Economic Development Potential in Spring, Cave, Dry Lake, and Delamar Valleys, Nevada

PRESENTATION TO THE OFFICE OF THE NEVADA STATE ENGINEER

Prepared by

SOUTHERN NEVADA
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Submitted to:
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Pertaining to:
Groundwater Applications 54003 through 54021 in
Spring Valley
and
Groundwater Applications 53987 through 53992 in
Cave, Dry Lake, and Delamar Valleys

June 2011

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ACRONYMS

BLM	Bureau of Land Management
CVR	Cave Valley Ranch, LLC
DETR	Nevada Department of Employment, Training and Rehabilitation
GBNP	Great Basin National Park
GIS	geographic information system
HB	hydrographic basin
I-15	Interstate 15
I-80	Interstate 80
NDOW	Nevada Department of Wildlife
NDWR	Nevada Division of Water Resources
NPS	National Park Service
NSE	Nevada State Engineer
RMP	Resource Management Plan
SNWA	Southern Nevada Water Authority
USDA	U.S. Department of Agriculture
US 50	U.S. Highway 50
US 93	U.S. Highway 93
WPCLUP	White Pine County Land Use Plan
WPCWRP	White Pine County Water Resource Plan

ABBREVIATIONS

afa	acre-foot annually
GWh	gigawatt hour
kV	kilovolt
mi	mile
mi^2	square mile
MW	megawatt
yr	year

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EXECUTIVE SUMMARY

The following report was prepared in support of water-right hearings related to Southern Nevada Water Authority (SNWA) Applications 54003 through 54021 in Spring Valley and groundwater Applications 53987 through 53992 in Cave, Dry Lake, and Delamar Valleys. The report is intended to assist the Nevada State Engineer as he considers whether the proposed action is an appropriate long-term use which will not unduly limit future growth and development in the basins from which the water is exported (Nevada Revised Statutes 533.370).

The report details the factors which define the potential for rural economic development and how they pertain to Spring, Cave, Dry Lake, and Delamar Valleys' hydrographic basins (Basins or Basins of Origin). The analysis of economic development factors for the Basins concludes that development requiring significant water resources is highly unlikely to occur in the Basins in the foreseeable future and, therefore, the use of water as described in the SNWA Applications is an appropriate long-term use that will not unduly limit future growth and development in the Basins.

Factors that typically support economic growth include proximity to large, established metropolitan centers, a sufficient population size and skilled labor force, a diversity of employment opportunities, location along a major transportation corridor, substantial transportation infrastructure, and high-capacity public utilities and public services.

These factors are remarkably absent in the Basins of Origin and will likely remain so into the future.

Geographically, the Basins are exceptionally remote and isolated (see Figure ES-1). There are no towns or cities in any of the four Basins. The largest city near any Basin is the city of Ely (pop. 4,291) in White Pine County. It is located 35 mi west of Spring Valley, in a separate hydrographic basin. From Ely, one would have to drive more than 200 mi in any direction in order to reach a metropolitan area with a city having a population greater than 50,000 residents. Moreover, there is no passenger rail, bus or commercial air service to the Basins and the nearest Interstate Highways, I-15 and I-80, are more than 100 mi away. The lack of proximity to a major transportation corridor creates an economic disincentive for businesses requiring easy access to markets and supplies with minimal transportation related expense.

Population densities for White Pine and Lincoln counties are some of the lowest in the United States at one person per square mile, or less. The four Basins are even more remote and uninhabited, with a combined estimated population of 82 persons (see Section 2.2.1) on approximately 3,750 mi^2 of land. Additionally, national migration trends over the last century have had little influence on the area. According to the U.S. Census Bureau (2002), over 59 million Americans have migrated to the western United States over the last 100 years, yet White Pine County's population is nearly the same today as it was in 1910. Furthermore, Americans are moving away from rural areas to more urban environments and this trend is expected to continue.

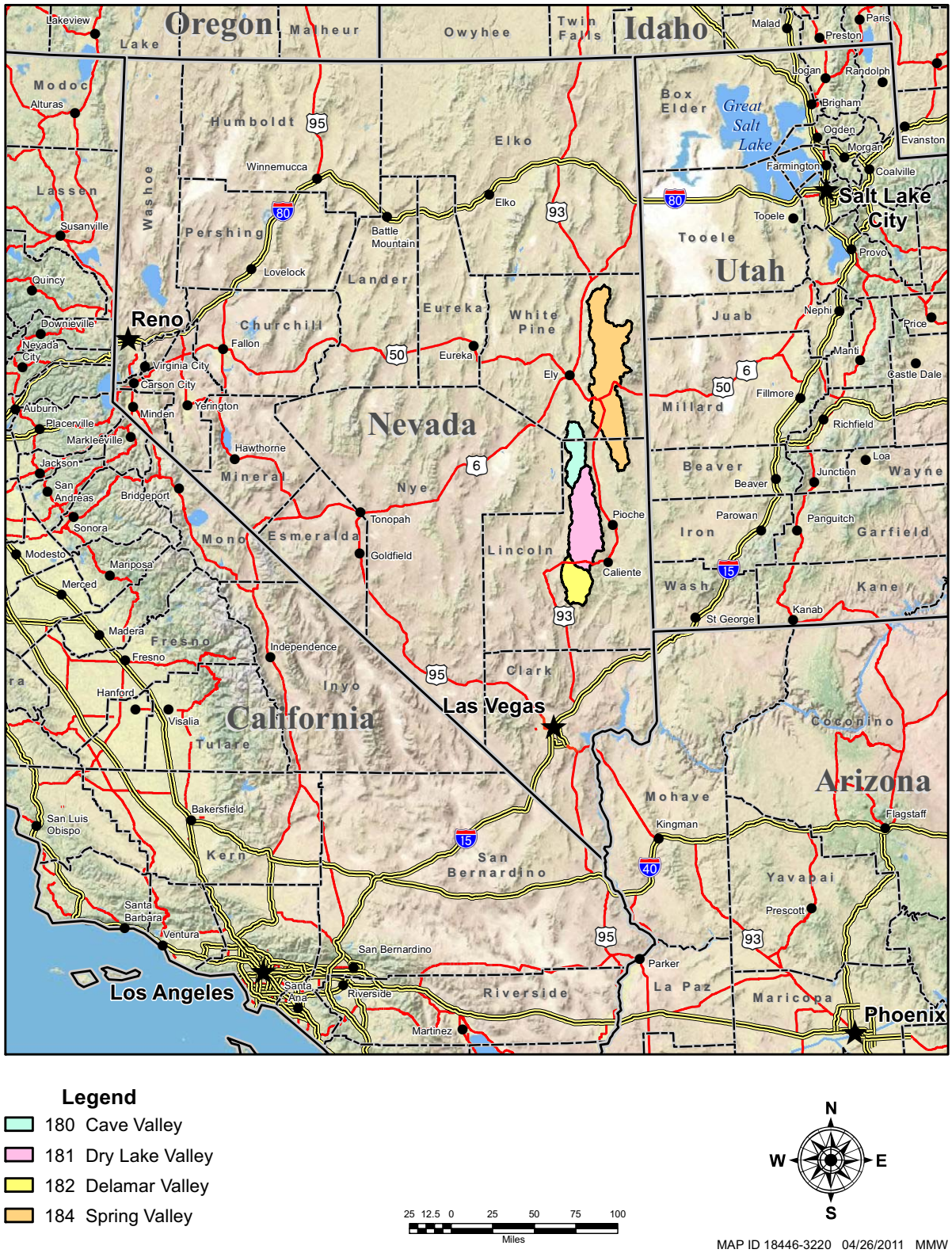

Figure ES-1
Location of the Basins of Origin

Within the Basins there are few, if any, paved roads, and limited access to electricity. There are no public water supplies, wastewater treatment facilities, or natural gas utilities in the Basins. Healthcare, emergency medical services and public safety services, including police and fire, are limited and generally great distances away due to local governments having to serve large expanses of territory with few resources.

Employment in White Pine and Lincoln Counties is primarily located near the counties' population centers (i.e., cities and towns) with the majority working for local government or in the mining industry. In Cave, Dry Lake, and Delamar Valleys, there is little or no permanent employment. Agricultural jobs exist in Spring Valley but the number of full-time workers is estimated to be fewer than 35 (see Section 2.3.1).

Given the century-long demographic trends and the intrinsic constraints of growth imposed by an enduring frontier setting and the great distance to any established major metropolitan area, the future growth potential of White Pine County, and most of Lincoln County, is severely limited. With regard to the four Basins of Origin, the above stated circumstances are even more pronounced, and there is greater certainty that any economic development requiring significant water resources is highly unlikely to occur in the foreseeable future.

The conclusion of this report is that the use of water as proposed in the SNWA Applications is an appropriate long-term use that will not unduly limit the future growth and development in the Basins from which the water is exported.

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1.0 INTRODUCTION

1.1 Purpose and Scope

This report provides an assessment of historic, current and future population and employment trends in the Spring, Cave, Dry Lake, and Delamar Valleys. Current and historic growth and development are analyzed to identify reasonable growth and development that is likely to occur in the Basins in the foreseeable future. Water requirements for future growth and development are estimated and potential sources of water to meet those requirements are identified.

To assess the potential for future growth and economic development in the Basins:

- The geographical and physical characteristics of the Basins are evaluated;
- Factors that foster rural economic growth are identified;
- Historical and current data and trends related to the factors are reviewed; and
- Historical and current land use and economic data are analyzed.

While the Basins are the primary focus of this report, historic, current and future population and economic activity within White Pine and Lincoln Counties are also examined to provide appropriate context for examining growth and development in the general areas adjacent to the Basins.

1.2 Sources

This report utilizes pertinent data and general information from several federal, state and local government agencies:

References from federal agencies include the U.S. Census Bureau, the National Park Service (NPS), the U.S. Department of the Interior - Bureau of Land Management (BLM), the U.S. Department of Agriculture (USDA), including USDA's Economic Research Service and Rural Assistance Center.

References from State agencies include the Nevada State Demographer's Office, the Nevada Department of Employment, Training and Rehabilitation (DETR), the Nevada Division of Water Resources (NDWR), Nevada Division of Minerals, the Nevada Department of Wildlife (NDOW) and the Nevada Department of Transportation.

Regional information and data are taken directly from current, locally prepared and adopted documents, including the 2008 White Pine County Land Use Plan (WPCLUP) and the 2007 Lincoln County Master Plan.

Land use data (including land acreages) for White Pine and Lincoln Counties and the Basins of Origin were obtained from the SNWA's Geographic Information Systems (GIS) parcel data, the County Assessors' parcel records for Spring, Cave, Dry Lake, and Delamar Valleys, the BLM GIS data for land ownership for Nevada, the BLM Surface Management Status Topographic Maps, the Hydrographic Area Boundary GIS Layer for the Basins, the United States state boundaries layer, and the Nevada county boundaries GIS layer.

Population estimates and projections for the state of Nevada and its counties, cities and towns were taken from the Nevada State Demographer's Office. Labor Force and employment information was obtained from DETR. Information to estimate populations for the Spring, Cave, Dry Lake, and Delamar Valleys' hydrographic basins were taken from decadal census estimates (U.S. Census) and geospatial boundary datasets for the years 1860-2000.

Mining information was taken from the Nevada Division of Minerals (Major Mines of Nevada, 2009), and from open source price data for metallic commodities.

Great Basin National Park (GBNP) information, visitation statistics and the forecast report were obtained from the NPS Public Use Statistics Office.

Hunting and Fishing permit information was obtained from the NDOW.

Sources for energy and agriculture potential in the Basins include those used in the separately submitted analyses on agriculture and solar energy growth potential (Linvill and Candelaria, 2011; Peseau and Carter, 2011).

2.0 KEY FACTORS THAT LIMIT ECONOMIC GROWTH POTENTIAL AND THEIR PRESENCE IN THE BASINS OF ORIGIN

Planning for the future growth and development of a city, town, or region relies, in part, on the field of urban geography – the study of people and their activities over geographic space, specifically within and among cities and their surrounding regions (Urban Geography; Kaplan, Wheeler, and Holloway, 2009). The educational requirements for urban and regional planners typically include a university-level course in urban geography, which focuses on he content of geographic areas, their interactions and relationships with other areas, and on the behavior and processes operating in society, such as those generating employment, unemployment, and technological change (University of Utah, 2007). Urban and regional planners also receive training and routinely deal with other factors related to growth and development such as transportation, water and wastewater treatment, and other community services and facilities.

Academic studies related to growth and development are often applied in more practical terms by agencies such as the USDA in their work to enhance rural prosperity. For example, the 1997 report by the USDA Economic Research Service titled, "Rural Economic Development; What Makes Rural Communities Grow?" identifies certain factors that lend economic growth potential to a region. Some of the most fundamental factors include close proximity to large, established metropolitan centers and markets, a sufficient population size and skilled labor force, a diversity of employment opportunities, location along a major transportation corridor, substantial infrastructure, including electricity, roads, and access to modern communications, and the availability of basic public utilities and services.

All of the above listed factors that are fundamental and typical for economic development to occur are absent within the Basins of Origin.

2.1 Isolation and Proximity to Urban Economies

Close physical proximity to established metropolitan centers and markets facilitates growth and economic development in outlying less-developed areas. But, if rural communities are too distant from these markets, their isolation alone can prohibit them from benefiting from the trade and commerce "spillover" that those larger economies create. White Pine and Lincoln Counties are some of the most remote and isolated counties in the entire United States, and the Basins of Origin, which are located in these counties, are even more isolated in nature (see Figure 2-1). This geographic circumstance puts the Basins at a severe economic disadvantage in competing for future growth.

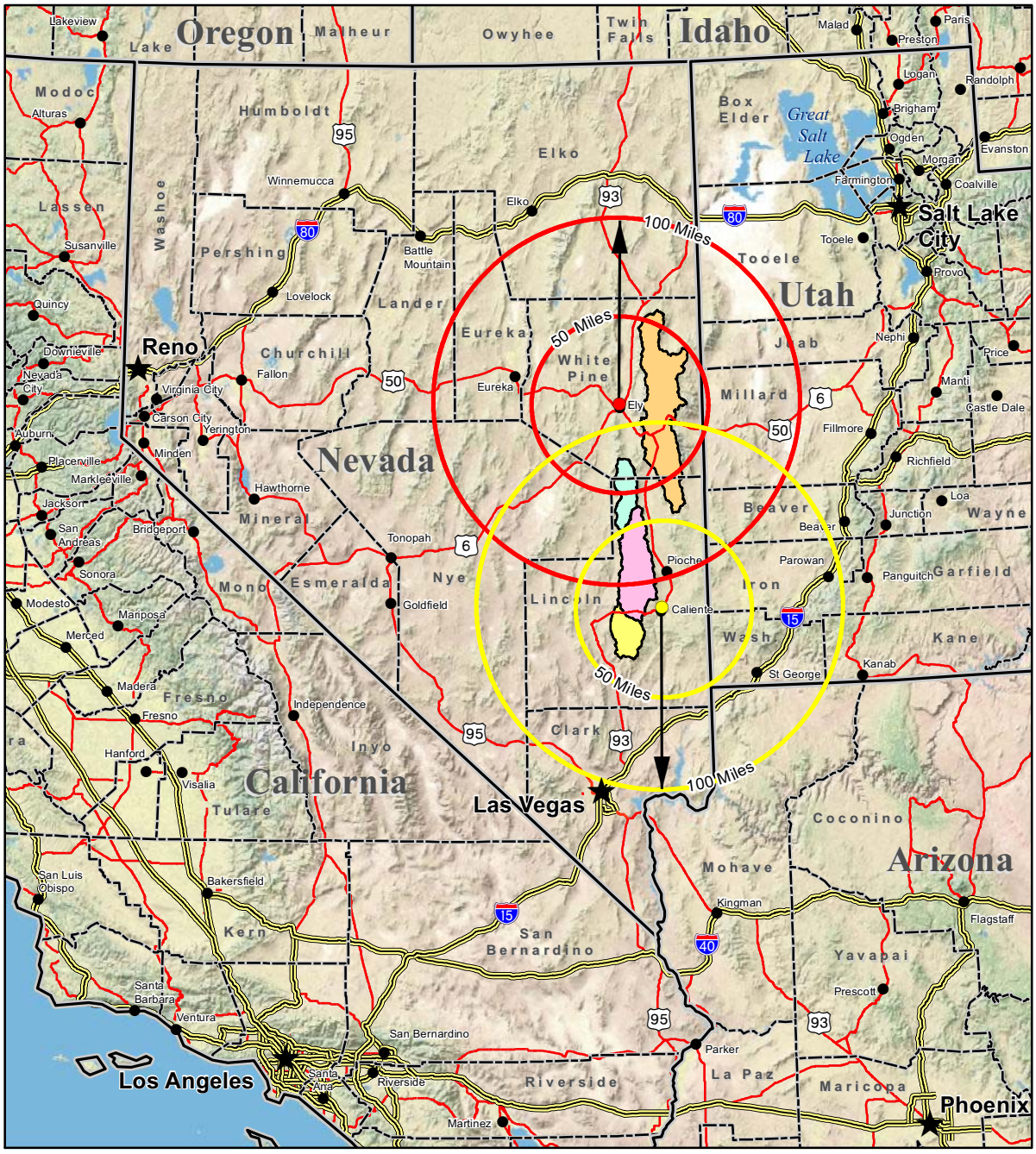


Figure 2-1
Proximity to Major Metropolitan Centers

2.1.1 White Pine and Lincoln Counties

White Pine County is located in the central-eastern portion of Nevada and is bordered by the state of Utah to the east. White Pine County is the fifth largest county, by area, in Nevada and covers approximately 8,900 mi^2 and accounts for nearly 8.1 percent of Nevada's total surface area of 110,500 mi^2. The county's population is 9,570 with the largest developed area being the city of Ely with a population of 4,291. Ely is located in Steptoe Valley about 30 mi west of northern-most Basin of Origin, Spring Valley.

Ely is an isolated town. From Ely, the region's largest cities are extremely distant. Ely is 250 mi from Las Vegas, Nevada; 235 mi from Salt Lake City, Utah; and 325 mi from Reno, Nevada. But Ely is also far from even a "Metro" area having a population over 50,000. Metro and Micro areas are geographic entities defined by the U.S. Office of Management and Budget for use by federal statistical agencies in collecting, tabulating and publishing federal statistics (U.S. Census Bureau, 2011). A Metro area contains a core urban area population of 50,000 or more. A Micro area contains a core urban area population of at least 10,000 residents (but less than 50,000). The closest Metro area to Ely is the city of St. George, Utah, more than 200 mi to the southeast. The closest Micro area is Elko, Nevada, approximately 150 mi to the north.

Lincoln County is located in the southeastern portion of Nevada and borders both the state of Utah and the state of Arizona on its eastern border. Lincoln County is the third largest county of Nevada's seventeen counties, covering approximately 10,650 mi^2 and accounting for nearly 9.6 percent of Nevada's total surface area. The county's population is 4,317 and the largest developed area is the town of Caliente with a population of 1,106, located in Panaca Valley. Caliente is approximately 150 mi from Las Vegas, Nevada and 345 mi from Salt Lake City, Utah. The closet Metro area with 50,000 persons or more is St. George, Utah, located off Interstate Highway 15 (I-15) approximately a 110 mi drive to the southeast.

In summary, White Pine and Lincoln Counties are extremely remote places in that they have few towns and are located a great distance from any major urban area. The Basins of Origins are even more remote and isolated in this way. They have no cities or towns, have very few permanent residents, and are located even further away from established urban centers.

2.1.2 Spring Valley Hydrographic Basin

The Spring Valley Hydrographic Basin is primarily located in White Pine County with approximately 90 percent of the basin, or 962,438 acres, in White Pine County and 10 percent, or 103,584 acres of the Basin in Lincoln County. Spring Valley has a total surface area of approximately 1,066,022 acres, accounting for 17 percent of the total surface area of White Pine County and 1.5 percent of the total surface area of Lincoln County.

Spring Valley has an estimated population of less than 100 persons (see Section 2.2.1). Within Spring Valley there are no cities or towns. The nearest major metropolitan areas are Las Vegas, Nevada and Salt Lake City, Utah, each, more than 200 mi away. The closest large community to Spring Valley is the city of Ely, 35 mi to the west. To the east of Spring Valley is the town of Baker, 25 mi from the valley. Baker has an estimated population of less than 160 persons, and is located in the separate hydrographic basin of Snake Valley.

2.1.3 Cave Valley Hydrographic Basin

The Cave Valley Hydrographic Basin is shared between White Pine and Lincoln Counties (see Section 2.2.1). Approximately 27 percent, or 62,892 acres, of the basin is located in White Pine County and 73 percent, or 166,753 acres, is located in Lincoln County. Cave Valley has a total surface area of approximately 229,646 acres, accounting for 1.1 percent of the total surface area of White Pine County and 2.5 percent of the total surface area of Lincoln County.

Cave Valley has an estimated population of less than five people (see Section 2.2.1). Within the Cave Valley Hydrographic Basin there are no cities, towns, or population clusters. There are no paved roads leading into, or within, the valley. The closest major community to the basin is the town of Lund (est. population of 158), approximately 25 mi drive northwest, in the adjacent hydrographic basin of White River Valley. Cave Valley is also extremely isolated from any major metropolitan area. The nearest Metro area with populations over 50,000 residents is St. George, Utah, over 130 mi away. Las Vegas, Nevada is nearly a 200 mi drive to the south.

2.1.4 Dry Lake Valley Hydrographic Basin

The Dry Lake Valley Hydrographic Basin is wholly located in Lincoln County. Its total surface area is approximately 573,400 acres, accounting for 8.4 percent of the total surface area of Lincoln County.

Dry Lake Valley has an estimated population of less than five people (see Section 2.2.1). Within the Dry Lake Valley there are no cities, towns or population clusters. There are no paved roads leading into, or within the valley other than U.S. Highway 93 (US 93), which crosses the extreme southern edge. The nearest Metro area with populations over 50,000 residents is St. George, Utah, 100 mi away. Las Vegas, Nevada is approximately a 150 mi drive to the south.

2.1.5 Delamar Valley Hydrographic Basin

The Delamar Valley Hydrographic Basin is wholly located in Lincoln County. Its total surface area is approximately 231,444 acres, accounting for 3.4 percent of the total surface area of Lincoln County.

Delamar Valley has an estimated population of less than five people (see Section 2.2.1). Within the Delamar Valley Hydrographic Basin there are no cities, towns, or population clusters. There are no paved roads leading into, or within, the valley other than US 93, which crosses the extreme northern edge. The closest communities are the town of Caliente, 23 mi drive to the northeast, and the town of Alamo, 26 mi drive to the west. The nearest Metro area with a population over 50,000 residents is St. George, Utah, approximately 100 mi away.

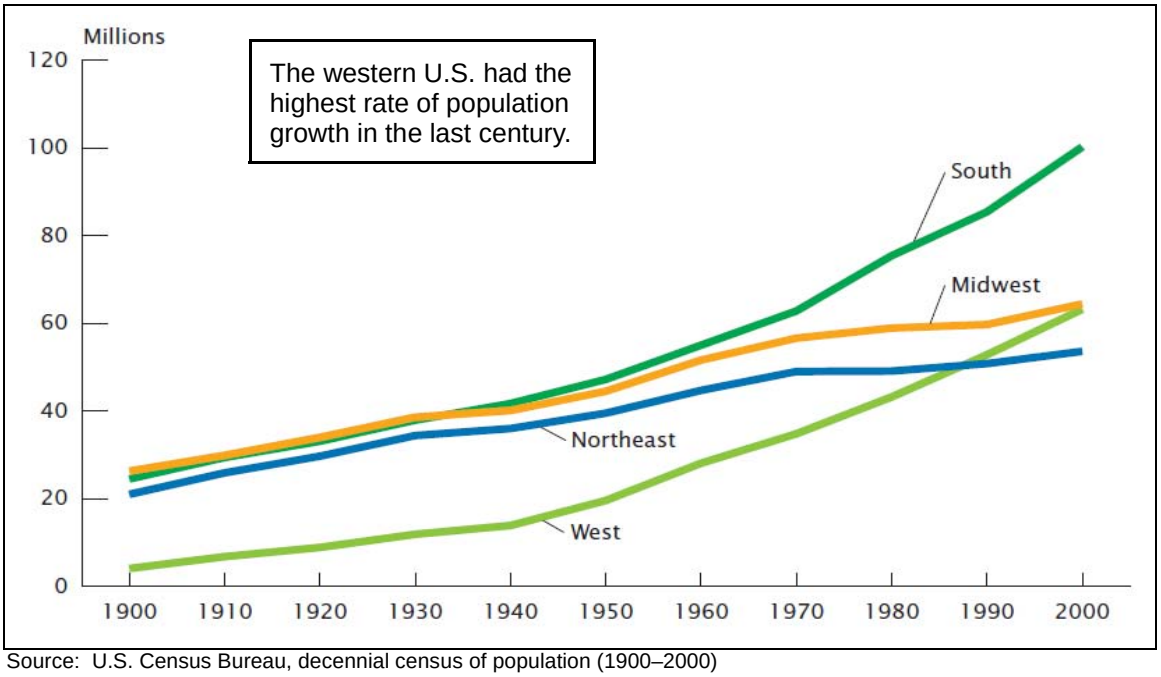
Because close proximity to established metropolitan centers is vital to economic development, White Pine and Lincoln Counties are at a great disadvantage for such development due to their extreme distance and subsequent isolation from any large urban center. The Basins of Origin, being even more remote and isolated face even greater challenges in this regard.

2.1.6 Demographic Shifts, Migration to West and Population Density

While millions of people over the last century moved west in search of economic opportunities, few people made White Pine or Lincoln Counties their permanent residence. Most migrants eventually settled in other, more advantageous regions to make their home and seek economic prosperity.

According to the U.S. Census Bureau (2002), as the United States entered the 20th century, most of the population lived in the Northeast or Midwest, in nonmetropolitan areas, was male, under 23 years old, White, and rented a home. Nearly half of the population lived in a household with five or more other people. One hundred years later, as the United States entered the 21st century, most of the population lived in the South or the West in metropolitan areas, was female, at least 35 years old, White (but much less so), owned a home, and lived alone or in a household with one, or two other people. According to the U.S. Census Bureau there have been many demographic changes in the United States, but perhaps the most significant is the population explosion and migration towards the western region of the country over the last century.

As shown in Figure 2-2, from 1900 to 2000, the population more than doubled in the Northeast (21 million to 54 million) and in the Midwest (26 million to 64 million). The South's population during this same period quadrupled from 25 million to 100 million, while the West's population was more the fifteen times larger in 2000, increasing from 4 million in 1900 to 63 million at the end of the century.

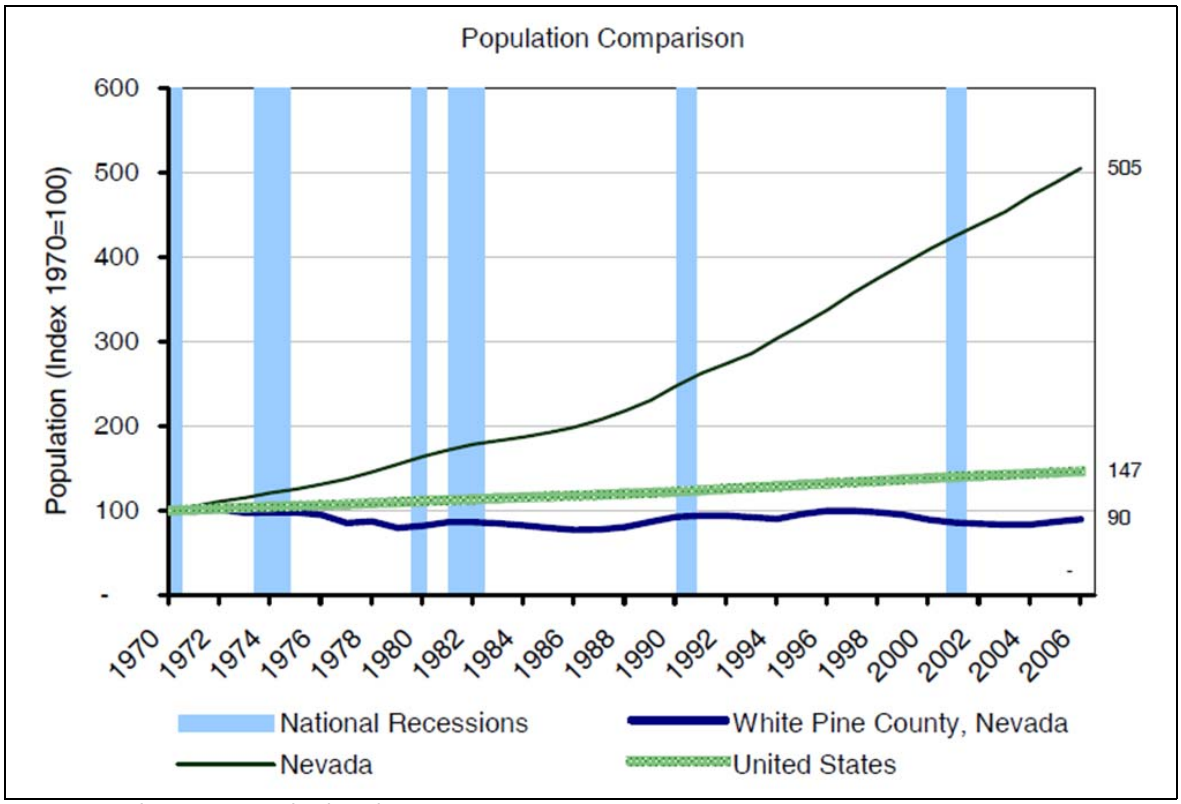


Source: U.S. Census Bureau, decennial census of population (1900–2000)

Figure 2-2
Total Population Growth by Region (1900-2000)

Yet, despite this massive population boom and migration West (59 million new residents) White Pine County's current population, at about 9,500 residents, is approximately where it was in 1910 (7,441 residents). Similarly, Lincoln County's population in 1910 of 3,489 people is only 861 less than its current population (U.S. Census Bureau, 1995).

Even considering a shorter and more recent time period (1970-2006, see Figure 2-3), White Pine and Lincoln Counties' percentage of population change was insignificant compared to the five-fold population increase of the state of Nevada over the same period (Headwaters Economics, 2009).

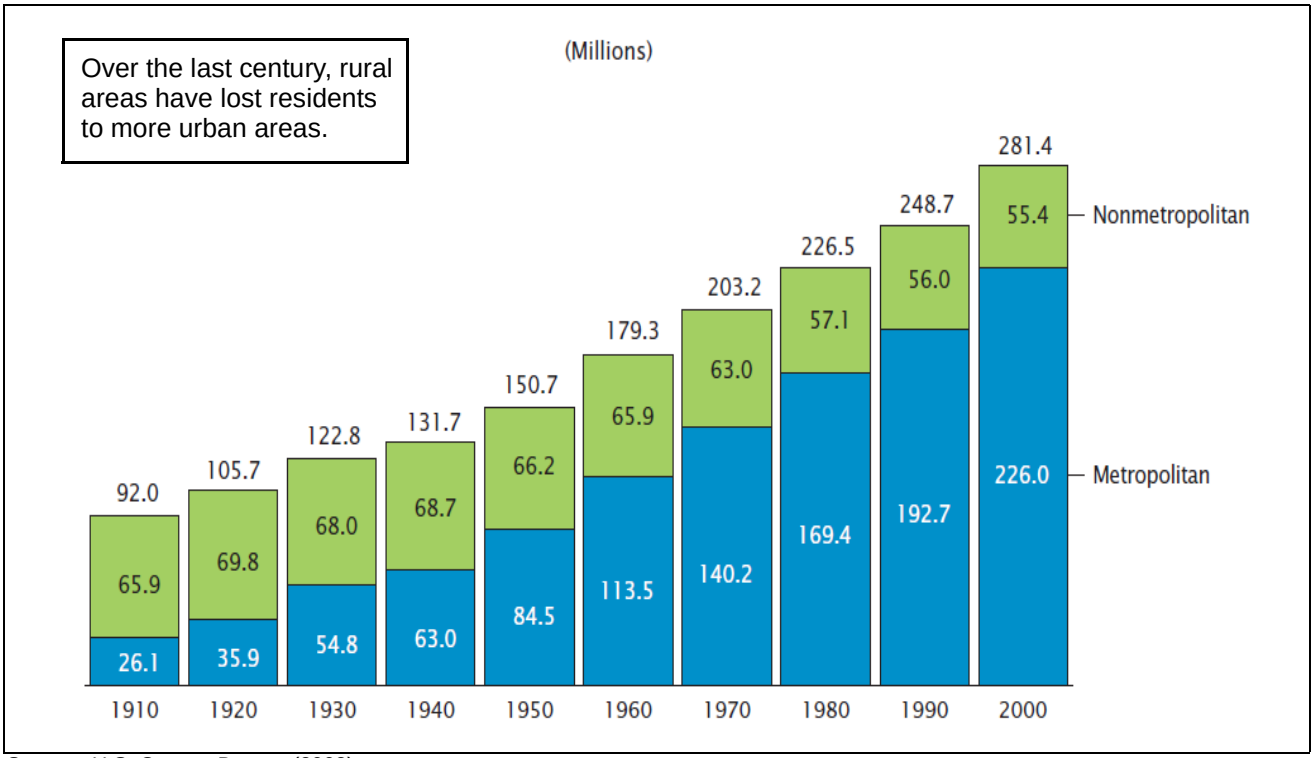


Source: Headwaters Economics (2009)

Figure 2-3
Population Growth Comparison United States, State of Nevada, White Pine County (1970-2006)

The U.S. Census Bureau (2002) also reports that Americans have not only migrated South and West, but also from rural to more metropolitan areas. Prior to World War II, the majority of Americans lived outside of metropolitan territory. By the year 2000, four out of every five people in the United States resided in a metropolitan area (see Figure 2-4).

The U.S Census Bureau (2002) defined metropolitan population concentrations for the first time in 1910. At that time, 26 million people lived in 19 metropolitan districts of 200,000 people or more and cities of 100,000-200,000 and their adjacent territory, leaving 65.9 million who lived in non-metropolitan territory. With each passing decade, the metropolitan population increased, while the nonmetropolitan population generally decreased.



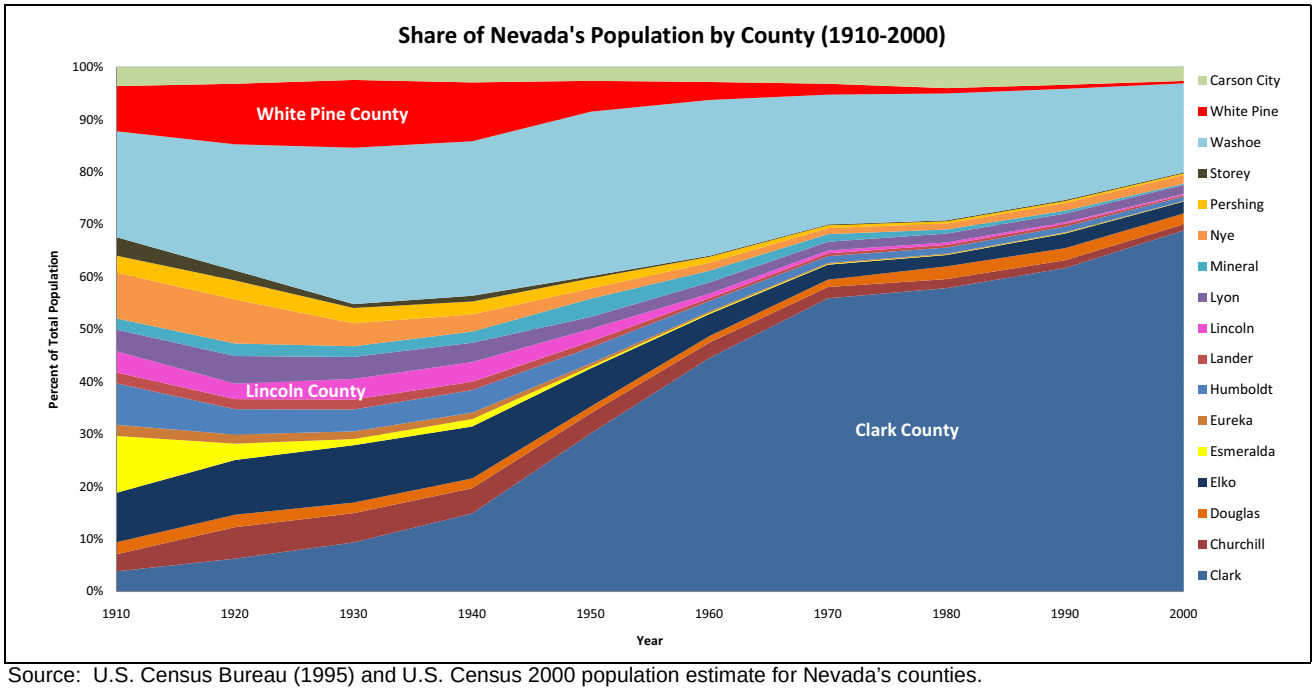
Source: U.S. Census Bureau (2002)

Figure 2-4
Total Population by Metropolitan Status (1910–2000)

This demographic change is also demonstrated by looking at the percentage share of Nevada's population by county over the years. Figure 2-5 below shows that in the early 1900s, White Pine and Lincoln Counties' combined population made up approximately 15 percent of the State's total population. Today, that combined share of the State's total population is less than 1 percent. Over the decades, each county's percentage share has steadily decreased while more urban areas, such as Clark and Washoe Counties, have experienced rapid population growth and now represent over 90 percent of the State's population.

Results from the recently released 2010 Census confirms this trend: Nevada was the fastest growing state for five straight decades, the only state to maintain a 25 percent population growth rate for the last three decades, and the fastest growing state in the most recent decade (2000-2010). But despite Nevada's explosive population growth, White Pine and Lincoln Counties' population experienced little growth and the Basins of Origin saw no recognizable population increase.

The trend of people moving from rural to urban areas has been continuous over the last century, which has also changed the population density of the West. From 1900 to 2000, United States population density increased twofold to a national average of 80 people/mi^2. Excluding Alaska, Nevada had the lowest population density of any state in every decade over the last one hundred years and continues to be sparsely populated outside of its major metropolitan centers which are located in Clark and Washoe Counties.



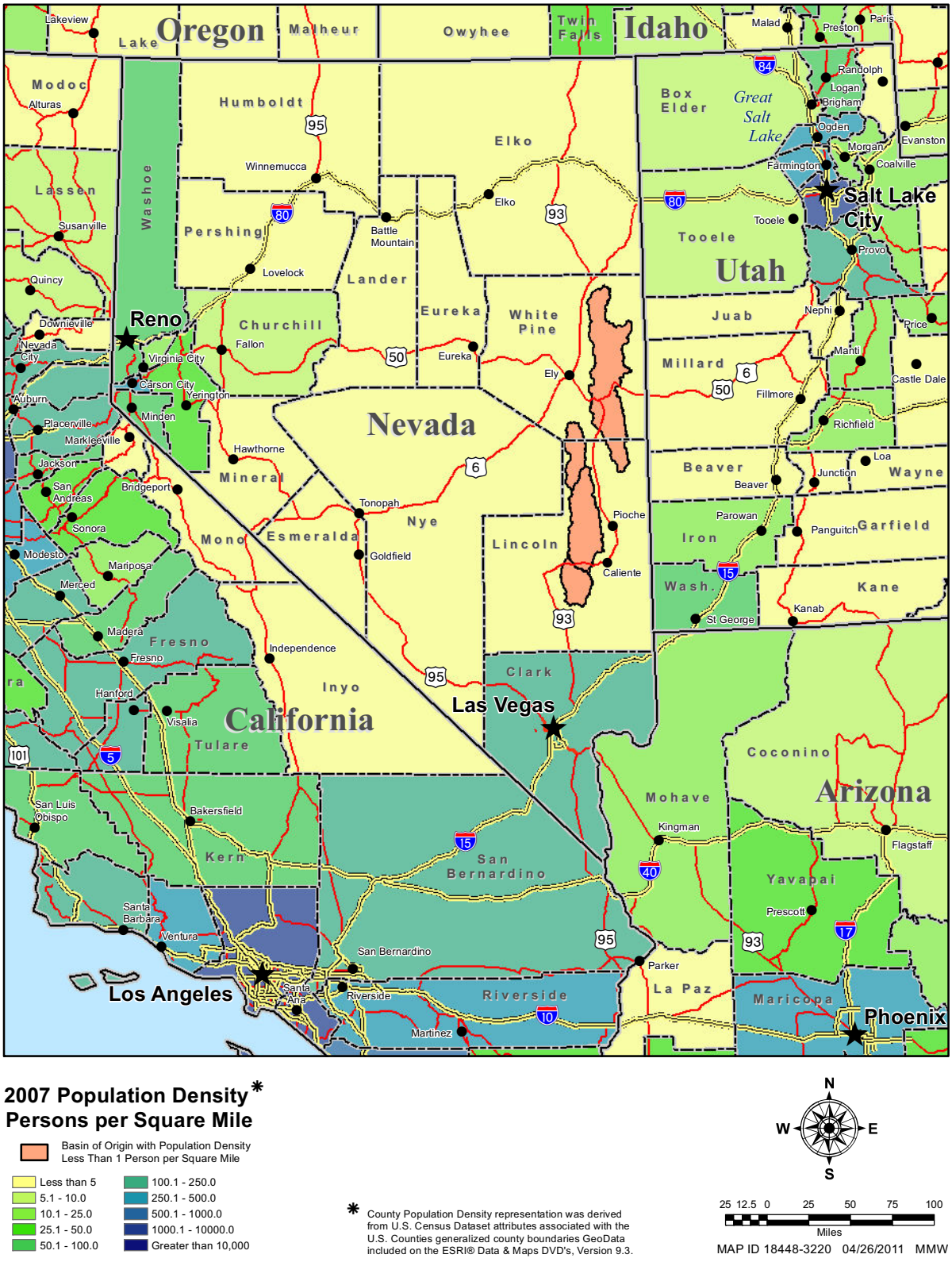
Source: U.S. Census Bureau (1995) and U.S. Census 2000 population estimate for Nevada's counties.

Figure 2-5
Comparison of Population Share by Nevada County (1910–2000)

White Pine and Lincoln remain two of the State's least inhabited counties. These counties and the four Basins can be characterized as "frontier communities," a term used by the USDA (2002).

The National Center for Frontier Communities have defined frontier communities as "sparsely populated rural areas that are isolated from population centers and services and typically have a population density of six or fewer people per square mile." An analysis of the 3,141 counties, parishes, boroughs, census-defined areas, and independent cities in the United States, shows only 440 meet the frontier definition. Of those 440 frontier areas, only 40 have fewer people per square mile than White Pine County (1 person/mi^2), and only 12 have a population density less than Lincoln County (0.4 persons/mi^2) (NCFC, 2000). Moreover, population density of the Basins of Origin is approximately 0.2 persons/mi^2 (82 people/3,750 mi^2, see Section 2.2.1).

Figure 2-6 below shows the population density of Nevada in 2007, including White Pine County, Lincoln County, and the Basins of Origin.



2007 Population Density*
Persons per Square Mile

Basin of Origin with Population Density Less Than 1 Person per Square Mile

- Less than 5
- 5.1 - 10.0
- 10.1 - 25.0
- 25.1 - 50.0
- 50.1 - 100.0
- 100.1 - 250.0
- 250.1 - 500.0
- 500.1 - 1000.0
- 1000.1 - 10000.0
- Greater than 10,000

* County Population Density representation was derived from U.S. Census Dataset attributes associated with the U.S. Counties generalized county boundaries GeoData included on the ESRI® Data & Maps DVD's, Version 9.3.

N W E S

25 12.5 0 25 50 75 100
Miles

MAP ID 18448-3220 04/26/2011 MMW

Figure 2-6
Population Density (2007)

2.2 Population Estimates and Trends

2.2.1 Current Population

Current population estimates for the Basins of Origin were derived from U.S. Census Block data for the year 2000 and recent county parcel information (see Table 2-1). The estimated current population of Cave, Dry Lake, and Delamar Valleys is between zero and three persons in each Basin. Spring Valley, the largest of the four Basins of Origin, has an estimated current population of 77 people.

Table 2-1
Population Estimate for the Basins of Origin (2000)

Basin	Population
Spring Valley HB	77
Cave Valley HB	2
Dry Lake Valley HB	3
Delamar Valley HB	0

Source: U.S. Census Bureau, National Historic Geographic Information System (2000)

2.2.2 Historical Population

When forecasting potential growth, including population growth, it can be useful to consider the historical record for signs that identify a clear growth trend or, conversely, evidence that a set of values fluctuate within a defined range, but without a growth trend.

Figures 2-7 and 2-8 below show the historical populations of White Pine and Lincoln Counties from 1950-2009 (Nevada State Library and Archives). As noted earlier, these counties encompass the Basins of Origin. Population estimates were obtained from the Nevada State Demographer's Office, a non-partisan agency which is funded by the Nevada Department of Taxation and is part of the Nevada Small Business Development Center. Data was available beginning in 1950.

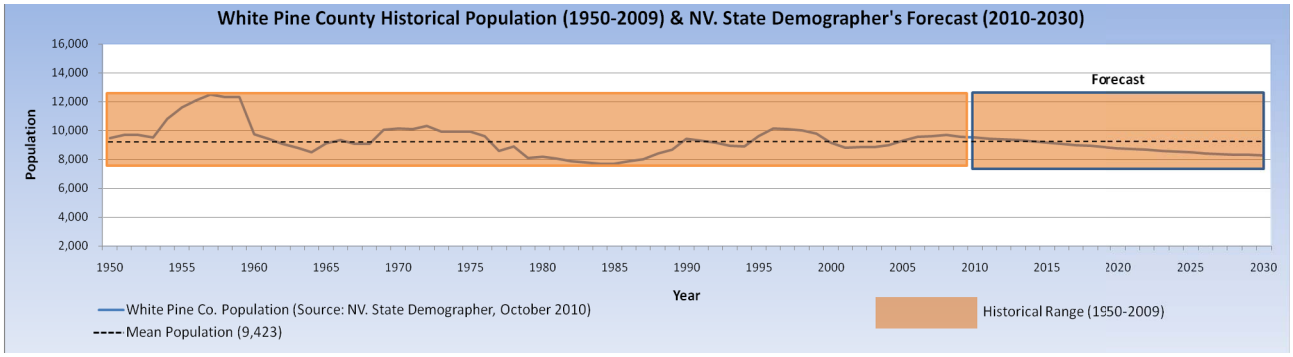


Figure 2-7
Historical Population Growth and Forecast for White Pine County, Nevada

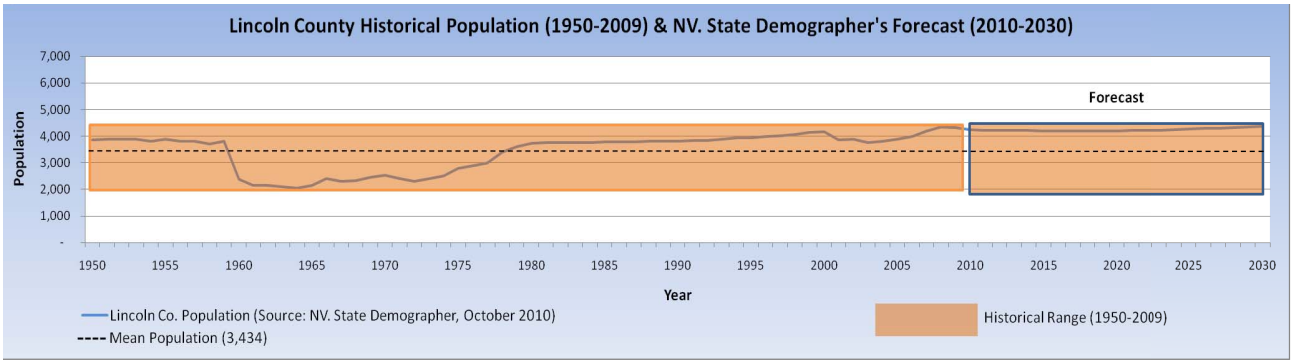


Figure 2-8
Historical Population Growth and Forecast for Lincoln County, Nevada

During this 60-year time period, both White Pine and Lincoln County's population did not experience steady growth or steady decline. Instead, their populations fluctuated within a defined range.

From 1950-2009, White Pine County's population ranged from a low of 7,710 (1984) to a high of 12,500 residents (1957) and had a mean (average) population of 9,423.

From 1950-2009, Lincoln County's population ranged from a low of 2,038 (1964) to a high of 4,352 residents (2008) and had a mean (average) population of 3,434.

The reason for the instability in population size is likely due to the cyclical nature of the mining industry, which tends to hire large numbers of workers when mines are active but also dismisses large numbers of workers when that activity is halted. White Pine and Lincoln Counties heavily reliance on the mining industry for employment puts them at great risk when a mine closes, as there is little else to fill the void. Thus, the resulting swings in the size of the local population.

But, despite the erratic nature of employment, White Pine County's population tends toward the historic average population. Figure 2-7 displays the historical and average population of White Pine County over the last 60 years. The Nevada State Demographer's 2009 population estimate of 9,570 residents is only 137 people more than the county's average population since 1950. In other words, the population of the county in 2009 is a near match of the average population over the last six decades. This fact demonstrates the limited movement of the population size and lack of long-term population growth.

Lincoln County, with a mean population of 3,434 over the last 60 years has also shown little signs of growth during this period. While the county's population has varied from its mean population over time, including a dramatic decrease in population in 1964 (Mean -40%), it too has stayed relatively close to its historic average (Figure 2-8).

Population projections are examined in the next section of this report, but Figures 2-7 and 2-8 also display the Nevada State Demographer's 2010-2030 forecasts for White Pine and Lincoln Counties.

Over the next twenty years, White Pine County is expected to see a decrease in population and continue to stay within its historical range. Lincoln County's population is expected to increase

slightly over the next twenty years, reaching 4,384 residents by 2030. However, this is only an increase of 32 people over Lincoln County's 2008 population.

This examination of the historical population size of White Pine and Lincoln Counties shows that both counties have experienced little growth over the last half-century. While there have been several periods of growth and decline, there is no evidence of any population growth trend. In fact, based on the historical data, both county's populations have stayed within a fairly narrow range over the last six decades, which suggests little potential for growth in the future without a new and significant outside influence.

Looking into the foreseeable future, the Nevada State Demographer is forecasting that over the next twenty years, both White Pine and Lincoln County's populations will essentially remain within their historic ranges, which again suggests a continuance of the stagnant nature of the populations.

2.2.3 Population Projections to 2030

The population projections that follow for White Pine and Lincoln Counties were produced by the Nevada State Demographer using the Regional Economics Model, Inc. (REMI) model. The REMI model has a 30-year history of development and economic theory and is used by a variety of public and private sector users across the country as a tool for conducting projections as well as looking at the economic impacts of specific projects. The REMI model allows the user to look at how regional economies interact with each other and with the nation as a whole. The current model was created with federal data beginning in 2001 using the North American Industrial Classification System (NAICS), which was implemented at that time. The data is through 2007 and the years from 2008 forward are modeled.

As demonstrated on Table 2-2, the Nevada State Demographer is projecting a decline in population for White Pine County over the next 20 years, from 9,495 residents in 2010 to 8,259 residents (-10.20%) by 2030. Lincoln County is projected to stay relatively unchanged moving from 4,238 to 4,384 (3.1%) by 2030.

Table 2-2
White Pine and Lincoln County Population Projection (2010–2030)

	2010	2016	2023	2030
White Pine County	9,495	9,081	8,599	8,259
Lincoln County	4,238	4,199	4,231	4,384

Source: Nevada State Demographer (2010)

While the Nevada State Demographer provides official forecasts for Nevada's counties, it is difficult to predict population change in the Basins of Origin due to their unique hydrographic boundaries and the extremely small size of their current and historical populations. Given these constraints, U.S. Census Enumeration District and Block data (U.S. Census, NHGIS, 2010) (which was available for the decadal periods of 1900, 1930, and 2000) provide some reference points which show the historical nature of Spring Valley's very small population.

According to the U.S. Census, 217 people lived in Spring Valley in 1900, 325 people in 1930, and 77 people in the year 2000. No detailed U.S. Census population data is available for Cave, Dry Lake, or Delamar Valleys prior to the year 2000, but it is estimated that less than five people live in these basins combined based on 2000 U.S. Census data.

Currently, Cave, Dry Lake, and Delamar Valleys are virtually uninhabited. And, considering the population forecasts for White Pine and Lincoln Counties, these three hydrographic areas will likely remain essentially uninhabited in the future. Spring Valley, with its agricultural history, has always had people living and working on ranches in the valley. It is likely, however, that based on the population decline in the valley since 1930, and considering the projected decline in the White Pine County population, the future population of Spring Valley will not be significantly greater than the current population.

In conclusion, given that the Nevada State Demographer forecasts negative population growth in White Pine and little growth in Lincoln County over the next 20 years, it is reasonable to expect that in more remote and isolated areas such as the Basins of Origin, there will be no significant population growth in the foreseeable future.

2.3 Narrow Employment Opportunities with Proximity to Towns

Economies grow in part due to the availability and creation of employment opportunities which are created from new business enterprises. As more people find work and receive wages, more of those wages are spent on goods and services in the immediate area, and the local economy grows. But, potential businesses looking to establish themselves in a community or to expand existing operations generally require an ample work force pool from which to choose, often including people with special skills needed to do the job. This labor requirement which facilitates economic growth is extremely limited in the Basins of Origin.

2.3.1 Estimated Labor Force of the Basins of Origin

Employment opportunities in the Basins of Origin are virtually nonexistent. Due to the extremely small population of the Basins, estimating the labor force is impossible to determine with certainty. However, based on the known ranching operations in Spring Valley and the small number of commercial businesses in the Valley (including Majors Crossing and Horns-A-Plenty), it is estimated there are between 20 and 35 full time workers in Spring Valley. However, more than 50 percent of the private land and most of the larger ranching/farming operations in the basin are owned by the SNWA. The SNWA currently employs between 12-25 people including seasonal and contract workers. The largest non SNWA-owned ranch is the Cleveland Ranch, owned and operated by the Church of Jesus Christ of Latter-day Saints.

Cave, Dry Lake, and Delamar Valleys likely have fewer than 10 full time workers combined, with the majority of these workers located at the Tenacity Perlite Mine on the southwestern edge of Delamar Valley.

Most of the jobs available in the region are located near White Pine and Lincoln Counties' population centers, Ely, Caliente, Alamo and Panaca. The information below is provided as further context to understanding the economic isolation of the Basins of Origin.

2.3.2 Labor Force of White Pine and Lincoln Counties

The Department of Employment, Training and Rehabilitation provides economic data, including labor force estimates, for Nevada counties, cities and towns. DETR compiles the data quarterly employment and wage reports submitted by employers according to the law. According to DETR (2009), White Pine County had 287 "worksites" which employed 3,867 people in 2009. And, Lincoln County had 140 "worksites" which employed 1,181 people.

Table 2-3 shows that White Pine and Lincoln Counties' labor force is concentrated in a small number of industries, mainly government and natural resources. In 2009, almost 38 percent of the workforce was employed by local, state or federal government. The natural resources category, which includes the mining industry, was the second largest employer in the counties, making up 20 percent of the labor force.

Table 2-3
Employment by Industry in White Pine and Lincoln Counties (2009)

2009 Total Payrolls by Industry	White Pine County		Lincoln County	
	No. of Worksites	No. Employed	No. of Worksites	No. Employed
Natural Resources and Mining	13	800	14	37
Construction	33	98	12	15
Manufacturing	9	25	1	1
Trade, Transportation, and Utilities	61	528	28	228
Information	6	32	3	28
Financial Activities	21	93	10	51
Professional and Business Services	20	92	15	25
Education and Health Services	15	167	5	41
Leisure and Hospitality	40	494	16	106
Other Services	18	78	4	7
Government	51	1,460	32	643
Total All Industries	**287**	**3,867**	**140**	**1,181**

Source: DETR (2009)

Table 2-4 below lists the main employers in White Pine County and their location within the county. Of the top 15 employers, nine are public institutions. These include the White Pine County School District, the BLM, the NPS, and the city of Ely. The largest current single employer is the Robinson Mining Company, which currently employs approximately 550 workers at its copper and nickel mine located in Ruth. The second largest employer is the prison, which employs approximately 410 workers.

Table 2-4
White Pine County's Largest Employers and Location in the County

White Pine County: Top 15 Employers (2009)					
No.	**Name**	**Size**	**City/ Town**	**Industry**	**Ownership**
1	Robinson Mining	500-599	Ruth	Copper Ore and Nickel Ore Mining	Private
2	Department of Corrections	300-399	Ely	Correctional Institution	State Government
3	White Pine County School District	200-299	Ely	Elem. & Secondary Schools	Local Government
4	Bald Mountain Mine	100-199	Ely	Gold Ore Mining	Private
5	White Pine County	100-199	Ely	Executive & Legislative Offices	Local Government
6	William Bee Ririe Hospital	100-199	Ely	General Medical Hospital	Local Government
7	Bureau of Land Management	90-99	Ely	Adm. of Conservation Programs	Federal Government
8	Department of Transportation	70-79	Ely	Trans. Program Administration	State Government
9	Great Basin College	60-69	Ely	Junior College	State Government
10	White Pine County Care Center	50-59	Ely	Nursing Care Facilities	Private
11	Ridleys Family Market	60-69	Ely	Supermarket	Private
12	National Park Service	40-49	Baker	Nature Parks	Federal Government
13	White Pine Boys Ranch	40-49	Lund	Mental & Substance Abuse Care	Private
14	Mt. Wheeler Power, Inc	30-39	Ely	Electric Power Distribution	Private
15	City of Ely	30-39	Ely	Executive & Legislative Offices	Local Government

Source: DETR (2009)

Again, all the largest companies listed are located in an established population center such as the city of Ely. None of these companies are located in the Basins of Origin. This is consistent with the notion that economic development, including job creation, generally occurs first near existing communities and not in outlying areas.

As in White Pine County, Lincoln County's largest employers (see Table 2-5) are government related and located in established population centers, such as the towns of Caliente, Pioche, and Alamo, and not in the Basins of Origin.

2.4 Limited Infrastructure and Proximity to Services

Infrastructure is the basic physical and organizational structures needed for the operation of a society or enterprise or the services and facilities necessary for an economy to function. The term typically refers to the technical structures that support a society, such as roads, water supply, sewers, electrical grids, telecommunications, and so forth. Viewed functionally, infrastructure facilitates the production of goods and services; for example, roads enable the transport of raw materials to a manufacturing site, and roads also provide for the distribution of finished products to markets. According to a USDA Economic Research Service Brief (USDA, 1997) infrastructure, including transportation, telecommunications, water and energy are fundamental to connecting rural America with the urban and global economies. The Basins of Origin have limited access to all of these basic infrastructure

Table 2-5
Lincoln County's Largest Employers and Location in the County

No.	Name	Size	City/Town	Industry	Ownership
1	Lincoln County	100-199	Pioche	Executive & Legislative Offices	Local Government
2	Lincoln County School District	100-199	Panaca	Elem. & Secondary Schools	Local Government
3	Child and Family Division	70-79	Caliente	Mental & Substance Abuse Care	Local Government
4	Grover Dils Medical Center	70-79	Caliente	General Medical Hospital	Local Government
5	Narcanon Southern California	30-39	Caliente	Mental & Substance Abuse Care	Private
6	Windmill Ridge LLC	20-29	Alamo	Full Service Restaurants	Private
7	Bureau of Land Management	20-29	Caliente	Adm. of Conservation Programs	Federal Government
8	"R" Place	20-29	Hiko	Gasoline Stations	Private
9	Town of Caliente	15	Caliente	Executive & Legislative Offices	Local Government
10	Lincoln County Telephone	15	Pioche	Wired Telecommunication	Private
11	McCrosky's "Y" Service	15	Panaca	Gasoline Stations	Private
12	Lincoln County Power District	15	Pioche	Electric Power Distribution	Local Government
13	Nevada Bank & Trust Co.	15	Caliente	Commercial Banking	Private
14	Department of Corrections	15	Pioche	Correctional Institution	Local Government
15	Panaca Market	15	Panaca	Supermarket	Private

Source: DETR (2009)

elements which make them less competitive in terms of economic development potential when compared to areas that have basic infrastructure that can support growth.

2.4.1 Limited Access to Electricity and Natural Gas

A prerequisite to rural development is access to electricity and other forms of energy, such as natural gas that is used to heat homes and to fuel businesses. The Basins of Origin are limited in this regard. Mt. Wheeler Power provides electricity to White Pine County and portions of the surrounding counties. However, in the Basins electric utility services are only available in part of Spring Valley. There are no electric or natural gas utility services in Cave, Dry Lake, or Delamar Valleys.

2.4.2 Limited Access to Public Water and Sewer Systems

According to the USDA (1997) rural water and sewer facilities generate private investment and public funds, and increase the property tax base. Without such infrastructure, it is difficult to attract new residents and new economic development. In the two closest communities to Spring Valley, the Ely Municipal Utilities System provides water and sewer services to residents of Ely and the immediate surrounding area, and the Baker General Improvement District provides water and sewer services to the residents of Baker. However, there is no public water or sewer infrastructure or service in the Basins of Origin. Outside of those willing and able to finance and operate their own water and sewer systems, this lack of basic infrastructure results in limited potential for economic growth in the Basins of Origin.

2.4.3 Limited Access to Communication Infrastructure

The USDA (1997) reports that in the last 20 years advanced telecommunications, including the Internet, have had an increased presence in rural areas, improving both the quality of life and the economy of its residents. Many rural areas envision high-speed broadband Internet services as a way to connect households, schools, hospitals, and other organizations as well as benefit rural business development. While White Pine and Lincoln Counties' populated areas in and adjacent to cities and towns have access to high-speed landline telephone and Internet service, access to landline services in Spring, Cave, Dry Lake, and Delamar Valleys is limited or nonexistent. Because of this shortcoming, the potential for growth in the Basins of Origin is diminished since they are less attractive to potential residents and businesses.

2.4.4 Limited Access to Police, Fire and Emergency Medical Service

In rural areas, healthcare, emergency medical services and public safety services, including police and fire, are limited and generally great distances away due to local government having to serve large expanses of territory with few resources. This is the condition for White Pine and Lincoln Counties, where public safety infrastructure is centrally located in towns. Any emergency taking place in the Basins of Origin which requires police, fire or emergency medical service will require a longer response time due to their isolation from the counties' population centers, a situation that is a constraint to future growth and development.

2.4.5 Limited Transportation Infrastructure and Proximity to Major Traffic Corridors

According to the USDA (1997) roads are probably the most fundamental form of infrastructure for any rural community, providing transportation to both communities and people, connecting businesses to suppliers and consumers, and connecting residents to critical public services, such as health, education, and emergency services. Shortcomings in a local or regional transportation network, including a lack of proximity to major transportation corridors, can limit the potential for economic development.

The Basins of Origin have a very limited road network. In Spring Valley, U.S. Highway 50 (US 50), known as the loneliest road in America due to its exceptionally low traffic volume, is the only paved east-west road that crosses the valley. U.S. Highway (US 93) runs south of US 50 toward Las Vegas. North of US 50, Nevada State Route 893 runs north along the western side of the basin. State Route 893 is paved for a portion of its length in Spring Valley and provides access to several ranches that run parallel to it. Cave, Dry Lake, and Delamar Valleys are devoid of any paved roads, except for US 93 which crosses both Dry Lake and Delamar Valleys from west to east.

Although United States highways exist in White Pine and Lincoln Counties, they have far less traffic than the transportation routes that connect the region's three metropolitan areas: Las Vegas, Salt Lake City, and Reno. The transportation routes that connect these three areas (I-15, I-80, and US 95) do not go through White Pine or Lincoln Counties and are remote from all of the Basins of Origin.

Interstate highways play an especially key role in economic development because they connect rural businesses to urban markets, rural residents to shopping and services, and urban tourists to rural destinations. The closest interstate highway to the Basins of Origin is I-15, which is the fourth-longest north–south interstate highway in the United States, traveling through the states of California, Nevada, Arizona, Utah, Idaho, and Montana. Since I-15's inception, it has served as a long-haul route for North American commerce. As a major trade route, I-15 connects to four transcontinental highways: I-10, I-40, I-80, and I-90. The I-15 corridor is a critical commerce corridor which plays a significant role in the movement of goods in the United States, commuters within or close to urban core areas, and recreational and seasonal travelers (NDOT, 2008).

All four of the Basins of Origin are located a great distance from I-15 (see Figure 2-9). It is over 100 mi from Cave, Dry Lake, and Delamar Valleys to Cedar City, located on I-15. Spring Valley is approximately 145 mi from the I-15 connection at Filmore, Utah. The great distances from a major transportation artery, such as I-15, reduces the economic development potential of the Basins of Origin because they do not, and likely will never, benefit from the large volume of cars and trucks that travel daily through the I-15 corridor and help support growth and development in the communities adjacent to it.

2.4.6 Limited Air, Rail and Bus Service

According the USDA (1997), interstate highways and airports can help attract tourists or residents to geographically isolated areas and both forms of infrastructure have been found to be statistically significant in terms of their effect on rural economic growth. While there is some limited air and bus service to some of the population centers within White Pine and Lincoln Counties, the is no such service to any of the Basins of Origin or within any of the Basins.

Ely Airport, also known as Yelland Field, is a county-owned public-use airport located 3 mi northeast of the central business district of Ely and 30 mi from Spring Valley, the closest of the Basins of Origin. It is served by one commercial airline, with service limited to one roundtrip flight per day from Las Vegas. The air service is currently subsidized by the federal government's Essential Air Service program (EAS) which aims to maintain a minimal level of scheduled air service to communities where air service otherwise would not be profitable. The public subsidy for Ely, Nevada, is reported to be the highest in the nation at $5,223 per airline passengers (Associated Press, 2011).

While federal subsidies help maintain some of the airlines serving rural areas, many residents, particularly those in sparsely populated areas such as the Basins, still lack local airline service and often must travel long distances to urban airports. For most residents in White Pine and Lincoln Counties, this would be either Las Vegas or Salt Lake City. There is no passenger rail (Amtrak) or bus service (Greyhound) in any of the Basins of Origin.

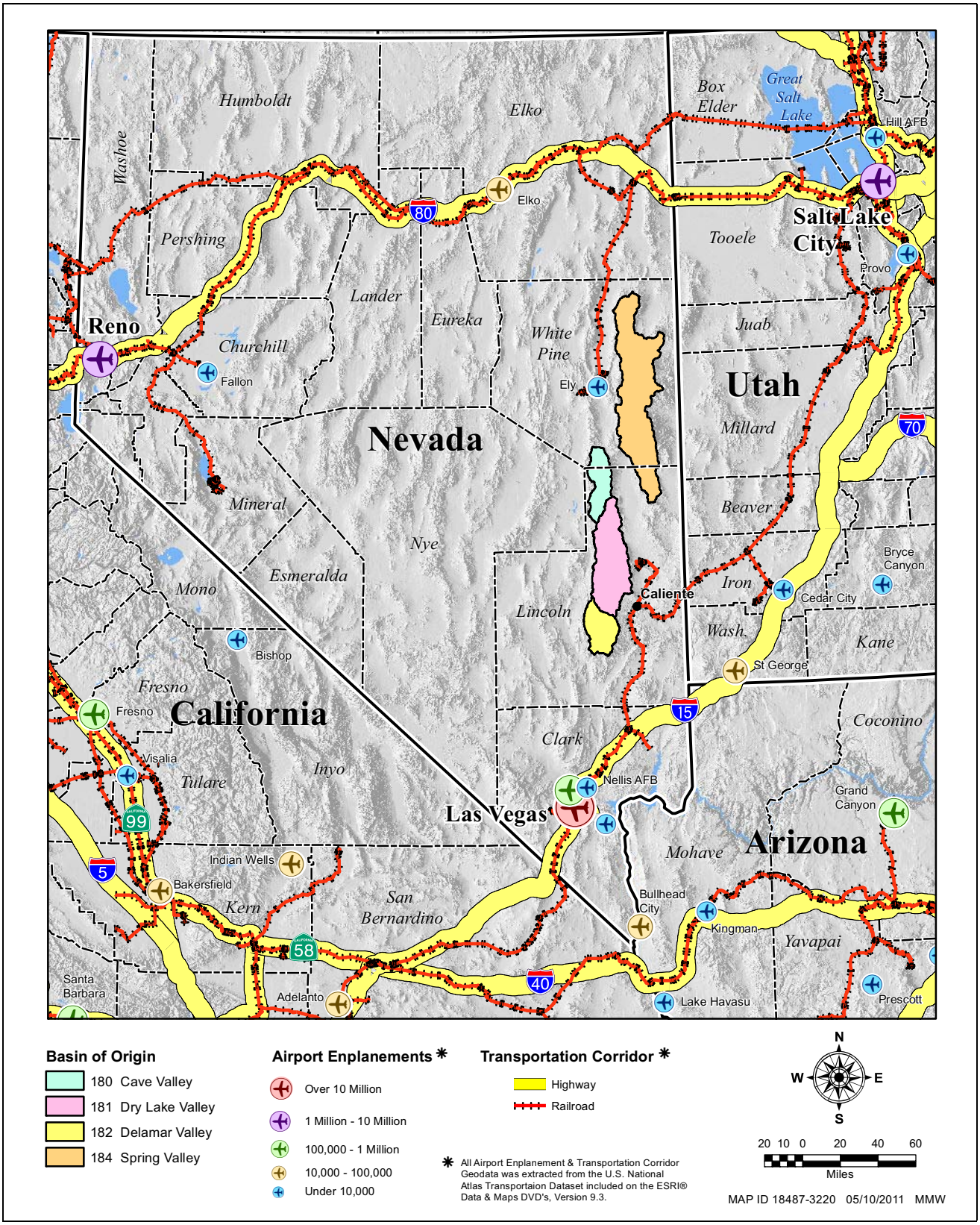


Figure 2-9
Transportation Corridors; Airport and Rail Line Locations

2.5 Summary of Key Factors that Limit Economic Growth in the Basins of Origin

The importance of developing infrastructure has long been recognized as central in promoting economic growth. Most potential residents and businesses to an area demand that basic infrastructure and services, including electricity, roads and telephone service be in place and available before they invest their time or money. However, in the Basins of Origin basic infrastructure is nonexistent or is limited at best. In addition, all four of the Basins are a great distance from I-15, a major economic corridor with millions of annual users. The Basins are at a competitive disadvantage for growth and development when compared to other areas that have basic infrastructure and good access to transportation networks.

Because of the factors described above, the potential for future economic development and new water requirements for such development in the Basins of Origin is extremely limited in the foreseeable future.

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3.0 FUTURE DEVELOPMENT POTENTIAL BY LAND USE CATEGORY IN THE BASINS OF ORIGIN

Section 2.0 analyzed various development-related factors and how they pertain to the potential future growth and development in the Basins of Origin. This section considers specific land use categories and potential for each type of land use to become established or to expand in each Basin: agriculture; residential; commercial, industrial, and governmental facilities; energy development; mining; and tourism and recreation. The conclusion of this section is that for any land use category, new development that would require a significant amount of new water rights from the Basins is highly unlikely to occur, and therefore approval of the SNWA Applications would not unduly limit the future growth and development in the Basins.

3.1 Potential Expansion of Agriculture and Livestock

The following summary and conclusion regarding the future potential of agriculture in the Basins of Origin is based on a separate and more detailed analysis of the subject, titled *"Future Economic Development of Agriculture in White Pine and Lincoln Counties,"* (Peseau and Carter, 2011).

The primary agricultural activities in the Basins of Origin are growing alfalfa hay and raising cattle and sheep. However, carrying out these activities in the Basins of Origin is exceptionally challenging due to productivity and cost disadvantages inherent to the area, most notably, the Basins' remoteness, climate, and additional costs associated with transporting the product to market. These disadvantages exist now and will continue to exist in the future.

The outlook for expansion of alfalfa hay production in the Basins of Origin is dismal. The breakeven analysis presented in Peseau and Carter (2011) indicates that for a new alfalfa stand, net returns per acre above total costs (including capital cost recovery) are negative except at exceptionally high yields combined with exceptionally high alfalfa hay prices. The lack of a reasonably certain and substantial return on investment indicates that an agricultural business investor would be unlikely to commit capital to development of a new alfalfa stand. Therefore, in the Basins of Origin it is unlikely in the foreseeable future that there will be new alfalfa stands proposed that will require new appropriations of water from the Basins.

As with many regions within Nevada, the gradual decline over the last 10 years of cow-calf operations and flat alfalfa production in White Pine and Lincoln Counties are indicative of marginal economics. Neither the sale price of calves has been consistently above breakeven levels, nor has the price of alfalfa (which is needed for supplemental feed for many months of the year) been consistently low enough to allow profit levels to foster major new investment in the cow-calf industry in Nevada. Moreover, the cow-calf production can be expected to be cyclical, as in many agricultural endeavors, with no discernible trend toward expansion. Conversely, the price of alfalfa has not been

consistently high enough to allow profit levels to foster new investment in alfalfa production. Therefore, new water demands for expansion of the cow-calf industry should be considered minimal or nonexistent.

The markets, fertile soils, moderate climates and abundant lands that have made numerous other areas of agricultural endeavor economically attractive to the growing corporate conglomerates around the world do not and will not exist in White Pine and Lincoln Counties. These agricultural attributes simply are not available and do not exist in White Pine and Lincoln Counties, and are particularly absent in the Basins of Origin. Due to these factors and others detailed in Peseau and Carter (2011), future growth in either livestock or alfalfa hay operations is highly unlikely in the Basins and will remain so into the foreseeable future.

3.2 Residential Growth Potential

3.2.1 Spring Valley

As of 2009, the SNWA was the largest non-federal land owner in Spring Valley, with 22,400 acres, which is more than 50 percent of the total private property in the Basin. The parcels currently include seven ranches: The Bransford Ranch, the El Tejon Ranch, the Harbecke Ranch, the Huntsman Ranch, the Phillips Ranch, the Robison Ranch and the Wahoo Ranch. There are approximately 15 additional private property owners in Spring Valley encompassing 20,921 acres. The largest collection of parcels is owned by the Cleveland Ranch (7,074 acres) with the Fillman Ranch (63 acres), being the smallest.

Based on U.S. Census 2000 data (U.S. Census, NHGIS, 2010) accessed through the National Historic Geographic Information System there are 36 households and 77 residents in Spring Valley. This is a substantial decline from the 1930 when there were 106 households and 325 residents. Most of these properties are associated with the ranches listed above which are owned by the SNWA and were constructed sporadically over the last 100 years. White Pine County reports that there has been some vacation homes built on the edges of the valley in recent years, but they are few and not part of a planned community.

Human settlement has been occurring in White Pine County for over 100 years, however, very few housing units have ever been built in Spring Valley. Considering this and other factors, such as the valley's remoteness from metropolitan areas, the lack of basic infrastructure, and the lack of proximity to major transportation corridors, it is reasonable to conclude that residential interest in the Basin will remain stagnant and the that future potential for new residential development in Spring Valley is bleak.

3.2.2 Cave Valley

Over 97 percent of Cave Valley is owned by the federal government. The remaining 3 percent includes a 192 acre parcel owned by the University of Nevada, Las Vegas, a 43 acre mining parcel, and approximately 5,779 acres of private land, 1,480 acres of which are restricted from development by a conservation easement (described below). The largest private land owner is Cave Valley Ranch,

LLC (CVR), which owns 11 parcels in Cave Valley, totaling 3,288 acres. Of the 11 parcels, 5 parcels (2,317 acres) are located in Lincoln County, and 6 parcels (971 acres) are located to the north in White Pine County.

- Cave Valley Ranch, LLC Conservation Easement

On December 7, 2009, a grant of Conservation Easement was made by the property owners of CVR for 20 land parcels totaling 1,480 acres. The easement confines the use of the property to protect its natural resources and habitat, which includes restricting real estate development, commercial and industrial uses, and certain other activities including on-going mutually agreed upon land uses. The property now may only be conveyed as a single tract of land and may not be subdivided for development.

Ownership of the property remains with CVR, which intends that certain conservation values be preserved and maintained by the continuation of the natural and agricultural land uses on the property, which will require that the water rights remain in use on, and appurtenant to, the property. The restrictions of the easement run with the land and are binding on all future owners of the property. A complete list of the restrictions set forth within the Conservation Easement is with the document, which has been recorded in the local land records of White Pine and Lincoln Counties.

Factors that make an area advantageous for new residents and businesses, as outlined in the previous section, are virtually absent in Cave Valley; moreover, the CVR conservation easement prohibits new development. Outside of a remote vacation home or temporary hunting outpost, on land not covered by the conservation easement, the potential for future residential growth is extremely limited.

3.2.3 Dry Lake and Delamar Valleys

Over 99 percent of both Dry Lake and Delamar Valleys are owned by the U.S. government. The remaining 1 percent includes seven mining parcels totaling 1,354 acres, two parcels owned by the SNWA as part of the El Tejon Ranch totaling 121 acres, and 996 acres of additional private land. In Delamar Valley, there is one abandoned mine on BLM land and no private property. Due to the geographic circumstances, specifically the extreme isolation, lack of basic infrastructure and lack of developable private land in these valleys, residential development is not expected to occur.

3.2.4 Bureau of Land Management Future Land Disposal

The BLM published its Record of Decision for the Approved Ely Resource Management Plan (RMP) in the Federal Register on September 26, 2008. The RMP will guide the management of BLM activities on about 11.5 million acres of agency-administered public lands and minerals in Lincoln, White Pine and a portion of Nye counties. The RMP includes a list of public lands nominated to be sold within this area, including approximately 18,500 acres that could open for private ownership in White Pine County and 57,000 acres in Lincoln County, Nevada. This is in accordance with the Lincoln County Conservation, Recreation, and Development Act of 2004 and the White Pine County Conservation, Recreation, and Development Act of 2006. The specific tracts of public lands offered

for sale must be nominated by interested parties and is accomplished through public input through the land use planning process or directly to the BLM.

Consistent with the WPCLUP (2008) and LCMP (2007) both counties recommended that BLM land transfers be located near existing communities to provide land for expansion rather than in undeveloped areas. This does not preclude sale of public land the Basins of Origin, but it makes it less likely that this will occur in the future. Figure 3-1 below shows where there is current demand for additional land.

None of the parcels which have been nominated by interested parties (private interests or the County) to date are within the Basins of Origin. It is reasonable to conclude that the sale of federal land will not be a factor that alters the conclusion that the potential for future residential growth in the Basins is extremely limited.

3.3 Potential Expansion of Commercial, Industrial, and Governmental Facilities

Currently, there is little commercial, industrial, or governmental activity within the Basins of Origin. Outside of tourism associated with hunting or fishing, which is established and relatively constant, the only known commercial businesses in the Basins are in Spring Valley: a convenience store (Majors Crossing) which is located near the junction of U.S. Highways 50 and 93, and a retail/ Internet based shop (D Bar X Lighting & Horns-A Plenty Art) which sells antler furnishings, located on US 50, 20 mi west of Baker, Nevada. There are no governmental facilities or employment centers in the Basins.

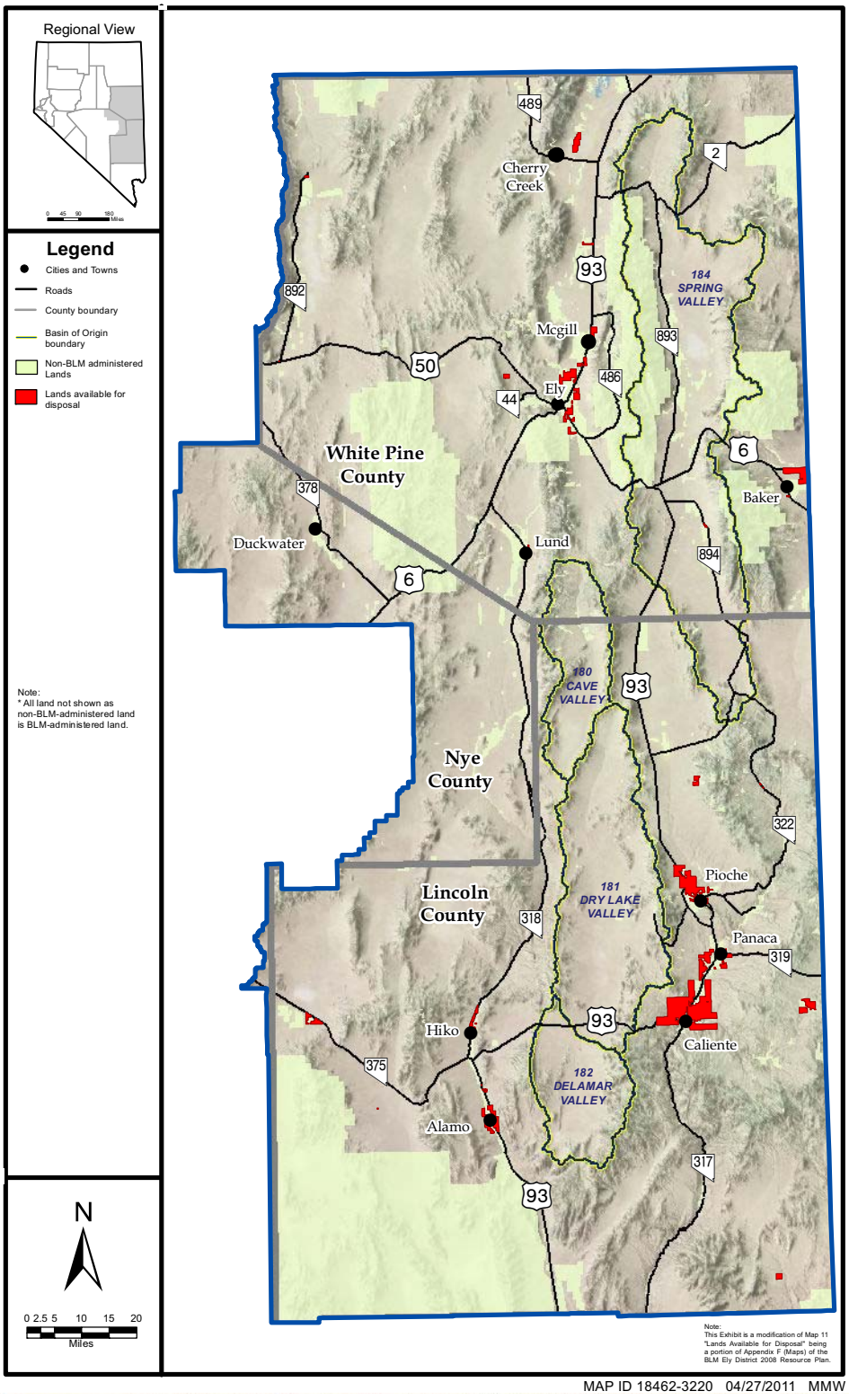
Due to the Basins' general remoteness, small population, extremely limited potential for residential growth, lack of basic infrastructure, and substantial distances to major transportation corridors, the potential for new commercial, industrial, or governmental enterprises, or the expansion of existing activity, is highly unlikely to occur in the foreseeable future.

3.4 Energy Development Potential in the Basins of Origin

In the State of Nevada, energy production includes coal and natural gas-powered generation as well as a growing renewable energy sector. Nevada's geographic location, being generally windy and sunny, gives it the potential for generating electricity from wind and solar, and the state has substantial geothermal resources that can be developed at relatively low cost.

3.4.1 Coal

For decades, White Pine County has been interested in housing a coal-fired electric power plant, and there have been several attempts over the years, including recent efforts in 2009 by Sierra Pacific Resources (NV Energy) and LS Power Company. While none of these projects were realized, they all had one thing in common, their location. In order to transport coal from Wyoming or elsewhere to a potential coal-fired electric power plant in White Pine County, it must have access to a major rail line. Coal is typically transported by train in United States, and in many cases it is transported long distances. In areas near the Basins, only Steptoe Valley (north of Ely) has a rail corridor to



Source: Modified from BLM (2008)

Figure 3-1
Nominated Lands to be Sold are Near Existing Population Centers and Outside the Basins of Origin

accommodate coal trains. Potential investors in a coal plant wanting to maximize their return-on-investment will likely chose Steptoe Valley over Spring Valley or any of the other Basins because the rail infrastructure is already available.

There are currently no proposals for the construction of a coal-fired electric power plant in the Basins of Origin, and due to the lack of rail service as described above, there is little potential for such a plant to be constructed in any of the Basins in the future.

3.4.2 Natural Gas

There are no large-diameter, high pressure natural gas pipelines in any of the Basins. There are currently no proposals for construction of a natural gas-fired electric power plan in the Basins, and without a suitable gas supply there is little potential for such a facility to be constructed in any of the Basins in the future.

3.4.3 Renewable Resources: Wind, Geothermal, and Solar

The following summary and conclusion regarding the future potential of renewable energy development in the Basins of Origin is based on a separate and more detailed analysis of the subject, titled *Delamar Valley, Cave Valley, Dry Lake Valley and Spring Valley Renewable Energy Viability Report*, as presented in Linvill and Candelaria (2011).

- Wind

Wind energy potential in Nevada is limited. The Amount of wind potential identified as class 4 or better in Nevada is only 60 MW, and the 60 MW of capacity is capable of producing about 175 GWh/yr (Linvill and Candelaria, 2011, p. 6). Nevada's total annual demand is about 32,000 GWh/yr so the high quality wind potential is relatively small.

However, according to the U.S. Department of Energy, Spring Valley has some of the highest average annual wind speeds in eastern Nevada. In early 2011, Spring Valley Wind, LLC began constructing a 150-megawatt wind generation farm on 7,673 acres of public land (BLM) in north Spring Valley. The project consists of 75 wind turbines, an electrical substation, and will utilize an existing 230 kV transmission line for distribution. Operation and maintenance of the project should require only a minimal amount of water for dust control on access roads and potable water at a small operations and maintenance building.

Additional wind energy development in Spring Valley may be possible, but only if projects have access to new electrical transmission lines that can carry that electricity to market.

Even if additional wind projects are developed in Spring Valley, their total requirements for water will be minimal. Furthermore, wind projects in Spring Valley will not require a large number of permanent employees and, therefore, the wind projects are not expected to create a demand for a significant amount of new housing or any other new land use that would require new water supplies in the valley.

- Geothermal

In contrast to wind resources, high quality geothermal resource potential is significantly higher in Nevada. Annual geothermal energy production potential is about 10,000 GWh/yr, or about one-third of Nevada's current annual demand (Linvill and Candelaria, 2011, p. 9). However, much of eastern Nevada is not rated as a "most favorable" area for deep enhanced geothermal systems. Additionally, transmission line capacity within the Basins to deliver geothermal energy to market is either nonexistent or severely limited, placing geothermal projects in the Basins of Origin at a disadvantage compared to other high-quality geothermal resources. A geothermal project in any of the Basins would face the daunting task of competing against 7,000 GWh of highly competitive geothermal resources elsewhere in Nevada (Linvill and Candelaria, 2011, p. 10).

Currently, there are no geothermal energy projects in the Basins and there no geothermal leases on BLM land in any of the Basins (BLM, 2011).

Considering the quality of the geothermal resources, the absence of any existing geothermal power plants, the absence of any existing geothermal leases, the lack of transmission capacity, and the competition from other geothermal resource areas in Nevada, it is unlikely that a geothermal resource energy project will be developed in any of the Basins in the foreseeable future.

- Solar

The State of Nevada and the West have abundant renewable resources, including solar, however, large scale solar projects in the Basins of Origin will not be competitive for the foreseeable future.

Compared to other solar development areas in Southern Nevada, projects in the Basins of Origin face a competitive disadvantage due to being remote from energy markets and from lacking transmission access. The cost of producing and delivering solar electricity from the Basins of Origin to potential markets is simply too high for these projects to be competitive given the potential size of the market for this energy between the present and 2030. Beyond 2030, predicting the size of the market for remote, large scale solar development is a speculative exercise. Even if the market turns out to be larger than expected beyond 2030, water needs will be very low. Photovoltaic systems with minimal water use self-cleaning capabilities are already under development and these technologies will become the large scale technology of choice in desert climates.

3.5 Potential Expansion of Mining

The economies of White Pine and Lincoln Counties have traditionally been tied to the mining industry. This is especially so for White Pine County. Throughout the 1980s and 1990s, White Pine County's prosperity continued to fluctuate with the boom and bust cycle of the mining industry. Similar to other industries which are linked to commodity price swings, mining operations tend to see an increase in activity when prices are relatively high and a decrease in activity when prices fall.

Over the last several years, the price of gold, silver, and copper have risen rapidly in the world, contributing to the state of Nevada's mining industry. White Pine County has two major mines in operation; the Robinson Mine, located 7 mi west of Ely, and the Bald Mountain Mine, located in the

extreme northwest corner of the county, approximately 75 mi northwest of Ely. In Lincoln County a small mining operation, the Tenacity Perlite Mine and Mill, is located at the far western edge of Delamar Valley. Figure 3-2 below shows the locations of these major mines.

The largest of the three mines, and closest to the city of Ely, is the Robinson Mine, a copper and gold mine owned by Quadra Mining, Ltd. The company currently employs approximately 550 people and is the largest single employer in White Pine County. The Bald Mountain mine is operated by Barrick Gold Corporation and mines gold exclusively while employing approximately 150 people. The Tenacity Perlite Mine and Mill in Delamar Valley employs seven people.

There are no major mining operations in Spring, Cave, or Dry Lake Valleys, and only the small perlite mining operation in Delamar Valley (Nevada Division of Minerals, 2009).

Exploration for new deposits is an ongoing effort by both the currently operating companies and by many others who do not operate mines in Nevada. Gold, silver, copper, lead, zinc, uranium, beryllium, and tungsten are all metallic locatable minerals that are mined in the state. Because of the favorable geology and extraordinarily high commodity prices over the last few years, especially for gold, silver and copper, there may be potential for additional mining of precious metals in White Pine and Lincoln Counties and in the Basins of Origin.

However, despite near record high commodity prices, as of December, 2010, there were no proposals for new precious metal mines in any of the Basins of Origin. Even in the unforeseen event of a new mining operation in the Basins, the granting of the SNWA applications will not limit future mining activity. The Nevada State Engineer (NSE) does not consider the appropriation of water for mining purposes a permanent use of a groundwater resource and does not deduct appropriations for mining from the perennial yield of a basin when calculating the amount of water available for appropriation. Therefore, there will be no conflict between the SNWA Applications, if approved, and a future request for water for mining (see Appendix A).

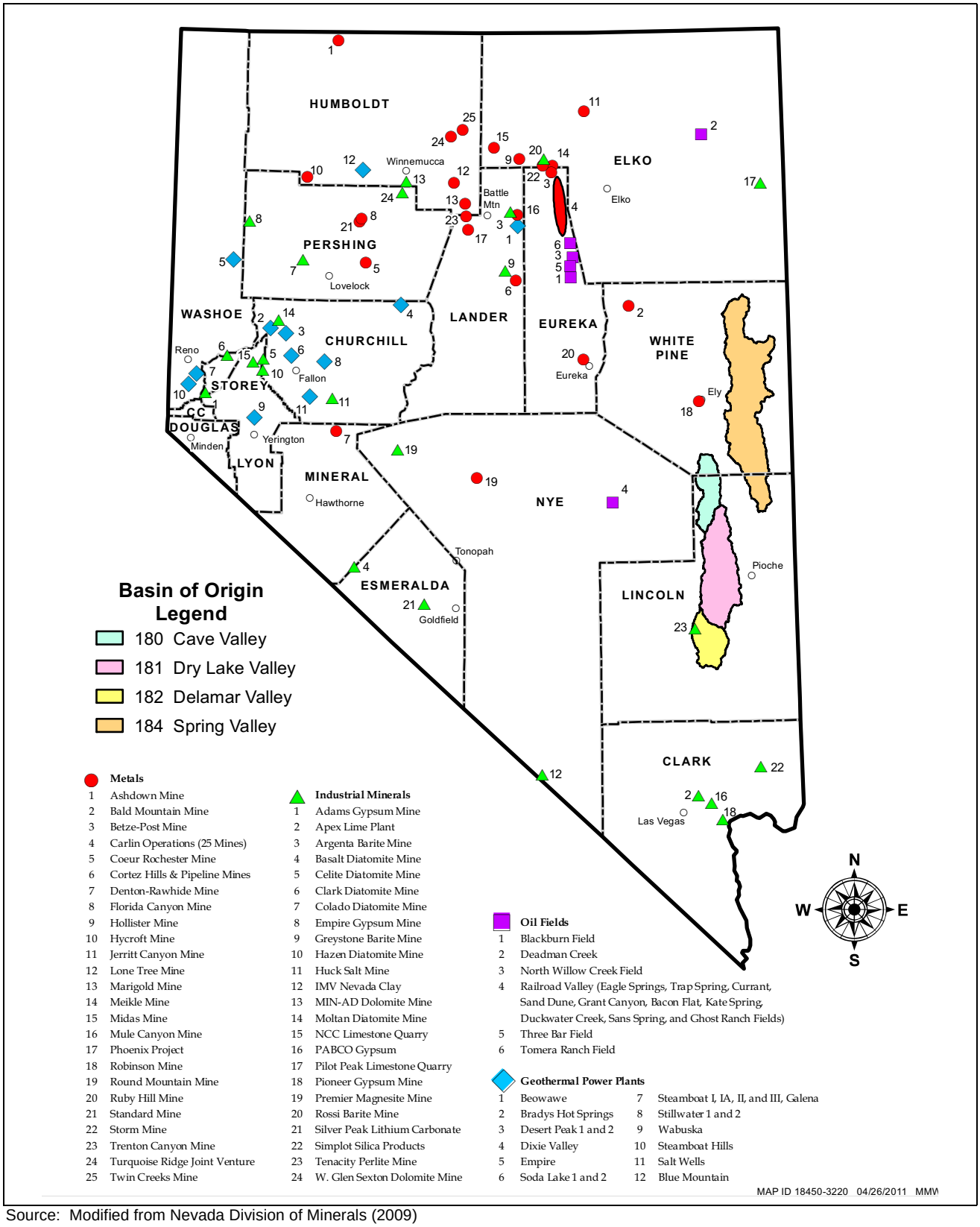
Given no new mining proposals, and considering the very small size of the one current mining activity in Delamar Valley, it is reasonable to conclude that mining will not require a significant long-term commitment of water in the Basins in the foreseeable future.

3.6 Potential Expansion of Tourism and Recreation

Tourism and recreation is a significant contributor to the economy in the rural areas of the Nevada, including White Pine and Lincoln Counties. Residents and visitors engage in a variety of outdoor recreational activities that include hunting, fishing, camping, hiking and visits to several State Parks and Great Basin Nation Park (GBNP).

3.6.1 Potential Growth in the Basins from Visitors to Great Basin National Park

GBNP was established on October 27, 1986. It encompasses 77,100 acres of federal land and an 80-acre administrative site in Baker, Nevada adjacent to Spring Valley. The Park is notable for the Lehman Caves at the base of Wheeler Peak (13,063 ft). The caves were originally protected on



Source: Modified from Nevada Division of Minerals (2009)

Figure 3-2
Major Mines of Nevada in 2008

January 24, 1922, as the Lehman Caves National Monument, which was later incorporated into the larger national park in 1986. There are a number of developed campsites within GBNP, as well as back country camping opportunities. In the town of Baker (near the Park's entrance) there are two restaurants, a small grocery store, and credit card gas pumps. A gas station, restaurant and motel are also located at the Nevada-Utah border.

GBNP is one of the least visited national parks in the United States, which is likely due to the Park's isolation. The nearest cities are Ely, Nevada, 60 mi to the west and Delta, Utah, 100 mi to the east. The closest major commercial airports are located in Salt Lake City, Utah and Las Vegas, Nevada. As shown in Figure 3-3, annual visitation averages approximately 80,000 visitors a year and has oscillated within a range from a low of 63,532 persons in 1987, to a high of 91,915 in 1993 (NPS, 2010b). For comparison, in 2009, Zion National Park (Utah) had 2.7 million visitors. According to the NPS (2010a), the number of people visiting GBNP in 2010 is expected to drop to 79,921, or 6 percent from 2009 (84,974). In 2011, visitation is projected to be 80,438, only 929 visits above the Park's average (Figure 3-3).

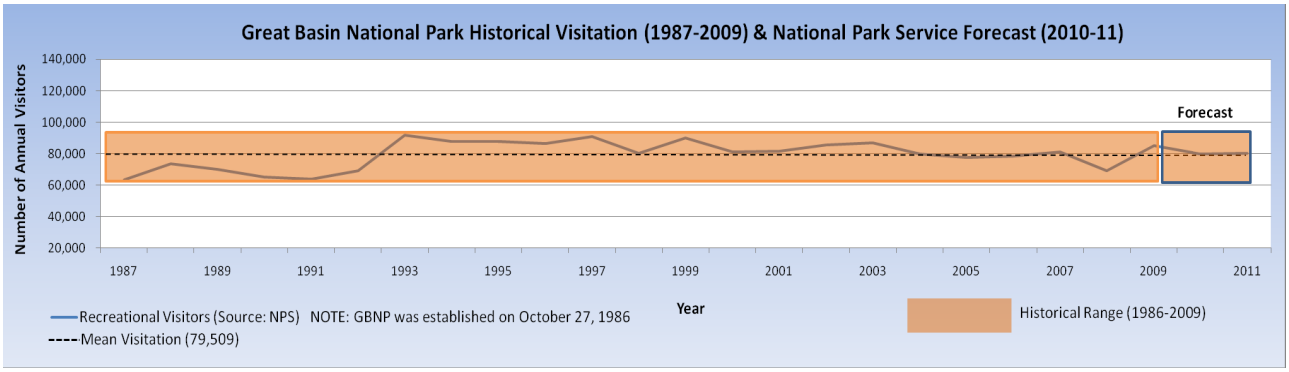


Figure 3-3
Historical Visitation and Forecast, Great Basin National Park (1987–2011)

Due to a combination of GBNP's great distance from major metropolitan centers, lack of public transportation access and relatively few amenities for tourists near the Park, it's reasonable to conclude that future annual visitation to GBNP will remain essentially constant into the foreseeable future and therefore will not be an catalyst for significant economic expansion in the surrounding area. If any economic expansion related to GBNP does occur, it will likely be in the town of Baker at the Park's entrance or in Ely where there are existing visitor services, and not in the Basins of Origin.

3.6.2 Potential Growth in the Basins from Hunting and Fishing Activity

In White Pine and Lincoln Counties, much of the hunting and fishing activity is by residents, but visitor spending on lodging, food, outfitters and permits are significant. However, while hunting and fishing are popular activities in the region, the numbers of people engaging in these recreational pursuits is relatively stable from year to year based on license and permit sales.

Table 3-1 below shows the number of hunting, trapping and fishing licenses and permits sold in White Pine and Lincoln Counties from 2001 to 2007. In 2001, White Pine County sold 4,498 licenses and permits. In 2007, the county sold 4,640, or about a 3 percent increase (142 additional permits).

Similarly, in 2001, Lincoln County sold 2,723 licenses and permits. Seven years later, it sold 2,540, a decrease of about 6 percent (183 permits less). Since some hunting and fishing permits can be bought in one county and used in another, it is difficult to know with certainty the exact number of people who hunt and fish in White Pine and Lincoln Counties annually. However, given that the number of hunting and fishing licenses and permits in White Pine and Lincoln Counties has remained relatively unchanged between 2001-2007 (the most recent and available data published by NDOW, 2010), it is reasonable to assume that hunting and fishing activity has, and will likely remain, fairly constant within the counties into the foreseeable future.

Table 3-1
Hunting, Trapping, and Fishing Licenses
(and Permits) Sold in White Pine County and Lincoln County (2001–2007)

Area of Purchase	2001	2002	2003	2004	2005	2006	2007
White Pine County	4,498	4,545	4,572	4,503	4,257	4,344	4,640
Lincoln County	2,723	2,534	2,425	2,410	2,223	2,471	2,540

Source: NDOW (2010)

In regard to the Basins of Origin, it is also important to note that while expenditures by non-resident hunters and fisherman are higher as a result of travel and other related costs, most of the money spent on hunting and fishing related activities is concentrated in the developed areas of the counties, (e.g., retail stores, hotels and guide services), which are located in Ely, Baker, or Caliente. Any expansion of economic activity related to hunting and fishing will likely occur in those existing, developed areas, not in the Basins of Origin.

Due to the factors described above, little or no additional water resources will be necessary for tourism and recreation activity in the Basins of Origin into the foreseeable future.

3.7 Summary of Future Development Potential by Land Use Category

As described in the previous sub-sections, there is limited potential for the establishment of new types of land uses or expansion of existing land uses in the Basins of Origin in the foreseeable future. Future demands for new water supplies in the Basins should be considered minimal or nonexistent. Approval of the SNWA Applications will not be a constraint to any reasonably-forecasted future land use and, therefore, approval of the SNWA Applications will not unduly limit the future growth and development in the Basins.

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4.0 DISCRETIONARY RESERVATION OF WATER IN THE BASINS OF ORIGIN

As demonstrated in the preceding sections of this report, there is no reasonable expectation for growth and development in the Basins in the foreseeable future and, therefore, there are no foreseeable additional water needs in the Basins. Since new homes that are built on existing lots in the Basins will be allowed to utilize domestic wells for their water needs, the SNWA Applications, if granted, will not limit the ability of such homes to be built. Given existing water rights in the Basins, and the ability to change the specified use of those existing water rights to accommodate the water needs of unforeseeable future growth (in the unlikely event that such growth should occur), the SNWA Applications, if granted, will not limit such unforeseen growth.

However, despite these conclusions and the analysis in this report, it is not possible to completely rule out the possibility that occasional future demands for small quantities of water will occur in the Basins. Examples of such minor demands include: water for a new residence on a newly created lot in a designated groundwater basin; a commercial, industrial, governmental, or recreational activity requiring a small amount of water; and the limited use of water for wildlife management or stockwatering purposes. Historically, these minor demands rarely occur in the Basins, as summarized in Table 4-1.

Table 4-1
Groundwater Rights Approved in the Basins of Origin (1960–2010)
Within the Last 50 Years

	Dry Lake Valley (afa)	Delamar Valley (afa)	Cave Valley (afa)	Spring Valley (afa)
Domestic	0	0	0	0
Quasi-municipal	0	0	0	6
Municipal	0	0	0	0
Stockwater	10	7	34	103
Commercial	0	0	0	0
Industrial	0	0	0	0
Construction	0	0	0	0
Wildlife	0	0	0	58
Other	0	0	0	0
Total	**10**	**7**	**34**	**167**

See Appendix A.

Based on the historical record, if the NSE believes it is prudent to reserve water for demands that are not foreseeable but which might possibly occur, the following amounts of water (based on Appendix A, with adjustments and rounding) would be adequate to accommodate the following uses of water in the Basins:

Spring Valley

A total reservation of 200-300 afa would accommodate:

- 500-800 new individual residences; or
- 10-15 commercial uses; or
- 9,000-13,000 additional head of cattle or 44,000-66,000 sheep (stockwater use);

Or any combination of the above listed uses.

Cave Valley

A total reservation of 25-50 afa would accommodate:

- 70-150 new individual residences; or
- 2-3 commercial uses; or
- 1,000- 2,000 additional head of cattle or 5,500-11,000 sheep (stockwater use);

Or any combination of the above listed uses.

Delamar Valley

A total reservation of 25-50 afa would accommodate:

- 40-80 new individual residences; or
- 2-3 commercial uses; or
- 1,000- 2,000 additional head of cattle or 5,500-11,000 sheep (stockwater use);

Or any combination of the above listed uses.

Dry Lake Valley

A total reservation of 25-50 afa would accommodate:

- 40-80 new individual residences; or
- 2-3 commercial uses; or
- 1,000- 2,000 additional head of cattle or 5,500-11,000 sheep (stockwater use);

Or any combination of the above listed uses.

5.0 CONCLUSIONS

This report considered the growth and economic development potential in the Spring, Cave, Dry Lake, and Delamar Valleys. The purpose of this analysis was to form an opinion on whether or not the SNWA groundwater applications, if approved, would unduly limit the future growth and development of the Basins.

Factors that typically support economic growth include proximity to large, established metropolitan centers, a sufficient population size and skilled labor force, a diversity of employment opportunities, location along a major transportation corridor, substantial transportation infrastructure, and high-capacity public utilities and public services.

The Basins of Origin have an extremely small population (under 100 persons combined); are a great distance to any large metropolitan center or market; are far from any interstate highway; have few paved roads; and have limited access to electricity and emergency response services. These factors put the Basins at a competitive disadvantage when compared to other areas that are not constrained in this way. According to the 2010 U.S. Census (U.S. Census Bureau, 2011), the State of Nevada was the fastest growing state in the country for each of the last five decades, the only state to maintain a 25 percent population growth rate for the last three decades, and the fastest growing state in the most recent decade (2000-2010). Meanwhile, the population and economic activity within the Basins of Origin remained virtually unchanged.

While current water use in the Basins is primarily limited to agriculture, the potential for expanding agricultural activity is extremely poor due to the challenges that would make a new venture economically attractive or even viable. For other industries, including energy production, it is highly unlikely that the Basins of Origin would experience any growth in the foreseeable future that would require large quantities of additional water resources.

The potential for large-scale residential home building as well as commercial development in the Basins is poor due to several factors, including distance from major metropolitan areas, small population and labor force, and a lack of basic infrastructure.

The potential for new mining activity in the Basins appears to be small. Despite the recent large price increase in precious metals, there have been no new proposals for mining in the Basins of Origin.

The potential for new economic development from tourism, including from hunting and fishing, is limited in the Basins. Even if there is some expansion of recreation activity in the Basins, the impacts on water resources will likely be in developed areas such as Ely, Baker, and Caliente where visitor and guest services are available, and not in the Basins themselves.

Considering the extremely limited potential for future growth and economic development in the Basins, new demands for additional water resources in the Basins of Origin should be considered minimal or nonexistent for the foreseeable future.

For events that are unforeseeable, but might possibly occur, such as the development of a new small commercial, industrial, or recreational activity or the limited use of water for wildlife management or stockwatering purposes, only a very small quantity of water would be required to provide for uses comparable to all such uses developed in the past 50 years. Additionally, for Spring Valley, which has the highest level of economic activity of any of the Basins, the existing water rights associated with agriculture could be repurposed to a different manner of use, allowing for sufficient water availability to meet virtually any reasonable, unforeseeable demand that may occur in the future.

The conclusion of this report is that the use of water as proposed by the SNWA Applications is an appropriate long-term use that will not unduly limit the future growth and development in the basins from which the water will be exported.

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Appendix A

Memos from Stanka Consulting, Ltd.

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Richard Holmes

May 16, 2011

Southern Nevada Water Authority
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Las Vegas, Nevada 89153

Per your request, this office has completed research and evaluation of the quantity of "underground" water rights that have been permitted or certificated within the past 50 years within Cave Valley, Dry Lake Valley, Delamar Valley, and Spring Valley. This evaluation was limited to the following manners of use: Domestic, Quasi Municipal, Municipal, Stockwater, Commercial, Industrial, Construction, Wildlife, and "other". Attachment 1 includes the estimated quantity of underground water rights [Acre-Feet Annually] per manner that have been permitted or certificated within the previous 50 years.

Please contact me at the above address / phone number if you have any questions.

Michael A. Stanka, P.E., WRS

Stanka Consulting, LTD

Attachment 1:

Manner of Use	Dry Lake Valley	Delamar Valley	Cave Valley	Spring Valley
Permitted or Certificated Groundwater Rights Within the Last 50 years [rounded to nearest Acre-Feet Annually]				
Domestic	0	0	0	0
Quasi Municipal	0	0	0	6
Municipal	0	0	0	0
Stockwater	10	7	34	103
Commercial	0	0	0	0
Industrial	0	0	0	0
Construction	0	0	0	0
Wildlife	0	0	0	58
"Other"	0	0	0	0
Total	10 afa	7 afa	34 afa	167 afa

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Richard Holmes

May 10, 2011

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1001 South Valley View Boulevard
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Per your request, this office has completed the research and evaluation to determine if future mining and milling rights are considered temporary rights and if they are included in quantifying the committed groundwater resources within a basin. Per numerous Nevada State Engineer rulings and also terms of current mining and milling permits, these rights are considered temporary in nature and should not be included in determining the committed groundwater resources of a basin.

Review of existing permits show that as far back as December 1981, the State Engineer included verbiage in the permits identifying the temporary nature of mining and milling rights. Permit No. 42141 to appropriate mining and milling rights was issued by State Engineer Peter G. Morris P.E. on December 17, 1981 and included the following statement:

> *"The manner of use of water under this permit is by nature of its activity a temporary use and any application to change the manner of use granted under this permit will be subject to additional determination and evaluation with respect to the permanent effect on existing rights and the resource within the ground water basin".*

A review of selected permits issued after 1981 shows that this statement or a similar statement is included in the mining and milling permits issues after that date. Based on the review of mining and milling permits issues by the Nevada State Engineer since 1981, these rights are considered temporary rights.

The Nevada State Engineer has issued permits and several ruling which addressed the issue of whether mining and milling rights should be considered part of the committed resources for a basin. Permit 80270 to appropriate mining and milling rights was issued by State Engineer Jason King P.E. on March 3, 2011 and stated the following:

> *"It is understood that the amount of water herein granted is only a temporary allowance issued under the provisions of NRS 533.371 for a finite period of time.*

This permit will expire upon cessation of mining operation and all rights herein will revert back to the source".

Ruling 5531, issued by State Engineer Hugh Ricci P.E. on September 19, 2005, denied Application 71501 to change the manner of use of Permit 35776, Certificate 12878 from a mining and milling use to irrigation use and concluded the following:

"The State Engineer concludes that to grant the change in manner of use requested by Application 71501, where the quantity of water under existing appropriations exceeds the perennial yield and where the change in manner of use would be from a temporary mining and milling use to a permanent irrigation use, would conflict with existing rights and would threaten to prove detrimental to the public interests".

Additionally, Ruling 5079, issued by State Engineer Hugh Ricci P.E. on September 27, 2001, included the following statement in reference to determining committed groundwater resources within a basin:

"The committed ground-water resource in the form of permits and certificates issued by the State Engineer's office to appropriate underground water from the Dodge Flat ground-water basin currently exceeds 5115.00 acre-feet annually. The State Engineer finds that only 672.00 acre-feet of the resource of the Dodge Flat ground-water basin has been committed to permanent uses out of the 2,100 acre-feet perennial yield of the ground-water basin. The remaining water resources are committed to temporary uses under mining and milling permits".

Based on the above cited permit language and ruling statements, it can be concluded that the State Engineer should not include future mining and milling permits in determining the committed resources of a basin. Please contact me at the above address / phone number if you have any questions.

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May 10, 2011

Per your request, this office has completed the research and evaluation of the quantities of water rights that are estimated to be used per selected manners of use within Cave Valley, Dry Lake Valley, Delamar Valley, and Spring Valley. Attachment 1 includes the estimated quantity of water rights that would be required.

Please contact me at the above address / phone number if you have any questions.

Michael A. Stanka, P.E., WRS

Stanka Consulting, LTD

Attachment 1:

Manner of Use	Acre-Feet Annually [afa]	Notes
Domestic [Cave Valley and Spring Valley]	0.34 / domestic well	0.57 afa per household pumped, 40% returned to groundwater system via septic tanks, remaining 60% "consumed". Please reference Sections 2.8 and 5.8 of "Committed Groundwater Resources in Cave, Dry Lake, Delamar, and Spring Valleys (2011)".
Domestic [Dry Lake Valley and Delamar Valley]	0.57 / domestic well	0.57 afa per household pumped. Due to significant depth of groundwater it is assumed that secondary recharge to the groundwater through septic tanks would not occur. Please reference Sections 3.8 and 4.8 of "Committed Groundwater Resources in Cave, Dry Lake, Delamar, and Spring Valleys (2011)".
Stockwater - Cattle / Horses [Cave Valley, Dry Lake Valley, Delamar Valley, and Spring Valley]	0.0224 afa / head	Based on 20 gallons per day per head [365 days] of cattle /horses. Reference NDWR "stockwater duty requirements" handout.
Stockwater -Sheep [Cave Valley, Dry Lake Valley, Delamar Valley, and Spring Valley]	0.00448 afa / head	Based on 4 gallons per day per head [365 days] of sheep. Reference NDWR "stockwater duty requirements" handout.
Commercial Cave Valley, Dry Lake Valley, Delamar Valley, and Spring Valley]	18.2 afa / permit	Based on average statewide groundwater permits and certificates with manner of use as commercial. Total number of permits and certificates listed statewide is 948 line items. Total quantity of rights is 20,556.1 afa. Average statewide is 21.6 afa. A portion of these rights are listed as supplemental groundwater rights. An initial estimate of non-supplemental rights adjusted the total duty per right to approximately 18.2 afa.