High in calcium
#22	1,090	1,912	0.18	
#23	715	1,014	-	
(1) TDS: Total Dissolved Solids.				