Chapter 2

Background on Water Resources

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Purpose and Scope

This chapter provides background information on the water resources specific to individual hydrographic basins and the Region as a whole. It discusses current conditions, knowledge, management practices, shortcomings and major municipal water supply issues.

Summary of Findings

The major findings of this chapter include:

- **The Truckee River is susceptible to non-point source pollution, including naturally occurring and human-caused microbiological contamination, such as coliform bacteria, giardia and cryptosporidium.** Additionally, rapid fluctuations in river turbidity from spring runoff and summer thunderstorms pose treatment challenges.

- **Meeting Truckee River water quality standards and enhancing regulations leading to the reduction of non-point source pollution is important to supporting continued use and potential expansion of treated effluent discharge to the Truckee River.**

- **A contamination event could render the Truckee River untreatable for an extended period of time.** Such events could be natural, such as debris and sediment flows from the Gray Creek watershed, or human-caused, such as highway- or railroad-related chemical spills. The current water system cannot meet the existing Regional Water Planning Commission (RWPC) emergency water supply standard (Policy 1.2.c).

- **Current Truckee River operating practices pertain primarily to hydroelectric power generation and agricultural irrigation.** It is anticipated that Truckee River Operating agreement (TROA) implementation will provide operational flexibility to meet changing demand conditions on the Truckee River.

- **During drought conditions, the Truckee River experiences low flows between Glendale and Steamboat Creek and during extreme drought periods, flow is sometimes reduced to zero.**

- **Two significant contributors of non-point source pollution to the Truckee River are Steamboat Creek and the North Truckee Drain.** Pollutants in Steamboat Creek include nitrogen, phosphorus, mercury and sediment loads.

- **The proposed construction of surface water treatment plants in the South Truckee Meadows is an integral part of developing future water supplies.** Future demands can be met most effectively by optimizing the use of various local water resources, including surface water and groundwater. Plans for conjunctive use of these resources rely on the availability of treated surface water to offset groundwater production. Additionally, surface water treatment plants will be capable of treating poor-quality groundwater to meet drinking water standards.

- **Areas of good quality groundwater that can be easily or economically captured are fairly well defined, and mostly developed and delineated by existing municipal well fields.**

- **The new federal arsenic standard for drinking water will affect 11 TMWA wells, 9 WCDWR wells and 2 STMGID wells. Purveyors will incur considerable treatment costs to comply with the new standard.**

- **Future groundwater development will need to optimize production in order to meet projected demands.** This will very likely involve limited production of poor-quality groundwater that will require treatment for constituents such as PCE, arsenic, iron, manganese, and possibly others.

- **Water quality in a portion of the aquifer underlying the central Truckee Meadows is affected by the presence of perchloroethylene (PCE).** Central Truckee Meadows Remediation District (CTMRD) studies indicate that PCE contamination covers more than 16-square miles to a depth greater than 350 feet. Eleven production wells are currently affected. District funding has paid for three treatment facilities that remove PCE from five TMWA wells. The District has developed a Remediation Plan, which was approved by the Board of County Commissioners (Board) and NDEP in 2002.

- **Estimates of groundwater perennial yield generally do not consider whether the water is potable or the ease of its capturability; therefore, most major groundwater basins are over-appropriated with respect to the estimated groundwater resource.** Annual pumping limitations and water rights dedication discount factors are being implemented in some basins to correct these imbalances.

- **Significant groundwater level declines have occurred in Golden Valley, East Lemmon Valley, and the South Truckee Meadows.** Because of projected water demands and consequent planned increases in groundwater pumping, the effect of declining groundwater levels on domestic wells has become an important regional issue.

- **County Assessor's files indicate that there are 8,349 domestic wells in the region as of August 2002. Some of these existing wells have failed because of declining water table elevations.** Although it is unknown how many domestic wells have gone dry for this reason, State Division of Water Resources records indicate that from 1984 through 2001, 762 domestic wells have been deepened or re-drilled.

- **Groundwater recharge is expected to diminish regionally over time due to development in natural recharge areas and the loss of secondary recharge sources such as agricultural irrigation and ditch leakage.** Opportunities exist locally; however, to enhance recharge and help mitigate this regional trend.

- **The groundwater resource in Spanish Springs is over-appropriated with respect to water rights.** It is estimated that two thirds of the groundwater supply is recharged from Orr Ditch leakage and irrigation practices, which are expected to diminish as irrigated lands are urbanized. Consequently, eventual groundwater depletion is predicted to occur unless additional resources are developed. Truckee River water or other imported sources will be needed to support the groundwater system over the long-term.

- **Portions of several hydrographic basins have groundwater quality degradation due to septic system effluent.** Elevated nitrate concentrations in groundwater have been detected, most notably, in Spanish Springs Valley, and also in portions of Washoe Valley, East Lemmon Valley, Cold Springs Valley and the South Truckee Meadows. Problems occur where the amount of septic system effluent discharged to the groundwater exceeds the aquifer's capacity to assimilate the discharge. Water resources are most significantly affected where groundwater is used for municipal or domestic supply and the nitrate concentration exceeds or approaches the drinking water standard.

- **There is evidence that septic system effluent in the groundwater near Verdi is migrating to the Truckee River.**

Introduction

General Discussion on Water Resources

Creeks and Rivers: The Truckee River is the primary source of water supply for the Truckee Meadows. Originating at the outlet from Lake Tahoe, the Truckee is fed from Donner and Independence Lakes in addition to Prosser, Boca and Stampede Reservoirs, all located in California. The Truckee River generally flows northerly through California and into Nevada at Verdi. It then flows easterly through the Truckee Meadows to Wadsworth and then northerly to Pyramid Lake. Most of the water that flows to the Truckee River within Nevada is generated from the east slope of the Carson Range. Within the Truckee Meadows, Hunter Creek, Steamboat Creek and the North Truckee Drain largely feed the river. Other lesser tributaries are derived from the north slope of the Carson Range, the Verdi Range and Peavine Mountain (see Figure 2-1).

Water for various uses is diverted from the Truckee River into a number of ditches. Water diverted for irrigation is conveyed several miles north to Spanish Springs Valley via the Orr Ditch, and to the south via Steamboat, Last Chance and Lake Ditches. Other irrigation ditches serve localized areas of the central Truckee Meadows. In general, historical and current ditch uses are the same: irrigation and hydropower generation. As the region has developed, however, some of the ditches, or their rights of way, have been used for storm water conveyance and as regional trails. Of the original fifteen ditches in the Truckee Meadows, ten remain in active use.

The North Truckee Drain was constructed to drain wetlands and to collect unused Orr Ditch water and irrigation tail water in Spanish Springs Valley. This drain carries flows south from Spanish Springs through Sparks and discharges to the Truckee River near Vista at the eastern edge of the Truckee Meadows. This confluence is approximately one mile west of the Steamboat Creek - Truckee River confluence.

Steamboat Creek is one of the most significant tributaries to the Truckee River. It originates at Washoe Lake, fifteen miles south of the Truckee River and flows northerly through Pleasant Valley, Steamboat Valley, and the south and central Truckee Meadows running north along the base of the Virginia Range, which constitutes the southeast boundary of the Truckee Meadows. Along its course it is fed from six perennial streams: Browns, Galena, Whites, Thomas, Dry and

Evans, that drain the east slope of the Carson Range, and one ephemeral stream (Bailey Creek) from the Virginia Range. Historically, Steamboat Creek was used for irrigation in the South Truckee Meadows in conjunction with Truckee River irrigation diversions (Steamboat, Last Chance and Lake Ditches). Runoff from irrigated fields also contributed flows to Steamboat Creek and ultimately the Truckee River. The reduction of irrigation to some lands in the southwest Truckee Meadows over the years has reduced secondary recharge to the groundwater aquifers in this area.

Regional Groundwater: The major hydrographic basins within the Region include Warm Springs Valley, Cold Springs Valley, West Lemmon Valley, East Lemmon Valley (including Golden Valley), Sun Valley, Spanish Springs Valley, Truckee Meadows, Truckee Canyon (Verdi/Mogul), Pleasant Valley, and Washoe Valley. These hydrographic basins were formed by the still active tectonic forces of the Sierra Nevada Batholith and Basin and Range extensional faulting. With the exception of the central Truckee Meadows, groundwater is the primary source of water supply in these basins. The central Truckee Meadows relies primarily upon Truckee River water augmented with groundwater. Although Spanish Springs Valley, Sun Valley and Lemmon Valley rely largely on groundwater, they are also supplied with Truckee River water via TMWA's distribution system.

Regional Wetlands: Wetlands generally occur on the valley floors of the Truckee Meadows. Today, many Truckee Meadows wetland areas have been altered or dewatered for development that has occurred over the last 120 years. Remaining wetlands are found in Spanish Springs Valley along the North Truckee Drain, the South Truckee Meadows east of U.S. 395, and along Steamboat Creek generally from the confluence with Whites Creek to the confluence with the Truckee River (Figure 2-2). Wetlands are also found within playas in Lemmon and Cold Springs Valleys.

2.1 Water Quantity

Municipal water supplies are primarily derived from two sources, the Truckee River and groundwater aquifers. Hunter Creek is also used for municipal supply, but is allowed to flow to the Truckee River and withdrawn downstream of this confluence. TMWA diverted nearly 70,000 af for municipal supply in 2003. TMWA treats Truckee River water at two plants, Chalk Bluff and Glendale. This municipal water is delivered throughout the Truckee Meadows and within the Stead area of Lemmon Valley and portions of Spanish Springs Valley. The other source of domestic and municipal supply comes from groundwater pumped from the various hydrographic basins within the region. Groundwater is generally distributed within the basin from which it is pumped. Groundwater pumpage by TMWA, Washoe County, and several private water companies amounted to approximately 30,000 af during 2003. In addition, approximately 9,300 af was pumped by domestic wells.

2.1.1 Groundwater Quantity

For basins outside the central Truckee Meadows, groundwater is the primary water resource. Table 2-1 on the following page, lists the estimated groundwater resources, water right appropriations and pumping activity of each hydrographic basin. Resource estimates are based upon the most recent studies and surveys, the details of which are presented in Appendix B. Figure 2-3 shows the relative location of each hydrographic basin. The appropriations listed are taken from State Engineer Basin Abstracts (which include supplemental water rights) or from hydrogeologic studies. Table 2-1 shows groundwater resources as estimates of the perennial yield. Perennial yield[1] estimates do not consider whether the water is potable or the ease of its capturability, which refers to aquifer accessibility and well construction, along with cost.

Table 2-1 also compares estimated perennial yield with current pumpage, which includes domestic, industrial, and irrigation uses. Review of this table shows that not only are most major basins over-appropriated with respect to the estimated groundwater resource, but groundwater pumping in most of the major basins is approximately equal to, or exceeds the estimated perennial yield. For example, Golden Valley's groundwater resources, including an estimated component of recharge from septic system effluent, have been estimated at 175 af/yr. The current pumpage is estimated at 590 af/yr, exceeding the available groundwater resource for this basin by 415 af/yr. An artificial recharge program was implemented in 2002 to address this imbalance.

Only Pleasant Valley is projected to under-pump the perennial yield; however, it is estimated that a substantial amount of groundwater leaves this basin and flows into the South Truckee Meadows (Katzer, 1984). Those basins that are being, or could be, considerably over-pumped are East Lemmon and Golden Valleys, Spanish Springs, Warm Springs, and Cold Springs. It should be recognized that particular areas within a basin might be experiencing over-pumping while the basin, as a whole is not. Secondary recharge from irrigation and septic systems is not included in Table 2-1 resource estimates, except where noted.

2.1.2 Surface Water Quantity

Table 2-2 lists the estimated surface water resources in terms of average annual flow. Most of these estimates are questionable in that individual creeks either have no measurement record or the period of record is short (identified with an asterisk). Average annual flow estimates expressed in af/yr give the appearance that the creeks have more yield than appropriations; however, most of the runoff occurs during the non-irrigation season and historically has not been usable because of the lack of upstream storage.

The Truckee River, in contrast, has a long hydrologic record at several measuring locations. The flow of the Truckee River is highly variable, as illustrated in Figure 2-4, which shows the high and low years of record. The critical aspect of the river's resource value is not the average or extreme flows, but rather the flows that have been experienced during an extended drought.

Drought

Drought is determined by several factors: the amount of precipitation that occurs during the year, the amount of water stored upstream, and the level of demand required to be met with available supplies. Two or three dry years in a row do not necessarily constitute a drought in terms of water supply unless storage is too limited to provide adequate water supply. Droughts affect both surface and groundwater supplies.

1 Perennial yield is an estimated amount of water a basin can produce on an annual basis that may be calculated using several methods and is a function of historic pumping, estimates of recharge, phreatophytic consumption, or evapotranspiration, etc. Many of the basin yields shown do not have a long history of such data and analyses and therefore the yield may be speculative at best.

Table 2-1
Estimated Groundwater Resources, Water Rights and Estimated Pumpage

Major Basins	Estimated Perennial Yield (af/yr)	Permits/ Certificates (af/yr)	Estimated 2001 Pumpage (af/yr)
Truckee Meadows	27,000	41,500	26,735
Spanish Springs	800	6,404	2,222
Pleasant Valley	4,700	6,602	1,249
North Valleys			
Golden Valley	175*	0	590
East Lemmon Valley	490*	1,569	2,250
West Lemmon Valley	1,100	1,986	1,478
Cold Springs	500	1,130	650
Long Valley	no data	2,336	257
Warm Springs	3,000	6,785	4,900
Washoe Valley	9,300	10,474	4,900
Truckee Canyon			
Verdi/Mogul	2,000	3,137	850
Tracy Segment (Wadsworth)	5,000	5,000	Unknown
Sun Valley	25	14	Minor
Antelope Valley	150	15	Unknown
Bedell Flat	300	105	Unknown

Notes: * Includes an estimated septic tank effluent component.
Annotated table showing notes and references is located in Appendix B

Source: RWPC

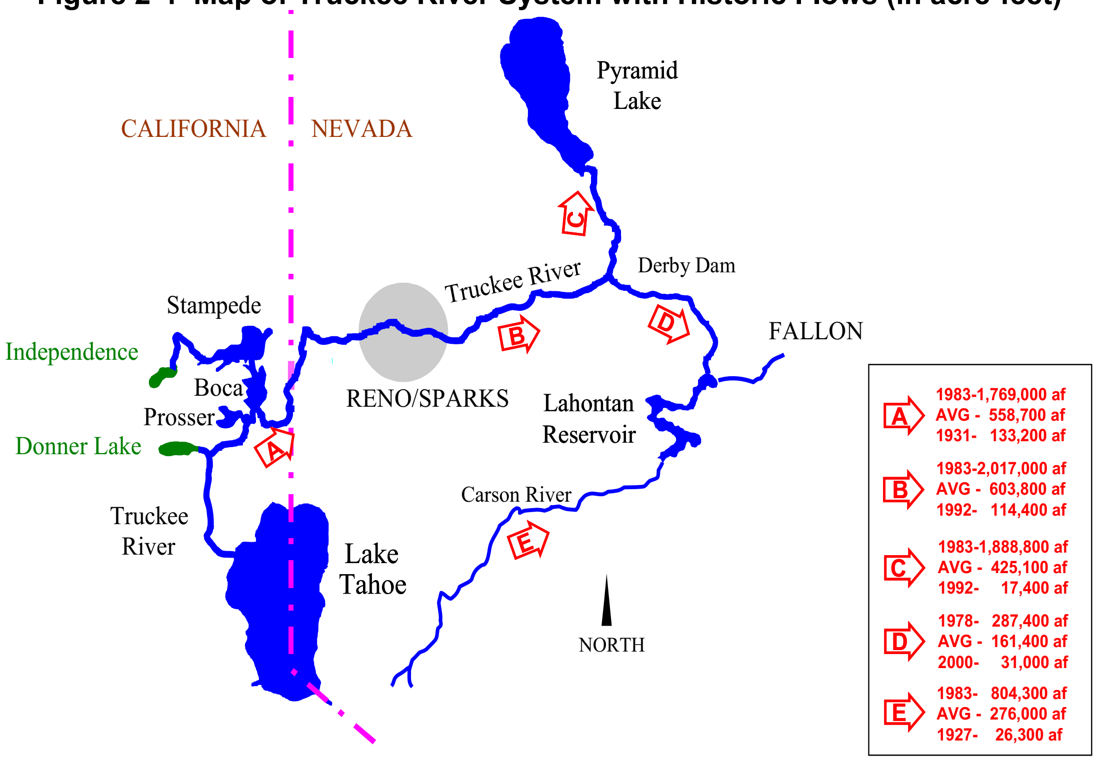
Table 2-2
Surface Water Resources

Major Basins	Average Annual Flow (af/yr)	Permits/ Certificates or Decreed Rights (af/yr)
Truckee River	561,800	182,164**
Dog Creek	4,000	1,816
Hunter Creek	6,520	9,965
Evans Creek	1,640*	1,358
Thomas Creek	3,185*	2,573
Whites Creek	5,140*	4,142
Galena Creek	9,265*	2,882
Galena and/or Steamboat Creek	-	15,199
Steamboat Creek	15,550	-
Other		
Thomas/Steamboat (claims 709-712)	-	3,668
Thomas/Whites (claims 730-731)	-	2,456
Washoe Valley Creeks	31,000*	36,436

Notes: * Short period of record.
** Does not include TCID diversions, Tribal rights, or other rights outside the study area.
Annotated table in Appendix B

Source: RWPC

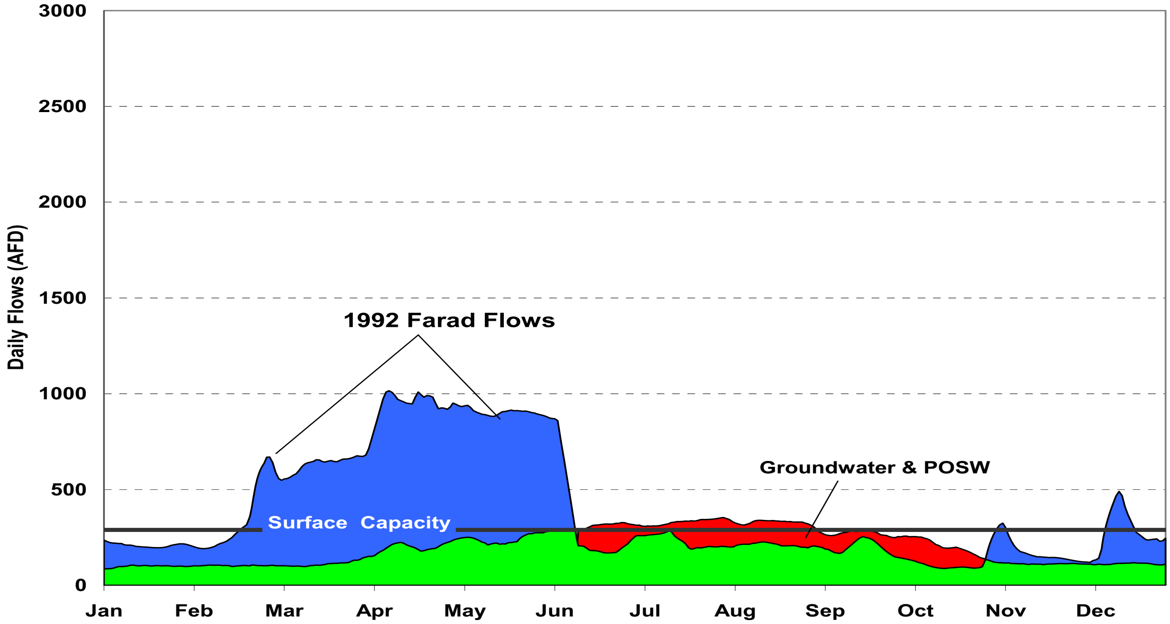
Figure 2-4 Map of Truckee River System with Historic Flows (in acre-feet)



Source: TMWA

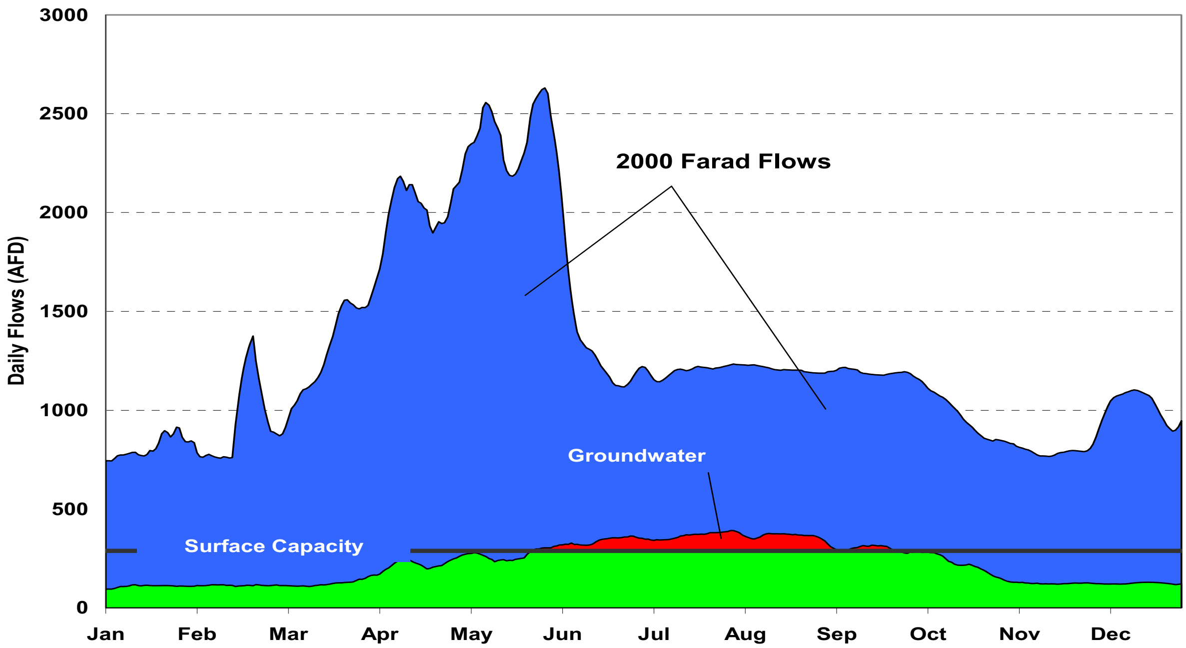
The following graphs illustrate water consumption by TMWA services during a typical drought and non-drought year. Figure 2-5 shows water supplies used to satisfy M&I demand during 1992, a drought year, and Figure 2-6 shows water supplies used to satisfy M&I demand during 2000, a non-drought year.

Figure 2-5
Drought Year Water Supplies to Meet Demand in 1992



Note: POSW refers to Privately Owned Stored Water, which is river water owned by or credited to TMWA. Farad Flows refers to Truckee river flow measured at the Farad gage. Source: TMWA

Figure 2-6
Non-Drought Year Water Supplies to Meet Demand in 2000



Note: Farad Flows refers to Truckee river flow measured at the Farad gage. Source: TMWA

Impact to Surface Water Supplies

Water stored in upstream reservoirs is used to maintain Floriston rates and carry over water supplies from plentiful water producing years for use in years when precipitation is low. Floriston Rates (the court-ordered flow rates of the Truckee River at the California-Nevada border) dictate minimum stream flow at which traditional users (irrigators, power producers, and M&I purveyors) meet their water requirements. If adequate storage is not available to augment low-flows, downstream users must curtail their water use. The summer low-flow period, which coincides with the peak-use period, requires water stored in Boca Reservoir and Lake Tahoe to be released into the Truckee River in order to maintain Floriston Rates. TMWA has privately owned water reserves held in Donner and Independence Lakes, and not accountable to Floriston Rates, for use during drought periods.

The most critical period for water supply in the region is summer and early autumn. As shown in Figure 2-5, if a drought exists, it is during these months that the Truckee River will have low flows, and water supplies will have to be augmented with groundwater and privately owned stored water. In a severe drought, low flows may occur during the early summer.

The threat of drought affecting the regional surface water supply is always present and no scientific research can provide a 100% reliable estimate of when one will occur or its duration. However, the longest drought period on record is eight years from 1987 to 1994. In determining the level of threat from a drought, the Region has to consider how likely it is that a drought of eight years or longer duration is to occur, and what is a reasonable length of time for which to plan. Such consideration must include the costs imposed on water customers to maintain an acceptable level of water supply to endure a drought.

An “acceptable level of water supply for the community” may be interpreted in several ways. For example, some members of the community may feel that adequate water for only health and safety purposes is required during summer months whereas others may feel it is unacceptable for landscaped areas to suffer or die. TMWA’s 2005-2025 Resource Plan leans on the conservative side in its modeling efforts and concludes that its customers will have water available for all uses, provided there is increased conservation during the critical year, to withstand a nine-year drought.

TMWA is the only water purveyor currently diverting surface water for M&I use. As part of its 2005-2025 Water Resource Plan, TMWA used historical Truckee River data to examine the likelihood of occurrence of droughts of various lengths and made the following findings:

- A good criterion to distinguish a drought year is monthly average flows at Farad being greater or less than required Floriston Rates.
- Drought-year cycles are relatively rare events, similar to flood events.
- Appropriate drought design criteria should reflect conditions that impact the ability of TMWA to divert surface water and require TMWA to use its upstream reserves. This happens only during the irrigation months and only during consecutive dry months.
- Occurrences of consecutive summer month flows less than 250 cfs are rare. When flows drop below 250 cfs, intakes at the Chalk Bluff and Glendale treatment facilities are reduced and increased groundwater pumping is necessary.
- A TMWA / UNR modeling effort to analyze drought frequencies estimated that the likelihood of a 8-, 9-, or 10-year event occurring is extremely rare with frequencies ranging from 1 in 230 years, 1 in 375 years and 1 in 650 years, respectively.

- A ten-year drought design imposes an unrealistic burden on the region's resources. Planning for the nine-year drought event with today's resources is more than adequate to meet expected drought frequencies.

When the 1995–2015 Regional Water Plan was being written (during the worst years of what would become the worst 8-year drought of record), the RWPC endorsed a drought protection policy designed to withstand an event more severe than the worst drought of record. The resulting policy required a 10-year drought design consisting of the actual drought of 1987–1994 plus two additional years, 1987–1988. The stricter, more conservative nature of that policy resulted, at least in part, due to the uncertainty of whether the 1995 water year would prolong the drought or end it. It so happened the drought ended after adoption of the policy. In light of the above findings, the projected water demands of the region (see Chapter 6), and the anticipated cost to the community to support a 10-year drought design, the RWPC recommended a 9-year drought planning standard. The Board however, retained the more conservative 10-year standard reflected in Policy 1.2.a.

Policy 1.2.a: Conjunctive Management of Surface Water and Groundwater Supplies to withstand a 10-year Drought Cycle

For planning purposes, the conjunctive management of surface water and groundwater supplies for municipal and industrial use shall be designed to withstand the worst drought cycle of record, that being the drought of 1987-1994, with 2 dry years (1987-88) added to the cycle.

The RWPC intends to review this policy, and revise it if necessary, during the next 3-year update of this Plan. Factors to consider in reviewing the performance of this policy might include updated demand projections, more hydrologic / climatologic data and analyses, increased conjunctive use and other measures that provide flexibility in managing water resources, new sources of water supply, or other appropriate factors.

Off-River Reliability

The 1995-2015 Regional Water Plan contains an off-river water supply goal to provide emergency water for the community during a potential contamination event that could render the Truckee River untreatable for an extended period of time. Such events could be natural, such as debris and sediment flows from the Gray Creek watershed, or man-made, such as highway- or railroad-related chemical spills. The current RWPC policy is as follows:

Policy 1.2.c: Emergency Water Supply Standard

Water service providers using Truckee River water rights supplemented with other water resources shall design and manage their supplies to withstand a short-term contamination event (1-2 days) with no interruption in service, and a 7-day event through the use of mandatory conservation. Water resources supplemental to Truckee River water rights shall be sufficient to meet system average daily demand for 7 days, which would be sufficient to meet all indoor water uses.

In the interest of achieving this standard, the Regional Water Management Fund paid for a study to analyze alternatives and provide recommendations. The resulting report "Recommended Projects to Provide an Emergency Water Supply to the Truckee Meadows" (ECO:LOGIC, 2002) concludes that the current water systems cannot meet the standard. It also evaluates sixteen project alternatives and recommends five projects for further evaluation. These recommendations are summarized and discussed in a later chapter.

2.1.3 Water Resources Available for Municipal Uses

Water resources available for municipal uses are covered in Section 6.2.2.

2.2 Water Quality for Municipal Use

2.2.1 Groundwater Quality

The quality of groundwater resources identified in Table 2-3 that can be used for quasi-municipal uses is dependent upon its capturability and its quality. The areas of good quality water that can be easily or economically captured are fairly well defined and mostly developed. In terms of wellfield development, the proximity of large concentrations of domestic wells must also be considered.

Figures 2-7 and 2-8 identify areas of non-potable groundwater quality within the planning area. The areas outlined in the figures are generalized and approximate. Industrial contamination includes organic pollutant sources (oils, fuels, solvents, etc.). Effluent from septic systems is outlined in areas where groundwater does not meet or is close to drinking water standards for nitrate (10 mg/L as nitrogen). These areas are a result of relatively large concentrations of septic systems and certain soil and groundwater conditions. Geothermal groundwater relates to the influence of geothermal systems on groundwater chemistry. This highly mineralized groundwater would need considerable treatment to make it potable by removing salts, iron, manganese, and/or arsenic. Areas of good quality and capturable groundwater are mostly delineated by the municipal wells indicated in these maps.

Probably the most immediate groundwater quality problem for this area is the industrial contamination caused by the release of perchloroethylene (PCE), an industrial solvent. As discussed in a following section, contamination is present in the Stead area of Lemmon Valley (Figure 2-7) and the central Truckee Meadows (Figure 2-8).

Because the potential exists for groundwater pumping to cause contaminated or otherwise poor quality groundwater to migrate toward production wells, the RWPC recommends the following policy:

> ***Policy 1.3.g: Groundwater Resource Development and Management of Water Quality***
>
> *Development of groundwater resources shall not result in deterioration of groundwater quality through migration of contaminants.*

Besides costly systems for wellhead treatment, the continued use and possible expansion of aquifer storage and recovery (ASR) in the Region, which has been shown successful in improving groundwater conditions, will help manage potential migration of subsurface contaminants. The Region should pursue conjunctive management of surface and groundwater resources as tools to achieve long-term health and management of the Region’s aquifers.

2.2.2 Aquifer Storage and Recovery (ASR)

During the winter season, many of TMWA's wells are used to inject treated surface water into the groundwater aquifer for storage and future peak season use. The injection of treated surface water for ASR in the Truckee Meadows has increased from 81 af as part of TMWA's 1993 pilot program, to 2,400 af in 2003. The total amount of water injected in the Truckee Meadows aquifer since 1993 is 10,800 af, while 670 af has been injected into the west Lemmon Valley hydrographic basin.

Golden Valley is a sub-basin to Lemmon Valley that was developed with more than 600 homes on domestic water wells and septic systems. Water quality and quantity has been deteriorating since the 1980s. Washoe County, after 6 years of a federally supported pilot project, has recently begun a long-term groundwater recharge project in Golden Valley. The project proposes to inject 106 af/yr to help offset declining water levels and improve water quality. Golden Valley property owners are funding the project.

ASR projects have also been investigated for the South Truckee Meadows. Successful pilot studies have been conducted on two wells owned by the South Truckee Meadows General Improvement District (CES, 1998 and Washoe County, 2002). However, at this time there are no firm plans to pursue full-scale projects.

2.2.3 Truckee River Quality

Truckee River water quality is very good for M&I purposes. Levels of regulated constituents including metals, inorganics, organics, and pesticides are significantly below the allowable standards. Aesthetically, the water quality is also very good, with low concentrations of TDS and hardness (typically 86 and 42 ppm, respectively). However, the river is susceptible to naturally occurring and human-caused microbiological contamination, including coliform bacteria, giardia and cryptosporidium. Rapid fluctuations in river turbidity from spring runoff and summer thundershowers also pose treatment challenges. Since the Truckee River basin is a highly developed area, watershed management and control programs to protect surface water quality are being developed as discussed in Section 2.4 and in Chapter 5.

2.2.4 Tributary Water Quality

Streams that emanate from the Carson, Verdi and Peavine Mountains are generally of the same pristine quality as the Truckee River. Stream flows are maintained by snowmelt runoff and snowmelt that infiltrates into the upper watershed and then provides base flows. Alum Creek and Chalk Creek are exceptions. Alum Creek is influenced by high sulfate concentrations due to hydrothermally altered rocks in the upper watershed. Chalk Creek is a perennial creek apparently because of high-density development within its watershed that generates a base flow from residential landscape irrigation. Its quality is affected by TDS concentrations measured as high as 3,000 ppm.

A few of these creeks are affected by irrigation practices and urban runoff that results in higher suspended sediment, fecal matter, road oil and grease, and higher dissolved solids. The stream that suffers most from these effects is Steamboat Creek, which is also affected by geothermal discharges, mercury in bank sediments and dissolution of salts in flood plain soils. The North Truckee Drain, while not a natural stream, has a regionally anomalous TDS load in the range of approximately 600-800 ppm, due to irrigation runoff from Spanish Springs and storm drain discharge within northeast Sparks. In addition, water is pumped to the drain from the Sparks Marina Lake when necessary to maintain a stable water level. Tributary creek water quality is discussed further in Chapter 5.

2.3 Factors Affecting the Availability, Quality and Cost of Water Resources for Municipal Use

Public drinking water is regulated by the EPA under authority of the Safe Drinking Water Act (SDWA), also discussed in Chapter 7. New and recently changed regulations, such as arsenic and radon standards and the groundwater rule, are discussed below. Natural and man-caused pollution problems, remediation and groundwater quality protection are discussed below and in Section 2.4.

2.3.1 Drinking Water Standards

The EPA has set MCLs, also known as drinking water standards that must be met by public and private water purveyors. The State Health Board and Washoe County District Board of Health, and their respective agencies, administer the SDWA programs and regulate water quality for public water systems. Private domestic wells are not regulated for drinking water quality. The above federal and state agencies set two types of standards: **primary** standards are set for health protection and **secondary** standards are set to protect aesthetic values such as taste and odor. Currently there are 87 federal primary drinking water standards, categorized as disinfectants, disinfectant byproducts, inorganic chemicals, microorganisms, organic chemicals and radionuclides, and 15 federal secondary standards. A table listing these standards appears in Appendix C. To ensure that this Plan is consistent with the SDWA and related state and local rules, the RWPC recommends the following policy:

> ***Policy 1.2.d: Water Supplies to Meet Safe Drinking Water Act Requirements***
>
> *All drinking water supplies shall meet or exceed the requirements of the Safe Drinking Water Act.*

2.3.2 EPA Changes in Arsenic and Radon Standards

In 2001, the EPA changed the arsenic MCL from 0.050 mg/L to 0.010 mg/L and announced that public water systems have until January 2006 to comply with the new standard. Compliance with the arsenic standard will be determined through the analysis of water samples collected at the points of entry into the distribution system. Those systems with arsenic concentrations greater than 0.010 mg/L will be required to collect samples on a quarterly basis. Compliance will be determined by calculating the annual average of the quarterly samples. Systems required to increase monitoring will not be considered in violation until the annual average exceeds the MCL. TMWA reports that the new arsenic standard affects 11 of its 30 wells. Water from most of these wells is, or can be, piped to a treatment facility. WCDWR anticipates that 9 County wells and 2 STMGID wells will be affected. Water purveyors are currently evaluating strategies to comply with the 0.01 mg/L arsenic standard.

The EPA has taken a somewhat unique approach to regulating radon and has proposed two standards. The proposed radon MCL is 300 pCi/L with an alternative MCL (AMCL) of 4,000 pCi/L if there is a "multi-media mitigation" program established to mitigate indoor air radon. The Nevada State Health Division is taking the lead in the establishment of a "multi-media mitigation" program acceptable to EPA. The EPA anticipates promulgation during 2005.

New monitoring requirements for radionuclides have recently been promulgated. The EPA retained current MCLs for radium, 226 and 228, gross alpha particle activity and beta particle and photon radioactivity; however, new uranium MCL of 30 μg/L has been established. This regulation became effective December 8, 2003.

2.3.3 EPA Groundwater Rule

The EPA is proposing a rule that specifies the appropriate use of disinfection in groundwater and addresses other components of groundwater systems to assure public health protection. The Groundwater Rule (GWR) establishes multiple barriers to protect against bacteria and viruses in drinking water sources and will establish a targeted strategy to identify groundwater systems at high risk for contamination. The rule was proposed in 2000 with a final rule to be implemented in 2005 or 2006. While still in draft form, the key components of the GWR are as follows:

- Sanitary surveys of each system addressing the 8 elements from the joint EPA and Association of Safe Drinking Water Administrators guidance
- Conduct hydrogeologic assessment of all groundwater systems that do not provide 4-log (99.99%) virus inactivation. EPA considers karst, gravel, or fractured bedrock aquifers to be "sensitive" to microbiological contamination.
- Systems that are sensitive or have contamination in their distribution systems and do not treat to the required level of virus removal must conduct routine source water monitoring.
- Corrective actions must be taken by systems with significant deficiencies or positive microbial samples indicating fecal contamination.
- All systems disinfecting in order to avoid source water monitoring and systems that disinfect as a corrective action must conduct routine compliance monitoring to ensure they are achieving the required viral inactivation.

2.3.4 Geothermal Influences

Groundwater supplies are limited in part due to the influence of geothermal systems, most notably the Moana Hot Springs in south-central Reno and Steamboat Springs in the southeast Truckee Meadows. For example, a small number of wells in the South Truckee Meadows have concentrations of antimony exceeding the drinking water standards. It is speculated that the antimony is related to geothermal activity to the south. Well water is blended with other sources such that the concentration meets drinking water standards before it is served to the public.

Smaller geothermal systems also exist in Spanish Springs Valley, Washoe Valley near New Washoe City, Warm Springs Valley, and west of Reno at the River Inn. Water derived from these geothermal systems is generally not potable and cannot be developed for municipal use. These areas are well known, especially by local water purveyors who take care to locate production wells outside of aquifer zones that have been influenced by geothermal systems. Potential domestic well sites are also limited by the presence of geothermal systems. Additionally, it is understood that large centers of municipal pumping peripheral to geothermal areas can induce geothermal water migration to the production wells. Consequently, consideration must be given to the prevention of geothermal migration as a result of municipal well pumping. This concern is the basis for one of the RWPC's recommended policies:

Policy 1.3.f: Well Siting and Geothermal Influence

Existing and proposed municipal and industrial well sitings must be evaluated for their influence on the potential for geothermal groundwater migration to areas of potable groundwater. Also, development of groundwater resources shall not result in deterioration of groundwater quality through migration of contaminants.

2.3.5 Nitrate Contamination

Nitrate contamination from septic systems is a growing problem in the region. Elevated nitrate concentrations in groundwater have been documented in Spanish Springs Valley (Washoe County, 2002), and New Washoe City (McKay, 1989). Evidence also indicates that portions of East Lemmon Valley are similarly affected. Problems occur where the amount of septic system effluent discharged to the groundwater exceeds the aquifer's capacity to assimilate the discharge. This can happen where septic systems are concentrated within a relatively small area with limited groundwater recharge. Widmer and McKay (1993) reported that septic system discharges, particularly in sandy soils, might contribute as much as half or more of the total groundwater recharge to a particular aquifer system. Water resources are most significantly affected when the drinking water standard for nitrate is exceeded.

Nitrate contamination is typically detected during routine drinking water analyses conducted by public water systems, or when domestic well water is tested. The problem is of immediate importance to homeowners because nitrate concentrations currently exceed drinking water standards in portions of these areas. It also appears likely that the contamination will migrate to nearby municipal wells if the problem increases in magnitude.

Nitrate contamination problems can occur simply due to a large concentration of septic tanks. This is the case in Spanish Springs, Cold Springs and the South Truckee Meadows. Particular to Spanish Springs, municipal wells are affected by this contaminant source. The NDEP is requiring Washoe County to take corrective action, which will be by mandatory sewering that would eliminate the nitrogen source. There is no evidence that municipal wells in Cold Springs or the South Truckee Meadows are affected. Another regional nitrate problem in Warm Springs Valley is probably the result of local farming practices (Washoe County, 1993). It does not appear to pose a health concern at present, but it will have to be addressed in the event of relatively large-scale development within Warm Springs Valley. Further discussions can be found in Section 3.7.

2.3.6 Central Truckee Meadows Remediation District and Other Contaminated Sites

Water quality in a large portion of the aquifer underlying the central Truckee Meadows is affected by the presence of perchloroethylene, or PCE, an organic solvent. This solvent was used extensively from the 1950s to the 1980s as a degreaser by various commercial establishments and is presently used by the dry cleaning, automobile service, and chemical manufacturing industries. In the 1980s the EPA identified PCE as a hazardous / toxic material and required municipal water systems to initiate water quality monitoring. In 1987, water quality tests on several of TMWA's production wells revealed the presence of PCE.

In 1995, the state legislature passed Senate Bill 489 (now NRS 540A) requiring the formation of a remediation district once a groundwater contamination problem is certified by NDEP and/or the WCDHD. Both agencies provided letters of certification in August of that year. In 1997, NRS 540A was amended to provide a funding mechanism to support groundwater remediation activities and the Central Truckee Meadows Remediation District (CTMRD) was formed later that year.

CTMRD studies indicate that PCE contamination is widespread, covering more than 16-square miles to a depth greater than 350 feet (Figure 2-8). Eleven production wells are currently affected. District funding has paid for three air-stripping treatment facilities that remove PCE from five TMWA wells. Additionally, funding was used to develop a Remediation Management Plan (RMP), which was approved by the Board and NDEP in 2003. The three primary components of the RMP are:

- Clean Drinking Water Activities – focused on the removal of PCE from the public drinking water supply to the benefit of water users within the TMWA wholesale and retail service area
- Remedial Activities – focused on the identification, characterization, evaluation and remediation of sources of PCE, and the related monitoring programs requisite to all remedial actions to the benefit of residential and commercial property owners located above the areas containing or suspected of containing PCE contamination
- Program Outreach, Education, and Administration Activities – focused on the management of resources to optimize the remedial activities including outreach and educational tasks, and project administration and fund management to the benefit of water users and property owners

Ongoing CTMRD activities include:

- Implementation of the RMP through:
    - Investigation of potential ongoing PCE discharges
    - Working with NDEP and the Cities of Reno and Sparks to revise sewer discharge ordinances and mitigate potential groundwater impacts associated with defects in the sewer lines
    - Working with NDEP to define a protocol whereby PCE hotspots and sources can be eliminated prior to impacting groundwater
    - Initiation of the Groundwater Monitoring Plan to better define the magnitude and extent of groundwater PCE contamination and support an evaluation of the behavior of PCE contaminated groundwater in response to various groundwater pumping and injection scenarios (early 2005)
    - Preparation of an annual report of 2003 CTMRD activities for presentation to the Washoe County Board Of Commissioners and the community (spring 2004)
    - Planned update of the CTMRD website (spring 2004) (www.co.washoe.nv.us\remediation)
- Investigation of the source and nature of PCE impacts to the Sparks and Poplar II water wells (to be completed in mid to late 2004)

Hydrocarbon fuel and organic solvent contamination originating from the Sparks Tank Farm and adjacent rail yard affects groundwater underlying the southern-most part of Sparks. The contamination forms a plume that roughly parallels I-80, extending from the tank farm to Sparks Marina Lake. The plume is being hydraulically contained with extraction wells, and contaminated groundwater is treated onsite. NDEP is overseeing and directing the ongoing, onsite remediation of contaminated soils and groundwater.

Groundwater underlying the West Lemmon Valley hydrographic basin, near the Reno-Stead Airport, is also affected by PCE contamination. This PCE plume, identified in 1994, is smaller than the one in the central Truckee Meadows. The contaminant source is connected with US Air Force activities at the Stead Air Force Base, which was active during the 1940s and 1950s. The potential exists for this contamination to migrate to TMWA production wells; however, TMWA is successfully controlling plume migration by injecting fresh water to form a hydraulic barrier in conjunction with implementation of NDEP's approved mitigation plan funded by the City of Reno, Airport Authority, Lear Family Trust, Silver Lake Water Distribution Company, and the United States. Remediation plans are being implemented under the direction and oversight of NDEP.

The RWPC supports appropriate regional involvement in these ongoing groundwater remediation efforts as expressed in the following policy.

Policy 1.3.h: Corrective Action for Remediation of Groundwater

The corrective action taken for remediation of groundwater contamination shall consider the level of cleanup desired by the affected community, realizing that public health concerns are typically the driving force for groundwater remediation.

2.3.7 Point and Non-Point Source Pollution

Meeting Truckee River water quality standards not only protects the main source of the Region's drinking water but also adds significant aesthetic value to the Truckee Meadows. Compliance with NPDES discharge permits is probably the single most effective measure to protect the Truckee River from point source pollution and assure that water quality standards are met. Expansion of wastewater treatment facilities will rely on the Region's ability to continue meeting water quality standards while discharging to the Truckee River. Key to these responsibilities is the elimination of point and non-point source pollution. These pollutant sources are primarily:

- Agricultural return flows from Steamboat Creek and the North Truckee Drain
- Debris and sediment flows from the Gray Creek drainage and others
- Wastewater discharges from septic systems and treatment facilities
- Industrial discharges and chemical spills
- River and stream bank erosion

It should be anticipated that a reduction in nutrient and sediment load discharges to the Truckee River from Steamboat Creek and the North Truckee Drain will be necessary. Treatment facilities and/or improved irrigation practices can significantly reduce sources of this loading to the Truckee River. Not as significant, but certainly measurable and worth addressing, are irrigation and subsurface return flows from other locations such as the Fernley / Wadsworth area. Other considerations for the Truckee River include nutrient loading from septic systems, other wastewater treatment facilities, and other activities adjacent to the river. It is anticipated that one solution to this problem will be the extension of the Lawton/Verdi Interceptor. These and other pollution sources are discussed more fully in the context of wastewater treatment in Chapter 3.

2.3.8 Water Quality Settlement Agreement

This agreement among the Cities, County, the Pyramid Lake Paiute Tribe (the Tribe), United States, and NDEP provides in broad terms that the community and the United States would purchase water rights to be used for in-stream flows in the Truckee River in exchange for dismissal of lawsuits by the Tribe. It is expected that the augmentation of flows in the river will enhance its water quality. For more information, please refer to Chapter 7.

2.3.9 Groundwater Level Declines

Because of projected water demands and the consequent planned use of existing groundwater rights, the effect of declining groundwater levels on domestic wells has become an important regional issue. County Assessor's files indicate that there are 8,349 domestic wells in the Region as of August 2002. Some of these existing wells have failed because of declining water table elevations. Although it is unknown how many domestic wells have gone dry for this reason, State Division of Water Resources records indicate that from 1984 through 2001, 762 domestic wells have been deepened or re-drilled (Figure 2-9).

Restoring water supply to affected homes is costly and typically involves deepening or re-drilling wells, or hooking up to a municipal water system. Since the Domestic Well Credit Bill (DWCB) was enacted in 1994, WCDWR has connected 42 individual lots to the municipal water system. Of those 42 lots, 37 were undeveloped and only five were required to abandon a well. TMWA has had eight lots voluntarily convert from a domestic well to its municipal water system under the DWCB.

The cause(s) of groundwater level declines may include, but may not be limited to, one or more of the following: diminished aquifer recharge due to drought or loss of irrigation or secondary recharge sources, and groundwater pumping by nearby municipal, domestic, irrigation or other wells. The effect on domestic wells may be aggravated by the fact that some domestic well installations are inadequate for the local hydrogeologic conditions. For example, some may not have been drilled deep enough and others may have been located in aquifer zones having historically poor yields.

2.3.10 Groundwater Recharge

Loss of natural groundwater recharge areas due to development is a regional concern. Local ordinances provide for the protection of groundwater recharge in most natural drainage ways; however, additional perennial and ephemeral drainage ways exist that are not identified in the ordinances. The RWPC strongly encourages incorporation of passive groundwater recharge and/or storm water infiltration when proposed projects are considered on sites that have good recharge potential and the water to be recharged can meet water quality standards. The "Southern Washoe County Groundwater Recharge Analysis" (Kennedy/Jenks, 2001), prepared for the RWPC, includes an initial identification of 30 such sites.

Diminished groundwater recharge to aquifers is occurring as irrigation practices are modernized and as agricultural lands are urbanized. This is because surface irrigation serves as a source of secondary or incidental recharge to the groundwater system. Secondary recharge occurs as seepage from conveyance ditches and as deep percolation of water applied to fields and pastures. Groundwater level declines associated with diminished agricultural irrigation have been documented in the South Truckee Meadows by Yeamans and Broadhead (1988) and CES (1998).

Diminishing groundwater recharge is of greatest concern in the Spanish Springs Valley hydrographic basin, where as much as 67 percent of the total groundwater recharge is from Orr Ditch leakage and irrigation practices (Hadiaris, 1988 and USGS, 1996). Recharge in Spanish Springs Valley due to Orr ditch losses in 2002 are estimated at 1,263 af, "Spanish Springs Valley Groundwater Budget Analysis" (ECO:LOGIC, 2004). The valley is also over-appropriated with respect to groundwater rights. Therefore, as Orr Ditch water rights are converted from agriculture to municipal supply and water is piped into the valley, eliminating recharge from irrigation and ditch leakage, groundwater levels are expected to drop dramatically as the valley develops. Consequently, additional imported water, from existing or new sources, will be necessary to mitigate a diminished groundwater supply.

2.4 Programs to Protect the Availability and Quality of Water Resources for Municipal and Industrial Use

2.4.1 Wellhead Protection Plans

Wellhead Protection Plans (WHPP) are developed to protect the quality of groundwater supplies through the delineation of zones of groundwater movement to municipal supply wells, and through the subsequent management of potential contaminant sources in those areas. The programs follow standard requirements set forth by the NDEP. This includes a substantial modeling effort to accurately delineate well capture zones and to identify groundwater recharge zones. Also included are inventories of potential contamination sources and locations, contaminant source management strategies, future well sites and their protection areas, contingency plans, and a public education program. WCDWR and TMWA are currently pursuing WHPPs (see Chapter 5).

2.4.2 Storm Water Management

As a result of the federal Clean Water Act the EPA has delegated to NDEP enforcement of the National Pollutant Discharge Elimination System (NPDES) Storm Water Program. In order to comply with storm water permit regulations, the Cities of Reno and Sparks, Washoe County and NDOT formed the "Truckee Meadows Interlocal Storm Water Permit Coordinating Committee". Their program for compliance can be found in the "Truckee Meadows Regional Storm Water Quality Management Program" (Kennedy/Jenks, 2002). The program outlines several processes for the reduction in polluted storm water discharge to the Region's streams and rivers. This topic is further detailed in Chapter 5.

2.4.3 Watershed Management

Watershed Management helps to safeguard community water supplies derived from both surface water and groundwater sources. The watershed approach is a coordinated effort of environmental management that focuses on public and private sector efforts to maintain or improve the quality of water resources within geographic areas. The objective of such a program is to determine the current "health" of the streams through assessment of their water quality. Currently, watershed protection and management issues are being developed for the Truckee River and its tributaries as discussed in Chapter 5.

2.4.4 Groundwater Resources Data Center and Domestic Well Mitigation

As discussed in a preceding section, the effect of declining groundwater levels on domestic wells has become an important regional issue. The RWPC and Washoe County formed the Groundwater Task Force in 2001 to explore these issues and develop options to mitigate water level decline impacts to domestic water wells. The RWPC and Washoe County approved Task Force recommendations in 2003 for the development of a Groundwater Resources Data Center and a Domestic Well Mitigation Program (RWPC, 2003).

The Task Force found that there is a considerable volume of useful groundwater data stored at a number of locations in various formats which, once compiled in a central location and kept current, would prove invaluable to water purveyors and domestic well owners. The data center would provide for monitoring of groundwater production, water levels, water quality sampling, well mapping, aquifer characterization, educational projects, annual reporting and other data dissemination. Data center staff would serve as a point-of-contact for domestic well owners and provide technical support for the proposed well mitigation program.

The Well Mitigation Program has been designed to address the causes and responsibilities for impacts to domestic wells and the need for mitigation measures. Mitigation would include, but not be limited to, well deepening or redrilling and municipal water system hook up. The program is expected to provide a process to determine the cause or causes of a domestic well impact, eligibility for mitigation, and a funding mechanism. The Task Force agreed that it would be equitable for municipal water purveyors to fund mitigation for domestic well owners if it were determined that a domestic well has been impacted unreasonably by municipal well pumping. Purveyors are expected to participate voluntarily and pay to mitigate impacts caused by their own wells. The program will require the formation of a volunteer board of hydrogeology experts, who are independent of water purveyors and domestic well owners, to make determinations. The State Engineer is and will remain the final authority on these matters.

2.5 Municipal Water Distribution

Five public water systems within the planning region provide 95% of the municipal water. In addition, various smaller private water companies serve trailer parks (approximately 1,600 units) or small subdivisions. Table 2-3 lists the major purveyors, their approximate number of services, their water source(s) and approximate 2001 deliveries. Figure 2-10 shows the locations of these major water service areas for Washoe County and TMWA as well as the locations of the water systems.

Table 2-3
Water Purveyors

Water Purveyor	Number of Connections	Water Source	2001 Deliveries (af)
Truckee Meadows Water Authority	86,091	Truckee River 30 municipal wells	86,500
Washoe County Department of Water Resources	10,626	44 municipal wells TMWA wholesale	5,400

Sun Valley GID	6,000	TMWA wholesale	1,600
South Truckee Meadows GID	3,140	9 municipal wells	3,154
Utilities Inc. of Nevada (Cold Springs)	2,152	5 municipal wells	1,132
Sky Ranch Water Service Corp.	580	2 municipal wells	687
Steamboat Springs Water Works, Inc.	290	3 municipal wells	200
Various trailer parks	Approx. 1,600	Water wells	550
Other water purveyors (see 2.5.7)	Approx. 400	Municipal wells	100

2.5.1 Truckee Meadows Water Authority

The Truckee Meadows Water Authority (TMWA) is the largest water purveyor in the Truckee Meadows. It currently serves more than 86,000 services primarily located in Reno and Sparks. Water sources for this system include the Truckee River (approximately 69,000 af in 2001) and 30 wells (approximately 17,500 af in 2001). TMWA also provides wholesale water to Sun Valley GID and WCDWR.

Table 2-4 shows the distribution of Truckee River water diverted for M&I uses in the TMWA service area. This table shows that 93% of Truckee River water diverted for M&I use remains within the central Truckee Meadows. The largest exports are to Lemmon Valley and Sun Valley.

Table 2-4
2001 TMWA Truckee River Water Distribution (af)

Central Truckee Meadows	South Truckee Meadows	Lemmon Valley	Spanish Springs Valley	Mogul	Sun Valley
64,238	343	2,591	280	205	1,600

The Chalk Bluff Water Treatment Plant (CBWTP) is TMWA's largest surface water treatment facility, with a current capability of producing approximately 69 MGD of finished water. The plant is located on Chalk Bluff overlooking the Truckee River on the west side of Reno. Untreated (raw) water is delivered to the plant via Highland Ditch by gravity or from the Orr pump station.

This plant treats raw water through settling of heavy solids, screening, flocculation and sedimentation, filtration, and chlorination. The plant is designed for modular expansions to an ultimate treatment capacity of 120 MGD. The next expansion of 15 MGD treatment capacity is tentatively planned for completion in 2004 at an approximate cost of $9 million. The plant currently has 12 million gallons (MG) of finished water reservoir capacity with the ability to add another 4 MG reservoir.

The Glendale Water Treatment Plant (GWTP) is the smaller of TMWA's surface water treatment facilities and is located just east of the Reno Hilton. The plant borders the north bank of the Truckee River and diverts raw water from the river directly to the plant. Originally built in 1976, GWTP was upgraded in 1996 and currently employs the same treatment processes as CBWTP. Although the plant is rated at 37.5 MGD, plant output is currently limited to 25 MGD because of raw water diversion and distribution system constraints. GWTP houses TMWA's pilot treatment plant, which is used to test chemicals and operational enhancements prior to full-scale implementation.

TMWA has 28 production wells in the Truckee Meadows basin and 2 production wells in the west Lemmon Valley basin. With a few exceptions, the wells pump water directly into the distribution system after chlorination. As discussed above, water from five wells (Morrill, Kietzke, High, Mill and Corbett) receives air-stripping treatment for PCE removal. Water from three wells (Terminal, Pezzi and Poplar #1) is pumped to the GWTP for arsenic removal and/or blending. The Peckham Well is not used due to high arsenic concentrations. Two wells are used for non-potable purposes only (e.g., construction water) and two wells are in need of rehabilitation and new distribution facilities. The wells have a rated capacity of approximately 58.5 MGD, are relied upon in the summer to handle peak water demands and typically supply between 15 and 20 percent of annual, net water production.

In the winter season, many of the wells are used to inject, or artificially recharge, treated water into the groundwater aquifer for storage and future peak season use. As discussed earlier, this practice is known as Aquifer Storage and Recovery (ASR). TMWA's ASR program has grown from 81 af of treated surface water injected during the 1993 pilot program to 2,400 af in 2003. The total volume of water injected in the Truckee Meadows aquifer since 1993 is10,800 af, while 670 af has been injected into the West Lemmon Valley hydrographic basin.

2.5.2 Washoe County Water Systems

Washoe County owns and operates 16 stand-alone water systems. As shown in Table 2-5, the systems are located throughout the planning region and serve approximately 14,000 services (Figure 2-10). All of these systems supply chlorinated groundwater and some receive additional, wholesale supply from TMWA. In combination, these systems consist of 53 production wells, 19 MG of storage in 37 tanks and 250 miles of distribution piping. Each water system has at least 2 production wells.

Washoe County also operates an aquifer recharge project in Golden Valley. The purpose is to inject approximately 100 af/yr to help offset declining water levels and to improve water quality. This small valley supplies groundwater to over 550 domestic wells with an annual demand of 500 af, but receives natural recharge of only approximately 120 af/yr.

Table 2-5
Washoe County Water Deliveries and Services by Hydrographic Basin

Basin	System	Services	2002 Deliveries (af)
Truckee Meadows	STMGID/Thomas Creek	3,375	2,603
	Hidden Valley	1,585	657
	Double Diamond	2,222	498
	ArrowCreek	613	741
Lemmon Valley	Lemmon Valley	1,280	1,050
	Horizon Hills	144	37

Spanish Springs Valley	Desert Springs Springs Creek/Countryside	2,857 1,155	1,013 1,031
Pleasant Valley	Sunrise Estates Mt. Rose	33 791	59 676
Washoe Valley	Old Washoe Estates Lightening W	53 32	53 52
Truckee Canyon	Wadsworth Mustang	61 5	206 na

2.5.3 Sun Valley General Improvement District

The Sun Valley General Improvement District (SVGID) was formed in 1967 to provide water and wastewater services for the growing community of Sun Valley north of Reno. SVGID provides service to approximately 6,000 connections. The fully metered system is supplied with TMWA wholesale water and consists of six water storage reservoirs totaling 6 MG and approximately 120 miles of water pipe.

2.5.4 South Truckee Meadows General Improvement District

The South Truckee Meadows General Improvement District (STMGID) was formed in 1983 in order to buy the Trans-Sierra Water Company that was serving poor-quality groundwater to approximately 400 services in the Virginia Foothills area of the southeast Truckee Meadows. It has grown through annexation into the primary water provider in the area with a service area covering a significant portion of the South Truckee Meadows. Over the past 20 years a new wellfield consisting of nine operating wells has been developed on the Mt. Rose Fan. Although STMGID has a current groundwater supply of 9,259 af, the "South Truckee Meadows Facility Plan" (ECO:LOGIC, 2002) provides for approximately 7,000 af/yr annual average groundwater production to manage groundwater levels. STMGID contracts its system operations to WCDWR.

2.5.5 Utilities, Inc.

Utilities Inc. of Nevada, an affiliate of Utilities, Inc., is a privately owned, PUC-regulated water utility that operates the Cold Springs water system. This utility has nearly doubled its size to more than 2,500 services over the last decade. The Cold Springs system consists of five wells, four storage reservoirs (2,260,000 gallons) and 33 miles of water main.

The Sky Ranch Water Service Corp., also a privately owned, PUC-regulated affiliate of Utilities, Inc., operates the Sky Ranch Water System in Spanish Springs Valley. The Sky Ranch system in Spanish Springs Valley includes two wells and three storage tanks (830,000 gallons).

Table 2-4 shows that these two Utilities, Inc. affiliates provide water to approximately 3,100 services.

2.5.6 Steamboat Springs Water Works, Inc.

Steamboat Springs Water Works, Inc. is a privately owned water utility that operates in the Steamboat Hot Springs area south of Reno. The utility has potable water wells in close proximity to geothermal wells used to generate electrical energy and to supply spas. The utility provides water to approximately 290 services with the potential to add 40 acres of undeveloped land.

2.5.7 Other Water Systems

Four additional small privately owned water systems are located within the area. The Panther Valley Water Users Association buys wholesale water from TMWA and serves 115 customers. Two additional small systems located in Lemmon Valley are the Silver Knolls Mutual Water Company, which operates two wells and serves 60 customers, and the Three T Water Company, which operates a system from a cluster of springs and serves 42 customers. The Verdi Meadows system is located in Verdi and serves 172 customers from three wells.

2.6 Discussion of Issues by Geographic Area

2.6.1 Central Truckee Meadows

Surface Water

Current operating procedures of Truckee River reservoirs pertain to hydroelectric operations and irrigation. They are incapable of responding to the changing needs or uses that today's water resource requirements warrant. Negotiations for a new operating agreement for the Truckee River (TROA) have been ongoing for several years and are expected to be completed by 2007. This new agreement will provide TMWA drought storage in all upstream federally controlled reservoirs. In addition, the draft TROA contains the following provisions:

- Interim drought storage for the TMWA services until Settlement becomes effective
- Permanent drought storage for TMWA services including emergency drought supplies during toxic spill conditions and worse than worst-case droughts
- Certainty associated with the Interstate Allocation of the Truckee and Carson Rivers as well as the Tahoe Basin between California and Nevada
- Improved flexibility of River operations to accommodate changing circumstances, policies and values while protecting historic water rights from injury
- Improved timing of river flows for the threatened and endangered species in Pyramid Lake
- Enhanced minimum reservoir releases and protects from claim to the contrary
- Increased recreational pools in the reservoirs
- Improved riparian habitat
- Improved water quality enhancement through flow augmentation and retiming of flow
- Reduced litigation and continued cooperation
- Water storage for California M&I use as well as environmental uses
- Sets minimum bypass flows for the hydroelectric plants and protects from claims to the contrary
- Consistent dispute resolution
- Reasonable and consistent rules for effluent reuse

With the additional storage provided by TROA, TMWA will be able to meet municipal demands using available resources including revised storage operations for the Truckee River during drought years beyond 2030.

The RWPC recognizes the importance of TROA in addition to other Truckee River-related agreements, especially as they relate to upstream storage of conserved water. Additionally, NRS 540A requires that the Regional Water Plan be consistent with and carry out, or support the carrying out, of all aspects of the Negotiated Settlement (PL 101-618).

Pollution of Truckee River water from industrial land use practices and the interstate transportation corridor remains a threat. Additionally, sediment runoff to the river during heavy rainstorms creates a water quality problem for the Chalk Bluff and Glendale Water Treatment Plants. A serious accident along the Truckee River corridor, especially in the Truckee River Canyon where I-80 and the railroad are in very close proximity to the river, could have serious consequences, such as a hazardous or toxic chemical spill. If a persistent toxic spill did occur, an emergency water supply plan would need to be in place and ready to implement. "Recommended Projects to Provide an Emergency Water Supply to the Truckee Meadows" (ECO:LOGIC, 2002) provides an initial plan to meet the RWPC's Emergency Water Supply Standard.

Non-point source pollution remains a threat to the Truckee River, as does storm water runoff. However, recent implementation of Phase II of the National Pollutant Discharge Elimination System Storm Water Program will help to control these sources of pollution. A recently approved watershed management and protection guidance document for tributaries to the Truckee River will also help to alleviate non-point source pollution.

Finally, during drought conditions, low river flows occur between Glendale and Steamboat Creek and during extreme drought periods, flow is sometimes reduced to zero.

Groundwater

Municipal water is supplied by TMWA with Truckee River water and groundwater. Adequate surface and groundwater resources exist for present and currently approved development. Future siting of production wells is limited due to urbanization and the proximity to areas of poor quality groundwater.

Several production wells in the eastern Truckee Meadows have slight to moderate problems with arsenic concentrations that exceed current drinking water standards, suggesting that poor quality groundwater is migrating westward. Although geothermal development occurs in the southern portion of this basin, it does not appear to be affecting water quality in the fresh water aquifers.

Water quality degradation from past industrial and commercial pollution remains a significant groundwater problem. TMWA operates nine production wells that are affected, in addition to numerous private wells. The area of contamination has been defined and encompasses 16.5 square miles (see Figure 2-8). The CTMRD is currently addressing the problems of the PCE contamination. A Remediation Plan has been approved and is being implemented through District taxation. Wellhead protection programs should help to prevent future contamination from industrial, commercial, and household practices.

It is acknowledged that future groundwater development will need to optimize production in order to meet long-term projected demands. This will very likely involve limited production of poor-quality groundwater that will require treatment for constituents such as PCE, arsenic, iron, manganese and possibly boron.

2.6.2 South Truckee Meadows

Surface Water

The South Truckee Meadows Facility Plan (ECO:LOGIC, 2002) proposes two surface water treatment plants to provide for future municipal water supply. The surface water treatment plants are an integral part of the plan for future water supply for the South Truckee Meadows. Initially, future diversions from Thomas, Whites and Galena Creeks for M&I development are approximately 6,700 af annually. The plan envisions converting historic irrigation diversions to be used for M&I development while preserving flows so as not to injure the rights of downstream water right holders. Future demands can be met most effectively by optimizing the use of various local water resources, including surface water and groundwater. Plans for conjunctive use of these surfaces with groundwater resources rely on the availability of treated surface water to offset groundwater production. Additionally, surface water treatment plants will be capable of treating poor-quality groundwater to meet drinking water standards.

Steamboat Creek remains a water quality problem affecting the Truckee River. Major pollutants in Steamboat Creek include nutrients (nitrogen and phosphorus), sediment loads and geothermal discharges. Geothermal discharges are naturally occurring, cannot be mitigated and therefore will remain a natural source of water quality degradation to Steamboat Creek. Mercury has also been identified in Steamboat Creek bank sediments. The sources of these pollutants are from naturally contributing sources plus historic and current land use practices. Future improved land use practices could help to alleviate this problem, but this will require private landowner cooperation. Some pollutants resulting from current land use practices and storm water runoff also affect certain reaches of tributaries to Steamboat Creek. Watershed management practices are expected to help manage water quality and riparian buffer zones. Storm water discharges and construction practices are being re-evaluated by the Cities of Reno and Sparks and Washoe County. This concerted effort will greatly increase the protection of these tributaries and water quality.

Groundwater

As discussed above, the RWPC, Washoe County and STMGID, in August 2002, approved a water and wastewater facility plan (ECO:LOGIC, 2002). The plan addresses future water supply issues at the projected level of development and indicates that adequate water resources exist for current and future development. Most of the existing development is served with groundwater for municipal and domestic uses. Some developments in Double Diamond are supplied by Truckee River water treated at Chalk Bluff. Concerns regarding future domestic well failures due to declining water table elevations will be addressed by the groundwater pumping plan contained in the South Truckee Meadows Facility Plan and the proposed Domestic Well Mitigation Program described previously in this chapter.

Due to the number of locations and concentrations of domestic wells and the large areas of poor quality groundwater, future municipal well sites are becoming limited even though water rights and actual water are available. Agricultural lands once irrigated by surface water contributed a significant volume of recharge to the groundwater system. As these lands are urbanized, this form of recharge will eventually cease. Subsurface geothermal discharge presents a potential source of pollution to the fresh water aquifers, although no evidence of geothermal influence in fresh water aquifers exists at this time. Within the current planning timeframe, there is a potential for the migration of poor quality water to areas of good quality as existing production wells increase their production rates. Wellhead protection plans have been adopted for STMGID and most Washoe County wells in this basin.

2.6.3 Spanish Springs Valley

The groundwater resource in Spanish Springs is over-appropriated with respect to water rights. Compounding this is the estimate that two thirds of the groundwater supply is recharged from Orr Ditch leakage and irrigation practices, which are both expected to diminish as irrigated lands are urbanized. Consequently, the potential for groundwater depletion will increase unless an additional resource is developed. Groundwater development for municipal uses will continue in the short-term to support existing and approved subdivisions; however, current pumping exceeds the perennial yield, which emphasizes the need for a long-term solution.

Truckee River water or other imported sources will be needed to support the groundwater system over the long-term. This could be accomplished through artificial groundwater recharge, possibly as part of a conjunctive use program where imported water is used for aquifer recharge during periods of off-peak demands and both import water and groundwater are used to meet peak demands. Storm water runoff could also be captured and used for recharge. (Truckee River water treated and delivered by TMWA is used in the southern portion of the valley to serve development within the Sparks Sphere of Influence, or SOI). Additionally, Washoe County owns limited surface water rights in adjacent basins in the northern portion of the valley that could be developed and imported. Currently, within some of the unincorporated areas of Spanish Springs Valley, developers are generally being required to dedicate water rights for imported water to obtain subdivision approval.

There is a potential for the migration of poor quality groundwater from the southern portion of the basin and from areas of large concentrations of septic systems (see Figure 2-7). Nitrate levels are increasing in groundwater supplied from some municipal wells. As a result, NDEP has directed Washoe County to plan for the conversion of approximately 2,000 septic systems to regional sewering. Washoe County responded by developing the Spanish Springs Valley Nitrate Occurrence Project (Washoe County, 2002), which includes plans for phased sewering of the approximately 2,000 homes served by septic systems, and a groundwater characterization and remediation program to manage existing nitrate concentrations in the aquifer. This effort is primarily being funded through federal grant opportunities.

2.6.4 Washoe Valley

Surface Water

Historically, the significant water resources provided by Washoe Valley streams have been used for irrigation. During non-irrigation periods, these waters support Washoe Lake and wildlife habitat. These practices are expected to continue. The poor riparian condition of Jumbo Grade Creek, located on the east side of the valley, continues to be a problem of erosion and flood control. Efforts for restoration are underway by Washoe County and the US Bureau of Land Management (BLM). Due to the widespread citizen support of lake and wetlands preservation, large tracts of lands within the northwest portion of the valley (Casey Ranch) are being pursued for public acquisition.

Groundwater

Groundwater resources within the basin appear to be generally adequate for the anticipated growth in Washoe Valley. The New Washoe City area is experiencing septic system effluent (nitrate) contamination and high levels of fluoride, iron, and manganese, which may result in the need for a long-term solution, such as provision of a local municipal water supply and/or centralized sewage treatment. The new municipal water resource could possibly come from the west side of the valley.

2.6.5 Lemmon Valley

Golden Valley and East Lemmon Valley have declining water tables because of overpumping and water quality degradation due to septic system effluent (Widmer and McKay, 1994). Estimates indicate that 300 to 400 af of water are needed per year in Golden Valley and approximately 1,500 af/yr in East Lemmon Valley to balance water withdrawal with annual recharge. Some areas within the Silver Lake sub-basin are also experiencing water level declines. Washoe County has constructed artificial groundwater recharge facilities in Golden Valley and East Lemmon Valley. Currently artificial recharge by underground injection is occurring in Golden Valley and is totaling 100 af/yr. TMWA is actively engaged in an ASR program to help with declining water levels and a conjunctive use program in West Lemmon Valley.

Expanding the use of Truckee River water in Lemmon Valley will impact water rights and facilities. At present, approximately 4,200 af of Truckee River water is committed to the Stead area in Lemmon Valley. Of this amount, 3,000 af is exempt from the effluent return flow requirement to the Truckee River. Continued expansion of exports to this basin will require an additional 0.5 af for every 1.0 af of new demand. Current transport facilities (a 14-inch main built by the Air Force in the late 1950s) from the Truckee Meadows to Lemmon Valley are limited to approximately 4.25 MGD, and its capacity fully allocated.

Washoe County and the RWPC have completed considerable water supply and facility plans for the North Valleys. The concept of integrating the North Valleys water systems and operating them as a single system has the following history:

- “Horizon Hills/North Valleys Conjunctive Use Evaluation” (ECO:LOGIC, 1997) prepared for Washoe County
- “North Valleys Water Supply Strategy” (JBR & Montgomery Watson, 1997) was amended to the Regional Water Plan.
- “North Valleys Water Facility Plan,” (ECO:LOGIC, 1999), prepared for the RWPC, provided additional information on water system integration and an economic evaluation.
- In 2001, the RWPC commissioned ECO:LOGIC to follow up the “North Valleys Water Supply Strategy,” by conducting a cost comparison between the most viable groundwater importation projects and a new Truckee River water main to serve the Lemmon Valley and Cold Springs areas.
- “North Valleys Water Supply Comparison” (ECO:LOGIC, 2002) concludes that projected build-out water demand for the Stead / Lemmon Valley area is 12,923 af, including 1,000 af for supplemental water resource needs. With estimated long-term groundwater withdrawals of 2,189 af based on present TMWA and Washoe County groundwater rights holdings, there is a need to import a total of 10,734 af to meet potential build-out demands.

In October 2003, the BLM began preparing a single Environmental Impact Statement (EIS) to jointly analyze two proposed groundwater importation projects, Fish Springs Ranch in the Honey Lake basin and Intermountain Water Supply, a combination of resources in Dry Valley, Warm Springs Valley, Bedell Flat and Newcomb Lake basin. This EIS is tentatively scheduled for completion in December 2004.

2.6.6 Cold Springs Valley

Municipal water supply is provided to Cold Springs from a combination of in-basin groundwater production and imported groundwater from Long Valley. A perennial yield estimate for the Long Valley basin does not exist; therefore it is unclear whether future water demands can be met with existing resources. Long-term concerns exist with importing water into a relatively small, topographically closed basin. Those concerns include raising the water table through septic system discharge, potentially decreased playa-lake flood storage capacity and septic system effluent impacts to groundwater quality. The construction of a sewage treatment plant is complete and will soon be expanded, which could help to alleviate any future septic system failure and effluent contamination. New development will be required to sewer to this plant. The Cold Springs Valley Wastewater Facility Plan (Kennedy/Jenks, 2002) identifies a current nitrate contamination problem caused by existing septic systems. Although the extent of nitrate pollution is limited and municipal wells are not affected, the plan proposes eventual sewering of some or all of the existing septic systems to address the contamination and prevent a municipal supply problem.

2.6.7 Warm Springs

Current demand, which is predominately agricultural, exceeds the groundwater supply. Groundwater levels continue to decline. Conversion of irrigation lands to urban development is expected to reduce the overall pumping. Water right dedication policies will help retire water rights. There is a nitrate problem with respect to a proposed community water system, but this should be overcome with proper municipal well siting.

2.6.8 Truckee Canyon—Verdi / Mogul

Groundwater resources appear to be adequate to meet current demands although groundwater levels are declining in specific areas. There are localized groundwater problems with production rates, hydrogen sulfide, arsenic, iron, and manganese. Washoe County is currently conducting a water resource evaluation. There is evidence that septic system effluent in the groundwater is migrating to the Truckee River, but not affecting groundwater drinking water supplies. The City of Reno and Washoe County are constructing the extension of the Lawton/Verdi Interceptor to Verdi to provide sewer service to this area.

2.6.9 Tracy Segment (Wadsworth)

Water supply resources are dependent entirely upon groundwater. These resources are currently adequate to meet demands although improvements could be made. Washoe County and the Tribe are discussing the construction of a new wastewater treatment plant. Due to irrigation practices in Fernley, poor quality groundwater is migrating to the Truckee River and increasing TDS loading to the river. Mitigation measures are being studied for their feasibility and cost.

2.7 Non-Municipal Water Uses

As noted earlier in this chapter, ten irrigation and two hydropower ditches[2] remain in active use in the Truckee Meadows (Figure 2-11). Table 2-6 summarizes the active ditches, listed in upstream to downstream order. Although pasture and alfalfa hay irrigation continues today, large-scale ranches of 100+ acres have generally been replaced by smaller ranchettes, typically 2.5 to 10 acres in size. Even with conversion of the large ranches, approximately 40,000 af of irrigation water is diverted annually from the Truckee River. Within the Truckee Meadows, the largest percentage of the irrigation application is the farthest geographically from the river. The majority of irrigated agricultural land is located south of South McCarran Boulevard. This requires delivery of water through the densest urban development in the Truckee Meadows prior to application. As a result, it has been a common practice to direct storm water runoff from urban development into the ditch network for conveyance.

Table 2-6
Irrigation and Hydropower Ditches in the Truckee Meadows

Name	Length (miles)	Operational Flow (cfs)	Approximate Diversion[1] (af/yr)
Steamboat	32	50	17,500
Coldron	5.5	unknown	40
Verdi Hydro	2.5	415±	
Highland	12	95	30,000
Washoe Hydro	2.2	415±	
Last Chance	17	20	4,000
Lake	14	15	3,500
Orr	34	40	11,000
Cochran	32	15	950
Pioneer	9	3	4,000

[1] 1989-2002, US Water Master Records

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[2] There are four run-of-the-river diversion and ditch works that operate along the Truckee River, but two of them divert, transport and spill into California, not in the planning area.

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