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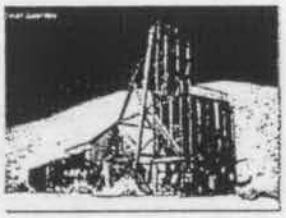
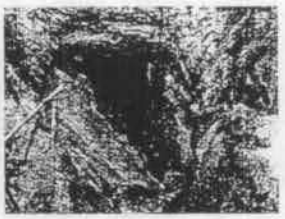
# NYE COUNTY WATER RESOURCES PLAN











Department of Natural Resources
and Federal Facilities

AUGUST 2004

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# NYE COUNTY WATER RESOURCES PLAN

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# CHAPTER 1. OVERVIEW, GOALS, AND GUIDELINES

The Nye County Water Resources Plan is designed as a tool to help guide the development, management, and use of the County's water resources. The plan sets forth the goals and guidelines for planning, defines the water resources and issues related to those resources, and provides specific alternatives and recommendations for the long-term (50-year) management of those resources. This plan was developed in cooperation with the Nevada Division of Water Planning and the Nevada Division of Water Resources.

## Introduction

In this chapter, the goals and objectives of the plan are presented along with the principles that guided its development. The legal and regulatory framework under which water resource development and use are governed a history, of the process that was used in developing the plan, and the relationship between this plan and other planning documents are also summarized. Subsequent chapters detail the socioeconomics, demographics and water resources of Nye County; the issues associated with the development and use of those resources; and specific plans and management practices aimed at addressing those issues.

## Statement of Purpose and Goals

Underlying Philosophy - Nye County's water resources are its most precious natural resource and are basic to all efforts to preserve the environment and resident lifestyles, and to meet the needs of area citizens by providing for their economic well-being and improving their quality of life.

Goals and Objectives - The Nye County Water Resources Plan has been prepared to ensure that adequate supplies of water remain available in Nye County to maintain and enhance the quality of the environment; to improve the quality of life for residents and visitors to the County; and to expand and diversify the economy of the County. The implementation of this plan is in the best interest of the County and the State of Nevada and provides the framework for cooperative management of those resources.

By meeting the following objectives, these goals will be achieved:

1) Define the existing surface and ground water resources of the County
2) Identify existing water uses in the County
3) Identify forecasted growth and future water demands for the period 2000 to 2050
4) Identify water supply issues and management practices
5) Establish short and long-term strategies for the use of water resources in the County to benefit its environment and its citizens

In addressing these objectives, this plan has adopted many of the principles used to guide the 1999 Draft Nevada State Water Plan. The guiding principles that were adopted in the development of this plan are listed in Table 1.

| Table 1. Guiding Principles for the Development of the Nye County Water Resources Plan |
|---|
| 1. All of the water resources of Nye County, whether above or below ground, belong to the public. |
| 2. The water resources needs of future generations of Nye County residents must be protected with a balanced approach that provides for the County's economic goals without detriment to the social, aesthetic, cultural, and ecological values of the County while addressing the needs of the State of Nevada as well. |
| 3. The appropriation and beneficial use of Nye County's water resources are administered by the Nevada State Engineer in accordance with the requirements of Nevada Water Law, and by state and federal court decrees and regulations. |
| 4. Public education and public input are vital aspects of water resources planning and all units of local government, water users, and interested parties should be allowed to participate in the planning process. |
| 5. The Nye County Water Resources Plan must be aimed at accommodating planned growth within the various economic sectors of the County, not restricting it. |
| 6. Water rights in Nye County are private property that may be bought, sold, or traded under free market conditions. |
| 7. The Nye County Water Resources Plan should integrate water supply, water quality, water use, and environmental issues, and should be used to guide decisions that affect the water resources of the County. |
| 8. All water resources development and use in Nye County should be conducted in a manner that is technically, environmentally, and economically sound, and consistent with state and federal laws. |
| 9. The Nye County Water Resources Plan must be consistent with Nevada Water Law and the State Water Plan and must be prepared in consultation with the Nevada Divisions of Water Resources and Water Planning as well as stakeholders in the County. |
| 10. Water conservation is an important component of the planning and management of Nye County's water resources. |
| 11. The Nye County Water Resources Plan must be based upon sound science and water resources evaluation and management principles. |
| 12. The Nye County Water Resources Plan shall be considered for adoption as an element to the Nye County Comprehensive Plan. |

## Institutional Framework

Water resources planning in Nye County must be consistent with County policies and with existing state and federal laws and regulations and any court decrees. In general, the State of Nevada governs the allocation, planning, and management of the water resources, while the federal government has enacted a number of laws and regulations that govern key environmental issues that must be carefully considered in the planning and development of the County's water resources. In this section, an overview of this institutional framework is provided.

**County Policy** - The Nye County Comprehensive Plan lists the County's goals, objectives, and specific policies regarding water resources:

**Goal:** Identify, develop, and maintain adequate water supplies throughout the County to maintain the existing environment and accommodate future economic development needs.

## Objectives:

Develop accurate assessments of water supply and demand in each basin by participating in the Division of Water Planning's work program to assess water use, quality, and future water needs in each basin in the state.

Identify future water demand based on locally developed economic and population projections, produce an inventory of the County's natural resources, and formulate estimates of water necessary to develop those resources.

## Policies:

Ensure that all area land use plans include projections of water demand to support future land use and economic development needs.

Research and develop possible water sources for future recreation potential.

Review the output of the Division of Water Planning's forecast models regarding Nye County to ensure that they are compatible with Nye County's demand forecasts and acceptable to the Nye County Board of County Commissioners.

Develop a conditional use permit process for all pipeline projects (excluding municipal, domestic, and agricultural pipelines within basins) including water transportation projects.

Investigate, develop, and implement other policies and mechanisms to ensure the availability of water supply for future Nye County economic and community development needs.

Established and granted state water rights shall continue to be recognized in support of state law. Water flow, even if originating on public land, even if originating in wilderness areas, shall be governed by the appropriate state laws. Water not currently under application shall not be granted to any federal, state, or local agency or any private entity without the express concurrence and approval of the Planning Commission.

**Statutory Guides** - All waters in Nye County belong to the public and are managed by the State of Nevada in accordance with the provisions of Nevada Water Law (NRS 533 and 534). The Nevada State Engineer determines the limit and extent of water rights including the quantity of appropriative right and any conditions that must be met for the water to be placed to a beneficial use. In ruling on a water right application, the State Engineer must consider four criteria:

1. Is there unappropriated water available for the proposed use?
2. Will the proposed use impair senior water rights?
3. Is the proposed water use in the public interest?
4. Is the proposed project feasible and not filed for speculative purposes?

The 1999 Nevada Legislature, through Senate Bill 108, amended Nevada Water Law to add additional criteria governing interbasin transfers of water by adopting the following revisions to the provisions of NRS 533.370:

> In determining whether an application for an interbasin transfer of ground water must be rejected pursuant to the section, the state engineer shall consider:

(a) Whether the applicant has justified the need to import the water from another basin;
(b) If the state engineer determines that a plan for conservation of water is advisable for the basin into which the water is to be imported, whether the applicant has demonstrated that such a plan has been adopted and is being effectively carried out;
(c) Whether the proposed action is environmentally sound as it relates to the basin from which the water is exported;
(d) Whether the proposed action is an appropriate long-term use which will not unduly limit the future growth and development in the basin from which water is exported; and
(e) Any other factor the state engineer determines to be relevant.

Nye County concurs with these provisions regarding interbasin transfers and has adopted them in the development of this plan.

NRS 278 requires counties in Nevada to prepare and implement master plans. These master plans may include the management and use of water resources.

**Regulatory and Legal Constraints** - Federal law and policy establish standards for clean water, controlling growth in flood plains, and protecting the environment. While each of these goals is beneficial and consistent with the long term goals and values held by Nye County and its citizens, the immediate impact of the legislation is often limiting. The Safe Drinking Water Act and its amendments requires certain protection for sources of drinking water and the Clean Water Act establishes standards for surface and ground water protection.

The National Environmental Policy Act and Federal Land Policy Management Act determine how federal land management agencies can allow the lands they administer to be used. The Endangered Species Act protects certain species of plants, insects, fish, and birds that are native to Nye County. Some of the provisions of these acts impose mandates that are costly for the County to implement, often forcing them to reduce or eliminate other programs that benefit the citizens of the area but are not mandated. Other provisions may hinder development by imposing costly controls on private industry wishing to use federal lands for mining exploration, mining activity, or other business or industrial uses. Nye County maintains good working relationships through Memoranda of Understanding with the local offices of the Department of Energy, Bureau of Land Management and U.S. Forest Service, which helps to minimize the negative impacts while trying to achieve the goals outlined in the federal legislation.

Most of the policy statements outlined in the State Water Policy and state water law and policy reflect the philosophies of Nye County residents. They believe that the state should have primacy in issuing water rights, and they agree that there must be a balance in the appropriation of water resources to protect the interests of rural communities whose populations do not afford them political strength in the state legislature.

## Development Process

**Planning History** - Nye County's Water Resources Plan was initiated and established by the Nye County Board of County Commissioners. The Board of Commissioners has recognized the need for long-term resource and development planning and has worked diligently to accomplish planning goals for several years.

**Consultation with State Authorities** - Preparation of the Nye County Water Resources Plan has involved close coordination with the Nevada State Engineer and the Nevada State Water Planner. Soon after initiating work, the planning team met with the State Engineer and State Water Planner to discuss the proposed outline for, and approach to, completing the final plan. Both the State Engineer and State Water Planner were very helpful in defining a scope for the final plan which would be responsive to both the needs of Nye County and the State of Nevada. Each state agency committed to provide (and have subsequently provided) invaluable information used in the preparation of this plan.

A second round of meetings was held with the State Engineer and staff of the Division of Water Planning to review draft projections of water supply and demand for hydrologic basins in Nye County. Input received from state agency staff have been considered in preparation of this final plan.

**Public Participation** - As noted previously, preparation of the preliminary draft Nye County water resources plan occurred with extensive public input through meetings with Town Boards, Regional Planning Commissions, and the County Commission. Preparation of this final plan has involved extensive interaction with members of the public. Public meetings and workshops were held in Amargosa Valley, Beatty, Pahrump, Tonopah, and Round Mountain. Comments and questions that were raised by the public are summarized in Appendix A to this plan.

## Relationship to Other Plans

**County and Community Plans** - The goals and objectives, conclusions, and recommendations of the Water Resources Plan are consistent with the basic goals, objectives, and priorities established in the County's comprehensive planning efforts for industrial and business development, agriculture and mining, and tourism and recreation, as defined in the following:

Each of these County plans has been reviewed and the pertinent portions included in this plan, either through direct incorporation, or by reference.

- **Nye County Comprehensive Plan 1994**
- **Nye County Overall Economic Development Plan 1993**
- **Amargosa Valley Science and Technology Park Master Plan 1998**
- **Pahrump Regional Planning District Master Plan 1999**

State Water Plan - In 1999, the Nevada Division of Water Planning issued the Nevada State Water Plan. The State Water Plan provides a great deal of information on the water resources and their use in Nye County at the county-wide level. Thus the State Water Plan serves as a useful framework for the more detailed information presented in this plan. In fact, the State Water Plan specifically addresses the need for local water planning and encourages that this planning be done at the basin and watershed level, the approach used in the development of the Nye County Water Resources Plan. The State Water Plan was developed over a five-year period to serve as a guide to the development, management and use of Nevada's water resources. The State Water Plan made a number of recommendations concerning water resource issues. These recommendations are summarized in Table 2. Many of the issues identified in the State Water Plan are relevant to Nye County and are reiterated in the appropriate sections of this plan.

Other Resource Management Plans and Planning Documents - The various state and federal agencies that have stewardship over areas in Nye County have prepared a number of plans that must be taken into consideration in water resources planning:

**U.S. Forest Service** - Humboldt National Forest Land and Resource Management Plan, 1986
**U.S. Department of Energy** - Nevada Test Site Resource Management Plan, 1998
**U.S. Department of Energy** - Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada, 1996
**U.S. Department of Energy** - Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, 1999
**National Park Service** - Draft Environmental Impact Statement and General Management Plan, 1999
**U.S. Air Force** - Draft Environmental Impact Statement Proposed Fallon Range Training Complex
**U.S. Air Force** - Integrated Natural Resources Management Plan, Nellis Air Force Base/Nellis Air Force Range, 1997
**U.S. Air Force** - Water Requirement Study of the Nellis Air Force Range, 1998
**Bureau of Land Management** - Las Vegas Resource Management Plan and Final Environmental Impact Statement 1998
**Bureau of Land Management** - Tonopah Planning Area Resource Management Plan, 1998
**State of Nevada** - Water Conservation Planning Guide

As 93 percent of Nye County's lands are under the stewardship of federal agencies, these documents were important in formulating the issues and management practices contained in this plan. Information contained in these documents related to water resources was incorporated into the Nye County Water Resources Plan either through direct incorporation or by reference.

| Table 2. 1999 Nevada State Water Plan - Issues and Recommendations | | |
|---|---|---|
| **Category** | **Issues** | **Recommendations** |
| **Water Supply and Allocation** | Water Conservation | Establish state Office of Conservation; revise plan requirements; formalize credits for conservation; technical assistance to farmers; fund demonstration projects; meter public supplies; increase reuse of water; start water measurement pilot program |
| | Integrated Water Management | Refine perennial yield estimates; increase recharge/recovery projects; increase multiple source use |
| | Interbasin and Intercounty Transfers | Recognize net value of transfers; ensure transfers are justified, environmentally sound, consistent with regional plans, and do not unduly limit growth; encourage mitigation plans; provide assistance to local government; additional research on water banking and water marketing |
| | Water Use Measurement & Estimation | Develop and fund a comprehensive water use measurement and estimation program |
| | Domestic Wells | Notify counties of impacts of parceling; inventory domestic wells; educate well owners; fund regional water supply and/or wastewater treatment where water quality is impaired |
| **Water Quality** | Non-point Source Pollution | Continue non-point source program |
| | Comprehensive Ground Water Protection and Management | Support state groundwater protection program; develop monitoring network; support evaluation of gasoline additives; expand regional water supplies where septic tank pollution is an issue |
| **Resource Conservation and Recreational Uses** | Maintenance of Recreational Values | Continued resource evaluation and planning; continue acquisition of water rights for recreational purposes; increase watershed and water recreation research and management |
| | Water for Wildlife and Environmental Purposes | Develop integrated plan for management; adopt policy encouraging acquisition of water rights for wildlife; establish incentive based restoration programs; establish working group of experts to study alternative water supplies for wildlife |
| **Flood Management** | Flood Management in Nevada | Develop modeling capability; develop plan to update flood maps; basin planning; review watershed management plans |
| **Water Planning and Management** | Watershed Planning and Management | Develop planning strategy; support local planning; continue basin plans; fund planning |
| | Water Resources Data Management | Develop GIS; establish water use, water level, and water quality monitoring networks; support research projects to update perennial yield estimates |
| | Water Planning Assistance to Local Governments | Enhance assistance to local governments; improve water use measurements and estimates; improve data management and sharing; enhance management and planning |
| | Water Education | Expand water education funding and staffing; increase program evaluation and coordination with water education activities |

# CHAPTER 2. SOCIOECONOMIC AND DEMOGRAPHIC ASSESSMENT

This chapter presents information on the historic, present, and future economy of Nye County, along with information on the population, growth trends, and demographics. As the future population of the County will determine the future demand for water, an understanding of past trends, current water use, and expected future conditions is an important consideration in water resources planning.

## Socioeconomic Background

**Nye County's Economic History** - Nye County's economic prosperity has historically been tied to the fortunes of the mining industry, ranching and farming, and the government sector (most notably the U.S. Air Force and the U.S. Department of Energy). In its early history, the County's settlements were gold and silver boom towns such as Tonopah, Belmont, Manhattan, Beatty, and Rhyolite, and numerous mining camps. While many of the ore bodies have been mined out, mineral extraction remains an important sector of the Nye County economy with significant production of gold, silver, magnesite, and clay minerals along with industrial minerals including zeolites, cinders, and dimension stone. Nye County currently ranks third in gold production in Nevada, behind Eureka and Humboldt counties.

Ranching and farming have been important sectors of Nye County's economy since the Homestead Act of 1862 opened up western lands for development. By 1964, about 446,000 acres of farmland had been developed in Nye County and irrigated pasture and harvested cropland peaked at 47,270 acres in 1965. Since that time, irrigated agriculture has ranged between 24,000 and 34,000 acres in the County. Agriculture remains the single largest user of water in Nye County with almost 80 percent of the total water used in the County going towards irrigation in 1995, according to the Nevada Division of Water Planning.

Since the 1940s, Nye County has been the host to a number of important federal facilities including the Nevada Test Site, the Tonopah Test Range, and portions of the Nellis Air Force Range. Nye County also hosts portions of Death Valley National Park, Ash Meadows National Wildlife Refuge, Railroad Valley Wildlife Management Area, the Yomba and Duckwater Indian Reservations, and portions of the Toiyabe and Humboldt National Forests. In total, 92.7 percent of Nye County's total land area is administered by the federal government. Privately owned lands account for 7.1 percent and state and County owned lands account for less than one percent. Although the federal government administers the vast majority of lands within the County, there has only been limited economic benefit associated with these lands. In 1996, only 189 federal jobs were based in the county, only two percent of the total employment. Over the last decade the reduction of activities at the Nevada Test Site and Tonopah Test Range have resulted in corresponding decreases in employment at these federal facilities and the loss of service jobs in nearby communities.

**Present Economic Conditions** - The County's total work force during 1998 was estimated at 11,510 persons. The primary economic sectors, in terms of employment, are service industries with about 43 percent of the workforce, mining with about 16 percent, and local government with about 13 percent. Recent cutbacks at the Barrick mining operation at Beatty resulted in declines in employment in the mining sector in 1999.

Growth has been explosive in southern Nye County over the last decade with most of the new residents settling in the community of Pahrump. The phenomenal growth of Pahrump has

established Nye County as the fastest growing county in Nevada, on a percentage basis. This growth has resulted in an increase in the construction, trade, and service industry sectors of the economy. An emerging employment sector is related to telecommuters who are increasingly taking advantage of the low cost of living in Nye County, the proximity to Las Vegas and southern California, and the desert environment. Recreation and tourism have also become increasingly important to the economy of Nye County in recent years.

## Demographics

Nye County has initiated aggressive programs to expand and diversify local economies. These initiatives are predicated on expectations of significant growth within the western region of the United States. Forecasts of the future population for western states prepared by the Census Bureau predict that the populations of Nevada and five bordering states will increase by almost 16 million people by 2025. While California will attract most of this growth (9 million), rapid growth is also projected for Nevada with an increase of 1 million people.

This regional demographic trend will likely result in increased demands for products, services, and opportunities within Nye County. With the advent of e-commerce, businesses in Nye County should have a greater capability to sell to a growing market for County-provided goods and services. In addition, tourism is expected to see increased demand as residents of this six-state region travel within and through the area. Nye County's strategic location in central and southern Nevada should be reflected by ever-increasing highway traffic through the area.

Table 3 shows population forecasts by the Nevada State Demographer, the Division of Water Planning, and Nye County through the year 2025. The State Demographer forecasts a larger population for Nevada in 2015 than the Census Bureau forecasts in 2025. If the Census Bureau forecasts are conservative, regional growth in the western states could be significantly greater than currently anticipated. The Division of Water Planning's forecast of Nye County's population in 2018 is 48% lower than the State Demographer's forecast. The Nye County forecast is 26% greater than the Division of Water Planning forecast but 17% less than the State Demographer forecast.

**Table 3. Population Forecasts** Source: Nevada State Demographer, April 1988; DWR June 1998; and PIC 1999.

| Area | 1999 | 2000 | 2010 | 2018 |
|---|---|---|---|---|
| **State Demographer - Nye County** | 32,710 | 35,050 | 53,720 | 65,750 |
| **Div. of Water Planning - Nye County** | 29,482 | 30,417 | 39,182 | 44,399 |
| **Nye County estimate** | 35,820 | 37,990 | 54,254 | 56,030 |
| **Clark Co. (Demographer estimate)** | 1,393,760 | 1,722,630 | 2,031,500 | 2,389,340 |
| **Nevada (Demographer estimate)** | 2,034,020 | 2,421,020 | 2,783,700 | 3,212,260 |

Figure 1 and Table 4 show the historic population of Nye County and the forecasts that have been made. The State Demographer estimates only extended through the year 2010. Nye County extended the Demographer's forecasts using the REMI model. The approach used by the County in running the REMI model was based on active residential utility accounts rather than vacancy factors, and a housing unit method rather than an employment based approach. The housing unit method was used because of the number of DOE employees

**Figure 1. Population Projections by DWP,State Demographer,and Nye County.**

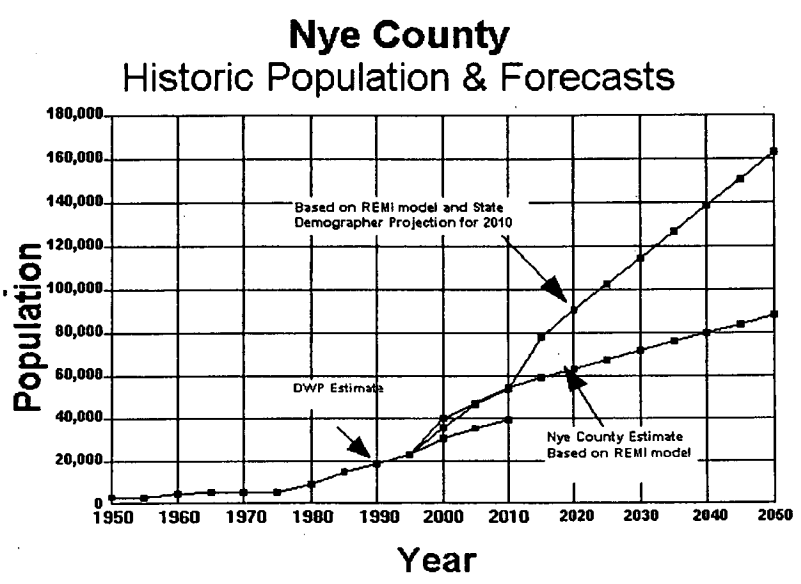



**Table 4. HISTORIC NYE COUNTY POPULATION AND BASELINE FORECAST**

| YEAR | US Census Data | State Demo. Estimate | DWP 1998 Estimate | Nye County | Change (% | Annual Change (% |
|---|---|---|---|---|---|---|
| 1920 | 6,504 | | | | | |
| 1930 | 3,989 | | | | -0.39 | -0.04 |
| 1940 | 3,606 | | | | -0.10 | -0.01 |
| 1950 | 3,101 | | 3,101 | | -0.14 | -0.01 |
| 1955 | | 2,600 | 2,600 | | | |
| 1960 | 4,624 | 4,642 | 4,624 | | 0.49 | 0.05 |
| 1965 | | 5,453 | 5,453 | | | |
| 1970 | 5,599 | 5,459 | 5,459 | | 0.21 | 0.02 |
| 1975 | | 5,500 | 5,500 | | | |
| 1980 | 9,048 | 9,048 | 9,048 | | 0.62 | 0.06 |
| 1985 | | 14,570 | 14,570 | | | |
| 1990 | 17,781 | 18,190 | 18,190 | 18,190 | 0.97 | 0.10 |
| 1995 | | 23,050 | 23,050 | | | |
| 2000 | | 35,050 | 30,417 | 39,495 | 1.17 | 0.12 |
| 2005 | | 45,750 | 34,988 | 46,800 | 0.18 | 0.04 |
| 2010 | | 53,720 | 39,182 | 54,254 | 0.16 | 0.03 |

**RESULTS OF REMI MODEL USING NYE AND STATE DEMOGRAPHER ESTIMATES TO 2010**

| YEAR | Nye County Estimate | Change (% | Annual Change (% | State Data Estimate | Change (% | Annual Change (% |
|---|---|---|---|---|---|---|
| 2010 | 53,900 | | | 66,300 | | |
| 2015 | 59,183 | 0.10 | 0.02 | 78,000 | 0.18 | 0.04 |
| 2020 | 63,131 | 0.07 | 0.01 | 90,100 | 0.16 | 0.03 |
| 2025 | 67,011 | 0.06 | 0.01 | 102,200 | 0.13 | 0.03 |
| 2030 | 71,341 | 0.06 | 0.01 | 114,300 | 0.12 | 0.02 |
| 2035 | 76,025 | 0.07 | 0.01 | 126,400 | 0.11 | 0.02 |
| 2040 | 79,665 | 0.05 | 0.01 | 138,500 | 0.10 | 0.02 |
| 2045 | 83,729 | 0.05 | 0.01 | 150,500 | 0.09 | 0.02 |
| 2050 | 88,000 | 0.05 | 0.01 | 162,700 | 0.08 | 0.02 |

that are in-commuters to Nye County work sites. As the County's approach only went through the year 2008, a constant annual growth rate of three percent was assumed for the period between 2005 and 2050. This assumption is consistent with the current trends in Pahrump Valley which suggest that the present explosive growth rate will not be sustained and that growth will slow appreciably after 2005. It should be noted that the of results the REMI model for such long-term extrapolations simply project future populations on the basis of a trend over a selected period of time. The use of different trends based on longer (or shorter) periods of time will yield varying results.

Because of the wide range in various forecasts of growth in Nye County, an alternative, land-based approach was used. This alternative acknowledges that long-term population projections are, at best, tenuous for regions such as southern Nevada. Table 5 lists the approximate distribution of privately owned lands in Nye County from the 1993 Nye County Overall Economic Development Plan and the 1999 Pahrump Regional Planning Commission Master Plan. There are 51,000 lots or parcels within the eight communities. Of these, the vast majority are located in Pahrump (more than 45,000 lots).

**Table 5. Private Land Uses in Nye County**

| Community | Land Uses | Comments |
|---|---|---|
| Amargosa Valley | 1,300 residential lots<br>732 acres agricultural | |
| Beatty | 741parcels<br>1,624 acres agriculture | |
| Crystal | 95± parcels | parceling planned |
| Gabbs/Reese Valley | 265 parcels in Gabbs | no inventory for Reese Valley |
| Pahrump | 2,500 acres agriculture<br>8,915 residential<br>591 commercial<br>36,109 vacant<br>255 under development | Since this inventory, agriculture has declined further and less than 1,000 acres are probably still irrigated. |
| Manhattan | 497 parcels | |
| Round Mountain | 420 parcels | |
| Tonopah | 1,767 total housing units | no inventory for Tonopah |

Given the forecasts for significant population growth in the western region and related potential for economic opportunity, assumptions about economic growth in Nye County through the Year 2050 have been made. These assumptions are based upon currently planned and approved developments, proposed but as yet unapproved developments, and forecasts of reasonably foreseeable developments.

There are a number of planned or potential developments that are not included in the baseline population projection. The proposed developments that have been identified are summarized in Table 6 along with their locations, hydrographic basin, and current status. Most of the major proposed developments are in Pahrump and ground has already been broken on some of the projects. As not all of these developments have been given final approval, the

**Table 6. Planned and Proposed Developments in Nye County.**

| Proposed Development | Type | Location | Basin | No. of units | Status |
|---|---|---|---|---|---|
| Mountain Falls | residential/commericial | South Pahrump | Pahrump Valley | 8,300 homes, casinos, golf course | started |
| Mayfield Ranch Estates | residential | North Pahrump | Pahrump Valley | 181 lots | started |
| Artesia at Hafen Ranch | residential | South Pahrump | Pahrump Valley | 898 lots | started |
| Front Sight | commercial/residential | Clark/Nye County line | Pahrump and Sandy Valleys | shooting range, 171 lots, 228 condos | started |
| Frito-Lay | agricultural/commercial | Railroad Valley | Railroad Valley | | planning |
| Science and Technology Corridor | public use/educationa commercial, industria | Amargosa Valley | Jackass Flats, Amargosa Desert Oasis Valley, Sarcobatus Flat Ralston Valley | Space museum, technology park 210 mile corridor, 800 acre: | planning |
| Wal-Mart | commercial | Clark County line | Pahrump Valley | 15 acres | planning |
| Lovell Canyon | residential/recreational | | Pahrump Valley | | approved |
| Desert Rock Sky Park | industrial | Nevada Test Site | Mercury Valley | 512 | planning |
| Gate 510 Business Park | industrial | north of Lathrop | Jackass Flats | | planning |
| Smotrich Development | residential | Amargosa Valley | Amargosa Desert | 64 lots | approved |
| Desert Trails | residential | North Pahrump | Pahrump Valley | 1,246 lots | started |
| Timbisha Tribal Lands | residential/commerical | Scotty's Junction | Sarcobatus Flat | unknown | started |
| Yucca Mountain | waste repository | north of Amargosa Valley | Jackass Flats and Crater Flat | repository and support facilities | planning |

growth associated with them is not included in the population forecasts in Figure 1 and Table 4. However, because of the magnitude of some of these projects, they must be accounted for in estimating future water demands in the County. In total, these new developments will result in an additional 11,000 new residential lots in Nye County and will bring the total number of residential lots to almost 59,000. Assuming a full build-out of all available land by the year 2050 and an occupancy rate of 2.5 persons per residence (from the 1990 census) and assuming 1,000 multi-unit lots, then the County's population would be at least 150,000 by the year 2050. The results of this land-based approach agree within 8 percent with the REMI model extrapolations based upon the State Demographers high estimate. Therefore, for planning purposes, the results shown on Figure 1 and Table 4 for the REMI model projections using the State Demographer data are considered the baseline population forecast for Nye County through the year 2050.

In some instances (for example the Science and Technology Corridor and the Desert Rock Sky Park), the exact nature of the land uses have not been well defined. Nonetheless, these developments may result in significant new water demands in some basins. Both direct and indirect increases in population are anticipated as a result of these projects. These increases will be additive to the baseline population forecast.

In addition to the developments listed in Table 6, there are a number of other developments that may be expected to result from the continued expansion and diversification of the Nye County economy over the next 50 years. While not proposed or planned at this time, such developments could result in increases above the baseline population forecasts. The following reasonably foreseeable activities have been identified that may result in additional growth beyond that currently included in the County baseline population forecast:

- Development of 2 destination resorts
- Increased U.S. Air Force activities at Tonopah Test Range
- Increased acreage under irrigation in Railroad and Hot Creek valleys
- Development of agricultural commodity processing and support industries
- Increased tourist visitation to Nye County
- Expansion of hotel/casino operations at the Nevada/California border
- Increased telecommuters locating in Nye County
- Increased semi-retired and retired persons locating in Nye County
- Development of one or more additional oil fields
- Development of one or more large mining projects
- Investment by the State of Nevada in back office facilities in Nye County
- Development of a four-year educational institution in Nye County
- Expanded air service between Pahrump and Las Vegas and Reno
- Other industrial development

It must be noted that forecasting future growth and population in a rapidly changing region such as southern Nevada is difficult and inexact. Any of a number of external factors can result in a significant impact on Nye County's future. However, water planning must be based upon the best available estimates of future demographics and the magnitude and distribution of water demands. With time, the projections and forecasts presented in this plan should be reviewed and the plan modified accordingly to reflect new information and developments.

# CHAPTER 3. WATER RESOURCE ASSESSMENT AND ISSUES

This chapter contains a summary of the surface water and groundwater resources of Nye County and projected water demands and trends. The summary provides information on the sources, quantity, and quality of those resources, the committed and applied-for water rights and the issues associated with the management and use of the water resources of the County.

## Topography

The general topographic expression of Nye County is shown in Figure 2. The topography is typical of the Great Basin physiographic province and is characterized by a number of generally north-south trending mountain ranges separated by broad valleys. Total relief in the basin is more than 9,000 feet, ranging from 11,949 feet above mean sea level at Mt. Jefferson in the Toquima Range to less than 2,300 feet in the lowland portions of Amargosa Valley.

## Climate

The general climate of Nye County depends upon the location. In the northern mountain ranges, sub-humid continental conditions occur, characterized by cold winters and moderate precipitation. The intervening valleys and the region as far south as about Highway 95 exhibit mid-latitude steppe and mid-latitude desert conditions characterized by cold winters, hot summers, and semi-arid to arid conditions. To the south, Pahrump Valley and most of Amargosa Desert have a typical low-latitude desert climate with very hot summers and arid conditions. Up-to-date climate data for each weather station in Nye County can be accessed at: http://www.wrcc.dri.edu/summary/mapnv.html.

Figure 3 shows the distribution of precipitation over Nye County. Most of the County is situated in the South Central climatological division with an average annual precipitation rate of only about 6.25 inches. The southernmost part of the County is in the Extreme South climatological division with an average annual precipitation rate of only about 4.5 inches. At higher elevations, precipitation is much greater and snow accumulates to considerable depths, with more than 80 inches per year of snowfall at the higher elevations of the Toiyabe, Toquima, and Monitor ranges.

Precipitation during the course of a year typically has a bi-modal distribution with most precipitation occurring during either a winter rainy season or during the late summer months. During the winter months, high pressure conditions predominate resulting in west-to-east trending winds and precipitation patterns. During the summer months, low pressure conditions predominate, resulting in southwest-to-northeast trending precipitation patterns. Winter storm events tend to last longer and produce more precipitation than the summer events which tend to produce widely scattered showers of short duration. Drought is common and expected, especially in the southern part of the County where droughts of more than 100 days occur.

In a mid-latitude, dry climate like Nye County's, the average potential evaporation rate exceeds the average annual precipitation, with actual average evaporation ranging from 51 to 72 inches. On an annual basis, as much as 90 to 95 percent of the total annual precipitation is lost through evaporation and transpiration; only an estimated 5 to 10 percent recharges the groundwater regime.

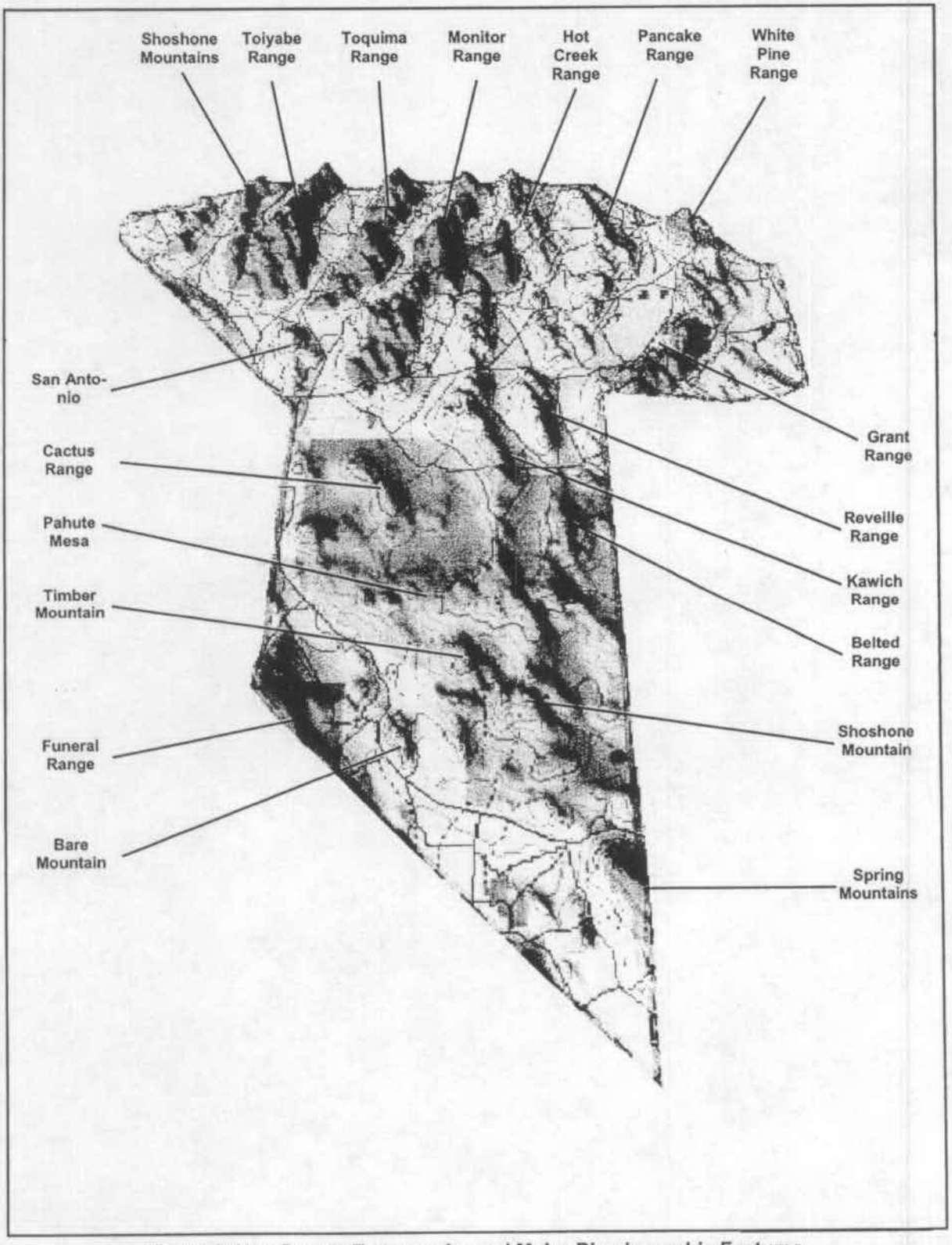



**Figure 2. Nye County Topography and Major Physiographic Features.**
(30° inclination north view from 3-D TopoQuads® Copyright 1999 DeLorme)

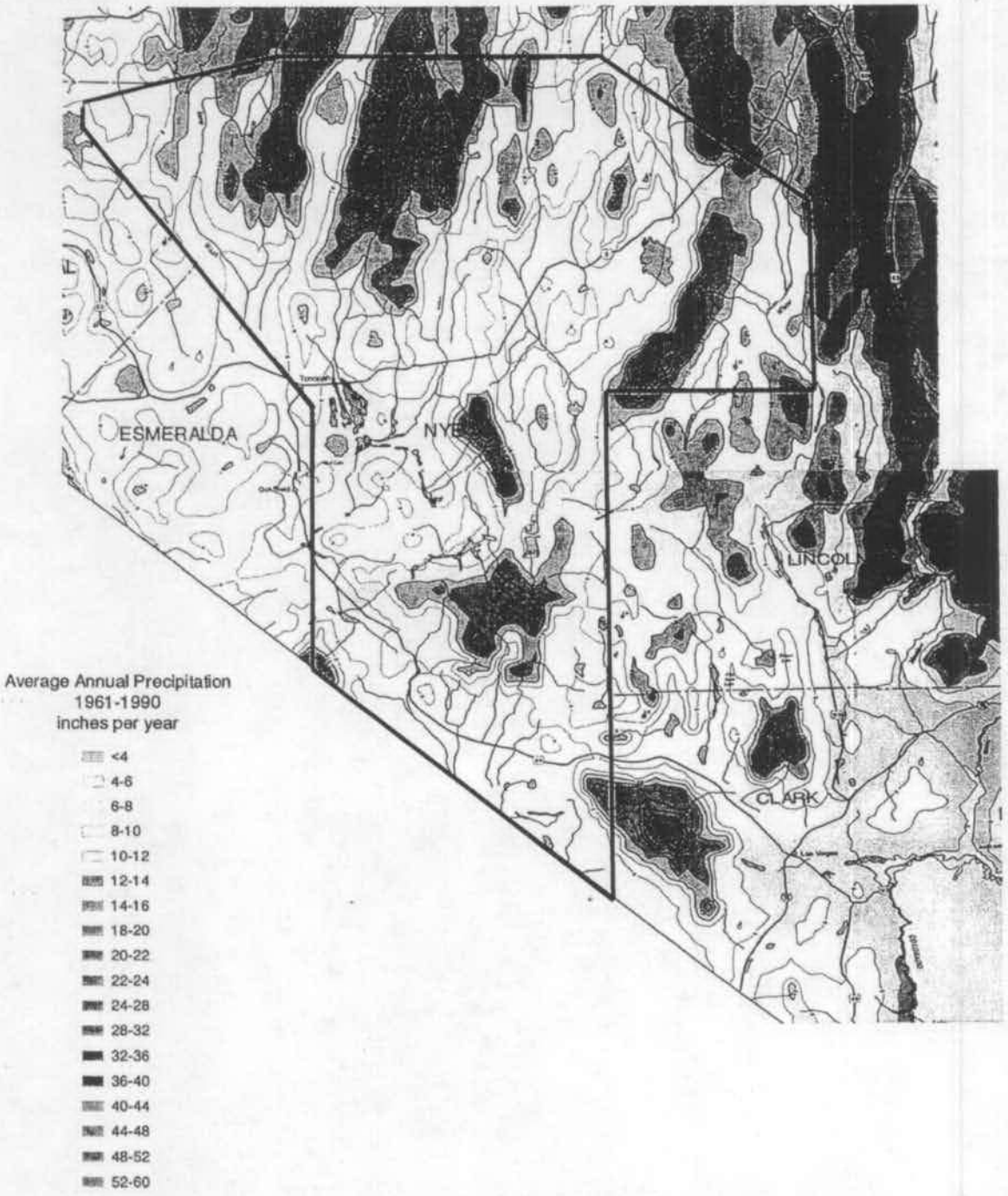



**Figure 3. Distribution of precipitation over Nye County and adjacent areas.**

Source: USDA Natural Resources Conservation Service Nevada Annual Precipitation Map 1998. Note that the published map does not have a contour interval for 16-18 inches.

## Surface Water Resources

Although Nye County has no major lakes, reservoirs, or rivers, there are important surface water resources in many locations. Surface water flows are important sources of irrigation water in the agricultural areas such as White River Valley. Groundwater that discharges to the surface at springs is also an important surface water resource. Many springs in Nye County have been developed for irrigation, livestock watering, municipal and domestic water supplies, and the mining industry. The surface water resources of Nye County are also used for recreational purposes including fishing, hunting, boating and skiing, swimming, camping, picnicking, and relaxation. Finally, but of no less importance, wildlife cannot thrive without a dependable source of water and the springs, streams, and lakes in Nye County support the habitat for many desirable species.

All of the surface water resources (and groundwater resources as well) are derived from the precipitation that falls over the County or adjacent recharge areas. Figure 4 shows a conceptual representation of the interrelationships between the precipitation that falls over the mountainous areas and the surface and groundwater regimes. In this section, information is presented on the surface water resources of Nye County and the issues associated with their protection and use.

Lakes - A complete inventory of all lakes and reservoirs has not been completed for Nye County. Table 9 lists the 22 lakes and reservoirs which are identified in various published sources and the files of the Nevada Division of Water Resources. The largest reservoirs in Nye County are located in White River Valley at the Wayne Kirch Wildlife Management Area (Adams-McGill Reservoir, Hay Meadows Reservoir, and Tule Field Reservoir). This wildlife management area is popular and is widely fished for rainbow trout, black bass, and other game fish. In addition to their importance for fish, these reservoirs also provide habitat for a number of bird species including Western Snowy Plover, Long-billed Curlew, and White-faced Ibis.

Streams - Although there are no major rivers in Nye County, there are many streams that drain the upland areas. These streams derive their flow from three main sources: spring discharges, groundwater discharge along the stream channel, and snow melt. The U.S. Geological Survey has published discharge records for the 16 gaging stations listed in Table 10. The discharge rates for most of these streams are seasonal with peak flows following the spring snow melt in the upland areas.

The streams of Nye County provide the aquatic habitat for many types of fishes including two types of trout (rainbow and brook), native species such as the Railroad Valley Springfish and Railroad Valley Tui Chub, and many other types of fishes. The primary streams that contain game fish populations are Cherry Creek, Cottonwood Dreek, Deep Creek, Hooper Canyon Creek, Pine Creek, and Troy Canyon Creek.

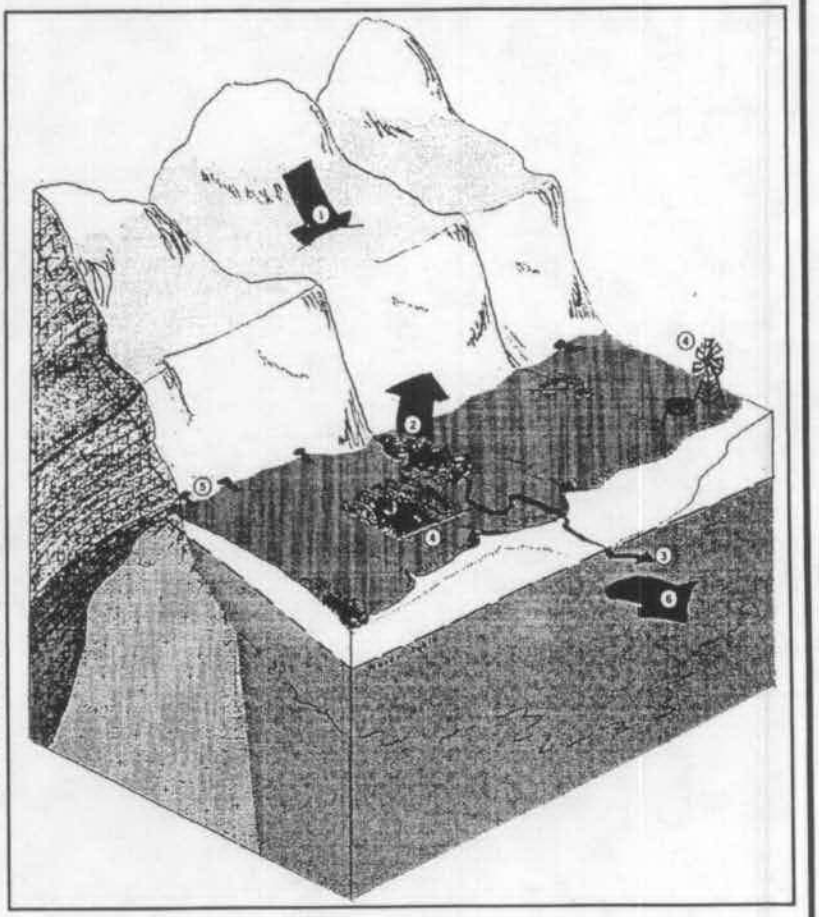
The streams also support extensive riparian and wetland areas. According to Bureau of Land Management documents, there are at least 20 streams in Nye County that support more than 25 miles of riparian habitat. The riparian areas of Nye County provide not only habitat for the fishes listed above and other aquatic species, they provide nesting for a number of bird species including the White-faced Ibis and a number of important raptors including the Bald Eagle, Ferruginous Hawk, and several species of owls.

(Text continues on page 21)

## Figure 4. Conceptual Hydrogeologic Model for Nye County

1. The water resources of Nye County originate as the rain and snow that falls over the upland areas of the County and adjacent areas. Rain and snowmelt run off into the channels and into the fractures in the rock. Some of this water is consumed by the plants and some infiltrates downward to the water table, a process known as *recharge*. Most of the recharge occurs at elevations above 6,000 feet.

2. The streams in Nye County are important water resources. The streams are fed by runoff from the mountains and by springs that discharge in the upland areas. The streams often support riparian areas and wildlife. Along the mountain front, additional recharge occurs through the channels that drain the upland areas. The vegetation that is supported by the streams and springs consume a considerable amount of water through *evapotranspiration*.



3. Surface water flows year round in some springs and streams, but the amount of flow is often quite variable. Following the snowmelt in the late spring, there is usually a surge of discharge in the streams and springs that drain the mountain areas. This surge of flow is also referred to as *rejected recharge* as it represents the excess water that the rocks are not able to intake. Streams that are fed by springs with seasonal flow may dry up completely in the dry months. Streams and springs that flow year round are called *perennial* and seasonal flows are referred to as *ephemeral*.

4. The water that is used by man for irrigation, stockwater, and quasi-municipal purposes is not completely consumed. Water stored in ponds and irrigation canals leaks back into the groundwater system. Some portion of the irrigation water (about 25 percent) infiltrates back into the ground. Even domestic septic systems may return a small quantity of water back into the ground. Collectively, the infiltration of water from these sources is called *secondary recharge*. Secondary recharge can be a large component of the water budget in basins where irrigation is widespread.

5. Spring lines often occur where geologic controls such as faults or contacts are present. These controls cause groundwater to rise to the surface and discharge. In some of the more water-rich basins of Nye County, there are spring lines that are tens-of-miles long.

6. In most basins, the water that recharges the aquifers ultimately flows from up-gradient basins to down-gradient basins. Basins that are hydraulically linked in this manner are referred to as *flow systems*.

**Table 7. Lakes and Reservoirs of Nye County. (Modified from: Scott et al, 1971 and the dam safety records of the Nevada Division of Water Resources; excludes reservoirs related to mining operations.)**

| Lake or Reservoir | Hydrographic Basin | Surface Area (acres) | Storage Capacity (acre feet) |
|---|---|---|---|
| | | | |
| Adams-McGill Reservoir | White River Valley | > 791 | 4,040 |
| Dacey Reservoir | White River Valley | 215 | 784 |
| Hay Meadow Reservoir | White River Valley | 203 | 1,120 |
| Tule Field Reservoir | White River Valley | > 218 | 875 |
| | | | |
| Angleworm Ranch | Railroad Valley | | 5 |
| Cold Springs Dam | Penoyer Valley | | 1,210 |
| Crystal Springs Dam | Amargosa Desert | | 2,300 |
| Little Fish Lake | Little Fish Lake Valley | 80 | 160 |
| Lake C | Amargosa Desert | 70 | 618 |
| Lake No 2 | Amargosa Desert | | 10 |
| Lake No 3 | Amargosa Desert | | 1,200 |
| Lake No 4 | Amargosa Desert | | 650 |
| Lake No 5 | Amargosa Desert | | 3,000 |
| Lake No 6 | Amargosa Desert | | 300 |
| Lake No 7 | Amargosa Desert | | 300 |
| Lake No 8 | Amargosa Desert | | 450 |
| Lower Crystal Marsh Dam | Amargosa Desert | | 400 |
| Manzonie Reservoir | Railroad Valley | 40 | 250 |
| Old Place Dike #3 | White River Valley | | 57 |
| Spring Meadows Lake #1 | Amargosa Desert | | 300 |
| Upper Crystal Marsh Dam | Amargosa Desert | | 50 |

| Table 8. Selected Stream Discharge Measurements in Nye County (Source: U.S. Geological Survey) | | | | |
|---|---|---|---|---|
| **Station Name USGS ID #** | **Period of Record** | **Range in Mean Annual Discharge (CFS)** | **Maximum Discharge (CFS)** | **Minimum Discharge (CFS)** |
| Pine Creek Near Belmont 10245900 | 1977-present | 5.77 to 13.8 | 340 | 0.24 |
| Mosquito Creek Near Belmont 10254910 | 1977-1982<br>1983-present | 2.41 to 7.87 | 119 | 0.04 |
| South Twin River Near Round Mountain 10249300 | 1965 - present | 2.40 to 20.1 | 510 | 0.35 |
| Andrews Creek Near Belmont 10245901 | 1998 | not available | 10 | 0.18 |
| Corcaran Creek Near Belmont 10245602 | 1998 | not available | 1.2 | 0.60 |
| Barley Creek Near Belmont 10245905 | 1998 | not available | 89 | 2.6 |
| Morgan Creek Near Belmont 10245905 | 1998 | not available | 3.1 | 0.61 |
| Big Creek Near Warm Springs 10247200 | 1991-1994 | 1.70 to 2.19 | 22 | 0.05 |
| Amargosa River at Beatty 10251217 | 1993-1996 | 0.63 | 1000 | 0.12 |
| Amargosa River at Highway 95 10251218 | 1963-1968<br>1991-1995 | 0.46 to 1.72 | 16000 | 0.00 |
| Fortymile Wash at Narrows, NTS 10251250 | 1983-1996 | 0.00 to 0.69 | 3000 | 0.00 |
| Fortymile Wash Near Amargosa Valley 10251258 | 1983-1996 | 0.00 to 0.49 | 1430 | 0.00 |
| Cason Slough at Ash Meadows 10251275 | 1983-1996 | 0.59 to 1.59 | 689 | 0.00 |
| Little Currant Creek Near Currant 10246846 | 1964-1981<br>1983-1986<br>1990-1994 | 3.32 to 9.65 | 366 | 0.00 |
| Willow Creek Near Warm Springs 10245190 | 1977-1992 | 1.16 to 5.91 | 92 | 0.00 |
| Sixmile Creek Near Warm Springs 10246930 | 1967-1968<br>1984-1991 | 0.67<br>(1985-1991) | 104 | 0.00 |

CFS = cubic feet per second

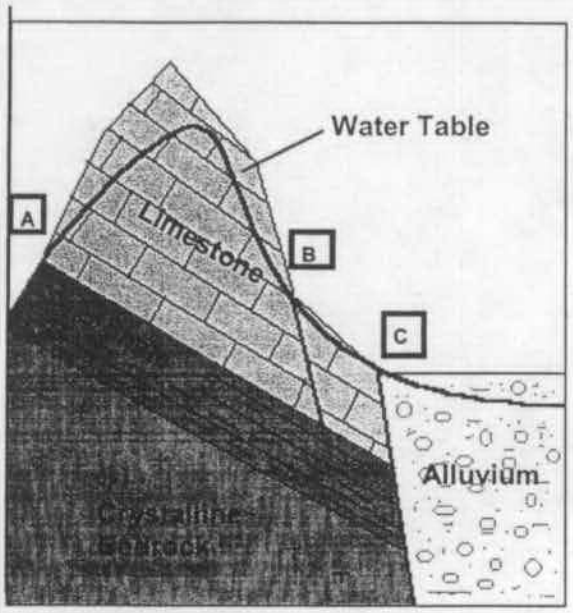
Springs - Nye County is blessed with hundreds of springs that support a number of uses including ranching, mining, and wildlife management. Springs occur wherever groundwater intercepts the land surface and discharges water to the surface water regime. Figure 5 shows the types of springs in Nye County and lists the springs that have measured discharge rates of 450 gallons per minute or more (one cubic foot per second, or cfs, is equal to 449 gallons per minute). The most significant springs in Nye County are located at Ash Meadows National Wildlife Refuge, located east of the community of Amargosa Valley. More than 30 springs and seeps discharge to the land surface at the refuge including Fairbanks Springs, Rogers Springs, School Spring, Point of Rocks Springs, Jackrabbit Springs, Big Spring, Bole Springs, and Grapevine Spring. The refuge was established in 1984 to protect the spring-fed wetlands that support more than 25 plant and animal species found nowhere else in the world. Ash Meadows is touted by the U.S. Fish and Wildlife Service as having the highest concentration of endemic species in North America. Almost 13,000 acres of land have been purchased to eliminate the potential threats to the wetlands that might occur as a result of development.

Adjacent to Ash Meadows National Wildlife Refuge is Devils Hole, a spring pool that is part of Death Valley National Park. Devils Hole is essentially the surface expression of a cavern system in the limestone rocks of the area. The spring pool is the habitat for the Devils Hole pupfish. On June 7, 1976, the U.S. Supreme Court ruled that state-permitted water withdrawals in the vicinity of Devils Hole must be limited to a level necessary to maintain water levels in Devils Hole above a determined level. This ruling followed a National Park Service appeal of a decision by the Nevada State Engineer to permit water withdrawals in the vicinity for irrigation purposes. As a consequence of the Court's ruling, the owners of the farm involved in the legal action were forced into bankruptcy resulting in the shutdown of a 12,000 acre ranch and the loss of more than 80 jobs with an annual payroll of more than $340,000. Because of the Supreme Court ruling and subsequent National Park Service actions, it is no longer feasible to obtain and develop new water rights for lands in the vicinity of Devils Hole.

Since the Court's ruling on Devils Hole, many endemic species at Ash Meadows have been identified resulting in an expanded area of protection. The U.S. Fish and Wildlife Service acquired more than 12,000 acre feet of water rights at Ash Meadows, establishing the federal government as the single largest water right holder in the Amargosa Desert hydrographic basin. The need to protect the wildlife values associated with Devils Hole and Ash Meadows has effectively eliminated a large area up gradient from Devils Hole and the refuge as a source of groundwater for other purposes.

The acquisition of water rights for wildlife is based on the assumption that wildlife values are higher than the value of agricultural productivity or residential development. In practice (at least in southern Nye County), it appears that this assumption is valid. It has already been demonstrated that the wildlife values associated with Ash Meadows and Devils Hole are higher, in pure economic terms, than the values associated with other types of productivity. These values benefit society as a whole, but the cost of the policy that provides these benefits falls on a small fraction of society, in the case of Ash Meadows, the economy of Nye County. The farmer in Amargosa Valley may not increase his productivity so that another individual, organization, or society in general may enjoy the benefit of the preservation of Ash Meadows.

Nye County recognizes the need to preserve the important wildlife values at Ash Meadows and Devils Hole and is committed to working with the federal and state agencies to protect these values. However, it must be noted that preservation is not without a price. In this instance, the cost to County includes a loss of productivity and associated revenues.




## FIGURE 5. TYPES OF SPRINGS IN NYE COUNTY

A. Contact Springs - This type of spring occurs where permeable rocks such as limestone come into contact with less permeable rocks such as shale. These types of springs occur widely throughout Nye County.

B. Structural Springs - This type of spring occurs where faults, joints, or fractures provide an avenue for water to reach the land surface. Structural springs are also widespread in Nye County in the mountainous areas.

C. Depression Spring - This type of spring occurs where the land surface is below the water table. Depression springs are common in the lowland portions of Nye County and are especially sensitive to the impacts of water withdrawals.

## MAJOR SPRINGS IN NYE COUNTY (> 450 gpm Discharge)

| BASIN | SPRING NAME | DISCHARGE (GALLONS PER MINUTE) ELEV. | MAXIMUM | MINIMUM | LATEST MEASUREMENT |
|---|---|---|---|---|---|
| 137B | CHARNOCK SPRINGS | | 450 EST | | 1913 |
| 137B | DARROUGHS HOT SPRING | | 450 EST | | UNK |
| 140A | DIANA'S PUNCH BOWL | | 900 EST | | 1964 |
| 156 | HOT CREEK SPRING | | 4000 EST | | UNK |
| 162 | BENNETTS SPRINGS | | 3350 | 0 | 1963[1] |
| 162 | MANSE SPRINGS | | 2700 | 0 | 1976[2] |
| 162 | POTTS RANCH SPRING | | 450 EST | | 1964 |
| 173B | BIG SPRING | 4820 | 539 | 539 | 1980 |
| 173B | BLUE EAGLE SPRINGS | 4765 | 2514 | 2065 | 1994 |
| 173B | LITTLE WARM SPRING | 5590 | 1527 | 1212 | 1994 |
| 173B | BIG WARM SPRING | 5605 | 6735 | 6286 | 1994 |
| 207 | HOT CREEK SPRING | 5225 | 9200 | 1527 | 1998 |
| 207 | BUTTERFIELD SPRING | 5320 | 1530 | 1482 | 1998 |
| 207 | FLAG SPRING #1 | 5290 | 1570 | 943 | 1998 |
| 207 | FLAG SPRING #2 | 5280 | 1570 | 1020 | 1998 |
| 207 | FLAG SPRING #3 | 5290 | 1260 | 539 | 1998 |
| 230 | FAIRBANKS | 2265 | 1500 | 1400 | 1993 |
| 230 | CRYSTAL POOL | 2195 | 2245 | 2155 | 1994 |
| 230 | BIG SPRING | 2240 | 1400 | | 1993 |
| 230 | ROGER'S SPRING | 2275 | 627 | 494 | 1994 |
| 230 | LONGSTREET SPRING | 2310 | 943 | 943 | 1997 |
| 230 | POINT OF ROCKS | | 1100 | | 1962 |

1 Discharge at Bennetts Spring was estimated at 3,350 gallons per minute in 1875. In 1940 the discharge was measured at 2,540. By 1956, the discharge had dropped to 2,540 gallons per minute and by 1959, the spring was dry.
2. Manse Spring was estimated 2,700 gallons per minute in 1875, 1100 gallons per minute in 1958-1960 and was dry during the summer months in 1975 with seasonal discharge since that time.

Value of Surface Water Resources - In addition to their direct value as water rights, the surface water resources have significant indirect economic benefits. According to the 1973 State of Nevada Water Planning Report, more than 28,000 visits were made to Nye County's streams, lakes and reservoirs, and springs in 1970, with an estimated total value of about $137,000, and it was projected that visits by 2020 would exceed 480,000. Based on 1970 dollars, this projected level of visitation would have an estimated total value of $2.4 million.

Water Quality - The quality of Nye County's surface water is in compliance with the 1972 Clean Water Act; however, surface water quality is subject to impacts from human activities and natural causes. The vulnerability assessments conducted for public water supply systems did not identify any contamination of surface water drinking sources in the County.

Committed Resources - The total quantity of surface water resources in Nye County is not known and the quantity of committed resources is not known with precision. Table 11 lists surface water right data obtained from the Nevada Division of Water Resources. These data have not in all cases been supplementally adjusted, and may, therefore, include water rights that are used with groundwater rights or with multiple points of diversion. The reader is referred to the notes on Table 14 regarding the accuracy and validity of these estimates.

In total, approximately 157,000 acre feet per year of surface water rights are outstanding in the basins that are wholly or in part located in Nye County. An additional 15,000 acre feet of applications are currently either ready for action or ready for protest. Of the 157,000 acre feet of surface water rights, more than 80 percent are located in four individual basins, about 44,000 acre feet in Big Smoky Valley, almost 37,000 acre feet in Amargosa Valley, about 30,000 acre feet in Monitor Valley, and almost 22,000 acre feet in Pahrump Valley. The bulk of the applications and applications that are ready for protest or action are also limited to a few basins, Big Smoky Valley, Alkali Spring Valley, and Hot Creek Valley.

Surface Water Issues - The key issues related to the surface water resources are the protection of spring and stream discharge rates, the management and use of riparian areas, and the maintenance of surface water quality. Spring and stream discharges in Nye County may be reduced by diversions for beneficial use (a permitted activity), drought (a natural condition), or the effects of groundwater pumping that is located too near to surface water bodies. Figure 6 shows how springs may be affected by groundwater pumping. The potential for impacts on springs depends upon the proximity of the pumping, the hydraulic characteristics of the aquifer, and the magnitude and duration of pumping.

Historic impacts on springs in Pahrump Valley have been well documented. Discharge at Bennett Spring was measured at 3,350 gallons per minute (7.5 cfs) in 1875, and more than 2,500 gallons per minute (5.6 cfs) in 1940, but was dry by the end of 1959. At Manse Spring discharge dropped from a historic high of 2,700 gallons per minute (6.09 cfs) in 1885 to 1,400 gallons per minute in 1940, and was dry during the summer months by 1975. In the late1990s, Manse Spring began to flow again, reflecting wetter than normal climatic conditions and a decrease in agricultural water withdrawals in the vicinity of the spring.

The reduction of spring discharges in Pahrump Valley has resulted in the loss of an endemic fish species, the Pahrump killifish, as well as other fish species that depended on the spring pools for habitat. The U.S. Fish and Wildlife Service had to save the endemic species from extinction by relocating the remaining population to a site in White Pine County.

(Text continues on page 26)

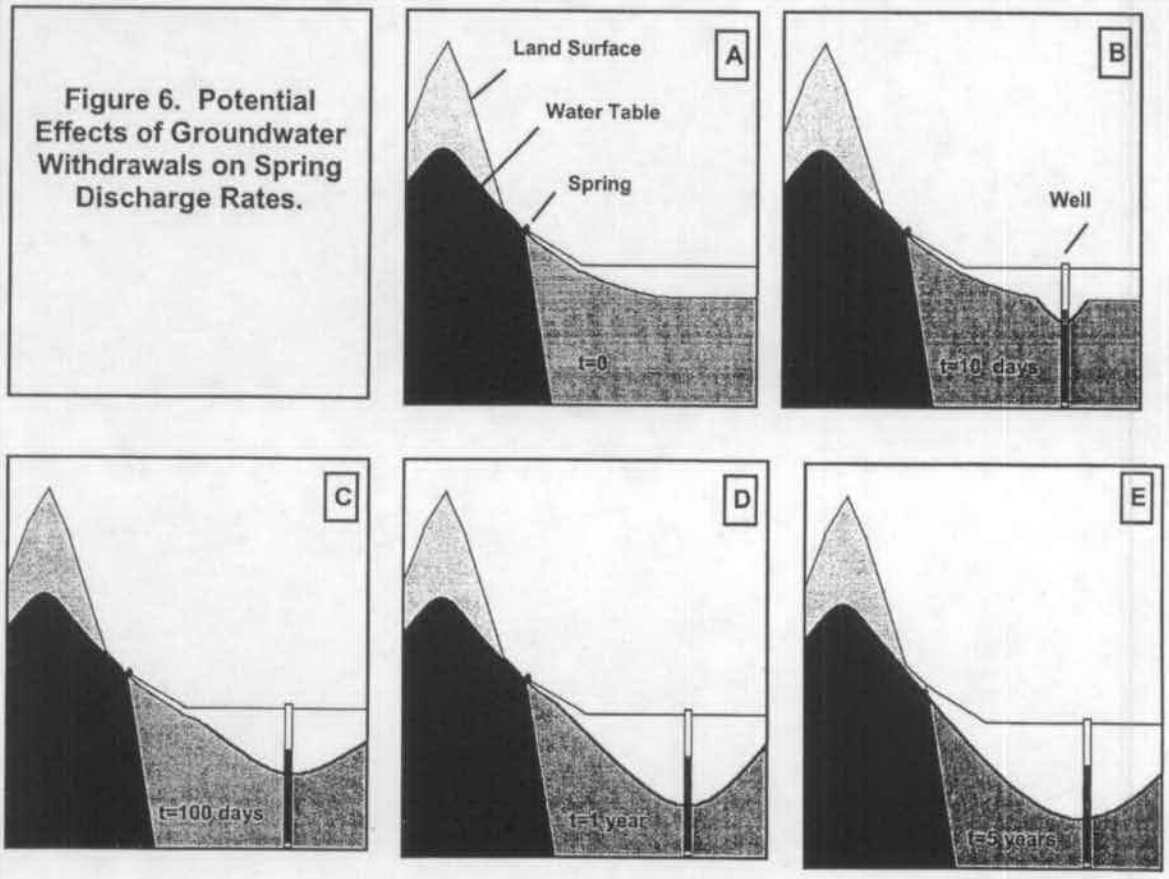
## Table 9. Summary of Surface Water Rights and Applications In Basins of Nye County.

**All figures in acre feet. Source: Division of Water Resources Files. *Note: Only basins with DWR data are listed.***

| BASIN | Applied For | Certificated | Permitted | Reserved | Vested | Ready for Action | Ready for Protest | Total Allocated | Total Demand |
|---|---|---|---|---|---|---|---|---|---|
| Alkali Spring Valley | | 199 | | | | | | 199 | 199 |
| Amargosa Desert | | 36,998 | 0 | | | | 2,800 | 36,999 | 39,799 |
| Antelope Valley (Eureka & Nye) | | 142 | | 543 | 11 | | | 696 | 696 |
| Big Smoky Valley | | | | | | | | 0 | 0 |
| Big Smoky Valley - Northern Part | | 18,198 | 9,481 | 236 | 5,631 | 1,280 | 8,330 | 33,546 | 43,156 |
| Big Smoky Valley - Tonopah Flat | | 9,049 | | 155 | 1,237 | | 5 | 10,441 | 10,447 |
| Buckboard Mesa | | | | | | | | 0 | 0 |
| Cactus Flat | | 151 | | | | | | 151 | 151 |
| Coal Valley | | | | | | | | 0 | 0 |
| Crater Flat | | 9 | | 2 | | | | 11 | 11 |
| Eagle Valley | | | | | | | | 0 | 0 |
| Emigrant V. - Groom Lake Valley | | 11 | | | 0 | 18 | 0 | 11 | 29 |
| Emigrant V. - Papoose Lake Valley | | | | | | | | 0 | 0 |
| Frenchman Flat | | 4 | | | | | | 4 | 4 |
| Gabbs Valley | | 820 | 3 | 7 | 293 | | | 1,123 | 1,123 |
| Garden Valley | | | | | | | | 0 | 0 |
| Gold Flat | | 11 | | | | | | 11 | 11 |
| Grapevine Canyon | | | | | | | | 0 | 0 |
| Hot Creek Valley | | 1,796 | 239 | 412 | 373 | 0 | 1,684 | 2,820 | 4,504 |
| Indian Springs Valley | | 6,018 | 275 | | 360 | | | 6,652 | 6,652 |
| Ione Valley | | 206 | | 54 | 396 | 160 | | 656 | 816 |
| Jackass Flats | | 4 | | | | | | 4 | 4 |
| Kawich Valley | | 4 | | | | | | 4 | 4 |
| Lida Valley | 4 | 2,623 | | 8 | 0 | | | 2,631 | 2,635 |
| Little Fish Lake Valley | | 50 | | 139 | 40 | | | 228 | 228 |
| Little Smoky Valley | | | | | | | | 0 | 0 |
| Little Smoky Valley Central Part | | 30 | | | | | | 30 | 30 |
| Little Smoky Valley Southern Part | | | | | | | | 0 | 0 |
| Mercury Valley | | | | | | | | 0 | 0 |
| Middle Reese River Valley | | 1,339 | | | 1,524 | | 0 | 2,863 | 2,863 |
| Monitor Valley | | | | | | | | 0 | 0 |
| Monitor Valley Northern Part | | 15 | 9 | 13 | 1,053 | | 16 | 1,090 | 1,106 |
| Monitor Valley Southern Part | | 5,608 | | 40 | 23,135 | 0 | | 28,783 | 28,783 |
| Oasis Valley | | 1,863 | 1,158 | 28 | 1,024 | | | 4,073 | 4,073 |
| Pahrump Valley | | 3,723 | 14,812 | | 3,135 | 0 | | 21,670 | 21,670 |
| Penoyer Valley (Sand Spring Valley) | | | | | | | | 0 | 0 |
| Railroad Valley Southern Part | | | | | | | | 0 | 0 |
| Ralston Valley | | 149 | 40 | 40 | 5 | 8 | 7 | 235 | 250 |
| Rock Valley | | | | | | | | 0 | 0 |
| Sarcobatus Flat | | 77 | | | | | | 77 | 77 |
| Smith Creek | | 1,847 | | | 25 | 640 | | 1,872 | 2,512 |
| Stone Cabin Flat | | | | | | | | 0 | 0 |
| Stonewall Flat | | | | 2 | | | | 2 | 2 |
| Yucca Flat | | 71 | | | | | | 71 | 71 |

**Demand = Sum of Applied For, Certificated, Permitted, Reserved, Vested, Ready for Action and Ready for Protest**
**Allocated = Sum of Certificated, Permitted, Reserved, and Vested**

**Figure 6. Potential Effects of Groundwater Withdrawals on Spring Discharge Rates.**




A. Prior to pumping, the natural hydrologic system is in balance with flow from recharge areas over the mountains to discharge areas along the valley axis or out of the basin via underflow. Where the water table intercepts the land surface, groundwater discharges to the surface as springs.

B. With the onset of pumping, water levels are lowered in the vicinity of the production wells. The amount of water level decline that will occur depends upon a number of factors, including the pumping rate and duration, and the ability of the underground aquifers to store and transmit groundwater. If more than one production well is present a pumping center may develop where the cones of depression of each well begin to overlap.

C. With continued pumping, the area over which declines occur begins to expand outward from the pumping well or wells.

D. As water withdrawals continue over time, the area of influence of the wells begins to approach the edges of the valley-fill aquifer or the geologic structure controlling the spring. Spring discharge rates may then begin to decline.

E. The effects of long-term withdrawals can expand beyond the valley-fill aquifer and can eliminate the natural discharge of springs. Springs have been dried up in this manner in a number of Nevada basins including Las Vegas Valley, Pahrump Valley, and Clayton Valley. Wetlands and habitats associated with the springs can also be eliminated or significantly reduced in size.

An issue of significance in northern Nye County centers around riparian areas. Figure 7 shows the general hydrologic characteristics of riparian areas and the management practices that can be employed for their protection. The use and management of riparian areas has become a source of increased awareness and conflict over the last decade. The goal of certain environmental groups and coalitions to remove cattle from all riparian areas in the western states is a threat to the livestock industry of Nye County. Conversely, the potential effects of cattle on riparian areas cannot be entirely discounted, and, if not properly managed, livestock grazing can adversely impact the sporting and tourism industries that also provide important sources of revenue to the County. Nye County does not believe that the goals of the ranching industry and sound environmental management are mutually exclusive. By adopting the appropriate management practices, the effects of livestock grazing on riparian areas can be minimized, if not entirely eliminated. Nye County has, and will continue to, promote cooperation between the diverse groups interested in the riparian areas within the County by coordinating resource management efforts with riparian and environmental enhancement coalitions.

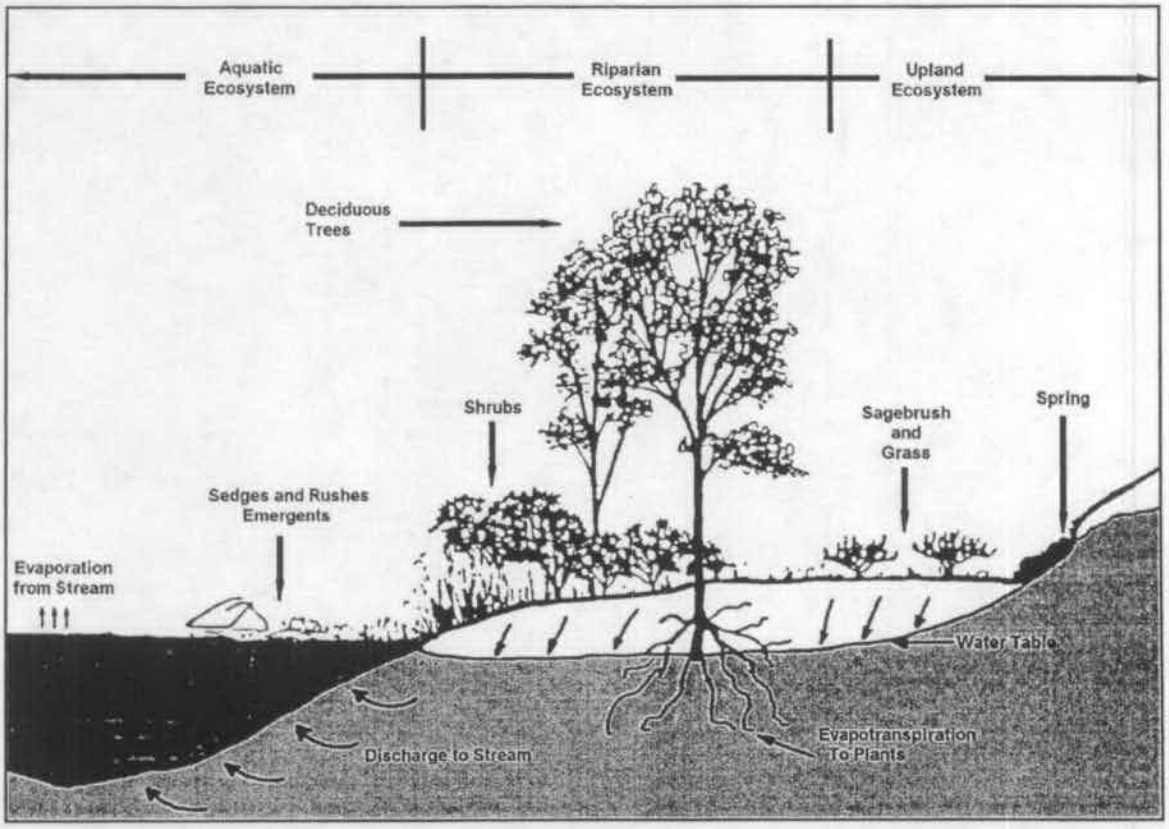
Several issues raised in the Nevada State Water Plan (Nevada Division of Water Planning, 1999) are relevant to surface water resources in Nye County. According to the State Water Plan, surface water accounted for 47 percent of total water use in the County during 1985. By 1990, surface water had dropped to 13 percent of the total water use in Nye County but by 1995 had risen to 17 percent of the total. The majority of surface water use is for agriculture.

Key surface water management issues in Nye County include:

- **Conservation**
- **Relationships between surface and ground water uses**
- **Interstate and intercounty management and use**
- **Water use measurement and estimation**
- **Nonpoint source pollution**
- **Meeting recreational demands**
- **Maintenance of instream flows**
- **Flood hazard reduction**

These issues are addressed in following sections to this plan.

**Figure 7. Riparian Area Issues & Management Practices**




## ISSUES

- Livestock production is an important economic sector in northern Nye County.
- The ranching industry, in accordance with Nevada Water Law, has obtained the legal right to divert water from streams and springs and to withdraw groundwater for livestock watering.
- Livestock and wildlife may trample vegetation and overgraze forage in riparian areas.
- Livestock and wildlife may disturb the soils in riparian areas.
- Wildlife may be trapped and drowned in troughs and spring developments.
- Livestock and wildlife may impact water quality in riparian areas.

## MANAGEMENT PRACTICES

- Convey water from streams to watering sites away from riparian areas.
- Move salt blocks away from riparian areas.
- Fence selected riparian areas in National Forests
- Monitor impacts of grazing on riparian areas.
- Install walkways to prevent trapping and drowning.
- Promote cooperation between the ranching industry and federal land management agencies for the long-term management of range lands.

## Groundwater Resources

In addition to its surface water resources, Nye County has considerable groundwater resources. Groundwater occurs at various depths under the entire county and has been developed for municipal, agricultural, and mining supplies as well as for other purposes. In recent years, the demand on the groundwater resources has grown significantly, in part reflecting the growth of the various economic sectors of the County, and in part reflecting the interest in exporting water from Nye County through large-scale interbasin transfers of water. Because most of the surface water resources of Nye County have already been appropriated, the groundwater resources represent the only remaining source of water that is available to support the future well-being of the County, through diversification and expansion of the economy.

In this section, an overview of the groundwater resources of Nye County is presented. This overview includes a description of the hydrologic conditions and sources of water, the quantity of water that is present, the quality of that water, the committed groundwater resources, and the issues associated with their development and use.

General Geologic Conditions - With respect to their significance to groundwater, the geologic units of Nye County may be grouped into seven categories: 1) valley-fill deposits, comprising mixtures of gravel, sand, silt and clay that include the alluvial and playa deposits; 2) younger volcanic rocks, comprising ash-flow tuff and basalt; 3) older volcanic rocks, comprising dacite, latite, andesite, and tuffs; 4) Triassic sediments, comprising freshwater limestone, conglomerate, sandstone, siltstone, and tuff; 5) intrusive rocks, comprising granitic plutons; 6) upper Paleozoic carbonate rocks, comprising predominantly limestone and dolomite, but with inter-bedded shale and siltstone aquitards; and 7) lower Paleozoic and older rocks, comprising predominantly clastic rocks including shale and quartzite, but with some inter-bedded carbonate units. For more detailed descriptions of the geologic units present, the reader is referred to Nevada Bureau of Mines and Geology Bulletin 77, Geology and Mineral Resources of Southern Nye County, Nevada, 1972, by Henry R. Cornwall, and Bulletin 99A, Geology of Northern Nye County, Nevada, 1985, by Frank J. Kleinhampl and Joseph I. Ziony.

In general, the geologic units of Nye County can be divided into three major aquifer systems, the valley-fill aquifers, the volcanic aquifers, and the regional carbonate aquifer. The regional carbonate aquifer is divided into six systems: an upper carbonate system, an upper clastic aquitard, a lower carbonate system, a Cambrian aquitard, a middle Cambrian carbonate aquifer, and a lower clastic aquitard.

The ability of the aquifer systems of Nye County to store and transmit groundwater, and to yield water to wells, depends upon the type of aquifer and its characteristics. Typically, the alluvial deposits are more productive where they comprise coarse-grained gravels and sand deposits, but exhibit low well yields in the playa areas where clay predominates. The production of the consolidated volcanic and carbonate aquifers depends largely on the degree of faulting and fracturing. The limestone and dolomite units, where fractured, can be quite productive aquifers, with yields of 3,000 gallons per minute reported for some wells drilled into similar units in Clark County.

Some geologic units have little or no productivity because of their fine-grained nature. These units include shale, quartzite, and granite. If fractured, these units may be capable of producing

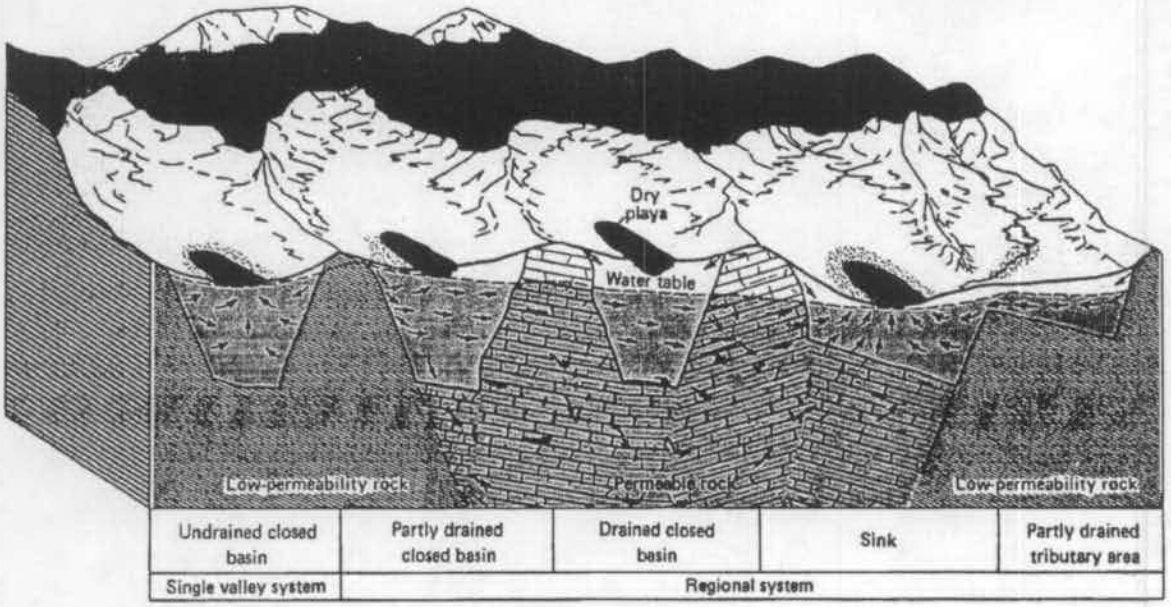



**Figure 8. Conceptual hydrogeology of the basins of Nye County.**
Modified from U.S. Geological Survey Professional Paper 813-G.

low to moderate well yields (a few tens of gallons per minute), but generally act as aquitards (units that tend to retard the movement of water horizontally and vertically between aquifers).

The distribution of geologic units and the relationships between aquifers and aquitards is quite variable because of the past geologic history of Nye County. The carbonate and other sedimentary rock units that were originally deposited as flat lying sediments on the ocean floor have since been faulted, folded, fractured, and in some instances, intruded by granitic rocks. Low-angle faults have resulted in older rocks being thrust over younger rocks while high-angle basin and range faults have resulted in significant offsets in geologic units. The intrusion of plutons has further disturbed the rocks and aquifers. The net result of this deformation is that the aquifers in Nye County are not continuous. Rather, they are broken into discrete compartments that are usually bounded either by fault zones or contacts between rocks with contrasting hydraulic properties. This compartmentalization is an important, but poorly understood, aspect of the regional hydrologic conditions. The regional carbonate aquifer, for example, is commonly perceived as a continuous aquifer while in reality, it has been broken up both horizontally and vertically into dozens, and perhaps hundreds, of individual compartments. A better understanding of how these compartments interact can only be achieved through further testing and study.

Groundwater Occurrence and Flow - Figure 4 shows the conceptual hydrogeologic conditions in Nye County. Recharge derived from precipitation over the upland areas replenishes the groundwater reservoir each year. Groundwater flows from the upland areas toward the valley floors. In undrained basins, all of the groundwater stays within the basin where the recharge fell and is discharged to the surface or consumed by plants (a process referred to as evapotranspiration).

Where two or more basins are hydraulically connected, they form a flow system. Figure 10 and Table 12 summarize the groundwater flow systems that underlie Nye County. The Railroad Valley system and the Death Valley system are the two major flow systems in the County, but recharge over Nye County provides appreciable water to the Northern Big Smoky Valley system, the Diamond Valley system, the White River system, and the South Central Marshes system. The hydraulic connection between individual basins in each of these systems is usually the carbonate rocks that underlie the valley-fill deposits and crop out in the mountains. These rocks are commonly referred to as the regional carbonate aquifer.

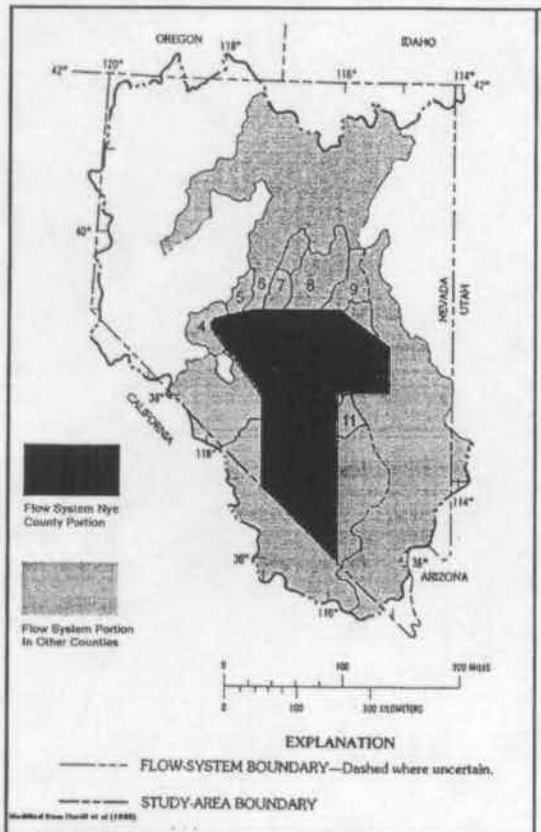
The sources of groundwater in these flow systems include recharge from precipitation, mountain runoff, and regional inflow from carbonate rock aquifers. The regional carbonate aquifer stores hundreds of millions of acre feet of water. However, the U.S. Geological Survey has estimated that if the water stored in the upper 100 feet were extracted, the central carbonate aquifer could yield about six million acre feet of stored water. It is important to note, however, that the extraction of such huge volumes of water, and the subsequent lowering of water levels, could have significant adverse impacts on the groundwater regime of the basins where extraction occurs. The issues associated with this type of groundwater development are discussed in a later chapter.

From a water planning perspective, the recognition of flow system sources and discharge areas is important. As an illustrative example, the Death Valley flow system is of particular note as it includes 20 hydrographic basins that are located wholly, or partially, in Nye County. Within this flow system, recharge derived from Clark County and northern Nye County provides the source of most of the groundwater in southern Nye County. The groundwater in Pahrump Valley and eastern Amargosa Desert is derived primarily from precipitation that falls over the Spring Mountains. The groundwater in central Amargosa Desert is derived primarily from recharge from the Sheep Range, in north-central Clark County.

Much of the groundwater in the eastern and central Death Valley system discharges at the springs and evapotranspiration areas in the Nevada portions of Amargosa Desert and Pahrump Valley. Some discharges in California at the springs at Tecopa and the playa area south of Death Valley Junction. Some portion of the groundwater discharge at the springs and saltpan at Death Valley may also be derived from the underflow of groundwater from Nye County that originated as recharge over Clark County (or even portions of Lincoln County). Thus, much of southern Nye County's groundwater resources are dependent upon recharge in Clark County and some areas in California are dependent upon the portion of this recharge that crosses the state line from Nye County into Inyo County. This situation points to the need for cooperative water planning across county and state lines to insure that developments in one part of a flow system do not result in unacceptable impacts in other portions of the flow system.

General Basin Hydrology - Nye County has all, or portions, of 43 individual hydrographic basins. Figure 11 shows the locations of these basins and Table 13 provides summary information concerning the water budget parameters for each of these basins. The water budget in its simplest form is an accounting of the inputs to and outputs from a basin. The water budget is a balance where the groundwater recharge from all sources equals the total discharge. Recharge to the groundwater system in each basin is derived primarily from the precipitation that falls above an elevation of about 6,000 feet above mean sea level. In the northern part of the County, the bulk of the recharge over the County occurs over the Toiyabe Range, Toquima Range, Hot Creek Range, and Grant Range. Lesser recharge in the north is contributed over the White Pine Range and Shoshone Mountains.

(Text continues on page 34)

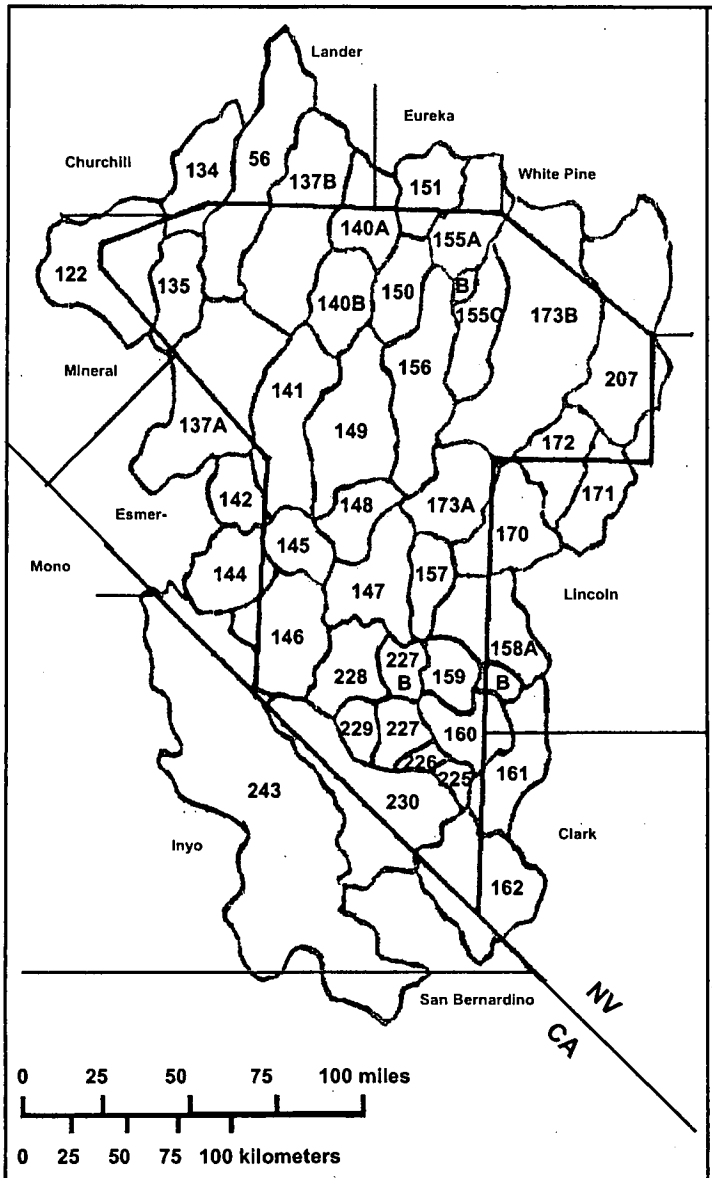



Nye County includes portions of eleven groundwater flow systems. Collectively, these flow systems total more than 68,000 square miles. The most important flow systems in Nye County are the Death Valley system, the South Central Marshes system, the Railroad Valley system, and the Colorado system. Recharge over the mountainous areas of the region sustains much of the flow through the Death Valley and Railroad Valley systems with much smaller contributions to the other flow systems.

The groundwater in these systems ultimately discharges to regional sinks including the saltpan at Death Valley in Inyo County, the Muddy Springs area in Clark County, discharge areas in Esmeralda County, and the extensive springs and evapotranspiration areas in central Railroad Valley, Big Smoky Valley, and Little Fish Lake Valley.

| Map No. | Flow System | Basins | Area sq mi | Nye County Portion |
|---|---|---|---|---|
| 1 | Death Valley system | 30 | 15,800 | Amargosa Desert, Buckboard Mesa, Cactus Flat, Crater Flat, Death V., Groom Lake V., Papoose V., Frenchman Flat, Gold Flat, Indian Springs V., Jackass Flats, Kawich V., Lida V., Mercury V., Oasis V., Pahrump V., Rock V., Sarcobatus Flat, Stonewall Flat, Yucca Flat |
| 2 | South Central Marshes system | 12 | 6,790 | Alkali Spring Flat, Big Smoky V., Ione V., Ralston V., Stone Cabin V. |
| 3 | Railroad Valley system | 4 | 4,130 | Hot Creek V., Little Fish Lake V., Little Smoky V. south Railroad V. north |
| 4 | Gabbs Valley | 1 | 1,280 | Gabbs V. |
| 5 | Smith Creek Valley | 1 | 582 | Smith Creek Valley |
| 6 | Humboldt system | 34 | 16,800 | Upper Reese V. |
| 7 | Northern Big Smoky V. | 1 | 1,320 | Big Smoky V. north |
| 8 | Diamond Valley system | 6 | 3,120 | Antelope V., Monitor V. north & south |
| 9 | Newark Valley system | 3 | 1,450 | Little Smoky V. north & central |
| 10 | Colorado system | 34 | 16,300 | Coal V., Garden V., White River V. |
| 11 | Penoyer Valley system | 1 | 700 | Penoyer Valley |

Figure 9 and Table 10. Flow Systems of Nye County.




| No. | BASIN NAME |
|---|---|
| 56 | Upper Reese River Valley |
| 122 | Gabbs Valley |
| 134 | Smith Creek Valley |
| 135 | Ione Valley |
| 137(A) | Big Smoky Valley Tonopah Flat |
| 137(B) | Big Smoky Valley Northern Part |
| 140(A) | Monitor Valley Northern Part |
| 140(B) | Monitor Valley Southern Part |
| 141 | Ralston Valley |
| 142 | Alkali Spring Valley |
| 144 | Lida Valley |
| 145 | Stonewall Flat |
| 146 | Sarcobatus Flat |
| 147 | Gold Flat |
| 148 | Cactus Flat |
| 149 | Stone Cabin Flat |
| 150 | Little Fish Lake Valley |
| 151 | Antelope Valley (Eureka and Nye) |
| 155(A) | Little Smoky Valley Northern Part |
| 155(B) | Little Smoky Valley Central Part |
| 155(C) | Little Smoky Valley Southern Part |
| 156 | Hot Creek Valley |
| 157 | Kawich Valley |
| 158(A) | Emigrant Valley - Groom Lake V. |
| 158(B) | Emigrant Valley - Papoose Lake V. |
| 159 | Yucca Flat |
| 160 | Frenchman Flat |
| 161 | Indian Springs Valley |
| 162 | Pahrump Valley |
| 170 | Penoyer Valley (Sand Spring V.) |
| 171 | Coal Valley |
| 172 | Garden Valley |
| 173A | Railroad Valley South |
| 173B | Railroad Valley North |
| 207 | White River Valley |
| 225 | Mercury Valley |
| 226 | Rock Valley |
| 227(A) | Jackass Flats |
| 227(B) | Buckboard Mesa |
| 228 | Oasis Valley |
| 229 | Crater Flat |
| 230 | Amargosa Desert |
| 243 | Death Valley |

**Figure 10. Hydrographic Basins of Nye County.** There are 43 hydrographic basins that are located in, or partially in, Nye County. Only about 20 of these basins are located almost entirely within the County boundaries; the remainder are shared basins. Nye County shares hydrographic basins with eight counties in Nevada and two counties in California. For example, although most of the developed areas in Pahrump Valley (Basin 161) are located in Nye County, the basin includes areas in Clark County, Nevada and Inyo County, California. Such political subdivisions within hydrographic basins can hamper water planning efforts.

## Table 11. Water Budget Parameters for the Basins in Nye County.

**All values are in acre feet per year.**

| Basin | Recharge | Inflow | Evapotranspiration | Outflow | Perennial Yield | Water Budget |
|---|---|---|---|---|---|---|
| Alkali Spring Valley | 100 | 5,500 | 400 | 5,000 | 3,000 | |
| Amargosa Desert | 600 | 44,000 | 24,000 | 19,000 | 34,000 | |
| Antelope Valley (Eureka & Nye) | **17,000** | **500** | **4,000** | **13,500** | 4,000 | **17,500** |
| Big Smoky Valley - Northern Part | 65,000 | 0 | 64,000 | 0 | 65,000 | |
| Big Smoky Valley - Tonopah Flat | 12,000 | 2,000 | 6,000 | 8,000 | 6,000 | |
| Buckboard Mesa | 1,400 | 5,800 | 0 | 7,200 | 3,600 | |
| Cactus Flat | 600 | 0 | 0 | 300 | 300 | |
| Coal Valley | 2,000 | 8,000 | Minor | 10,000 | 6,000 | |
| Crater Flat | 220 | 1,500 | 0 | 1,700 | 900 | |
| Eagle Valley | 1,100 | 0 | 290 | 0 | 300 | |
| Emigrant Valley - Groom Lake Valley | 3,200 | 0 | 0 | 3,200 | 2,800 | |
| Emigrant Valley - Papoose Lake Valley | <10 | 0 | 0 | <10 | <10 | |
| Frenchman Flat | 100 | 33,000 | 0 | 33,000 | 16,000 | |
| Gabbs Valley | 5,000 | 0 | >3,700 | 0 | 5,000 | |
| Garden Valley | 10,000 | 0 | 2,000 | 8,000 | 6,000 | |
| Gold Flat | 3,800 | 0 | 0 | 3,800 | 1,900 | |
| Grapevine Canyon | 50 | 500? | Minor | 400 | 400 | |
| Hot Creek Valley | **5,800** | **0** | **5,000** | **800** | 5,500 | **5,800** |
| Indian Springs Valley | 10,000 | 22,000 | Minor | 32,000 | 500 | |
| Ione Valley | 8,000 | 0 | 1,300 | 2,000 | 2,500 | |
| Jackass Flats | 900 | 7,200 | 0 | 8,100 | 4,000 | |
| Kawich Valley | 3,500 | 1,000 | 0 | 4,500 | 2,200 | |
| Lida Valley | 500 | 200 | 0 | 700 | 350 | |
| Little Fish Lake Valley | **9,700** | 0 | **9,700** | **0** | 10,000 | **9,700** |
| Little Smoky Valley (Northern) | 4,000 | Some | 1,900 | 1,000 | 5,000 | |
| Little Smoky Valley Central Part | 200 | 0 | 0 | 200 | 100 | |
| Little Smoky Valley Southern Part | 1,400 | Some | 0 | Some | 1,000 | |
| Little Smoky Valley (Total) | **13,000** | **0** | **6,000** | **7,000** | | **13,000** |
| Mercury Valley | 250 | 16,000 | 0 | 17,000 | 8,000 | |
| Monitor Valley Northern Part | 6,300 | 2,000 | 2,000 | 6,000 | 8,000 | |
| Monitor Valley Southern Part | 15,000 | 0 | 9,200 | 2,000 | 10,000 | |
| Oasis Valley | 1,000 | 2,500 | 2,000 | 1,500 | 2,000 | |
| Pahrump Valley | 22,000 | 0 | 10,000 | 13,000 | 12,000 | |
| Penoyer Valley (Sand Spring Valley) | 4,300 | 0 | 6,400 | 0 | 5,000 | |
| Railroad Valley Northern Part | **61,000** | **24,000** | **85,000** | **0** | 50,000 | **85,000** |
| Railroad Valley Southern Part | 6,000 | | | 1,000 | with RR North | |
| Ralston Valley | 5,000 | 3,000 | 2,500 | 5,500 | 6,000 | |
| Rock Valley | 30 | 17,000 | 0 | 17,000 | 8,000 | |
| Sarcobatus Flat | 1,200 | 1,300 | 3,000 | 500 | 3,000 | |
| Smith Creek | 12,000 | 0 | 6,600 | 0 | 10,000 | |
| Stone Cabin Flat | 5,000 | 0 | 2,000 | 3,000 | 2,000 | |
| Stonewall Flat | 100 | Some | 0 | 200 | 100 | |
| Upper Reese River Valley | 37,000 | 0 | 37,000 | 500 | 37,000 | |
| Yucca Flat | 700 | 0 | 0 | 700 | 350 | |

**Note: Values shown in bolded text are from Nichols (2000) U.S. Geological Survey Professional Paper1628, Table C15. All other values are from Water for Nevada, Report No. 3, Nevada's Water Resources, State Engineer's Office, Nevada Department of Conservation and Natural Resources, October 1971.**

In the southern part of the County, little recharge is derived from precipitation that falls over Nye County. Rather, as noted previously, the aquifers in Pahrump Valley and Amargosa Valley are recharged primarily by precipitation over the Spring Mountains and Sheep Range in Clark County.

The quantity of recharge that is contributed each year is not known. Reconnaissance level estimates of recharge have been developed based on estimates of discharge, climate data, and the topography of the landscape. In addition to this natural recharge, activities by man can result in additional recharge to the groundwater reservoir, a process referred to as secondary recharge. Secondary recharge occurs where water infiltrates to the water table from irrigated cropland or pastures; leakage from canals, ditches, and natural stream channels; and even from septic systems. Secondary recharge can total several thousand acre feet per year in some basins.

Groundwater flows from the upland recharge areas to discharge areas at springs and areas where shallow groundwater is discharged to evapotranspiration. The largest areas of evapotranspiration in Nye County are in Railroad Valley and Big Smoky Valley. Lesser but still significant evapotranspiration occurs in Amargosa Desert, Little Fish Lake Valley. Significant discharge once occurred in Pahrump Valley but has been diminished over the last five decades by groundwater development.

In recent years, Nye County has been the focus of studies by the U.S. Geological Survey to better define evapotranspiration rates. These studies have found that the quantity of groundwater being discharged to evapotranspiration is generally more than double that estimated in the old reconnaissance evaluations in the northern part of the County, but not significantly greater than historic estimates in the southern part of the County. The results of these studies suggest that the recharge over northern Nye County is significantly greater than previously thought. There is still considerable uncertainty, however, in these estimates, and a greater understanding of both recharge and discharge is needed to help guide water resources evaluations and planning in the region.

Groundwater Quantity and Availability - Nye County has significant groundwater resources but they are poorly defined. The perennial yields listed in Table 13 offer only a first order approximation of how much water can actually be drawn on an annual basis. As noted in the previous discussion, the U.S. Geological Survey is revising the estimates of evapotranspiration upward, suggesting that the perennial yield of the basins in the northern part of the County may be appreciably higher than historic published values indicate. However, until such time as the evaluations have been completed and a more complete understanding of the groundwater regime is available, the existing perennial yield values must serve as the basis for planning.

Determining the quantity of water available within Nye County is further complicated by the fact that only 16 hydrographic basins are wholly situated within the County. In the north, Nye County shares two hydrographic basins with Churchill County, three basins with Lander County, three basins with Eureka County, and three basins with White Pine County. On the east, seven basins are shared with Lincoln County and three basins are shared with Clark County. On the west, two basins are shared with Mineral County and six basins are shared with Esmeralda County. To the south, in California, Nye County shares three basins with Inyo County.

Because of the rural development of the counties in Nevada and California that share hydrographic basins, there have not been conflicts in the past over groundwater commitments and use. This situation may change, however, as growth is expected to occur across the entire region and a number of entities are looking at the water resources of the shared basins as

sources of water for exportation to urban areas. For example, water development in Clark County may result in direct competition with Nye County and developments in Nye County may result in direct competition with Inyo County for the shared groundwater resources.

The estimated committed groundwater resources in Nye County are large and the estimated totals are summarized in Tables 14 and 15. Table 14 lists the water rights by status in each basin and Table15 lists the water rights by type of use category. The values shown are only estimates and the reader is referred to the notes on Table14 concerning the accuracy and validity of these estimates. In all, about 271,000 acre feet of groundwater have been appropriated in the basins that are located wholly or partially in Nye County. The valleys with the largest committed groundwater resources are Pahrump Valley with over 68,000 acre feet committed, Big Smoky Valley - Northern Part with about 38,000 acre feet committed, Middle Reese Valley with over 37,000 acre feet committed, Amargosa Desert with more than 28,000 acre feet committed, and Big Smoky Valley - Tonopah Flat with almost 27,000 acre feet committed.

In addition to the water resource commitments shown in Table 14, there are large water right filings in some basins that are ready for action by the Division of Water Resources. In all, applications are outstanding for more than 333,000 acre feet in the basins that are located wholly or partially in Nye County (as of March 1999). Foremost are those associated with the Southern Nevada Water Authority's plans to export water from Nye County and other rural Nevada counties to metropolitan Las Vegas. In 1989, the Las Vegas Valley Water District filed 32 groundwater permit applications with points of diversion in Nye County. Six of these applications have been withdrawn but the remaining 26 applications, totaling more than 140,000 acre feet in Railroad Valley (North and South), Garden Valley, and Coal Valley, are ready for protest.

Numerous water right applications associated with Carey Act and Desert Land Entry applications are outstanding in Railroad Valley (North and South) with more than 112,000 acre feet requested, Big Smoky Valley North (14,000 acre feet), Hot Creek Valley (13,760 acre feet), Monitor Valley South (7,680 acre feet), Smith Creek Valley (2,560 acre feet), and Ione Valley (640 acre feet). A number of applications are also ready for action for water rights for irrigation. Applications for irrigation total more than 21,000 acre feet in Big Smoky Valley - Northern Part, 640 acre feet in Smith Creek Valley, and 200 acre feet in Oasis Valley.

Since March 1999, a number of new applications have been filed that have significantly increased the demand for water in some parts of Nye County. In September 1999, CSS Company filed 50 irrigation water right applications for 5.4 cfs each in Railroad Valley (34 applications in Railroad Valley North and 16 in Railroad Valley South). In February 2000, the Nye County Board of County Commissioners filed 10 water right applications totaling over 33,000 acre feet per year in the basins of the Nevada Test Site (Yucca Flat, Mercury Valley, Rock Valley, Jackass Flats, and Crater Flat).

Existing groundwater allocations (vested rights plus permits plus certificated rights) exceed the perennial yield in six basins (Alkali Spring Valley, Amargosa Desert, Crater Flat, Gabbs Valley, Middle Reese Valley, and Pahrump Valley). The demand for water, as defined by the sum of existing water rights, applications that are ready for action, and implied federally reserved water rights, exceeds the perennial yield in three additional basins (Hot Creek Valley, Railroad Valley North, and Railroad Valley South). The demand for water equals the perennial yield in four more basins (Yucca Flat, Mercury Valley, Rock Valley, and Jackass Flats).

## Table 12. Summary of Underground Water Rights in Nye County BasinsThrough March 1999

**Source: Division of Water Resources Files. Note: Only basins with DWR data are listed.**

| | --------WATER RIGHTS IN ACRE FEET BY STATUS------- | | | | | | Total | Total |
|---|---|---|---|---|---|---|---|---|
| **BASIN** | **VEST** | **APPL** | **RFA** | **PER** | **REL** | **CERT** | **Rights** | **Demand** |
| Alkali Spring Valley | | | | 1,209 | | 12,378 | 13,587 | 13,587 |
| Amargosa Desert | | 116 | 32,780 | 7,276 | | 16,261 | 23,537 | 56,317 |
| Antelope Valley (Eureka & Nye) | | | 0 | 0 | | 1,746 | 1,746 | 1,746 |
| Big Smoky Valley - Northern Part | | | 35,721 | 26,166 | | 11,871 | 38,037 | 73,758 |
| Big Smoky Valley - Tonopah Flat | | | | 5,423 | | 21,300 | 26,724 | 26,724 |
| Buckboard Mesa | | | | 7 | | | 7 | 7 |
| Cactus Flat | | | | | | 248 | 248 | 248 |
| Crater Flat | | | | 1,094 | | 144 | 1,239 | 1,239 |
| Frenchman Flat | | | | | | | 0 | 0 |
| Gabbs Valley | 94 | | 11 | 8,654 | | 10,298 | 19,046 | 19,056 |
| Gold Flat | | | | 423 | | 34 | 457 | 457 |
| Hot Creek Valley | 23 | | 13,760 | 1,204 | | 1,412 | 2,639 | 16,399 |
| Indian Springs Valley | | | | 692 | | 631 | 1,323 | 1,323 |
| Ione Valley | | | 640 | 18 | | 130 | 147 | 787 |
| Jackass Flats | | | 2,150 | 444 | | 58 | 502 | 2,652 |
| Lida Valley | | | | 1 | | 26 | 27 | 27 |
| Little Fish Lake Valley | | | 33 | | | | 0 | 33 |
| Little Smoky Valley Central Part | | | | | | 4 | 4 | 4 |
| Middle Reese River Valley | | | | 1,664 | | 36,170 | 37,834 | 37,834 |
| Monitor Valley Northern Part | | | | 443 | | 184 | 627 | 627 |
| Monitor Valley Southern Part | 101 | | 7,696 | 13 | | 431 | 545 | 8,241 |
| Oasis Valley | | | 200 | 319 | | 932 | 1,251 | 1,451 |
| Pahrump Valley | 695 | 1,120 | 3,943 | 29,667 | 5,090 | 29,093 | 64,545 | 69,608 |
| Railroad Valley North | | | 190,467 | 8,076 | | 16,248 | 24,324 | 214,791 |
| Ralston Valley | | | | 996 | | 971 | 1,967 | 1,967 |
| Sarcobatus Flat | | | | 100 | | 1,104 | 1,204 | 1,204 |
| Smith Creek | | | 0 | 2,481 | | 1,104 | 3,585 | 3,585 |

**Note: Total Rights = Vested + Permits +Certificated**
**Total Demand = Vested + Permitted + Certificated +Applications + Ready for Action**
**APPL = Applications, RFA = Ready for Action, PER = Permited, REL = Relinquished, CERT = Certified**

**Note: Values shown are from the Nevada Division of Water Resources water rights database. These values represent estimated resources committed as of March 1999. The database is still under development and all committed resource numbers presented in this, and other tables in this report, are approximate. The values are preliminary and intended to be used for planning purposes only. There are a number of limitations in the use of these estimates:**

**1. The values shown represent the estimated maximum committed groundwater, not the actual groundwater withdrawal and consumption, which are significantly less.**

**2. Some groundwater rights are supplemental with surface water rights. A groundwater right that is pumped only as needed to augment low surface water flows is a supplemental right that is usually not put to full use each year.**

**3. Some groundwater rights are supplemental with other groundwater rights. Withdrawals may be distributed among multiple wells with a combined annual pumpage for the entire well field. The NDWR database does not account for these supplemental rights; NDWR staff have made adjustments for about 35% of the basins in Nevada.**

**4. Some groundwater rights may not be exercised to their full appropriative right each year. Municipal water rights often far exceed the actual use, providing communities with available water for future use.**

**5. Irrigation and mine dewatering may be supplemental in some instance where mine effluent is used to irrigation crops while the irrigation rights are idle.**

**6. The values are time-sensitive and subject to change due to pending water right applications, and possible cancellations.**

**7. Nye County does not warrant the validity of these values.**

## TABLE 13. UNDERGROUND WATER RIGHTS ABSTRACT SUMMARY BY TYPE OF USE FOR NYE COUNTY BASINS.

---------WATER RIGHTS IN ACRE FEET BY TYPE OF USE CATEGORY ----------

| BASIN | COM | DOM | ENV | IND | IRR | M&M | MUN | POW | QM | REC | STK | WILD | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alkali Spring Valley | | | | | 16 | 8,403 | 4,923 | | 286 | | 15 | | |
| Amargosa Desert | 154 | 3 | | | 22,444 | 4,618 | | | 1,048 | | | 298 | |
| Antelope Valley (Eureka & Nye) | | | | | 1,013 | | | | | | 8 | | |
| Big Smoky Valley - Northern Part | 8 | 4 | | | 34,972 | 1,077 | | | 1,773 | 21 | 157 | | 46 |
| Big Smoky Valley - Tonopah Flat | | | | | 11,797 | 12,683 | 1,507 | | 14 | | 864 | | |
| Buckboard Mesa | | | | 7 | | | | | | | | | |
| Cactus Flat | | | | | | | | | 243 | | 5 | | |
| Crater Flat | | | | | | 1,239 | | | | | | | |
| Frenchman Flat | | | | | | | | | | | | | |
| Gabbs Valley | | | | | 9,656 | 8,835 | 307 | | | | 248 | | |
| Gold Flat | | | | | | | | | 423 | | 34 | | |
| Hot Creek Valley | | | | | | | | | | | | | |
| Indian Springs Valley | 31 | 1 | | | 215 | | | | 1,076 | | | | |
| Ione Valley | | | | | 61 | 15 | | | | | 71 | | |
| Jackass Flats | | | | 7 | | | | | | | | | |
| Kawich Valley | | | | | | | | | | | | | |
| Lida Valley | | | | | | 8 | | | | | 19 | | |
| Little Fish Lake Valley | | | | | | | | | | | | | |
| Little Smoky Valley Central Part | | | | | | | | | | | 4 | | |
| Middle Reese River Valley | | | | | 37,734 | | | | | | 100 | | |
| Monitor Valley Northern Part | | | | | 175 | 434 | | | | | 18 | | |
| Monitor Valley Southern Part | 13 | | | | | 414 | | | 6 | | 112 | | |
| Oasis Valley | 11 | | | | 75 | | 1,163 | | | | 2 | | |
| Pahrump Valley | 389 | 62 | | 65 | 48,740 | 2 | 19,815 | | 2,228 | 25 | 53 | | 48 |
| Railroad Valley Northern Part | | | | 134 | 21,978 | 69 | | | | 1,994 | 145 | | |
| Ralston Valley | | | | | 32 | | 1,554 | | 36 | 240 | 104 | | |
| Rock Valley | | | | | | | | | | | | | |
| Sarcobatus Flat | | | | | 982 | 33 | | | 114 | | 76 | | |
| Smith Creek | | | | | 1,828 | 7 | | | | | 18 | | |

**M&M = Mining and Milling MUN = Municipal POW = Power QM = QuasiMunicipal REC = Recreation STK = Stock Water WILD = Wildlife Water**

Groundwater Quality - With the exception of the areas used for underground nuclear testing on the Nevada Test Site, the general quality of the groundwater in Nye County is suitable to marginally suitable with limited exceptions based on specific locations and proposed uses. Naturally occurring fluoride and uranium concentrations in Oasis Valley and Crater Flat exceed drinking water standards. The total dissolved solids concentration of groundwater in portions of Alkali Spring Valley, Big Smoky Valley, Gold Flat, Monitor Valley, Railroad Valley (North and South), Sarcobatus Flat, and Stone Cabin Valley exceed state or federal drinking water standards. In these basins, the total dissolved solids are elevated because of the natural process of salt buildup by evaporation in areas of shallow groundwater. With the recent lowering of the drinking water standard for arsenic from 50 to 10 parts per billion, community water systems in Beatty, Round Mountain, and Manhattan are faced with additional (and costly) treatment requirements.

The activities of man have resulted in the contamination of significant volumes of groundwater in Nye County. First and foremost, of course, is the remaining radioactivity on the Nevada Test Site. About 250 square miles at this facility are contaminated with radioactivity as a result of historic underground nuclear weapons testing. This testing was conducted in six hydrographic basins (Yucca Flat, Frenchman Flat, Gold Flat, Kawich Valley, Oasis Valley, and Buckboard Mesa). Figure 12 shows the locations of the underground nuclear testing areas and the possible paths that this contamination might take. These paths are based upon a regional numerical model prepared by the U.S. Department of Energy as part of its ongoing investigations of the underground testing areas. According to this simulation, radionuclide contamination in the groundwater underlying the Nevada Test Site may migrate off of the facility toward the communities of Beatty and Amargosa Valley, and ultimately to the regional discharge areas in California in Death Valley and southernmost Amargosa Desert.

According to the U.S. Department of Energy, more than 295 million curies of radioactivity remain in the deep subsurface at the Nevada Test Site, of which an estimated 112 million curies are under or within 100 meters (328 feet) of the water table. This federal agency has long emphasized that the majority of this contamination is tritium, a short-lived isotope of hydrogen (with a total activity of 100.6 million curies remaining as of January 1994). There are, however, a number of longer-lived radionuclides of concern that are also present in appreciable quantities. Specific radionuclides of concern include isotopes of americium (11,500 curies), plutonium (37,000 curies), strontium (2,733,000 curies), and uranium (1,200 curies). These radionuclides exhibit half-lives ranging from 28 years for strontium to 4.4 billion years for some uranium isotopes. Also of concern are the daughter isotopes that result from the decay of these radionuclides, especially neptunium and technetium. One of the legacies of the nation's nuclear weapons program has been the contamination of an estimated five million acre feet or more of groundwater in Nye County. For all practical purposes, the water resources under the testing areas have been destroyed as a result of nuclear testing, and are lost to the County in perpetuity.

Contamination of groundwater with radionuclides in Nye County is not limited to only the Nevada Test Site. Tritium has been detected in the upper aquifer underlying portions of the U.S. Ecology disposal site near Beatty. Between 1962 and 1992, wastes with a total activity of about 715,000 curies were disposed of at this site (except for a period in 1976-1979 during which the operator's license was suspended for improper waste handling and disposal). Elevated activities of gross alpha, gross beta, and tritium have been detected in groundwater sampled from on-site monitoring wells since about 1973, but have significantly decreased since maximum levels were detected in the early 1980s.

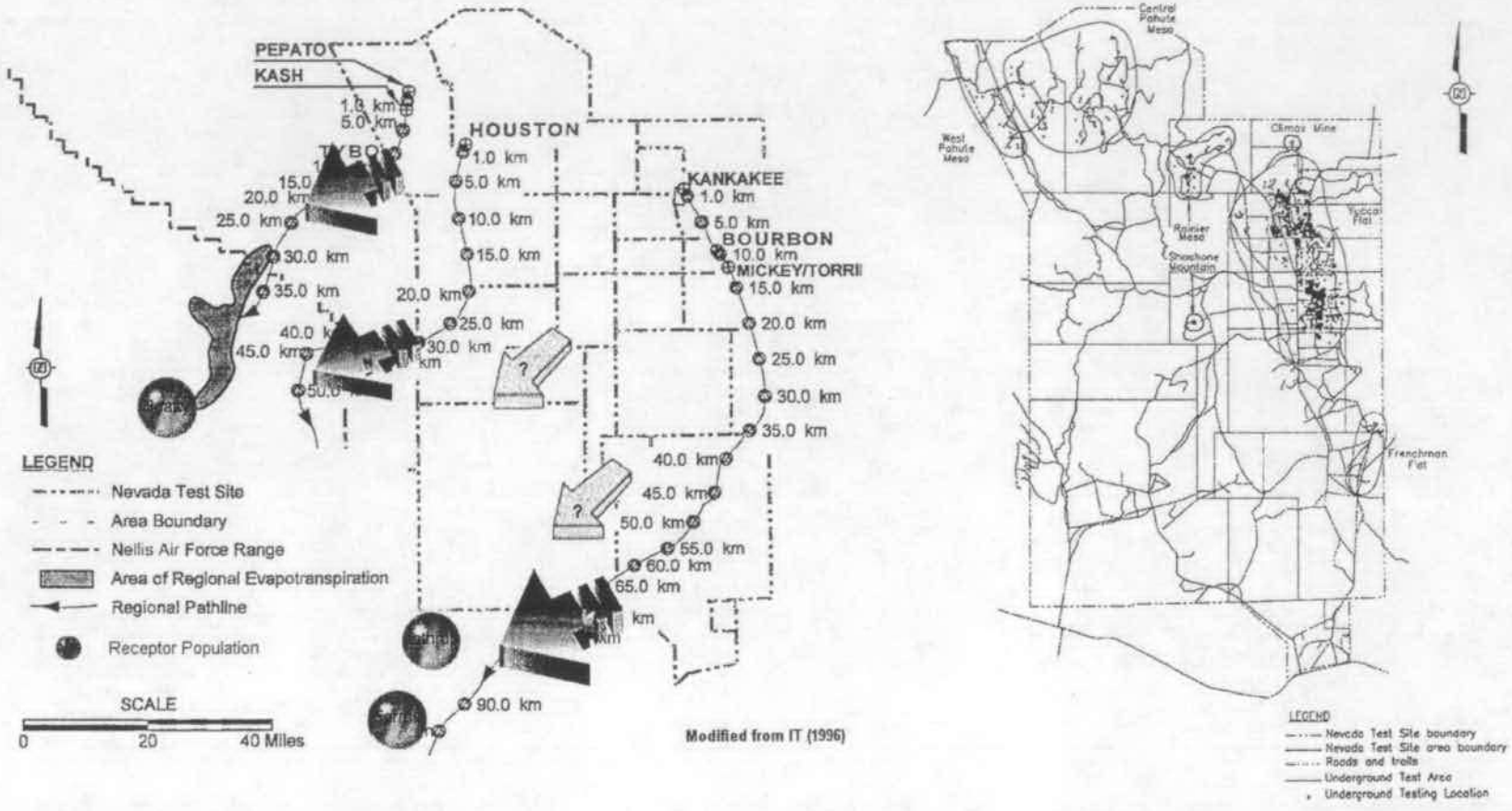



**Figure 11. Location of underground nuclear tests at the Nevada Test Site, and regional paths for contaminant transport.** Modified from: U.S. Department of Energy, 1997, Regional Groundwater Flow and Tritium Transport Modeling and Risk Assessment of the Underground Testing Area, Nevada Test Site. Note: Since these maps were originally published, the northwest boundary of the Nevada Test Site has been changed.

Possible groundwater contamination has been reported, but not yet substantiated in Pahrump Valley. Nitrate contamination has been reported and attributed to agriculture but sufficient data was not made available to either confirm or refute this claim.

Groundwater Issues - The key issues related to the groundwater resources of Nye County are:

- **Inadequate groundwater supplies to meet projected demands in Pahrump Valley**
- **Damage to groundwater resources on the Nevada Test Site**
- **Naturally occurring arsenic in the groundwater in Amargosa Desert and Big Smoky Valley**
- **Potential migration of contamination off of the Nevada Test Site**
- **Potential future contamination associated with Yucca Mountain**
- **Competition for groundwater in Railroad Valley**
- **Proposed water exportation by the Southern Nevada Water Authority**
- **Unpredictable growth in Amargosa Desert**
- **Federal land use policies**
- **Water resource speculation in Nye County and adjacent areas**

In addition to these key issues, there are concerns regarding the over-commitment of water in some basins and the poor understanding of the physical and legal water availability in terms of perennial yield, effects of groundwater withdrawals, and the interactions between the surface water and groundwater regimes. Other issues include growth and water availability, conservation, drought protection, wastewater reuse, and aquifer management.

The Nevada State Water Plan also identified numerous issues regarding groundwater resources, several of which are applicable in Nye County:

- **Management of groundwater in multi-county/bi-state basins**
- **Intercounty transfers**
- **Groundwater protection**
- **Groundwater data and monitoring**

These issues are addressed in following sections to this plan.

# CHAPTER 4. WATER DEMAND TRENDS AND FORECASTS

This chapter presents information on the demand for water in Nye County and trends and forecasts associated with that demand. First, the historic demand for water is summarized. Next, the current demand (for 2000) is estimated along with future trends. The time-phased demands for water by each sector of the County's economy are then presented and discussed.

## Historic Demands and Trends

Historic water use data in Nye County is largely lacking. Estimates of past water use were prepared by the Division of Water Planning, are presented in the State Water Plan, and are summarized in Table 16.

**Table 14. Nye County Water Withdrawals, 1985, 1990, 1995, Estimated Annual Water Use by Type (acre feet per year).** Source: Nye County Socioeconomic Overview, Nevada Division of Water Resources, July, 1998.

| Category | 1985 | 1990 | 1995 | Percent of 1995 Total |
|---|---|---|---|---|
| Domestic (including public supplies) | 2,756 | 2,767 | 5,130 | 6.81% |
| Commercial | 358 | 1,904 | 784 | 1.04% |
| Industrial | 370 | 22 | 0 | 0.00% |
| Thermoelectric | 0 | 0 | 0 | 0.00% |
| Mining | 4,940 | 7,505 | 7,057 | 9.37% |
| Livestock | 538 | 739 | 739 | 0.98% |
| Irrigation | 79,598 | 49,511 | 60,233 | 79.97% |
| Public Use & Losses | 148 | 426 | 1,378 | 1.83% |
| **TOTAL** | 88,705 | 99,817 | 99,668 | n/a |

## Current Demand

The current demand for water in Nye County is not known precisely and can only be estimated on the basis of the limited information that is available. The vast majority of current water use falls into five categories: public water supply systems, domestic wells, mining, agriculture (farming, livestock, and dairies), and federal use. The estimates of current water use were derived by updating water use figures to current populations and conditions and from information from the Nevada Division of Water Planning, the Nevada Division of Water Resources, the Nevada State Demographer's Office, and the federal agencies with stewardship over vast tracts of land in the County. While it should be noted that the values given are only estimates, they are based upon the best information that is available and are suitable for planning purposes.

Public Water Supply Systems - According to the records of the U.S. Environmental Protection Agency, there are 93 water supply systems in Nye County. The records of the Nevada Bureau

of Health Protection Services indicate that 48 of these systems are classified as public water supply systems. Summary information provided by 26 of these systems is presented in Table 17. No major water supply related problems were identified by any of the system operators who provided information.

**TABLE 15. Public Water Supply Systems in Nye County that Responded to Survey Questions.**

| Public Water Supply System | Sources | | Population | Adequate | New | Peak Demand | Water Quality |
|---|---|---|---|---|---|---|---|
| | Wells | Springs | Served | Rights | Applications | Shortfall | Problems |
| Amargosa Elementary School | 1 | | 170 | YES | NO | NO | NO |
| Amargosa Town Complex | 1 | | 100 | YES | NO | NO | N0 |
| Amargosa Water Company | 1 | | 25 | YES | NO | NO | NO |
| Anchor In Mobile Home Park | 1 | | 50 | YES | NO | NO | NO |
| Beatty Water & Sanitation District | 4 | | 1850 | YES | YES | NO | NO |
| Big Five Trailer Park | 1 | | 150 | YES | NO | NO | NO |
| C-Valley Mobile Park | 2 | | 50 | YES | NO | NO | NO |
| Central Nevada Utilities | 12 | | N/A | YES | NO | NO | NO |
| Chipmunk Retreat | 1 | | 60 | YES | NO | NO | NO |
| Gabbs Water System | 2 | | 210 | YES | YES | NO | NO |
| I.M.V. - Division of Floridin | 1 | | 25 | YES | NO | NO | NO |
| LDS Church/Pahrump Ward | 1 | | 25 | YES | NO | NO | NO |
| Manhattan Town Water | 1 | | 35 | YES | NO | NO | NO |
| Nye County Complex | 2 | | 60 | YES | NO | NO | NO |
| Foreland Refining (Petro Source) | 1 | | 27 | YES | NO | NO | NO |
| Round Mountain Public Utility | 2 | | N/A | YES | NO | NO | NO |
| Shoshone Estates Water Co. | 2 | | 250 | YES | NO | NO | NO |
| Shoshone Water Company | 1 | 2 | 31 | YES | NO | NO | NO |
| Smoky Valley Mine Public Water | 3 | | 650 | YES | NO | NO | NO |
| Sunset Mobile Home Park | 1 | | 70 | YES | NO | NO | NO |
| Tolicha Peak Electronic | 1 | | N/A | YES | NO | NO | NO |
| Tonopah Conservation Camp | none | none | 152 | YES | NO | NO | NO |
| Tonopah Electronic Combat Range | 1 | | N/A | YES | NO | NO | NO |
| Tonopah Test Range - Area 10 | 3 | | N/A | YES | NO | NO | NO |
| Tonopah Test Range, Mancamp | 2 | | N/A | YES | NO | NO | NO |
| Tonopah Water System | 8 | | 3000 | YES | NO | NO | NO |

Very few of the water supply systems in Nye County are public owned. Water resource planning is constrained by the presence of so many private water supply systems. In Pahrump, for example, there are more than 20 public water supply systems but only the Nye County Complex system is public owned. The Town of Pahrump has expressed an interest in acquiring the largest utility, Utilities, Inc., but progress toward this goal has been limited. Upon completion, the Mountain Falls subdivision may turn its water supply system over to the Town. The acquisition of these two systems would allow the Town of Pahrump to better plan and manage the water resources of the basin.

The State Water Plan lists the total quantity of water supplied by public water supply systems in 1995 at 6,127 acre feet, the percentage of the population served by such systems as 68 percent of the total population, and the per capita water use rate at 347.7 gallons per day. Using the population projections by the State Demographer, Division of Water Planning, and Nye County for the year 2000, and these percent served and per capita demand rates, then the current demand for water from public water supply systems has grown to 8,000 to 10,500 acre feet per

year. The lower value is based upon the Division of Water Planning estimated population of 30,417 in the year 2000 and the higher value on the Nye County estimate of 39,495.

Domestic Water Wells - The total number of domestic water wells in Nye County is not known but there are probably about 9,000 domestic wells throughout the County as a whole. In Pahrump alone, there are about 8,300 domestic wells and 600 to 700 new wells are drilled each year. There are some 400 domestic wells in Amargosa Desert in the communities of Amargosa Valley and Crystal. Other domestic wells are scattered throughout the County.

The Nevada State Water Plan estimated a total self-supplied domestic water use of 542 gallons per day in 1995. Assuming this rate and a total of 9,000 domestic wells at the beginning of 2000, the corresponding water use is estimated to be approximately 5,500 acre feet per year. However, if the rate of 1 acre foot per year per domestic well (the rate assumed by the Nevada Division of Water Resources and equivalent to 893 gallons per day) is used, then total domestic water use is 9,000 acre feet per year. In most areas of the County, the difference between the two rates is of little concern as the total use in any given basin is less than 500 acre feet per year.

The difference is significant now in Pahrump Valley, and will be increasingly important in the future. It is estimated that there will be as many as 20,000 additional domestic water wells drilled in Pahrump Valley over the next 50 years (assuming that current trends continue and no basin-wide water supply system is developed). With the existing domestic wells and these projected new wells, the total demand for domestic self served water will range from 17,000 to 28,000 acre feet per year.

There is concern about possible groundwater contamination as the community of Pahrump grows. Assuming a one-to-one correspondence between the number of domestic wells and the number of household septic systems, then 20,000 new septic systems may ultimately be built in Pahrump Valley. Although these systems will typically be built on large lots, the number of septic systems that may ultimately be in the basin is of concern.

Mining - The primary mining companies in Nye County are currently located in Big Smoky Valley, Gabbs Valley, Amargosa Desert, and Crater Flat. The largest mining operation is Round Mountain Gold Corporation in Big Smoky Valley. This operation has produced more than one-half million ounces of both gold and silver and employs 673 people. The second largest operation at present is the Premier Chemical mine at Gabbs that produces magnesium oxide and employs 79 people. The Daisy Gold Mine and Sterling Mine are both located in Crater Flat and collectively employ 63 people. IMV and American Borate produce specialty clays and calcium borate from their operations in Amargosa Desert and provide 47 jobs. The Bullfrog Mine, formerly the second largest operation in the County with 127 employees, significantly reduced its operation and employment in 1999.

Water use by the mining industry has increased over the last 15 years. The State Water Plan lists water withdrawals for mining in Nye County at 4,940 acre feet in 1985 and 7,695 acre feet in 1995. The reductions at the Bullfrog Mine reduce the demand for water by about 1,500 acre feet per year over the short term but new mining operations may increase the demand in the future.

Although minerals exploration activity is continuing in Nye County, new mining operations and their locations cannot be predicted with certainty. Currently, activity in the vicinity of Tonopah and Round Mountain is particularly encouraging. For planning, it is assumed that two new mining operations will start over the next 50 years but these new ventures will probably be offset by two mine closures elsewhere in the County. Thus, water consumption by the mining industry is expected to remain stable over the planning period at a total annual rate of about 8,000 acre feet. Because mining operations are typically located in remote areas, are of temporary duration, and the water use is recognized as a preferred use, it can be assumed that the water demand for any new operations will be met on a case-by-case basis. It is also assumed that adequate water supplies will be available to support temporary development for mining.

Agriculture, Livestock, and Dairies - Over the last decade, the contribution of the agricultural sector of the economy has become more important even though the land in farms, the number of farms and average farm size, and the total irrigated acreage have declined. In 1997, the market value of agricultural products from Nye County was just under $28 million, a 102 percent increase over 1992. Hay is the primary crop grown and livestock production accounts for $20 million of the total agricultural sales. Nye County ranks first among Nevada counties in nursery and greenhouse groups and in orchard acreage (254 acres), and second in the production of dairy products and nuts.

Both surface water and groundwater are included in the available estimates of water use by agriculture. The total acreage of irrigated farm and pasture land has declined but current factors suggest that increases in irrigation water use are likely over the planning period. In 1985 there were an estimated 19,350 acres of irrigated cropland but by 1990 irrigated acreage dropped to 12,200 acres. Between 1990 and 1995 irrigated acreage rose to 14,800 acres. The Nevada State Water Plan lists irrigation water withdrawals in 1995 at 60,233 acre feet with a consumptive use of 39,383 acre feet per year. Of the 60,000 acre feet of total agricultural water withdrawals, 48,000 acre feet were groundwater and 12,000 acre feet were surface water. Current agricultural water use is not known but is probably between 50,000 and 60,000 acre feet per year with about the same proportions of surface water and groundwater.

Over the coming decades, agricultural production is expected to decrease in Pahrump Valley, increase moderately in Amargosa Valley, and increase significantly in Railroad Valley. In Pahrump Valley, agricultural lands continue to give way to urbanization. In 1998, almost 15,000 ace feet of groundwater were withdrawn in Pahrump Valley to cultivate about 3,000 acres of land. In Amargosa Valley, approximately 2,400 acres were irrigated in 1998 with 12,000 acre feet of water. Irrigated land in Railroad Valley totals about 7,000 acres but only about 5,000 acres are under cultivation in any given year and most of the irrigation source water is surface water rather than groundwater.

In the late 1990s, significant tracts of farmland in Pahrump Valley were subdivided for development and probably only about 1,000 acres are still under cultivation. Agricultural production in Amargosa Valley is expected to increase by as much as 50 percent over the foreseeable future as new pivot irrigators are brought on line. The demand for groundwater for agricultural purposes is expected to increase significantly in Railroad Valley over the coming decades. Desert Land Entry applicants have filed for permits to appropriate almost 95,000 acre feet and the CSS Corporation has filed 50 applications for 5.4 cfs each in the basin to grow potatoes for Frito-Lay. This agricultural venture, should it go forward, would require an estimated 64,000 acre feet of water annually for the irrigation of almost 13,000 acres of new cropland in Railroad Valley.

There is considerable uncertainty in the actual quantity of water used each year for agricultural and livestock production in Nye County. The actual acreage under irrigation in any given year is unknown. The Nevada Division of Water Resources conducts crop inventories in only one basin, Upper Reese Valley. Pumpage inventories are conducted in three basins, Pahrump Valley, Amargosa Valley, and Penoyer Valley. Agricultural production can vary depending upon the individual farmer's crop plan and market conditions. The consumptive use rates for the crops grown in the County (primarily hay) also varies. The irrigation efficiency can also be quite variable reflecting the skill of the farmer, soil characteristics, seasonal rainfall, the type of crop, the manner of irrigation, the preparation of the cropland, and the cost of the water in terms of electricity and waterworks.

According to the 1994 Nevada Agricultural Fact Book, the County's livestock industry in 1987 had approximately 33,000 head of cattle and 6,200 head of sheep. In terms of water withdrawals, this converts to 713 acre feet per year for cattle and 65 acre feet per year for sheep for a total of 778 acre feet per year for all livestock. This estimate agrees closely with the 1995 estimated livestock water withdrawals of 739 acre feet given in the State Water Plan, suggesting that livestock production in the County has been stable for more than a decade. Based upon this trend, water withdrawals for livestock purposes are assumed to remain constant at a rate of 800 acre feet per year into the foreseeable future. The bulk of this demand (about 700 acre feet) will be met from surface water resources and the remainder from remotely located stock wells.

In 1987, only 26 milk cows were inventoried in the agricultural census for Nye County. Since that time, the dairy industry has grown into a key economic sector in southern Nye County, producing one-third of Nevada's total milk production. Two dairies are situated in southern Nye County, the Ponderosa Dairy in Amargosa Valley (5,000 cows, 62 employees, and 1,000 acres of cultivated farmland) and Pahrump Dairy in Pahrump Valley (2,300 cows, 30 employees, and 300 acres). According to an economic evaluation made by Nye County, the dairy had a total impact of almost $39 million in 1999 on output within Nevada with almost $8 million on output in Nye County. The two dairies provide 92 direct jobs in Nye County and 705 indirect jobs (183 in Nye County, 359 in Clark County, and 163 elsewhere in Nevada).

Nye County's dairies do not produce enough feed to meet their demands and have had an important impact on the agricultural production of the region. In fact, for every dollar spent on labor, the dairies spend seven dollars on supplies and services, with much of these spent on feed grown within the region. The Ponderosa Dairy has plans to increase their feed production as do several farmers in Amargosa Valley. Water use by the dairy industry and associated agriculture is included within the estimates given above for agricultural water use.

Federal Use - The primary federal water users in Nye County are the water supply systems at the Nevada Test Site (U.S. Department of Energy), Nellis Air Force Range, and Tonopah Test Range (U.S. Department of Defense), and for wildlife conservation in Amargosa Valley and Railroad Valley (U.S. Fish and Wildlife Service). Water use on Department of Interior lands managed by the U.S. Forest Service and Bureau of Land Management is small by comparison. The U.S. Park Service does not use water in Nye County but has become a significant factor in water resource planning through the protection of Devils Hole and Death Valley National Park.

**Department of Energy** - The Department of Energy operates four water supply systems at the Nevada Test Site. Ten water supply wells are pumped into a system of storage tanks, sumps,

and distribution systems over portions of the 1,350 square mile facility. The groundwater is withdrawn from six hydrographic basins (Mercury Valley, Yucca Flat, Frenchman Flat, Buckboard Mesa, Jackass Flats and Gold Flat). Water is used for quasi-municipal purposes and current use is well below historic demand, less than 900 acre feet.

In their Nevada Test Site Resource Management Plan, the Department of Energy asserts sovereign immunity from State Water Law for the water needed to support the purpose of the land withdrawal. The agency semi-quantifies this implied water right by establishing interim volumes based on historic pumping rates. These rates are as follows:

| | Mercury Valley | Yucca Flat | Frenchman Flat | Buckboard Mesa | Jackass Flats | Gold Flat | Total |
|---|---|---|---|---|---|---|---|
| **Maximum Historic Groundwater Discharge** (acre feet per year) | 428 | 856 | 1,664 | 524 | 277 | 426 | 4,175 |

**U.S. Department of Defense** - The U. S. Air Force operates water supply systems on the Nellis Air Force Range and the Tonopah Test Range. The Air Force has 25 water rights in Nye County for springs and surface water sources totaling 485.07 acre feet and has 15 groundwater appropriations in Nye County totaling 1,669.44 acre feet. Although the U.S. Air Force water right holdings in Nye County are appreciable, the actual quantity of water is small. Between 1995 and 1997, metered water use at seven water supply wells in Nye County ranged from 129.2 to 159.51 acre feet per year.

**National Park Service** - Although the National Park Service has not developed any water supplies in Nye County, the impacts of Park Service policies and practices have had a demonstrable impact on water resource availability in the County. These impacts are discussed in detail in Chapter 5.

The National Park Service has no water rights in Nye County but asserts a federally reserved right to all unappropriated water from any water source identified within the boundaries of the park. This assertion of federal right would cover the portions of Death Valley National Park that are within Nye County (about 107,000 acres).

**Bureau of Land Management** - Historic water use by the BLM has been quite limited and probably is no more than a few tens of acre feet County-wide. The agency has a few water rights in the County in widely spread locations, primarily for stock watering and quasi-municipal purposes. One of the stated management directions for the Las Vegas District is to determine water needs to meet management objectives and to file for appropriative water rights on public and acquired lands in accordance with the Nevada Water Law for water sources that are not federally reserved. Other management directions are focused on the preservation of mesquite and acacia woodlands, riparian areas, and any other areas of significant wildlife value by disallowing projects that may adversely impact the water table supporting these areas.

**U.S. Fish and Wildlife Service** - The Fish and Wildlife Service holds extensive surface water rights in Amargosa Valley for the conservation of Ash Meadows. The Service purchased 54 permitted or certificated water rights totaling about 12,573 acre feet, making it the largest single water right holder in the basin. The Fish and Wildlife Service does not plan to make any applications for new water rights but may continue their program of purchasing rights to spring discharges at Ash Meadows as willing sellers come forward.

**U.S. Forest Service** - Historic water use by the Forest Service as been quite limited. The agency has a few water rights in the County in widely spread locations for wildlife, fire control, recreation, and other purposes. No new water demands have been identified for the 1.9 million acres of Forest Service lands in Nye County.

Summary - Based upon the available data and the estimates detailed above, the total water use in Nye County in 2000 is about 101,000 acre feet. This estimate is 13 percent higher than the estimate given for 1995 but identical to the projected 2000 water withdrawals in the Nevada State Water Plan. Again, it must be stressed that there is considerable uncertainty in the estimates presented both in this plan and the Nevada State Water Plan.

## Forecasted Future Demand 2000-2050

In this section, the forecasted water demand in Nye County through the year 2050 is presented and discussed. The process that was used in developing this forecast mirrors the method used in the Nevada State Water Plan for linking water forecasts with the socioeconomic forecasts. This process involved the following steps.

1. The population was projected on the basis of census trends and projections, economic forecasts, and assumptions for each sector of the economy. (See Chapter 2)

2. The population forecasts were multiplied times the per capita water use rates. Per capita water use rates for Nye County were taken from the State Water Plan. The results are listed in Table 18 and serve as the baseline water demand forecast for Nye through the year 2050.

3. Water demands for various modes of development were then projected by multiplying the employment water demand by a per capita worker rate for Nye County (again from the State Water Plan). Non-employment water use was then estimated for the various modes of development. For example, a destination resort uses minimal water for staff (about 60 acre feet per year) but golf courses and the ancillary commercial operations consume appreciable quantities of water. The results are listed in Table 19.

4. The water demands associated with the various modes of development were time-phased. It is unrealistic to assume that the demands for these types of developments would all occur simultaneously. Rather, the developments are likely to occur sporadically over the next decade or two. The projected timing of each mode of development is based on judgement and is only meant to be used for the purposes of planning. The results are listed in Table 20.

5. The baseline forecast was added to the current water use and to the time-phased demand for various modes of development to develop the forecast for water in Nye County through the year 2050. The results are also listed in Table 20 and are shown in Figure 13.

The forecast projects that in the year 2020, the total demand for water in Nye County is estimated at 166,000 acre feet, 62 percent greater than the estimated demand of 102,000 acre feet listed in the State Water Plan. By 2050, this demand will rise to an estimated 252,000 acre feet; the State Water Plan does not project demand beyond 2020. As this plan and the State Water Plan share the same approach and per capita water consumption rates, the marked difference in the results are due to the different assumptions about the economic future of Nye County, related population

(Text continues on page 52)

## Table 16. PROJECTED FUTURE WATER DEMAND
### Baseline Water Demand for all Domestic Uses

| Year | Projected Population | Water Demand mgd | Water Demand afy | Other afy |
|---|---|---|---|---|
| 1995 | 23,050 | 7.11 | 10,162 | 69,451 |
| 1999 | 37,189 | 11.47 | 15,046 | 70,000 |
| 2000 | 39,495 | 12.18 | 15,843 | 85,000 |
| 2005 | 46,800 | 14.43 | 18,366 | 85,000 |
| 2010 | 66,300 | 20.45 | 25,102 | 85,000 |
| 2015 | 78,000 | 24.05 | 29,143 | 85,000 |
| 2020 | 90,100 | 27.79 | 33,323 | 85,000 |
| 2025 | 102,200 | 31.52 | 37,502 | 85,000 |
| 2030 | 114,300 | 35.25 | 41,682 | 85,000 |
| 2035 | 126,400 | 38.98 | 45,862 | 85,000 |
| 2040 | 128,500 | 39.63 | 46,587 | 85,000 |
| 2045 | 150,500 | 46.41 | 54,186 | 85,000 |
| 2050 | 162,700 | 50.18 | 58,401 | 85,000 |

| Per Capita Rates (gallons per day) | |
|---|---|
| Public Water Supply | 347.7 |
| Domestic Self Supplied | 224.1 |
| Commercial & Industrial | 82.4 |

| Water Use By Category (acre feet per year) | |
|---|---|
| Domestic | 3,150 |
| Commercial | 800 |
| Public Water Supply Systems | 10,500 |
| Public Use & Losses | 1,400 |

**Assumption:**

1. **Percentage of domestic use from public water supply systems is a constant 68.2% per State Water Plan, Jan 1999, App. 1A, Table 4.**
2. **Other water use is baselined at 8,000 afy for mining, 60,000 for agriculture, and 17,000 afy for federal uses at the NTS, Ash Meadows, Nellis Air Force Range, and Tonopah Test Range.**

## Table 17. PROJECTED FUTURE WATER DEMAND FOR VARIOUS MODES OF DEVELOPMENT

| Mode of Development | Employment Minimum Water Demand Over Baseline mgd | afy | Employment Maximum Water Demand Over Baseline mgd | afy | Non-Employment Water Use mgd | afy | Total Minimum Water Demand Over Baseline mgd | afy | Total Maximum Water Demand Over Baseline mgd | afy |
|---|---|---|---|---|---|---|---|---|---|---|
| Destination resort (golf) | 0.05 | 61 | 0.08 | 92 | 1.07 | 1,200 | 1.13 | 1,261 | 1.15 | 1,292 |
| Activity at Tonopah Test Range | 0.05 | 59 | 0.11 | 118 | 0.14 | 160 | 0.20 | 219 | 0.25 | 278 |
| Non-farming agribusinees | 0.07 | 78 | 0.10 | 116 | | | 0.07 | 78 | 0.10 | 116 |
| Agricultural expansion (20,000 acres) | 0.01 | 10 | 0.01 | 16 | 89.28 | 100,000 | 89.29 | 100,010 | 89.29 | 100,016 |
| Tourism growth (5% per year) | 0.69 | 775 | 1.04 | 1,163 | | | 0.69 | 775 | 1.04 | 1,163 |
| Stateline area expansion | 0.35 | 388 | 0.42 | 465 | 1.07 | 1,200 | 1.42 | 1,588 | 1.49 | 1,665 |
| Increased telecommuters | 0.07 | 78 | 0.14 | 155 | | | 0.07 | 78 | 0.14 | 155 |
| Oilfield | 0.03 | 31 | 0.04 | 47 | | | 0.03 | 31 | 0.04 | 47 |
| One new mine opening | 0.69 | 775 | 1.04 | 1,163 | | 1,500 | 0.69 | 775 | 1.04 | 1,163 |
| State back-office facilities | 0.07 | 78 | 0.10 | 116 | | | 0.07 | 78 | 0.10 | 116 |
| Four-year college | 0.14 | 155 | 0.21 | 233 | 0.33 | 1,250 | 0.47 | 529 | 0.54 | 606 |
| Expanded air service | 0.02 | 23 | 0.03 | 31 | 0.89 | 1,000 | 0.91 | 1,023 | 0.92 | 1,031 |
| Other industrial development | 0.42 | 465 | 0.69 | 775 | | 500 | 0.42 | 465 | 0.69 | 775 |
| TOTALS | 2.66 | 2,976 | 4.01 | 4,489 | 92.79 | 106,810 | 95.45 | 106,909 | 96.80 | 108,423 |

mgd = million gallons per day afy = acre feet per year MW = megawatt

Assumptions:

1. Golf course use rate based on Champion Golf Course.
2. Agricultural water use at 5 acre feet per acre application rate.
3. Stateline area expansion assumes small casino and RV park similar to Longstreet Inn.
4. Water use at campus assumes 5 ft per acre time 250 acres.

## POPULATION IMPACTS OF VARIOUS MODES OF DEVELOPMENT

| Mode of Development | Minimum Direct Employees | Maximum Direct Employees | Minimum Indirect Employees | Maximum Indirect Employees | Minimum Population Over Baseline | Maximum Population Over Baseline |
|---|---|---|---|---|---|---|
| Destination resort (golf) | 50 | 75 | 19 | 28 | 178 | 266 |
| Activity at Tonopah Test Range | 40 | 80 | 26 | 52 | 170 | 341 |
| Non-farming agribusinees | 50 | 75 | 37 | 55.5 | 224 | 337 |
| Agricultural expansion (20,000 acres) | 6 | 10 | 5 | 7.4 | 28 | 45 |
| Tourism growth (5% per year) | 500 | 750 | 370 | 555 | 2,245 | 3,367 |
| Stateline area expansion | 250 | 300 | 185 | 222 | 1,122 | 1,347 |
| Increased telecommuters | 50 | 100 | 37 | 74 | 224 | 449 |
| Oilfield | 20 | 30 | 15 | 22.2 | 90 | 135 |
| One new mine opening | 500 | 750 | 370 | 555 | 2,245 | 3,367 |
| State back-office facilities | 50 | 75 | 37 | 55.5 | 224 | 337 |
| Four-year college | 100 | 150 | 74 | 111 | 449 | 673 |
| Expanded air service | 15 | 20 | 11 | 14.8 | 67 | 90 |
| Other industrial development | 300 | 500 | 222 | 370 | 1,347 | 2,245 |
| TOTALS | 1,931 | 2,915 | 1,408 | 2,122 | 8,614 | 12,996 |

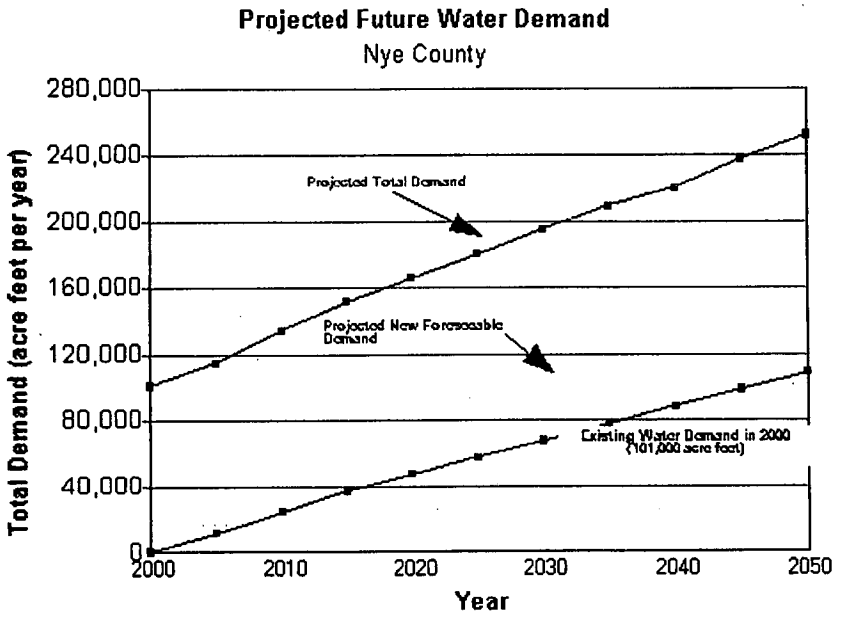
**Table 18. PROJECTED MAXIMUM FUTURE WATER DEMAND - BASELINE PLUS NEW DEVELOPMENT**

| Year | Resorts (golf) afy | Ag-Bus afy | New Agr. afy | Tourism afy | State Line afy | Tele Commute afy | Oilfield afy | New Mine afy | State Offices afy | College afy | Air Service afy | Other afy | Total New Demand afy | New Plus Baseline afy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2000** | | 11 | | 106 | | 14 | | | | | | | 130 | 100,973 |
| **2005** | | 21 | 10,000 | 211 | | 28 | | 1,142 | 114 | | | 76 | 11,593 | 114,959 |
| **2010** | 1,292 | 32 | 20,000 | 317 | 1,665 | 42 | | 1,142 | 114 | | 30 | 152 | 24,786 | 134,888 |
| **2015** | 2,584 | 42 | 30,000 | 423 | 1,665 | 56 | 6 | 1,142 | 114 | 1,228 | 30 | 228 | 37,518 | 151,662 |
| **2020** | 2,584 | 53 | 40,000 | 529 | 1,665 | 70 | 12 | 1,142 | 114 | 1,228 | 30 | 304 | 47,731 | 166,054 |
| **2025** | 2,584 | 63 | 50,000 | 634 | 1,665 | 85 | 18 | 1,142 | 114 | 1,228 | 30 | 381 | 57,943 | 180,445 |
| **2030** | 2,584 | 74 | 60,000 | 740 | 1,665 | 99 | 24 | 1,142 | 114 | 1,228 | 30 | 457 | 68,155 | 194,837 |
| **2035** | 2,584 | 84 | 70,000 | 846 | 1,665 | 113 | 29 | 1,142 | 114 | 1,228 | 30 | 533 | 78,368 | 209,229 |
| **2040** | 2,584 | 95 | 80,000 | 952 | 1,665 | 127 | 35 | 1,142 | 114 | 1,228 | 30 | 609 | 88,580 | 220,167 |
| **2045** | 2,584 | 105 | 90,000 | 1,057 | 1,665 | 141 | 41 | 1,142 | 114 | 1,228 | 30 | 685 | 98,792 | 237,979 |
| **2050** | 2,584 | 116 | 100,000 | 1,163 | 1,665 | 155 | 47 | 1,142 | 114 | 1,228 | 30 | 761 | 109,005 | 252,405 |

**afy = acre feet per year Ag-Bus = Agricultural related businesses e.g. farm equipment sales and service, chemical suppliers, etc.**

**Assumption: Agricultural expansion at 400 acres per year.**

**Figure 12. Projected Future Water Use Considering Existing, Baseline Projections** and Foreseeable New Demands.




| Year | Total New Demand afy | Baseline | Total with Baseline afy |
|---|---|---|---|
| 2000 | 130 | 100,843 | 100,973 |
| 2005 | 11,593 | 103,366 | 114,959 |
| 2010 | 24,786 | 110,102 | 134,888 |
| 2015 | 37,518 | 114,143 | 151,662 |
| 2020 | 47,731 | 118,323 | 166,054 |
| 2025 | 57,943 | 122,502 | 180,445 |
| 2030 | 68,155 | 126,682 | 194,837 |
| 2035 | 78,368 | 130,862 | 209,229 |
| 2040 | 88,580 | 131,587 | 220,167 |
| 2045 | 98,792 | 139,186 | 237,979 |
| 2050 | 109,005 | 143,401 | 252,405 |

projections, and modes of development over the planning period. The rationale behind the assumptions that lead to these differences is discussed below for each sector of the economy.

Total Municipal and Industrial Water Use - The State Water Plan projects that 13,000 acre feet will be needed in the year 2020 to supply public water supplies for domestic, commercial, industrial, and thermoelectric uses while this plan projects an estimated 33,000 acre feet per year. The reason for this difference is the population projections that were used. The State Water Plan projected a County population of only 44,000 by the year 2018 while Nye County projects the population at 90,000 by the year 2020. The water demands in this category are based on the State Demographer data projected by Nye County. As in Chapter 2, a comparison of this projection with the available undeveloped lots in the County suggests that the results are reasonable.

Mining - The State Water Plan projects mining water use at 7,977 acre feet in the year 2020. In this plan a constant demand of 8,000 acre feet per year was assumed. The difference is inconsequential. Mining has been, and continues to be, a volatile sector of the County's economy. Fluctuations in gold, silver, and other mineral prices have created wide swings in population and employment. Nye County has considerable proven mineral reserves and resources for several metals and non-metal resources. Further exploration could yield more deposits than have been identified to date, and exploration is active. For the purposes of planning, this plan assumes that three new large mining projects will occur over the foreseeable future but that two of these projects will be offset by closure of existing mining operations. The additional demand for water associated with a net gain of one new mine is estimated at 1,142 acre feet per year beginning in the year 2005. Because of the many unpredictable factors in forecasting the mineral industry, the use could be appreciably higher. However, as the use is typically temporary (5 to 40 years), in isolated locations, and a preferred use under Nevada Water Law, it is further assumed that water will be available to support the mining industry.

Agriculture: The largest single difference between the two water forecasts is projected water demand by the agricultural sector. The State Water Plan forecasts that agricultural water demands will increase to a high of 83,000 acre feet in 2000 and then decline to 77,000 acre feet by the year 2020. This plan assumes that short-term reductions in agriculture in Pahrump Valley will be offset by increases in Amargosa Valley and that agricultural water use will be constant at 60,000 acre feet through the year 2005. Thereafter, this plan is based on the assumption that irrigated cropland will increase at the rate of 400 acres per year. Total new irrigation by the year 2050 is assumed to be 20,000 acres with an associated water withdrawal rate of 100,000 acre feet per year. The standing water right applications for Desert Land Entries in key northern basins (Railroad Valley and Hot Creek Valley) and recent interest by major agribusiness suggests that these assumptions are appropriate, and if anything, may be too conservative.

Federal Water Users - The State Water Plan did not discriminate federal water users as is done in this plan. This plan assumes that federal water use will remain at a constant 17,000 acre feet per year. The majority of this use will continue to be the 12,600 acre feet of spring discharge appropriated by the U.S. Fish and Wildlife Service to sustain the wildlife habitat at Ash Meadows. Water use at the Nevada Test Site and U.S. Air Force Ranges may be quite variable but total water use at these facilities is not expected to be more than 4,400 acre feet per year.

# CHAPTER 5. WATER MANAGEMENT AND PLANNING ISSUES

The potential for growth and development in Nye County over the next 50 years must take into account changes that seem to be well beyond prediction. Las Vegas is of course the prime example of how unpredictable growth can be. All sectors of the Nye County economy are subject to changes in market conditions, policies, and technology that are decided and controlled on a regional, national, and/or global level. These factors could change the economic outlook, population, employment patterns, and water use anticipated in the County by the year 2050. There are a myriad of issues associated with planning, development, and management of the water resources that exist. This chapter provides an overview of the laws and regulations that govern water development, use and protection, and the water supply and environmental issues that must be considered in developing a long-term resource management strategy for the County.

## Regulatory Framework

While the water resources of Nye County occur within the boundaries of the County, the County has very little authority over the use of those resources. The County only has limited statutory authority over some aspects of sewer facilities and the development of master plans and regional plans. In this section the major state and federal laws that must be taken into consideration are briefly identified and discussed. For a more comprehensive overview of the federal, state, and local agencies and the regulatory framework governing the issues related to water resources, the reader is referred to the State Water Plan, Part 1, Section 7.

Nevada Water Law - Nevada Water Law governs the administration of the waters of the State of Nevada. The Nevada Department of Conservation and Natural Resources is the branch of State government responsible for management of water resources and the Division of Water Resources, directed by the Nevada State Engineer, is responsible for the allocation of the public waters of the State, administrating the law, and resolving disputes. The State Engineer's actions and decisions areas bound by the water law and its implementing regulations:

**Nevada Revised Statues, Title 49**

**Chapter 532 - State Engineer**
**Chapter 533 - Adjudication of Vested Water Rights; Appropriation of Public Waters**
**Chapter 534 - Underground Water and Wells**
**Chapter 534A - Geothermal Resources**
**Chapter 535 - Dams and Other Obstructions**
**Chapter 536 - Ditches, Canals, Flumes, and Other Conduits**
**Chapter 537 - Navigable Waters**
**Chapter 538 - Interstate Waters, Compacts, and Commissions**

**Nevada Administrative Code**

**Chapter 534 - Underground Water and Wells**

The Division of Water Resources and the Nevada State Engineer were instrumental in the development of this plan. The Division provided a great deal of the data and information presented in this plan in a timely manner. Direct consultations were held with the State Engineer and the Deputy State Engineer in the development of this plan.

The Division of Water Planning (DWP) was created by legislation in 1977 and, after completion of the mandated State Water Plan in 1999, was incorporated into the Division of Water Resources in 2000. The DWR was responsible for water management and planning, conservation plans, planning assistance to local governments, and development of the State Water Plan. The State Water Planner administered community assistance and flood mitigation assistance under the national Flood Insurance Program and the Small Community Grant Program. The State Water Planner's actions and decisions areas are bound by the water law and its implementing regulations. Direct consultations were held in both Carson City and Pahrump with the State Water Planner and Division Staff, who made significant contributions to development of this plan.

**Nevada Revised Statues, Title 49**

**Chapter 540 - Planning and Development of Water Resources**
**Chapter 349 - State Obligations**

The Division of Water Planning and the Nevada State Water Planner were also instrumental in the development of this plan. The State Water Planner, as part of the development of the State Water Plan, held public meetings concerning the State Water Plan. The Division provided a great deal of the data and information used in the preparation of this plan in a timely manner.

Policy for Compliance

It is the policy of Nye County to cooperate and comply fully with Nevada Water Law and its implementing regulations, to encourage business and industry to comply fully with applicable regulations, and to foster a spirit of cooperation between the regulatory agencies and all of the stakeholders in Nye County. Nye County believes that sound long-term planning and management of the development and use of County's water resources is in the best interest of both the County and the State.

Clean Water Act - The Clean Water Act is the primary federal law enacted to prevent pollution to surface waters. The act was established to "restore the chemical, physical, and biological integrity of the nation's waters." It requires that states establish standards for surface water quality, provides federal funding for sewage treatment plants, and sets goals of zero toxic discharges to, and realization of "fishable" and "swimable," surface waters. The Clean Water Act also mandates a regulatory system for reporting of hazardous spills to surface waters, and a wetlands preservation program.

The Nevada Division of Environmental Protection (NDEP) has been delegated the authority to implement programs of the Clean Water Act. Enforceable provisions of the Clean Water Act include permitting programs (National Pollution Discharge Elimination System), technology-based effluent standards for point sources of pollution, and water quality standards. NDEP also implements federally mandated programs for the management of non-point sources of pollution, and a construction grants program to build or upgrade sewage systems. The State Environmental Commission is responsible for developing water quality standards for specific water bodies within the State, and for developing a handbook of best management practices to control pollution from diffuse sources.

Additionally, the State of Nevada has adopted regulations that define State programs to implement the provisions of the Clean Water Act and Nevada Water Pollution Control laws. Nevada's Water Pollution Control laws, contained in Chapter 445A of the Nevada Revised Statutes, establish several non-federal water pollution control programs. These programs, implemented by the NDEP, include programs for issuing Water Pollution Control Permits with zero-discharge performance standards, and State Ground Water Permits for infiltration basins, land application of treated effluents, large septic systems, and industrial facilities.

Policy for Compliance

It is the policy of Nye County to cooperate and comply fully with state and federal regulatory programs of the Clean Water Act and the Nevada Water Pollution Control Laws, to encourage business and industry to comply fully with applicable regulations, and to ensure that the County's surface water resources are clean and free from pollution. Additionally, the County supports the use of the State Environmental Commission's Handbook of Best Management Practices for all activities that have the potential to degrade surface waters.

Safe Drinking Water Act - The Safe Drinking Water Act, an amendment to the Public Health Service Act, is the primary federal law enacted to protect underground sources of drinking water from pollution, and to ensure the quality of drinking water delivered at the tap. The Act established a program for setting primary and secondary standards for drinking water, a permit program for injection wells, and mandated a program of wellhead protection practices. The Nevada Water Pollution Control Act authorizes the State Board of Health to promulgate standards for tap and bottled drinking water.

Authority to implement the various programs of the Safe Drinking Water Act has been granted by the EPA to the Nevada Bureau of Health Protection Services (BHPS) and the NDEP. The State Board of Health has promulgated standards for over 100 contaminants in drinking water, consistent with federal standards. BHPS implements permitting programs for public suppliers of tap and bottled water, which include routine sampling and monitoring of public water supplies to demonstrate compliance with drinking water standards. BHPS also implements a permit program for domestic septic systems to ensure underground water supplies are adequately protected. Industrial waste water treatment systems, and waste and enhanced mineral and hydrocarbon recovery injection wells, are permitted through the NDEP.

The wellhead protection program is implemented by NDEP, in cooperation with local water supply systems. Elements of the wellhead protection program include delineating the wellhead protection area (WHPA), identifying potential pollution sources within the WHPA, defining constraints on siting of new wells, contingency planning and emergency response, and defining roles of state and local governments and water purveyors. Local governments are encouraged to support and participate in wellhead protection programs.

Policy for Compliance

It is the policy of Nye County to cooperate and comply fully with state and federal regulatory programs of the Safe Drinking Water Act as implemented through the Nevada Water Pollution Control Laws. Nye County encourages business and industry to comply fully with applicable regulations, to ensure that the County's public drinking water supplies are clean and free from contamination. The County has received grants from NDEP for the preparation of a basin wide Wellhead Protection Plan for Pahrump and a separate plan for the County Complex water supply wells in Amargosa Valley. These plans will be completed in 2005.

Endangered Species Act - The purpose of the Endangered Species Act is to ensure that any action, administrative or real, does not unduly jeopardize the continued existence of an endangered or threatened species or cause the destruction or adverse modification of a critical habitat. With respect to the water resources of Nye County, the Endangered Species Act provides protection not only to threatened or endangered species, but also to the water resources that support the habitat for these, and other sensitive species. There are a number of threatened and endangered bird species, and a fish species that has been relocated to protect it from extinction, as well as sensitive species and species of concern.

The State of Nevada has a number of statutes governing the protection of imperiled species that are administrated by the Division of Wildlife. The State has a listing of sensitive plant and wildlife species that have been designated as State-protected species.

Policy for Compliance

It is the policy of Nye County to cooperate and comply fully with the Endangered Species Act and all State laws and regulations governing wildlife. Nye County encourages all of its citizens, visitors, and businesses to comply fully with these laws and regulations.

Regulatory Issues - Federal laws, regulations, and policies establish standards for clean water, controlling growth in flood plains, and protecting the environment. While each of these goals is beneficial and consistent with the long term goals and values held by Nye County and its citizens, the immediate impact of the legislation is often limiting. Some of the provisions of these many levels of regulation impose mandates that are costly for the County or the towns within the County to implement, often forcing a local unit of government to reduce or eliminate other discretionary programs that benefit the citizens of the area. Other provisions may hinder development by imposing costly controls on private industry wishing to use federal lands for mining exploration, mining activity, or other business or industrial uses. Nye County maintains working relationships through Memoranda of Understanding with the local offices of the BLM and U.S. Forest Service, which helps to minimize the negative impacts that may be associated with decisions regarding public land management.

## Water Supply Issues

In Chapter 3, a number of key water supply issues were identified:

- **Inadequate water supplies to meet projected demands in Pahrump Valley**
- **Federal land use policies**
- **Proposed water exportation by the Southern Nevada Water Authority and others**
- **Unpredictable growth in Amargosa Valley**
- **Competition for water in Railroad Valley**
- **Water resource speculation in Nye County and adjacent areas**
- **Management of groundwater in multi-county/bi-state basins**

This section provides information and a discussion on each of these issues. Subsequent sections provide a similar treatment of environmental issues and federal water management issues.

Pahrump Valley - Most of the growth projected for Nye County over the next half-century is expected to occur in Pahrump Valley. Of the 162,000 County residents projected by the year 2050, almost 150,000 are projected to reside in Pahrump. For the purposes of planning, it is assumed that agriculture will be phased out completely by that time. Based upon current per capita water demands, the total demand for water by the year 2050 will probably be about 58,000 acre feet per year for residential purposes. Assuming four golf courses, two-hundred acres of public parks and facilities, continued expansion of the gaming industry, and approximately 25,000 commercial units, total water use is projected to be about 80,000 acre feet per year by the year 2050.

Withdrawals of groundwater in excess of the perennial yield will result in overdraft conditions in Pahrump. The published perennial yield of 19,000 acre feet per year and the published sustained yield of 26,000 acre feet per year are not adequate to provide the water necessary to support a full build-out of the community. Based upon these values, a shortfall of 54,000 to 61,000 acre feet per year is projected by the year 2050.

The effects of groundwater overdraft in Pahrump Valley have already been well documented and include the lowering of static and pumping water levels, reductions or elimination of spring discharges, and subsidence. Between the mid 1940s and late 1960s, groundwater withdrawals from the basin rose from 10,000 acre feet per year to a peak of 47,100 acre feet in 1968. During this period, the static groundwater level declined as much as 100 feet in some portions of the basin and the flow of Manse Spring dropped from three cubic feet per second to less than one cubic foot per second. (By the mid-1970s, discharge at this spring was seasonal.) In 1986, the U.S. Geological Survey published the results of a study of groundwater depletion in Pahrump Valley and developed a numerical model of the basin (see Harrill, 1986 in the reference section). The results of this model indicated that continued pumping of the valley-fill aquifer at a rate of about 42,000 acre feet per year for 65 years would result in additional water level declines of as much as 30 feet in the central portions of the basin to more than 50 feet along the base of the Pahrump and Manse fans (the alluvial fans along the western slopes of the Spring Mountains). Pumping at the higher projected rate of 80,000 acre feet per year will likely result in faster water level declines and additional water level declines over a broader area.

The future consequences of overdraft of the valley-fill aquifer in Pahrump Valley will probably include the elimination of all discharge from springs, reductions in natural evapotranspiration by mesquites and phreatophytes, increased pumping and well drilling costs, water quality degradation, and, perhaps most importantly, subsidence of the land surface through the compaction of dewatered sediments. The U.S. Geological Survey study of groundwater depletion in Pahrump Valley estimated that more than two feet of subsidence occurred between 1962 and 1975 over an area of about eight square miles, and more than one foot of subsidence had occurred over an area of more than 40 square miles. An increase in pumping to the projected rate necessary to support a full build-out of the existing lots and parcels in the basin will result in more subsidence over a larger area. Problems associated with similar subsidence in the Las Vegas Valley and elsewhere have included damage to building foundations and slabs, fissuring, shearing of well casings, and extensive damage to roadbeds. The U.S. Geological Survey study found that, "*Eventually, either pumping in Pahrump Valley will have to be curtailed or additional water will have to be imported to alleviate the overdraft problem. However, ....considerable time may elapse before either action becomes necessary.*"

Population forecasts for Pahrump suggest that the demand for water will exceed 40,000 acre feet within ten years, reflecting the buildout of more than 15,000 lots and parcels. By that time, one to four feet of annual water level decline is expected over a broad area of the basin and, with time and increased pumping, these rates of decline may be expected to increase.

To address the anticipated water supply shortfalls in Pahrump, Nye County has initiated a number of actions including:

- Master planning
- A baseline water supply and demand study
- Geologic mapping of portions of Pahrump Valley
- Geophysical surveys of the basin including gravity and low-altitude aeromagnetic surveys
- Development of a new water level baseline for 1999-2000
- Applications to appropriate water for importation to Pahrump Valley
- Coordination with the Division of Water Planning and Division of Water Resources

Master planning by the Pahrump Regional Planning Commission (in coordination with the Nye County Department of Planning) led to the development of the Pahrump Regional Planning District Master Plan in April, 1999. This planning effort identified the following specific policies on water resources beyond those listed in the Nye County Comprehensive Plan (see page 3):

- Develop a local public monitoring program to assess water use, quantity, quality, and future water availability.
- Encourage developers to provide the Regional Planning Commission with access to monitoring wells.
- Participate with the Town of Pahrump, Nye County, and state agencies to develop accurate assessments of water supply and demand.
- Develop the ability to work regionally with other local governments, state and federal agencies, and established water purveyors in identifying and planning for future water importation projects.
- Develop a program of public awareness and education concerning water conservation including reuse of gray water.
- Require that well heads for new wells located in areas of special flood hazard are elevated a minimum of six inches above the base flood elevation as shown on the community's Flood Insurance Rate Maps.
- To implement a program to ensure that all wells are properly sealed or capped.
- To work with state agencies to develop and establish a District-wide Wellhead Protection Program.

In 1998, Nye County initiated a temporary moratorium on land parceling until the Pahrump Regional Planning Commission could develop an ordinance that was subsequently enacted by the Board of County Commissioners. This ordinance requires that persons who parcel lands in Pahrump Valley must deed water rights to Nye County for each additional lot that is created through parceling. These water rights are being "banked" by Nye County to use for future groundwater management programs. Through December 2001, only about 11 acre feet had been transferred and another 50± acre feet had been committed and were in the process of being transferred. The small number of water right transfers serves as an example of the success of the ordinance in restricting parceling in the basin.

The baseline water supply and demand study concluded that there are four alternatives for meeting projected future water shortfalls in Pahrump Valley:

1. Managed overdraft of the basin - If additional water supplies cannot be obtained, then Pahrump will have to rely solely upon the water resources of Pahrump Valley. To mitigate problems associated with

declining water levels, the distribution of water supply wells in the basin will have to be optimized. Wells producing from areas prone to subsidence will have to be reduced in favor of wells located higher on the alluvial fans. Recharge wells could be used to inject water into areas where subsidence is expected. Water quality degradation can be mitigated through water treatment, an expensive alternative.

The management of the valley-fill aquifer is complicated by the lack of a basin-wide water utility and the number of domestic wells that are anticipated. None of the existing water supply systems have the resources (or the incentive) to solve the future water supply problems of the community. Domestic well owners have no incentive to work toward a solution until individual wells actually begin to fail. Water planning is also hampered by the public perception that the water resources of Pahrump Valley are unlimited. This misconception is largely due to the publication of estimates of the groundwater in storage in the sediments of the basin.

2. Development of the carbonate aquifer that underlies the basin - Groundwater in the carbonate aquifer that lies deep under the valley could be developed to partially mitigate the impacts of long-term overdraft of the basin. The capture of groundwater which discharges via this aquifer into California could augment water supplies from the valley-fill aquifer. Alternately, water could be withdrawn from the carbonate aquifer along the western flanks of the Spring Mountains and injected into the valley-floor area to decrease the subsidence potential. Either of these two approaches would require careful evaluation to insure that regional hydrologic conditions are not adversely impacted.

3. Importation of water from other basins - Potential sources of water identified for export to Pahrump include Amargosa Desert, the basins in which the Nevada Test Site and Nellis Air Force Range are located, and the basins of northern Nye County.

4. Administrative actions - Administrative actions include specific codes and ordinances aimed at water conservation, zoning changes, moratoriums, and regulations on wells, particularly domestic wells. The 1998 parceling ordinance is an example of an administrative action aimed at better water resource planning and management.

The geologic mapping initiative by Nye County is part of a larger effort by the U.S. Geological Survey and the Nevada Bureau of Mines and Geology to map all of Pahrump Valley. These maps are useful in identifying the extent and nature of the water-bearing sediments and in the identification of areas that are more susceptible to subsidence. To augment the information gathered during this mapping effort, Nye County has sponsored two geophysical surveys by the U.S. Geological Survey. These surveys covered most of Pahrump Valley and Amargosa Desert and portions of Crater Flat, Jackass Flat, and Rock Valley as well. Interpretations of these geophysical data sets have provided important information concerning the depth to rock under the valley-fill sediments, the thickness of the valley-fill, and subsurface geologic features (faults, buried volcanoes, etc.) that are important with respect to groundwater flow. Nye County is working with the U.S. Department of Energy and U.S. Air Force to expand the coverage of these important geophysical surveys to include more of southern Nye County.

Nye County is developing a new baseline of information on the depth to water and elevation of the water table in the southern part of the County. Between November 1999 and March 2000, more than 150 water level soundings were taken in Pahrump Valley. These soundings are being used to generate new depth to water and water elevation maps for the basin. Comparison of this new baseline with historic water level data will help to define areas where water level declines may occur. Nye County is working in consultation with the U.S. Geological Survey and the Nevada Division of Health to identify wells for water quality sampling and for long-term monitoring.

Nye County has held a number of consultations with the State Engineer and State Water Planner regarding issues and alternative strategies that can be used. The Nye County Department of Planning and the Pahrump Regional Planning Commission were also consulted. These consultations were instrumental in the development of this plan, and the County will continue to work with the Division of Water Planning and Division of Water Resources in evaluating conditions in Pahrump and developing water management strategies.

Federal Land Use Issues - Almost 94 percent of Nye County is under federal stewardship. Although the various federal agencies generally only impose small demands for water, federal actions, federal land withdrawals and federal land management policies impose significant constraints on water resource development and management.

Federal Water Use - The total federal water use in Nye County is more than 15,000 acre feet per year. Most of this amount, almost 13,000 acre feet, is permitted by the U.S. Fish and Wildlife Service for spring discharges at Ash Meadows. The Department of Energy has appropriations totaling 353 acre feet of groundwater and claims a reserved right of 4,175 acre feet. The U.S. Air Force holds rights to almost 1,700 acre feet but actually uses only about 160 acre feet a year. The National Park Service claims a federal reserved right for lands within Death Valley National Park but has not quantified this claim. Water rights and use by the Bureau of Land Management and U.S. Forest Service are small.

Federal Actions - Federal actions that have directly impacted the water resources of Nye County include operations at the Nevada Test Site and Nellis Air Force Range, and management policies being implemented or proposed by the three agencies in the Interior Department, the National Park Service, the U.S. Fish and Wildlife Service, and the Bureau of Land Management. The federal actions have also resulted in a number of direct and indirect impacts. These impacts are listed in Table 19 and include widespread resource damages at the Nevada Test Site, significant reductions in resource availability, and the corresponding adverse socioeconomic impacts on the tax base, growth, and productivity of Nye County's economy.

Land Withdrawals - More than two million acres of land have been withdrawn for federal reservations in Nye County including the Nellis Air Force Range (1,290,000 acres), the NevadaTest Site (864,000 acres), Death Valley National Park (106,961 acres) and the Ash Meadows National Wildlife Refuge (12,000+ acres). Additionally, the Bureau of Land Management has designated almost 46,000 acres as Areas of Critical Environmental Concern, the Fish and Wildlife Service has co-use of a large area of the Nellis Air Force Range and wildlife management areas in Railroad Valley, and the U.S. Forest Service manages more than 1,940,000 acres of National Forests. Smaller areas have been set aside for Indian reservations and a Legislative Environmental Impact Statement is currently under preparation that would add more tribal lands in the County. The impacts of federal land withdrawals and designations on the water resources of Nye County are listed in Table 20.

In 1991, the Special Nevada Report concluded that the withdrawal of land from public access and/or the purchase of water rights by the Departments of Defense and Energy has the greatest potential for effects on Nevada. The water resources associated with withdrawn lands could, if they were available, play a significant role in the continued growth of southern Nevada. The designation of lands for special management or as buffer zones around protected areas also has impacts on the water resources of the County. The Bureau of Land Management has developed management directives that include filing for water rights for water sources that are not federally reserved, and the protection of riparian areas and habitat by not allowing projects that might adversely impact the water table supporting those areas or spring flows. The implementation of these directives will reduce the quantity of water available for other uses,

increase water demand in Amargosa Desert, and restrict the area available for future water supply development. Indirect impacts of these management directives include increased water costs, decreased tax revenues and tax base growth, and decreases in the long-term productivity of the affected lands .

**Table 19. Impacts of Federal Activities and Actions**

| Agency | Actions | Direct Impacts | Indirect Impacts | Significance |
|---|---|---|---|---|
| Department of Energy | Nevada Test Site Operations Past Actions; Implement Resource Management Plan | Contamination of subsurface; physical damage to aquifers; water level perturbations; increased recharge down chimneys. | Contamination of recharge; removal of contaminated areas from future water development. | Significant resource injuries and constraints on water development. |
| U.S. Air Force | Nellis Air Force Range Operations Past Actions | Surficial contamination; water level perturbations. | Increased water demand in employment centers. | Not significant. |
| Bureau of Land Management | Past Actions; Implement Resource Management Plan | Reduced water availability; increased over-appropriation of Amargosa Valley; restricted area for development; increased water demand. | Increased water costs; decreased tax revenues; decreased long-term productivity of private lands; decreased tax base growth; increased overdraft of Pahrump Valley. | Significant increased demand for water and overdraft in Pahrump and over-appropriation in Amargosa Valley. |
| National Park Service | Past Actions; Implement General Management Plan | Reduced water availability; increased over-appropriation of Amargosa Valley; restricted area for development; increased appropriation time; increased appropriation cost; increased water demand. | Increased water costs; decreased tax revenues; decreased long-term productivity of private lands; decreased tax base growth; increased overdraft of Pahrump Valley. | Significant losses of long-term productivity of private lands; increases in costs of obtaining water rights; decrease in tax revenues to County. |
| U.S. Fish & Wildlife Service | Past Actions | Reduced water availability; increased over-appropriation of Amargosa Valley; decreased long-term productivity. | Increased water costs; decreased tax revenues. | Significant losses of long-term productivity and tax revenues to County. |

Land Disposals - The Bureau of Land Management has designated 27,904 acres in Amargosa Valley and 14,768 acres in Pahrump Valley for disposal. While Nye County welcomes these land disposals, these actions will result in increased demands for water in both basins and will likely exacerbate overdraft in Pahrump Valley and future overdraft in Amargosa Desert. If it is assumed that the future demand for water associated with the lands will only be 1.0 acre foot per acre, then the demand for water will almost double in Amargosa Valley and the overdraft in Pahrump Valley will be increased significantly.

The disposal of these and additional lands in the future introduces considerable uncertainty into water resource planning. If the lands are developed, additional water supplies will be needed. Given that Amargosa Desert is fully appropriated and Pahrump Valley is over-appropriated, additional demands in these basins will result in overdraft above the established perennial yields. These overdrafts can be mitigated by importing water from other basins, but such projects are costly and time-consuming. Under the provisions of the Southern Nevada Land Sales Act, some portion of the purchase funds are transferred to the Southern Nevada Water Authority to address the water demands associated with the privatized lands. A similar mechanism may be needed in Nye County to help mitigate the adverse impacts of land disposal by federal agencies on the water resources of the County.

**Table 20. Cumulative Impacts From Land Withdrawals and Designations**

| Agency | Withdrawal or Designation | Direct Impacts | Indirect Impacts | Significance |
|---|---|---|---|---|
| **Department of Energy** | Nevada Test Site Land Withdrawal (864,000 acres ±) Central Nevada Test Area | Restricted area for development. | Reduced water availability; increased water costs. | Significant reduction in water availability |
| **U.S. Air Force** | Nellis Air Force Range Withdrawal (1,290,000 acres ±) | Restricted area for development. | Reduced water availability; increased water costs. | Significant reduction in water availability |
| **Bureau of Land Management** | 46,444 acres designated for disposal; 45,963 acres designated as Areas of Critical Environmental Concern | Reduced water availability; increased over-appropriation of Amargosa and Pahrump Valleys; restricted areas for development; increased water demand. | Increased water costs; decreased tax revenues; decreased long-term productivity of private lands; decreased tax base growth. | Significant increased demand for water and overdraft in Pahrump and increased demand in Amargosa Valley. |
| **National Park Service** | Death Valley National Park Land Withdrawals (106,961 acres) | Reduced water availability; increased over-appropriation of Amargosa Valley; restricted area for development; increased water demand. | Increased water costs; decreased tax revenues; decreased long-term productivity of private lands; decreased tax base growth. | Significant losses of long-term productivity of private lands, and decreased tax revenues to County. |
| **U.S. Fish & Wildlife Service** | Ash Meadows National Wildlife Refuge (12,000+ acres in Ash Meadows and land at Railroad Valley Wildlife Management Area and co-use of Nellis Air Force Range lands) | Reduced water availability; increased over-appropriation of Amargosa Valley; decreased long-term productivity. | Increased water costs; decreased tax revenues. | Significant losses of long-term productivity and tax revenues to County. |
| **U.S. Department of Agriculture** | Lands designated as National Forests (1,942,983 acres) | None identified | None identified | Not significant |

Water Exportation - The potential exportation of water from Nye County to serve the ever increasing demand for water in the urban areas of Clark County is the single most contentious issue with regard to water supply allocation. Figure 14 summarizes the key issues associated with water exportation from the basins in Nye County to metropolitan Clark County. In 1989, the Las Vegas Valley Water District made application to the Division of Water Resources for water rights in Railroad Valley (both the Railroad Valley North and Railroad Valley South hydrographic basins), Hot Creek Valley, Garden Valley, and Coal Valley. The applications are for the Cooperative Water Project which proposes to develop groundwater in rural areas of Nevada and convey the water to metropolitan Las Vegas. The applications in Hot Creek Valley were subsequently dropped, but the District's applications for the other basins (as well as a number of basins in White Pine and Lincoln counties) are still ready for protest. The water right filings caused the citizens of Nye County to voice strong concern regarding the impact of the proposed water withdrawals on the quality of life, economies, and ecosystems of the targeted basins.

The applications of the LVVWD have been protested by more than 1,000 individuals and entities, including Nye County. Since the water right filings were made, Nye County has

expended considerable time and funds reacting to the filings. In March 2000 a resolution and memorandum of understanding was signed by Nye, Lincoln, and White Pine counties and the District that resolved some of the issues associated with the Cooperative Water Project. The District and the three affected counties agree to work cooperatively to develop a process to address specific issues related to the applications. The memorandum of understanding lays the foundation for the development of a Management Committee, technical assistance and the exchange of technical information, and an interim process to handle water requests by other parties in the rural counties. This process involves the following steps:

*1. The Water District and the rural counties establish interim estimates of the quantity of groundwater that is available within each basin that the District has applications in and interim estimates of the quantities in each basin that may be made available to meet immediate water needs in the rural counties. In Nye County, the interim estimates of the quantity of water that may be available are 30,000 acre feet in Railroad Valley, 3,000 acre feet in Garden Valley, and 1,000 acre feet in Coal Valley.*

*2. If a rural county supports a local development, and if the proponent of the development has filed an application(s) to appropriate water pursuant to Nevada Water Law in one of the basins, then the rural county shall notify the District that the county supports the project, and of the estimated amount of water needed for the project.*

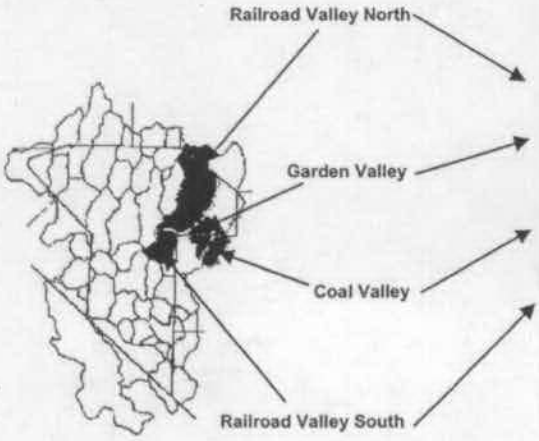
*3. Upon receiving such notification, the District will subordinate their filings in the amount of water reasonably needed by the project. This subordination shall be conditioned upon an agreement between the project's water right applicant and the District that provides: 1) the water must be put to beneficial use for the project within five years; 2) no extension of time will be granted by the District; 3) the only beneficial use made of the water during this five year period shall be for the project in question; and 4) these conditions shall be made part of any agreement and shall be filed with the State Engineer.*

Under this agreement, the applications of the proponent of the local development are subject to the policy and procedures of the State Engineer and Nevada Water Law. The subordination of the District's water right filing(s) does not in any way affect either water right filings in the basin of origin pre or post dating the District's filings.

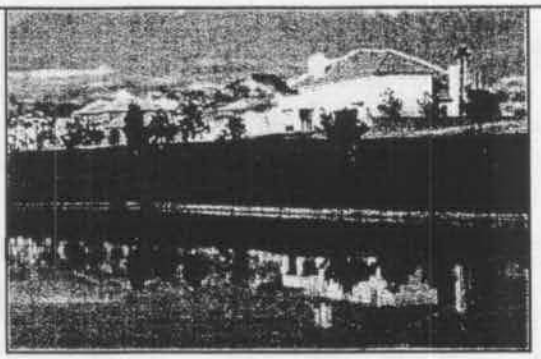
In addition to the proposed Cooperative Water Project, other schemes for water development and exportation have come forward recently including Vidler Water Company's joint water filings with Lincoln County, and 2004 filings in Mercury Valley. These filings include two basins shared between Nye County and Lincoln County, Garden Valley and Coal Valley, and Mercury Valley (shared with Clark County), and are discussed under the issue of speculation.

Amargosa Valley - The future of the community of Amargosa Valley represents the "wild card" in water planning for the southern part of Nye County. Currently agricultural, the nature of the community may change dramatically over the coming decades as the pivot center irrigators give way to residential and commercial development. Over the short term, agricultural production and water use are expected to expand. The preparation of additional land for irrigation is underway to support the demand for forage products generated by the dairy. The current population projections and forecasts for agricultural development suggest that there will be adequate water to meet the demands for the next twenty years. Water right forfeitures in the

## Figure 13. Water Exportation Issues




Four basins in northeast Nye County were the target of the District's applications along with other basins in White Pine and Lincoln counties.



**Runaway growth in metropolitan Clark County is fueling an ever-increasing demand for water. Public utilities and private groups have targeted basins in Nye County as sources of water to export to Clark County. The Las Vegas Valley Water District plans no actions on these applications until 2016, if ever. The State Engineer may act on them at any time, however, casting doubt on water allocations in these basins. Lincoln County has requested that the State Engineer take action on the applications in Coal Valley.**

## ISSUES

- The availability of water supplies is of paramount concern to Nye County and its citizens.
- There is a common need for water in the urbanized areas of the state and in the rural counties.
- There is a finite quantity of water available to meet the demands of the urban and rural counties without unacceptable impacts to the environment in the source basins.
- The future of Nye County's economic well-being, its valued natural resources and environment, and the quality of life of its citizens are dependent on the long-term availability of water resources.
- Water cannot be exported to the benefit of urban areas at the expense of rural areas without fair compensation.

## MANAGEMENT PRACTICES

- Work to modify Nevada Water Law to protect the economic well-being and environment of Nye County.
- Begin comprehensive water planning at the county level to define future water needs.
- Establish cooperation between the Las Vegas Valley Water District and Nye County.
- Facilitate conditional subordination of District water right filings to County approved projects.
- Provide better definition of the water resources and the impacts of their development.
- Assist in the development of mitigating measures in consultation with interested parties via the Board of County Commissioners and local advisory boards.

mid 1990s have brought the total appropriations in the basin in line with the published perennial yield of 24,000 acre feet. In 2000 the water use inventory identified less than 13,000 acre feet of total groundwater pumpage. Thus it appears that there is available water for the further expansion of agriculture and the dairy industry in Amargsoa Desert for the next decade or so.

Over the longer term, increased urbanization is expected as the community begins to feel the effects of "spillover" from Pahrump. Assuming a full buildout of all land at an average of one acre per lot (including the land slated for disposal by the Bureau of Land Management), as many as 30,000 residential and commercial lots could ultimately be subdivided or parceled. With a resulting population of 50,000 persons and a per capita water demand of 350 gallons per day, a total demand of 20,000 acre feet for domestic purposes and 8,000 acre feet for commercial and quasi-municipal purposes is projected. This projected demand is only 17 percent greater than the published perennial yield of 24,000 acre feet and is likely within the sustained yield for the basin.

Overdraft of the basin could occur if growth is greater than these projections *or* if there is not a corresponding decrease in agriculture. For example, in 1996, a development was proposed for Amargosa Valley (the Valle del Sol) that envisioned a 10,000 unit retirement community replete with three golf courses and other amenities, including 200 commercial lots, 400 industrial lots, and 380 acres of community area. The total water demand estimated for this ambitious proposal was 24,000 acre feet per year, the entire perennial yield of the basin. Such a project would result in significant overdraft of the basin unless agricultural is eliminated, not a likely scenario over the next few decades.

In 2002 and 2004, Nye County filed numerous water right applications for the unappropriated groundwater resources remaining in Nye County's basins (see Figure 14). None of the proposed points of diversion are located in Pahrump Valley or the Amargosa Desert hydrographic basin as defined by maps, but five of the points are located in the area covered by the order of designation for Amargosa Desert. The points of diversion are on lands managed by a number of agencies including the Bureau of Land Management, the U.S. Air Force, and the Department of Energy. More detailed information on these filings is available in the Nye County Water Resources Stewardship Plan available from the Nye County Department of Natural Resources.

Nye County's 2000 applications were protested by two organizations within the U.S. Department of Energy (Nevada Test Site Operations, and the Yucca Mountain Project), the U.S. Fish and Wildlife Service, and the National Park Service. The applications are now ready for protest, but formal protest hearings and the Nevada State Engineer's final ruling on the anticipated protests could be years away. The applications are for municipal purposes and the place of use includes land in Amargosa Valley. The 2004 applications are expected to be protested as well.

Railroad Valley - The competition for the water resources in Railroad Valley has increased significantly over the last twelve years and more than 190,000 acre feet per year of water right applications in the basin have been filed and are classified by the Division of Water Resources as ready for action or protest. Applications for groundwater rights for Desert Land Entries in the basin total almost 95,000 acre feet. The Las Vegas Valley Water District has filed applications for groundwater rights in the basin to export to metropolitan Las Vegas but has agreed to subordinate 30,000 acre feet of water to applicants within the basin. The 50 water right applications in Railroad Valley by the CSS Corporation on behalf of Frito-Lay further increase the demand for water in this basin.

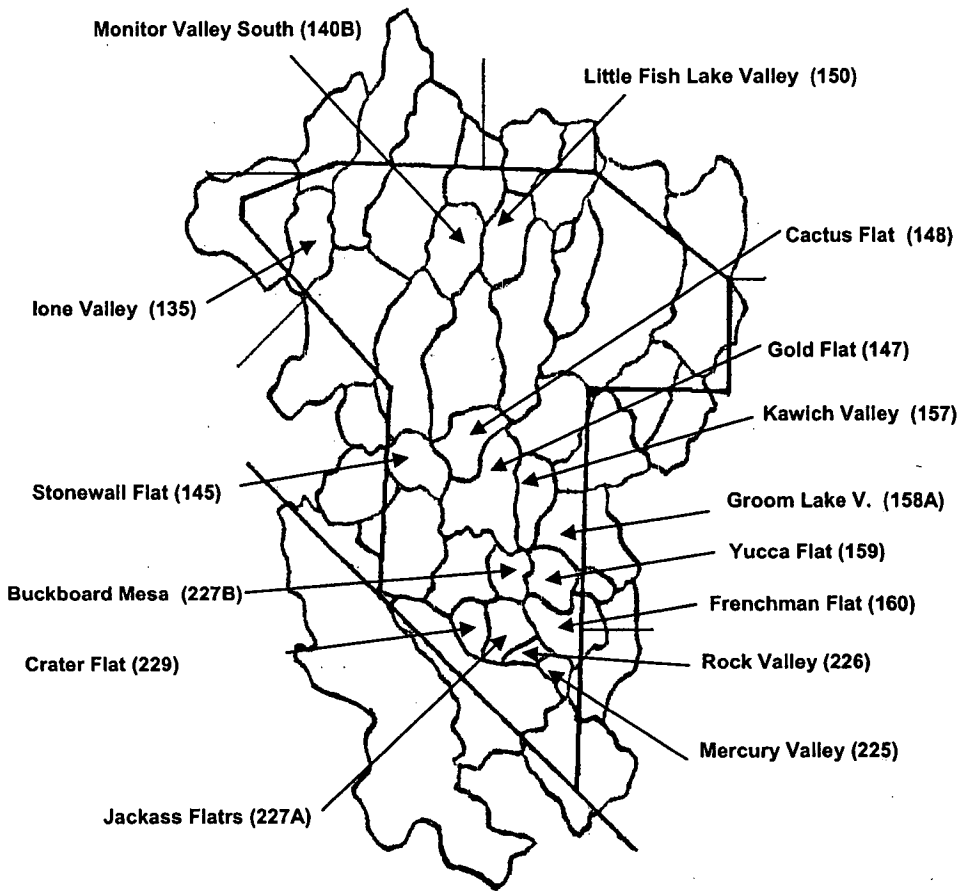



**Figure 14. Nye County Water Right Filings.** The map above shows the basins in which Nye County has filed for the remaining available water resources. Most of the basins are under the control of either the U.S. Department of Energy, the U.S. Air Force, or the Bureau of Land Management.

From Nye County's perspective, the resolution of Desert Land Entry applications by Nye County's citizens and the development of new agriculture by Frito-Lay are the preferred uses as the water would be used for the production of crops, agribusiness, and associated goods and services within the County. Exportation of the water to Clark County would negate these returns to the County. Under the provisions of the "Four Party Agreement" between Nye, Lincoln, and White Pine Counties and the Las Vegas Valley Water District, the District will subordinate up to 30,000 acre feet of water rights to applicants that are approved by the County. This subordination would somewhat offset the adverse economic impacts of the Cooperative Water Project.

The published perennial yield of Railroad Valley is 50,000 acre feet per year but a recent U.S. Geological Survey study by Nichols (2000) suggests that the perennial yield is actually larger, an estimated 85,000 acre feet per year. With existing water rights totaling less than 25,000 acre feet per year, the new water budget estimates suggest that there may be as much as 60,000 acre feet of unappropriated groundwater in the basin. Assuming that the subordination of 30,000 acre feet will occur, then as much as 30,000 acre feet may be available for other applicants.

Speculation - Water right filings for speculative purposes or projects have become increasingly common in Nevada, and Nye County has had a history of such filings, most notably those by Amargosa Resources, Inc. in Amargosa Desert. Although Vidler Water Company vehemently denies that their water right applications in Mercury, Garden, and Coal valleys are speculative, no firm plans are in place for the use of the water should be rights be granted. Similarly, the water right filings in Railroad Valley by both Las Vegas Valley Water District and CSS Corporation can be considered speculative insofar as they are for projects that may never be completed. Most recently, the national energy situation has led to increased proposals for power generation stations including seven in Clark County. Although no projects have been proposed yet for Nye County, there may be proposals in the future that are accompanied by speculative water right filings.

Multi-County/State Management - Many of the basins in Nye County are shared with other counties and Amargosa Desert and Pahrump Valley are shared with California. Multiple jurisdictions can complicate water planning efforts. As an example, Pahrump Valley includes portions of Nye County and Clark County in Nevada and portions of Inyo County in California.

With different groundwater law in California, conflicts can arise between competing developers or other factions that want to develop (or alternatively, preserve) the shared resources. Nye County has consulted with Inyo County in the preparation of this plan and will continue to work with that county in the resolution of water management issues.

One of the recommendations of the State Water Plan was that the Department of Conservation and Natural Resources should continue to work with local, regional and federal agencies and non-governmental organizations to develop and implement integrated water basin plans for Nevada's hydrographic regions. One Nye County Commissioner, Mr. Carver, has suggested that it may be time to consider redrawing some of the county boundaries so that integrated watershed management can be more easily achieved. While this novel idea makes "sound hydrologic sense", it may take a great deal of effort to ever implement it because of the many political, legal, social, and technical issues that would have to first be resolved.

## Environmental Issues

In Chapter 3, a number of key environmental issues were identified:

- Damage to groundwater resources on the Nevada Test Site
- Potential migration of contamination off of the Nevada Test Site
- Potential future contamination associated with Yucca Mountain
- Potential future contamination from septic systems in Pahrump
- Continued protection of wildlife conservation areas and Death Valley National Park
- Groundwater protection
- Groundwater data and monitoring

Resource Damages at the Nevada Test Site - As was noted in Chapter 3, the underground nuclear weapons testing at the Nevada Test Site is the most significant area of groundwater contamination in the County (and the State of Nevada as well). In addition to the 106 million curies of tritium, which has a relatively short half-life of 12.5 years, there are 2.7 million curies of strontium (with a half-life of 28 years), and more than 93,000 curies of very long half-lived radionuclides such as americium (458 years), plutonium (up to 24,400 years), and uranium (up to 4.4 billion years) . This legacy of groundwater contamination has significantly reduced the water resources available for use in the County.

The maximum contaminant level for strontium in groundwater is only 8 picocuries per litre (pCi\L); 15 pCi\L for americium, plutonium, and uranium; and 20,000 pCi\L for tritium. Estimates of the quantity of groundwater necessary to dilute the activity levels remaining at the Nevada Test Site are staggering:

- >270 ***billion*** acre feet to dilute the 2.7 million curies of strontium to 8 pCi\L
- 5 ***billion*** acre feet to dilute the 93 thousand curies of americium, plutonium, and uranium
- 4 ***billion*** acre feet to dilute the 106 million curies of tritium to 20,000 pCi\L

Alternately, the magnitude of contamination remaining at the underground testing areas on the Nevada Test Site can be estimated using a volumetric method:

**(V)olume of contaminated water = (A)rea contaminated X (D)epth of contamination X aquifer (P)orosity**

if A = 250 square miles = 160,000 acres
D = 300 feet
P = 0.10

then V = 4,800,000 acre feet

At present, water rights in Amargosa Desert have a fair market value of $675 per acre foot and water rights in Pahrump Valley have a fair market value of $7,000 per acre foot. Using an average value of $ 3,800 per acre foot, the dollar value of the groundwater resources that have been destroyed at the Nevada Test Site is estimated to be on the order of ***18 billion dollars!*** Groundwater that otherwise could be developed for use in southern Nye County has been sacrificed for national security purposes. The Department of Energy now cites those same security concerns as their basis for protesting Nye County's water right filings on the Nevada Test Site.

Contaminant Migration at the Nevada Test Site - Key questions with respect to the groundwater contamination at the Nevada Test Site are the mobility of the contaminants, the direction in which they may be moving, and the speed with which they migrate. It is not up to Nye County to

determine the contaminant migration directions and rates at the Nevada Test Site but it is of paramount concern to the County. Although the Department of Energy has studied the contamination for more than a quarter-century, these key questions remain unanswered. According to the Department's projections, more decades of study at considerable cost will be needed before the scientific objectives of the program can be met.

Nye County's participation in this process has been limited to its involvement with the Community Advisory Board (CAB) and the technical review of selected documents released by the Department of Energy. While the opportunity to participate in the process has been welcomed by the County, a much more active role by the County might help the program to move forward at a faster pace. In late 1999, Nye County's technical representative to the CAB questioned the validity of the data and modeling approach employed in studying the testing areas, and suggested that the salvage of potable water sources over the short-term, and the conveyance of water into southern Nye County over the long-term, would be more cost effective and safer than the current approach. It may be necessary for the County to assert their rights as stakeholders under the natural resource damage assessments provisions of existing federal environmental laws to resolve these issues.

High-Level Radioactive Waste Disposal at Yucca Mountain - The Department of Energy is moving forward with its studies of Yucca Mountain as a location for a high-level nuclear waste repository. Nye County has maintained a policy of strict neutrality with respect to the repository and has conducted its own scientific investigations of a number of key repository related issues. These studies have helped to further define the groundwater conditions in the region hydraulically down gradient of the proposed repository site through the installation of a number of monitoring wells, the collection of aquifer test data, and routine sampling and analyses of key water chemistry parameters.

Nye County has documented its concerns with regard to the repository in formal written comments on key Department of Energy decision documents. The major concerns with respect to water resources are:

- Transportation accidents and the potential for contamination of public water supplies along routes used to haul the radioactive wastes;
- The loss of land suitable for groundwater development because of the permanent withdrawal of land for the repository;
- Contamination of the groundwater resources of Jackass Flats and Amargosa Desert because of a cask handling problem or because of leakage from the repository;
- Reductions in land and water resource values as a result of the stigma, real or perceived, associated with the existence of a high-level nuclear waste repository in a watershed; and
- The cumulative consequences of Yucca Mountain related impacts with those from other past, present, and reasonably foreseeable future actions by both the federal and private sectors.

The Nuclear Waste Policy Act and its amendments provide the legislative mandate for the mitigation of impacts, direct compensation to the host county, and equity offsets. The guarantee of permanent uncontaminated water supplies for southern Nye County should be a cornerstone of any mitigation, compensation, or equity agreements between the federal government and the County.

Septic Systems in Pahrump Valley - There are presently more than 8,000 domestic water wells located in Pahrump Valley and most (if not all) of the lots with domestic wells also have domestic septic systems. A number of commercial operations also have larger septic systems. Figure 16 shows the distribution of domestic wells in the basin and serves as an approximation of the density of septic systems. One section (one square mile) has more than 400 septic systems and many sections have more than 100 septic systems. In fact, more than 33 square miles in the lowland portions of the basin have septic system densities of more than 100 per square mile.

Of concern is the potential for a great number of additional septic systems in the basin as the community of Pahrump continues to grow. Given the number of existing lots, there will likely be an additional 25,000 or more individual septic systems in Pahrump by the year 2050. While the larger subdivisions use package treatment works or other types of sewage disposal, the potential for so many septic systems, and the corresponding potential for groundwater contamination is a serious issue.

Conservation and Preservation - Groundwater conservation is a key issue with respect to Pahrump Valley and groundwater preservation is a key issue related to the protection of environmentally sensitive areas in Amargosa Desert and Oasis Valley in the south, and Railroad Valley, and White River Valley in the northern part of the County

Conservation measures may be used to reduce the per capita demand for water in Pahrump and help mitigate the overdraft of the basin. Conservation measures have been well established elsewhere and include zoning restrictions, building requirements for water conserving fixtures and appliances, education, and pricing of water supplies to encourage low water use. Zoning is in its early stages in Pahrump and it may be years before restrictions on landscape and landscape features can be put into effect. Similarly, building codes have only recently begun to be rigidly enforced and the housing market may not yet be ready to bear the impact of imposed conservation. Because there is no single water purveyor in the valley and there are so many domestic water well users, the approach to conservation through pricing is likely to be of only limited success.

Education of the public offers the most viable method at this time and Nye County has stressed this approach through working with the Regional Planning Commission, real estate agents and developers, and private parties to "get the word out". More work is needed in this area and the Southern Nye County Conservation District has taken the lead in working with the schools and developers in educating and implementing water conservation measures.

The preservation of water quantity and quality at wildlife refuges and national parks is considered essential to their stewards and has resulted in conflict in southern Nye County. Nye County recognizes that the goals of preservation in these areas are mandated not only by federal law but also by sound water management practices. Nye County has fostered increased cooperation between the County, it's citizens, and the federal agencies with stewardship over environmentally sensitive areas. As examples of these efforts the County has:

- Worked with the BLM to mitigate the impact of mining claims and water use on sensitive habitat in the Amargosa Flats area, the Amargosa River near Beatty, and areas of natural mesquite bosques in Pahrump Valley;
- Worked with the National Park Service to mitigate the impacts of water development on Devils Hole and Death Valley National Park by hosting and participating in Devils Hole workshops and Death Valley Regional Groundwater Flow System Numerical Modeling workshops; and

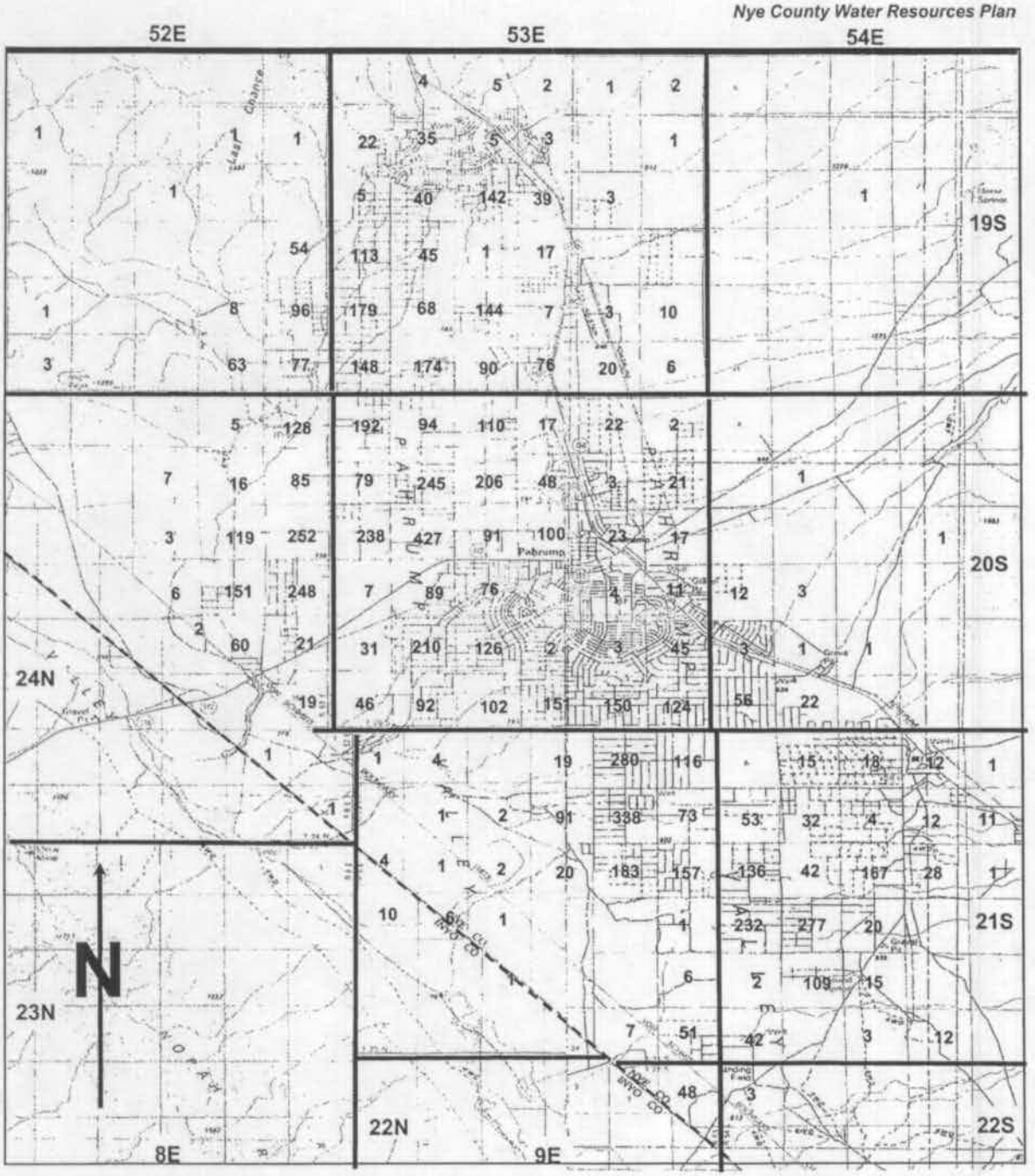



**Figure 15. Distribution of Domestic Water Wells in Pahrump Valley Through August 2001.**

Notes: Scale approximately 1:158,000.
Base map reduced from 1:100,000 USGS 30 X 60 Minute Las Vegas and Death Valley Quadrangles from NBMG web page.

- Worked with the U.S. Fish and Wildlife Service in the development of habitat conservation plans and strategies for mitigating the impacts of development in the region on wildlife values.

The continued viability of healthy fish and wildlife conditions are of particular benefit to the northern basins of Nye County. Communities in this region (such as Sunnyside) are dependent in part upon the revenues generated through recreational fishing and hunting.

Nye County's continued involvement in the development of management plans for wildlife refuges, habitat conservation plans for specific areas or species, and resource management plans by the various federal agencies will help to insure that future generations of Nye County's citizens will be able to enjoy the natural (and often unique) wildlife in the County while still having the opportunity to engage in recreational fishing and hunting.

Groundwater Protection - The protection of the quality of Nye County's water resources and drinking water supplies is of paramount importance. The two health protection issues that have been identified include sources of potential contamination and wellhead protection.

Sources of contamination include both point sources such as leaking underground tanks, landfills, and mine tailings, and non-point sources which are diffuse sources that can collectively cause contamination of surface water supplies. Examples of non-point sources include runoff from agricultural or feedlots, mining and construction activities, and urban areas.

The State Water Plan notes that non-point source pollution is best addressed by implementing Best Management Practices. (Those methods, measures or practices designed to prevent or reduce water pollution, including, but not limited to structural and nonstructural controls, and including both operation and maintenance procedures.) Best Management Practices should be the most effective, practical means of preventing or reducing the amount of water pollution from non-point sources to a level compatible with water quality goals. Soil conservation, restoration of disturbed areas, proper planning, storage, and use of fertilizers, pesticides, herbicides and other chemical agents, wetland protection and enhancement, stabilization of tailings piles, and storm water treatment. The cost of implementing Best Management Practices can be an obstacle and some federal grant money may be available to help implement them on private land, however, matching funds must be provided, typically from local agencies, organizations, and landowners. Presently, there is no State source of funding for this purpose.

Potential point sources of groundwater contamination include the infiltration of irrigation water over cropland, livestock feed lots, septic systems, storage tanks, mines, business and industry, and solid and hazardous waste disposal sites. The Nevada Bureau of Health Protection Services has conducted groundwater vulnerability assessments of each of the public water supply systems in Nye County. These assessments surveyed each water supply well or spring and defined any sources of contamination are present within the vicinity of the water supply source.

In 2004, NDEP awarded Nye County two grants wellhead protection planning. One grant is for the development a formal state-endorsed plan for the Nye County Complex in Amargosa Valley. The other grant is for the development of a plan for Pahrump that encompasses the entire valley rather than only a few public water supply systems within the community.

Groundwater Data and Monitoring -Because of its oversight activities related to Yucca Mountain, Nye County is active in the collection of primary data on water resources under the auspices of its Early Warning Drilling Program (EWDP) and has an active monitoring program. This program has included:

- The installation of more than 25 exploratory boreholes, piezometers, and monitoring wells at 22 sites in Crater Flat, Jackass Flats, and Amargosa Desert;
- The sampling and chemical analysis of all EWDP wells;
- Aquifer testing at some of these monitoring wells along with privately owned irrigation wells in Amargosa Valley; and
- Continuous or monthly water level monitoring at selected wells in Amargosa Desert, and bi-annual or more frequent monitoring of water levels in selected wells in Amargosa Desert and Pahrump Valley.

Nye County continues to conduct these monitoring efforts and will do so as long as funding from the Department of Energy continues. The results of the data collection are routinely posted on Nye County's web page at www.nyecounty.com and through technical publications issued by the Nye County Department of Natural Resources and Federal Facilities.

## Federal Water Management Issues

With 93 percent of Nye County under federal stewardship, there are a number of water management issues associated with federal management policies and practices. These policies and practices vary from agency to agency, resulting in additional constraints to long-term water resource planning efforts.

### U.S. Department of Energy

The Department of Energy has stewardship over 864,000 acres withdrawn for testing nuclear weapons and other stockpile activities supporting our national defense. The DOE has identified the agency's policy and goals for management of the water resources through its Nevada Test Site Resource Management Plan. As a matter of policy, the Department has committed to follow the principles of ecosystem management in the utilization of water resources. To implement this policy, four goals were defined:

- Maintain an adequate water supply for existing and new uses on the Nevada Test Site while ensuring a long-term sustainable supply of water for the NTS and the surrounding ecosystem.
- Maintain the quality of waters that are presently clean.
- Minimize the impact to groundwater quality should resumption of underground nuclear testing be required.
- Manage groundwater resources to maximize the availability of water while minimizing the impacts to human health and the environment from contamination remaining from underground nuclear testing.

As discussed in Chapter 3 (see page 39 and Figure 12) and in the environmental issues section of this chapter, the historic nuclear weapons testing program has rendered millions of acre feet of groundwater unusable. Although unlikely in the near future, additional testing and groundwater contamination may occur. If directed by the President, underground nuclear tests may be conducted in the future. To minimize the environmental insult from such tests, the Department of Energy has established the following limitations:

- Any future tests will use previously used areas of underground nuclear testing.
- Minimize tests with the working point (depth of detonation) at or below the water table.
- Place working points no closer than two cavity radii from the regional carbonate aquifer.
- Tests must be sited more than 1,500 meters (4,921 feet) from the boundary of the Test Site where groundwater is leaving the facility.
- The borehole beneath the working point must be plugged to a minimum of one cavity radius beneath the working point.

As discussed previously, the Department of Energy has initiated the Underground Test Area Project to address the contamination at the Nevada Test Site,. This program ostensibly is aimed at characterizing the nature and extent of contamination and the selection and implementation of remedial alternatives. This work is being conducted in consultation with the regulatory authority, the Nevada Division of Environmental Protection. Progress toward achieving the goals of the program has been slow and it may be more than a decade before enough information is collected to allow the evaluation of remedial alternatives and another decade or more before any alternatives are implemented.

The widespread groundwater contamination at the Nevada Test Site poses a major conundrum to water resource planning. Unlike most situations where groundwater contamination has occurred, there has been little in the way of a response by either the Department of Energy, the State of Nevada, or the U.S. Environmental Protection Agency. The search for the responsible parties and the assignment of liability are usually performed in such instances, but in the case of the Nevada Test Site the contamination was a result of testing that was done with the full knowledge of the State of Nevada, the United States Congress, and all of the regulatory agencies charged with environmental protection. Nye County recognizes that the groundwater contamination is a consequence of national security issues and policies. Nonetheless, extensive water resource damage has occurred and has resulted in the loss of significant resources and associated socioeconomic values to the County.

The Nevada Test Site is not the only location in Nye County where nuclear weapons testing has been conducted. The Central Nevada Test Site, located about 60 miles east of Tonopah was the site of a single nuclear test conducted in 1968. The Department of Energy also conducted a series of safety experiments on the Nevada Test and Training Range. These experiments destroyed nuclear weapons using chemical explosives and resulted in almost 3,000 acres of soils contaminated with plutonium, americium, and other radionuclides.

**U.S. Air Force**

The U.S. Air Force has withdrawn 1,290,000 acres in Nye County for military training and bombing practice. These lands are closed to ranching, mining, grazing, water resources development, recreation, and other purposes.

Although the Air Force has adopted an integrated natural resources management plan, the plan that was prepared provides only limited information on surface resources and no plans, goals, or objectives are related to groundwater. The impacts of Air Force actions were identified in the Renewal of the Nellis Air Force Range Land Withdrawal Draft Legislative Environmental Impact Statement (1998) and The Special Nevada Report (1991). The Special Nevada Report identified the impacts associated with actions taken by the U.S. Air Force, the U.S. Navy, and the U.S. Department of Energy in compliance with the Military Lands Withdrawal Act of 1986.

Actions taken at the Nevada Test and Training Range have resulted in: the dispersal of more than 40,000 tons of explosion debris, residues, and contamination (depleted uranium, beryllium, and explosive products) on alluvial fans and playas; the disposal of solid wastes, paint products, solvents, batteries, and petroleum products in landfills, pits, and explosive ordnance disposal pits; leaks from underground storage tanks; and the consumption of water in support of mission related activities.

According to the Special Nevada Report, the dispersion of explosion debris may have resulted in the contamination of groundwater; however, the amount of groundwater that may have been contaminated as a result of these by products is not known and cannot be estimated on the basis of existing studies. Similarly, insufficient studies have been done to allow the definition of contamination that may have resulted from land filling of wastes, the operation of explosive ordnance disposal facilities, or leaking tanks. According to the final contamination report for the proposed Nellis Land Withdrawal, three sites in Nye County were found to have surface soils contaminated with arsenic and beryllium.

Subsequent evaluations indicated that contamination of surface soils is known to occur but the potential for groundwater contamination from this source is discounted because of the "low precipitation, high evaporation, generally low solubility of the contaminants of concern, and the considerable depth to groundwater across most of the range". This more recent study identified two categories of contamination on NAFR, ordnance residues and operations and maintenance spills. The study concluded that there was little potential for the contaminants to migrate vertically downward to an aquifer.

There have been impacts on the water resources of Nye County associated with the withdrawal of the lands that now comprise the Nellis Air Force Range and Tonopah Test Range. These withdrawals have effectively removed large areas of Nye County from future development. There are areas on the range where groundwater resources could be developed however, their development is inconsistent with the mission of the facility and such development is considered at best to be highly unlikely. As a consequence, the water resources that would otherwise be available to Nye County have been withdrawn as well as the land. In the Special Nevada Report, the analysis of the effects of the land withdrawals noted that::

> **"The withdrawal of land from public access and/or the purchase of water rights by DOD and DOE has the greatest potential for effects on Nevada. ... The water resources associated with these lands could, if they exist and were available, play an important role in the continued growth of southern Nevada."**

Possible mitigating measures identified in the Special Nevada Report included the provision of access for water resources evaluation and development (if possible and consistent with mission requirements); assistance in water resources evaluation on withdrawn lands; the provision of rights-of-way for water transmission facilities where such action would not limit, constrain, or deny the purpose of the withdrawal; and considering opportunities to cooperate with local agencies to enhance water supply sources and programs.

The appropriations associated with the U.S. Air Force-related water withdrawals reduce the legal availability of water in the basins and flow systems in which they occur, and are additive to the appropriations of all water right owners in the region of influence. Although the U.S. Air Force water right holdings in Nye County are appreciable (1,700 acre feet), the actual quantity of water being used is small, about 130 to 160 acre feet per year. The direct impacts of water use in support of U.S. Air Force actions are limited and include the localized effects of water withdrawals in the vicinity of water supply wells.

### Bureau of Land Management

The BLM has stewardship over 6.7 million acres of land in Nye County and the administration of these lands is divided between three district offices. The three offices have each prepared resource management plans with different objectives, goals, and management direction with respect to water resources. In general, the BLM objectives are to maintain water quality, maintain or reduce salt yields, and ensure the availability of adequate water to meet management objectives including the recovery and/or reestablishment of special status species.

In recent years, access to public lands has become increasingly more limited by the designation of special status lands. For example, the Resource Management Plan for the Las Vegas District identifies a number of Areas of Critical Environmental Concern (or ACECs) in southern Nye County that comprise a total of almost 46,000 acres. The BLM has identified management options to acquire water rights to support management decisions, deny projects that might adversely impact groundwater conditions in the vicinity of resting/nesting habitat, such as riparian areas and mesquite/acacia woodlands.

Water rights that are appropriated or purchased and/or any federal water right claims for the protection of ACECs will reduce the availability of water for non-federal uses. In basins that are already fully appropriated such as Pahrump Valley and Amargosa Desert, the overdraft will be exacerbated as the federal rights would be additive to the over-appropriation of both basins. In other areas, such as along the Amargosa River near Beatty, protection of species associated with the riparian area (the Amargosa Toad) has the potential to significantly hinder growth and development through land restrictions. Private conservation parties are trying to list the Amargosa Toad as an endangered species. Nye County, the Town of Beatty, and the Beatty General Improvement District are working towards a habitat preservation plan that would still allow development for recreation and historic purposes.

Another potentially significant impact on water resources availability in Nye County results from the BLM's designation of land for disposal via public sale. More than 46,000 acres of land have been designated for disposal in Amargosa Desert (27,904 acres in Amargosa Valley and 3,772 acres at Lathrop Wells) and Pahrump Valley (14,786 acres). In their environmental documentation, the BLM noted that the addition water requirements associated with these land disposals could lead to further over-drafting of available groundwater and resultant water quality deterioration.

### U.S. Forest Service

The U.S. Forest Service has stewardship over 1.9 million acres of land in Nye County comprising portions of the Toiyabe and Humboldt National Forests. In essence, the Forest Service serves as the steward for most of the major recharge areas in Nye County. Water use by the Forest Service is negligible and there are no major issues related to water availability. The only issue associated with the National Forests in Nye County is with respect to access to favorable locations for water development.

## U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service has stewardship over 13,000 acres in Nye County at the Ash Meadows Wildlife Refuge. As noted in Chapter 3, the Fish and Wildlife Service has acquired more than 12,000 acre feet of water rights at Ash Meadows and the need to protect the wildlife values associated with the refuge and Devils Hole has effectively eliminated a large area up gradient of the refuge as a source of groundwater for other purposes.

## National Park Service

As noted in Chapter 4, the National Park Service has not developed any water supplies in Nye County, but the impacts of Park Service policies and practices have had a demonstrable impact on water resource availability in the County. The Park Service has stewardship for Death Valley National Park which includes two areas in Nye County, the "Nevada Triangle" (an area of about 105,000 acres in Nye County and about 4,000 acres in Esmeralda County), and Devils Hole, an area of 40 acres located adjacent to the Ash Meadows National Wildlife Refuge. The National Park Service has prepared a General Management Plan for Death Valley National Park that identifies a number of water resources issues:

> **"Restoration of numerous springs is needed (e.g. Marl Spring) to make them suitable for wildlife.**
>
> **Consider the possible effects of BLM and NPS activities and regional developments (e.g. Stateline and Yucca Mountain) on water quality and quantity and vegetation.**
>
> **Address Department of the Interior leadership needed in resolving water issues, including adjudication.**
>
> **Address water resource issues (e.g. potential conflict of federal management objectives for Ash Meadows area)."** (NPS, September, 1998, p. 44).

Specific actions aimed at achieving management objectives and addressing these issues were also identified by the NPS and include:

> **Identify all water sources within the boundaries of the park;**
>
> **Identify as a federally reserved water right all unappropriated water from any water source identified on federal lands within the boundaries of the park;**
>
> **Share water source inventory data;**
>
> **Vigorously defend federally reserved water rights through the state of California administrative process and in proceedings pursuant to Nevada Water Law that may authorize groundwater withdrawals that may impact water sources to which federally reserved or appropriated water rights are attached; and**
>
> **Pursue acquisition of water rights within the park.** (NPS, September 1998, pp. 61-62)

Since 1989, in response to concerns over the massive water right filings by the Las Vegas Valley Water District, the National Park Service has protested numerous water right applications within the Death Valley Flow System, which encompasses all of southern Nye County. The stated policy of the NPS is:

> **"...to follow state administrative procedures and to pursue negotiated**

> **settlements to protect its** [NPS] **water rights. Following State procedures, the NPS has protested numerous water appropriation applications. In many instances NPS reached settlement agreements with the applicants (for example, an agreement between NPS and the Department of Energy concerning water right applications of DOE).**" (NPS Water Resources Division, October 1997 p. 10-12)

In practice, the NPS has protested 90 water right applications in southern Nye County since 1989 that requested more than 6 acre feet per year of appropriative right. The NPS actions taken to fulfill their management objectives have had, and continue to have, a number of demonstrable impacts upon the availability of water resources in Nye County. The direct impacts of NPS actions on the water resources of Nye County include the loss of agricultural jobs and productivity, a decrease in the water available for other uses in the region of influence, increased costs in water right acquisitions, increased operational costs, and a decrease in the rate of growth of the agricultural sector of the County's economy.

# CHAPTER 6. COMMUNITY AND BASIN WATER ISSUES

Previous chapters discussed the water resources on a county-wide basis. In this chapter, the current status of water supplies, water resource issues, and future needs are presented for the communities of Amargosa Valley, Beatty, Manhattan, Pahrump, Railroad Valley, Round Mountain, and Tonopah; for other rural areas such as Gabbs and Carvers; and the federal lands that make up most of the county. For the communities, the existing water uses and trends, future demands, water availability, special management areas, and management objectives are described and discussed. Next the water supply requirements and issues at the basin level are discussed with respect to mining and milling, federal lands, and watershed maintenance and protection. Specific management alternatives are identified and discussed and recommendations made for developing specific County policies with respect to water resources management.

Public participation was an important element in identifying the local issues of concern. Draft copies of this plan were widely distributed for public review and comment. Workshops held at various locations across the county provided useful input from the citizens and organizations that reside in Nye County. Appendix A summarizes the comments and questions that were received during these workshops along with responses. Where appropriate, changes were made to the draft plan and are incorporated into this final plan.

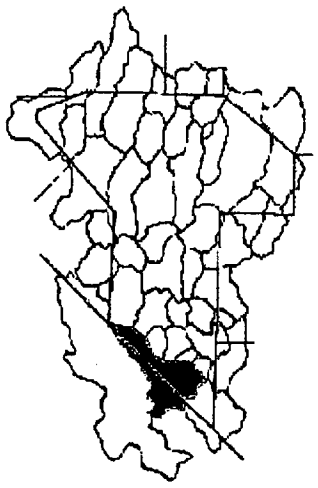
The 1994 Nye County Comprehensive Plan identified the following goal and objective for water resources:

> **Goal: Identify, develop, and maintain adequate water supplies throughout the County to maintain the existing environment and accommodate future economic development needs.**
>
> **Objective: Nye County will develop accurate assessments of water supply and demand in each basin by participating in the Nevada State Department of Conservation and Natural Resources, Division of Water Resources work program to assess water use, quantity, quality, and future water needs in each basin in the state.**

To achieve this goal, the County must balance the water resource needs for continued economic growth and the needs of the natural environment. Springs and riparian areas and associated fish and wildlife values must be protected, and water must be made available to support the remarkable growth that is expected over the coming decades. With proper water planning and management, Nye County can improve its overall economic well being while maintaining environmentally sensitive areas and recreational values. Perhaps more importantly, the County can insure that future generations of Nye County's citizenry have the necessary water to meet their demands without environmental degradation.

Nye County has neither the legal nor regulatory authority to impose constraints on the appropriation or use of the public waters of Nevada. This authority resides with the State of Nevada, primarily the Nevada Division of Water Resources. It is incumbent upon the County to continue to work with this agency in the planning and development of the County's water resources. It is also incumbent upon the County to cooperate with the many federal agencies that have stewardship of the vast majority of the land in Nye County.

## Amargosa Valley and Crystal



| **Amargosa Desert Basin** | **Perennial Yield: 24,000 acre feet/year** |
|---|---|

**Water Budget Parameters** (acre feet per year rounded) from NDCNR 1971

| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 600 | 44,000 | 24,000 | 19,000 |

**Water Rights Status** (acre feet rounded) from DWR database February 1999 for surface water and May 2004 for groundwater

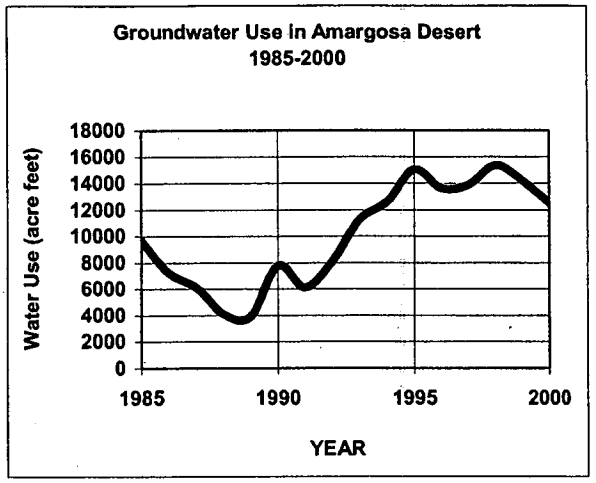
| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 37,000 | <1 | 0 | 2,800 | 0 |
| **Groundwater** | 16,262 | 7,276 | 32,780 | | |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action **RFP** = Ready for Protest, **VST** = Vested

**Assumptions** - For the purposes of planning, the following assumptions were made:

1. **A full build-out of all private lands in Amargosa Valley and Crystal will occur by the year 2050.**
2. **Lands designated for disposal by the BLM will be purchased and developed by 2050.**
3. **A high-level nuclear waste repository will be permitted and constructed at Yucca Mountain and most waste shipments will be routed through the Amargosa Desert.**
4. **The U.S. Air Force will continue operations at Nevada Test and Training Range.**
5. **The Gate 510 Business Park and Science Museum will be developed at the Lathrop Wells intersection.**
6. **At least one new mining operation will open in a rural area of the Amargosa Desert.**
7. **No further expansions of Death Valley National Park will occur and no buffer zone will be established around the existing Park boundary.**
8. **Future designations of land for disposal by the BLM will be limited to those needed for specific community purposes such as landfills, air fields, roads, etc., and these disposals will only result in negligible additional demands for water.**

### Water Resources Issues and Constraints



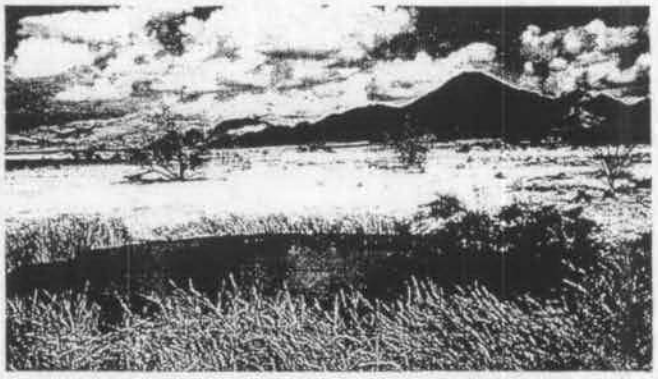

Water resource issues and constraints in Amargosa Desert include a number of factors related to water quantity and use, the protection of environmentally sensitive areas, and existing and potential sources of groundwater contamination.

Water Quantity and Use - The existing groundwater rights of 28,600 acre feet exceed the published perennial yield of 24,000 acre feet. However, water use in the basin is far less and has not yet exceeded 16,000 acre feet. Water use in the basin grew from 1989 through 1995 and then has remained relatively stable reflecting the reduced operations and then closure of the Barrick Bullfrog Mine. Water use for irrigation peaked at 12,350 acre feet in 1995 and had dropped 9,700 acre feet in 2000. Commercial water use has grown significantly over the last decade from a mere 10 acre feet in

1990 to 1,057 acre feet in 2000. Most of this growth in commercial demand can be attributed to the construction of the Longstreet Inn and the expansion of the Ponderosa Dairy. Domestic self-supplied water use has also grown over the last decade. In 1990 only an estimated 100 acre feet were used for domestic purposes but by 2000 the number of domestic wells in the basin had increased to 378 with a corresponding estimated water use of 378 acre feet per year. Between 1997 and 2000, 45 new domestic wells were drilled in the basin.

In 1996, a number of water rights were forfeited for non use in the Amargosa Desert. These actions reduced the permitted water rights from 41,400 acre feet to 28,600 acre feet, much closer to the published perennial yield. There is information, however, that suggests that the perennial yield of the basin may be appreciably greater than 24,000 acre feet per year. This value was based upon the original reconnaissance report for the basin by Walker and Eakin (1963) who described the value estimated for perennial yield as tentative. These workers relied upon the best available information at the time but new studies have been conducted that suggest that the perennial yield is higher, on the order of 40,000 acre feet per year or more.

Environmentally Sensitive Areas - Spring pools at Ash Meadows, like the one shown on the right, provide the vital source for water and habitat for a number of threatened and/or endangered species as well as numerous other fishes, birds, and mammals. The protection of Ash Meadows and Devils Hole from the impacts of water withdrawals in the basin is a key consideration in water planning for Amargosa Valley.



While there is no question that historic groundwater withdrawals in the immediate vicinity of Ash Meadows and Devils Hole resulted in unacceptable water level declines and spring discharge reductions, these withdrawals have ceased. To determine the historic and current trends in water levels in the basin, an evaluation of past studies was supplemented with new water level measurements. Two studies of water levels in the Amargosa Desert have been published, Nichols and Akers (1985) and Kilroy (1991). Since that time, water levels in numerous wells in the basin have been monitored by the U.S. Geological Survey and others as part of studies related to Yucca Mountain and the Nevada Test Site.

The National Park Service has expressed concerns about groundwater development in Amargosa Desert and the potential for impacts on Devils Hole and the springs discharging in Death Valley National Park. To address this concern, the Nye County Department of Natural Resources and Federal Facilities compiled the historic water level data and supplemented this data base with additional water level measurements in 1999 and 2000 at wells located throughout the basin. Figure 16 shows the long-term water level trends in Amargosa Desert. Although some water level declines have occurred in the Amargosa Farms area, water levels over most of the basin have either remained stable or risen over the last two decades. In the environmentally sensitive area of Ash Meadows (and Devils Hole), water levels have increased

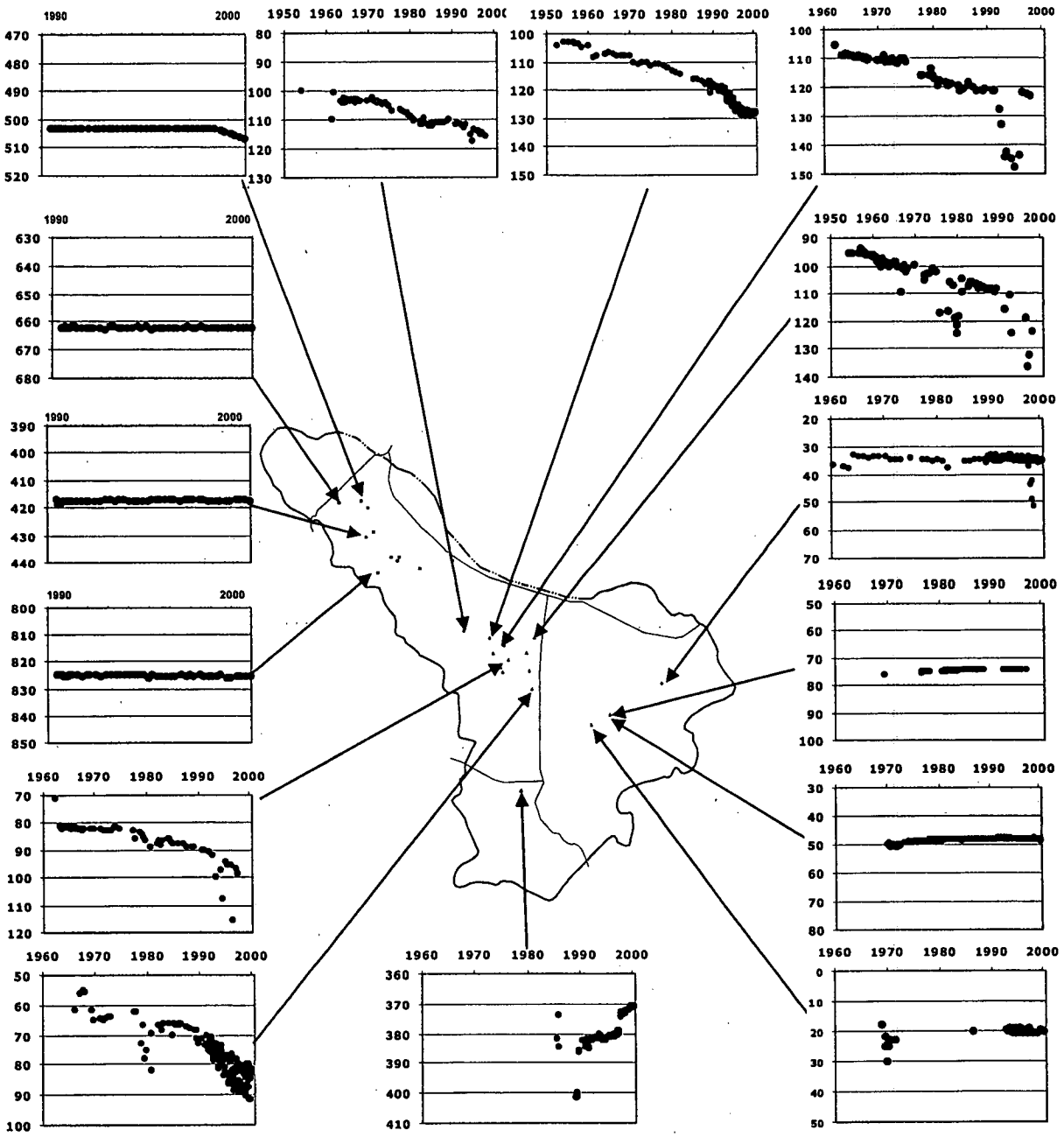


**Figure 16. Long-Term Water Level Trends In Amargosa Desert**

Notes: Depth to water in feet shown on Y axis on all graphs.
Y axis 50 ft on all graphs.
Updated and modified from Kilroy (1991).
Data from U.S. Geological Survey and Barrick Bullfrog Mine records.

since the cessation of pumping in the late 1970s and have recovered to their pre-pumping levels at several monitoring wells. In the northwest part of the basin, water levels have remained remarkably constant over the last decade even though active dewatering operations were underway at the Barrick Bullfrog Mine near Beatty. Water levels continue to decline in the agricultural areas of the basin, reflecting the higher agricultural productivity and the transition of the water levels in the area to a new state of equilibrium (as groundwater is recovered from transitional storage).

Based on this evaluation, it appears that there is no need for concern with respect to impacts on water levels or spring discharge rates in Death Valley as a result of increased pumping in the Amargosa Farms or Lathrop Wells areas. If dramatic declines in water levels in the Amargosa Farms area were to occur, agricultural economics and the total thickness of the alluvial aquifer dictate that pumping levels will not be lowered to a depth of more than 500 feet. Even if this were to occur, the hydraulic heads in the area would still be about 1,800 ft above those in Death Valley. Further, the alluvial aquifer (the sole source of water used for irrigation) is isolated from the regional carbonate aquifer that supplies the springs in Death Valley by several thousand feet of clay-rich Tertiary sediments.

Water Supply Requirements - Additional groundwater withdrawals will be needed in the future to provide for increased agricultural and dairy production and for the expected growth in population. As noted in Chapter 5, a full buildout of land that is already in private hands and land designated for disposal by the BLM could result in a total of 30,000 residential and commercial lots with a total estimated water demand of 28,000 acre feet per year.

In 2000 the demand for water for irrigation water in Amargosa Desert was under 10,000 acre feet. Agricultural use is expected to increase over the next decade as new pivot irrigators are installed to meet the increased demand for forage by the dairy operation. Existing permitted and certificated water rights for irrigation total about 22,500 acre feet, adequate for a doubling of the agricultural water use in the basin. However, it is considered likely that some agricultural water rights will continue to be converted to other uses to support growth of the community of Amargosa Valley, and that the future demand for water for irrigation will be no more than 15,000 acre feet, a 50 percent increase over current demand. The total projected demand for both quasi-municipal and agricultural purposes is 43,000 acre feet per year with a consumptive use of about 36,000 acre feet.

Future water demand for mining purposes is assumed through the development of one new mining property in the basin over the planning period. As water development for such an operation is likely to be moderate (1,000 acre feet per year or less), temporary in duration, and in a remote location, it should be possible to develop the necessary water without detriment to existing or future water right holders or the environment.

Water sources - Existing groundwater sources are considered adequate to provide for the anticipated needs for the next fifty years if the higher perennial yield value of 40,000 acre feet per year can be established and is accepted by the Division of Water Resources. If the perennial yield value is not increased, then overdraft conditions will occur unless agricultural water rights are changed to quasi-municipal purposes or growth is curtailed, conservation is very successful, or additional water supplies are brought into Amargosa Desert from adjacent basins. As noted in preceding discussions, Nye County has applied for water from the basins adjacent to the Amargosa Desert. Some portion of this water, if rights are permitted, could be supplied to users in the Amargosa Valley area or re-injected in the basin to offset any

withdrawals in excess of the established perennial yield. Nye County is currently evaluating a concept first proposed but rejected by the Department of Energy, i.e., extracting clean groundwater from the northern part of the Nevada Test Site, and re-injecting that water in the southern part of the test site, or in northern Amargosa Valley. Alternatively, if the water is not needed to meet future demands in Amargosa Valley, it would be available for export to other areas of the County, albeit at great expense.

Feasibility of Alternatives - Given the lack of present water supply problems, no specific feasibility assessments are necessary at this time. Continued monitoring of water use and water levels in the basin by the Division of Water Resources, U.S. Geological Survey, and Department of Energy should provide adequate oversight of trends and conditions in the basin. Any future problems may be best addressed in consultation with the regulatory agencies, the stakeholders, and the application of best management practices.

Constraints on Water Development - All surface waters in the Amargosa Desert have been fully developed or appropriated for wildlife purposes, imposing a binding constraint on future development of this source. Future groundwater development is constrained by both environmental and water quality considerations. Because of its location up gradient of Ash Meadows and Devils Hole, it is likely that large-scale development in the Crystal area will not be possible unless new groundwater supplies are imported to the area. As noted in previous sections, groundwater contamination on the Nevada Test Site and restrictions on access to this facility and the Nevada Test and Training Range impose severe constraints on the locations of new water wells in areas north of Highway 95. During the public workshop regarding this plan in Amargosa Valley, local residents expressed concern that more monitoring should be done in the areas between past nuclear tests and water users in Amargosa Valley and that a better understanding of climate change and its effects is needed. Similarly, the designation of numerous Areas of Environmental Concern by the BLM imposes constraints on the location of water wells near these areas. The citizens of Amargosa Valley clearly expressed their desire for the community to grow.

### Recommendations

Based upon the current and projected water demands in Amargosa Valley, the issues related to additional development and the constraints on that development, the following recommendations are made:

**Continue monitoring of water withdrawals.**

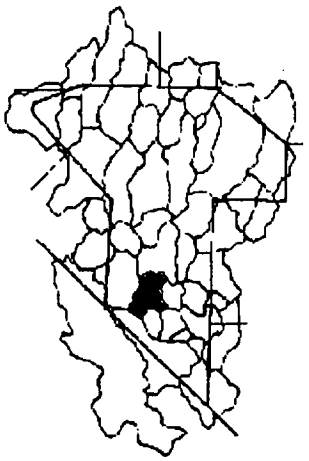
**Coordinate more detailed planning with local water users and the Nevada Division of Water Resources.**

**Continue the dialogue with the National Park Service and Fish and Wildlife Service concerning the likely impacts of increased water use in the basin.**

**Discussions should be held with the Division of Water Resources concerning the perennial yield of the basin.**

**Conduct a cost and feasibility study to determine if the water supplies in the Amargosa Desert can be supplemented with water withdrawn from adjacent basins north of Highway 95,**

## Beatty - Oasis Valley



**Oasis Valley** **Perennial Yield: 2,000 acre feet/year**

**Water Budget Parameters** (acre feet per year rounded) from NDCNR 1971

| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 1,000 | 2,500 | 2,000 | 1,500 |

**Water Rights Status** (acre feet rounded) from DWR database February 1999

| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 1,863 | 1,159 | 0 | | 1,024 |
| **Groundwater** | 932 | 319 | 200 | | |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action **RFP** = Ready for Protest, **VST** = Vested

**Assumptions** - For the purposes of planning, the following assumptions were made:

1. **A full build-out of all private lands in Beatty will occur by the year 2050.**
2. **A high-level nuclear waste repository will be permitted and constructed at Yucca Mountain and some waste shipments will be routed through Beatty.**
3. **The U.S. Air Force will continue operations at Nevada Test and Training Range.**
4. **Operations at the Rayrock and Cathedral Gold mines will continue at maintenance levels.**
5. **At least one new mining operation will open in a rural area of Amargosa Desert.**
6. **Some type of industrial or warehousing facility will open operations near the Beatty airport.**
7. **Future designations of land for disposal by the BLM will be limited to those needed for specific community purposes such as landfills, air fields, roads, etc., and these disposals will only result in negligible additional demands for water.**

### Water Resources Issues and Constraints

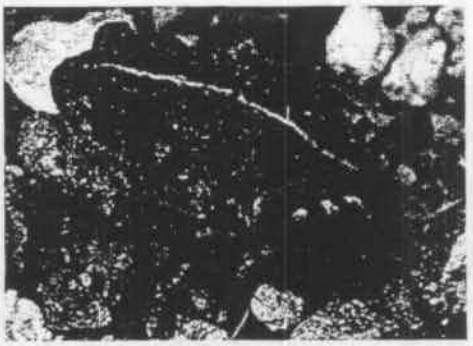
The only significant water issues in Beatty are with respect to the naturally occurring levels of arsenic and fluoride in the groundwater. In the past, fluoride has been managed by blending water from various sources. The groundwater sources for the Beatty Water and Sanitation District average less than 20 ppb of arsenic after blending. In 2001 the U.S. Environmental Protection Agency lowered the drinking water standard for arsenic from 50 parts per billion (ppb) to 10 ppb. The new standard mandates that all community water systems and non-transient, non-community systems comply with this standard by January 2006. On a national basis, more than 3,000 community water systems will have to implement costly treatment systems to lower the arsenic to the new standard and Beatty will be one of those communities. Beginning July 1, 2002, the District will have to include educational statements and health effects statements in their Consumer Confidence Report.

Water Supply Requirements - The Beatty Water and Sanitation District has adequate water rights and wells to meet projected future demands. The water connection moratorium that was in effect in 1996 has been lifted by bringing the former Barrick Gold Well EW-4 on line. Total groundwater withdrawals in 2001 were 100.5 million gallons (about 308 acre feet), about 28 percent lower than the quantity pumped in 1995. The declined demand for water since 1995 reflects the closure of the Bullfrog Mine and reduced operations at the Rayrock and Cathedral mines, and the corresponding drop in the population of Beatty. At present, there are 450 service connections that are being used.

Water Sources - The Beatty Water and Sanitation District relies upon four water supply sources, Well #1, the Summit Well, the Indian Springs Well, and well EW-4 for its potable water supplies. Well #1, the Summit Well, and the Indian Springs Well all meet safe drinking water standards. The groundwater at EW-4 has elevated concentrations of arsenic that exceed standards and fluoride concentrations that almost meet the drinking water standard for that constituent.

Feasibility of Alternatives - Treatment has already been identified as the only likely method that can be implemented to meet the new arsenic standard. The District is investigating treatment options that would also lower fluoride levels as well. The District is evaluating better methods for the regulation of flows and pressures through filtration systems and options that will minimize the operation and maintenance costs and hazmat requirements. In northern Nevada, utilities at Gardnerville and Reno have found that in some areas the arsenic concentration of the groundwater increases significantly with depth. If such conditions exist in the northwestern part of the Amargosa Desert (where EW-4) is located, it may be possible to eliminate the need for costly treatment by drilling one or more shallower replacement wells.

Constraints on Water Development - Existing sources are adequate to meet projected future demand if treatment is implemented resulting in no need for additional development within the planning horizon. Past constraints imposed by concerns over the Amargosa Toad, shown at right, resulted in delays in pipeline improvements but these improvements have now been implemented. This toad species as well as the Oasis Valley Speckled Dace, Pacific tree frogs, a snail species, and other aquatic life, pose constraints on any future water supply developments in southern Oasis Valley.



During the Beatty workshop regarding the draft version of this plan, local residents expressed concerns related to the effects of concentrated feedlot operations on water quality, the impacts of invasive plants such as salt cedar, the potential for leakage of contaminants from the Nevada Test Site, and the need to keep the information in this plan up-to-date.

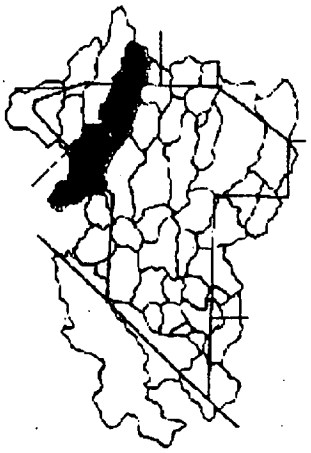
**Recommendations**

Based upon the present conditions and discussions with the system operator, the following recommendations are made:

**Support the Beatty Water and Sanitation District in evaluating the arsenic problem by screening existing wells in northwest Amargosa Desert to determine if shallower wells could be used in lieu of treatment facilities.**

**Support the District in identifying and obtaining grants for the design, construction, and operation of a treatment facility to reduce arsenic and fluoride concentrations below action levels.**

**Support the District in identifying mitigating measures to protect Beatty's water supplies from the risk associated with the transportation of high-level nuclear waste to a repository at Yucca Mountain.**



## Manhattan - Round Mountain

**Big Smoky Valley Tonopah Flat (Manhattan)** **Perennial Yield: 6,000 acre ft/yr**
**Big Smoky Valley North (Round Mountain)** **Perennial Yield: 65,000 acre ft/yr**

**Combined Water Budget Parameters** (acre feet per year rounded) from NDCNR 1971

| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 77,000 | 2,000 | 70,000 | 8,000 |

**Combined Water Rights Status** (acre feet rounded) from DWR database February 1999

| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 27,250 | 9,481 | 1,280 | | 6,867 |
| **Groundwater** | 33,171 | 31,589 | 35,721 | | |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action **RFP** = Ready for Protest, **VST** = Vested

**Assumptions** - For the purposes of planning, the following assumptions were made:

1. **Open pit operations at the Round Mountain gold mine will cease in 2006 along with dewatering, ore processing will cease by 2011, and heap leaching and reclamation will continue until about 2016.**
2. **Heap leach operations at the mine will continue at significantly lower water demand rates and the work force will be reduced from 720 to about 360.**
3. **One or more new mining operations will be started and completed through 2050.**

### Water Resources Issues and Constraints

The key issues in Big Smoky Valley are the unpredictable future of the minerals exploration and development and naturally occurring concentrations of arsenic and fluoride in the groundwater. The existing mining operation at Round Mountain plans to stop open pit mining operations in less than five years but recovering and reclamation operations will continue for another 10 years with a reduced workforce. Arsenic concentrations exceed the new standard of 10 parts per billion at Shoshone Estates (29ppb), the Smoky Valley RV Park (36 ppb), and Manhattan (50 ppb). At the old community of Round Mountain, the water is blended to meet the standard. The primary water well has a concentration of 55 ppb and water from this well is blended with spring water to meet the standard.

Water Supply Requirements - Existing supplies are adequate to meet the present demand for water. Given the bust and boom nature of mines (and mining communities) in the region, future water demands cannot be reasonably projected. The demand for water totals about 101,000 acre feet in the basin as a whole, but water use is significantly less than this amount. Permitted and certificated water rights total about 65,000 acre feet; applications total 36,000 acre feet, almost all for irrigation.

Water sources -Existing water sources include both wells and springs. In general, areas of mineralization exhibit water quality constraints in terms of arsenic, fluoride, and metals.

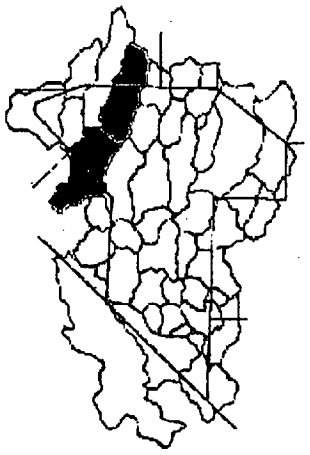
Feasibility of Alternatives - Arsenic treatment is costly and studies will have to be done on a case-by-case basis to determine whether treatment alternatives or new wells in unaffected areas are most appropriate. At the workshop held in Round Mountain, the residents expressed their sincere concern that no water be exported from the region regardless of its destination (Las Vegas *or* Pahrump)

### Recommendations:

**Continue to monitor water system performance and needs.**

**Cooperate with the Division of Environmental Protection and Bureau of Health Protection Services in identifying funding sources to assist systems in meeting the new arsenic standard.**

**Seeking funding for replacement of the existing water well at Manhattan.**



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| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 77,000 | 2,000 | 70,000 | 8,000 |

**Combined Water Rights Status** (acre feet rounded) from DWR database February 1999

| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 27,250 | 9,481 | 1,280 | | 6,867 |
| **Groundwater** | 33,171 | 31,589 | 35,721 | | |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action **RFP** = Ready for Protest, **VST** = Vested

**Assumptions** - For the purposes of planning, the following assumptions were made:

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### Recommendations:

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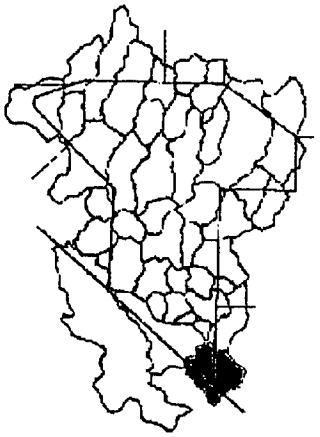
**Seeking funding for replacement of the existing water well at Manhattan.**

## Pahrump



| Pahrump Valley | Perennial Yield: 12 ,000 to 19,000 acre ft/yr |
|---|---|

**Combined Water Budget Parameters** (acre feet per year rounded) from NDCNR 1971

| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 22,000 | 0 | 10,000 | 13,000 |

**Combined Water Rights Status** (acre feet rounded) from DWR database May 2004 for groundwater and February 1999 for surface water.

| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 3,723 | 14,812 | | | 3,135 |
| **Groundwater** | 29,093 | 29,667 | 3.943 | 5,090 | 695 |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action **RFP** = Ready for Protest, **VST** = Vested

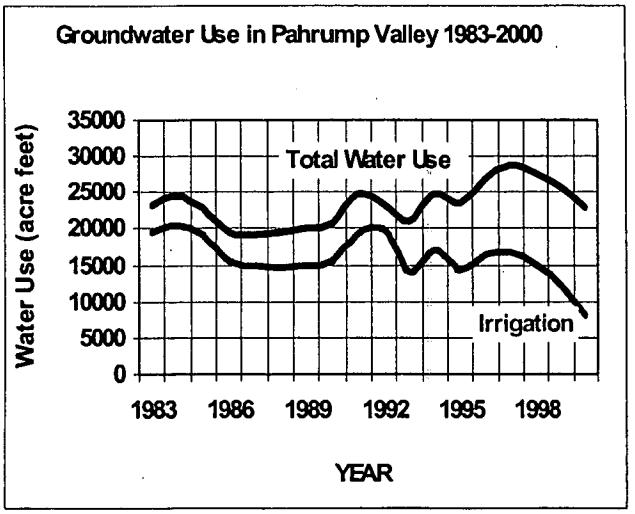
**Assumptions** - For the purposes of planning, the following assumptions were made:

1. **A full build-out of all private lands in Pahrump Valley will occur by the year 2050.**
2. **Lands designated for disposal by the BLM will be purchased and developed by 2050.**
3. **A high-level nuclear waste repository will be permitted and constructed at Yucca Mountain and some waste shipments may be transported through Pahrump.**
4. **Agricultural activity will continue to decline and will cease by the year 2050.**
5. **Current commercial development trends will continue throughout the build out of Pahrump.**
6. **Future designations of land for disposal by the BLM will be limited to those needed for specific community purposes such as landfills, air fields, roads, etc., and these disposals will only result in negligible additional demands for water.**

### Water Resources Issues and Constraints

Water resource issues and constraints in Pahrump include those related to both water quantity and water quality issues. The issues are typical of basins where rapid urbanization of former agricultural land is changing the nature and distribution of water withdrawals and the types of contaminant threats to the water resources.

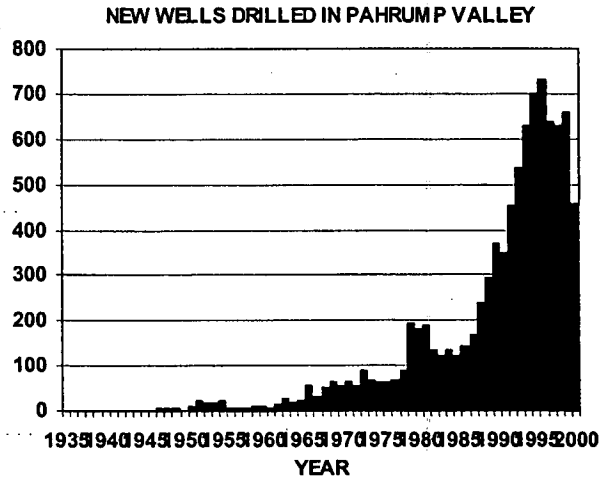
Water Quantity and Use - The existing groundwater rights of 69,000 acre feet exceed the published perennial yield of 12,000 to 19,000 acre feet and the sustained yield of 26,000 acre feet. However, water use in 2000 was only about 23,000 acre feet, the lowest demand since 1993. Historic water use in the basin grew to 47,100 acre feet in 1968 and then declined to less than 20,000 acre feet in 1986 through 1988. With the increased urbanization in the 1990s, water use increased and by 1996 demand was once again above both the perennial and sustained yields. The conversion of farmland to the Mountain Falls subdivision and the slow start up of that venture has been the primary



reason for the decline in water use in 2000. In 2000, the total water demand for irrigation dropped to about 8,000 acre feet, only about 17 percent of the 1968 peak.

With the growth of the community, commercial, quasi-municipal, and domestic water uses have of course grown significantly over the last two decades, from 2,550 acre feet in 1983 to almost 14,000 acre feet in 2000. Most of the former agricultural acreage in the basin has been converted to subdivisions and parcels. The site of the town cotton gin is now a casino. RV parks, a new bank and office buildings, and a myriad of new businesses have been built over the last ten years and construction continues.

The chart at right shows the number of wells drilled each year in Pahrump Valley. Through August 2001, a total of 9,255 wells had been drilled in Pahrump. Well drilling peaked in 1996 when 728 wells were drilled in the basin. Since that time, drilling activity has decreased somewhat but is still significant, with 456 wells drilled in 1999. Almost 300 irrigation wells have been drilled in the valley and 254 municipal, commercial, and industrial wells have been drilled. Of concern is the number of domestic wells (more than 8,700) and the potential for drilling of as many as 25,000 more domestic wells over the coming decades.




As a result of historic water withdrawals, groundwater levels have declined over a large portion of the valley. Figure 18 shows the history of water level declines and rises in Pahrump Valley for the period 1940 through 2000. This figure shows the long-term water level measurements taken by the U.S. Geological Survey at nine wells and supplemental water level data from the Division of Water Resources.

As shown, there are two basic trends in water levels in the basin, 1) declining water levels until about 1980 followed by a rise in water levels over the last two decades, and 2) a general decline in water levels over the entire period of development. A reduction in pumping rates since peak withdrawals in 1969 and a number of wet years in the 1980s and 1990s have generally reversed the water level declines along the toe of the alluvial fan in the eastern part of the valley floor. In this area, the groundwater levels have risen by as much as 45 feet from their historic lows in the late 1970s and early 1980s. Water levels have continued to decline, however, over the central, southern, and western lowland portions of the basin. Given that the groundwater withdrawals in recent years were above the perennial yield, continued water level declines are to be expected.

The proliferation of wells in some sections of land has resulted in faster water level declines. Figure 19 shows the long-term water level trends in a six square mile area in the southern part of Pahrump where more than 900 wells have been drilled along with projected water level trends through the year 2020.

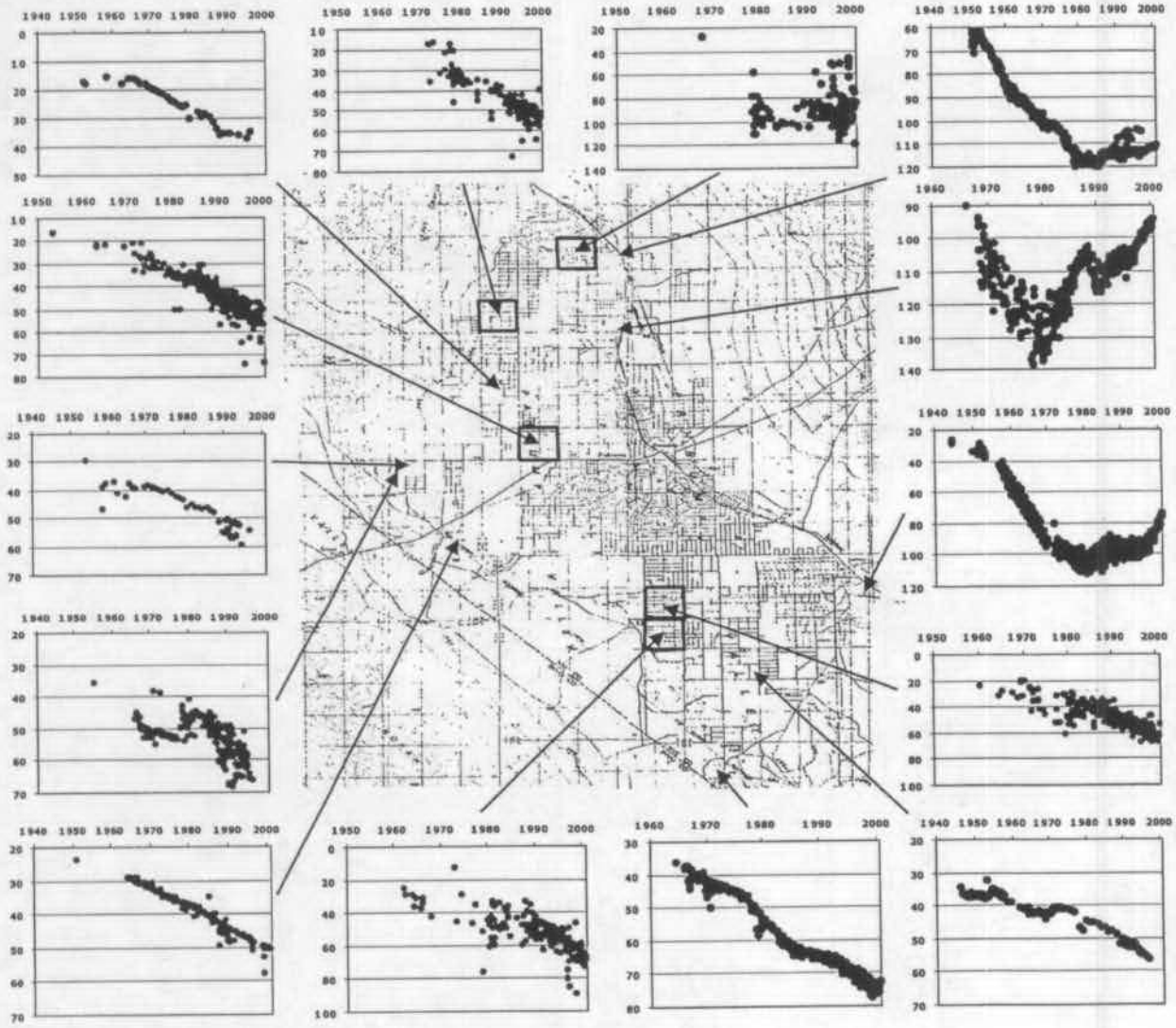


Figure 17 Long-Term Water Level Trends in Pahrump Valley

Notes: Charts shown for specific locations for USGS long-term water level monitoring wells (red)
Charts shown for specific sections with high densities of water wells (blue)
Depth to water in feet shown on Y axis on all graphs.
X axis varies depending on period of record.
Y axis varies depending on water level variation.
Data from U.S. Geological Survey and Nevada Division of Water Resources web pages.

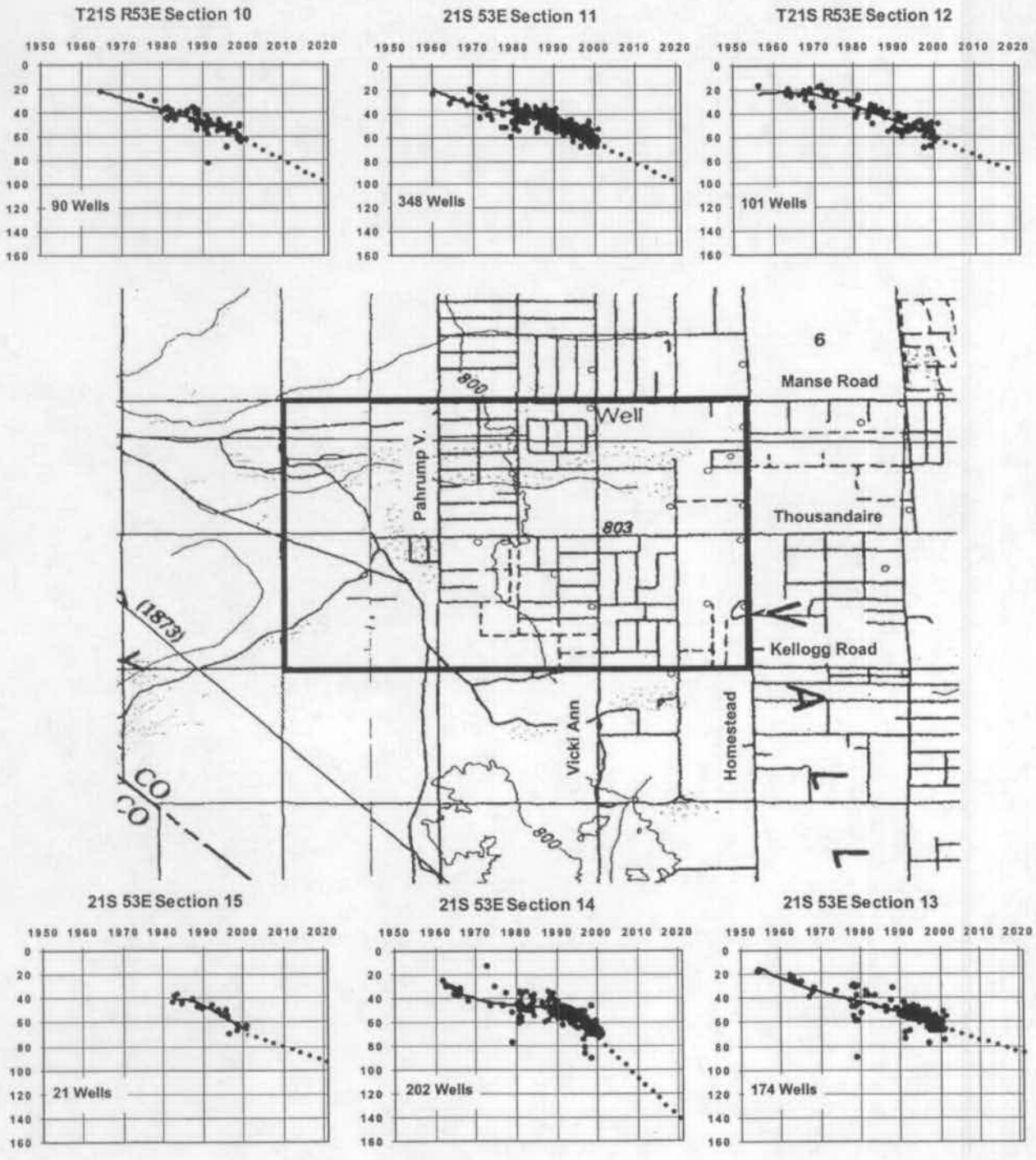



**Figure 18. Long-Term Water Levels for 936 Water Wells in Southern Pahrump**

Notes: Water level data is from the Nevada Division of Water Resources Well Log data base.
Water levels are those reported by the well driller at the time the well was completed.
Neither the Division of Water Resources nor Nye County attest to the validity of the data presented on these charts.
Solid red lines are 4th order polynomial fits.
Dashed red lines are visual straight-line projections of recent water level trends.

In general, the water levels in this area declined between 40 and 50 feet between 1960 and 2000. Projected minimum future decline rates are one to three feet per year for the next twenty years. These projections indicate that future wells will have to be drilled deeper and hundreds of existing wells will have to be deepened or replaced by 2020 in some sections of southern Pahrump. Bi-annual monitoring of water levels in high well density areas of Pahrump should be initiated to better define the rates of decline.

Figure 20 shows the distribution of water withdrawals in Pahrump Valley in 1999. The majority of withdrawals occurred in the north-central and southern portions of the community. Ten sections of land had groundwater withdrawals in excess of one acre foot per acre. Monitoring of groundwater levels should also be initiated in these areas of high groundwater production.

Water Quality - Currently, the overall quality of the groundwater in Pahrump is quite good. However, the lack of community-wide sewage treatment, the 8,000+ existing septic systems, and the potentially for an additional 25,000 septic systems all point to the vulnerability of the valley-fill aquifer to contamination. As discussed in Chapter 5, there are 33 sections of land in Pahrump with more than 100 septic systems in each section. Of these, ten sections have more than 200 septic systems. The vulnerability of the groundwater under these areas to contamination depends upon the type of soils, the depth to groundwater, and the practices of the individual septic system owners.

To determine if contamination from septic systems has already occurred, selected wells need to be identified and sampled. The groundwater samples need to be analyzed for the basic water quality indicators (nitrogen, dissolved oxygen and biochemical oxygen demand, e. coli, total dissolved solids, and phenols). In the event that elevated levels of any of these constituents are detected, then the wells should be re-sampled and analyses run for metals, orthophosphate, and possibly trihalomethanes. Based upon the results of the sampling and analyses, a limited number of wells should be selected for annual monitoring. The Southern Nye County Conservation District has allocated funds to conduct the first water quality sampling program in Pahrump Valley and in conjunction with the Nye County Department of Natural Resources, selected a network of fifty groundwater wells for sampling.

The infiltration of water applied over irrigated areas back to the water table is another potential source of contamination. Since the heyday of cotton production, the acreage of irrigated land in Pahrump Valley has declined steadily. The distribution of irrigated land in 1999 is shown on Figure 21 and is now largely restricted to areas in the west central part of the basin and southern Pahrump. Sampling of selected wells in these areas should also be conducted to determine if any impacts have resulted from past or on-going agricultural practices. In 2000, the land under irrigation declined even further, to less than one-half that irrigated as recently as 1997. The continued conversion of farmland to urban use will further reduce the threat associated with agricultural land uses.

Another future source of potential contamination are the waste shipments associated with the proposed high-level nuclear waste repository at Yucca Mountain. Final transportation routes have not been selected but some shipping routes may include Highway 160 or a rail line through Pahrump to avoid metropolitan Clark County. Although the Department of Energy has indicated that the risk of a transportation incident is quite small, the consequences of an incident could be catastrophic and could include deaths, contamination of surface soils, and contamination of drinking water supplies. Nye County does not have the wherewithal to adequately respond to such an incident and needs assistance from the federal government in protecting the water resources of Pahrump.

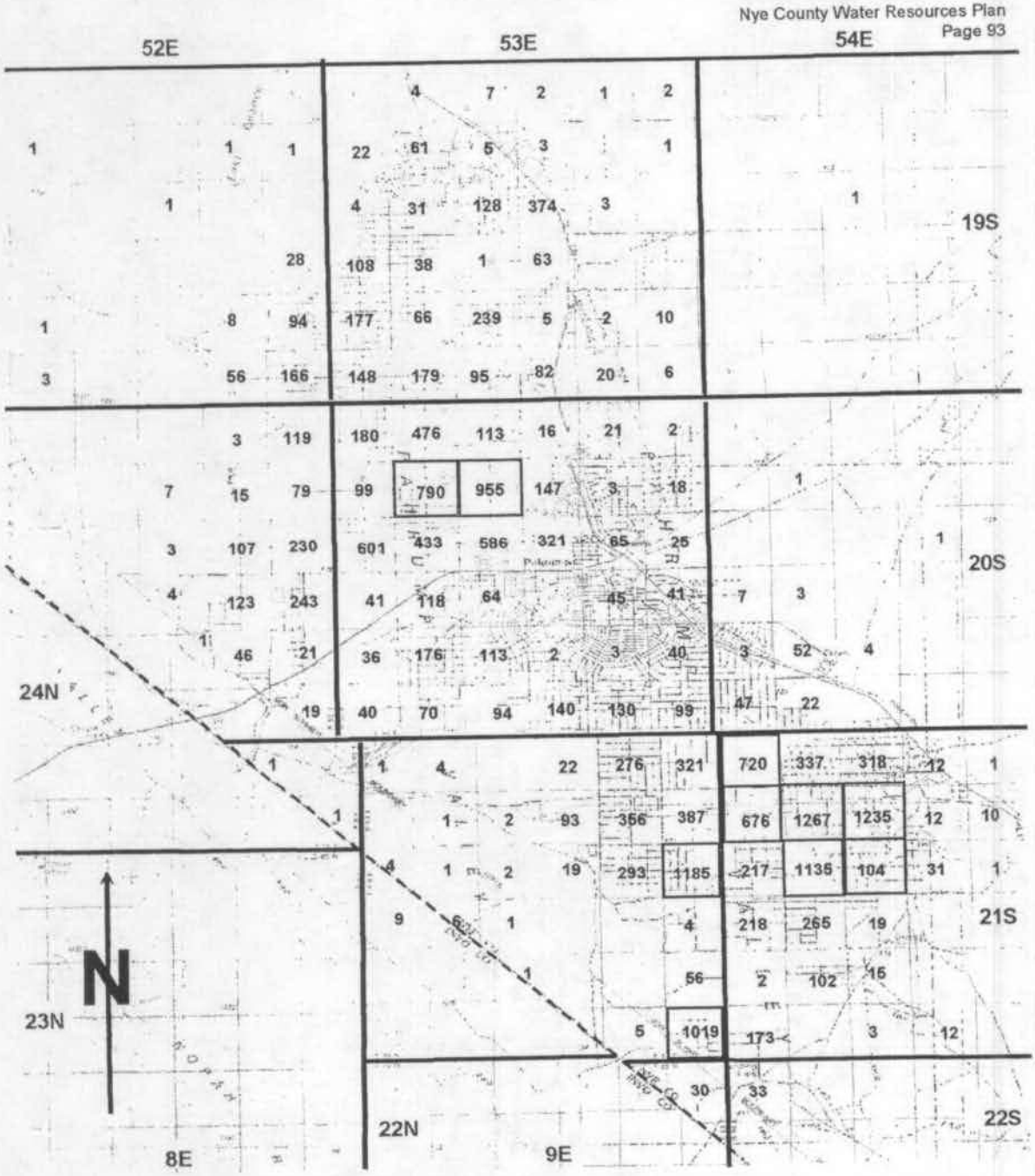



**Figure19. Distribution of Groundwater Withdrawals in Pahrump Valley in 1999.**

Source: Nevada Division of Water Resources Pumpage Inventory and Well Log Database

Notes: Withdrawals are shown in acre feet for each section of land.
Total withdrawals based on inventoried pumpage plus number of domestic wells drilled through 31 Dec 1999.
Assumed use rate of one acre foot per year per domestic well.
Sections outlined in red have pumpage rates of about one acre foot per acre or more.
Scale approximately 1:158,000.
Base map reduced from 1:100,000 USGS 30 X 60 Minute Las Vegas and Death Valley Quadrangles from NBMG web page.

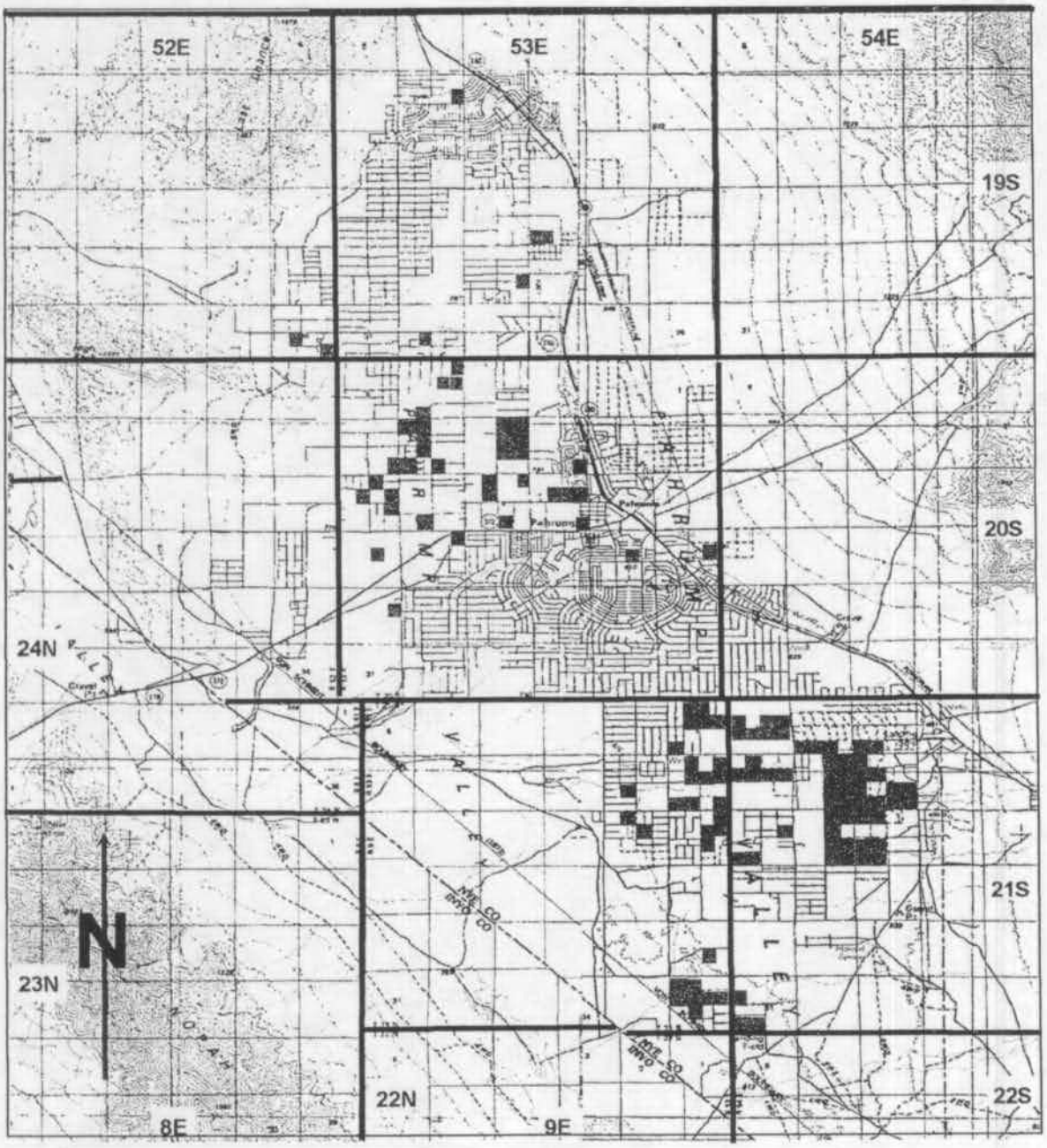



**Figure 20. Distribution of Irrigation Water Use in Pahrump Valley in 1999.**

Source: Nevada Division of Water Resources Well Log Database

Notes: Shaded areas correspond with quarter-quarter sections where the 1999 DWR pumpage inventory indicated the use of more than 10 acre feet of water for irrigation. In some instances, the area of use may be smaller than the forty acre areas shown on the map.
Calvada municipal water rights and other public water supply rights not shown.
Scale approximately 1:158,000.
Base map reduced from 1:100,000 USGS 30 X 60 Minute Quadrangle from NBMG web page.

Environmentally Sensitive Areas - Unfortunately, many of the environmentally sensitive areas of Pahrump Valley have already been eliminated by the activities of man. Bennetts Spring and Stump Spring have gone dry and Manse Spring now discharges only during wet years at a fraction of its former discharge. The natural habitat associated with these springs has been destroyed and the native Pahrump killifish had to be relocated by the U.S. Fish and Wildlife to a refuge to protect it from extinction.

The most pressing environmental issue at this time is the potential impact of declining water levels on the mesquite bosques in the southern part of Pahrump. These bosques provide habitat for a number of species of birds and mammals. The groundwater in some of these areas has declined to almost 50 feet below land surface, the limit at which mesquite trees can maintain their vigor. Monitoring of water levels in these areas is needed to determine the rate of water level decline and mitigating measures need to be evaluated. Mitigation could include the application of treated waste water to the bosques or injection of the water immediately up gradient of the bosques.

Water Supply Requirements - Increased groundwater withdrawals will be needed to meet the projected future growth in Pahrump. With a projected population of 150,000 by the year 2050, the demand for water will be about 80,000 acre feet per year. This estimate assumes continuing reductions in agricultural water use in the valley and a per capita water use rate of 486 gallons per day (including all domestic, municipal, and industrial uses). Most of this water will be supplied by community water supply systems, the remainder will be supplied by domestic wells, and as many as 25,000 new domestic wells may ultimately be drilled in the basin.

The existing groundwater rights of 64,500 acre feet are not sufficient to meet the projected demand for municipal water. Domestic wells will likely make up the shortfall in areas not serviced by community water systems. Water conservation measures could result in some savings and the use of treated water for some purposes could further "stretch" the available resources.

Water Sources - Presently, the only source of groundwater in Pahrump Valley is the valley-fill aquifer. The perennial yield of this aquifer has been estimated at 12,000 to 19,000 acre feet per year. The results of recent re-evaluations of water budgets in southern Nevada suggest that the perennial yield of Pahrump Valley could be higher, on the order of 30,000 acre feet per year or more. But even if the perennial yield were 38,000 acre feet per year (double the U.S. Geological Survey estimate), there is still insufficient recharge to meet the projected demand.

Current groundwater withdrawals are distributed throughout much of the basin. Figure 20 shows the distribution of water use in 1999. Total groundwater withdrawals are shown for each section of land based upon the Division of Water Resources pumpage inventory and the number of domestic wells in each section.

To meet the projected future water demand in Pahrump, one or more of the following alternatives will have to be implemented: 1) the valley-fill aquifer will have to be over drafted, i.e., groundwater will have to be removed from storage, 2) water will have to be imported to the valley from other basins, 3) severe conservation measures will have to be taken to reduce per capita water use, or 4) growth will have to be restricted through administrative means.

If additional water supplies cannot be obtained, then overdraft of the valley-fill aquifer will continue and will accelerate as growth continues. While there is a great deal of water stored in the upper valley-fill sediments, and this water is recoverable, there will likely be detrimental consequences as a result of continued overdraft of the basin. The consequences of overdraft

include subsidence, higher well drilling and pumping costs, and degradation of water quality.

As shown in Figure 22, subsidence has already been documented in Pahrump Valley and there is active fissuring in a few areas. Subsidence can damage roads and utilities as well as structures, and costs can be substantial. The more the water table is lowered in the basin, the greater the potential for subsidence and the greater the costs associated with this phenomena.

The costs associated with resetting pumps and re-drilling wells to tap the aquifer deeper will be incremental, but will be significant because of the numbers of wells that are likely to be affected. The potential for degradation of water quality as the aquifer is exploited to ever greater depths is not known because of the lack of deep well data over much of the basin. If evaporite deposits (salt beds) are present at depth, then there may be severe limitations on water quality.

Water imported to Pahrump from other basins in Nye County could be used to meet the future water demands of the community and to mitigate the past impacts of overdraft in the basin. As discussed in Chapter 5, Nye County has applications to appropriate groundwater in all of the basins in the County that have unappropriated water resources. If permits to develop these sources are granted, then the portion of water that is not needed for future demands in the source basins or other parts of the County could be conveyed to Pahrump.

The Nye County applications total a little more than 60,000 acre feet. If that amount were to be permitted and available for development, then as much as 16,000 acre feet of the water would be needed in Amargosa Valley. The remaining 44,000 acre feet would be available for other purposes. The full 60,000 acre feet could be available if the perennial yield of the Amargosa Desert basin is raised or if the growth of agriculture and urbanization is less than that assumed in this plan. For planning purposes, it is assumed that 40,000 acre feet may be available. It must be noted however, that the development of these water resources would require time and considerable expense first to acquire the water rights and then in the development of well fields and conveyance systems.

In the event that no water rights are granted, or the amount granted is insufficient to justify an interbasin transfer of water, then alternate supplies would have to be identified, permitted, and developed. Water could be imported from the Colorado River system and conveyed to Pahrump via pipeline or aqueduct. There are also a number of issues that are associated with this approach and federal concurrence and funding would be needed for implementation.

Conservation can reduce the demand for water. If the per capita water demand in Pahrump can be reduced from 486 gallons per day to 350 gallons per day, then the projected demand for water at a full build out would drop from about 80,000 acre feet to about 60,000 acre feet, a 25 percent reduction. Conservation measures can include water reuse, smart landscaping, and watering, and low volume fixtures in residences. Water reuse in Pahrump is already underway at Central Nevada Utilities where treated waste water is used for golf course irrigation. Smart landscaping and watering is best achieved through a program of public education. Low volume fixtures in residences can be required by building ordinances and/or regulations. One of the most effective conservation techniques, pricing, cannot be easily implemented in a community such as Pahrump where the numerous community water systems have rate structures regulated by the Public Service Commission.

## Figure 21. Subsidence in Pahrump Valley

### Fissure formation

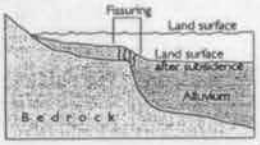
Several theories explain the mechanism of fissure formation

**Scanned from USGS Circular 1182**

Several mechanisms have been proposed for earth fissures, the most widely accepted of which is differential compaction. As ground-water levels decline in unconsolidated alluvial basins, less compaction and subsidence occurs in the thinner alluvium near the margin of the basin than in the thicker alluvium near the deeper, central part of the basin. The tension that results from the differential compaction stretches the overlying sediment until it fails as a fissure.

**Differential compaction**

As the land surface subsides, alluvium stretches and eventually fails, generally in a region of abrupt change in alluvium thickness.




Fissures are concentrated in areas where the thickness of the alluvium changes, such as near the margin of basins or where bedrock is near the surface.


Lateral stresses induce tension cracking.

Surface water infiltrates, dissolving the natural cement bonding the soil, connecting hairline cracks, and further eroding and enlarging the fissure.

Fissure progressively enlarges, capturing surface runoff, sediment, and debris. Eventually vegetation establishes itself, creating a line of vegetation along the trace of the fissure.

#### OTHER POSSIBLE MECHANISMS

Horizontal seepage stresses and rotation of a rigid slab over an incompressible edge are other mechanisms that have been suggested. The observation that new fissures have formed between existing fissures and the mountain front argues against these two hypotheses. Hydrocompaction, or collapse of low-density soils upon complete wetting, and increased soil-moisture tension have also been suggested as possible mechanisms. Hydrocompaction in fact did occur during construction of sections of the CAP Aqueduct between the Picacho Mountains and Marana.

Other proposed mechanisms include piping erosion, soil rupture during earthquakes, renewed faulting, collapse of caverns or mines, oxidation of organic soils, and diapirism. Piping (subsurface soil erosion) along the trace of a fissure certainly plays a part in the opening, progressive enlargement and subsequent development of fissure gullies.

(Slaton and others, 1972; Carpenter, 1993)

**Areas of Active Fissuring**

**In Pahrump Valley**

**West of Pahrump Valley Rd. between Manse Rd. and Thousandaire.**

**East of Hafen Ranch Rd. between Manse Rd. and Turner Blvd.**

**East and west of Homestead Rd. between Highway 160 and Gamebird Rd.**

**East and west of Parkridge Ave. between Hacienda and Deerskin.**

If voluntary conservation cannot be successfully implemented and water cannot be imported from outside the basin, then limiting growth would be the only approach that could keep the demand for water in line with the yield of the basin. Such an approach is not acceptable as it would unduly limit the future prosperity of both the community of Pahrump and Nye County and would represent a water management failure. From a practical point of view, it may be possible to place restrictions on future growth in the form of conservation requirements for developers and builders.

The best approach to matching water sources with future demand is probably a combination of these alternatives. If conservation can reduce the demand from 80,000 to 60,000 acre feet per year, restrictions aimed at wise water use are implemented, and 40,000 acre feet can be imported from other basins in southern Nye County, then withdrawals from the groundwater reservoir in Pahrump Valley could be limited to about 20,000 acre feet per year, slightly above the perennial yield of 19,000 acre feet per year, but well above the safe yield of 26,000 acre feet per year. This volume of pumping would probably be within the sustainable yield of the basin and, at a minimum, would lessen both the timing and severity of the adverse impacts of long-term overdraft of the basin. If water rights and funding for water importation can be obtained, then the overdraft of the basin can be limited in both duration and severity.

Feasibility of Alternatives - Water conservation is a proven method for achieving water savings and can be implemented through education, regulation, or pricing. The importation of water from other basins would be a costly and time-consuming process. If water rights are secured, design work, environmental documentation, and permitting will all have to be completed before construction can begin. Nye County does not have the financial wherewithal to fund such a project, which could cost 100 million dollars or more for water from north of Highway 95 and as much as 500 million dollars or more to convey water from the Colorado River system. Regardless of the source, financial assistance would be required to construct the facilities. Such assistance could either come from the federal government or from a private water development entity such as Vidler Water Company, who has offered to assist the County in the development of any water rights granted by the State Engineer.

Constraints on Water Development - The legal availability of water, water system ownership and domestic well issues, land and environmental restrictions, and costs all constrain the feasibility of the options that are available for Pahrump. It may be possible to drill deeper wells in the basin to help mitigate the adverse impacts of overdraft but any withdrawals from deeper zones would have to be done under existing water right permits as no new permits will be issued. In any target basins for the development of water supplies, the amount of water available for export will be limited by the legal availability of water in the basin of origin.

The presence of more than 20 community water systems under different ownership also complicates the implementation of alternatives. If water were to be imported to the basin, it would not be practical to "hook up" each of these systems because of the reluctance of individual owners to bear the costs. Similarly, domestic well owners would be reluctant to abandon their wells so that they could pay to join an existing utility. It would likely be necessary to inject the imported water into the valley-fill aquifer so that the community as a whole would receive the benefit of the water. The water could be injected into those areas with the greatest rates of water level decline and those areas with the greatest potential for subsidence.

Any water importation project would be constrained by whatever conditions are imposed on the water right permits and by the many restrictions on the development of water supplies and the construction of a conveyance system. First, the County must go through the protest period and

state its case to the Division of Water Resources who will then issue a ruling that may or may not grant the County water rights in each of the 14 basins where the County filed. Next, access to federal lands would have to be obtained in the form of rights-of-way across portions of the Nevada Test Site and the BLM land over which a pipeline would run, and mitigation fees would have to be paid. Monitoring programs would likely have to be developed and implemented before construction could begin. Construction would probably require another decade. In total, it could take decades and more than $ 1 billion to develop the infrastructure necessary to develop the groundwater resources on federal lands and convey that water to populated basins.

**Recommendations:**

Based upon the current and projected water demands in Pahrump, the issues related to additional development and the constraints on that development, the following recommendations are made:

**Water wells should be selected for long-term monitoring and water levels should be monitored on at least a bi-annual basis at these wells.**

**A basin-wide water quality survey should be conducted to identify problem areas and monitoring requirements. Water wells should be identified for sampling and chemical analysis and funding from state and federal agencies should be sought to pay for the costs of sample collection, packaging, shipping, and analysis.**

**Local utilities should be encouraged to adopt conservation practices similar to those already being employed by Central Nevada Utilities.**

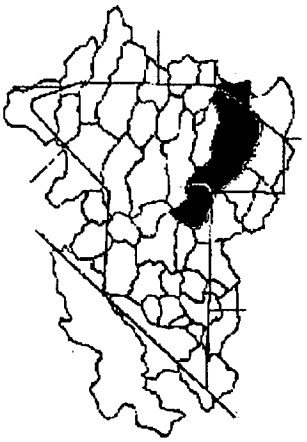
**Coordinate more detailed planning with the Nevada Division of Water Resources.**

**Continue the dialogue with the National Park Service and Fish and Wildlife Service concerning the likely impacts of increased water use in the basin.**

**Discussions should be held with the Division of Water Resources concerning the perennial yield of the basin.**

**Conduct a cost and feasibility study to determine if the water supplies in Pahrump can be supplemented with water withdrawn from adjacent basins north of Highway 95 or from the Colorado River.**

Other recommendations concerning Pahrump are included in the next Chapter which provides an overall strategy for water resources management in Nye County.



## Railroad Valley

**Railroad Valley North and South** **Perennial Yield: 50,000 acre ft/yr**

**Combined Water Budget Parameters** (acre feet per year rounded) from NDCNR 1971

| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 52,000 | some | 50,000 | 1,000 |

**Combined Water Rights Status** (acre feet rounded) from DWR database February 1999

| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 10,876 | 21,373 | 1,600 | | 307 |
| **Groundwater** | 16,248 | 8,076 | 190,467 | | |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action **RFP** = Ready for Protest, **VST** = Vested

**Assumptions** - For the purposes of planning, the following assumptions were made:

1. **Oil and gas production may increase over existing levels but will not increase above historic levels.**
2. **The full agricultural productivity of the basin will be realized by 2050.**
3. **The Duckwater Shoshone Reservation and the Railroad Valley Wildlife Management Area will not increase in size.**

### Water Resources Issues and Constraints

The primary water resources issues in Railroad Valley are water availability and the protection of environmentally sensitive areas. The published perennial yield of the basin is only 50,000 acre feet but recent studies by the U.S. Geological Survey suggest that it may be appreciably higher, on the order of 85,000 acre feet for Railroad Valley North. Current groundwater rights total less than 25,000 acre feet but large water right filings have been made for Carey Act and Desert Land Entries for irrigation (almost 95,000 acre feet), and for municipal purposes primarily by the Las Vegas Valley Water District (almost 96,000 acre feet). The water district has agreed to subordinate up to 30,000 acre feet to users within the basin. The presence of the wildlife management area and Railroad Valley Springfish habitat at two geothermal springs on the Duckwater Shoshone Reservation place binding constraints on the development of water in adjacent areas.

Water Supply Requirements - Existing water supplies are adequate to meet demands for quasi-municipal, mining, and industrial purposes. Growth of agri-business is expected and the demand for water should be met through existing water rights and applications.

Water sources - While surface water supplies are abundant, environmental constraints restrict further development in most areas. Groundwater, in supplement with some surface water supplies, is the primary source of water.

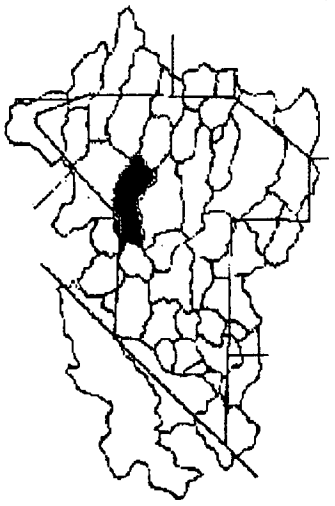
Feasibility of Alternatives - No alternatives have been identified for Railroad Valley.

**Recommendations :**

**Support the continuation of family farms by encouraging agricultural expansion**

**Continue cooperation with the Las Vegas Valley Water District under the Four Parties Agreement**

## Tonopah



**Ralston Valley** **Perennial Yield: 6,000 acre ft/yr**

**Combined Water Budget Parameters** (acre feet per year rounded) from NDCNR 1971

| Recharge | Inflow | Evapotranspiration | Outflow |
|---|---|---|---|
| 5,000 | 3,000 | 2,500 | 5,500 |

**Combined Water Rights Status** (acre feet rounded) from DWR database February 1999

| | CERT | Permits | RFA | RFP | VST |
|---|---|---|---|---|---|
| **Surface Water** | 149 | 40 | 8 | 7 | 5 |
| **Groundwater** | 995 | 971 | | | |

Note: All water right figures are approximate **CERT** = Certificated, **RFA** = Ready for Action
**RFP** = Ready for Protest, **VST** = Vested

**Assumptions** - For the purposes of planning, the following assumptions were made:

1. **A full build-out of all private land in Tonopah will occur by the year 2050.**
2. **Lands designated for disposal by the BLM will be purchased and developed by 2050.**
3. **A high-level nuclear waste repository will be permitted and constructed at Yucca Mountain and a transportation route will go through Tonopah and Ralston Valley.**
4. **U.S. Air Force activities at the Nevada Test and Training Range will continue through the year 2050.**
5. **One or more commercial and/or industrial facilities will be sited at the Tonopah Airport.**
6. **Future designations of land for disposal by the BLM will be limited to those needed for specific community purposes such as landfills, air fields, roads, etc., and these disposals will only result in negligible additional demands for water.**

### Water Resources Issues and Constraints

Existing supplies and sources meet current needs. The arsenic concentration of the eight water supply wells averages 11 ppb, slightly above the standard above the standard 10 ppb. Town members are apprehensive about the consequences of the new standard and how their water supply system will be treated from a regulatory standpoint. Residents are also concerned with regard to the development of water for a large mine that is proposed a short distance from the town's well field.

Water Supply Requirements - Existing water rights are adequate to serve the population and the forecasted growth of the community. Water is available for appropriation to support future growth of the community but additional supplies may be needed to support demands associated with industrial development at the airport.

Water sources - Water supplies for Tonopah are pumped from Ralston Valley. The existing water rights and well production capacities are adequate to meet projected future demand unless industrial demand becomes too great. The municipal water rights of 1,554 acre feet account for almost 80 percent of all rights allocated. Second is recreation with 240 acre feet, agriculture, stockwater, and other uses total less than 500 acre feet.

Feasibility of Alternatives - No alternatives have been identified for Ralston Valley.

**Recommendations:**

**Request or require industrial developers to prepare water demand forecasts**

**Track the implementation of the new arsenic standard**

## Surface Water and Watershed Requirements

According to the Nevada Division of Wildlife, ten of Nevada "Top 100 Waters" are located in Nye County. The Hay Meadows, Adams McGill, Cold Springs, and Dacey reservoirs are all located at Kirch Wildlife Management area in the Nye County portion of White River Valley. Barley, Pine, and Mosquito Creek in the Monitor Range, the Upper Reese River and San Juan Creek in the Toiyabe Mountains, and Sportsmans Park Pond, about 12 miles north of Tonopah, all provide prime fishing, hunting, and recreational opportunities. Other important surface water occurrences include Amargosa River, the springs that form Ash Meadows, Little Currant Creek, Warm Springs, and Hot Creek in Railroad Valley, and the hundreds of springs and seeps in the County that provide important sources of water for livestock and wildlife.

### Surface Water Issues and Constraints

In Chapter 3, a number of surface water issues were identified:

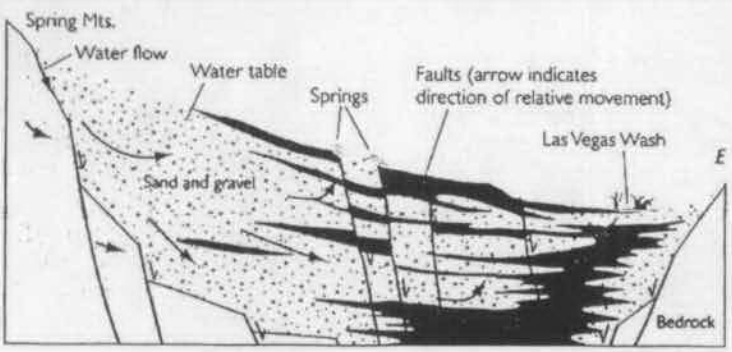
1. **Conservation of surface water sources**
2. **Relationships between surface and ground water uses**
3. **Interstate and intercounty management and use**
4. **Water use measurement and estimation**
5. **Nonpoint source pollution**
6. **Meeting recreational demands**
7. **Maintenance of instream flows**
8. **Flood hazard reduction**

Conservation of surface water sources is active at the wildlife management areas and Nye County is developing a habitat conservation plan to address concerns regarding the Amargosa River habitat at Beatty. As discussed previously, groundwater pumping has already reduced or eliminated spring discharge in the lower elevation portions of Pahrump Valley. Figure 23 shows the impacts of historic groundwater overdraft in that basin on the discharge of springs. Some springs have ceased flow completely while other springs have become seasonal or discharge at significantly lower rates.

No interstate or intercounty surface water management issues have been identified for Nye County. Nonpoint source pollution includes surface water contamination from mining and construction activities, grazing, agriculture, sewage disposal, and naturally occurring salts and metals. With the continued growth of Nye County (and Nevada as a whole), increasing demands are being placed on recreational water sources. The maintenance of instream flows is an issue for the Amargosa River and the Reese River which has its headwaters in northern Nye County. Finally, flooding in Pahrump Valley is becoming more of an issue as that community grows.

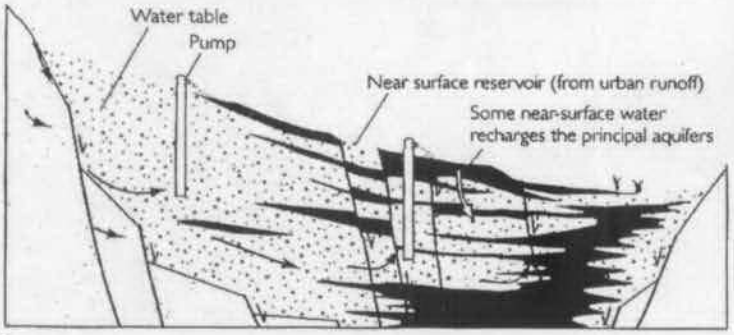
The primary constraint with respect to surface water resources is the fact that most of the watersheds that provide the source water for streams and springs are under federal stewardship. As a consequence, Nye County has little participation in the development and implementation of management alternatives. More active participation by the County in the development of federal resource management plans would help ensure that the County's issues and concerns are addressed.

**Figure 22. Effects of Groundwater Overdraft on Spring Discharge Rates.**

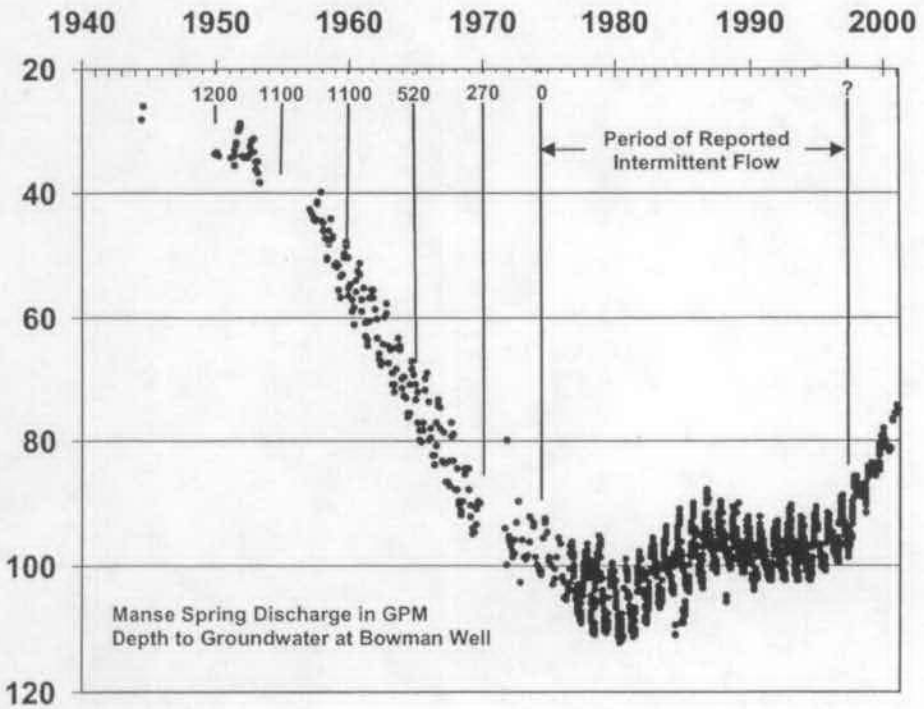




Scanned from USGS Circular 1182







## Management Strategy

Management of Nye County's surface water resources at the watershed level requires a strategy that is applicable for various conditions and alternative development scenarios. The areas that need protection including Death Valley National Park, wildlife refuges, riparian and wetland habitats, existing and future public water supply sources have been identified; other Areas of Critical Environmental Concern designated by the Bureau of Land Management. There is no one strategy that can perfectly fit all situations. Therefore, the strategy is outlined that is designed to be flexible and, with modification as needed on a case-by-case basis, provides a framework for the long-term management of the County's surface water resources. The strategy is shown on Figure 24 and includes recommended setback distances from springs, streams, and riparian areas and recommendations for monitoring prior to and during groundwater developments associated with interbasin groundwater withdrawals such as those proposed by the Las Vegas Valley Water District and Lincoln County/Vidler Water Company for basins located in Nye County.

The implementation of these setbacks and development of impairment criteria can help prevent the detrimental impacts of development that have already been observed in some areas of the County. Such requirements are not legally binding requirements; Nye County does not have the authority to impose such requirements. Rather, the criteria should serve as a planning guideline to ensure that any future water development in Nye County is not done to the detriment of the watersheds and ecosystems of the County.

**Recommendations:**

The following recommendations are made with regard to surface water management:

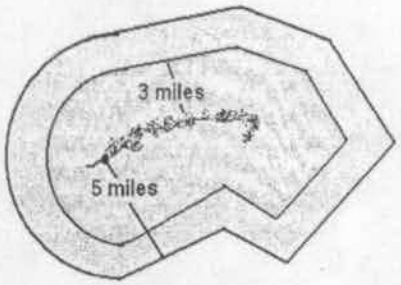
**Maintenance of Spring Discharge Rates - Establish baseline data on the discharge rates and trends of selected springs in environmentally sensitive areas. Nye County does not have the resources in terms of staff and financial status to collect these data. The County should work with the Division of Water Planning, the University of Nevada system, the U.S. Geological Survey, other organizations, and developers to implement baseline data collection efforts.**

**Cooperate With Stakeholders - Consultations should continue with the agencies, both State and Federal that are stakeholders in Nye County, especially with the Division of Water Resources.**

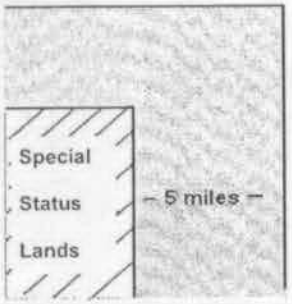
**Mitigate Adverse Impacts - Nye County should cooperate in the design and implementation of any mitigating actions, such as water banking used to offset impacts of the County's water resources.**

## Figure 23. REQUIREMENTS FOR EXPORT WATER SUPPLY WELLS


Minimum one mile setback distance from all existing underground water rights and water supply wells. Monitor water withdrawals, pumping levels, and static water levels at all existing wells within 2 miles of diversion. Reduce pumping rate if a water level decline of 10 feet is detected within 2 miles.




Minimum three mile setback distance from all springs, riparian areas, streams, and wetlands. Monitor spring discharges and stream flows within five miles of diversion. Reduce pumping rates if a decline in spring discharge rates is detected.




Minimum five mile setback distance from all State and Federal Wildlife Refuges, State and National Park boundaries, Native American Reservations, and all Public Water Supply Systems. Monitor all water withdrawals and water levels as required by State or Federal agencies and tie pumping rates to trigger levels for drawdown and surface water flows.

The setback distances and monitoring requirements shown above should serve as a guide for the location of water supply wells used for the interbasin transfer of water. In addition to these requirements, the water exporter must meet the following conditions prior to water withdrawals:

- Develop a monitoring plan that specifies the points of diversion that will be used for exportation, all land and water right owners within the distances specified above, the locations of sites that will be monitored, and the frequency of monitoring.
- Conduct monthly monitoring of springs and water levels for one year prior to the operation of any water supply wells used for exportation. These data will establish the baseline pre-pumping conditions.
- Enter into a cooperative agreement with Nye County and the Nevada Division of Water Resources regarding data reporting, roles and responsibilities, permit conditions, and dispute resolution.

## Mining Requirements

Assumptions - For the purposes of this plan, it is assumed that mining activities and their associated water use will continue at relatively constant levels through the year 2050. Mining has been the one of the more volatile sectors of the County's economy. Fluctuations in gold, silver, and copper prices have created wide swings in population and employment. Over the next half-century, the pattern of population, employment, economic fortunes, and water use will likely change. While much uncertainty surrounds the political and technological forces that shape the mining industry, one important fact is certain: Nye County has a wealth of mineral resources, both metal and non-metal, available to be mined. When market conditions, policy, and technology converge to produce a favorable climate for mining, the mineral resources in the County will be developed and mined.

Water Supply Requirements - Water supplies are used throughout mining and post-mining reclamation operations. The quantities of water required depend primarily on the type of operation, where or not milling and a town site are included, and the requirements for dewatering and reclamation. Typically, mining operations require from a few hundred to a few thousand acre feet per year. Water supplies for a given mining project are usually required for temporary periods ranging from a few years to a few decades.

Water Supply Sources - Water supplies in Nye County are generally ample for meeting the demand of future mining activities. As such activities are usually in remote locales, water development for mining operations often involves the development of springs or one or more water supply wells. The availability of water within the vicinity of any given mining property varies depending upon the local hydrologic conditions, water chemistry, and environmental constraint. As most new mining activities are expected to occur on federal lands, the appropriate environmental assessments and evaluations will be performed under the National Environmental Policy Act. The recent lowering of the drinking water and discharge standards for arsenic may restrict development in some areas or impose costly treatment requirements on the facility.

Feasibility of Alternatives - Historically, water availability has not been a binding constraint on the mining industry. In many areas of Nevada where reliable water supplies are absent, water has been conveyed via pipelines considerable distances to support mining and milling activities. Dewatering is still largely a technical issue although requirements for monitoring, treatment, and environmental mitigation now impose somewhat larger costs on these types of operations. The feasibility of the various alternatives for developing water for any given mining property can only be evaluated on a case-by-case basis.

Recommendations - The following recommendations are made with regard to mining water use:

1. **Continue working with the mining industry in the management of the water resources of Nye County.**
2. **Facilitate cooperation between the mining industry and state and federal regulatory authorities in the development of water resources and the mitigation of past adverse impacts related to mining activities.**
3. **Continue to monitor water use and water trends in the mining industry.**

## Self-Supplied Domestic Requirements

There are about 9,500 domestic wells in Nye County. However, with the exception of Pahrump Valley (about 8,800 wells), self supplied domestic water use is not large, on the order of 700 acre feet per year. There are about 380 domestic wells in Amargosa Valley, 115 in Big Smoky Valley, and 70 wells Indian Springs Valley (all in Clark County). While there are hundreds of other domestic wells in the County, they are generally widely separated.

Water Supply Requirements - Water use for domestic purposes can vary widely depending upon the size of the household and individual habits and preferences. Generally, a single domestic well will pump about one acre foot of water per year for an average household.

Water Supply Sources - With the exception of Pahrump, there are ample water supplies for domestic supplies throughout the portions of Nye County not served by public water supply systems. The depth and yield of domestic water wells varies from place-to-place.

Feasibility of Alternatives - The alternative to domestic water supplies is to convert from residential water wells to public water supply systems. Public systems can be established by private entities under the requirements of the Public Service Commission and under the various Nevada laws and regulations governing public water supply systems. At present, no new public water supply systems are anticipated. However, growth in the Amargosa Valley area or along Highway 95 could result in the creation of new systems. Any types of development, such as a casino-resort or golf resort may also lead to the establishment of one or more new public systems. Any new public water supply systems will have to do design work, permitting, and compliance monitoring in accordance with the prevailing regulations.

Recommendations - The following recommendations are made with regard to self-supplied domestic water:

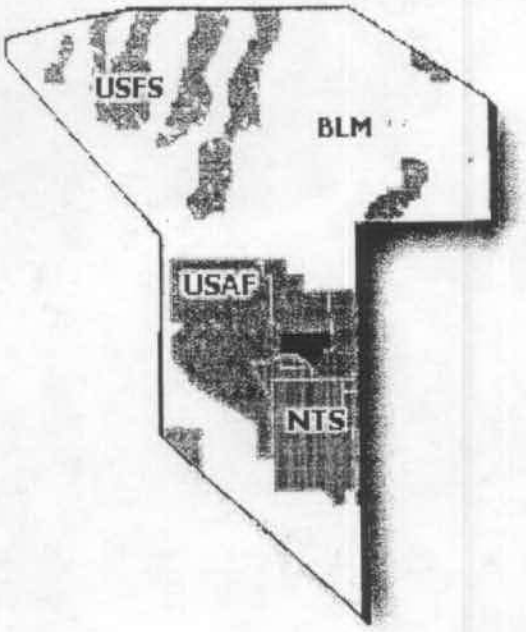
**Work with the Bureau of Health Protection Services to keep Nye County's domestic water users informed regarding proper sanitation methods and practices.**

**Cooperate with the Nevada Division of Water Resources in monitoring domestic water use and trends.**

## Federal Lands Water Requirements

With over 93 percent of Nye County managed by federal agencies, there is a demand for water resources to meet the mission of each agency with stewardship over an area. As such, the water resource requirements for the continued management of federal lands in the County must be taken into account as part of the planning process.

Water Supply Requirements - The demand for water to meet federal needs in Nye County has not been well defined. Federal water uses include preservation, conservation, wildlife management, construction, fire control, and quasi-municipal use. The direct demand for water to meet the infrastructure requirements for federal facilities in the county is not large. However, the demands placed on the water resources for environmental purposes are large and in some areas may pose a binding constraint of future water development.




In the past, some of the valleys in Nye County were targeted as potential locations for a national missile defense system, the MX system. In the future, the County may be called upon to host a federal activity of a similar nature. The location of such a facility would have to consider water resources during the planning stages and is not addressed in this plan.

Water Supply Sources and Issues - The water to meet federal water demands comes from numerous springs, streams, reservoirs, and wells. In recent years, an increased emphasis has been placed on the management and restoration of the water resources of springs, streams, and riparian areas. The U.S. Forest Service manages the water resources of the Humboldt and Toiyabe National Forests. It is Forest Service policy to file for water rights (in the name of the United States), for all water needed to support the proper use and management of National Forest administered lands.

The Bureau of Land Management is responsible for public lands, their management, use, and disposition. Present water use by the BLM is modest and it is not considered likely that any significant new supplies will be needed in the foreseeable future. Any lands that are designated for disposal (privatization) will have an associated, but un-defined demand for water that is proportionate to the subsequent use of the land. Any developments on lands disposed by the BLM will have to obtain water rights in accordance with Nevada Water Law.

The U.S. Fish and Wildlife Service is responsible for the management of key lands in Nye County and has regulatory authority over activities and developments on other federal lands. The interests of the Fish and Wildlife Service with respect to water resources management are shared with the County.

The National Park Service is responsible for management of Death Valley National Park. In this capacity, the Park Service has developed a well-defined water policy. The Park Service is also

involved as a protestant with regard to the Las Vegas Valley Water District's filings in Nye County and, in this capacity, has a shared interest with the County. Conversely, the Park Service has protested more than 90 water right applications in Nye County including those filed by the County in basins on, or adjacent to the Nevada Test Site.

Feasibility of Alternatives - Alternative actions in the management of federal lands is subject to periodic review under the National Environmental Policy Act. These reviews determine the feasibility and impacts associated with changes in management practices for the land under the stewardship of the various federal agencies. The federal agencies have implemented practices aimed at improving water quantity and quality; alternative practices have been evaluated and preferred actions established. These, and new alternatives are considered during the regular reviews of management plans.

**Recommendations**

Given the many shared interests between Nye County and the federal agencies with stewardship over the federal lands, a policy of cooperation aimed at implementing sound water management practices should serve as the framework for interactions with the federal government. Such interactions cannot succeed without the participation and cooperation of the state agencies with regulatory authority over the water resources of the County. Therefore, the following recommendations are made:

**The County should continue to be an active participant with cooperating agencies in the development of federal management plans.**

**Nye County should continue to facilitate cooperative data collection, information sharing, and water resources by the entities involved in the management of the County's resources.**

**The County should continue to cooperate with the Division of Water Resources in implementing the recommendations of the State Water Plan with respect to watershed planning and management and water resources data management. The County also should encourage the participation of federal agencies, and their resources, in these planning efforts.**

# CHAPTER 7. WATER RESOURCE MANAGEMENT ALTERNATIVES

In the preceding chapters, the baseline water resources conditions were described and the issues related to past, current, and future development of those resources were identified and discussed. In this chapter, alternative strategies for long-term resource management are defined and discussed. These strategies include measures aimed at addressing the many water resource issues and problems that Nye County is faced with. For the purposes of discussion, the alternatives are organized into the following five categories:

- **No Action Alternative**
- **Advisory Alternative**
- **Administrative Alternatives**
- **Legal Alternatives**
- **Combined Advisory, Administrative, and Legal Alternatives**

Each alternative approach to water resource management has its own advantages and disadvantages in terms of feasibility, cost, and implications. The following sections discuss each alternative.

## No Action Alternative

Under the no action alternative Nye County would not adopt or implement any of the recommendations made in Chapter 6 of this plan. Water planning activities would revert solely to those undertaken by the Nevada Division of Water Resources. Individual water supply system owners would not benefit from any level of County support and would be left to their own resources in meeting future demands and system requirements.

Such an approach would result in no direct cost impact to the County. However, water supply system owners and operators might conduct redundant activities as well as going to the expense of collecting information that is already available from the County or other sources. Further, most of the public water supply systems in the County are privately owned and usually do not qualify for grants, low interest loans, or other programs administered by the state. Thus, negative cost impacts would likely occur to individual water supply systems (and their customers) under the no action alternative.

Adopting the no action alternative would send the message to the state that Nye County is not concerned about water issues or water resource planning. The Division of Water Resources prefers that local entities are involved in the water planning process and Nye County has already held discussions with division personnel regarding water resource issues and alternatives in Nye County. Abandoning the resource planning efforts that have already been undertaken would undermine the cooperation between the state and the County.

## Advisory Alternative

Under the advisory alternative, Nye County would serve only in an advisory capacity as an interface between the state regulatory agencies and the individual water supply system owners/operators and domestic well owners in the County. The County would cease data collection efforts and "hands on" water resources planning but would continue to work with the Division of Water Resources, federal agency stakeholders in the County, and water supply system owners. In limiting its participation to an advisory capacity, the County would only adopt the following recommendations made in Chapter 6 of this plan:

- **Coordinate more detailed planning with local water users and the Division of Water Resources**
- **Continue the dialogue with the National Park Service and the US Fish & Wildlife Service concerning the impacts of increased water use in Amargosa Desert**
- **Hold discussions with the Division of Water Resources concerning the perennial yields of Amargosa Desert and Pahrump Valley**
- **Cooperate with the Division of Environmental Protection and the Bureau of Health Protection Services in identifying funding sources to assist water supply systems in Big Smoky Valley, Tonopah, and Beatty in meeting the new arsenic standard**
- **Encourage all water supply systems in Pahrump Valley to adopt conservation practices**
- **Continue consultations on surface water issues with stakeholder agencies**
- **Facilitate cooperation between the mining industry and state and federal regulators**
- **Work with the Bureau of Health Protection Services to keep Nye County's domestic water users informed about proper sanitation methods and practices**
- **Continue participating with cooperating agencies in the development of federal resource management plans and action specific environmental documentation**
- **Support the continuation of family farms by encouraging agricultural expansion**
- **Continue cooperation with the Las Vegas Valley Water District under the Four Parties Agreement**
- **Continue cooperating with DWR in watershed planning and management and water resources data management**

Under the advisory alternative, the Nye County Department of Natural Resources and Federal Facilities (DNRFF) would continue to consult with various organizations on water resource issues. These organizations include the Division of Water Resources, the Division of Environmental Protection, and the Bureau of Health Protection Services at the state level, and the Southern Nye County Conservation District, the Community Advisory Board for the Nevada Test Site, and individual water system owner/operators at the local level. Communications and consultations would also continue with each of the federal land stakeholders in the County.

The primary advantage to the advisory alternative would be the low cost to the County. Consultations with state, federal, and local agencies and organizations would continue to be held by the DNRFF through a number of venues including the formal review of agency plans and documents, participation at scientific forums such as the annual Devils Hole Workshop, and presentations to the Pahrump Regional Planning Commission, the Nuclear Waste Technical Review Board and Advisory Council on Nuclear Wastes, and other groups and organizations.

The primary disadvantage of the advisory alternative approach would be the County's continued lack of any regulatory or statutory authority in the water planning process. Nye County would not have any basis or standing for mandating compliance with this plan or with any future plans or water resource initiatives. Water resource decisions would continue to be the responsibility of the state and the many federal agencies that operate facilities in the County.

## Administrative Alternatives

Under the administrative management alternative, Nye County would exert authority over the water planning process through the development of a management authority. There are three management authority options available to the County:

- **Establishing a General Improvement District (GID)**
- **Establishing a Water Planning Commission, Comprehensive Regional Plan, and Remediation District(s)**
- **Establishing a Regional Water Authority**

### General Improvement District

A General Improvement District (GID) can be created pursuant to the provisions and requirements of NRS Chapter 318. Nye County currently has five GIDs: Beatty GID, Beatty Water & Sanitation, Pahrump Swimming Pool, Railroad Valley GID, and Smoky Valley Television. The organization of a GID must serve a public use and promote the health, safety, prosperity, security, and general welfare of the inhabitants thereof and the State of Nevada.

The Nye County Board of County Commissioners has the jurisdiction, power, and authority to create districts with the County by adopting a resolution. Once the resolution has been adopted, the property owners within the district boundaries are notified and may protest the formation of the district. After hearing the protests and determining that the district is required by public necessity and convenience, and that the creation of the district is economically sound and feasible, then the board of commissioners can adopt an ordinance creating the district. In Nye County (and other counties with less than 400,000 residents), the Board of County Commissioners has the option of appointing five people to serve as the first board of trustees with subsequent positions filled through general elections. The Board also has the option of serving as the ex officio board of trustees .

With respect to water resources, a GID can have the following basic powers:

- **Furnishing facilities for storm drainage or flood control**
- **Furnishing sanitary facilities for sewage**
- **Furnishing facilities for water**

NRS Chapter 318 has specific provisions regarding the establishment of GIDs that encompass more than one county. NRS 318.50(3) states that the board of county commissioners of the county in which is located the larger or largest proportion of the area of the proposed district has the jurisdiction, power, and authority to create the district, to broaden its basic powers and otherwise supervise the district. No provisions are made for interstate districts.

The board of a GID may approve the acquisition, construction, reconstruction, improvement, or extension of systems and facilities for the supply, storage, and distribution of water for both private and public purposes.

Over the short-term planning horizon (one to five years), the establishment of one or more GIDs could be used primarily as a mechanism for addressing water quality concerns in Pahrump Valley and Big Smoky Valley. Over the long-term (five to twenty years), a GID could provide a mechanism for the development, conveyance, and delivery of any groundwater rights granted to Nye County by the State Engineer in the basins north of Amargosa Desert and the rights turned over to the County through the parceling process in Pahrump.

The advantages of a GID include the ability to qualify for grant monies, and to borrow money and issue short-term notes and a number of types of bonds. A GID would also serve as a non-profit umbrella entity over the many for profit water supply systems in the County. For example, utilities under private ownership do not qualify for state administered federal grants for the implementation of Wellhead Protection Programs. A GID would qualify however, and could assist local utilities in the preparation of plans and the implementation of the steps needed for wellhead protection. The ability of a board to utilize debt depends on the nature of the district and the population. The GID can generate revenues from a number of sources including state sources, state and federal grants, property taxes, special assessments, tolls, rates, and service charges.

The primary disadvantages of a GID include the potential need for one or more new Nye County employees and the potential negative reaction of or by citizens or water supply systems that would operate within the GID boundaries. Any revenue generating measures that would include an increase in property taxes or service charges on water bills would likely be negatively received by the public or the system customers.

### Water Planning Commission

A Water Planning Commission can be established pursuant to the provisions and requirements of NRS Chapter 540A Regional Planning and Management. This chapter applies only to counties whose population is 100,000 or more but less than 400,000 and Nye County would have to seek legislation to extend the applicability of this chapter to the County. Such legislation would allow the creation of a water planning commission. All actions taken under the provisions of Chapter 540A require a super majority of the Board of County Commissioners. The Water Planning Commission (WPC) must consist of nine voting members who are Nevada residents as follows:

- **One member appointed by the governing boy of the largest city in the County;**
- **One member appointed by the governing body of the next largest city in the County;**
- **One member appointed by the Board of County Commissioners;**
- **One member appointed by the board to represent owners of domestic wells;**
- **One member appointed by the governing body of a general improvement district having the greatest number of customers for water and sewerage in the region;**
- **One member appointed by the supplier of water having the greatest number of customers for water in the region which is a public utility;**
- **One member appointed by the governing body of the largest Indian reservation in the County;**
- **One member of the public at large appointed by the governing bodies of the two largest cities in the county by mutual agreement to represent environmental, biological, conservation or public concerns; and**
- **One member appointed by the governing body of the largest irrigation district in the County.**

In addition to the voting members, the WPC includes the following non-voting members:

- **One member appointed by the Public Utilities Commission of Nevada;**
- **One member appointed by the advocate for customers of public utilities in the office of the attorney general;**
- **One member appointed by the administrator of the Division of Environmental Protection;**
- **One member appointed by the State Engineer;**
- **One member appointed by the Division of Water Resources;**
- **One member appointed by the board of directors of the largest water conservancy district;**
- **One member appointed by the county or district board of health:**
- **One member of the public at large appointed by the affirmative vote of a majority of the voting members; and**
- **Additional members with expertise in an area that the majority of the voting members determines is necessary, appointed by a majority affirmative vote.**

Further, both the voting and non-voting members may not hold elective office but may be government employees and each member must be qualified pursuant to at least one of the following:

- **A professional licensed engineer with experience related to comprehensive planning, natural resources or environmental protection;**
- **A specialist in hydrology;**
- **Experienced in law, management or planning related to water;**
- **Experienced in municipal finance;**
- **Experienced in construction, planning or operations of facilities or systems for supplying or treating water, for collecting or treating sewage, for draingage of storm water, or for flood control; or**
- **Knowledgeable in the areas of water conservation, biology, natural systems, water quality, and water management.**

NRS Chapter 540A also requires the development of a comprehensive regional plan and sets forth specific requirements for such a plan. Before submitting the plan to the Board of County Commissioners, the WPC must hold at least one public hearing on the plan and the WPC must approve the submittal of the plan to the Board with a two-thirds vote of affirmation. The plan may then be adopted by the Board of County Commissioners and then submitted to the regional planning commissions who review the plan for conformance and may appeal the adoption of the plan.

The WPC may acquire and use water rights and other sources of water, within or outside the region, for future use in accordance with the comprehensive plan. Any right or source of water belonging to a local government or governmental agency within the region must be used in accordance with the adopted comprehensive plan.

Finally, NRS 540A.250 provides for the creation of a Remediation District by the Board of County Commissioners if a condition exists in an area of the region that is affecting or will affect the quality of water that is available for municipal, industrial, or domestic use in the region. The Central Truckee Meadows Remediation District is an example of a Remediation District in Nevada.

The Board of County Commissioners must prepare a remediation plan prior to creating the Remediation District and the plan must be approved by the Division of Environmental Protection.

This plan includes any actions which are reasonable and economically feasible in the event of the release or threat of release of any hazardous substance into the environment which may affect the water quality in the state. Actions may include:

- **Monitoring, assessing, and evaluating the water which may be affected;**
- **Removing or disposing of the substance or remedying the condition of the water in any other manner; and**
- **Taking such actions as are necessary to prevent, minimize or mitigate damage to the affected water.**

After the plan is approved by the Division of Environmental Protection, the Board of County Commissioners must determine the costs of developing and carrying out the plan for remediation. The Board then determines the boundaries of the Remediation District and holds a public hearing. The district boundaries can then be adjusted as necessary but cannot be expanded to include any property not included in the original boundaries. The Board may then establish fees or an ad valorem tax on property within the district to recover the costs of developing and carrying out the plan for remediation. Only the federal government is exempt from assessment or taxation.

If during the investigation to establish the Remediation District boundaries, the development of the remediation plan, or the carrying out of the plan, the Board of County Commissioners obtains evidence that a person has caused or contributed to the condition requiring remediation, the Board shall provide this evidence to the Division of Environmental Protection for appropriate action. In addition to any action authorized by statute, the Department of Conservation and Natural Resources may take legal action to recover the costs of remediation incurred by the County or Remediation District. Any monetary recovery must be distributed to the Department to cover the costs of recovery, to the Board of County Commissioners to offset the costs of remediation, and to reduce any fees or taxes that would otherwise be charged against parcel or properties within the district, as determined by the Board.

There are two potential areas where the creation of Remediation Districts would be applicable to Nye County, possible areas of nitrate contamination in Pahrump Valley, and the massive contamination on the Nevada Test Site. If nitrate contamination is found to occur in areas of Pahrump Valley, the creation of a Remediation District would provide an equitable approach to recovering the costs of cleanup or treatment of the water. Under the provisions of NRS 540A, the boundaries of a Remediation District need not be contiguous and can be amended through a formal process. Areas that are proven to be contaminated would be addressed and the costs levied only against the property owners within the District Boundaries.

The primary advantages of establishing a Water Planning Commission are the formal delegation of authority to the local level and the adoption of a formal plan that must be taken into consideration by federal agencies in the development of their resource management plans, environmental impact statements, and environmental assessments. The creation of one or more Remediation Districts provides a method to address the potential problems associated with high-density septic systems in Pahrump. With regard to the Nevada Test Site, the creation of a Remediation District could significantly decrease the life cycle costs and projected schedule for addressing the groundwater contamination at the underground testing areas. The disadvantages include the costs and the difficulty in building a consensus (or at least a super majority) in a County as diverse and geographically dispersed as Nye County.

### Regional Water Authority

The third administrative alternative is the establishment of a Regional Water Authority (RWA). Such an authority could be based on the Southern Nevada Water Authority model and would require enabling legislation. A RWA would be given the charter of ensuring that water supplies are available to support growth, a healthy economy, and the protection of public water supplies and the environment. A RWA would provide an interface with state and federal agencies, other counties, and other water authorities on water related issues. The authority could also provide assistance to the more than 30 public water supply systems in complying with laws and regulations and promoting sound management practices.

The Nye County Board of County Commissioners would likely comprise the Board of Directors of a RWA. Administrative and operations support would be provided by existing County staff during the initial stages of development. Membership in the RWA would include voting and non-voting public water supply systems. The RWA's area of authority could be established on the basis of either political or hydrologic boundaries. For example, the entire Nye County portions of the Death Valley flow system could be established as the region of authority or the boundaries of the communities within the County.

Funding sources for an RWA could include the transfer of water systems from federal ownership to Nye County ownership, federal and state funding, and local funding sources. Past informal discussions with the Department of Energy have indicated some interest in the County becoming the operator for the five water supply systems on the Nevada Test Site and informal discussions with the US Air Force have not ruled out a similar arrangement on the Air Force ranges. Currently the water supply systems at these facilities are operated by management and operations contractors and the costs of delivered water are quite high. Transferring the systems to Nye County could reduce the cost of delivered water and provide an important source of revenue to the RWA.

A RWA would serve as an umbrella authority that would qualify for grants and low-interest loans from federal and state sources. Funding could be sought for assistance for system operation and capital projects, wellhead protection programs, interbasin transfers of water, and an artificial recharge project in Pahrump. Local funding sources could include direct sales of water to utilities, water rate surcharges, impact fees on developers, and bonding.

The advantages of establishing a RWA are the same as the other administrative alternatives, more local authority over water management decisions, qualification for grant monies, and increased cooperation between private utilities. The disadvantages include likely increases in the costs of water delivered by each utility and the potential need for new County employees after the RWA has been established.

## Legal Alternatives

Legal alternatives that are available to Nye County include the establishment of a Water Conservation District, petitions to the State Engineer, water right application protests, and litigation. Legal action, or the threat of legal action, may ultimately be needed to resolve some issues, particularly those related to federal land stewardship, actions on federal facilities, water right claims by federal agencies, and federal policies that impact the water resources of the County.

### Water Conservancy District

A Water Conservancy District (WCD) can be created pursuant to the provisions and requirements of NRS Chapter 541. Nye County currently has no WCDs. To establish a WCD, a petition must be filed in the office of the clerk of the court vested with jurisdiction in the county in which all or the greatest part of the lands that will comprise the district are situated. The petition must be approved and filed by the Board of County Commissioners with a bond of $1,000. A hearing time and place is set by the district court and protesting petitions may be filed if they meet certain conditions. If the protests are overruled, the court declares the district a corporation and notifies the secretary of state and the county clerk and recorder. The governor then appoints a board of directors in accordance with the petition.

Once established, a WCD has the authority to construct and maintain works including power, access roads, pipelines, canals, and other facilities. The WCD also has the power to fix water rates, enter into contracts, acquire water and water rights, to develop those rights, and transport water for sale or lease. Any municipality, irrigation district, or person or private corporations can petition the board to purchase, lease, or otherwise obtain the beneficial use of the waters of the district. The development of a WCD is a legal action alternative that is available if administrative actions are not deemed appropriate or if enabling legislation cannot be afforded to the County.

### Petitions to the Nevada State Engineer

Nye County can formally petition the State Engineer to take certain actions such as imposing or lifting orders of designation or changing the perennial yield value of a hydrographic basin. The procedure is quite simple: a petition is submitted in the form of a letter to the State Engineer with an optional information package. The letter states what the requested action is and the basis for the request.

Upon receipt, the State Engineer may consider the petition and act accordingly or may require additional information and/or reviews. For example, upon receipt of a petition to change the perennial yield of a basin, the State Engineer will likely request that the U.S. Geological Survey review the petition and supporting information and conduct whatever additional evaluations that may be necessary. Funding must be arranged to compensate the Geological Survey for their work and this can either be arranged through direct funding from the County or through the legislature. Given the two-year budget cycle and the need for reviews within the Geological Survey, it may take as long as four years before a final recommendation is made to the State Engineer and the requested action is taken or disallowed.

### Water Right Application Protests

Nye County can protest any water right applications (including change applications) if it deems that the proposed water development is not in the public interest, if it will impair senior water rights, if unappropriated water is not available for the proposed use, or if the proposed project is not feasible or is speculative. For interbasin transfers of water, Nye County can protest applications if it deems that the proposed action is not environmentally sound, the need for exportation to another basin has not been justified by the applicant, or the proposed development will unduly limit the future growth and development in the basin of origin. The County has outstanding protests of water right applications by the Las Vegas Valley Water District.

To initiate a water right protest, Nye County must file a protest in a timely manner (within 30 days of the last date of publication of the notice of application. The protest must set forth the grounds for the protest. The State Engineer will consider the protest and may, at his discretion, hold hearings and require additional evidence. If a hearing is held, the County would be called upon to present evidence to support its protest in a quasi-legal proceeding.

The costs of water right protests can be appreciable depending upon the number of expert witnesses and testimony provided by both the applicant and the protestant(s). The burden of proof for a protest falls upon the protestant not the applicant and all costs associated with the hearing must be borne equally by the applicant and the protestant(s).

It is not possible to predict what future water right filings might be protested by Nye County, if any. Any applications that would export water from a basin located in Nye County to another county should be carefully reviewed to determine if the County should file a protest. Speculative water right filings, filings by the federal government, and claims of reserved water rights are areas where the County may wish to file protests.

**Natural Resource Damage Assessment**

Any person can initiate a Natural Resource Damage Assessment (NRDA) under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Under 40 CFR 310(a), any person can sue the United States for relief from an inadequate response to a release of a hazardous substance, including an alleged inadequate execution of natural resource trustee duties. Nye County could take legal action to initiate a NRDA of the groundwater contamination at the underground testing areas on the Nevada Test Site. However, any claim for monetary damages can only be pursued by a state, tribe, or a federal agency.

If Nye County or any person initiates a "citizen's suit", it can compel the natural resource trustee to file an initial or supplemental damage claim against the Department of Energy and may result in the Department being required to implement unplanned remedial or corrective actions or provide additional monies for restoration or replacement of the injured resource. This suit notifies the resource trustees of a potential injury loss or damage to the natural resources, in this case the groundwater resources underlying the Nevada Test Site.

Once notified, the natural resource trustee may conduct a pre-assessment screening to determine if the releases to the environment justify a NRDA. This screening relies upon the available information and generally only takes a few days to complete. If the results of the screening find that the releases were covered by CERCLA, they may have injured the resources, the extent of potential injury are of concern, and the potential benefits outweigh the costs of performing a NRDA, then an Assessment Plan is prepared. This plan must include a confirmation of exposure and lays out an assessment process. The next step is injury determination which must determine a pathway between the release and the resource. In the case of the Nevada Test Site where nuclear weapons tests were conducted under, or within close proximity to water table, injury has already been established.

The Assessment Plan is then reviewed and revised as necessary and the next step of the process, quantification of effects, is implemented. In this step, the effects of the release on the injured resource are evaluated. A damage determination is then performed to determine what financial compensations are appropriate. The results of the NRDA are documented in a Report of Assessment that must be filed with a court. The final step of the NRDA process is the establishment of an account into which all monies awarded pursuant to secton 107 of CERCLA must be planed. All funds recovered for injuries must be retained by the trustee only for restoration,

rehabilitation, replacement, or the acquisition of the equivalent of the injured resource, and to reimburse the trustee for the cost of the assessment.

With respect to the contaminated groundwater at the Nevada Test Site, there are no known remedial alternatives for the restoration or rehabilitation of the injured resources. Thus the resources would have to be replaced either by the direct delivery of water to Nye County or through the development of an alternate water supply source that would be constructed by the County using the compensation funds. Any action to initiate a NRDA for the underground testing areas on the Nevada Test Site would have to be taken within three years of the Record of Decision for the completion of the remedial action for each individual underground testing area.

### Combined Advisory, Administrative, and Legal Alternatives

Overall, water resources management will probably be best accomplished with a combination of the alternatives discussed previously. Figure 25 shows a flow diagram that shows the basic approach to resource management. If the Board of County Commissioners approves the adoption of administrative alternatives, then one of three paths forward are available to establish local authority over the planning process, a Water Planning Commission, a General Improvement District, or a Regional Water Authority. Enabling legislation would be required for a Water Planning Commission of a Regional Water Authority. The County already has the authority to establish a General Improvement District. If none of these alternatives are considered viable, or if the legislation cannot be passed, then the only alternative left open to the County is the establishment of a Water Conservancy District.

The next steps in the process are developing funding for the administrative authority and the acquisition of water rights. Although the flow chart shows these steps before negotiations with the federal agencies, they could actually occur concurrent with, or following, negotiations. The County already has water right applications on file with the Division of Water Resources and action on these applications could occur after negotiations have occurred.

The negotiations with the federal agencies are an important next step in the management process. If negotiations are successful, then funding in the form of direct compensation, mitigation for past and future federal impacts on the water resources, or through equity offsets aimed at treating Nye County fairly for hosting both the nation's atomic weapons testing facility and a high-level nuclear waste repository. Other issues that will require resolution include water right conflicts with the National Park Service, and the recognition of County planning efforts in the development of federal resources management plans and environmental impact statements. If the negotiations are successful and the federal agencies recognize Nye County's issues and concerns and provide the proper mitigating measures, then the County can move forward with resource development.

If the County is not successful in the negotiations or if the federal agencies do not provide adequate mitigation, then the only alternative that may be available is the initiation of the Natural Resource Damage Assessment provisions under existing environmental laws. While such an action should be considered as a last resort to be used only if negotiations are unsuccessful, it may ultimately be the only approach to acquiring the water resources needed to insure the future, health, well-being, and economic prosperity of the citizens of Nye County.

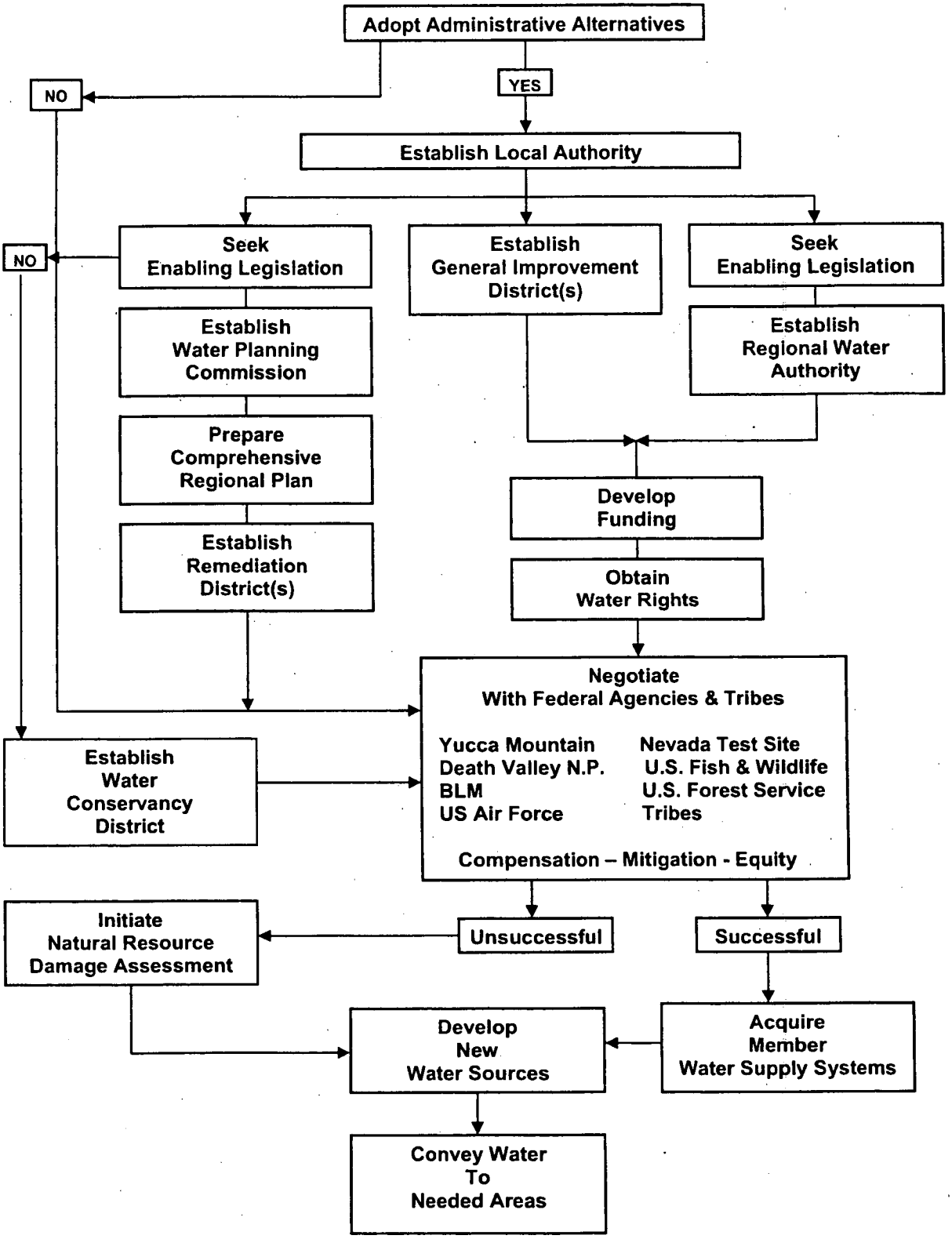



**Figure 24. Flow Chart for Implementation of Water Resource Management Alternatives**

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# NYE COUNTY WATER RESOURCES PLAN

## APPENDIX A - COMMENT RESPONSES

supply systems the water will either have to be treated (at significant cost) or new sources of water found that do meet the new standard. The new arsenic standard has imposed a heavy burden on many systems in the western United States.

55. **New mining ventures may impact publicly owned well fields. What can they do to protect themselves from the liability of having to move their well field?** In the event that a water right owner believes that their rights are being impaired, it should be immediately brought to the attention of the Nevada State Engineer by letter. The State Engineer will review the available information and may schedule a formal or informal hearing to hear both sides of the argument and direct what additional information may be required.

56. **Growth projections may be faster than current projections.** Yes it can be but growth generally occurs in steps (or spurts) rather than as a nice straight-line percentage increase. The latest estimated population of Pahrump is 30,500 and 38,000 for Nye County as a whole (June 2004). These numbers are above the Division of Water Planning estimates but below the estimates of both the Nevada State Demographer and Nye County's REMI projections. Most of the difference is a result of the delays in development of the Mountain Falls project.

57. **How does the State Engineer fit into our plan?** The State Engineer is the regulatory authority governing water appropriate and disputes in the State of Nevada. Consultations were held with the State Engineer in the development of the Nye County Water Resources Plan.

58. **The plan must address local concerns and not be biased toward the population center (Pahrump).** The plan does just that through the development of issues and management alternatives for each area of the County. Given the weight of water issues in Pahrump, this area of course was the focus of more of the text in the document.

59. **Interbasin transfer of water is an important issue even if the transfer is within the county.** The North County residents do not want to see their water developed an exported anywhere. It makes no difference whether the water would be exported to metropolitan Las Vegas or to Pahrump (or any other location in Nye County). The residents asked what would prevent the county from changing its mind in the future and trying to export water from their area to other areas. The primary limitation on exporting water from one area of Nye County to another county or to other areas in Nye County is the cost, which would likely exceed $1 billion. While it is recognized that the unappropriated water resources do not belong to the local residents, Nevada Water Law provides protection of senior water rights from impairment and the future economic well being of the communities within the areas targeted for groundwater development for export. The County made the concerns of the North County residents known to participants at the water plan workshops in Amargosa Valley, Valley, and Pahrump.

60. **Wording in the plan about water rights north of Highway 95 should be revised to indicate that all the water is designated for use in Amargosa Valley.** Only the original water right filings in Amargosa Valley, Crater Flat, and Frenchman Flat were designated for use in Amargosa Valley.

61. **The BLM is an important federal agency that should be part of the "federal dialogue" process mentioned in the plan.** The Bureau of Land Management is indeed part of the process and will continue to be consulted.

62. **What is the model for a regional water authority?** There are two good models in Nevada, the Southern Nevada Water Authority and the Truckee Meadows Water Authority.

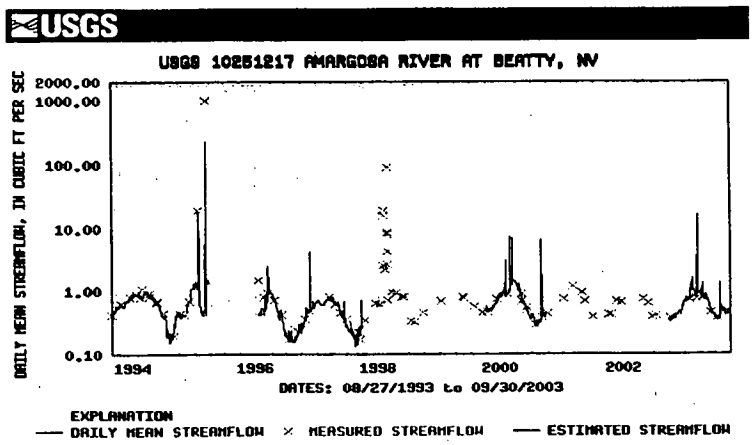
63. **Are comments about a regional water authority directed toward Pahrump only?** At this time, the problem is primarily related to Pahrump but proper water planning cannot "rob" other areas of Nye County to "pay" Pahrump. The final boundaries of a water authority, if one is

established, will be of sufficient size to encompass a much larger area than just Pahrump, if appropriate.

64. **The federal agency (e.g., National Park Service; Fish and Wildlife Service) water rights need to be described more clearly.** It is beyond the scope of the water plan to identify all of the thousands of water right owners in the County. The National Park Service has no state water rights, rather, the service claims a federally reserved water right. Details on the Fish and Wildlife Service water rights are available from the Division of Water resources.

65. **Flood control and riparian vegetation are important issues in Beatty.** Both flooding and riparian vegetation are addressed in the plan. Because the plan focuses on water supply, it does not emphasize flooding, which is more appropriately covered in flood control planning.

66. **The flow of the Amargosa River in Beatty is very low. Should this be mentioned in the Plan?**




67. As shown in the hydrograph at left, flow in the Amargosa River has not shown any, significant decline over time.

68. **Can the plan emphasize local citizen's opinion that monitor wells down-gradient of the NTS are not in the proper locations?** This opinion has repeatedly been brought to the attention of the Department of Energy through Citizens Advisory Boards and both formal and informal discussion. The plan already emphasizes that there is insufficient information to support a claim that no contaminated groundwater has migrated from the testing areas and states that this lack of information is due to the failure of the Department to install monitoring wells in the proper locations.

69. **Commercial development at the Beatty airport is expected by 2050.** That is a planning assumption and hopefully, this assumption will be met long before 2050.