AIR ANALYSIS FRAMEWORK FOR THE CARSON CITY DISTRICT (CCD) RESOURCE MANAGEMENT PLAN

Prepared for:

Bureau of Land Management
Carson City District Office

Prepared by:

ENVIRON International Corporation
773 San Marin Drive, Suite 2115
Novato, California 94945
www.environcorp.com
415-899-0700

and

Carter Lake Consulting
Laramie, Wyoming

June 6, 2013

This page intentionally left blank.

TABLE OF CONTENTS

Section Page

1. INTRODUCTION 1-1

1.1 Climate and Meteorology 1-4
1.2 Air Quality 1-9
1.3 Emissions 1-9

2. EMISSION SOURCES 2-1

2.1 Criteria and Hazardous Pollutants 2-1
2.2 Air Quality Observations 2-7
2.2.1 Ozone 2-7
2.2.2 Carbon Monoxide 2-9
2.2.3 $PM_{2.5}$ 2-11
2.2.4 PM_{10} 2-12
2.2.5 Sulfur Dioxide and Nitrogen Dioxide 2-13
2.3 Climate Change 2-14
2.4 Local Emission Sources 2-16
2.4.1 Recreation 2-16
2.4.2 Mineral Extraction/Mining 2-17
2.4.3 Renewable Energy 2-18
2.4.4 Transportation 2-21
2.4.5 Fires 2-21

3. AIR QUALITY ASSESSMENT 3-1

4. REFERENCES 4-1

TABLES

Page

1 Land Status in the Carson City District Planning Area 1-3
2 Land Area by County for the CCD Planning Area 1-3
3 State and National Ambient Air Quality Standards 2-2
4 Highest Observed 1-hour Ozone (ppb) in the CCD Planning Area 2-9
5 Fourth Highest Observed 8-hour Ozone (ppb) in the CCD Planning Area 2-9
6 Second Highest Observed 1-hour CO (ppm) in the CCD Planning Area 2-10
7 Second Highest Observed 8-hour CO (ppm) in the CCD Planning Area 2-10
8 Three-year Average of 24-hour $PM_{2.5}$ Concentrations at the 98th Percentile ($\mu g/m^3$) 2-11
9 Three-year Average of Annual $PM_{2.5}$ Concentrations ($\mu g/m^3$) 2-11
10 Second Highest 24-hour PM_{10} for Each Year ($\mu g/m^3$) 2-13
11 1-hour NO_2 at the 98th Percentile and 1-hour SO_2 at the 99th Percentile in Reno 2-13
12 Number of Visitors and Visitor-Days to the CCD Planning Area 2-16
13 Average Number of Fires and Fire Sizes in the CCD Planning Area 2-22

FIGURES

Page

1 Map of the Carson City District Planning Area 1-2
2 Elevation Heights (feet) in and CCD Planning Area and Vicinity 1-5
3 1981-2010 Annual Average Precipitation in the CCD Planning Area and Vicinity 1-6
4 1981-2010 Monthly Averaged High (top) and Low (bottom) Temperatures (°F) in January (left) and July (right) 1-7
5 Location of Air Quality Monitors in the CCD Planning Area 2-8
6 Major Mines and Geothermal Plants in 2011 2-18
7 Comparison of CO_2 Emissions from Coal, Natural Gas, and Geothermal Power Plants 2-19
8 Comparison of SO_2, Emissions from Coal, Natural Gas, and Geothermal Power Plants 2-20
9 Comparison of CO_2, SO_2, and NO_X Emissions from Coal, Natural Gas, and Geothermal Power Plants 2-20

ACRONYMS AND GLOSSARY

	Full Phrase
AUM	animal unit month
BLM	United States Department of the Interior, Bureau of Land Management
CCD	United States Department of the Interior, Bureau of Land Management, Carson City District, Nevada
decision area	lands within the planning area that are administered by the United States Department of the Interior, Bureau of Land Management and are the subject of the Carson City RMP
EIS	environmental impact statement
EPA	United States Environmental Protection Agency
°F	degrees Fahrenheit
MACT	Maximum Available Control Technology
NAAQS	National Ambient Air Quality Standards
OHV	off-highway vehicle
planning area	all lands, regardless of ownership, within the United States Department of the Interior, Bureau of Land Management, Carson City District
ppb	parts per billion
ppm	parts per million
public lands	lands administered by the United States Department of the Interior, Bureau of Land Management
RMP	resource management plan
US	United States
VOC	volatile organic compound

This page intentionally left blank.

SECTION 1
INTRODUCTION

The Bureau of Land Management (BLM) in the Carson City District (CCD) is updating its resource management plan (RMP) to reflect changes in the area since the last RMP in the region was approved in 2001. The new RMP will then be used to guide the BLM on how to administer the public land. This report focuses on air quality issues in the planning area, including air pollutants that can affect public health and visibility and contribute to climate change.

The Carson City District planning area covers 8.9 million acres of land in Nevada and California, of which 4.8 million acres are administered by the BLM. **Figure 1**, Map of the Carson City District Planning Area, shows the location of the Planning Area and the area administered by the BLM, and **Table 1**, Land Status in the Carson City District Planning Area, lists all of the owners and size of land (BLM 2013a).

The CCD planning area includes part or all of Carson City, and Churchill, Douglas, Lyon, Mineral, Nye, Storey, and Washoe Counties in Nevada, and Alpine, Lassen, and Plumas Counties in California. **Table 2**, Land Area by County for the CCD Planning Area, lists the size of the Planning Area and BLM-administered land by county (BLM 2013a). The majority of the BLM-administered land is in Churchill and Mineral Counties (38 percent and 33 percent, respectively), while less than 10 percent of the land is in California. The Reno-Sparks metropolitan area is within the CCD planning area but is outside of the BLM jurisdiction.

Figure 1. Map of the Carson City District Planning Area

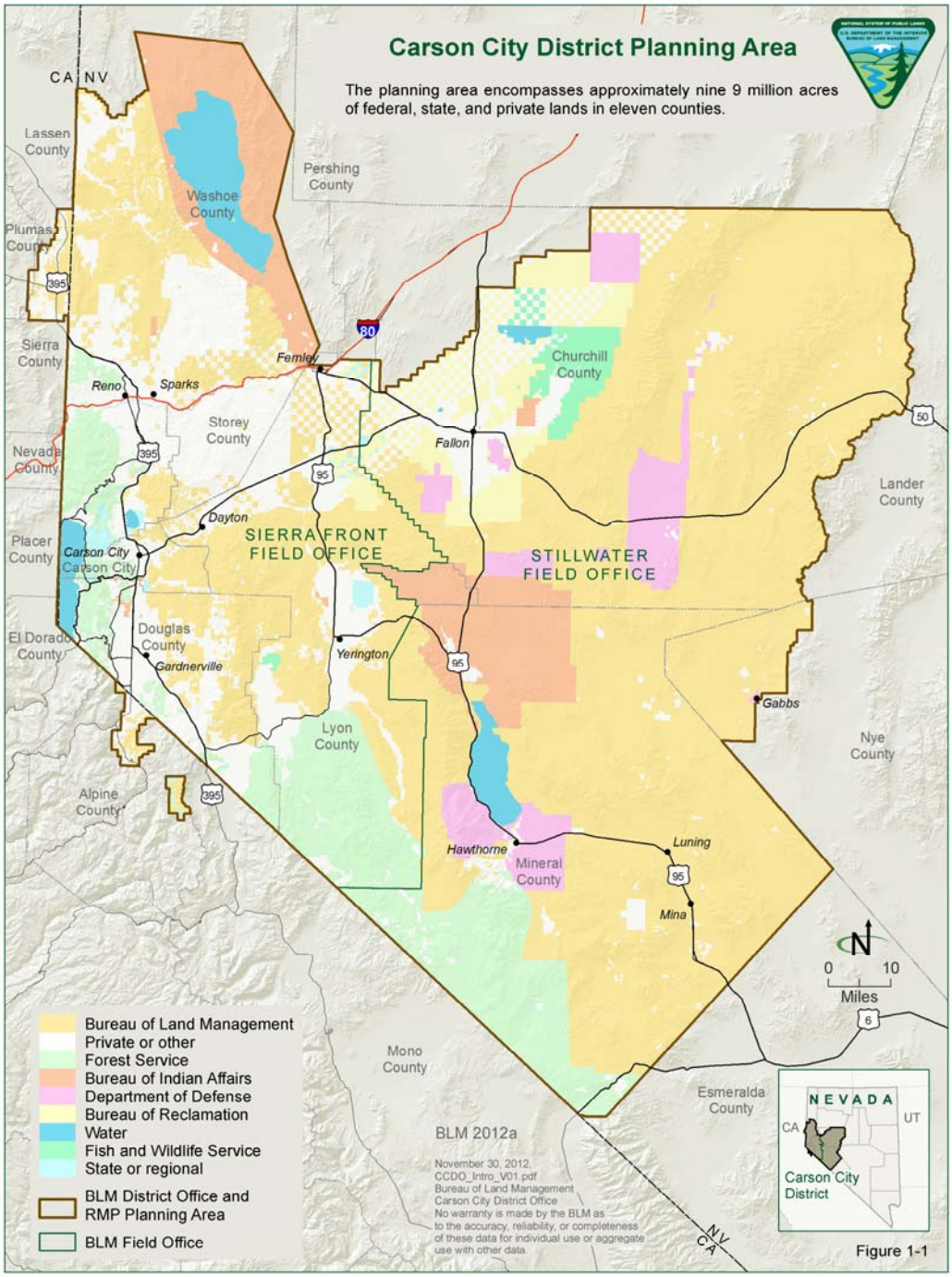


Table 1
Land Status in the Carson City District Planning Area

Surface Ownership	Approximate Acres in Planning Area
Nevada	
BLM	4,760,400
Private	1,517,250
US Forest Service	864,780
Bureau of Indian Affairs	654,080
Department of Defense	341,840
Bureau of Reclamation	313,010
Water (lakes and ponds)	252,790
US Fish and Wildlife Service	100,160
Nevada State Parks	24,380
Nevada Regional Parks	15,960
California	
BLM	45,460
US Forest Service	4,700
Unclassified[1]	43,790
California Department of Fish and Game	2,330
Total	8,940,940

Source: BLM 2013a
[1]Includes Bureau of Reclamation, Bureau of Indian Affairs, Department of Defense, regional park, and private lands

Table 2
Land Area by County for the CCD Planning Area

County	BLM Land (acres)	Acres in Planning Area	Percent of County in Planning Area
Nevada			
Carson City	41,270	100,630	100
Churchill	1,811,450	2,758,190	86
Douglas	162,460	472,900	100
Lyon	569,450	1,276,600	99
Mineral	1,581,050	2,442,090	100
Nye	189,080	194,060	1
Storey	15,170	168,830	100
Washoe	390,470	1,431,360	34
California			
Alpine	18,230	40,130	0.1
Lassen	26,520	53,770	0.1
Plumas	710	2,380	0.1
Total	4,805,860	8,940,940	

Source: BLM 2013a

1.1 CLIMATE AND METEOROLOGY

The CCD planning area is located in the Great Basin on the east side of the Sierra Nevada Mountain Range. Elevation ranges from 3,796 feet at Pyramid Lake to 11,236 feet at Mount Grant in Mineral County. Several mountain ranges and deep sediment-filled basins are located in the region. Most of the mountain ranges are aligned in a north-south direction. **Figure 2**, Elevation Heights (feet) in and CCD Planning Area and Vicinity, shows an elevation map of the area (NOAA 2013).

The predominant wind direction for the state of Nevada is from the west. In Reno and Fallon, winds are mostly southerly in the winter months and westerly to northwesterly from spring to fall (WRCC 2013). The local topography could channel the local winds in another direction. When an air mass approaches from the west, it first hits the western slope of the Sierras, where it is forced upwards and cooled. The moisture condenses and can fall out as precipitation. When the air mass descends on the eastern slope of the Sierras, most of the moisture has fallen out. As a result, the air mass over the CCD planning area is typically low in humidity; annual precipitation at most meteorological observation sites averages only 5 to 10 inches per year with higher totals over the mountain ranges, as can be seen from the 1981 to 2010 annual average precipitation plot in **Figure 3**, 1981-2010 Annual Average Precipitation in the CCD Planning Area and Vicinity, using a GIS dataset obtained from the PRISM Climate Group at Oregon State University (PRISM 2013).

In the summer, most areas in the Planning Area have an average daytime high temperature in the upper 80s to lower 90s degrees Fahrenheit (°F) with lows in the upper 40s and 50s. Temperatures are cooler at the higher elevations. In the winter, temperatures typically range from the teens to mid-20s at night to the 40s in the daytime. **Figure 4**, 1981-2010 Monthly Averaged High and Low Temperatures in January and July, displays 1981-2010 climatological monthly-averages of the high and low temperatures for January and July using additional datasets obtained from the PRISM Climate Group.

Figure 2. Elevation Heights (feet) in and CCD Planning Area and Vicinity

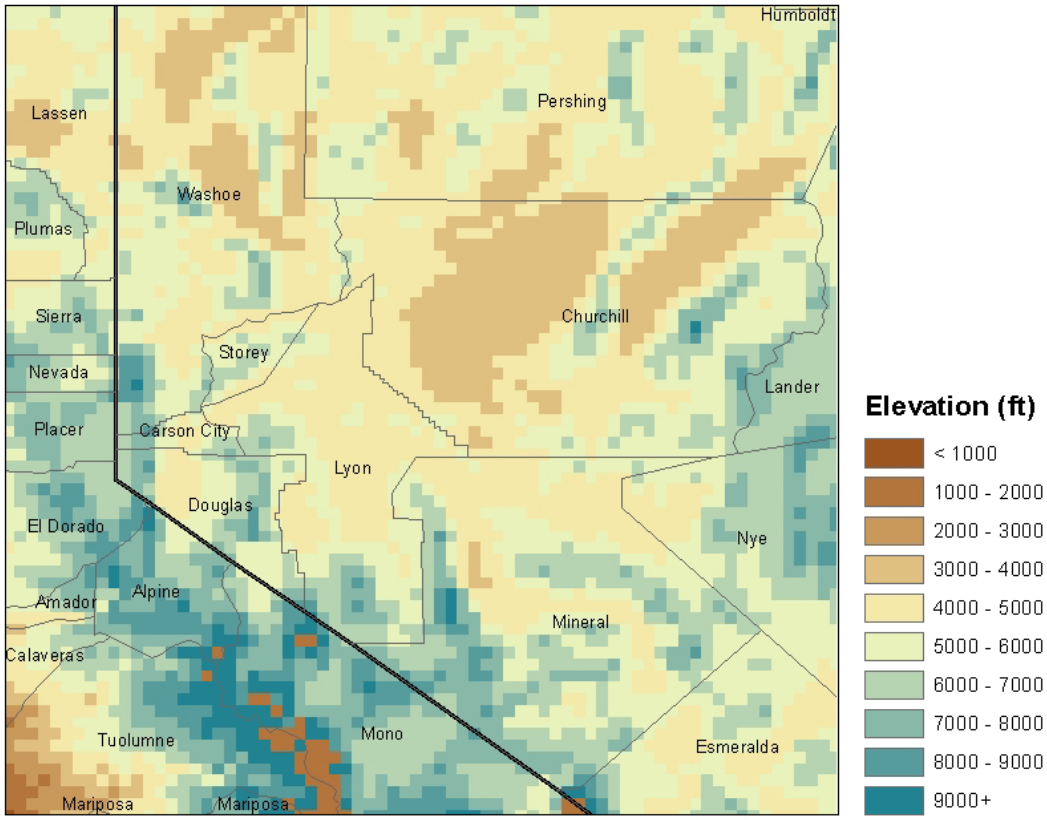


Figure 3. 1981-2010 Annual Average Precipitation in the CCD Planning Area and Vicinity

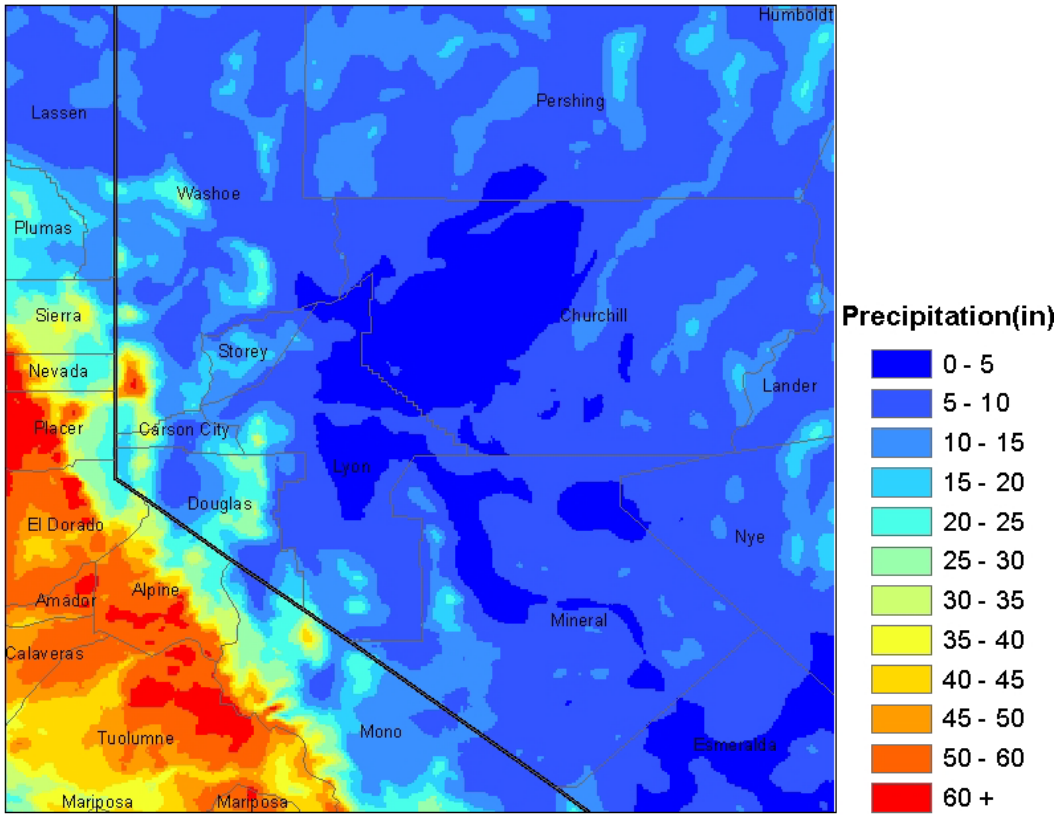
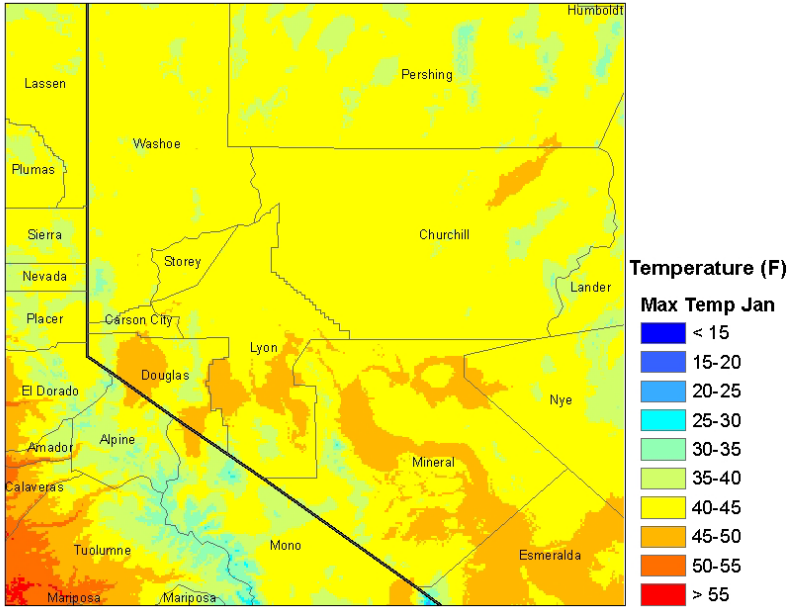
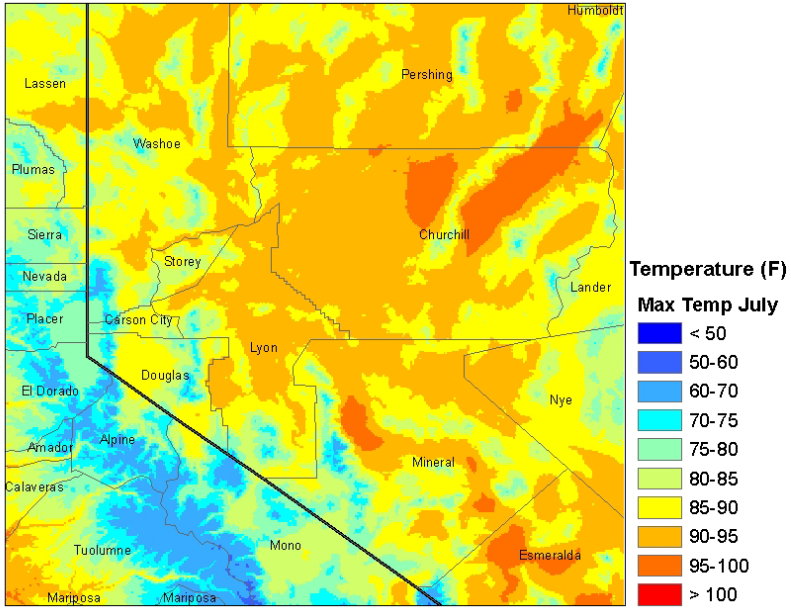
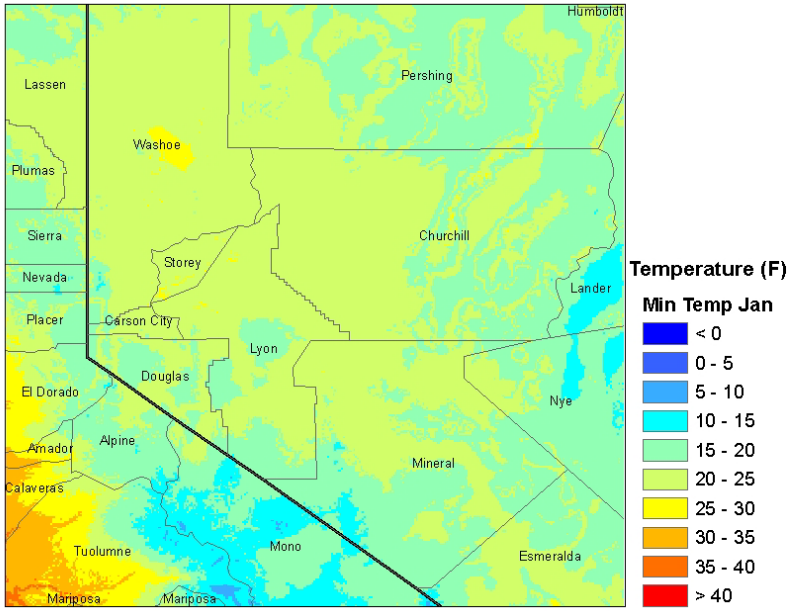
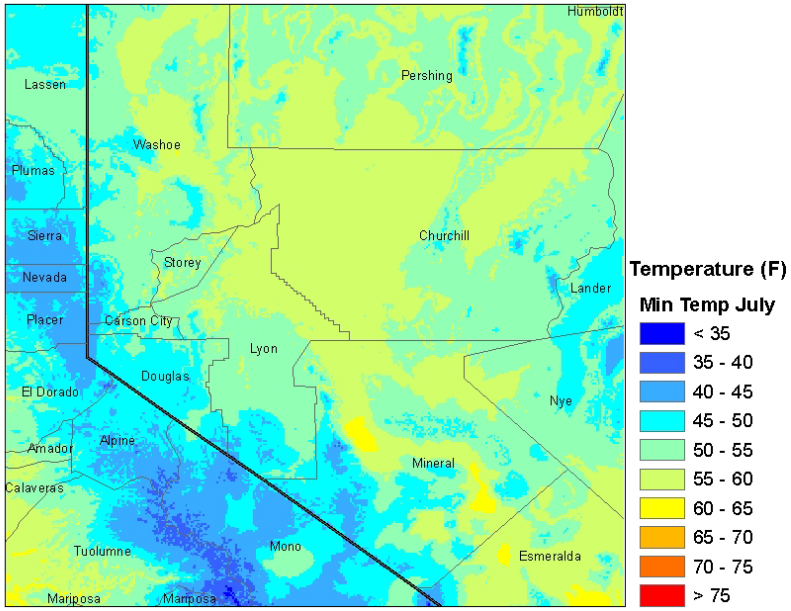


Figure 4. 1981-2010 Monthly Averaged High (top) and Low (bottom) Temperatures (°F) in January (left) and July (right)

	January	July
Monthly Average High Temperatures		

	January	July
Monthly Average Low Temperatures		

1.2 AIR QUALITY

The US Environmental Protection Agency (EPA) and the states of Nevada and California have identified several criteria air pollutants that could impact public health when exposed for a period of time at high concentrations. These include ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), suspended particulate matter, and lead. The state of Nevada and California also list hydrogen sulfide (H_2S) as a criteria air pollutant. State and National Ambient Air Quality Standards (NAAQS) have been set for each of these pollutants and must be met. In addition to the criteria pollutants, hazardous air pollutants such as mercury need to be monitored for health concerns. Controls are usually required at the source to limit the release of these air toxics into the atmosphere. Suspended particulates can also reduce visibility, so their emissions should be minimized.

Climate change has become an increasingly important issue as concentrations of greenhouse gases like carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) continue to rise. Greenhouse gases absorb terrestrial infrared radiation and send some of the heat back to earth. The more greenhouse gases that are emitted, the greater the potential for a warmer planet. Climate change's greatest impacts are expected to be in the Polar Regions, but they could also influence the climate in the CCD planning area. One possible change could be the precipitation pattern. More precipitation could fall as rain instead of snow, which could affect stream flows, water availability, and ecosystems. Curtailing greenhouse gas emissions in the CCD planning area and around the world would be needed to minimize the impacts of climate change.

1.3 EMISSIONS

The BLM-administered land in the Carson City District contains vast areas of land for recreational activities, geothermal activity, farming, and mining. Emissions from each sector will be addressed in **Section 2**. Planning must also take into account emissions from non-BLM land such as the Reno-Sparks region, which could impact air quality downwind.

This page intentionally left blank.

SECTION 2
EMISSION SOURCES

Section 2.1 first describes the typical state and federal actions taken to reduce the concentrations of criteria pollutants and to reduce the emissions of air toxics. It also includes the general emission sources of these pollutants and their adverse impacts on human health. Section 2.2 reviews the air quality at monitors within the CCD planning area. This is followed by a discussion of some potential impacts due to climate change in Section 2.3, borrowed from the Winnemucca RMP (BLM 2010). Section 2.4 discusses the major sources of criteria and hazardous air pollutants and greenhouse gases within the Carson City District Planning Area.

2.1 CRITERIA AND HAZARDOUS POLLUTANTS

Federal and state air quality management programs have evolved using two distinct management approaches:

- The State Implementation Plan sets ambient air quality standards for acceptable exposure to air pollutants, conducts monitoring programs to identify locations experiencing air quality problems, and develops programs and regulations designed to reduce or eliminate those problems.
- The Hazardous Air Pollutant regulatory process identifies specific chemical substances that are potentially hazardous to human health and sets emission standards to regulate the amount of those substances that can be released by individual commercial or industrial facilities or by specific types of equipment.

Air quality programs based on ambient air quality standards typically address air pollutants that are produced in large quantities by widespread types of emission sources and are of public health concern because of their toxic properties. The EPA has established NAAQS for several different pollutants, which often are referred to as criteria pollutants (ozone, nitrogen dioxide, carbon monoxide,

sulfur dioxide, suspended particulate matter, and lead). Standards for suspended particulate matter have been set for two size fractions: inhalable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) that are particulate matter of a size equal or less than 10 and 2.5 microns, respectively. NAAQS are based primarily on evidence of acute and chronic health effects. NAAQS apply to outdoor locations to which the general public has access.

Both California and Nevada have adopted state ambient air quality standards that are equal to or more stringent than the comparable NAAQS. The only exceptions are the one-hour nitrogen dioxide and sulfur dioxide standards, in which the federal standards were revised in 2010 to be more stringent than in California. Both states also adopted an ambient air quality standard for hydrogen sulfide, a pollutant that is not covered by federal ambient air quality standards. **Table 3** summarizes current Nevada, California, and federal ambient air quality standards.

Table 3
State and National Ambient Air Quality Standards

Pollutant	Averaging Time	Nevada Standards	California Standards	National Standards
Ozone	1 hour (outside Lake Tahoe Basin)	0.12 ppm	0.09 ppm	Standard rescinded
Ozone	1 hour (in Lake Tahoe Basin)	0.10 ppm	0.09 ppm	Standard rescinded
Ozone	8 hour	Not applicable	0.070 ppm	0.075 ppm
Carbon Monoxide	1 hour	35 ppm	20 ppm	35 ppm
Carbon Monoxide	8 hour (areas below 5,000 feet elevation)	9 ppm	9 ppm	9 ppm
Carbon Monoxide	8 hours (areas at or above 5,000 feet elevation)	6 ppm	6 ppm	9 ppm
Nitrogen Dioxide	Annual average	0.053 ppm	0.030 ppm	0.053 ppm
Nitrogen Dioxide	1 hour	Not applicable	0.18 ppm	0.100 ppm
Sulfur Dioxide	Annual average	0.030 ppm	Not applicable	Standard rescinded
Sulfur Dioxide	24 hour	0.14 ppm	0.04 ppm	Standard rescinded
Sulfur Dioxide	3 hour	0.5 ppm	Not applicable	0.5 ppm
Sulfur Dioxide	1 hour	Not applicable	0.25 ppm	0.075 ppm
Inhalable Particulate Matter (PM_{10})	Annual arithmetic mean	50 μg/m³	20 μg/m³	Not applicable
Inhalable Particulate Matter (PM_{10})	24 hours	150 μg/m³	50 μg/m³	150 μg/m³

Table 3
State and National Ambient Air Quality Standards

Pollutant	Averaging Time	Nevada Standards	California Standards	National Standards
Fine Particulate Matter ($PM_{2.5}$)	Annual arithmetic mean	Not applicable	12 µg/m³	12 µg/m³
Fine Particulate Matter ($PM_{2.5}$)	24 hours	Not applicable	Not applicable	35 µg/m³
Lead Particles (TSP sampler)	Calendar quarter	1.5 µg/m³	Not applicable	1.5 µg/m³
Lead Particles (TSP sampler)	Rolling 3-month average	Not applicable	Not applicable	0.15 µg/m³
Lead Particles	30-day average	Not applicable	1.5 µg/m³	Not applicable
Hydrogen Sulfide	1 hour	0.08 ppm	0.03 ppm	Not applicable
Sulfates	24-hour	Not applicable	25 µg/m³	Not applicable
Vinyl Chloride	24-hour	Not applicable	0.01 ppm	Not applicable

Sources: California Air Resources Board Ambient Air Quality Standards (CARB 2009); Nevada Division of Environmental Protection (NDEP 2010); US Environmental Protection Agency National Ambient Air Quality Standards (EPA 2013a)

Notes:
ppm = parts per million
All standards except the national PM_{10} and $PM_{2.5}$ standards are based on measurements corrected to 25 degrees C and 1 atmosphere pressure.
The national PM_{10} and $PM_{2.5}$ standards are based on direct flow volume data without correction to standard temperature and pressure.
The national 1-hour ozone standard was rescinded for 41 states (including Nevada) prior to June 2005 but remains in effect for portions of Colorado, Georgia, Maryland, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
The national 8-hour ozone standard was revised from 0.08 ppm to 0.075 ppm effective May 27, 2008.
A 1-hour NO_2 standard was added in California in February, 2007 and nationally on April 12, 2010
The national 24-hour standard for $PM_{2.5}$ was revised from 65 micrograms per cubic meter to 35 micrograms per cubic meter effective December 17, 2006. The national primary standard for annual $PM_{2.5}$ was revised from 15 micrograms per cubic meter to 12 micrograms per cubic meter on December 14, 2012.
The "10" in PM_{10} and the "2.5" in $PM_{2.5}$ are not particle size limits but identify the particle size class (aerodynamic diameter in microns) collected with 50 percent mass efficiency by certified sampling equipment. The maximum particle size collected by PM_{10} samplers is about 50 microns. The maximum particle size collected by $PM_{2.5}$ samplers is about 6 microns.
The national 3-month rolling average standard for lead was adopted in November 2008. The previous calendar quarter lead standard will remain in effect for a minimum of one year.
The Nevada standard for hydrogen sulfide represents an increment above naturally occurring background concentrations.

Air pollutants covered by federal and state ambient air quality standards can be categorized by the nature of their toxic effects as:

- Irritants (such as ozone, particulate matter, nitrogen dioxide, sulfur dioxide, sulfate particles, and hydrogen sulfide) that affect the respiratory system, eyes, mucous membranes, and the skin

- Asphyxiates (such as carbon monoxide and nitric oxide) that displace oxygen or interfere with oxygen transfer in the circulatory system, affecting the cardiovascular and central nervous systems
- Necrotic agents (such as ozone, nitrogen dioxide, and sulfur dioxide) that directly cause cell death
- Systemic poisons (such as lead particles) that affect a range of tissues, organs, and metabolic processes

Ozone, suspended particulate matter, and carbon monoxide are the air pollutants of greatest concern in most parts of the country. Ozone is seldom released directly into the atmosphere but forms from complex chemical reactions that occur in sunlight. The chemical reactions that produce ozone involve a wide range of organic compounds, nitric oxide, nitrogen dioxide, and oxygen. Reactive organic compounds and nitrogen oxides (NO_X) (the combination of nitric oxide and nitrogen dioxide) are the precursor emission products that form ozone. The atmospheric chemical reaction processes that produce ozone also produce chemically formed particulate matter and acidic compounds. Combustion processes and evaporation of volatile organic compounds (VOC) are the major emission sources for organic compounds. Common fuel combustion sources include fuel combustion in motor vehicles, fuel combustion in industrial processes, agricultural burning, prescribed burning, and wildfires. Common evaporative sources of organic compounds include paints, solvents, liquid fuels, or liquid chemicals. Combustion processes are the major source of emissions for nitrogen oxides. Biogenic sources are also a source for VOC emissions.

The major emission source categories for suspended particulate matter include combustion sources (fuel combustion in motor vehicles and industrial processes, agricultural burning, prescribed burning, and wildfires); industrial grinding and abrasion processes; soil disturbance by construction equipment, agricultural and forestry equipment, recreational vehicles, or other vehicles and equipment; mining and other mineral extraction activities; and wind erosion from exposed soils and sediments. Suspended particulate matter is also formed by the types of atmospheric chemical reactions that produce ozone and acidic compounds secondary particulate matter). Secondary particulate matter precursors include sulfur dioxide, nitrogen oxides, ammonia and some VOC species.

The major sources of carbon monoxide are combustion processes, such as fuel combustion in motor vehicles and industrial processes, agricultural burning, prescribed burning, and wildfires.

Ozone is a strong oxidizing agent that reacts with a wide range of materials and biological tissues. It is a respiratory irritant that can have acute and chronic effects on the respiratory system. Recognized effects include reduced pulmonary function, pulmonary inflammation, increased airway reactivity, aggravation of

existing respiratory diseases (such as asthma, bronchitis, and emphysema), physical damage to lung tissue, decreased exercise performance, and increased susceptibility to respiratory infections. In addition, ozone is a necrotic agent that significantly damages leaf tissues of crops and natural vegetation. Ozone also damages many materials by acting as a chemical oxidizing agent. Because of its chemical activity, indoor ozone levels are usually much lower than outdoor levels.

Suspended particulate matter represents a diverse mixture of solid and liquid material having size, shape, and density characteristics that allow the material to remain suspended in the air for meaningful time periods. The physical and chemical composition of suspended particulate matter is highly variable, resulting in a wide range of public health concerns. Many components of suspended particulate matter are respiratory irritants. Some components (such as crystalline or fibrous minerals) are primarily physical irritants. Other components are chemical irritants (such as sulfates, nitrates, and various organic chemicals). Suspended particulate matter also can contain compounds (such as heavy metals and various organic compounds) that are systemic toxins or necrotic agents. Suspended particulate matter or compounds adsorbed on the surface of particles can also be carcinogenic or mutagenic chemicals.

Public health concerns for suspended particulate matter focus on the particle size ranges likely to reach the lower respiratory tract or the lungs. Inhalable particulate matter (PM_{10}) represents particle size categories that are likely to reach either the lower respiratory tract or the lungs after being inhaled. Fine particulate matter ($PM_{2.5}$) represents particle size categories likely to penetrate to the lungs after being inhaled. The "10" in PM_{10} and the "25" in $PM_{2.5}$ are not upper size limits but refer to the particle size range collected with 50 percent mass efficiency by certified sampling devices; larger particles are collected with lower efficiencies, and smaller particles are collected with higher efficiencies.

In addition to public health impacts, suspended particulate matter causes a variety of material damage and nuisance effects: abrasion; corrosion, pitting, and other chemical reactions on material surfaces; soiling; and transportation hazards due to visibility impairment.

Carbon monoxide is a public health concern because it combines readily with hemoglobin in the blood and thus reduces the amount of oxygen transported to body tissues. Relatively low concentrations of carbon monoxide can significantly affect the amount of oxygen in the blood stream since carbon monoxide binds to hemoglobin 200 to 250 times more strongly than oxygen. Both the cardiovascular system and the central nervous system can be affected when 2.5 to 4.0 percent of the hemoglobin in the blood is bound to carbon monoxide rather than to oxygen. Because of its low chemical reactivity and low solubility, indoor carbon monoxide levels usually are similar to outdoor levels.

Air quality programs based on regulation of other hazardous substances typically address chemicals used or produced by limited categories of industrial facilities. Programs regulating hazardous air pollutants focus on substances that alter or damage the genes and chromosomes in cells (mutagens); substances that affect cells in ways that can lead to uncontrolled cancerous cell growth (carcinogens); substances that can cause birth defects or other developmental abnormalities (teratogens); substances with serious acute toxicity effects; and substances that undergo radioactive decay processes, resulting in the release of ionizing radiation. Federal air quality management programs for hazardous air pollutants focus on setting emission limits for particular industrial processes rather than setting ambient exposure standards. Federal emission standards for hazardous air pollutants have been promulgated as National Emission Standards for Hazardous Air Pollutants and as Maximum Available Control Technology (MACT) standards. The federal MACT standard for mercury emissions from coal-fired power plants represents an example of such hazardous air pollutant control programs. Nevada has adopted a state MACT standard for mercury emissions from thermal process units at precious metals mining operations. The National Emission Standards for Hazardous Air Pollutants and MACT standards are implemented through federal and state air quality permit programs.

In general, states have assumed primary responsibility for enforcing most federal permit requirements, with the EPA exercising a formal review and oversight responsibility. Some states, including Nevada and California, have separate air permit programs authorized by state legislation. State air permit requirements typically cover emission sources that are smaller than those subject to federal permit requirements. In most cases, state air permit programs have been integrated with federal New Source Review, Prevention of Significant Deterioration, and Title V requirements to provide a consolidated permit program. Under most consolidated permit programs, basic state permit requirements apply to all sources that are not specifically exempted. Additional New Source Review and Prevention of Significant Deterioration program requirements (including US EPA review of the permit) become applicable if sources exceed various size or emission thresholds.

There are no Prevention of Significant Deterioration program Class I visibility protection areas within the CCD planning area. The only Class I area in Nevada is the Jarbidge Wilderness in north-central Elko County. In California, the nearest Class I area is in the Mokelumne Wilderness in Alpine County, which is outside of the CCD planning area.

The federal Clean Air Act requires each state to identify areas that have ambient air quality in violation of federal standards. States are required to develop, adopt, and implement a State Implementation Plan to achieve, maintain, and enforce federal ambient air quality standards in these nonattainment areas. Deadlines for achieving the federal air quality standards vary according to air pollutant and the severity of existing air quality problems.

The State Implementation Plan must be submitted to and approved by the EPA. State Implementation Plan elements are developed on a pollutant-by-pollutant basis whenever one or more air quality standards are being violated.

The status of areas with respect to federal ambient air quality standards is categorized as nonattainment, attainment (better than national standards), or unclassified (due to an absence of monitoring data). Areas that have been designated from nonattainment to attainment are considered maintenance areas, although this designation is seldom indicated in formal listings of attainment status designations. Unclassified areas are treated as attainment areas for most regulatory purposes. In the CCD planning area, Washoe County (contains Reno-Sparks) is currently designated as a non-attainment area for PM_{10}. All other areas are considered attainment or unclassified for all federal ambient air quality standards.

2.2 AIR QUALITY OBSERVATIONS

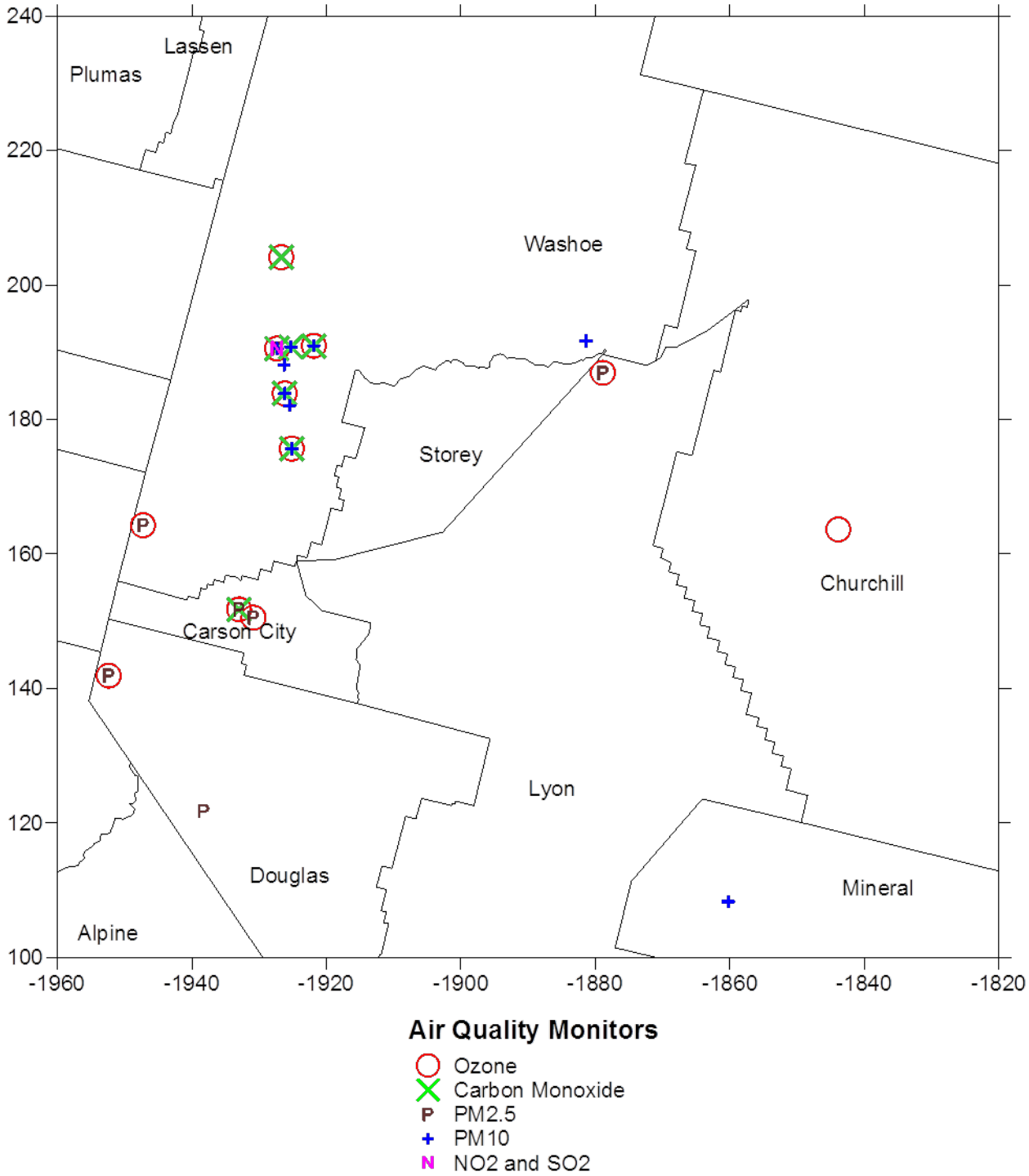
Air quality data was obtained from the EPA (EPA 2013b) and from the "Nevada Air Quality Trend Report, 2000-2010", published by the Nevada Division of Environmental Protection (NDEP 2013), whose Bureau of Air Quality Planning operates and maintains a network of ambient air quality monitors in rural Nevada. No air quality data in the small regions of the California counties in the CCD planning area was available. Air quality statistics from both EPA and NDEP monitors in the CCD planning area for the past decade are listed in **Tables 4** to **11** with their locations plotted in **Figure 5**, Location of Air Quality Monitors in the CCD Planning Area.

2.2.1 Ozone

The federal 1-hour ozone standard has been rescinded, but the state of Nevada still implements a 1-hour ozone standard of 120 parts per billion (ppb), and 100 ppb in the Lake Tahoe basin. **Table 4**, Highest Observed 1-hour Ozone (ppb) in the CCD Planning Area, lists the highest 1-hour ozone from ozone monitors in the CCD for the past 10 years; all sites are in attainment.

The federal 8-hour ozone standard requires that the fourth highest daily maximum 8-hour ozone averaged over a 3 year period be 75 ppb or less. All monitors in the CCD have met the criteria in the past 10 years including all sites in the Reno-Sparks area, as listed in **Table 5**, Fourth Highest Observed 8-hour Ozone (ppb) in the CCD Planning Area. It should be noted that the fourth highest ozone in 2012 was the highest since 2008 at all monitors except Fallon and Fernley.

Figure 5. Location of Air Quality Monitors in the CCD Planning Area



Source: Nevada Air Quality Trend Report 2000-2010, NDEP 2013

Table 4
Highest Observed 1-hour Ozone (ppb) in the CCD Planning Area

Year	Carson City (5th St, left; Long St, right)	Cave Rock	Incline Village	Fallon	Fernley	Reno*	Lemmon Valley	Sparks
2012	80		78	61	80	94	82	93
2011	74		77	68	94	79	79	86
2010	71		71	70	77	83	76	84
2009	81		73	74	73	77	76	76
2008	106		92	82	83	110	85	112
2007	80			81	74	90	85	88
2006	86			79		99	93	107
2005	72		70	69		81	82	83
2004	82	61	73			86	75	86
2003	79	80	87			102	74	99

Source: EPA 2013b; NDEP 2013
*highest value from three monitors in Reno (301 A State St, 4110 De Lucci Ln, and 684a State Route 341)

Table 5
Fourth Highest Observed 8-hour Ozone (ppb) in the CCD Planning Area

Year	Carson City (5th St, left; Long St, right)	Cave Rock	Incline Village	Fallon	Fernley	Reno*	Lemmon Valley	Sparks
2012	72		65	52	71	72	71	71
2011	64		59	54	72	66	66	67
2010	64		62	62	63	70	68	68
2009	69		63	60	58	65	65	64
2008	74		72	68	69	72	71	74
2007	67			70	62	72	73	71
2006	70			65		74	72	74
2005	61	51	63	58		69	69	68
2004	66	66	64			72	65	70
2003	65	74	68			74	60	76

Source: EPA 2013b; NDEP 2013
*highest value from three monitors in Reno (301 A State St, 4110 De Lucci Ln, and 684a State Route 341)

2.2.2 Carbon Monoxide

Carbon monoxide (CO) violates the NAAQS when the second highest 1-hour and 8-hour averages exceed 35 ppm and 9 ppm, respectively. Over the past decade, all monitors in the CCD were in attainment for both federal and state level CO standards. **Tables 6**, Second Highest Observed 1-hour CO (ppm) in the CCD Planning Area, and **7**, Second Highest Observed 8-hour CO (ppm) in the CCD Planning Area, list the second highest 1- and 8-hour CO

Table 6
Second Highest Observed 1-hour CO (ppm) in the CCD Planning Area

Year	Carson City	Stateline	Reno*	Lemmon Valley	Sparks
2012		9.2	2.7	1.9	2.8
2011		6.8	2.7	2	3.4
2010		5.7	2.7	2.2	3.1
2009		7.6	3.0	2.6	4.2
2008	2.7**	5.4	3.4	1.9	3.9
2007	4.6	7.5	4.2	3.3	4.7
2006	4.3	5.0**	4.8	3.4	4.5
2005	4.3	7.8	4.0	2.7	4.4
2004	5.1	9.4	5.3	3.2	5.8
2003	5.3	11.2	6.1	3.7	6.1

Source: EPA 2013b; NDEP 2013
*highest of the four observations in Reno (301 A State St, 4110 DeLucci Ln, 305 Galletti Way, and 684a State Route 341)
**incomplete year

Table 7
Second Highest Observed 8-hour CO (ppm) in the CCD Planning Area

Year	Carson City	Stateline	Reno*	Lemmon Valley	Sparks
2012		5.4**	1.7	1.5	2.2
2011		2.7	1.9	1.4	2.6
2010		3.1	2.1	1.5	2.6
2009		2.6	2.3	1.6	2.6
2008	1.7**	2.4	2.4	1.5	2.9
2007	2.6	3.7	3.3	1.8	3.1
2006	2.7	3.0**	3.3	1.9	3.0
2005	2.7	3.6	3.2	1.8	3.2
2004	2.9	4.4	3.9	2.1	3.9
2003	3.1	6.5	3.6	1.9	3.8

Source: EPA 2013b; NDEP 2013
*highest of the four observations in Reno (301 A State St, 4110 DeLucci Ln, 305 Galletti Way, and 684a State Route 341)
**incomplete year

concentration, respectively, for each year. The 5.4 ppm 8-hour CO at Stateline in 2012, when only about a quarter of the annual observations were available, was the highest value in nine years and very close to the 6 ppm state standard for areas over 5,000 feet.

2.2.3 $PM_{2.5}$

Samples of 24-hour particulates are often only measured once every 3 or 6 days. $PM_{2.5}$ metrics typically rank all of the samples in the year and identify the concentration at the 98th percentile for each year. A 3-year average is used to determine attainment status for both the 24-hour and annual metrics. **Tables 8**, Three-year Average of 24-hour PM2.5 Concentrations at the 98th Percentile (µg/m3), and **9**, Three-year Average of Annual $PM_{2.5}$ Concentrations (µg/m³), show the 3-year averages of the 24-hour $PM_{2.5}$ observations at the 98th percentile and the annual averages, respectively.

Table 8
Three-year Average of 24-hour $PM_{2.5}$ Concentrations at the 98th Percentile (µg/m³)

Year	Carson City (5th St, left; Long St, right)	Fernley	Gardner-ville	Cave Rock	Incline Village	Reno (State St. Monitor 1)	Reno (State St. Monitor 2)
2010 - 2012						17.3	22.3
2009 – 2011	27.0	15.2	29.3			26.0	31.0
2008 – 2010		15.4	29.2			29.0	33.7
2007 – 2009	24.8	14.5	28.4			31.7	33.3
2006 – 2008	21.3	10.6	27.0			27.0	29.3
2005 – 2007	34.9	12.8	42.2			30.7	35.0
2004 – 2006	36.4	13.8	46.1			32.3	36.7
2003 – 2005	36.2	14.1	45.2			29.7	33.7
2002 – 2004	21.0	15.0	30.5			24.7	25.0
2001 – 2003	20.5	18.5	28.3			27.0	29.7
2000 – 2002	23.9	21.7	29.4	8.7	11.0	31.0	33.3

Source: EPA 2013b; NDEP 2013

Table 9
Three-year Average of Annual $PM_{2.5}$ Concentrations (µg/m³)

Year	Carson City (5th St, left; Long St, right)	Fernley	Gardner-ville	Cave Rock	Incline Village	Reno (State St. Monitor 1)	Reno (State St. Monitor 2)
2010 - 2012						6.1	6.1
2009 - 2011	13.4	4.8	10.9			6.8	6.9
2008 - 2010		4.4	11.7			7.4	7.4
2007 - 2009		4.2	11.2			8.1	8.0
2006 - 2008			11.4			8.0	7.9
2005 - 2007	5.4		10.2			8.2	8.0
2004 - 2006	4.8		8.9			8.2	8.1
2003 - 2005	4.8	3.8	7.0			8.1	7.9
2002 - 2004	4.1	3.9	6.5			8.2	8.0
2001 - 2003	4.4	4.5	6.1			8.7	8.8
2000 - 2002	4.8	5.0	6.2	3.3	5.4	9.3	9.4

Source: EPA 2013b; NDEP 2013

In December, 2006, the national 24-hour $PM_{2.5}$ standard was reduced from 65 μg/m³ to 35 μg/m³. In the past decade, all monitors in the CCD planning area met the original standard, but between the 2003-2005 and 2005-2007 periods, three areas exceeded the new standard: Carson City, Gardnerville, and Reno (if using Monitor 2 at the 310 A State Street site; Monitor 1 complied with the new standard). All sites have complied with the more stringent 24-hour standard since the 2006 to 2008 three-year period.

In December 2012, the EPA modified the primary standard for annual $PM_{2.5}$ from 15 μg/m³ to 12 μg/m³. An area would be classified as non-attainment if the average annual $PM_{2.5}$ for three consecutive years exceeded the standard; no designation will be assigned for the new standard until at least 2014 (EPA 2012).

In the past decade, all sites within the CCD planning area complied with the older annual $PM_{2.5}$ standard. However, the 2009 – 2011 annual $PM_{2.5}$ at Carson City (13.4 μg/m³) is higher than the new standard. The Carson City 5th Street monitor was relocated from the Long Street monitoring site for a special study (BLM 2013a). The 5th Street location was adjacent to a maintenance yard and sewage treatment plant, and the annual $PM_{2.5}$ concentration was more than double the concentration at the older Long Street site. The 5th Street monitor was discontinued and relocated in December, 2012. It is unknown whether a local source influenced the elevated 5th Street $PM_{2.5}$ concentrations or particulate concentrations have become more elevated in recent years in Carson City.

The other $PM_{2.5}$ monitoring site that bears watching is in Gardnerville. The annual $PM_{2.5}$ concentration has been trending upwards; the 2007-2009 annual $PM_{2.5}$ (11.7 μg/m³) is very close to the new standard.

The Carson City and Gardnerville monitors reside on private land. To their east are the Pine Nut Mountains, which are on federal land. Although easterlies are not the predominant wind direction, there could be cold air drainage on calm nights that could trap and/or transport the emissions from the mountains into the valleys. Plans to limit particulate emissions in these areas should be considered considering the high annual $PM_{2.5}$ concentrations at these monitors.

2.2.4 PM_{10}

The NAAQS for 24-hour PM_{10} is 150 μg/m³; no monitor should exceed this threshold more than once per year on average over a three year period. The monitor in Wadsworth (340 Pyramid St), which turned online in 2010, is located about 1,000 feet from the Pyramid Lake Scenic Byway (State Route 447) and has exceeded the threshold twice in both 2011 and 2012, putting it on track towards exceeding the NAAQS 24-hour PM_{10} standard, as highlighted in **Table 10**, Second Highest 24-hour PM_{10} for Each Year (μg/m³). All other monitors meet the national 24-hour standard for PM_{10}.

Table 10
Second Highest 24-hour PM_{10} for Each Year (µg/m³)

Year	Schurz	Reno*	Sparks*	Wadsworth
2012	24**	73	47	194
2011	145	112	62	169
2010	80	77	48	48**
2009	31	88	64	
2008	79	87	63	
2007	55	115	67	
2006		104	69	
2005		60	71	
2004		80	66	
2003		84	77	

Source: EPA 2013b; NDEP 2013
*Largest of second highest concentrations from multiple monitors in each city
** Observations valid for only < 100 days in the year

2.2.5 Sulfur Dioxide and Nitrogen Dioxide

Sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) observations were only available at one monitoring station in the CCD planning area -- Reno (301 A State Street). **Table 11**, 1-hour NO_2 at the 98th Percentile and 1-hour SO_2 at the 99th Percentile in Reno, lists the 1-hour concentrations at the 98th percentile for NO_2 and 99th percentile for SO_2. These concentrations averaged over a 3-year period needed to be below 100 ppb and 75 ppb for NO_2 and SO_2, respectively, to achieve attainment of the NAAQS. The Reno monitor met both standards.

Table 11
1-hour NO_2 at the 98th Percentile and 1-hour SO_2 at the 99th Percentile in Reno

Year	NO_2 [ppb]	SO_2 [ppb]
2012	53	6
2011	58	5
2010	55	
2009	67	
2008	56	
2007	63	
2006	70	
2005	65	
2004		
2003		

Source: EPA 2013b; NDEP 2013

2.3 CLIMATE CHANGE

Climate is the long-term average of annual and seasonal weather conditions in a region. Greenhouse gases are compounds in the atmosphere that absorb infrared radiation and re-radiate a portion of that back to the earth's surface, thus trapping heat and warming the atmosphere. Greenhouse gases have the potential to affect climate patterns, which in turn can affect resource management. The most important naturally occurring greenhouse gas compounds are carbon dioxide, methane, nitrous oxide, ozone, and water vapor. Carbon dioxide, methane, and nitrous oxide are produced naturally by the following processes:

- Respiration and other physiological processes of plants, animals, and microorganisms
- Decomposition of organic matter
- Volcanic and geothermal activity
- Naturally occurring wildfires
- Natural chemical reactions in soil and water

Ozone is not released directly by natural sources but forms during complex chemical reactions in the atmosphere, among organic compounds and nitrogen oxides in the presence of ultraviolet radiation. While water vapor is a strong greenhouse gas, its concentration in the atmosphere is primarily a result of, not a cause of, changes in surface and lower atmospheric temperature conditions.

Although naturally present in the atmosphere, concentrations of carbon dioxide, methane, and nitrous oxide also are due to industrial processes, transportation technology, urban development, agricultural practices, and other human activity. The Intergovernmental Panel on Climate Change (IPCC) estimates the following changes in global atmospheric concentrations of the most important greenhouse gases (IPCC 2001, 2007):

- Atmospheric concentrations of carbon dioxide have risen from a preindustrial background of 280 parts per million (ppm) by volume to 379 ppm in 2005.
- Atmospheric concentrations of methane have risen from a preindustrial background of about 0.70 ppm to 1.774 ppm in 2005.
- Atmospheric concentrations of nitrous oxide have risen from a preindustrial background of 0.270 ppm to 0.319 ppm in 2005.

The IPCC has concluded that these changes in atmospheric composition are almost entirely the result of human activity, not the result of changes in natural processes that produce or remove these gases (IPCC 2007).

The EPA estimates that national greenhouse gas emissions in 2007 were 7,881 million tons of carbon dioxide equivalents (CO_2eq; EPA 2009). National greenhouse gas emissions in 2007 represented a 17.24 percent increase from estimated 1990 national greenhouse gas emissions (6,722 million tons of carbon dioxide equivalents). The EPA categorized the major economic sectors contributing to US emissions of greenhouse gas compounds as follows:

- Electric power generation (34.2 percent)
- Transportation (27.9 percent)
- Industrial processes (19.4 percent)
- Agriculture (7.0 percent)
- Commercial land uses (5.7 percent)
- Residential land uses (5.0 percent)
- US Territories (0.8 percent)

The Nevada Division of Environmental Protection (2008) has estimated Nevada's statewide greenhouse gas emissions at 56.7 million tons of carbon dioxide equivalent in 2005. This was 0.79 percent of the US national greenhouse gas emission inventory for 2005. The major sectors contributing to Nevada's greenhouse gas emissions in 2005 were as follows:

- Electric power generation (46.6 percent)
- Transportation (30.1 percent)
- Industrial processes (4.4 percent)
- Agriculture (2.8 percent)
- Residential, commercial, and industrial land uses (12.1 percent)
- Waste management (2.5 percent)
- Fossil fuel industries (1.4 percent)

Sources of greenhouse gas emissions in the CCD planning area include wildfires and prescribed burns, vehicles (including OHVs), construction and operation for mineral and energy development, and grazing livestock, wild horses, and burros. To the extent that these activities increase, greenhouse gas emissions are also likely to increase.

Chambers et al. (2008) notes that historical data show an increase in mean annual temperature in the Great Basin, with most of the change resulting from higher minimum temperatures rather than higher maximum temperatures. Most portions of the Great Basin show a warming of 0.6 to 1.1°F over the past century. Regional climate models typically predict an additional warming of 3.6 to 9°F over the next century. Historical data also indicate an increase in annual

precipitation amounts in the Great Basin over the past century, together with increased year-to-year variability in precipitation amounts and a decrease in winter snow pack. These changes have resulted in earlier snowmelt, higher winter streamflow volumes, reduced spring peak volumes, and lower summer and fall streamflow volumes.

2.4 LOCAL EMISSION SOURCES

Significant sources of pollutant emissions in the CCD planning area include transportation, exploration and development of mineral resources, construction, agriculture, and geothermal power development. The largest changes since the last RMP would be the increase in off-highway vehicles (OHV), such as all-terrain vehicles, and geothermal energy extraction.

2.4.1 Recreation

The vast amount of open space in the CCD planning area attracts numerous tourists for recreational activities like camping, OHV traveling, hiking, horseback riding, hunting, and fishing. **Table 12**, Number of Visitors and Visitor-Days to the CCD Planning Area, lists the number of visitors and visitor days (aggregate of 12 visitor hours at an area) to the CCD planning area each year between 2006 and 2011, based on data from the BLM Recreation Management Information System. The number of visitors was highest in 2008, when the recession began, as lower-cost activities like camping may have become more popular.

Table 12
Number of Visitors and Visitor-Days to the CCD Planning Area

Year	Number of Visitors	Visitor-Days
2006	972,726	929,440
2007	1,010,192	948,757
2008	1,040,303	912,562
2009	972,392	863,017
2010	945,623	831,742
2011	945,623	840,653

Source: BLM 2012

Most of these activities require the use of motor vehicles to reach the destinations. The major emissions from motor vehicles would be nitrogen oxides (NOx) and some volatile organic compounds (VOCs), both of which are precursors to ozone production, and CO_2, a greenhouse gas. If the vehicle runs on diesel fuel, fine particulates would be emitted. Campfires would release NOx, VOCs, particulates, CO_2, and some CO. OHVs like all-terrain vehicles and snowmobiles would emit NOx, VOCs, and CO_2 from fuel combustion and fugitive dust. Emissions naturally would increase if there are more visitors.

In addition, maintenance and construction of new trails and trailhead facilities will locally add more ozone precursors and CO_2. Particulate emissions may also

increase locally during the construction phase as tractors may be used to haul dirt and gravel needed to level the trails.

The vast amount of space and low population density in the CCD, especially in the eastern half, would suggest that the visitors would be widely dispersed throughout the CCD planning area and that their emissions would not result in an accumulation of pollutants that would elevate concentrations high enough to exceed state or federal air quality standards. The Sand Mountain Recreation Area in Churchill County is a popular destination for OHV use. The number of OHVs may increase the level of dust locally, but with few other nearby sources of emissions besides Highway 50 traffic, it should not pose any health risks to air quality.

In Carson City, where $PM_{2.5}$ is higher than the new NAAQS annual $PM_{2.5}$ standard, trailhead construction and maintenance in areas such as the Silver Saddle Ranch and Prison Hill Recreation Area may minimally increase the $PM_{2.5}$ concentration in Carson City on calm nights due to cold air drainage, particularly when using diesel-burning machinery that emits a lot of particulate matter.

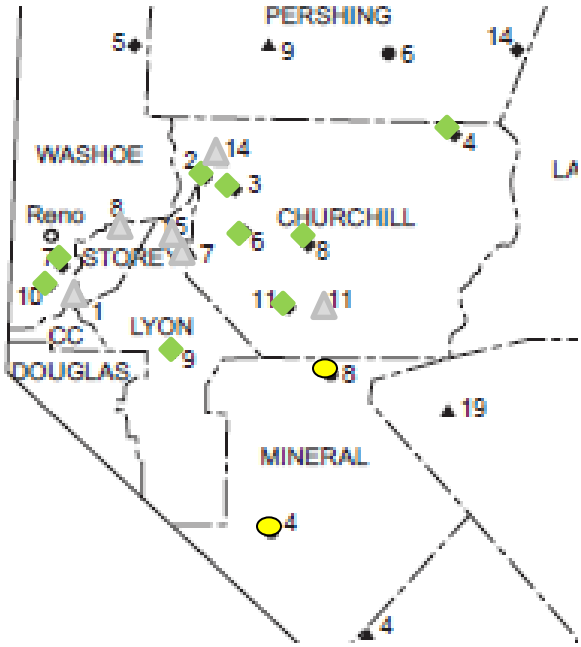
2.4.2 Mineral Extraction/Mining

Mining requires the use of heavy-duty diesel vehicles and machinery to drill, process, and transport the minerals. The use of such equipment will generate locally high fugitive dust emissions at the mining site and on unpaved roads leading in and out of the area. In addition to NO_X emissions from fuel combustion and fine particulates from diesel-powered machinery, CO_2 emissions are another by-product of fuel combustion.

Interest in mining for metallic minerals like gold, silver, and copper has risen in recent years due to the high prices for these metals. **Figure 6**, Major Mines and Geothermal Plants in 2011, shows the locations of the major active mines in the CCD planning area in 2011 (Nevada Division of Minerals 2012). Gold and silver were mined at two locations in Mineral County in 2011 while interest in copper mining near Yerington is growing. Besides the typical NO_X and particulate emissions coming from fuel combustion and dust, the mining and processing of gold can release mercury into the atmosphere. The State of Nevada has implemented a Nevada Mercury Control Program MACT to minimize mercury emissions at precious metal mines. All involved mining entities are required to comply with this Program.

Other minerals being mined in the CCD planning area include diatomite, gypsum, barite, and salt. These other mines have minimal local impacts on the air quality. Leasable minerals like coal, oil, and gas have had limited exploration and are not expected to be a major source of emissions in the foreseeable future.

Figure 6. Major Mines and Geothermal Plants in 2011



Metals
4. Borealis Mine
8. Denton-Rawhide Mine

Industrial minerals
1. Adams Gypsum Mine
5. Greystone Barite Mine
7. Celite Diatomite Mine
8. Clark Diatomite Mine
11. Huck Salt Mine
14. Moltan Diatomite Mine

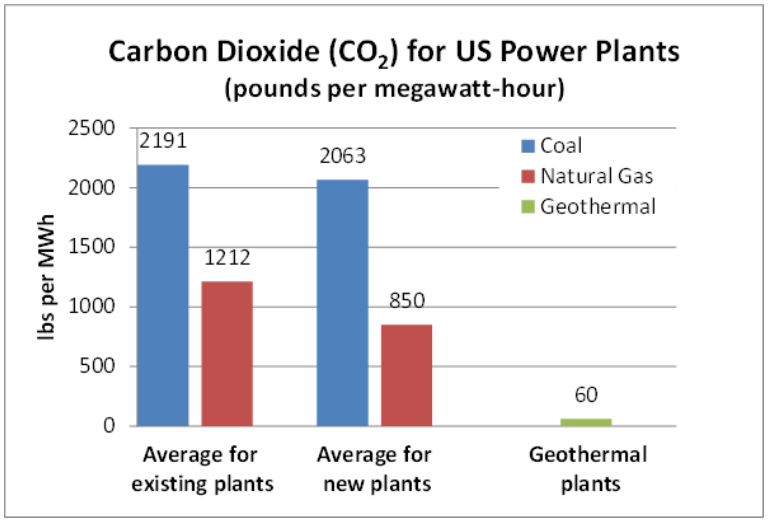
Geothermal power plants
2. Brady Hot Springs
3. Desert Peak 2
4. Dixie Valley
6. Soda Lake 1 and 2
7. Steamboat I, IA, II, and III, Galena
8. Stillwater 1 and 2
9. Wabuska
10. Steamboat Hills
11. Salt Wells

2.4.3 Renewable Energy

Geothermal power is a renewable energy source that emits very little CO_2 and hydrogen sulfide (which readily converts into SO_2), and no NO_X compared to existing and new coal and natural gas plants, as shown. Side by side emissions comparisons of these compounds from new coal and natural gas plants and geothermal plants are shown in **Figure 7**, Comparison of CO_2 Emissions, **Figure 8**, Comparison of SO_2 Emissions, and **Figure 9**, Comparison of NOx Emissions The CCD planning area is a very active geothermal resource area. As of January, 2012, there were 193 geothermal leases and several active geothermal power producers in the CCD planning area, as was shown in **Figure 6**. Geothermal exploration and development is likely to continue in the near future as the current administration encourages more renewable energy.

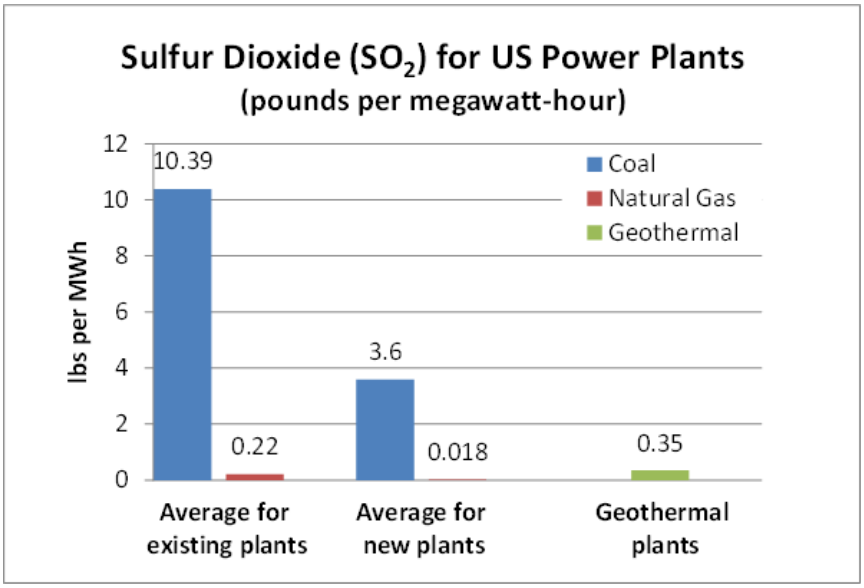
A geothermal plant takes years of construction before it can become an active energy producer. Heavy duty machinery to drill deep underground is needed, along with road systems for the crew to reach the plant, and power lines to

Figure 7. Comparison of CO_2 Emissions from Coal, Natural Gas, and Geothermal Power Plants



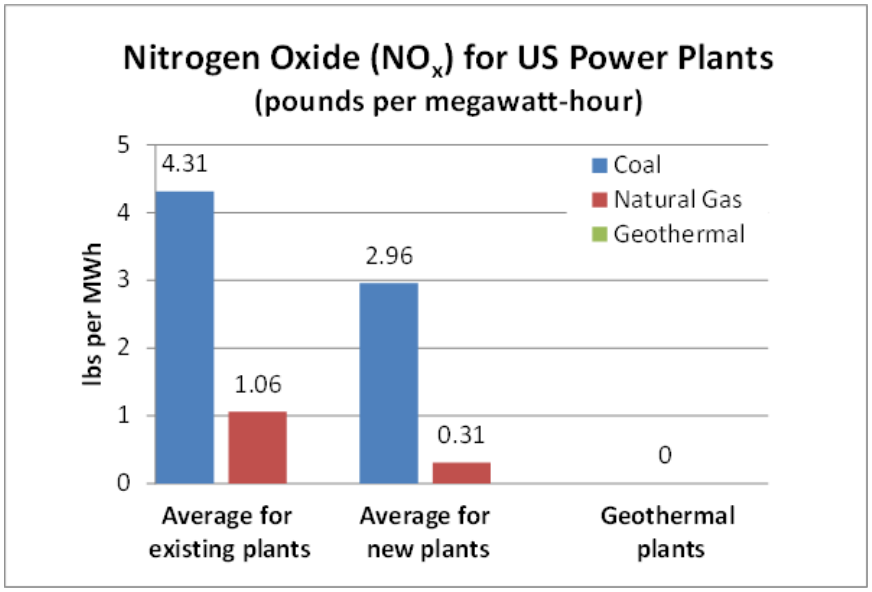
Source: Coal and natural gas emissions information from Platts Research and Consulting based on data from the Environmental Protection Agency's Continuous Emissions Monitoring System, 2003; geothermal information from US Department of Energy, 2000.
Existing - For all existing U.S. coal power plants; natural gas averages include steam cycle, simple gas turbine, and combine cycle.
New - Coal plants built in 1990s; natural gas combined cycle plants built in 2002.
Geothermal - 60 lbs/MWh for flash plants; 0 lbs/MWh for binary plants.
Co_2 is not classified as a pollutant by the U.S. Environmental Protection Agency.

Figure 8. Comparison of SO_2, Emissions from Coal, Natural Gas, and Geothermal Power Plants



Source: Coal and natural gas emissions information from Platts Research and Consulting based on data from the Environmental Protection Agency's Continuous Emissions Monitoring System, 2003; geothermal information from US Department of Energy, 2000.
Existing - For all existing U.S. coal power plants; natural gas averages include steam cycle, simple gas turbine, and combine cycle.
New - Coal plants built in 1990s; natural gas combined cycle plants built in 2002.
Geothermal - .35 lbs/MWh for flash plants, 0 lbs/MWh for binary plants.
SO_2 from geothermal plants is from hydrogen sulfide contained in geothermal fluids. Modern systems return 90 percent of the hydrogen Sulfide to the reservoir.

Figure 9. Comparison of CO_2, SO_2, and NO_X Emissions from Coal, Natural Gas, and Geothermal Power Plants



transmit the energy. NO_X and CO_2 from fuel combustion and fine particulates from diesel-burning machinery would be the major emissions, along with fugitive dust from drilling activity and from vehicles driving on dirt roads.

Currently, there is no federal standard for hydrogen sulfide, but Nevada and California have established state air quality standards for this gas. Hydrogen sulfide emissions are expected to be very small, but as more geothermal plants in the area become active, some accumulation of hydrogen sulfide or SO_2 may occur.

2.4.4 Transportation

Most forms of transportation will emit NO_X and CO_2, and particulates for vehicles with diesel engines. Particulates like road and brake dust may also be emitted. In the CCD planning area, Interstate 80 runs through the Reno-Sparks area – the most populated region in the Planning Area. This is a major corridor for heavy-duty diesel trucks transporting goods in the east-west direction. Highways 50 and 395 are also major roadways in the area. In addition, over 200 miles of operational railroads and 29 Federal Aviation Administration-designated airports are located in the CCD planning area.

The BLM maintains 789 miles of roads within the CCD planning area, which provide access to some of the remote areas within the CCD. Visitors are likely to drive a motor vehicle to get to the destination; some will even haul an OHV to explore further in areas like Sand Mountain. Emissions from the road usage and OHV activity are not significant contributions for these areas.

However, some organized group events, such as motorcycle races, military training exercises, and equestrian endurance events, will result in many motor vehicles congregating in a local area. Emissions may increase locally for a short period of time, but they are unlikely to contribute to any exceedances in air quality in such remote areas.

2.4.5 Fires

One way to minimize the build-up of hazardous fuel and to clear invasive plant species is to issue prescribed fires. Fires emit a lot of ozone precursors (NO_X and VOCs) that can result in locally high ozone concentrations. Particulates are also emitted, which can affect public health and reduce visibility. CO_2 and some CO are also released from biomass burning.

Wildfires in the CCD planning area can also be started from a lightning strike, from campfires that are not completely extinguished, and from gunfire shots by hunters, which will emit NO_X, CO_2, and fine particulates. Pollutants from wildfires in Northern California, Yosemite, and the Lake Tahoe area can also sometimes be transported into the CCD planning area and reduce visibility in scenic areas.

Table 13, Average Number of Fires and Fire Sizes in the CCD Planning Area, summarizes the average number of fires (wild and prescribed) and acres burned per year, based on data from the BLM Wildland Fire Management Information (BLM 2013b). The area of land burned each year is relatively small compared to the total size of the CCD planning area.

Table 13
Average Number of Fires and Fire Sizes in the CCD Planning Area

Year	Average Number of Fires per Year	Average Number of Acres Burned per Year in CCD planning area	Average Fire Size [acres]
1980 – 1989	112	25484	227
1990 – 1999	85	22268	262
2000 – 2009	97	22419	230
2010 – 2011	83	8197	99

Source: EPA 2013b; NDEP 2013

SECTION 3
AIR QUALITY ASSESSMENT

As the BLM prepares to update the RMP to help maintain the sustainability of public lands, the following must be taken into consideration:

- The area's population will continue to increase.
- Air pollutants from the Reno-Sparks metropolitan area can be transported onto BLM-administered lands.
- The Carson City 2009-2011 annual $PM_{2.5}$ observations do not comply with the new NAAQS for annual $PM_{2.5}$ approved in December 2012.
- The 2010-2011 Wadsworth 24-hour PM_{10} does not comply with the NAAQS for PM_{10}.

The majority of the BLM-administered lands in the CCD planning area are in Mineral and Churchill Counties, where the 2010 population densities average 1.3 and 5.0 people per square mile, respectively. These low population densities suggest that there are not enough sources (vehicles, industries, construction) to lead to an exceedance of any federal or state air quality standard.

Mining activity for precious metals could increase as the economy recovers and as global demand and prices for metals like gold, silver, and copper remain high. Dust from vehicles on unpaved roads and from the excavation through rocks and soil, along with fine particulates from diesel-burning machinery could elevate $PM_{2.5}$ and PM_{10} concentrations locally. NO_X and CO_2 emissions would also increase near mining sites due to more fuel combustion. Gold mining operations are expected to adhere to the Nevada MACT standards to minimize the amount of mercury released into the atmosphere, but the amount of mercury could increase with more precious metal mining activity.

Geothermal energy development is currently very active in the region and should remain popular for years to come. Exploration and plant construction and operation will generate fugitive dust, NO_X, CO_2, SO_2, and fine particulates. Potential air quality impacts will be local and generally of short duration.

OHV activities are expected to continue to increase in the CCD planning area, but they should remain widely dispersed in relatively remote areas such that they should not enhance any air quality problems.

Air quality observations for ozone, CO, $PM_{2.5}$, PM_{10}, NO_2, and SO_2 were all available in Reno, and all pollutants in the city are in compliance with the latest NAAQS. Monitors in Carson City, Sparks, Fernley, Fallon, Gardnerville, and a few other remote locations each measured at least one pollutant. All monitors were in attainment for the gaseous pollutants. $PM_{2.5}$ at the 5th Street monitor in Carson City, located adjacent to a maintenance yard and sewage plant had a 3-year annual $PM_{2.5}$ average that exceeded the new NAAQS annual $PM_{2.5}$ standard. In addition, Gardnerville's annual $PM_{2.5}$, which currently complies with the more stringent standard, has been trending upwards to levels close to the new standard. PM_{10} has been well below the federal standards at all available sites in the CCD planning area except at Wadsworth, which is located near Interstate 80 and State Route 447. Any additional activity releasing particulate emissions near these monitors or in the mountains that can drain onto the valley floors in which these monitors reside may need to be limited by the appropriate regulatory agency.

SECTION 4
REFERENCES

BLM (United States Department of the Interior, Bureau of Land Management). 2010. Winnemucca District Office. Draft Resource Management Plan and Environmental Impact Statement. May 2010.

_____. 2012. Recreation Management Information System (RMIS), a BLM recreation database. Data from Fiscal Years 2006-2011. BLM, Carson City District Office, Carson City, NV. Unpublished data. Retrieved August 2012.

_____. 2013a. Resource Management Plan Revision and Environmental Impact Statement. Socioeconomic Baseline Assessment Report. BLM, Carson City District Office, Carson City, NV. January 2013.

_____. 2013b. Analysis of the Management System. Draft report. BLM, Carson City District Office, Carson City, NV. January 2013.

California Department of Finance, Demographic Research Unit. 2012. Interim Projections of Population for California: State and Counties. May 7, 2012. Internet website: http://www.dof.ca.gov/research/demographic/reports/projections/interim/view.php. Accessed May 29, 2012.

CARB (California Air Resources Board). 2009. California Ambient Air Quality Standards (CAAQS). http://www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm.

Chambers, Jeanne C. 2008. Climate Change and the Great Basin. USDA Forest Service General Technical Report RMRS-GTR-204, pages 29 - 32. US Forest Service, Rocky Mountain Research Station. Internet Web site: www.fs.fed.us/rm/pubs/rmrs_gtr204_029_032.pdf.

EPA (Environmental Protection Agency). 2009. Inventory of US greenhouse gas emissions and sinks: 1990–2007. Accessible at http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

_____. 2012. Fine Particle Concentrations Based on Monitored Air Quality from 2009 – 2011. http://www.epa.gov/pm/2012/20092011table.pdf.

_____. Accessed March 15, 2013a. http://www.epa.gov/air/criteria.html

_____. Accessed March 21, 2013b. http://www.epa.gov/airdata/ad_rep_mon.html

IPCC (Intergovernmental Panel on Climate Change). 2001. Climate Change 2001 Synthesis Report: Summary for Policymakers. Internet web site www.ipcc.ch.

_____. 2007. Climate Change 2007: Technical Summary of the Working Group I Report. Internet Web site: www.ipcc.ch.

NDEP (Nevada Division of Environmental Protection). Nevada Statewide Greenhouse Gas Inventory and Projections,1990-2020. Carson City, Nevada. December 2008.

_____. 2010. Ambient Air Quality Monitoring Program – Pollutants of Concern. http://ndep.nv.gov/baqp/monitoring/aaqstd.html. Accessed March 15, 2013.

_____. 2013. Nevada Air Quality Trend Report 2000-2010. http://ndep.nv.gov/baqp/monitoring/docs/trend.pdf. January.

Nevada Division of Minerals. 2012. Major Mines of Nevada 2011. http://www.nbmg.unr.edu/dox/mm/mm11.pdf

Nevada State Demographer's Office. 2011. Nevada County Population Projections, 2010 to 2030. October 1, 2011. Internet Web Site: http://nvdemography.org/wp-content/uploads/2011/09/2011-Projections-Email-attachment-090911.pdf. Accessed May 29, 2012.

NOAA (National Oceanic and Atmospheric Administration). 2013. Accessed February, 2013. ftp://ftp.ncdc.noaa.gov/pub/data/prism100/us_25m.dem.gz

PRISM Climate Group. 2013. Oregon State University. Accessed March 19, 2013. http://prism.oregonstate.edu

US Census. 2010. Accessed March 12, 2013. http://quickfacts.census.gov/qfd/states/32000.html

US Department of Energy. 2006. Accessed March 28, 2013. http://www1.eere.energy.gov/geothermal/geopower_cleanair.html

WRCC (Western Regional Climate Center). 2013. Accessed March 15, 2013. http://www.wrcc.dri.edu