3.1 Air and Atmospheric Values

3.1.1 Affected Environment

3.1.1.1 Overview

Nevada air quality airsheds are defined by hydrologic basin boundaries. Thus, the study area for air quality consists of the hydrologic basins within which project facilities would be constructed. Because of the potential for indirect effect on soils from groundwater level declines, the air quality study area also encompasses the region of study shown in **Figure 3.3.1-1** of Section 3.3, Water Resources. This section describes air quality on a regional level without distinguishing between the ROWs, groundwater development areas and the larger area that may be affected indirectly by groundwater pumping.

3.1.1.2 Air Quality and Air Quality Related Values

Regulatory Framework

Air quality is defined by the concentration of various pollutants and their interactions in the atmosphere. Pollution effects on receptors have been used to establish a definition of air quality. Measurement of pollutants in the atmosphere is expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Both long-term climatic factors and short-term weather fluctuations are considered part of the air quality resource because they control dispersion and affect concentrations. Physical effects of air quality depend on the characteristics of the receptors and the type, amount, and duration of exposure. Ambient Air Quality Standard (AAQS) specify acceptable upper limits of pollutant concentrations and duration of exposure. Air pollutant concentrations below the standards generally are not considered to be detrimental to public health and welfare.

Ambient air quality and the emission of air pollutants are regulated under both federal and State of Nevada laws and regulations. A summary of the pertinent federal and state regulations governing air pollutant emissions (including particulates, such as construction generated dust) is contained in **Appendix F3.1**.

The relative importance of pollutant concentrations can be determined by comparison with an appropriate national and/or state AAQS. An area is designated by the USEPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the National AAQS. An area is not in attainment if violations of the National AAQS for that pollutant occur. Areas where insufficient data are available to make an "attainment" status designation are listed as unclassifiable and are treated as being in attainment for regulatory purposes.

QUICK REFERENCE

AAQS – Ambient Air Quality Standard
AQRV – Air Quality Related Values
CCA – Clean Air Act
CO – Carbon monoxide
CO_2 – Carbon Dioxide
ET– Evapotranspiration
GBNP – Great Basin National Park
HB – Hydrologic Basin
IMPROVE – Interagency Monitoring of Protected Visual Environment
IPCC – Intergovernmental Panel on Climate Change
Mm^{-1} – Inverse Megameters
NDEP – Nevada Division of Environmental Protection
NO_2 – Nitrogen dioxide
NO_x – Nitrogen oxides
NRCS – Natural Resources Conservation Service
PM_{10} – Particles of 10 microns or less
PM – Particulate matter
$PM_{2.5}$ – Particles of 2.5 microns or less
ppm – Parts per million
ppmw – Parts per million by weight
SO_2 – Sulfur dioxide
TSP – Total Suspended Particulate
VOCs – Volatile Organic Compounds
$\mu g/m^3$ – micrograms per cubic meter
USEPA – United States Environmental Protection Agency
WEG – Wind Erodeability Group

USEPA regulations allow exceptional events, if properly documented and approved, to be excluded from attainment status designation. An exceptional event refers to high pollution levels caused by a natural or human activity, such as a wildfire or high wind event, which is not reasonably controllable or preventable and is unlikely to reoccur at a particular location (USEPA 2007).

Regional Air Quality

The existing air quality of most of the project area is typical of the largely undeveloped regions of the western U.S. Current sources of air pollutants in the region include wildland fire, mining, agriculture, industrial sources, urban transportation, rural transportation on unpaved roads, construction activities, and disturbed land. With the exception of urban transportation, which emits other air pollutants, all of these sources predominately emit PM. Urban transportation combined with naturally occurring sources of volatile organic compounds (VOCs) react and create tropospheric ozone. PM and ozone are the primary pollutants of concern in the ROW/groundwater development area.

For the purposes of statewide regulatory planning, all of the northern portions of the project area have been designated as attainment areas for all pollutants that have an AAQS; however, parts of Nevada and Utah are designated as nonattainment or maintenance areas for specific pollutants as described below.[1]

Particulate Matter

Natural sources of PM are dust generated by wind across unvegetated soil surfaces and wildland fire. Dry playa basins and areas cleared of vegetation are particularly susceptible to dust generation, particularly where soils are silty. In the Las Vegas area, most PM air pollution is a result of windblown dust from disturbed ground.

The size of PM is important from a human health perspective. There are three common size classifications of PM: the largest size classification is total suspended particulates (TSP); the second largest classification is particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}); and the smallest classification is particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

The current AAQS for PM are: the 24-hour average PM_{10} concentration is not to exceed 150 µg/m^3 more than once per year; the 3 year average of the 98th-percentile 24-hour average $PM_{2.5}$ concentration is not to exceed 35 µg/m^3 more than once per year; the annual average PM_{10} concentration is not to exceed 50 µg/m^3; and the 3-year average of the annual mean $PM_{2.5}$ concentration is not to exceed 15 µg/m^3. For a complete listing of all applicable state and national AAQS, see **Appendix F3.1**.

The most recent and available monitoring data were analyzed over a 3-year period at sites in Nevada and Utah. These data are used to define the current ambient concentrations for PM_{10} and $PM_{2.5}$ in the project area and nearby population centers. The sites were selected for analysis based on: the location relative to the region of study, the frequency of observations, and data capture. The design values were calculated from the 3-year dataset at each site and compared to the AAQS.

Particulate data are collected in GBNP by the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor. These data are considered representative of the project area and are provided in **Table 3.1-1**.

Importantly, IMPROVE data are not collected for the purpose of an AAQS comparison; however, the data are considered to be high quality and provide information about existing air quality in the project area. IMPROVE data do not contain flags to exclude exceptional events, such as high wind events or natural fires. The air quality data collected at the GBNP IMPROVE site demonstrate that the area is well below all applicable air quality standards for PM_{10} and $PM_{2.5}$.

[1] Attainment, maintenance, and nonattainment designations as described throughout the text are based on the current status of these areas as of March 23, 2012.

Table 3.1-1 Great Basin National Park PM_{10} and $PM_{2.5}$ Concentrations in 2008-2010

Year	24-hour (µg/m^3)		Annual (µg/m^3)	
	PM_{10} (Second highest)	$PM_{2.5}$ (98th percentile)	PM_{10}	$PM_{2.5}$
2008	48	21	7.3	3.6
2009	21	7.2	5.8	2.3
2010	41	7.5	5.7	2.3
2008-2012 Design Value	48	12	6.3	2.7

Source: IMPROVE 2012.

Particulate data in Clark County, Nevada, is collected by the NDEP. These data are considered representative of air quality conditions in the southern portion of the study area and are shown in **Table 3.1-2**. In comparison to the more rural GBNP IMPROVE site, the monitored particulate values are higher in the urban Las Vegas area. Of the 3 years that were analyzed for particulates, only year 2010 had monitored exceptional event(s) for $PM_{2.5}$[2].

Table 3.1-2 Las Vegas, Nevada PM_{10} and $PM_{2.5}$ Concentrations 2008-2010 (Monitor 32-003-2002)

Year	24-hour (µg/m^3)		Annual (µg/m^3)	
	PM_{10} (Second highest)	$PM_{2.5}$ (98th percentile)	PM_{10}	$PM_{2.5}$
2008	91	19	31	9.0
2009	74	16	28	7.7
2010	61	13	24	6.5
2008-2012 Design Value	91	16	28	7.7

Source: USEPA 2012a.

While the groundwater development area is located in rural areas and is classified as attainment for all applicable AAQS, portions of the project area and nearby surrounding areas are designated nonattainment of particulate AAQS. In the past, monitors in Clark County, Nevada, have exceeded the 24-hour PM_{10} AAQS. This has caused a portion of Clark County to be designated as a nonattainment area for PM_{10} (see **Appendix F3.1** for additional information regarding attainment designations). Recently, Clark County was declared as attainment of the PM_{10} AAQS and will be re-designated as attainment following approval of the maintenance plan[3]. Average annual PM_{10} concentrations in this region generally range from 20 to 30 µg/m^3, which is below the 50 µg/m^3 State of Nevada AAQS (USEPA 2008a). Monitored $PM_{2.5}$ in Clark County are below the applicable AAQS.

Salt Lake, Provo, and Logan counties in Utah are collectively referred to as the Wasatch Front. Particulate data are collected in the Wasatch Front by the State of Utah. These data are considered representative of air quality conditions in the Wasatch Front, including the cities of Ogden, Salt Lake City, and Provo, Utah. These data are shown in **Tables 3.1-3** through **Tables 3.1-5**, respectively. Each of these sites has higher monitored particulate values than found in either the project area or the Las Vegas area. Exceptional events were monitored in Ogden for PM_{10} in the years 2009 and 2010 and $PM_{2.5}$ in 2008, 2009, and 2010. Exceptional events were monitored in Salt Lake City for PM_{10} in 2008, 2009, and 2010 and for $PM_{2.5}$ in 2009 and 2010. Exceptional events were monitored in Provo for $PM_{2.5}$ in 2008 and 2010[4].

[2] http://www.epa.gov/airquality/airdata/ad_rep_mon.html

[3] http://www.clarkcountynv.gov/Depts/daqem/Documents/Planning/SIP/PM10/75_%20FR_45485.pdf

[4] http://www.epa.gov/airquality/airdata/ad_rep_mon.html

Table 3.1-3 Ogden, Utah PM_{10} and $PM_{2.5}$ Concentrations in 2008-2010 (Monitor 49-057-0002)

Year	24-hour (µg/m^3)		Annual (µg/m^3)
	PM_{10} (Second highest)	$PM_{2.5}$ (98th percentile)	$PM_{2.5}$
2008	118	32	9.8
2009	100	37	10.2
2010	102	42	9.1
2008-2010 Design Value	118	37	9.7

Source: USEPA 2012a.

Table 3.1-4 Salt Lake City, Utah PM_{10} and $PM_{2.5}$ Concentrations in 2008-2010 (Monitor 49-035-3006)

Year	24-hour (µg/m^3)		Annual (µg/m^3)
	PM_{10} (Second highest)	$PM_{2.5}$ (98th percentile)	$PM_{2.5}$
2008	99	36	10.3
2009	102	45	10.8
2010	125	49	9.7
2008-2010 Design Value	125	43	10.3

Source: USEPA 2012a.

Table 3.1-5 Provo, Utah PM_{10} and $PM_{2.5}$ Concentrations in 2008-2010 (Monitor 49-049-0002)

Year	24-hour (µg/m^3)		Annual (µg/m^3)
	PM_{10} (Second highest)	$PM_{2.5}$ (98th percentile)	$PM_{2.5}$
2008	90	33	9.7
2009	80	42	9.9
2010	55	31	8.5
2008-2010 Design Value	90	35	9.4

Source: USEPA 2012a.

Along the Wasatch Front in Utah, several counties have been designated as nonattainment for PM_{10} and/or $PM_{2.5}$, including the metropolitan areas of Ogden, Salt Lake City, and Provo (see **Appendix F3.1** for additional information regarding attainment designations). In 2005, the State of Utah requested the PM_{10} nonattainment areas be re-designated to attainment. Approval of this request by the USEPA is pending. In this area, average annual $PM_{2.5}$ monitored values are below the AAQS, while 24-hour PM_{10} monitored values are also below the AAQS but generally elevated and 24-hour $PM_{2.5}$ values are at or above the AAQS. There is no annual PM_{10} standard in Utah.

Ozone

In the past, monitoring results in Las Vegas Valley (HB 212) in Clark County have exceeded the 1997 8-hour ozone standard (see **Appendix F3.1** for additional information regarding attainment designations). In 2004, the USEPA designated hydrograhic basins 164A, 164B, 165, 166, 167, 212, 213, 214, 216, 217, and 218 as nonattainment for the 1997 8-hour ozone standard.[5] On March 31, 2011, the USEPA determined that the Clark County 8-hr ozone nonattainment area has attained the 1997 8-hr ozone National AAQS. Although the USEPA has not formally re-designated Clark County as "attainment", the area is now considered to be following a maintenance strategy and continues to meet the 1997 8-hour ozone standard. In 2008, the USEPA lowered the 8-hour ozone standard from 0.08 ppm to 0.075 ppm. In a letter issued by the USEPA to the Governor of Nevada in December, 2011, the USEPA indicated their plans to designate Clark County and all of Nevada as unclassifiable or attainment for the 2008 8-hour ozone standard.

[5] Federal Register Volume 69, Number 180. September 17, 2004. p. 55956.

Current levels of ozone monitored in the groundwater development area are also of concern. Ozone is monitored at GBNP and values are close to the 2008 8-hour ozone standard, as shown in **Table 3.1-6**. The USEPA will consider revising the 2008 8-hour ozone standard in 2013. If the standard is lowered to 0.070 ppm or below, the region surrounding the Great Basin monitoring station and portions of Clark County will likely be classified as a nonattainment area for the new 8-hour ozone standard.

Table 3.1-6 Great Basin National Park 8-hour Average Ozone Concentrations in 1998-2008

Year	8-hour Ozone (ppm)	
	Fourth Highest Daily Maximum	Number of Exceedences[1]
1998	0.070	0
1999	0.072	0
2000	0.077	0
2001	0.067	0
2002	0.074	0
2003	0.071	0
2004	0.072	0
2005	0.073	0
2006	0.072	0
2007	0.075	0
2008	0.071	0

[1] The 2008 8-hour ozone standard is that the 3-year average of the fourth-highest daily maximum 8-hour average ozone must not exceed 0.075 ppm. Therefore, although the fourth-highest daily maximum 8-hour average value exceeded 0.075 ppm in 2000, there has not been a 3-year period with an average over the AAQS.

Source: USEPA 2008a.

Prevention of Significant Deterioration

In addition to the designations relative to attainment of conformance with the National AAQS, the CAA requires the USEPA to place selected areas within the U.S. into one of three categories, which are designed to limit the deterioration of air quality when it is better than the National AAQS. Class I is the most restrictive air quality category. It was created by Congress to prevent further deterioration of air quality in national parks and wilderness areas of a given size, which were in existence prior to 1977, or those additional areas that have since been designated Class I under federal regulations (40 CFR 52.21). The Jarbidge Wilderness northeast of Elko is the only Federal Class I area in Nevada. The closest Class I area in Utah is Zion National Park, which lies about 90 miles east of the project area. All remaining areas outside of the designated Class I boundaries are designated as Class II areas, which are allowed a relatively greater deterioration of air quality, although it must still be maintained below National AAQS. The GBNP is a Class II area, based on the Congressional legislation that brought the park into existence. Additionally, Lake Mead National Recreation Area is a Class II area. No Class III areas have been designated in the U.S.

The project impacts to the GBNP are analyzed due to the proximity of the park to the project area. Project impacts to all other designated Class I and Class II area are anticipated to be less than the impacts predicted at the GBNP.

Regional Air Quality Related Values

Air quality related values include changes in visibility or atmospheric deposition of pollutants to soils and waterbodies. Regional haze is visibility impairment caused by the cumulative air pollutant emissions from numerous sources over a wide geographic area. Visibility impairment is caused by particles and gases in the atmosphere. Some particles and gases scatter light while others absorb light. The primary cause of regional haze in many parts of the country is light scattering resulting from fine particles (i.e., $PM_{2.5}$) in the atmosphere. Additionally, coarse particles between 2.5 and 10 microns in diameter can contribute to light extinction. Coarse particulates and $PM_{2.5}$ can be naturally occurring or the result of human activity. The natural levels of these species result in some level of visibility impairment, in the absence of any human influences, and will vary with season, daily meteorology, and geography (Malm 1999).

The visibility at the GBNP is one of the best in the nation.[6] In other words, at the GBNP, one can see farther distances than in other areas of the U.S. During the regional haze baseline period from 2000-2004, the total light extinction for the 20 percent best days was 13.4 inverse megameters (Mm^{-1}), for the worst 20 percent days it was 29.2 Mm^{-1}, and averaged over the whole baseline period, it was 19.7 Mm^{-1} (IMPROVE 2010). Most of the particulate matter at the GBNP is composed of organic material, sulfates, and soil. The relative fractions of each component vary seasonally. The summer season is typically the time of year when the Great Basin region experiences the greatest reduction in visible range (IMPROVE 2010). Currently, there are no concerns regarding the atmospheric deposition of pollutants to soils or waterbodies in Class II areas of Nevada and there are no Class I areas of concern for this project. The total nitrogen deposition trend is relatively stable at around 2.0 kilograms per hectare per year (approximately 40 percent from dry deposition and the remaining 60 percent from wet deposition). The total sulfur deposition trend is relatively stable, perhaps decreasing slightly over the last 10 years, and is approximately 0.7 kilograms per hectare per year (approximately 30 percent from dry deposition and the remaining 70 percent from wet deposition) (Clean Air and Trends Network [CASTNet] 2010).

3.1.1.3 Climate

The climate study area is part of two different climate regions: the Southwest and Great Basin Desert. The Southwest climate region generally is a low-elevation area extending from the Mohave Desert in southern California in the west to the western edge of Texas, reaching as far north as the Four Corners area and extending into the northern portions of Mexico. The Great Basin Desert is a mountainous desert, primarily contained within the state of Nevada, bordered by the Sierra Nevada mountain range on the west and the Great Salt Lake Desert on the east.

Generally, the Southwest climate region is warmer in the summer and drier in the winter than the Great Basin Desert. The Southwest also experiences summer precipitation associated with the North American Monsoon system, a system that does not reach as far north as the Great Basin Desert.

The climatic conditions across the hydrologic study area are highly variable and reflect the wide variations in elevation, the presence of numerous mountain ranges, and the wide range in latitude. Precipitation generally increases with elevation (Welch and Bright 2007, Figure 20). In the Great Basin, the mean annual precipitation ranges from less than 5 inches to 16 inches in the valleys and approximately 16 inches to 60 inches in the mountains (Harrill and Prudic 1998).

Meteorological stations within the region typically are located at lower elevations. This is due to access and maintenance difficulties at higher elevations and because more intensive land uses commonly take place in valleys. Precipitation estimates at high elevations are largely based on snowpack measurements taken by the Natural Resources Conservation Service (NRCS) or other agencies.

Average annual precipitation values for selected monitoring stations distributed throughout the project study area are shown in **Table 3.1-7**. The station locations are listed from north to south. Most of these station locations are situated in valley settings. Elevation and precipitation generally decreases from north to south across the region. An example of localized effects of mountainous terrain and elevation on precipitation is made evident by comparison of the average annual precipitation for the GBNP (13.24 inches) with Garrison, Utah (7.61 inches), which is located approximately 10 miles east of the park.

In addition to the trend of increasing precipitation with increasing elevation, the seasonal distribution of precipitation changes generally from north to south. In the northern portion of the hydrologic study area, the greatest amount of precipitation normally falls in March, April, and May. This is illustrated by data for Ely, the GBNP, and Garrison in **Table 3.1-8**. The months of June and July typically are drier, and a slight increase in rainfall occurs in the late summer and early fall. Further south, precipitation is greatest in January and February at Overton and Las Vegas. Precipitation dramatically decreases in April, May, and June, and then recovers to mid-range levels for the rest of the year. In the extreme south, at Las Vegas, an increase in mid- to late-summer precipitation (July and August) is typical.

[6] Maps of regional haze measured across the U.S. can be viewed at http://vista.cira.colostate.edu/improve/Data/Graphic_Viewer/seasonal.htm.

Table 3.1-7 Average Annual Precipitation for Selected Meteorological Stations in the Region of Study

Station Location	Elevation (feet)	Average Annual Precipitation (inches)
Lages, Nevada	5,960	8.2
Ely, Nevada	6,250	9.6
GBNP, Nevada	6,830	13.2
Garrison, Utah	5,280	7.6
Lund, Nevada	5,570	10.2
Pioche, Nevada	6,170	13.2
Pahranagat Wildlife Refuge, Nevada	3,400	6.3
Overton, Nevada	1,290	4.4
Las Vegas, Nevada	2,160	4.2

Table 3.1-8 Monthly Precipitation at Lower Elevations in the Study Area

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ely	0.74	0.74	0.97	1.02	1.09	0.68	0.60	0.81	0.75	0.85	0.68	0.62
GBNP	1.02	1.11	1.41	1.18	1.24	0.90	0.97	1.18	1.08	1.26	1.00	0.87
Garrison	0.45	0.45	0.86	0.76	0.73	0.50	0.57	0.77	0.69	0.78	0.58	0.46
Overton	0.56	0.67	0.46	0.33	0.13	0.07	0.31	0.27	0.34	0.33	0.48	0.45
Las Vegas	0.51	0.58	0.46	0.21	0.15	0.07	0.44	0.44	0.32	0.26	0.36	0.39

Regional trends in precipitation and temperature over a 66-year period of record were evaluated for Las Vegas, Caliente, and Ely. The purpose of this analysis was to provide background on the annual precipitation input to the region over time and to provide data for a discussion of potential climate change.

Variations in mean annual precipitation from 1930 through 2007 for Ely, Caliente, and Las Vegas are shown in **Figure 3.1-1**. The graph illustrates that all of the sites have experienced wet and dry cycles lasting up to a decade or more.

In addition, there was a slight trend towards wetter conditions over the period for both Ely and Caliente while the overall precipitation trend for Las Vegas essentially was flat (i.e., does not exhibit a long-term trend towards either wetter or drier conditions).

Average annual temperatures at these three stations have shown a slight upward trend for Caliente and Ely and a 3 to 4 degrees Fahrenheit (ºF) average annual increase in Las Vegas over the 66-year period of record illustrated on **Figure 3.1-2**. An analysis of the annual maximum temperatures at the three stations indicates little or no difference over the period of record (**Figure 3.1-3**). However, the analysis of the annual minimum temperatures indicates a very strong upward trend in Las Vegas (nearly 10°F), and a moderate upward trend in Caliente (2 to 3°F), and no trend in Ely (**Figure 3.1-4**). One possible explanation for the upward temperature trend in Las Vegas annual minimum temperatures is the increasing urbanization of this area, with an associated increase in relative humidity and greater area of heat absorbing surfaces.

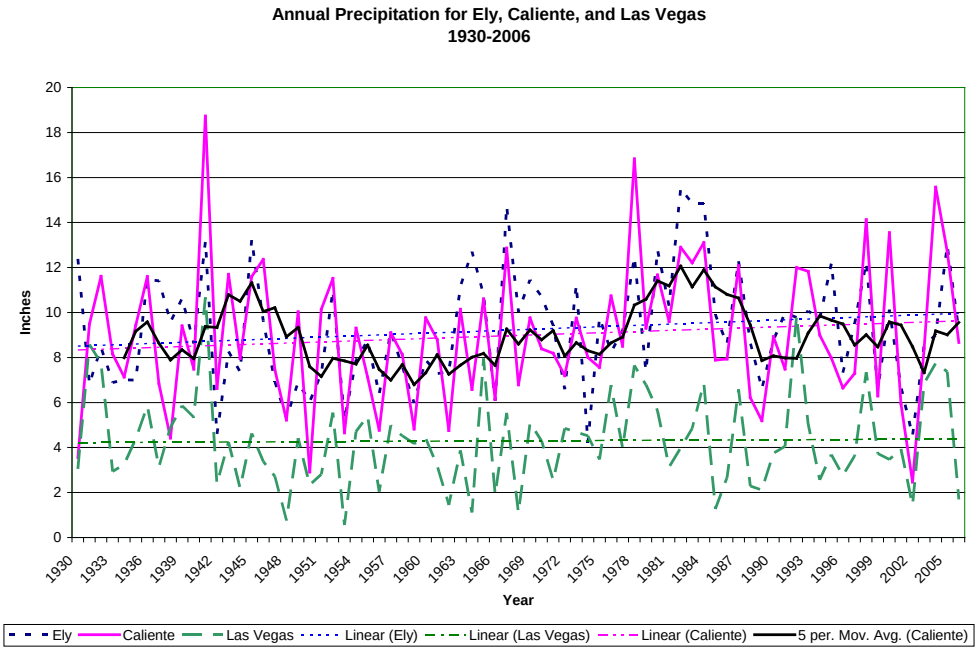
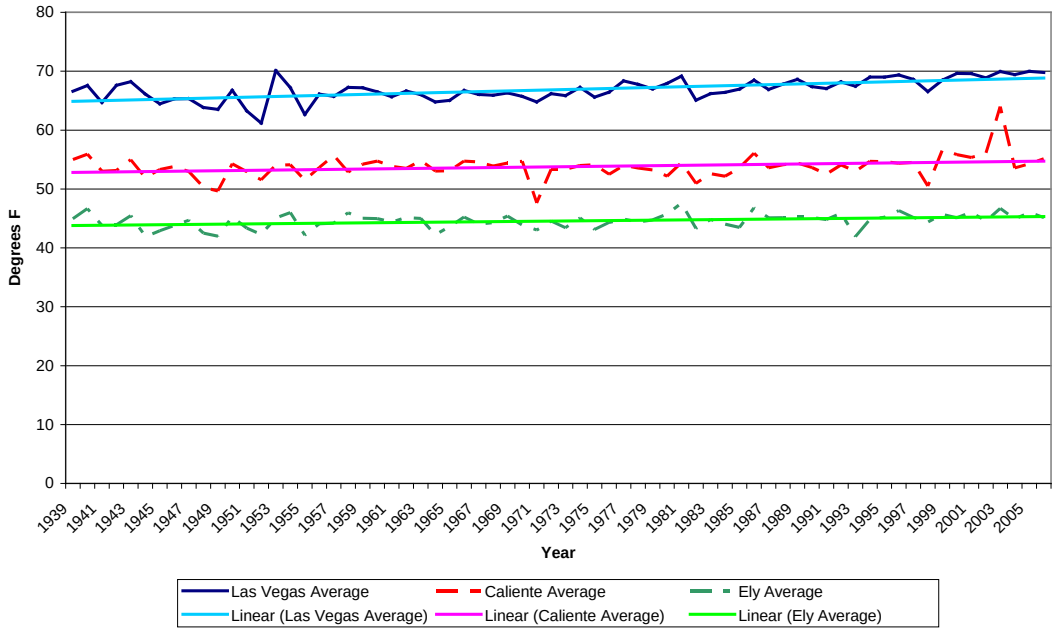


Figure 3.1-1 Annual Precipitation for Ely, Caliente, and Las Vegas with 5 Year Moving Average for



Caliente and Linear Trend Line

Figure 3.1-2 Average Annual Temperature 1938-2006, Las Vegas, Caliente, and Ely

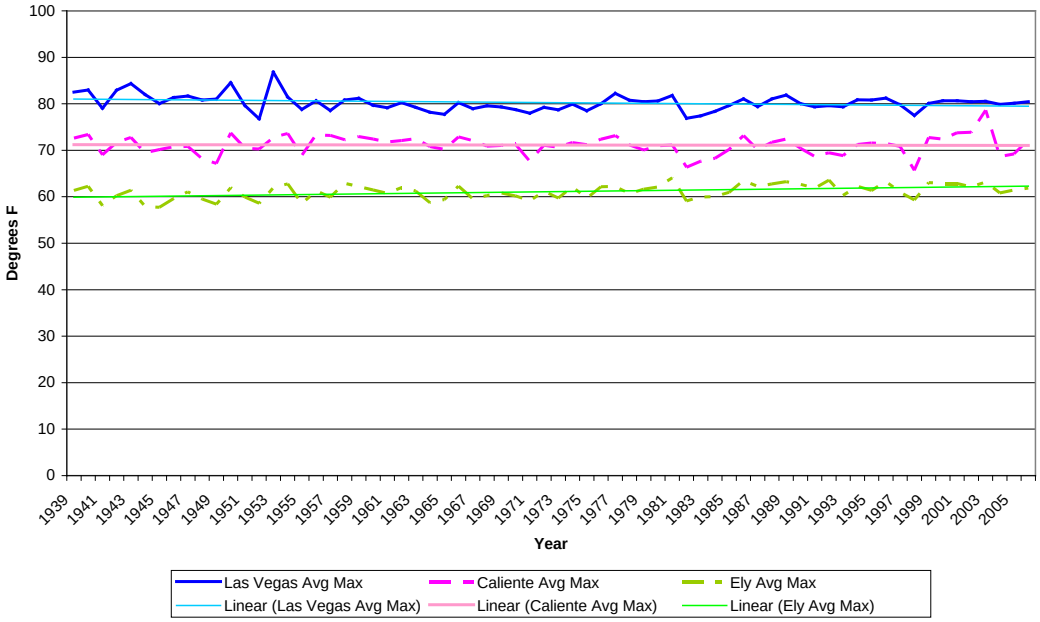


Figure 3.1-3 Annual Average Maximum Temperature 1938-2006, Las Vegas, Caliente, and Ely

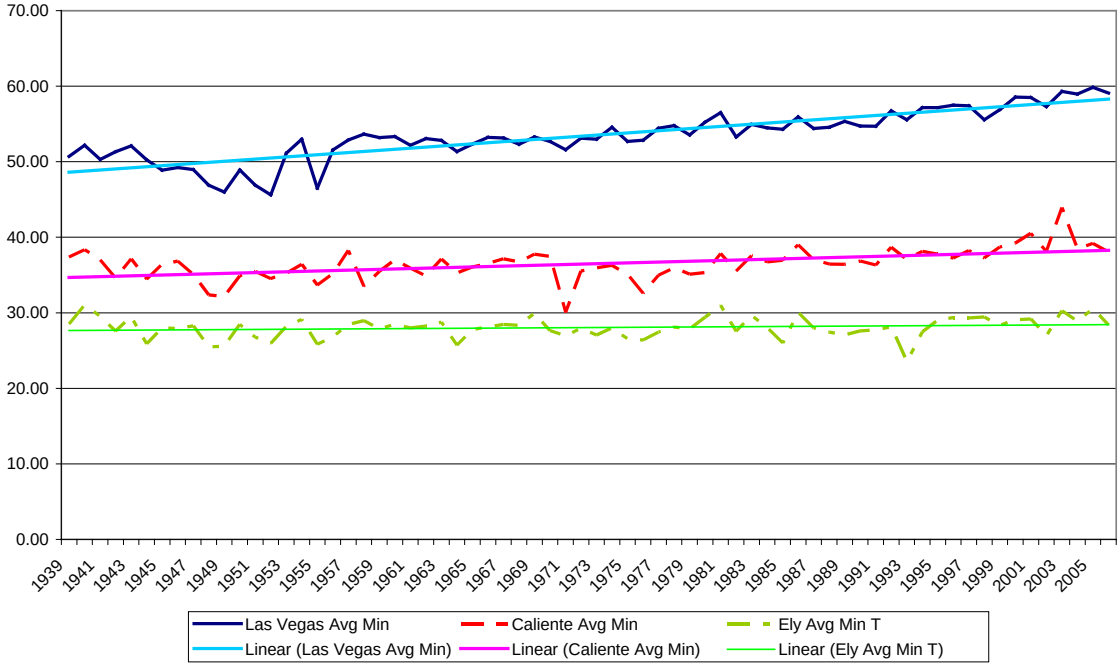


Figure 3.1-4 Annual Average Minimum Temperature 1938-2006, Las Vegas, Caliente, Ely

3.1.1.4 Climate Change Trends

Global Changes

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) greenhouse gas emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these greenhouse gas emissions and net losses of biological carbon sinks (e.g., vegetation) could cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although greenhouse gas levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused carbon dioxide equivalent concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentration" (Intergovernmental Panel on Climate Change [IPCC 2007).

Global mean surface temperatures have increased nearly 1.8ºF from 1890 to 2006. From the IPCC (2007), Global Climate Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24 degrees north) have exhibited temperature increases of nearly 2.1ºF since 1900, with nearly a 1.8ºF increase since 1970 alone. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of greenhouse gases are anticipated to accelerate the rate of climate change.

In 2001, the IPCC indicated that by the year 2100, the global average surface temperatures would increase 2.5 to 10.4ºF above 1990 levels. The National Academy of Sciences has confirmed these findings, but has also indicated there are uncertainties regarding how climate change may affect different regions. Global climate model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes (IPCC 2007). Warming during the winter months is expected to be greater than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict.

As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends (USEPA 2008b).

Several activities contribute to the phenomena of climate change, including emissions of greenhouse gases (especially carbon dioxide [CO_2] and methane) from fossil fuel development, large wildfires, and activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces and surface reflectivity (i.e., albedo). It is important to note that greenhouse gases will have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 can influence climate for hundreds of years.

It may be difficult to discern whether global climate change is already affecting resources, let alone the study area. In most cases, there is more information about potential or projected effects of global climate change on resources. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change described below may not be measurably discernable within the reasonably foreseeable future.

Existing and anticipated effects of climate change on regional natural resources and resource uses are described in the Historical Regional Climate and Predicted Future Trends sections.

Historical Regional Climate

The climate in the Southwest and Great Basin Desert is and historically has been highly variable due to their locations with respect to atmospheric circulation patterns and complex topography. Historic precipitation and temperature events have been assessed using many types of paleoclimate indicators, including tree-ring chronologies, packrat middens, pollen records, and oxygen 18 data from sediment cores.

Based on paleoclimate records, both the Southwest and Great Basin Desert have experienced several "megadroughts" over the last millennia (Mensing et al. 2008; Benson et al. 2002; Ni et al. 2002; Herweijer et al. 2007; Sheppard et al. 2002). Megadrought is defined as a drought with the severity of present-day major droughts, but lasting 20 to 40 years. Less severe, but longer lasting droughts of 100 years or more, also have been documented as occurring in the regions (Mensing et al. 2008; Benson et al. 2002; Sheppard et al. 2002). Generally, precipitation events simultaneously affect both the Southwest and the Great Basin Desert, such as the severe droughts documented in the late 1500s and 1950s (Benson et al. 2002; Ni et al. 2002; Swetnam and Betancourt 1998), and anomalously wet periods in the 1330s, 1610s, and the 1910s-1920s (Ni 2002; Schwinning et al. 2008).

As is discussed throughout this EIS, the timing, amount, and form of precipitation are important factors for groundwater recharge rates, and temperature plays an important role in the form of precipitation. Temperature records typically have an inverse relationship to precipitation (i.e., lower temperatures during periods of higher than normal precipitation). This pattern is consistent with observed present day climate influenced by the El Nino/La Nina cycles (Jin et al. 2006; Sheppard et al. 2002; Cayan et al. 1999). Evidence suggests that multi-decade periods of warmer or cooler than normal temperatures have been increasing in their severity since the 1700s and temperature is increasing to an unprecedented extent in the last 400 years (Sheppard et al. 2002).

A historical analysis of temperature in White Pine County conducted by Redmond (2009) indicates that decadal means since the late 1990s are higher than any other decadal mean on record, with spring time temperatures rising more than other seasons. Data from 1948 to 2009 were used to analyze seasonal changes in freezing levels in White Pine County (Redmond 2009) and spring is the season that shows the greatest rise in the freezing level. Spring time temperatures and freezing levels are important considerations for the timing and rate of spring snowmelt and the manner that snow is converted into soil moisture, groundwater, and streamflow.

State-wide decadal precipitation has increased in Arizona, New Mexico, Utah, and Nevada each 30-year "normal" period from 1930 through 2000 as shown in **Figure 3.1-5**[7]. The measured average annual precipitation has increased approximately 1 to 1.5 inches in each state over this 70-year period. Precipitation has changed the least amount in Utah, while precipitation in New Mexico increased the most over this same period of time. Annual average 30-year normal state-wide precipitation increased by 1.25 inches in Nevada.

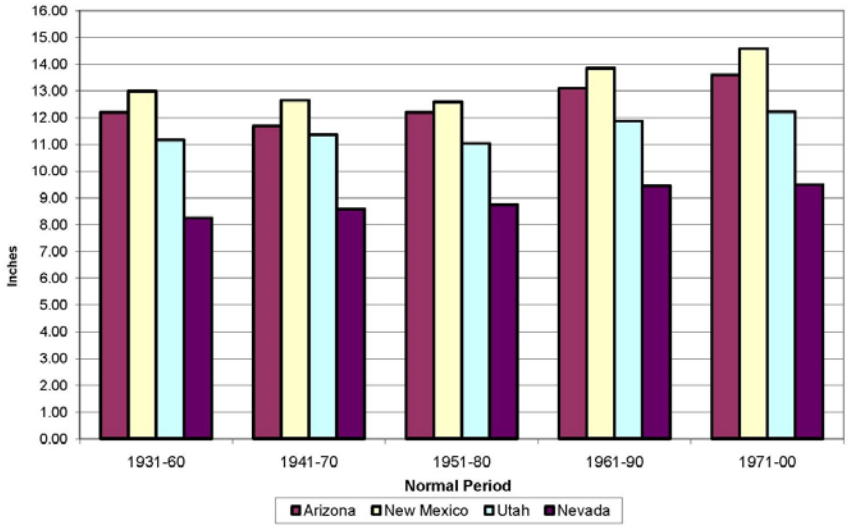


Figure 3.1-5 Southwest Statewide Normal Precipitation, 1931 to 2000

[7] These statewide averages are obtained as follows: Each state is divided into climate divisions and an average precipitation value is calculated for each division. These division averages are then weighted by the amount of area within each division. Source: National Climatic Data Center, Historical Climatography Series 4-2. http://www.wrcc.dri.edu/htmlfiles/avgstate.ppt.html.

Predicted Future Trends

Temperature

Temperatures in North America are projected to increase with a greater than 66 percent probability (Christensen et al. 2007). Global climate models predict that temperatures in the western U.S. will increase between 4.5 to 10.8°F, relative to pre-1900 levels, over the next 100 years (Christensen et al. 2007). Seasonally, warming is likely to be the largest in the summer for the American Southwest. Model-predicted temperatures in the Great Basin are anticipated to increase as well; however, the change in temperature is not predicted to be as large as the predicted changes in the Southwest. It is predicted that warm extremes will be more frequent and last longer (Field et al. 2007).

The Redmond report (Redmond 2009) analyzed results from 15 different global climate models with grid resolutions of about 2x2 degrees of latitude/longitude (approximately 140x100 miles) containing Spring Valley. The 15 global climate models all were in agreement that temperatures in Spring Valley will likely increase for all seasons relative to the 1971-2000 period. The magnitude of this increase varied by model; however, the median increase for all 15 models suggest that annual average temperature in Spring Valley will increase approximately 7.2ºF in the next century.

Monitored temperatures in valleys within the region of study during the last 65 years generally support global climate model predictions for the Great Basin. Temperature records are widely available for much of the 20th century. As shown in **Figure 3.1-2**, these records demonstrate that annual average temperatures have increased between 1º and 4ºF in the region of study. In addition to this change in monitored annual average temperature, the largest temperature changes in the region of study have been between1º to 10ºF increases in the annual average minimum temperatures over the last 65 years, which are shown in **Figure 3.1-4**. At the three monitoring stations examined, the largest change in seasonal warming occurred during the winter months. This trend differs from Christensen et al. (2007) prediction that the largest change in warming in the southwest would occur during the summer season.

Precipitation

The confidence in precipitation predictions for the Southwest is somewhat weaker than the confidence in temperature predictions. This is primarily due to the complexity of circulation patterns bringing moisture to the area. Generally, global climate models predict that arid regions of the world will experience decreased precipitation levels and the Southwest is no exception (Christensen et al. 2007; Seager et al. 2007). The available moisture (precipitation minus evaporation) in the Southwest is predicted to decrease by 0.01 to 0.18 millimeters per day relative to available moisture during the period 1950-2000, with an average decrease of 0.1 millimeters per day. This change is predicted to occur sometime mid-21st century, with a quarter of the global climate models predicting this decrease over the next several decades (Seager et al. 2007). As a reference, precipitation between 1948 and 1957 (the 1950s drought) decreased by 0.13 millimeters per day, indicating that the recent year droughts may become the new baseline level of precipitation. As shown in **Figure 3.1-1**, monitored precipitation at sites in the Great Basin region has shown an increased level of precipitation relative to the 1948-1957 drought.

The Redmond report (Redmond 2009) analyzed results from 15 global climate models with grid resolutions of about 2x2 degrees of latitude/longitude (approximately 140x100 miles) containing Spring Valley. The 15 global climate models generally agreed that there will be no net annual change in precipitation in Spring Valley in the next century. However, the seasonal distribution of precipitation could potentially change. Using the Spring Valley data as a proxy, the Redmond report (Redmond 2009) concludes that the Great Basin is likely to experience an increase in winter precipitation amount in the latter part of the 21st century, which may be offset by reduced precipitation in the spring and summer seasons (Redmond 2009).

Water Availability (Combination of Precipitation and Temperature)

There is a high level of confidence that due to increasing temperatures, western mountains will experience a change in the timing, amount, and form of precipitation (Field et al. 2007). The Great Basin region might not see any change in the amount of annual precipitation (neither an increase nor decrease, which is supported by the Redmond report [2009]); however, water resources still could be diminished due to the higher temperatures alone (affecting evaporation, transpiration rates, etc.) (Christensen et al. 2007). The distribution of precipitation over the year is important for plant growing cycles and water availability. Generally, it is predicted (with >66 percent probability) that summertime precipitation in the Southwest associated with the North American Monsoon System will be reduced as the circulation system is forced northward due to differences in land/sea heating (Christensen et al. 2007). How this

will impact the Great Basin Desert (located to the north of the Southwest) is dependent upon how far to the north the North American Monsoon is displaced. Wintertime precipitation in the Great Basin Desert typically is in the form of snow, and the accumulation and timing of snow melt are important for ecological and economic resources. It is predicted that there will be a decline in snowpack associated with warmer temperatures due to a latter onset and earlier spring melting (Field et al. 2007). A declining snowpack already has been documented in much of the western U.S. (Miller and Piechota 2008; Pierce et al. 2008; Jin et al. 2006; McCabe and Wolock 1999; Regonda et al. 2005).

Anticipated effects of climate change on resources and resource uses in the region of study are described and analyzed in Section 3.1.3, Climate Change Effects. The following resources have been or are anticipated to be affected by climate change: air quality, aquatic resources, range and livestock grazing/wild horses and burros, soil, vegetative communities, water resources, wildlife, and wildland fire ecology and management.

3.1.2 Environmental Consequences

3.1.2.1 Rights-of-way

Issues

- Air pollutants emitted from the tailpipes of construction equipment, including criteria pollutants, ozone precursors, and greenhouse gas emissions.
- Fugitive dust generated during construction and facility maintenance.
- Windblown dust generated due to wind erosion of disturbed surfaces.
- Impairment of visibility conditions at the GBNP.
- Conformity requirements in nonattainment areas.
- Entrainment and transport of radioactive material and erionite due to wind erosion of disturbed surfaces.

Assumptions

Assumptions regarding compliance with regulatory requirements, detailed project operations, inputs for emission factors, and future conditions are required to estimate impacts to air quality and climate.

Key assumptions regarding compliance with regulatory requirements include:

- All state and local air quality construction permits will be received prior to initiation of project construction.
- Any operating permits or dust control plans required in nonattainment areas will address conformity requirements or demonstrate that total emissions in nonattainment areas will be below applicable thresholds.

In order to estimate emission rates of air pollutants and greenhouse gases, two types of data are required: activity data and emission factors. To develop activity data, several operational assumptions were necessary due to a lack of detailed project information at this stage. Additionally, in some cases, site-specific information is required to select the appropriate emission factors. The following assumptions will be revised, as required, based on project-specific data during the permit application phase:

- For tailpipe emissions from construction equipment, assumptions include:
  - All construction equipment, except for pick-up trucks, will consume ultra low sulfur diesel fuel. Pick-up trucks are assumed to be equivalent to light-duty, gasoline powered, passenger vehicles.
  - Construction activities will occur for 12 hours per day, 6 days a week, 50 weeks per year.
  - Not all pieces of construction equipment will operate simultaneously. At any given time, roughly a third of the equipment will be operating; thus, it is assumed that each piece of equipment operates 4 hours out of a 12-hour construction day. This is a conservative approach since a particular piece of equipment, such as a crane, has a very specific function and must remain on-site to perform this function, but this function is not required to occur continuously.
  - Pick-up trucks used for transporting crew and as lead cars for road closers will make 2 trips per hour on average over a 12-hour work day (24 trips per day). Each trip is assumed to be 4 miles on average.
  - Emission factors for year 2012 are used since this is predicted to be the first year of construction. Future years are anticipated to have lower emission rates due to federal and state emission reduction programs for mobile equipment.
- For fugitive dust from construction and maintenance, assumptions include:
  - One mile of pipeline and 1 mile of power line are under active construction per day. With the requested ROWs for construction, this equates to 36 acres per day. This is a conservative assumption for the purposes of estimating the maximum daily emissions of fugitive dust from construction equipment.

- For ancillary facilities, 2.5 acres are actively being constructed per day. This is a conservative assumption for the purposes of estimating the maximum daily emissions of fugitive dust from construction equipment.
- For the purposes of estimating the $PM_{2.5}$ emissions associated with construction fugitive dust, the USEPA recommends that 10 percent of the PM_{10} is in the $PM_{2.5}$ size range (USEPA 1998; Western Regional Air Partnership [WRAP] 2005, 2006).
- A control efficiency of 50 percent is assumed for purposes of emission calculations based on the ACM described in Chapter 2.5. Controls will be described in the dust control plan.
- Maintenance of equipment is independent of pumping (e.g., once the facilities are built they will require maintenance regardless of groundwater pumping actions). It is assumed that the ROW facilities will be regularly maintained and a light-duty truck will travel the length of the pipeline and power line once per month.

- SNWA would be required to implement a comprehensive COM Plan that would include all future hydrographic basins and all facilities associated with the SNWA GWD Project. The COM Plan includes a requirement for comprehensive monitoring and mitigation program for the entire project that would integrate the various required monitoring and mitigation actions. The COM Plan would integrate protective measures from the following: BLM RMP Management Actions and BMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. Details of the COM Plan are provided in Section 3.20, Monitoring and Mitigation Summary, along with measures to protect air resources from ROW construction and operation activities.

Methodology for Analysis

For the estimation of air quality related impacts, the methodology depends on the activity (construction equipment, windblown dust, etc.) and the type of air impacts (criteria emissions, greenhouse gases, etc.). The activity/air impact combinations are grouped together based on the issues identified above. The calculation methodology for each activity impacting air quality is described below.

Tailpipe Emissions from Construction Equipment and Facility Maintenance

Tailpipe emissions from construction are based on equipment-specific emission factors, the equipment type, the number of each type of equipment, and estimated hours of operation. At any given time, roughly a third of the equipment will be operating; thus, it is assumed that each piece of equipment operates 4 hours out of a 12-hour construction day. Equipment-specific emission factors are from the California Environmental Quality Act, Air Quality Handbook (South Coast Air Quality Management District 2010). The estimated amount and type of construction equipment is provided in the POD in **Appendix E**, Tables 4-3, 4-4, and 4-5 for the pipeline, power line, and ancillary facilities, respectively. The hours of operation were calculated based on assumptions regarding typical construction activities.

Tailpipe emissions from maintenance vehicles are calculated the same as for construction equipment. Emissions are based on the emission factors for light-duty passenger vehicles (South Coast Air Quality Management District 2010) and the calculated maintenance trips.

Fugitive Dust Emissions from Construction Equipment and Facility Maintenance

Fugitive dust is lofted into the air by construction equipment during many types of activities: driving over unpaved surfaces, excavation of top soil and rock, and transfer of excavated material from one place to another, etc. The USEPA has developed a generic emission factor for fugitive dust that includes all construction activities (USEPA 1995). The emission calculations for fugitive dust associated with ROW construction activities are based on the estimated acres of land actively undergoing construction and emission factors for heavy construction operations from the USEPA (USEPA 1995). The estimate of area actively constructed on includes the pipeline ROW plus the temporary ROW, power line ROW, temporary construction staging areas and access roads, and other ancillary facilities. However, all this area is not undergoing construction simultaneously; for the purposes of project emission calculations, it is estimated that approximately 40 acres per day (36 acres for pipelines and power lines, and 2.5 acres for ancillary facilities) are under active construction. Fugitive dust emissions during construction will be controlled as specified in

the required dust control plan. For the purposes of emission calculations, the estimated fugitive dust emissions are assumed to be reduced by 50 percent through use of appropriate control measures.

Fugitive dust from maintenance of project facilities is expected to be minimal. As a result, emissions calculations were not performed; impacts were qualitatively compared with fugitive dust generated by construction activities.

Wind Erosion from Disturbed Surfaces

In addition to fugitive dust that is lofted into the air from construction equipment, construction activities disturb the soil surface, leaving the surface susceptible to wind erosion. Emissions calculations for windblown dust are based on the total estimated acres of land disturbed from construction and the PM_{10} emission factor for wind erosion from the Clark County Wind Tunnel Study (Wacaser et al. 2006). The $PM_{2.5}$ size range is estimated based on USEPA guidance (USEPA 1998; WRAP 2005, 2006), whereby 10 percent of the PM_{10} is in the $PM_{2.5}$ size range.

Conformity Requirements in Nonattainment Areas

As described in Section 3.1.1.1 and **Appendix F3.1**, portions of Clark County, Nevada, and Tooele County, Utah, are designated nonattainment or maintenance for one or more federally regulated pollutants.[8] On September 27, 2010, Clark County (Hydrographic area 212) was re-designated as attainment for carbon monoxide (CO) by the USEPA. March 31, 2011, USEPA published a final rule determining that the Clark County, Nevada, nonattainment area has attained the 1997 8-hour ozone National AAQS and that Clark County is currently attaining the ozone 8-hour standard. On August 3, 2010, USEPA published a final rule determining that the Las Vegas Valley nonattainment area has attained the National AAQS for PM_{10} by the applicable attainment date (December 31, 2006), and that the Las Vegas Valley nonattainment area is currently attaining the standard. However, until the USEPA officially re-designates Clark County as attainment for PM_{10} and ozone, project activities in the hydrographic basins in Clark County must continue to meet conformity requirements. Portions of Tooele County, Utah, are designated nonattainment for sulfur dioxide (SO_2). There are no areas of the ROW that extend into Utah; therefore, Utah nonattainment designations are not considered in the evaluation of the ROW impacts.

Since the project is predicted to emit all of these emissions (or precursors in the case of ozone), a conformity review was conducted based on U.S. Department of Energy (USDOE) guidance (USDOE 2000). To conduct the conformity review, the impact of the project ROW construction and facility maintenance activities was assessed in the nonattainment areas and maintenance areas. The nonattainment and maintenance areas are a small subset of the whole project area. Emissions in these nonattainment and maintenance areas were calculated using the methodology described above for tailpipe emission and fugitive dust emissions, except calculations were limited to the nonattainment and maintenance areas. Estimated emissions were compared with the emissions threshold for conformity determinations as published by USDOE (2000).

Radionuclides and Erionite

There is not anticipated to be re-suspension and transport of radionuclides from past nuclear testing at levels considered to be harmful to human health. Erionite has not been identified in the project area and is not expected to be an air contaminant resulting from project activities. For more information on these compounds, please refer to Sections 3.2, Geologic Resources, and 3.4, Soil Resources.

3.1.2.2 Proposed Action, Alternatives A through C

The development associated with the primary pipeline and power line ROWs would be the same for the Proposed Action and Alternatives A through C. The proposed development within the ROW areas is described in detail in Chapter 2. Chapter 2 also provides estimates of surface disturbance from construction related activities. In summary, the development would include construction of 306 miles of pipeline, 323 miles of overhead power lines, and two primary and five secondary electrical substations. Ancillary facilities that would be developed include five pumping stations, six regulating tanks, three pressure reducing stations, a water treatment facility, a buried storage reservoir, access roads, and communication facilities.

[8] Attainment, maintenance, and nonattainment designations as described throughout the text are based on the current status of these areas as of April 4, 2011.

The proposed GWD Project would generate air emissions through short-term construction activities. Construction air emissions include criteria pollutants, ozone precursors, fugitive dust, and greenhouse gas emissions. The actual fugitive dust emissions would depend on many site-specific factors such as the moisture content and texture of the soils that would be disturbed. Continued air quality impacts due to wind erosion of surfaces disturbed during construction will occur, at decreasing levels, until most surfaces are revegetated.

Emissions from all phases of construction would be subject to applicable state, local, and federal air regulations.

The COM Plan would be developed and implemented to monitor and mitigate the effects of surface disturbing activities on air resources. The COM Plan would integrate protective measures from the following: BLM RMP Management Actions and BMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

Construction and Facility Maintenance

Tailpipe Emissions from Construction Equipment and Facility Maintenance

Localized air quality emissions at a given location due to construction activities are expected to be short term, which is consistent with the project schedule shown in **Figure 2.5-7**. Short-term impacts are defined as being 5 years or less for all resources. Emissions from construction equipment will be controlled by following state and local regulations. As part of the ACMs, the SNWA will complete a final POD (ACM A.1.1), which will detail actual construction control measures as part of a Construction Plan and a Dust Control Plan (ACM A.10.1). In addition, operating permits for stationary sources, such as aggregate handling equipment, and operating permits for major combustion sources, such as engines greater than 250 horsepower, will be obtained prior to construction activities (ACMs A.10.4 and A.10.5). The development of a Construction Traffic Management Plan (ACM A.1.28) with measures to reduce the number of construction trips will also reduce air emissions from construction transportation vehicles.

Based on the POD presented in **Appendix E**, the proposed construction equipment is comprised primarily of heavy-duty, non-road mobile equipment powered by diesel fuel. Only pick-up trucks will operate on gasoline rather than diesel fuel. Emissions from diesel engines would be minimized because engines must be built to meet the standards for mobile sources established by the USEPA mobile source emissions regulations (40 CFR Part 85). In addition, the USEPA is requiring that the maximum sulfur content of diesel fuel for highway vehicles be reduced from 500 ppm by weight (ppmw) to 15 ppmw, making ultra low sulfur diesel available nationwide.

Table 3.1-9 shows the construction emissions for each criteria pollutant, ozone precursors, and greenhouse gases that are estimated to result for the Proposed Action and Alternatives A through C.

Greenhouse gas emissions from construction would be short term and have an inconsequential contribution to long-term global climate change. For context, the estimated greenhouse gas emissions from construction equipment (in carbon dioxide equivalent) are less than 0.00045 percent of the carbon dioxide equivalent estimated to be emitted in 2010 by the U.S. (USEPA 2012b) , and 0.04 percent of the of the carbon dioxide equivalent estimated to be emitted in the state of Nevada in 2005 (NDEP 2008). The total estimated annual emissions of carbon dioxide equivalent associated with construction activities are approximately 24,000 metric tons, which is less than the recommended threshold of 25,000 metric tons, a USEPA reporting threshold for certain industrial and intensive agricultural activities (40 CFR 98.2; 74 FR 56374).

The estimated emissions published in **Table 3.1-9** are based on very general information and cover the whole project area. In many cases the assumptions lead to a large over-prediction of the values. Therefore, it is reasonable to assume that the actual emissions would potentially be much lower than is reported in **Table 3.1-9**. Emissions will be calculated as required for project permits and will comply with applicable local, state, and federal air regulations. Emissions from construction are not expected to cause or contribute to exceedences of any AAQS. Emissions from construction are not expected to impair visibility conditions at GBNP.

While most emissions shown in **Table 3.1-9** are expected to be short-term in duration and impact local air quality only during periods of construction, the emissions from maintenance vehicles are anticipated to last the life of the project.

Table 3.1-9 Emissions from Right-of-way Construction Equipment for Proposed Action, Alternatives A through C

Source	CO		VOC		Nitrogen Oxides (NO_X)		SO_2		PM_{10} and $PM_{2.5}$		Carbon Dioxide Equivalent	
	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Metric Tons per Year
Pipeline Construction Equipment Operations	254	38.1	75	11.3	608	91.3	0.69	0.10	29	4.3	64,514	8,777
Power line Construction Equipment Operations	86	12.9	26	3.8	220	33.1	0.27	0.04	10	1.4	25,541	3,475
Facilities Construction Equipment Operations	297	44.5	88	13.3	723	108.5	0.83	0.12	33	5.0	78,157	10,634
Construction Transportation Vehicles	56	8.3	6	0.9	6	0.9	0.07	0.01	0.60	0.09	7,420	1,009
Maintenance Vehicles	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	55	8
Total Tailpipe Emissions[1]	**693**	**104**	**195**	**29**	**1,558**	**234**	**2**	**0.3**	**72**	**11**	**175,688**	**23,903**

[1] Totals are rounded.

Note: Construction and permanent acreage numbers in the table include a minimal acreage of facilities that currently exist. Therefore the reported acreages conservatively overestimate the amount of disturbance anticipated by the proposed project by approximately 1 percent across all alternatives.

Conclusion. Localized air quality emissions due to construction activities are expected to be short term (5 years or less). Conservative assumptions were used to estimate tailpipe emissions from construction and maintenance vehicles. Based on these assumptions, the potential annual emissions vary from less than 1 ton per year of SO_2, to approximately 24,000 metric tons of carbon dioxide equivalent. Emissions from construction are not expected to cause or contribute to exceedences of any AAQS nor impair visibility conditions at GBNP because the construction equipment would be operated in accordance with required permits on an as-needed-basis over a large project area.

Application of the ACMs to obtain required air permits should minimize the potential impacts to local air quality and ensure protection of applicable AAQS. Although the ACMs would minimize air quality impacts, some criteria pollutants may have elevated concentrations locally.

Proposed mitigation measures:

None.

Residual impacts include:

In close proximity to construction sites, some criteria pollutants may have elevated concentrations relative to current background conditions; however, any elevated concentrations are expected to be limited to construction areas, be short-term in duration, and below applicable AAQS. Long-term impacts to air quality from maintenance vehicles are minimal and range from close to 0 tons per year of SO_2 up to approximately 8 metric tons per year of carbon dioxide equivalent.

Fugitive Dust from Construction and Facility Maintenance Activities

Construction of the proposed pipeline and ancillary facilities would result in intermittent and short-term fugitive emissions. Dust control permits (required in Clark County) and Surface Area Disturbance permits (required in Lincoln and White Pine counties) will be obtained prior to construction activities (ACMs A.1.1 and A.10.1). Dust control permits require a Dust Control Plan and description of all the BMPs that will be used to minimize fugitive dust from construction. The Dust Control Plan will detail the use and application of an approved dust suppression method (ACMs A.10.1 and A.10.3). The application of a dust suppressant (e.g., water, or appropriate tackifier) will be added to active construction sites (ACM A.10.6), unpaved roads (ACM A.10.6), and soil stockpiles (ACM A.10.8). In addition to these ACMs specifically designed to protect air resources, there are several ACMs developed for other purposes (e.g., protection of other resources, safety, etc.) that also will control fugitive dust from construction and maintenance activities. Additional ACMs that will reduce fugitive dust emissions include: crushing rather than removing vegetation when possible (ACM A.1.20), the development of a Construction Traffic Management Plan (ACM A.1.28), limiting the vehicle speeds on unpaved roads (ACM A.1.29), and minimization and removal of dust from paved surfaces (ACMs A.1.33 and A.1.34).

The fugitive dust emissions associated with active construction activities can be calculated by making conservative assumptions of daily construction rates. A rate of construction of 1 mile per day was assumed for the pipeline and 1 mile per day for the power line. This assumption results in a conservatively high estimate of emissions of fugitive dust. When this assumed construction rate is combined with the requested permanent and temporary construction ROW width, a total of 36 acres is under active construction on any given day. In addition, it is assumed that 2.5 acres for building required ancillary facilities are under active construction on any given day. Altogether, approximately 40 acres per day are under active construction. Based on this estimate, the total fugitive dust emission rate can be calculated by multiplying the active construction area by the appropriate emission factor for uncontrolled heavy construction operations (USEPA 1995). By applying water or other dust suppressants as an ACM (ACM A.10.6), potential emissions may be reduced 50 to 80 percent. For the purposes of estimating emissions, it is assumed that ACM A.10.6 will control fugitive dust emissions by 50 percent. Based on these calculations and assumptions, it is estimated that 1,172 pounds per day of PM_{10} (176 tons per year) and 117 pounds per day of $PM_{2.5}$ (18 tons per year) will be emitted in the project area due to fugitive dust during construction activities.

Emissions from construction activities would be restricted to the short-term construction period along the pipeline and power line routes or near the proposed locations of ancillary facilities. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions. Any elevated

concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP. Construction impacts would diminish once construction activities end.

Fugitive dust from maintenance of project facilities is expected to be minimal. Tailpipe emissions from maintenance vehicles were estimated to be approximately 1 percent of tailpipe emissions from construction transportation vehicles. Similarly, it is anticipated that fugitive dust from maintenance will be one percent of the construction fugitive dust. Therefore, it is estimated that 1 ton per year of PM_{10} and 0.1 ton per year of $PM_{2.5}$ will be emitted in the project area due to fugitive dust associated with maintenance vehicles. At these low levels, fugitive dust emissions from maintenance vehicles are expected to be below applicable AAQS and not impair visibility conditions at the GBNP. Emissions from maintenance activities are anticipated to be long-term (lasting the life of the project).

Conclusion. Localized fugitive dust emissions due to construction activities are expected to be short term (5 years or less). Conservative assumptions were used to estimate fugitive dust emissions from construction activities. Based on these assumptions, it is estimated that 1,172 pounds per day of PM_{10} (176 tons per year) and 117 lbs/day of $PM_{2.5}$ (18 tons per year) will be emitted in the project area. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions. Any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP.

Localized fugitive dust emissions due to maintenance activities are expected to continue for the life of the project. It is estimated that 1 ton per year of PM_{10} and 0.1 ton per year of $PM_{2.5}$ will be emitted in the project area due to fugitive dust associated with maintenance vehicles. At these low levels, fugitive dust emissions from maintenance vehicles are expected to be below applicable AAQS and not impair visibility conditions at the GBNP.

Application of the ACMs to develop a Dust Control Plan and obtain required air permits should minimize the potential impacts to local air quality and ensure protection of applicable AAQS. Although the ACMs would minimize impacts from fugitive dust, areas in close proximity to construction sites and the ROW may experience elevated concentrations of PM during periods of construction or maintenance activities.

Proposed mitigation measures:

The COM Plan would be developed and implemented to monitor and mitigate the effects of surface disturbing activities on air resources.

The following proposed mitigation measures are not currently addressed in SNWA's ACMs and are intended to bring SNWA's ACMs into conformance with the BLM RMPs.

ROW-AQ-1: Project Road Inspections to Reduce Wind and Water Erosion. The SNWA and the BLM's Environmental Compliance Monitor would inspect project roads in areas prone to air and water erosion bi-weekly during construction, or more frequently during periods of adverse weather conditions. Repairs would be completed within 5 working days of notification to the SNWA or sooner depending on public safety and the nature of the issue detected. SNWA would make a photographic documentation of the road condition prior to and immediately after road repairs. Effectiveness: This mitigation measure would be very effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a substantial reduction of short-term fugitive dust impacts. Effects on other resources: This mitigation measure would have a small (negligible) increase in vehicular traffic along the ROW during construction activities.

ROW-AQ-2: **Alternative Dust Control Measures**. Areas where soil tackifiers are prohibited (e.g., threatened and endangered species habitat, perennial stream drainages) would be determined in cooperation with the BLM and the USFWS prior to construction, and identified in both the Construction and Mitigation Plans. Other mitigation (e.g., gravel application) may be required to reduce impacts and to ensure protection of public safety. This measure would supplement SNWA ACM A.10.3. Effectiveness: This mitigation measure would be moderately effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a noticeable reduction of short-term fugitive dust impacts. Effects

on other resources: This measure would have a minor positive effect on threatened and endangered species habitat by reducing dust cover and on sensitive aquatic species by reducing water contamination by chemicals.

Residual impacts include:

Implementation of the federal and state requirements, ACMs, and proposed mitigation measures should effectively mitigate fugitive dust impacts to air quality. It is estimated that 1 ton per year of PM_{10} and 0.1 ton per year of $PM_{2.5}$ will be emitted long-term in the project area due to fugitive dust associated with maintenance vehicles. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions; however, any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, and below applicable AAQS.

Wind Blown Dust from Disturbed Surfaces

Construction of the proposed pipeline and ancillary facilities would result in tracts of disturbed surfaces that are prone to wind erosion. Dust control permits (required in Clark County) and Surface Area Disturbance permits (required in Lincoln and White Pine counties) will be obtained prior to construction activities (ACMs A.1.1 and A.10.1). Dust control permits require a Dust Control Plan and description of all the BMPs that will be used to minimize windblown dust from disturbed surfaces. The Dust Control Plan will detail the use and application of an approved dust suppression method (ACMs A.10.1 and A.10.3). The application of a dust suppressant (e.g., water, or appropriate tackifier) will be added to active construction sites (ACM A.10.6), unpaved roads (ACM A.10.6), and soil stockpiles (ACM A.10.8). Since the generation of windblown dust is strongly dependent on wind speed, the Dust Control permit will include measures for assessing the need to stop work or increase dust control measures based on wind and/or air quality monitoring (ACMs A.10.2 and A.10.7).

In addition to these ACMs specifically designed to protect air resources, there are several ACMs developed for other purposes (e.g., protection of other resources, safety, etc.) that will also control windblown dust from disturbed surfaces. Additional ACMs that will reduce windblown dust include: crushing rather than removing vegetation when possible (ACM A.1.20), minimization and removal of dust from paved surfaces (ACMs A.1.33 and A.1.34), and the development of a Restoration Plan (ACM A.1.69).

Based on the estimated total acres of surface disturbed during construction of ROW and ancillary facilities (12,303 acres) and the Clark County emission factors for windblown dust of open exposed land (0.01 tons PM_{10} per acre-year) (Wacaser et al. 2006), the total windblown dust emission rate can be calculated. Given the level of ACMs aimed to minimize windblown dust, it is reasonable to assume a 50 percent control efficiency will be obtained. By multiplying the emission factor by the estimated total acres of disturbed surface and applying a 50 percent control efficiency, a maximum PM_{10} emission rate for the project is approximately 62 tons PM_{10} per year. For the western region, it is a conservative assumption that $PM_{2.5}$ is 10 percent of PM_{10} (WRAP 2005, 2006). Therefore, the $PM_{2.5}$ emission rate is estimated to be 6 tons per year. At these levels, windblown dust emissions from disturbed surfaces associated with ROW construction are not expected to impair visibility conditions at the GBNP.

Windblown dust impacts would diminish once construction activities end and after disturbed areas are reclaimed. Revegetation measures will be conducted as part of the reclamation process (ACM A.1.69). Disturbed soils would be protected by mulches and other surface treatments as specified in the approved POD, thereby reducing the risk of wind erosion.

Emission impacts from facility maintenance would be much less than those impacts during the construction phase. Only 1,014 acres (primarily access roads) of the original 12,303 acres of disturbed surfaces would remain prone to wind erosion. Long-term windblown dust impacts would be approximately 8 percent (1,014 acres ÷ 12,303 acres) of the estimated maximum windblown dust impacts. Therefore, the long-term PM_{10} emission rate is estimated to be 5 tons per year and the $PM_{2.5}$ emission rate is estimated to be 1 tons per year over the project area. Windblown dust emissions from disturbed surfaces associated with ROW construction and maintenance are not expected to impair visibility conditions at the GBNP.

Conclusion. A majority of the windblown dust emissions due to surfaces disturbed due to construction are expected to be short term (5 years or less) until surfaces are revegetated. It is estimated the short-term PM_{10} windblown dust would

be 62 tons per year and the $PM_{2.5}$ windblown dust would be 6 tons per year over the whole project area. The windblown dust over the ROW areas that will not be revegetated (and the impacts are therefore long-term) is estimated to be 5 tons per year of PM_{10} and 1 tons per year of $PM_{2.5}$ near the permanent ROW. Windblown dust emissions from disturbed surfaces are not expected to impair visibility conditions at the GBNP.

Application of the ACMs to develop a Dust Control Plan and obtain required air permits should minimize the potential impacts to local air quality and ensure protection of applicable AAQS. Although the ACMs would minimize impacts from windblown dust, areas in close proximity to construction sites and the ROW may experience elevated concentrations of PM during periods of high winds.

Proposed mitigation measures:

None.

Residual impacts include:

Implementation of the federal and state requirements and ACMs should effectively mitigate windblown dust impacts to air quality in the short-term. Revegetation measures should effectively mitigate of windblown dust impacts to air quality in the long-term. The long-term windblown dust over the permanent ROW areas, which will not be revegetated, is estimated to be 5 tons per year of PM_{10} and 1 tons per year of $PM_{2.5}$. There may be elevated concentrations of PM relative to current background conditions caused by windblown dust near the permanent ROW; however, any elevated concentrations are expected to be limited to areas in close proximity to the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP.

Conformity Review for Nonattainment Areas

For areas classified as nonattainment or maintenance, a conformity review is required. To conduct the conformity review, emissions from ROW construction and facility maintenance activities predicted to occur in the nonattainment areas and maintenance areas were calculated. The nonattainment and maintenance areas are a small subset of the whole project area (see **Appendix F3.1** for more information regarding attainment classifications and pending redesignations). As part of the conformity review, the emission rates of the project are compared with thresholds defined in 40 CFR 93.153(b). If the project emissions exceed the thresholds, a conformity determination is required. For the purposes of the conformity review, estimates of the project emissions are conducted following the approach outlined above for tailpipe emissions, fugitive dust, and windblown dust.

The conformity threshold for the ozone precursors, VOCs, or NO_X, emitted in the ozone nonattainment area is 100 tons per year for each type of precursor. The Nevada nonattainment area for ozone that also contains the ROW development areas includes HB 212, Las Vegas Valley; HB 216, Garnet Valley; HB 217, Hidden Valley; and HB 218, California Wash Valley.

For areas classified as serious nonattainment for PM_{10}, a conformity determination would be required if the PM_{10} emission rates exceed 70 tons per year. The portion of Clark County, Nevada, that is designated as a serious nonattainment area for PM_{10}, is limited to HB 212, Las Vegas Valley.

Using the approach presented in the preceding sections to estimate the impacts to air quality due to ROW construction and facility maintenance, the emissions in the nonattainment areas can be calculated and compared with the applicable thresholds. Since the emissions thresholds defined under 40 CFR 93.153(b) are for any given year of the project, the maximum possible annual emissions are calculated for the nonattainment and maintenance areas.

Only tailpipe emissions from construction equipment emit ozone precursors (i.e., fugitive dust and windblown dust do not produce NO_X or VOC emissions). The amount of NO_X and VOC emitted by construction equipment in the nonattainment area is based on the proposed length of pipeline (28.1 miles) and power line (14.6 miles) to be constructed in HB 212, Las Vegas Valley; HB 216, Garnet Valley; HB 217, Hidden Valley; and HB 218, California Wash Valley. It can be conservatively assumed that construction of 28.1 miles of pipeline and 14.6 miles of power line will take less than 150 days. One hundred and fifty days of pipeline construction, power line construction, and associated construction transportation would emit 8 tons per year of VOC and 63 tons per year of NO_X in the

nonattainment area, well below the 100 tons per year conformity threshold. Therefore, a conformity determination is not required for this project for ozone.

To assess the PM_{10} project emissions in the nonattainment area, all sources of PM_{10} were estimated, including tailpipe emissions, fugitive dust, and windblown dust. The Nevada PM_{10} nonattainment area is limited to HB 212, Las Vegas Valley. The amount of PM_{10} emitted by construction equipment in the nonattainment area is based on the proposed length of pipeline (8.8 miles) and power line (0 mile) to be constructed in Las Vegas Valley. It can be conservatively assumed that construction of 8.8 miles of pipeline will take less than 100 days. One hundred days of pipeline construction and associated construction transportation would emit 2 tons per year of PM_{10} in the nonattainment area. To calculate the fugitive and windblown dust in the Nevada PM_{10} nonattainment area, the estimated area of surface disturbance during construction is 241 acres in Las Vegas Valley. If this whole area was actively being constructed in a year, the USEPA emission factor for fugitive dust could be multiplied by the estimated acres of active construction and applying a 50 percent control efficiency. With these assumptions, the maximum fugitive dust PM_{10} emission rate for the nonattainment portions of the project area is 4 tons per year. Similarly, the PM_{10} emissions from windblown dust can be calculated by multiplying the Clark County emission factor for windblown dust by the estimated acres of surface disturbance. The resulting estimated PM_{10} windblown dust emissions for the nonattainment portions of the project area are 1 tons per year.

Altogether the maximum annual PM_{10} emission rate within the nonattainment area due to ROW activities would be 7 tons per year, this includes tailpipe emissions, fugitive dust, and windblown dust. The PM_{10} emissions in the nonattainment area are less than the conformity threshold of 70 tons per year. Therefore, a conformity determination is not required for this project for PM_{10}.

Conclusion. Portions of Clark County, Nevada, are designated as nonattainment or maintenance for PM_{10} and ozone. There are no areas of the ROW that extend into Utah; therefore, Utah nonattainment designations are not considered in the evaluation of the ROW impacts. It is estimated that the project would emit 8 tons of VOC per year, 63 tons of NO_X per year, and 8 tons of PM_{10} per year in the Nevada nonattainment areas. These emissions levels are well below the conformity threshold for each pollutant. Therefore, a conformity determination is not required for this project.

Proposed mitigation measures:

None.

Residual impacts include:

None.

Entrainment of Radionuclides or Erionite from Construction Activities

As described in Section 3.4, Soil Resources, soil testing for radioactive nuclides in the project area has shown that any fallout from nuclear testing conducted in the past has decayed to low levels that are not considered harmful to human health. Likewise, any fugitive dust generated by construction activities will not contain radioactive material from past nuclear testing at levels that are harmful to human health.

As described in Section 3.2, Geologic Resources, erionite has not been identified in the project area. Therefore, it not expected that erionite deposits will be exposed and suspended into the air during construction activities.

Conclusion. The project is not expected to contribute to increases in radionuclides or erionite.

Proposed mitigation measures:

None.

Residual impacts include:

None.

Summary of Proposed Action and Alternatives A, B, and C

The estimated long-term (residual) emissions from construction and maintenance of the ROW are shown in **Table 3.1-10**.

Tailpipe Emissions from Construction Equipment and Facility Maintenance

It is assumed that construction occurs 12 hours per day, 300 days per year. It is assumed that only a third of the construction fleet is operating at a given time. Maintenance vehicles will inspect the length of the pipeline and power line once a week. ACMs include measures that are required by state and local regulations, such as obtaining dust control permits and operating permits. Implementation of these measures would result in estimated annual emissions from construction and maintenance activities varying between less than 1 ton per year of SO_2 to approximately 24,000 metric tons of carbon dioxide equivalent. Localized air emissions due to construction activities are expected to be short term (5 years or less), while maintenance activities are expected to occur for the life of the project. Long-term impacts to air quality from maintenance vehicles are minimal and range from close to 0 tons per year of SO_2 up to approximately 8 metric tons per year of carbon dioxide equivalent. Emissions from construction and maintenance are not expected to cause or contribute to exceedences of any AAQS. Emissions from construction and maintenance are not expected to impair visibility conditions at the GBNP.

Fugitive Dust from Construction and Facility Maintenance Activities

The construction of 306 miles of pipeline, 322 miles of power lines, and ancillary facilities requires disturbance of a large surface area. Fugitive dust is generated during construction and maintenance activities. Mitigation measures ROW-AQ-1 (inspection and repair of project roads) and ROW-AQ-2 (application of tackifiers and gravel) can be effective at minimizing fugitive dust. Implementation of the federal and state requirements, ACMs, and proposed mitigation measures should effectively mitigate fugitive dust impacts to air quality. Localized fugitive dust emissions due to construction activities are expected to be short term (5 years or less). It is estimated that 176 tons per year of PM_{10} and 18 tons per year of $PM_{2.5}$ will be emitted in the project area during construction. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions. Any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and are not expected to impair visibility conditions at the GBNP. Localized fugitive dust emissions due to maintenance activities are expected to continue for the life of the project. It is estimated that 6 tons per year of PM_{10} and 1 ton per year of $PM_{2.5}$ will be emitted in the project area due to fugitive dust associated with maintenance vehicles. Fugitive dust emissions from maintenance vehicles are expected to be below applicable AAQS and not impair visibility conditions at the GBNP.

Wind Blown Dust from Disturbed Surfaces

The construction activities are anticipated to disturb the surface of 12,303 acres and create a permanent ROW of 1,014 acres. Disturbed surfaces are more prone to wind erosion. A majority of the windblown dust emissions due to surfaces disturbed during construction are expected to be short term (5 years or less) until surfaces are revegetated as part of ACMs. It is estimated the short-term PM_{10} windblown dust would be 62 tons per year and the $PM_{2.5}$ windblown dust would be 6 tons per year over the whole project area. The windblown dust over the ROW areas that will not be revegetated (and the impacts are therefore long-term) is estimated to be 5 tons per year of PM_{10} and 1 tons per year of $PM_{2.5}$ near the permanent ROW. Windblown dust emissions from disturbed surfaces associated with ROW construction and maintenance are not expected to impair visibility conditions at the GBNP.

Conformity Review for Nonattainment Areas

Portions of Clark County, Nevada, are designated as nonattainment or maintenance for PM_{10} and ozone. There are no areas of the ROW that extend into Utah; therefore, Utah nonattainment designations are not considered in the evaluation of the ROW impacts. It is estimated that the project would emit 8 tons of VOC per year, 63 tons of NO_X per year, and 7 tons of PM_{10} per year in the Nevada nonattainment areas. These emissions levels are well below the conformity threshold for each pollutant. Therefore, a conformity determination is not required for this project.

Entrainment of Radionuclides or Erionite from Construction Activities

The project is not expected to contribute to increases in radionuclides or erionite.

Table 3.1-10 Long-term Emissions from Right-of-way Construction and Maintenance for Proposed Action, Alternatives A through C

Source	CO		VOC		NO_X		SO_2		PM_{10}		Carbon Dioxide Equivalent	
	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Metric Tons per Year
Tailpipe Emissions from Maintenance Vehicles	0	0.06	0.04	0.01	0.04	0.01	0.00	0.00	0.00	0.00	55	7.55
Fugitive Dust from Maintenance	-	-	-	-	-	-	-	-	9	1	-	-
Windblown Dust from Permanent ROW	-	-	-	-	-	-	-	-	28	5	-	-
Total Long-term Emissions	**0**	**0.06**	**0.04**	**0.01**	**0.04**	**0.01**	**0.00**	**0.00**	**37**	**6**	**55**	**8**

Note: Construction and permanent acreage numbers in the table include a minimal acreage of facilities that currently exist. Therefore the reported acreages conservatively overestimate the amount of disturbance anticipated by the proposed project by approximately 1 percent across all alternatives.

3.1.2.3 Alternative D

The proposed development of Alternative D within the ROW areas is described in detail in Chapter 2. Chapter 2 also provides estimates of surface disturbance from construction related activities. In summary, the development would include construction of 225 miles of pipeline, 208 miles of overhead power lines, and 2 primary and 2 secondary electrical substations. Ancillary facilities that would be developed include two pumping stations, five regulating tanks, three pressure reducing stations, a water treatment facility, a buried storage reservoir, access roads, and communication facilities.

The proposed GWD Project would generate air emissions through short-term construction activities. Construction air emissions include criteria pollutants, ozone precursors, fugitive dust, and greenhouse gas emissions. The actual fugitive dust emissions would depend on many site-specific factors such as the moisture content and texture of the soils that would be disturbed. Continued air quality impacts due to wind erosion of surfaces disturbed during construction will continue, at decreasing levels, until most surfaces are revegetated. The estimated long-term emissions from construction and maintenance of the ROW for Alternative D are shown in **Table 3.1-11**.

The COM Plan would be developed and implemented to monitor and mitigate the effects of surface disturbing activities on air resources. The COM Plan would integrate protective measures from the following: BLM RMP Management Actions and BMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

Summary of Alternative D

Tailpipe Emissions from Construction Equipment and Facility Maintenance

It is assumed that construction occurs 12 hours per day, 300 days per year. It is assumed that only a third of the construction fleet is operating at a given time. Maintenance vehicles will inspect the length of the pipeline and power line once a week. ACMs include measures that are required by state and local regulations, such as obtaining dust control permits and operating permits. Implementation of these measures would result in an estimated annual emissions from construction and maintenance activities varying between less than 1 ton per year of SO_2 to approximately 24,000 metric tons of carbon dioxide equivalent. Localized air emissions due to construction activities are expected to be short term (5 years or less), while maintenance activities are expected to occur for the life of the project. Long-term impacts to air quality from maintenance vehicles are minimal and range from close to 0 tons per year of SO_2 up to approximately 5 metric tons per year of carbon dioxide equivalent. Emissions from construction and maintenance are not expected to cause or contribute to exceedences of any AAQs. Emissions from construction and maintenance are not expected to impair visibility conditions at the GBNP.

Proposed mitigation measures:

None.

Residual impacts include:

In close proximity to construction sites, some criteria pollutants may have elevated concentrations relative to current background conditions; however, any elevated concentrations are expected to be limited to construction areas, be short-term in duration, and below applicable AAQS. Long-term impacts to air quality from maintenance vehicles are minimal and range from close to 0 tons per year of SO_2 up to approximately 5 metric tons per year of carbon dioxide equivalent.

Fugitive Dust from Construction and Facility Maintenance Activities

The construction of 225 miles of pipeline, 208 miles of power lines, and ancillary facilities require disturbance of a large surface area. Fugitive dust is generated during construction and maintenance activities. Mitigation measures ROW-AQ-1 (inspection and repair of project roads) and ROW-AQ-2 (application of tackifiers and gravel) can be effective at minimizing fugitive dust. Implementation of the federal and state requirements, ACMs, and proposed mitigation measures should effectively mitigate fugitive dust impacts to air quality. Localized fugitive dust emissions due to construction activities are expected to be short term (5 years or less). It is estimated that 174 tons per year of PM_{10} and 17 tons per year of $PM_{2.5}$ will be emitted in the project area during construction. In close proximity to

Table 3.1-11 Long-term Emissions from Right-of-way Construction and Maintenance for Alternative D

Source	CO		VOC		NO_X		SO_2		PM_{10}		Carbon Dioxide Equivalent	
	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Metric Tons per Year
Tailpipe Emissions from Maintenance Vehicles	0	0.04	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	38	5.20
Fugitive Dust from Maintenance	-	-	-	-	-	-	-	-	6	1	-	-
Windblown Dust from Permanent ROW	-	-	-	-	-	-	-	-	23	4	-	-
Total Long-term Emissions	**0**	**0.04**	**0.03**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**29**	**5**	**38**	**5**

Note: Construction and permanent acreage numbers in the table include a minimal acreage of facilities that currently exist. Therefore the reported acreages conservatively overestimate the amount of disturbance anticipated by the proposed project by approximately 1 percent across all alternatives.

construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions. Any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at the GBNP. Localized fugitive dust emissions due to maintenance activities are expected to continue for the life of the project. It is estimated that 1 ton per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$ will be emitted in the project area due to fugitive dust associated with maintenance vehicles. Fugitive dust emissions from maintenance vehicles are expected to be below applicable AAQS and not impair visibility conditions at the GBNP.

Proposed mitigation measures:

The COM Plan would be developed and implemented to monitor and mitigate the effects of surface disturbing activities on air resources.

The following proposed mitigation measures are not currently addressed in SNWA's ACMs and are intended to bring SNWA's ACMs into conformance with the BLM RMPs.

ROW-AQ-1: Project Road Inspections to Reduce Wind and Water Erosion. The SNWA and the BLM's Environmental Compliance Monitor would inspect project roads in areas prone to air and water erosion bi-weekly during construction, or more frequently during periods of adverse weather conditions. Repairs would be completed within 5 working days of notification to the SNWA or sooner depending on public safety and the nature of the issue detected. SNWA would make a photographic documentation of the road condition prior to and immediately after road repairs. Effectiveness: This mitigation measure would be very effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a substantial reduction of short-term fugitive dust impacts. Effects on other resources: This mitigation measure would have a small (negligible) increase in vehicular traffic along the ROW during construction activities.

ROW-AQ-2: **Alternative Dust Control Measures**. Areas where soil tackifiers are prohibited (e.g., threatened and endangered species habitat, perennial stream drainages) would be determined in cooperation with the BLM and the USFWS prior to construction, and identified in both the Construction and Mitigation Plans. Other mitigation (e.g., gravel application) may be required to reduce impacts and to ensure protection of public safety. This measure would supplement SNWA ACM A.10.3. Effectiveness: This mitigation measure would be moderately effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a noticeable reduction of short-term fugitive dust impacts. Effects on other resources: This measure would have a minor positive effect on threatened and endangered species habitat by reducing dust cover and on sensitive aquatic species by reducing water contamination by chemicals.

Residual impacts include:

Implementation of the federal and state requirements, ACMs, and proposed mitigation measures should effectively mitigate fugitive dust impacts to air quality. It is estimated that 1 ton per year of PM_{10} and 0.1 ton per year of $PM_{2.5}$ will be emitted long-term in the project area due to fugitive dust associated with maintenance vehicles. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions; however, any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP.

Wind Blown Dust from Disturbed Surfaces

The construction activities associated with this alternative are anticipated to disturb the surface of 8,843 acres and have a permanent ROW of 823 acres. Disturbed surfaces are more prone to wind erosion. A majority of the windblown dust emissions due to surfaces disturbed during construction are expected to be short term (5 years or less) until surfaces are revegetated as part of ACMs. It is estimated the short-term PM_{10} windblown dust would be 44 tons per year and the $PM_{2.5}$ windblown dust would be 4 tons per year over the whole project area. The windblown dust over the ROW areas that will not be revegetated (and the impacts are therefore long-term) is estimated to be 4 tons per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$ near the permanent ROW. Windblown dust emissions from disturbed surfaces associated with ROW construction and maintenance are not expected to impair visibility conditions at the GBNP.

Proposed mitigation measures:

None.

Residual impacts include:

Implementation of the federal and state requirements and ACMs should effectively mitigate windblown dust impacts to air quality in the short-term. Revegetation measures should effectively mitigate of windblown dust impacts to air quality in the long-term. The long-term windblown dust over the permanent ROW areas, which will not be revegetated, is estimated to be 4 tons per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$. There may be elevated concentrations of PM relative to current background conditions caused by windblown dust near the permanent ROW; however, any elevated concentrations are expected to be limited to areas in close proximity to the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP.

Conformity Review for Nonattainment Areas

Portions of Clark County, Nevada, are designated as nonattainment or maintenance for PM_{10} and ozone. There are no areas of the ROW that extend into Utah; therefore, Utah nonattainment designations are not considered in the evaluation of the ROW impacts. It is estimated that the project would emit 8 tons of VOC per year, 63 tons of NO_X per year, and 8 tons of PM_{10} per year in the Nevada nonattainment areas. These emissions levels are well below the conformity threshold for each pollutant. Therefore, a conformity determination is not required for this project.

Proposed mitigation measures:

None.

Residual impacts include:

None.

Entrainment of Radionuclides or Erionite from Construction Activities

The project is not expected to contribute to increases in radionuclides or erionite.

Proposed mitigation measures:

None.

Residual impacts include:

None.

3.1.2.4 Alternatives E and F

The proposed development of Alternatives E and F within the ROW areas is described in detail in Chapter 2. Chapter 2 also provides estimates of surface disturbance from construction related activities. In summary, the development would include construction of 263 miles of pipeline, 280 miles of overhead power lines, and two primary and four secondary electrical substations. Ancillary facilities that would be developed include three pumping stations, five regulating tanks, three pressure reducing stations, a water treatment facility, a buried storage reservoir, access roads, and communication facilities.

The proposed GWD Project would generate air emissions through short-term construction activities. Construction air emissions include criteria pollutants, ozone precursors, fugitive dust, and greenhouse gas emissions. The actual fugitive dust emissions would depend on many site-specific factors such as the moisture content and texture of the soils that would be disturbed. Continued air quality impacts due to wind erosion of surfaces disturbed during construction will continue, at decreasing levels, until most surfaces are revegetated. The estimated long-term emissions from construction and maintenance of the ROW for Alternatives E and F are shown in **Table 3.1-12**.

The COM Plan would be developed and implemented to monitor and mitigate the effects of surface disturbing activities on air resources. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, BMPs, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

Summary of Alternatives E and F

Tailpipe Emissions from Construction Equipment and Facility Maintenance

It is assumed that construction occurs 12 hours per day, 300 days per year. It is assumed that only a third of the construction fleet is operating at a given time. Maintenance vehicles will inspect the length of the pipeline and power line once a week. ACMs include measures that are required by state and local regulations, such as obtaining dust control permits and operating permits. Implementation of these measures would result in an estimated annual emissions from construction and maintenance activities varying between less than 1 ton per year of SO_2, to approximately 24,000 metric tons of carbon dioxide equivalent. Localized air emissions due to construction activities are expected to be short term (5 years or less), while maintenance activities are expected to occur for the life of the project. Long-term impacts to air quality from maintenance vehicles are minimal and range from close to 0 tons per year of SO_2 up to approximately 7 metric tons per year of carbon dioxide equivalent. Emissions from construction and maintenance are not expected to cause or contribute to exceedences of any AAQs. Emissions from construction and maintenance are not expected to impair visibility conditions at the GBNP.

Proposed mitigation measures:

None.

Residual impacts include:

In close proximity to construction sites, some criteria pollutants may have elevated concentrations relative to current background conditions; however, any elevated concentrations are expected to be limited to construction areas, be short-term in duration, and below applicable AAQS. Long-term impacts to air quality from maintenance vehicles are minimal and range from close to 0 tons per year of SO_2 up to approximately 7 metric tons per year of carbon dioxide equivalent.

Fugitive Dust from Construction and Facility Maintenance Activities

The construction of 263 miles of pipeline, 280 miles of power lines, and ancillary facilities require disturbance of a large surface area. Fugitive dust is generated during construction and maintenance activities. Mitigation measures ROW-AQ-1 (inspection and repair of project roads) and ROW-AQ-2 (application of tackifiers and gravel) can be effective at minimizing fugitive dust. Implementation of the federal and state requirements, ACMs, and proposed mitigation measures should effectively mitigate fugitive dust impacts to air quality. Localized fugitive dust emissions due to construction activities are expected to be short term (5 years or less). It is estimated that 175 tons per year of PM_{10} and 18 tons per year of $PM_{2.5}$ will be emitted in the project area during construction. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions. Any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP. Localized fugitive dust emissions due to maintenance activities are expected to continue for the life of the project. It is estimated that 1 ton per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$ will be emitted in the project area due to fugitive dust associated with maintenance vehicles. Fugitive dust emissions from maintenance vehicles are expected to be below applicable AAQS and not impair visibility conditions at the GBNP.

Table 3.1-12 Long-term Emissions from Right-of-way Construction and Maintenance for Alternatives E and F

Source	CO		VOC		NO_x		SO_2		PM_{10}		Carbon Dioxide Equivalent	
	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Tons per Year	Pounds per Day	Metric Tons per Year
Tailpipe Emissions from Maintenance Vehicles	0	0.05	0.04	0.01	0.04	0.01	0.00	0.00	0.00	0.00	48	6.53
Fugitive Dust from Maintenance	-	-	-	-	-	-	-	-	8	1	-	-
Windblown Dust from Permanent ROW	-	-	-	-	-	-	-	-	26	5	-	-
Total Long-term Emissions	**0**	**0.05**	**0.04**	**0.01**	**0.04**	**0.01**	**0.00**	**0.00**	**34**	**6**	**48**	**7**

Note: Construction and permanent acreage numbers in the table include a minimal acreage of facilities that currently exist. Therefore the reported acreages conservatively overestimate the amount of disturbance anticipated by the proposed project by approximately 1 percent across all alternatives.

Proposed mitigation measures:

The COM Plan would be developed and implemented to monitor and mitigate the effects of surface disturbing activities on air resources.

The following proposed mitigation measures are not currently addressed in SNWA's ACMs and are intended to bring SNWA's ACMs into conformance with the BLM RMPs.

ROW-AQ-1: Project Road Inspections to Reduce Wind and Water Erosion. The SNWA and the BLM's Environmental Compliance Monitor would inspect project roads in areas prone to air and water erosion bi-weekly during construction, or more frequently during periods of adverse weather conditions. Repairs would be completed within 5 working days of notification to the SNWA or sooner depending on public safety and the nature of the issue detected. SNWA would make a photographic documentation of the road condition prior to and immediately after road repairs. Effectiveness: This mitigation measure would be very effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a substantial reduction of short-term fugitive dust impacts. Effects on other resources: This mitigation measure would have a small (negligible) increase in vehicular traffic along the ROW during construction activities.

ROW-AQ-2: **Alternative Dust Control Measures**. Areas where soil tackifiers are prohibited (e.g., threatened and endangered species habitat, perennial stream drainages) would be determined in cooperation with the BLM and the USFWS prior to construction, and identified in both the Construction and Mitigation Plans. Other mitigation (e.g., gravel application) may be required to reduce impacts and to ensure protection of public safety. This measure would supplement SNWA ACM A.10.3. Effectiveness: This mitigation measure would be moderately effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a noticeable reduction of short-term fugitive dust impacts. Effects on other resources: This measure would have a minor positive effect on threatened and endangered species habitat by reducing dust cover and on sensitive aquatic species by reducing water contamination by chemicals.

Residual impacts include:

Implementation of the federal and state requirements, ACMs, and proposed mitigation measures should effectively mitigate fugitive dust impacts to air quality. It is estimated that 1 ton per year of PM_{10} and 0.1 ton per year of $PM_{2.5}$ will be emitted long-term in the project area due to fugitive dust associated with maintenance vehicles. In close proximity to construction sites and the ROW, there may be elevated concentrations of PM relative to current background conditions; however, any elevated concentrations are expected to be limited to areas in close proximity to construction and the ROW, be short-term in duration, below applicable AAQS, and not impair visibility conditions at GBNP.

Windblown Dust from Disturbed Surfaces

The construction activities associated with this alternative are anticipated to disturb the surface of 10,696 acres and creat a permanent ROW of 960 acres. Disturbed surfaces are more prone to wind erosion. A majority of the windblown dust emissions due to surfaces disturbed during construction are expected to be short term (5 years or less) until surfaces are revegetated as part of ACMs. It is estimated the short-term PM_{10} windblown dust would be 53 tons per year and the $PM_{2.5}$ windblown dust would be 5 tons per year over the whole project area. The windblown dust over the ROW areas that will not be revegetated (and the impacts are therefore long-term) is estimated to be 5 tons per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$ near the permanent ROW. Windblown dust emissions from disturbed surfaces associated with ROW construction and maintenance are not expected to impair visibility conditions at the GBNP.

Proposed mitigation measures:

None.

Residual impacts include:

Implementation of the federal and state requirements and ACMs should effectively mitigate windblown dust impacts to air quality in the short-term. Revegetation measures should effectively mitigate of windblown dust impacts to air quality in the long-term. The long-term windblown dust over the permanent ROW areas, which will not be revegetated, is estimated to be 5 tons per year of PM_{10} and 1 tons per year of $PM_{2.5}$. There may be elevated concentrations of PM relative to current background conditions caused by windblown dust near the permanent ROW; however, any elevated concentrations are expected to be limited to areas in close proximity to the ROW, be short-term in duration, and below applicable AAQS.

Conformity Review for Nonattainment Areas

Portions of Clark County, Nevada, are designated as nonattainment or maintenance for PM_{10} and ozone. There are no areas of the ROW that extend into Utah; therefore, Utah nonattainment designations are not considered in the evaluation of the ROW impacts. It is estimated that the project would emit 8 tons of VOC per year, 63 tons of NO_X per year, and 8 tons of PM_{10} per year in the Nevada nonattainment areas. These emissions levels are well below the conformity threshold for each pollutant. Therefore, a conformity determination is not required for this project.

Proposed mitigation measures:

None.

Residual impacts include:

None.

Entrainment of Radionuclides or Erionite from Construction Activities

The project is not expected to contribute to increases in radionuclides or erionite.

Proposed mitigation measures:

None.

Residual impacts include:

None.

3.1.2.5 Alignment Options 1 through 4

There is a negligible change to air quality impacts for Alignment Options 1 through 4 relative to the Proposed Action. The change in the acres of surface disturbance for these alignment options is less than 1 percent, which is less than the uncertainty in the emission factors used to estimate emissions. For all intents and purposes, the air quality impacts estimated for the ROW Proposed Action are considered to be applicable to Alignment Options 1 through 4.

3.1.2.6 No Action

Under the No Action Alternative, the proposed project would not be constructed or maintained. No project-related surface disturbance would occur. Natural (biogenic) and human (anthropogenic) sources of pollutant emissions would continue. Anthropogenic emissions are expected to increase in proportion to projected population increases in Lincoln County (see Section 3.18, Socioeconomics and Environmental Justice). Without project surface disturbance, there would be some increase in current levels of fugitive dust generation due to continued groundwater pumping activities. Current anthropogenic activities, as well as natural wind conditions, would continue to generate dust as discussed in Section 3.1.1.1. Climate changes would continue; the scale of these changes would depend on the interactions of the atmospheric and oceanic circulation patterns and level of future anthropogenic emissions of greenhouse gases.

3.1.2.7 Comparison of Alternatives

Generally, the impacts to air quality from the ROW construction and maintenance are very similar among alternatives. **Table 3.1-13** shows the estimated maximum annual construction emissions for each alternative for each pollutant. Only the emissions of PM_{10} and $PM_{2.5}$ vary between alternatives since PM emissions depend on the acres of surface disturbance. The emissions of all other pollutants depend on the tailpipe emissions from construction activities, which, over a year, are the same for each alternative. **Table 3.1-14** shows the estimated long-term (residual) maintenance emissions for each alternative for each pollutant. The maintenance emissions for all pollutants depend on the length and area of the permanent ROWs for the pipeline and power line, which vary slightly for each alternative. **Table 3.1-15** summarizes the impacts to all air quality metrics from ROW construction and maintenance activities for each alternative.

Table 3.1-13 Estimated Maximum Annual Emissions from Right-of-way Construction of the Proposed Action, Alternatives A through F and Alignment Options 1 through 4

Alternative	CO	VOC	NO_X	SO_2	PM_{10}	$PM_{2.5}$	Carbon Dioxide Equivalent
	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Metric Tons per Year
Proposed Action, Alternatives A through C, and Alignment Options 1 through 4	104	29	234	0.3	248	35	23,903
Alternative D	104	29	234	0.3	229	33	23,901
Alternatives E and F	104	29	234	0.3	239	34	23,902

Note: Construction and permanent acreage numbers in the table include a minimal acreage of facilities that currently exist. Therefore the reported acreages conservatively overestimate the amount of disturbance anticipated by the proposed project by approximately 1 percent across all alternatives.

Table 3.1-14 Estimated Long-term Annual Emissions from Right-of-way Maintenance of the Proposed Action, Alternatives A through F and Alignment Options 1 through 4

Alternative	CO	VOC	NO_X	SO_2	PM_{10}	$PM_{2.5}$	Carbon Dioxide Equivalent
	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Tons per Year	Metric Tons per Year
Proposed Action, Alternatives A through C, and Alignment Options 1 through 4	0.06	0.01	0.01	8.1E-05	6.4	0.6	8
Alternative D	0.04	0.00	0.00	5.6E-05	5.0	0.5	5
Alternatives E and F	0.05	0.01	0.01	7.0E-05	5.9	0.6	7

Note: Construction and permanent acreage numbers in the table include a minimal acreage of facilities that currently exist. Therefore the reported acreages conservatively overestimate the amount of disturbance anticipated by the proposed project by approximately 1 percent across all alternatives.

Table 3.1-15 Summary of Impacts to Air Quality from Right-of-way Construction and Maintenance of the Proposed Action and Alternatives A through F, and Alignment Options 1 through 4

Parameter	Proposed Action, Alternatives A through C, and Alignment Options 1 through 4	Alternative D	Alternatives E and F
Tailpipe emissions	Maximum annual emissions from construction equipment range from less than 1 ton per year of SO_2, to approximately 24,000 metric tons of carbon dioxide equivalent. Long-term annual emissions from maintenance equipment range from close to 0 tons per year of SO_2 up to approximately 8 metric tons per year of carbon dioxide equivalent.	Maximum annual emissions from construction equipment range from less than 1 ton per year of SO_2, to approximately 24,000 metric tons of carbon dioxide equivalent. Long-term annual emissions from maintenance equipment range from close to 0 tons per year of SO_2 up to approximately 5 metric tons per year of carbon dioxide equivalent.	Maximum annual emissions from construction equipment range from less than 1 ton per year of SO_2, to approximately 24,000 metric tons of carbon dioxide equivalent. Long-term annual emissions from maintenance equipment range from close to 0 tons per year of SO_2 up to approximately 7 metric tons per year of carbon dioxide equivalent.
Fugitive Dust	Maximum annual emissions from construction fugitive dust are 176 tons per year of PM_{10} and 18 tons per year of $PM_{2.5}$. Long-term annual emissions from maintenance fugitive dust are 1 ton per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$.	Maximum annual emissions from construction fugitive dust are 174 tons per year of PM_{10} and 17 tons per year of $PM_{2.5}$. Long-term annual emissions from maintenance fugitive dust are 1 ton per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$.	Maximum annual emissions from construction fugitive dust are 175 tons per year of PM_{10} and 18 tons per year of $PM_{2.5}$. Long-term annual emissions from maintenance fugitive dust are 1 ton per year of PM_{10} and less than 1 ton per year of $PM_{2.5}$.
Windblown Dust	Maximum annual emissions from windblown dust due to surfaces disturbed by construction activities are 62 tons per year of PM_{10} and 6 tons per year of $PM_{2.5}$. Long-term annual emissions of windblown dust from surfaces disturbed by maintenance activities are 5 tons per year of PM_{10} and less than 1 tons per year of $PM_{2.5}$.	Maximum annual emissions from windblown dust due to surfaces disturbed by construction activities are 44 tons per year of PM_{10} and 4 tons per year of $PM_{2.5}$. Long-term annual emissions of windblown dust from surfaces disturbed by maintenance activities are 4 tons per year of PM_{10} and less than 1 tons per year of $PM_{2.5}$.	Maximum annual emissions from windblown dust due to surfaces disturbed by construction activities are 53 tons per year of PM_{10} and 5 tons per year of $PM_{2.5}$. Long-term annual emissions of windblown dust from surfaces disturbed by maintenance activities are 4 tons per year of PM_{10} and less than 1 tons per year of $PM_{2.5}$.
Conformity Review	All project emissions in nonattainment areas are less than conformity thresholds. No conformity determination is required for this project.	All project emissions in nonattainment areas are less than conformity thresholds. No conformity determination is required for this project.	All project emissions in nonattainment areas are less than conformity thresholds. No conformity determination is required for this project.
Radionuclides and erionite	The project is not expected to contribute to increases in radionuclides or erionite.	The project is not expected to contribute to increases in radionuclides or erionite.	The project is not expected to contribute to increases in radionuclides or erionite.

3.1.2.8 Groundwater Development and Groundwater Pumping

Issues

Groundwater Development Construction and Facility Maintenance

- Air pollutants emitted from the tailpipes of construction equipment, including criteria pollutants, ozone precursors, and greenhouse gas emissions.
- Fugitive dust generated during construction and facility maintenance.
- Windblown dust generated due to wind erosion of surfaces disturbed by construction and facility maintenance.
- Impairment of visibility conditions at the GBNP due to construction and facility maintenance.
- Entrainment and transport of radioactive material and erionite due to wind erosion of disturbed surfaces.

Groundwater Pumping

- Windblown dust generated due to wind erosion of surfaces disturbed from groundwater pumping.
- Impairment of visibility conditions at the GBNP due to wind erosion of surfaces disturbed from groundwater pumping.
- Indirect greenhouse gas emissions from groundwater pumping energy requirements.
- Changes in Salt Lake City's PM_{10} air quality due to the effects of groundwater pumping on soils and vegetation.

Assumptions

Assumptions regarding compliance with regulatory requirements, detailed project operations, inputs for emission factors, and future conditions are required to estimate impacts to air quality and climate.

Key assumptions regarding compliance with regulatory requirements include:

- All state and local air quality construction permits will be received prior to initiation of project construction.
- Any operating permits or dust control plans required in nonattainment areas will address any conformity requirements (although no groundwater development activities are planned in nonattainment areas at this time) or demonstrate that total emissions in nonattainment areas will be below applicable thresholds.

Groundwater Development Construction and Facility Maintenance

- The Ely and Las Vegas RMP management actions and BMPs would be applied to all proposed construction activities, based on the most current RMPs – Ely 2008; Las Vegas 1998 (BLM 2008, 1998).
- The ACMs included in the SNWA POD to manage surface disturbance effects for ROWs provide a basis for appropriate measures that may be submitted in future SNWA ROW applications. For purposes of impact analysis, it has been assumed that measures appropriate for ROW construction would be applied to construction in groundwater development areas.
- In order to estimate emission rates of air pollutants and greenhouse gases, two types of data are required: activity data and emission factors. In the absence of actual activity data (e.g., estimates of the number and types of required construction equipment), emissions calculations for groundwater development construction activities cannot be performed. Rather, it is assumed that the magnitude of groundwater development construction emissions will be qualitatively similar to the ROW construction on a annual basis. This assumption implies that the assumptions made in the estimation of ROW construction emissions are appropriate for groundwater development construction emissions.
- Similarly, the long-term impacts associated with maintenance of groundwater development wells and collector pipelines are assumed to be qualitatively similar to the ROW maintenance impacts. This assumption implies that the assumptions made in the estimation of ROW maintenance emissions are appropriate for groundwater development maintenance emissions.

- SNWA would be required to implement a comprehensive COM Plan that would include all future hydrographic basins and all facilities associated with the SNWA GWD Project. The COM Plan includes a requirement for comprehensive monitoring and mitigation program for the entire project that would integrate the various required monitoring and mitigation actions. The COM Plan would integrate protective measures from the following: BLM RMP Management Actions and BMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. Details of the COM Plan are provided in Section 3.20, Monitoring and Mitigation Summary, along with measures to protect air resources from ROW construction and operation activities.

Groundwater Pumping

Assumptions regarding future conditions are required to estimate future long-term project impacts. Importantly, the expected changes in vegetation and soil surface conditions are critical for the estimation of future fugitive dust impacts due to groundwater drawdown. It is possible that there would be no net increase in soil erosion in groundwater drawdown areas undisturbed by construction activities. However, there is inherent uncertainty and spatial variability in plant communities' response to drawdown, as discussed in Section 3.5, Vegetation Resources. Therefore, to provide an upper bound on the uncertainty associated with the effects of soil erosion and plant cover on air quality, a 10 percent decrease of the current plant cover is assumed to result from drawdown. This assumption provides a conservatively high estimate of potential air quality impacts from groundwater drawdown. Current plant cover and calculated changes were categorized based on ET units defined for the groundwater modeling analysis (see Section 3.3, Water Resources) and vegetation analysis (see Section 3.5, Vegetation Resources). ET units and assumptions regarding their capability to generate fugitive dust are further explained in the next section.

- The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, BMPs, and additional mitigation recommended in this EIS. Details of the COM Plan are provided in Section 3.20, Monitoring and Mitigation Summary, along with measures to protect air resources from groundwater pumping activities.

Methodology for Analysis

For the estimation of air quality related impacts, the methodology depends on the activity (construction, pumping, etc.) and the type of air impacts (criteria emissions, greenhouse gases, etc.). The activity/air impact combinations are grouped based on the methodology used to estimate impacts. The calculation methodology for each category is described below.

The different methodologies for developing air impacts are grouped into the following categories:

- Groundwater Development Construction and Operational Maintenance
  - Tailpipe emissions
  - Fugitive dust
  - Greenhouse gases
  - Radionuclides and erionite
  - Fugitive dust from maintenance activities
- Groundwater Pumping
  - Windblown dust from soils exposed as a result of groundwater pumping
  - Indirect greenhouse gas emissions from groundwater pumping energy requirements

Groundwater Development Construction and Facility Maintenance

In the absence of actual estimates of the number and type of required construction equipment, actual emissions estimates from construction activities cannot be calculated. Rather, it is assumed that the magnitude of groundwater field development construction and maintenance emissions will be qualitatively similar to the ROW construction and maintenance. Actual emissions calculations for groundwater development construction and maintenance activities will be revised, as required, based on project-specific data during the permit application phase. The methods outlined for ROW emissions calculations are applicable to emissions calculations for groundwater development surface development.

Groundwater Pumping

Windblown Dust Impacts from Groundwater Drawdown

Windblown dust impacts from groundwater drawdown are estimated by first generating emissions estimates, then the emissions estimates are modeled, and the model-predicted impacts are analyzed and summarized.

Future windblown dust estimates are based on the primary ET units that were used for estimating water losses from the groundwater system via evaporation from soils and playas, and via vegetation transpiration, as described in Section 3.5, Vegetation Resources. Windblown dust impacts for each alternative are estimated based on the change in area for each ET unit. The percentage of soil surface that is covered is a critical factor in windblown dust erosion. Soil cover is measured by the canopy of live vegetation, plant residue, rock fragments, and soil crusts. As described in Section 3.5, Vegetation Resources, plant species are anticipated to change due to groundwater drawdown in some affected communities; however, total plant cover is not expected to decrease as a result of groundwater drawdown. As described in Section 3.4, Soil Resources, biological and physical soil crusts, where they currently exist, would not be affected by drawdown. As such, it is possible that there would be no net increase in soil erosion in groundwater drawdown areas undisturbed by construction activities. However, there is inherent uncertainty and spatial variability in plant communities' response to drawdown, as discussed in Section 3.5, Vegetation Resources. Therefore, to provide an upper bound on the uncertainty associated with the effects of soil erosion and plant cover on air quality, a 10 percent decrease of the current plant cover is assumed to result from drawdown. This approach provides an upper bound on the estimated windblown dust and associated impacts that may occur as a result of drawdown. The percent of the area that is estimated to become susceptible to wind erosion is calculated for each ET unit as shown in **Table 3.1-16**. The susceptible ET units are described below.

Playas: It is assumed that the soil binding properties of this cover type would not change as a result of groundwater drawdown. It is assumed that windblown dust from playa surfaces would remain at baseline levels.

Bare soil/sparse vegetation: It is assumed that plant canopy and soil stabilization by plant roots may vary from place to place.

Phreatophyte/medium vegetation: It is predicted that the composition and structure of this cover type may change toward higher dominance by upland and exotic annual species, and lower dominance by existing phreatophytic shrubs under long-term pumping regimes. It is expected that annual species would continuously bind the soil surface with living or dead root systems, even though the individual annual plants would not act as long-term barriers to wind. As is discussed in Section 3.5, Vegetation Resources, it is not expected that these affected areas would become barren of vegetation, rather there would be changes to species composition over time. In addition, plant canopy and soil stabilization by plant roots may vary from place to place.

Wetland/meadow: It is predicted that this cover type may change in species composition toward a greater fraction of shrubs and drought tolerant grasses and forbs. It is assumed that the soil binding properties of this cover type would not change, even though species composition may change.

Table 3.1-16 Current and Estimated Future Plant Coverage Percent for Each ET Unit

ET Unit	Current Plant Coverage (% of Area)	Plant Coverage Change due to Groundwater Drawdown (%)	Future (Post-Groundwater Drawdown) Plant Coverage (% of Area)	Change in Bare Soil Susceptible to Wind Erosion (% of Area) Relative to Current Conditions
Playa	0	10	0	0
Wetland/Meadow	90	10	81	9
Phreatophyte/Medium Vegetation	25	10	22.5	2.5
Bare Soil/Low Vegetation	10	10	9	1

The change in exposed area for each ET unit is calculated relative to the No Action Alternative for a 10-foot groundwater drawdown contour for each alternative. See **Figure 3.1-6**, for a visual representation of how the impacts from alternatives are calculated relative to current conditions and the No Action Alternative. The estimated change in surface area for each ET unit is projected for three model time frames for each alternative: at full build out, at full build out plus 75 years, and at full build out plus 200 years. For example, the total acres of Phreatophyte/Medium Vegetation predicted to be affected by a 10-foot groundwater drawdown under the Proposed Action at full build out is 19,099 acres; however, 6,298 of these acres are predicted to be affected under the No Action Alternative. Therefore, only 12,801 acres of Phreatophyte/Medium Vegetation is directly attributable to the Proposed Action (project-specific) impacts.

Alternative Impacts (acres) = Total Area Affected by 10-foot Groundwater Drawdown (acres) - No Action Alternative (acres).

The amount of this area that may become susceptible to wind erosion is calculated based on the estimated change in bare soil for each ET unit shown in **Table 3.1-16**. Using the same example as above, the value in the last column of **Table 3.1-16** for Phreatophyte/Medium Vegetation (2.5 percent) is multiplied by the affected 12,801 acres of Phreatophyte/Medium Vegetation. This results in an estimate that, at full build out, an additional 320 acres of Phreatophyte/Medium Vegetation may become susceptible to wind erosion under the Proposed Action relative to current conditions and the No Action Alternative.

The area of each ET unit that is susceptible to wind erosion is classified by wind erodeability group (WEG) and multiplied by the PM_{10} emission factor for wind erosion from the Clark County Wind Tunnel Study (Wacaser et al. 2006). This results in an estimate of hourly PM_{10} windblown emissions as a function of hourly wind speed. The Clark County emission factors were developed from field measurements using a portable wind tunnel at a variety of sites, encompassing tests on different soil types (stable, unstable, and stabilized) and WEGs. The result of the Clark County Wind Tunnel Study is a mathematical relationship between particulate matter flux rates (with units of tons/acre-hr-wind band) that vary as a function of wind erodeability group and soil stability. The Clark County emission factors are applied using the following equation.

$$E_{WB} = \sum_{ET=1}^{ET=4} \sum_{WEG=1}^{WEG=8} A_{ET,WEG} \text{ x } EF_{WEG,WB} \text{ x } (\%PC/100)$$

Where:

E_{WB} = PM_{10} Emissions Rate (ton/hr-windband) for each Alternative

$A_{ET,WEG}$ = Area of each alternative affected by the 10-foot groundwater drawdown relative to the No Action Alternative classified by ET unit and WEG (acres)

$EF_{WEG,WB}$ = Windblown dust emission factor, by WEG and Wind Band (ton/acre-hr-windband)

%PC = Percent Change in Bare Soil for Each ET Unit Susceptible to Wind Erosion (% of area) Relative to Current Conditions (%) (from **Table 3.1-16**)

This calculation is performed for each combination of ET unit and WEG category. Using the same example as above, the predicted additional 320 acres of Phreatophyte/Medium Vegetation that are susceptible to wind erosion is divided into WEG classifications and multiplied by each combination of $EF_{WEG,WB}$ from the Clark County Wind Tunnel Study. The resulting emission rates are added together for each WEG type and ET unit for a specific wind band, resulting in an estimate in the total tons/hour-windband for each Alternative.

The PM_{10} emission rate is then converted from units of tons per hour per windband into estimates of tons per year using the average number of hours per year that the wind speed is with each wind band. This wind speed frequency distribution is shown in **Table 3.1-17**. The typical number of hours per year with a wind speed in each wind band was calculated based on 10 years of monitoring data collected at the Ely, National Weather Service Station. This frequency distribution is used to convert the PM_{10} emission rate from units of tons per hour per windband into estimates of total tons per year. The $PM_{2.5}$ size range is estimated based on USEPA guidance (USEPA 1998; WRAP 2005, 2006), whereby 10 percent of the PM_{10} is in the $PM_{2.5}$ size range.

Figure 3.1-6 Visual Representation of the Groundwater Drawdown Windblown Dust Impact Analysis

Table 3.1-17 Frequency Distribution for Each Wind Band

Wind Band (Wind Speed mph)	Frequency (%)	Number of Hours Per Year for Each Wind Band
0 - 10	57.2	5,011.78
10 - 15	32.1	2,815.14
15 - 20	7.0	612.74
20 - 25	2.4	212.72
25 - 30	1.0	89.32
30 - 35	0.167	14.64
35 - 40	0.032	2.82
40 - 45	0.010	0.84
Total[1]	**100**	**8,760**

[1] Values may not sum to the total due to rounding.
Source: National Climatic Data Center (2011).

The hourly emissions were used in a modeling analysis to estimate the potential air quality and air quality related impacts of the groundwater drawdown. The CALPUFF model (Scire et al. 2000a,b) was used to evaluate changes in air quality and regional haze impacts associated with a reduction or loss of vegetation due to potential groundwater drawdown. CALPUFF modeling assessed air concentrations in areas currently designated as nonattainment for PM_{10} and $PM_{2.5}$. This includes areas in Clark County, Nevada, as well as along the Wasatch Mountain Range in Utah and southern Idaho, referred to collectively as the Wasatch Front. The Wasatch Front includes cities of Ogden, Salt Lake City, and Provo, Utah. In addition to modeling the impacts at nonattainment areas, air quality impacts were assessed at GBNP. In addition to the assessment of air quality impacts, visibility impacts are analyzed for GBNP, which is a Class II area. Class II areas do not have visibility protection under federal or state law. Visibility impacts at GBNP are provided for informational purposes only.

Only several alternatives were selected for modeling: Alternative A, Alternative E, Alternative F, and the No Action Alternative. Given the large uncertainty in the emissions estimates for groundwater drawdown, it is more appropriate to apply the modeling results in a relative sense than in an absolute sense. Therefore, impacts for alternatives not explicitly modeled are assessed qualitatively using the relative difference in predicted emission levels. Alternative A was selected for modeling to assess the relative differences between alternatives that include groundwater pumping in all 5 basins (Spring, Delamar, Dry Lake, Cave, and Snake Valleys). The Proposed Action and Alternatives A, B, and C all would allow groundwater pumping in the 5 basins. Alternatives E and F were selected for modeling to evaluate the effects of groundwater pumping in 4 basins (Spring, Delamar, Dry Lake, and Cave Valleys). Alternatives D, E, and F all would allow groundwater pumping in 4 basins. Alternative E allows groundwater pumping at reduced levels relative to Alternatives A and F. Importantly, Alternative E is the alternative that is most closely aligned with the water right quantities granted by the Nevada State Engineer. Alternatives A and F allow similar levels of groundwater pumping; however, Alternative A includes pumping in Snake Valley, while Alternative F does not. More information about the alternatives is provided in Chapter 2, and **Table 2.6-2** provides a comparison of the alternatives.

Importantly, as shown in **Figure 3.1-6**, some air quality thresholds, such as Significant Impact Levels (SILs) are used to assess project-alone impacts, while others are used to assess total air quality impacts. The project-alone impacts were modeled using the predicted emissions for each alternative. The total impacts are assessed by modeling emissions from both the No Action and the alternative being modeled. This analysis is performed since the emissions for each alternative are not the total emissions expected to occur under the alternative, rather the emissions presented for each alternative is the additional amount of emissions from the alternative alone. The total emissions anticipated for each alternative are the combination of the alternative's emissions and the No Action emissions. Therefore, the total air quality impacts were modeled using the combined emissions from the alternative being evaluated (e.g. Alternative A 75 years after full build out) and the No Action Alternative (at 75 years after full build out). The modeling analysis compares the model-predicted concentrations to established significance thresholds, AAQS, and other environmental parameters.

For more detail regarding the modeling methods, configuration options, assessment areas, and input data, please see **Appendix F3.1.2**.

There are two caveats with the use of Clark County emission factors and the resulting model impacts: 1) the Clark County emission factors were developed using disturbed the soils, thus the emission factors are conservatively high for surfaces affected by groundwater drawdown, where the soil crusts are otherwise undisturbed; and 2) the emission factors assume that all material is lofted into the air and not immediately deposited. However, regional scale emissions flux estimates are likely an overestimate since not all particles lofted into the air are transported out of the immediate area.

Generally, particulate matter flux refers to the rate at which dust particles are created and suspended in air under the influence of wind. Three processes contribute to flux: 1) aerodynamic entrainment, where dust particles are lifted directly off the ground surface; 2) saltation bombardment, in which sand or aggregate grains strike the surface and eject dust particles; and 3) aggregate disintegration where dust particles attached to sand grains disintegrate under strong winds. The Clark County wind tunnel studies determined vertical flux rates experimentally.

One of the principal findings of a WRAP study published in 2000 (Countess 2001) is that not all suspendable dust particles are transported long distances. The WRAP study concluded that the fraction of windblown dust emissions that are transported long distances from the source of emissions varies and is influenced by a number of factors, including dust deposition rates, vertical mixing height, and transport time. Further, this study reported that the fraction of windblown dust emissions that is transported beyond the source area can vary between 100 percent and zero due to these factors. The study concluded that knowledge about, and integration of, the combined effects of the landscape, particle size and density, and meteorological conditions should be considered during emission flux calculations. In this regard, regional scale dust flux is smaller than local scale dust flux. The emission estimates for this EIS, however, conservatively assume a transport fraction of 100 percent (i.e., all of the particles that are suspended are transported out of their source area). Since no information was available to account for near-field particle deposition, the particulate matter emissions and air quality impacts resulting from windblown dust generation are conservatively high.

Greenhouse Gas Emissions

The amount of electricity required to operate the pumps was estimated for each alternative. Annual electricity consumption was used to estimate how much carbon dioxide equivalent would be released annually during the generation of the electricity. This calculation is based on the typical emissions of carbon dioxide equivalent from natural gas combustion in the project area.

3.1.2.9 Proposed Action

The construction and maintenance methods for well pad, collector pipelines, access roads, and distribution power lines are anticipated to be the same as those described for the mainline pipeline and ancillary facilities. Effects on air quality would also be similar, since the same activities will be conducted, with the exception that no construction will occur in Clark County nonattainment areas and therefore, a conformity review is not required. The major effect of future groundwater field development would be an expansion of surface disturbance activities over a large area within each hydrographic basin. Consequently, the ACMs for ROWs are applicable, and likely to be proposed as part of future ROW applications to the BLM.

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

Groundwater Development Area

Groundwater Development Construction and Facility Maintenance

Short-term Emissions from Construction Equipment

Localized air quality emissions due to construction activities are expected to be short term (5 years or less). Qualitatively, emissions will be similar to the values estimated for ROW construction activities for the Proposed Action (shown in **Table 3.1-10**), except for construction fugitive and windblown dust (PM_{10} and $PM_{2.5}$) which are a function

of surface disturbance. Under the Proposed Action, groundwater development construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 8,400 acres. Based on the estimated disturbed surface area, fugitive and windblown dust emissions due to construction activities in the groundwater development areas would be approximately two-thirds of the emissions estimated for ROW construction activities for the Proposed Action (shown in **Table 3.1-15**). Maximum annual emissions from ROW construction activities are 176 tons per year of PM_{10} and 18 tons per year of $PM_{2.5}$ from fugitive dust and 62 tons per year of PM_{10} and 6 tons per year of $PM_{2.5}$ from windblown dust. Therefore, maximum annual emissions from groundwater development construction activities are 120 tons per year of PM_{10} and 12 tons per year of $PM_{2.5}$ from fugitive dust and 42 tons per year of PM_{10} and 4 tons per year of $PM_{2.5}$ from windblown dust. Emissions from construction are not expected to impair visibility conditions at the GBNP.

Proposed mitigation measures:

ROW-AQ-1: Project Road Inspections to Reduce Wind and Water Erosion. The SNWA and the BLM's Environmental Compliance Monitor would inspect project roads in areas prone to air and water erosion bi-weekly during construction, or more frequently during periods of adverse weather conditions. Repairs would be completed within 5 working days of notification to the SNWA or sooner depending on public safety and the nature of the issue detected. SNWA would make a photographic documentation of the road condition prior to and immediately after road repairs. Effectiveness: This mitigation measure would be very effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a substantial reduction of short-term fugitive dust impacts. Effects on other resources: This mitigation measure would have a small (negligible) increase in vehicular traffic along the ROW during construction activities.

ROW-AQ-2: **Alternative Dust Control Measures**. Areas where soil tackifiers are prohibited (e.g., threatened and endangered species habitat, perennial stream drainages) would be determined in cooperation with the BLM and the USFWS prior to construction, and identified in both the Construction and Mitigation Plans. Other mitigation (e.g., gravel application) may be required to reduce impacts and to ensure protection of public safety. This measure would supplement SNWA ACM A.10.3. Effectiveness: This mitigation measure would be moderately effective at reducing construction related fugitive dust impacts. Implementation of this mitigation measure combined with other federal and state requirements, would likely result in a noticeable reduction of short-term fugitive dust impacts. Effects on other resources: This measure would have a minor positive effect on threatened and endangered species habitat by reducing dust cover and on sensitive aquatic species by reducing water contamination by chemicals.

Potential residual impacts include:

- Impacts to air quality from groundwater development construction activities are predicted to range from less than 1 ton per year of SO_2 up to approximately 24,000 metric tons per year of carbon dioxide equivalent. Importantly, no construction activity is proposed for the nonattainment hydrologic basins; therefore, construction emissions do not need to be compared with conformity thresholds.

Long-term Emissions from Facility Maintenance

Long-term air pollutant emissions in the groundwater development areas from maintenance activities would be much less than the emissions generated from construction activities. Maintenance vehicles would generate small volumes of fugitive dust and tailpipe emissions, and groundwater development maintenance emissions are assumed to be qualitatively similar to the ROW maintenance emissions for the Proposed Action (shown in **Table 3.1-14**). Air emissions from groundwater development maintenance activities are predicted to range from almost 0 tons per year of SO_2 up to approximately 8 tons per year of carbon dioxide equivalent. Emissions from maintenance are not expected to cause or contribute to exceedences of any AAQS. Emissions from maintenance are not expected to impair visibility conditions at the GBNP.

Entrainment of Radionuclides or Erionite from Construction Activities

Similar to the analysis for the ROW impact, there would not be re-suspension and transport of radionuclides from past nuclear testing at levels considered to be harmful to human health.

Conclusion. Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 8,300 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term emissions from groundwater development maintenance activities are anticipated to be similar to the long-term emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite. It is assumed that: 1) SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and short-term in nature and impacts are not expected to impair visibility conditions at GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent groundwater development ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-18**). The Proposed Actions incremental PM_{10} emissions due to windblown dust after full build out are estimated to be up to 2,226 tons per year more than the No Action Alternative. Given that the USEPA estimates $PM_{2.5}$ to be 10 percent of PM_{10} (WRAP 2005, 2006), the corresponding increase in $PM_{2.5}$ emissions due to windblown dust after full build out under the Proposed Action are estimated to be up to 223 tons per year. The increase in PM_{10} emissions are estimated to be up to 12,104 tons per year and 17,840 tons per year, after full build out plus 75 and full build out plus 200 years, respectively. The increase in $PM_{2.5}$ emissions are estimated to be up to 1,405 tons per year and 1,784 tons per year after full build out plus 75 years and full build out plus 200 years, respectively.

Table 3.1-18 Proposed Action, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	4,901	78,821	114,168	289	4,189	5,685
Phreatophyte/ Medium Vegetation	12,801	58,169	77,338	1,883	7,929	9,386
Wetland/Meadow	117	5,460	8,048	54	1,927	2,770
Total				**2,226**	**14,046**	**17,840**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

[2] These emissions are the upper limit of the range of potential estimates.

As described in the methodology section, the predicted emissions associated with groundwater drawdown were modeled for Alternative A and the estimated impacts for other alternatives are assessed qualitatively relative to Alternative A. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for Alternative A (**Table 3.1-20**). The emissions for the Proposed Action are approximately 19 percent greater than Alternative A at 75 years after full build out. Based on the differences in the

emissions between the Proposed Action and Alternative A, it can be inferred that the future impacts from the Proposed Action are marginally higher than Alternative A. Even if the impacts from the Proposed Action are marginally higher than Alternative A, it is anticipated that the Proposed Action impacts would also be insignificant at Clark County and the Wasatch Front. Based on this no further analyses are required for Clark County and the Wasatch Front since the project would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). The emissions for the Proposed Action are approximately 19 percent greater than Alternative A at 75 years after full build out. Based on the differences in the emissions between the Proposed Action and Alternative A, it can be inferred that the future impacts from the Proposed Action would be marginally higher than the modeled impacts for Alternative A. Even if the impacts from the Proposed Action are marginally higher than Alternative A, it is anticipated that the Proposed Action impacts would also be in compliance with applicable National and State AAQS at GBNP.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). The emissions for the Proposed Action are approximately 19 percent greater than Alternative A at 75 years after full build out. Based on the differences in the emissions between the Proposed Action and Alternative A, it can be inferred that the future visibility impacts from the Proposed Action would be marginally higher than Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be approximately 97 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 327,000 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 35,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.006 percent of the carbon dioxide equivalent estimated to be emitted by the U.S. in 2010 (USEPA 2012b) and less than 0.6 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

The power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Monitoring and Mitigation

In its Protection Measures, **Appendix E**, SNWA outlined measures that could be used to mitigate adverse effects resulting from groundwater pumping. As part of ACM B.1.2, solar panels will be used at monitoring wells to the extent possible to reduce power requirements. This measure would offset the estimated indirect greenhouse gas emissions associated with power needs.

COM Plan

The COM Plan for designing and implementing monitoring and mitigation would integrate protective measures from the BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation (air-specific protection measures are summarized below). Details of the COM Plan are provided in Section 3.20, Monitoring and Mitigation Summary. One of the objectives of the COM Plan is to avoid, minimize or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. In alignment with this objective, protective measures for air resources are summarized below for ACMs and mitigation recommendations.

Given the potential for large quantities of windblown dust to be generated as a result of groundwater pumping, the following mitigation measure is recommended:

GW-AQ-3: Monitoring, Mitigation, and Management Plan for Air Quality. SNWA would develop an air monitoring plan approved by the BLM, which would detail the siting and operation of at least three collocated PM_{10} and $PM_{2.5}$ air monitoring stations, one of which would be upwind of the project area. Recommended monitoring locations include Snake, Spring, and Lake valleys. These valleys are selected for consideration based on predicted changes to the bare soil/sparse vegetation ET unit, which has the greatest potential for windblown dust impacts. Baseline air measurements would be initiated at least a year prior to groundwater pumping construction activities, since these activities may increase measured particulate values. Once baseline air quality levels are established, monitoring would continue for the duration of groundwater pumping activities. Finally, the monitoring plan would comply with USEPA monitoring guidance when selecting the site locations and instruments, developing the data management plan, and establishing quality assurance criteria. Effectiveness: It is anticipated that the Plan would be effective in identifying early warning of potentially undesirable impacts to air resources and provide a substantial amount of time and flexibility to implement management measures and gage their effects. However, since groundwater development presumes some level of change to air quality and visibility, not all impacts would be avoided by this mitigation measure. Effects on other resources: This measure would have minor effects on resources impacted by proximity to the monitoring sites. In addition, this measure increases the project's overall power requirements due to power required for operation of the monitoring equipment.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

Conclusion

- The level and extent of impacts from a groundwater drawdown contour of 10-feet and greater are highly uncertain and the following estimated impacts should be used for comparison purposes only. It is estimated that an additional 2,226 tons of PM_{10} would be emitted per year after full build out, 14,046 tons of PM_{10} would be emitted per year for full build out plus 75 years, and 17,840 tons of PM_{10} would be emitted per year for full build out plus 200 years. Also, it is estimated that an additional 223 tons of $PM_{2.5}$ would be emitted per year after full build out, 1,405 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years, and 1,784 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at GBNP. The extent of possible visibility impairment is highly uncertain.
- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gases associated with electricity generation would be approximately 327,000 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- The 3M Plan for Snake Valley (**Appendix B**) will include PM_{10} and meteorological monitoring in Snake Valley, Utah. In order to strengthen the SNWA's adaptive management program, mitigation measure GW-AQ-3 is recommended.

3.1.2.10 Alternative A

Groundwater Development Area

Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 4,700 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term emissions from groundwater development maintenance activities are anticipated to be similar to the long-term

emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite.

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

It is assumed that: 1) the SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) the SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) the SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and short-term in nature and impacts are not expected to impair visibility conditions at the GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent groundwater development ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-19**). The incremental increase in PM_{10} emissions due to windblown dust after full build out are estimated to be approximately 1,518 tons per year relative to the No Action Alternative. Given that the USEPA estimates $PM_{2.5}$ to be 10 percent of PM_{10} (WRAP 2006), the corresponding increase in $PM_{2.5}$ emissions due to windblown dust after full build out under Alternative A are estimated to be approximately 152 tons per year. The increase in PM_{10} emissions are estimated to be 11,826 tons per year and 13,327 tons per year for full build out plus 75 years and full build out plus 200 years, respectively. The increase in $PM_{2.5}$ emissions are estimated to be 1,183 and 1,333 tons per year for after full build out plus 75 years and full build out plus 200 years, respectively.

Table 3.1-19 Alternative A, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	2,785	55,224	67,422	160	3,124	3,643
Phreatophyte/ Medium Vegetation	9,274	51,190	56,017	1,319	7,035	7,509
Wetland/Meadow	92	4,624	6,118	39	1,667	2,175
Total				**1,518**	**11,826**	**13,327**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for Alternative A (**Table 3.1-20**). No further analyses are required for Clark County and the Wasatch Front since the modeling results indicate that the project would not cause or contribute to an exceedance of applicable AAQS. Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs for PM_{10} at GBNP. Therefore, a more refined analysis was conducted to assess the total PM_{10} impacts at GBNP. The

model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**).

Table 3.1-20 Air Quality Impacts from Alternative A Compared to SILs

Pollutant	Area	Averaging Period	Maximum Modeled Concentrations[1] Project-Alone (Alternative A Full Build Out+ 75 Years) (µg/m^3)	SIL (µg/m^3)	Model Impacts Exceed SILs?
$PM_{2.5}$	Clark County	24-hr	0.10	1.2	No
		Annual	0.002	0.3	No
	GBNP	24-hr	1.17	1.2	No
		Annual	0.16	0.3	No
	Wasatch Front	24-hr	0.18	1.2	No
		Annual	0.003	0.3	No
PM_{10}	Clark County	24-hr	0.25	5	No
	GBNP	24-hr	9.92	5	Yes
	Wasatch Front	24-hr	0.51	5	No

[1]Concentrations represent the highest modeled concentrations.

Table 3.1-21 Total Air Quality Impacts from Alternative A Compared to Ambient Air Quality Standards

Pollutant	Area	Averaging Period	Maximum Modeled Concentrations[1]		Background[2]	Cumulative Impacts (Total Future + Background)	AAQS	Cumulative Impacts as a percent of AAQS
			Project-Alone (Alt A Full Build Out + 75 Years)	Total Future (No Action + Alt A Full Build Out + 75 Years)				
			(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
PM_{10}	GBNP	24-hr	9.92	9.92	48.00	57.92	150	39%

[1] Concentrations represent the highest modeled concentrations.
[2] PM_{10} 24-hr concentration is the highest second highest over 3 years (2008-2010) from GBNP IMPROVE monitor.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Table 3.1-22 Modeled-Predicted Visibility Impacts for Alternative A at Great Basin National Park

Great Basin National Park	Days > than 5% ΔB_{ext}	Days > than 10% ΔB_{ext}	8th Highest % ΔB_{ext}
Alternative A (Full Build Out + 75 Years)	149	60	22.48
Total (No Action + Alt A Full Build Out + 75 Years)	149	60	22.48

Note that GBNP is a Class II area, which does not have visibility protection under federal or state law. Impacts are presented for informational purposes only.

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be approximately 74.4 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 250,400 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 27,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.005 percent of the carbon dioxide equivalent estimated to be emitted by the U.S. in 2010 (USEPA 2012b) and less than 0.5 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

These power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Conclusion

- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and the following estimated impacts should be used for comparison purposes only. It is estimated that an additional 1,518 tons of PM_{10} would be emitted per year after full build out; 11,826 tons of PM_{10} would be emitted per year for full build out plus 75 years; and 13,327 tons of PM_{10} would be emitted per year for full build out plus 200 years. Also, it is estimated that an additional 152 tons of $PM_{2.5}$ would be emitted per year after full build out; 1,183 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years; and 1,333 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at GBNP. The extent of possible visibility impairment is highly uncertain.
- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gas associated with electricity generation would be approximately 250,400 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- The monitoring, mitigation, and management plan for Snake Valley will include PM_{10} and meteorological monitoring in Snake Valley, Utah. In order to strengthen SNWA's adaptive management program, mitigation measure GW-AQ-3 (Monitoring, Mitigation, and Management Plan for Air Quality) is recommended. In addition, the Snake Valley 3M Plan (**Appendix B**), which is part of the project-wide COM Plan, would be implemented.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be

reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

3.1.2.11 Alternative B

Groundwater Development Area

Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 4,600 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term emissions from groundwater development maintenance activities are anticipated to be similar to the long-term emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite.

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

It is assumed that: 1) the SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) the SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) the SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and short-term in nature and impacts are not expected to impair visibility conditions at the GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent groundwater development ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-23**). It is estimated that an additional 2,233 tons of PM_{10} would be emitted per year after full build out, 12,104 tons of PM_{10} would be emitted per year after full build out plus 75 years, and 15,995 tons of PM_{10} would be emitted per year after full build out plus 200 years. Also, it is estimated that an additional 223 tons of $PM_{2.5}$ would be emitted per year after full build out, 1,210 tons of $PM_{2.5}$ would be emitted per year after full build out plus 75 years, and 1,599 tons of $PM_{2.5}$ would be emitted per year after full build out plus 200 years.

As described in the methodology section, the predicted emissions associated with groundwater drawdown were modeled for Alternative A and the estimated impacts for other alternatives are assessed qualitatively relative to Alternative A. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for Alternative A (**Table 3.1-20**). The emissions for the Alternative B are approximately 2 percent greater than Alternative A at 75 years after full build out. Based on the similarity in the emissions between the Alternative B and Alternative A, it can be inferred that the future impacts from the Alternative B would be similar to the modeled impacts for Alternative A. Therefore, the Alternative B impacts would also be insignificant at Clark County and the Wasatch Front and no further analyses are required for Clark County and the Wasatch Front since the project would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). Since the emissions for the Alternative B are approximately 2 percent greater than Alternative A at 75 years after full build out, then it can be inferred that the future impacts from the Alternative B are the same as Alternative A, and the Alternative B impacts would also be in compliance with applicable National and State AAQS at GBNP.

Table 3.1-23 Alternative B, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	4,759	42,781	72,112	257	2,550	3,731
Phreatophyte/Medium Vegetation	13,545	54,393	74,886	1,798	7,484	9,127
Wetland/Meadow	441	5,794	9,190	178	2,070	3,136
Total				**2,233**	**12,104**	**15,995**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). Since the emissions for the Alternative B are approximately 2 percent greater than Alternative A at 75 years after full build out, then it can be inferred that the future visibility impacts from the Alternative B are similar to Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be approximately 97 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 327,000 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 35,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.006 percent of the carbon dioxide equivalent estimated to be emitted by the U.S. in 2010 (USEPA 2012b) and less than 0.6 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

These power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Conclusion

- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and the following estimated impacts should be used for comparison purposes only. It is estimated that an additional 2,233 tons of PM_{10} would be emitted per year after full build out, 12,104 tons of PM_{10} would be emitted per year for full build out plus 75 years, and 15,995 tons of PM_{10} would be emitted per year for full build out plus 200 years. Also, it is estimated that an additional 223 tons of $PM_{2.5}$ would be emitted per year after full build out, 1,210 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years, and 1,599 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions

from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gases associated with electricity generation would be approximately 327,000 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- The monitoring, mitigation, and management plan for Snake Valley (**Appendix B**) will include PM_{10} and meteorological monitoring in Snake Valley, Utah. In order to strengthen the SNWA's adaptive management program, mitigation measure GW-AQ-3 (Monitoring, Mitigation, and Management Plan for Air Quality) is recommended.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

3.1.2.12 Alternative C

Groundwater Development Area

Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 4,800 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term emissions from groundwater development maintenance activities are anticipated to be similar to the long-term emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite.

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

It is assumed that: 1) the SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) the SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) the SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and short-term in nature and impacts are not expected to impair visibility conditions at the GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent groundwater development ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-24**). It is estimated that an additional 1,518 tons of PM_{10} would be emitted per year after full build out; 5,416 tons of PM_{10} would be emitted per year for full build out plus 75 years; and 6,690 tons of PM_{10} would be emitted for full build out plus 200 years. Also, it is estimated that an additional 152 tons of $PM_{2.5}$ would be emitted per year after full build out; 542 tons of $PM_{2.5}$ would be emitted for full build out plus 75 years; and 669 tons of $PM_{2.5}$ would be emitted for full build out plus 200 years.

Table 3.1-24 Alternative C, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200)
Bare Soil/Sparse Vegetation	2,785	19,262	22,017	160	1,278	1,457
Phreatophyte/Medium Vegetation	9,274	23,440	28,059	1,319	3,462	4,173
Wetland/Meadow	92	2,287	3,250	39	676	1,060
Total				**1,518**	**5,416**	**6,690**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

As described in the methodology section, the predicted emissions associated with groundwater drawdown were modeled for Alternative A and the estimated impacts for other alternatives are assessed qualitatively relative to Alternative A. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for Alternative A (**Table 3.1-20**). The emissions for the Alternative C are approximately 54 percent less than Alternative A at 75 years after full build out. Based on the differences in the emissions between the Alternative C and Alternative A, it can be inferred that the future impacts from the Alternative C would be somewhat lower than the modeled impacts for Alternative A. If the impacts from the Alternative C are somewhat lower than Alternative A, it is anticipated that the Alternative C impacts would also be insignificant at Clark County and the Wasatch Front and no further analyses are required for Clark County and the Wasatch Front since the project would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). Since the emissions for the Alternative C are approximately 54 percent less than Alternative A at 75 years after full build out, then it can be inferred that the future impacts from the Alternative C are somewhat lower than Alternative A and the Alternative C impacts would also be in compliance with applicable National and State AAQS at GBNP.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). Since the emissions for the Alternative C are approximately 54 percent less than Alternative A at 75 years after full build out, then it can be inferred that the future visibility impacts from the Alternative C are somewhat lower than Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be approximately 74.4 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 250,400 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 27,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.005 percent of the carbon dioxide equivalent estimated to be

emitted by the U.S. in 2010 (USEPA 2012b) and less than 0.5 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

These power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Conclusion

- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and the following estimated impacts should be used for comparison purposes only. It is estimated that an additional 1,518 tons of PM_{10} would be emitted per year after full build out; 5,416 tons of PM_{10} would be emitted per year for full build out plus 75 years; and 6,690 tons of PM_{10} would be emitted per year for full build out plus 200 years. Also, it is estimated that an additional 152 tons of $PM_{2.5}$ would be emitted per year after full build out; 542 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years; and 669 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.
- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gases associated with electricity generation would be approximately 250,400 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- The monitoring, mitigation, and management plan for Snake Valley (**Appendix B**) will include PM_{10} and meteorological monitoring in Snake Valley, Utah. In order to strengthen the SNWA's adaptive management program, mitigation measure GW-AQ-3 (Monitoring, Mitigation, and Management Plan for Air Quality) is recommended. This measure is part of the COM Plan, which is described in Section 3.20.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

3.1.2.13 Alternative D

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

Groundwater Development Area

Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 4,000 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term emissions from recommended monitoring maintenance activities are anticipated to be similar to the long-term emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite.

It is assumed that: 1) the SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) the SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) the SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and short-term in nature and impacts are not expected to impair visibility conditions at GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent recommended monitoring ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-25**). It is estimated that no additional PM_{10} would be emitted per year after full build out; 2,474 tons of PM_{10} would be emitted per year after full build out plus 75 years; and 8,252 tons of PM_{10} would be emitted per year after full build out plus 200 years. Also, it is estimated that no additional $PM_{2.5}$ would be emitted per year after full build out; 247 tons of $PM_{2.5}$ would be emitted per year after full build out plus 75 years; and 825 tons of $PM_{2.5}$ would be emitted per year after full build out plus 200 years.

Table 3.1-25 Alternative D, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	0	5,901	35,066	0	363	1,385
Phreatophyte/Medium Vegetation	0	10,846	46,282	0	1,678	5,326
Wetland/Meadow	0	1,507	4,453	0	433	1,541
Total				**0**	**2,474**	**8,252**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

As described in the methodology section, the predicted emissions associated with groundwater drawdown were modeled for Alternatives A, E, and F. The estimated impacts for other alternatives are assessed qualitatively relative to the modeled alternatives. Alternative D is most similar to Alternative E both in terms of allowable pumping quantities and basins. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ are insignificant for Alternative E for all areas modeled (**Table 3.1-27**). The emissions for Alternative D are approximately 66 percent less than Alternative E at 75 years after full build out. Based on the differences in the emissions between the Alternative D and Alternative E, it can be inferred that the future impacts from Alternative D would be notably lower than the modeled impacts for Alternative E. If the impacts from the Alternative D are notably lower than Alternative E, it is anticipated that the Alternative D impacts would also be insignificant at Clark County, GBNP, and the Wasatch Front and no further air quality analyses are required since the project would not cause or contribute to an exceedance of applicable AAQS.

The modeled visibility impacts for Alternative E (**Table 3.1-28**) indicate that eighth highest day has less than a 5 percent change in light extinction and therefore visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (Federal Land Manager's Air Quality Related Values Workgroup [FLAG] 2010). Since the emissions for the Alternative D are approximately 66 percent less than Alternative E at 75 years after full build out, then it is likely that the future visibility impacts from Alternative D are

even lower than Alternative E (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be approximately 54 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 182,000 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 19,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.004 percent of the carbon dioxide equivalent estimated to be emitted by the U.S. in 2012 (USEPA 2012b) and less than 0.4 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

These power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Conclusion

- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and the following impacts should be used for comparison purposes only. It is estimated that no additional PM_{10} would be emitted per year after full build out; 2,474 tons of PM_{10} would be emitted per year after full build out plus 75 years; and 8,252 tons of PM_{10} would be emitted per year after full build out plus 200 years. Also, it is estimated that no additional $PM_{2.5}$ would be emitted per year after full build out; 247 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years; and 825 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met and visibility conditions at the GBNP are unlikely to be impaired. The extent of possible visibility impairment is highly uncertain.
- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gases associated with electricity generation would be approximately 182,000 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- In order to strengthen the SNWA's adaptive management program, mitigation measure GW-AQ-3 (Monitoring, Mitigation, and Management Plan for Air Quality) is recommended. This measure is part of the COM Plan, which is described in Section 3.20.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

3.1.2.14 Alternative E

Groundwater Development Area

Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 4,000 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term

emissions from groundwater development maintenance activities are anticipated to be similar to the long-term emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite.

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

It is assumed that: 1) the SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) the SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) the SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and be short-term in nature and impacts are not expected to impair visibility conditions at GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent groundwater development ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-26**). It is estimated that an additional 1,518 tons of PM_{10} would be emitted per year after full build out; 7,464 tons of PM_{10} would be emitted per year after full build out plus 75 years; and 8,563 tons of PM_{10} would be emitted per year after full build out plus 200 years. Also, it is estimated that an additional 152 tons of $PM_{2.5}$ would be emitted per year after full build out; 746 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years, and 856 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years.

Table 3.1-26 Alternative E, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	2,785	32,882	40,586	160	1,595	1,834
Phreatophyte/Medium Vegetation	9,274	38,548	42,803	1,319	4,986	5,400
Wetland/Meadow	92	2,548	3,835	39	882	1,329
Total				**1,518**	**7,464**	**8,563**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

As described in the methodology section, the predicted emissions associated with groundwater drawdown were modeled for Alternative E. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County, GBNP, and the Wasatch Front are insignificant (below the SILs) for Alternative E (**Table 3.1-27**). The modeled impacts of Alternative E are less than that of Alternative A, as expected since the emissions for the Alternative E are approximately 37 percent less than Alternative A at 75 years after full build out. Therefore, all PM_{10} and $PM_{2.5}$ impacts are insignificant in the areas analyzed for Alternative E.

Table 3.1-27 Air Quality Impacts from Alternative E Compared to SILs

Pollutant	Area	Averaging Period	Maximum Modeled Concentrations[1] Project-Alone (Alternative E Full Build Out+ 75 Years) (µg/m^3)	SIL (µg/m^3)	Model Impacts Exceed SILs?
$PM_{2.5}$	Clark County	24-hr	0.06	1.2	No
		Annual	0.001	0.3	No
	GBNP	24-hr	0.36	1.2	No
		Annual	0.03	0.3	No
	Wasatch Front	24-hr	0.10	1.2	No
		Annual	0.002	0.3	No
PM_{10}	Clark County	24-hr	0.18	5	No
	GBNP	24-hr	2.07	5	No
	Wasatch Front	24-hr	0.24	5	No

[1]Concentrations represent the highest modeled concentrations.

The modeled visibility impacts for Alternative E (**Table 3.1-28**) indicate that the eighth highest day would have less than a 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010) (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Table 3.1-28 Modeled-Predicted Visibility Impacts for Alternative E at Great Basin National Park

Great Basin National Park	Days > than 5% ΔB_{ext}	Days > than 10% ΔB_{ext}	8th Highest % ΔB_{ext}
Alternative E (Full Build Out + 75 Years)	3	0	4.13
Total (No Action + Alt E Full Build Out + 75 Years)	4	0	4.37

Note that GBNP is a Class II area, which does not have visibility protection under federal or state law. Impacts are presented for informational purposes only.

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be an additional 55 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 185,000 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 20,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.004 percent of the carbon dioxide equivalent estimated to be emitted by the U.S. in 2010 (USEPA 2012b) and less than 0.4 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

These power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Conclusion

- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and the following impacts should be used for comparison purposes only. It is estimated that an additional 1,518 tons of PM_{10} would be emitted per year after full build out, 7,464 tons of PM_{10} would be emitted per year after full build

out plus 75 years, and 8,563 tons of PM_{10} would be emitted per year after full build out plus 200 years. Also, it is estimated that an additional 152 tons of $PM_{2.5}$ would be emitted per year after full build out, 746 tons of $PM_{2.5}$ would be emitted per year after full build out plus 75 years, and 856 tons of $PM_{2.5}$ would be emitted per year after full build out plus 200 years. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met and visibility conditions at the GBNP are unlikely to be impaired. The extent of possible visibility impairment is highly uncertain.

- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gases associated with electricity generation would be approximately 185,000 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- In order to strengthen the SNWA's adaptive management program, mitigation measure GW-AQ-3 (Monitoring, Mitigation, and Management Plan for Air Quality) is recommended. This measure is part of the COM Plan, which is described in Section 3.20.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

3.1.2.15 Alternative F

Groundwater Development Area

Construction of well pads, access roads, collector pipelines, and power lines would result in an estimated maximum surface disturbance of approximately 4,000 acres. It is assumed that short-term construction emissions will be qualitatively similar to the values estimated for ROW construction activities for the Proposed Action, although somewhat reduced levels of PM will be emitted due to the smaller amount of disturbed surface area. Long-term emissions from groundwater development maintenance activities are anticipated to be similar to the long-term emissions from ROW maintenance activities. The project is not expected to contribute to increases in radionuclides or erionite.

The COM Plan would be developed and implemented to protect air resources from groundwater development activities. The COM Plan would integrate protective measures from the following: BLM RMPs, BO, ACMs, Stipulated Agreements, and additional mitigation recommended in this EIS. The COM Plan also would be applied to other impact issues discussed in this section.

It is assumed that: 1) the SNWA would implement its ROW ACMs, including measures required as part of Dust Control Permits and other required operating permits; 2) the SNWA would routinely inspect and repair project roads with a BLM inspector; and 3) the SNWA would use soil tackifiers and other materials to suppress dust in accordance with the BLM approval. Based on these measures, it is expected that impacts due to construction would be minimized and be short-term in nature and impacts are not expected to impair visibility conditions at GBNP. There would be a small incremental increase in the concentration of air pollutants in areas near the permanent groundwater development ROW during periods of maintenance.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of 10-foot or greater drawdown over different pumping time frames (**Table 3.1-29**). It is estimated that an additional 1,068 tons of PM_{10} would be emitted per year after full build out; 8,747 tons of PM_{10} would be emitted per year after full build out plus 75 years; and 11,608 tons of PM_{10}

would be emitted per year after full build out plus 200 years. Also, it is estimated that an additional 107 tons of $PM_{2.5}$ would be emitted per year after full build out; 875 tons of $PM_{2.5}$ would be emitted per year for full build out plus 75 years; and 1,161 tons of $PM_{2.5}$ would be emitted per year for full build out plus 200 years.

Table 3.1-29 Alternative F, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust Relative to No Action (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	1,585	45,448	70,312	94	2,134	2,928
Phreatophyte/Medium Vegetation	6,687	43,600	60,280	939	5,590	6,890
Wetland/Meadow	85	3,097	5,519	36	1,023	1,790
Total				**1,068**	**8,747**	**11,608**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

As described in the methodology section, the predicted emissions associated with groundwater drawdown were modeled for Alternative F. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County, GBNP, and in the Wasatch Front are insignificant (below the SILs) for Alternative F (**Table 3.1-30**). Therefore, all PM_{10} and $PM_{2.5}$ impacts are insignificant in the areas analyzed for Alternative F.

Table 3.1-30 Air Quality Impacts from Alternative F Compared to SILs

Pollutant	Area	Averaging Period	Maximum Modeled Concentrations[1] Project-Alone (Alternative F Full Build Out+ 75 Years) ($\mu g/m^3$)	SIL ($\mu g/m^3$)	Model Impacts Exceed SILs?
$PM_{2.5}$	Clark County	24-hr	0.06	1.2	No
		Annual	0.001	0.3	No
	GBNP	24-hr	0.25	1.2	No
		Annual	0.02	0.3	No
	Wasatch Front	24-hr	0.09	1.2	No
		Annual	0.002	0.3	No
PM_{10}	Clark County	24-hr	0.16	5	No
	GBNP	24-hr	1.34	5	No
	Wasatch Front	24-hr	0.24	5	No

[1]Concentrations represent the highest modeled concentrations.

The modeled visibility impacts for Alternative F (**Table 3.1-31**) indicate that the eighth highest day would have less than a 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010) (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Table 3.1-31 Modeled-Predicted Visibility Impacts for Alternative F at Great Basin National Park

Great Basin National Park	Days > than 5% ΔB_{ext}	Days > than 10% ΔB_{ext}	8th Highest % ΔB_{ext}
Alternative F (Full Build Out + 75 Years)	1	0	2.94
Total (No Action + Alt F Full Build Out + 75 Years)	2	0	3.33

Note that GBNP is a Class II area, which does not have visibility protection under federal or state law. Impacts are presented for informational purposes only.

Greenhouse Gas Emissions from Groundwater Pumping

Since the pump stations would be electrically powered and greenhouse gases are emitted during the generation of most electricity, the power requirements of this project have an indirect contribution to the emissions of greenhouse gases. The continuous power requirements to operate the pump stations and other ancillary equipment are estimated to be an additional 55 MW (**Table 2.6-2**). The continuous generation of this electricity amount is estimated to release approximately 185,000 metric tons of carbon dioxide equivalent per year, and is comparable to the emissions from the electricity use of nearly 20,000 homes for 1 year. For context, the estimated indirect greenhouse gas emissions from electricity generation for this alternative are less than 0.004 percent of the carbon dioxide equivalent estimated to be emitted by the U.S. in 2010 (USEPA 2012b) and less than 0.4 percent of the carbon dioxide equivalent estimated to be emitted in Nevada in 2005 (NDEP 2008).

These power requirements, and thus the associated carbon dioxide equivalent emissions, would be offset by electrical generation as part of the project via installation of hydroturbines (detailed in **Appendix E**) and solar panels to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Conclusion

- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and the following impacts should be used for comparison purposes only. It is estimated that an additional 1,068 tons of PM_{10} would be emitted per year after full build out, 8,747 tons of PM_{10} would be emitted per year after full build out plus 75 years, and 11,608 tons of PM_{10} would be emitted per year after full build out plus 200 years. Also, it is estimated that an additional 107 tons of $PM_{2.5}$ would be emitted per year after full build out, 875 tons of $PM_{2.5}$ would be emitted per year after full build out plus 75 years, and 1,161 tons of $PM_{2.5}$ would be emitted per year after full build out plus 200 years It has been demonstrated that these emission will not significantly contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts also indicate that applicable AAQS at GBNP would be met and visibility conditions at the GBNP are unlikely to be impaired.
- Based on predicted power requirements for pumping activities, indirect emissions of greenhouse gases associated with electricity generation would be approximately 185,000 metric tons of carbon dioxide equivalent per year. These power requirements would be offset by electrical generation via installation of hydroturbines (**Appendix E**) and solar panels to the extent possible.
- In order to strengthen the SNWA's adaptive management program, mitigation measure GW-AQ-3 (Monitoring, Mitigation, and Management Plan for Air Quality) is recommended. This measure is part of the COM Plan, which is described in Section 3.20.

Potential residual impacts include:

- The COM Plan, ACMs, and monitoring and mitigation measures for air and water resources could be effective in reducing impacts to air quality. An objective of the COM Plan is to avoid, minimize, or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation. By avoiding or minimizing drawdown effects on soil and vegetation, the magnitude of airborne particulates could be reduced. However, residual effects on air quality could occur considering the long recovery period for soils and vegetation conditions. Some unavoidable adverse effects could occur at some locations.

3.1.2.16 No Action

Groundwater Development Area

Under the No Action Alternative, the proposed project would not be constructed or maintained. No project-related surface disturbance would occur. Without project construction and operation activities, there are no emissions of criteria pollutants, fugitive dust, or greenhouse gases. It is expected that natural (biogenic) and human (anthropogenic) sources of pollutant emissions would continue. Anthropogenic emissions are expected to increase in proportion to projected population increases in Lincoln County (see Section 3.18, Socioeconomics and Environmental Justice). Current anthropogenic activities, as well as natural wind conditions, would continue to generate dust as discussed in Section 3.1.1.1. Climate change would continue but the scale of these changes would depend on the interactions of the atmospheric and oceanic circulation patterns and the level of future anthropogenic emissions of greenhouse gases.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

Current groundwater pumping for agricultural and municipal purposes would continue, without addition of new wells, pipelines or pumping stations from the proposed project. There would be some increase in current levels of fugitive dust generation due to continued groundwater pumping activities. The amount of dust generated by areas affected by a 10-foot or greater drawdown are shown in **Table 3.1-32**.

Table 3.1-32 No Action, Estimated Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	PM_{10} Emissions from Windblown Dust (tons per year)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	4,296	14,966	18,830	109	399	511
Phreatophyte/Medium Vegetation	6,298	17,263	22,606	418	1,374	1,928
Wetland/Meadow	1	261	2,023	0	95	795
Total				**527**	**1,869**	**3,234**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

The potential increases in dust generation from areas affected by a 10-foot or greater drawdown under the No Action Alternative are estimated to be approximately 527 tons of PM_{10} per year gradually increasing to 1,869 tons of PM_{10} per year in roughly 75 years, and would reach 3,234 tons of PM_{10} per year in roughly 200 years. Also, it is estimated that approximately 53 tons of $PM_{2.5}$ would be emitted per year; 187 tons of $PM_{2.5}$ would be emitted per year after 75 years; and 323 tons of $PM_{2.5}$ would be emitted per year after 200 years.

The modeling results show that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County, GBNP, and in the Wasatch Front are insignificant (below the SILs) for the No Action Alternative (**Table 3.1-33**); therefore no further air quality analyses were conducted since the No Action Alternative would not cause or contribute to an exceedance of applicable AAQS.

Table 3.1-33 Air Quality Impacts from No Action Alternative Compared to SILs

Pollutant	Area	Averaging Period	Maximum Modeled Concentrations[1] (No Action Alternative Full Build Out+ 75 Years) (µg/m^3)	SIL (µg/m^3)	Model Impacts Exceed SILs?
$PM_{2.5}$	Clark County	24-hr	0.020	1.2	No
		Annual	0.0004	0.3	No
	GBNP	24-hr	0.072	1.2	No
		Annual	0.004	0.3	No
	Wasatch Front	24-hr	0.027	1.2	No
		Annual	0.0004	0.3	No
PM_{10}	Clark County	24-hr	0.039	5	No
	GBNP	24-hr	0.200	5	No
	Wasatch Front	24-hr	0.037	5	No

[1]Concentrations represent the highest modeled concentrations.

The modeled visibility impacts for the No Action Alternative (**Table 3.1-34**) indicate that eighth highest day would have less than the 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010) (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Table 3.1-34 Modeled-Predicted Visibility Impacts for No Action Alternative at Great Basin National Park

Great Basin National Park	Days > than 5% ΔB_{ext}	Days > than 10% ΔB_{ext}	8th Highest % ΔB_{ext}
No Action (Full Build Out + 75 Years)	0	0	0.47

Note that GBNP is a Class II area, which does not have visibility protection under federal or state law. Impacts are presented for informational purposes only.

Greenhouse Gas Emissions from Groundwater Pumping

Since there would be no pump stations constructed under the No Action alternative, there would be no increase to greenhouse gas emissions from power requirements.

Conclusion. Without project construction and operation activities, there are no additional emissions of criteria, fugitives dust, nor greenhouse gas pollutants from the proposed project. It is expected that:

- Natural (biogenic) and human (anthropogenic) sources of pollutant emissions would continue. Anthropogenic emissions are expected to increase in proportion to projected population increases in Lincoln County.
- Current anthropogenic activities, as well as natural wind conditions, would continue to generate dust as discussed in Section 3.1.1.1.
- Climate change would continue but the scale of these changes would depend on the interactions of the atmospheric and oceanic circulation patterns and level of future anthropogenic emissions of greenhouse gases.
- Current groundwater pumping for agricultural and municipal purposes would continue. At current levels of groundwater pumping, there may be some increase in current levels of windblown dust generation due to changes in vegetation and groundcover. The potential increases in dust generation from areas affected by a 10-foot or greater drawdown are estimated to be approximately 527 tons of PM_{10} per year gradually increasing to 1,869 tons of PM_{10} per year in roughly 75 years, and would reach 3,234 tons of PM_{10} per year in roughly 200 years. Also, it is estimated that approximately 53 tons of $PM_{2.5}$ would be emitted per year, 187 tons of $PM_{2.5}$ would be emitted per year after 75 years, and 323 tons of $PM_{2.5}$ would be emitted per year after 200 years. Windblown dust emissions

from groundwater drawdown under the No Action Alternative are not predicted to impair visibility conditions at the GBNP.

3.1.2.17 Alternatives Comparison

Generally, the impacts to air quality from the groundwater field development construction and maintenance are very similar between alternatives. **Table 3.1-35** shows the estimated maximum annual construction emissions for each alternative for PM_{10} and $PM_{2.5}$. Only the emissions of PM_{10} and $PM_{2.5}$ vary between alternatives since PM emissions depend on the acres of surface disturbance. The emissions of all other pollutants depend on the tailpipe emissions from construction activities which over a year, are the same for each alternative.

Table 3.1-35 Estimated Maximum Annual PM_{10} and $PM_{2.5}$ Emissions from Groundwater Field Development Construction of the Proposed Action and Alternatives A through F

Alternative	PM_{10} (tons per year)	$PM_{2.5}$ (tons per year)
Proposed Action	173	27
Alternative A	104	20
Alternative B	101	20
Alternative C	104	20
Alternative D	88	19
Alternative E	89	19
Alternative F	89	19

Table 3.1-36 shows the estimated windblown dust emissions that would result from groundwater drawdown for each alternative. As described in the preceding sections, the impacts for the alternatives are the project-alone impacts (i.e. the total impacts for an alternative would be the No Action impact plus the alternative's impacts). Generally, the impacts to air quality vary considerably between the groundwater drawdown alternatives. The Proposed Action is predicted to have the highest impacts to air quality. The air quality impacts due to the Proposed Action may be up to two-thirds higher than any other alternative. Alternative C is predicted to have the lowest air quality impacts out of the project alternatives.

Table 3.1-36 Estimated Long-Term Windblown Dust Emissions from Groundwater Drawdown for the Proposed Action and Alternatives A through F

Alternative	PM_{10} Emissions from Windblown Dust (tons per year) (full build out)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)	$PM_{2.5}$ Emissions from Windblown Dust (tons per year) (full build out)	$PM_{2.5}$ Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	$PM_{2.5}$ Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
No Action	527	1,869	3,234	53	187	323
Proposed Action[1]	2,226	14,046	17,840	223	1,405	1,784
Alternative A[1]	1,518	11,826	13,327	152	1,183	1,333
Alternative B[1]	2,233	12,104	15,995	223	1,210	1,599
Alternative C[1]	1,518	5,416	6,690	152	542	669
Alternative D[1]	0	2,474	8,252	0	247	825
Alternative E[1]	1,518	7,464	8,563	152	746	856
Alternative F[1]	1,068	8,747	11,608	107	875	1,161

[1] Project-alone impacts are shown for each alternative. Total impacts for each alternative are the No Action impacts plus the Alternative's impact.

3.1.3 Cumulative Impacts

3.1.3.1 Climate Change Effects to Air Quality and Other Resources

Climate Change Effects

Climate change already appears to be influencing both natural and managed ecosystems of the American Southwest and Great Basin Desert (Breshears et al. 2005, Westerling et al. 2006, Seager et al. 2007) and models indicate the likelihood of the Southwest being a climate change "hotspot" in the coming decades (Diffenbaugh et al. 2008). Recent warming in the Southwest is among the most rapid in the nation, significantly more than the global average in some areas (USGCRP 2009). Projections suggest continued strong warming in the study area, with significant increases in temperature (USGCRP 2009) and decreases in precipitation (Seager et al. 2007). In the coming century, mean global temperature could increase significantly, with an associated increase in both the frequency of extreme events (heat waves, droughts, storms) and the frequency and extent of wildfire (IPCC 2007; Westerling & Bryant 2008; Krawchuk et al. 2009). Under such conditions, future impacts could be substantial for some resources, impacting biodiversity, protected areas, and agricultural lands.

Climate change effects are evaluated separately for air resources versus all other resources. While air resources may directly affect the magnitude of climate change with the emissions of greenhouse gases, other resources are affected by climate change. Due to the nature of greenhouse gas emissions into the atmosphere, it is impossible to link a specific greenhouse emission and a specific climate change.

Proposed Project's Air Impacts to Climate Change

The USEPA has new regulations that now require mandatory reporting of greenhouse gases if production exceeds 25,000 metric tons of carbon dioxide equivalent per year for certain industrial and intensive agricultural activities (40 CFR 98.2; 74 FR 56374). Twenty-five thousand metric tons represent approximately 0.0000041 of 1 percent of annual national emissions, which is estimated to be six billion metric tons (USEPA 2009). It is important to note that this new USEPA reporting requirement does not apply to any of the proposed actions and it is shown here to give a sense of scope and scale to potential impacts. It is for comparison purposes only.

Table 3.1-37 shows the estimated annual greenhouse gas emissions for each project alternative. The estimated maximum annual greenhouse gas emissions during the ROW construction and maintenance activities for all alternatives are anticipated to be less than 25,000 metric tons a year in terms of carbon dioxide equivalent, while indirect emissions of greenhouse gases from power generation required for groundwater pumping could be as high as 327,000 metric tons of carbon dioxide equivalent, which is less than 0.006 of 1 percent of annual U.S. emissions in 2010 (USEPA 2012b) and less than 0.6 percent of Nevada emissions in 2005 (NDEP 2008). The greenhouse gas emissions would be highest for the Proposed Action and lowest for Alternative D.

Table 3.1-37 Estimated Direct and Indirect Greenhouse Gas Emissions for the Proposed Action and Alternatives A through F

Alternative	Maximum Emissions from ROW Construction and Maintenance (Tonnes of Carbon Dioxide Equivalent per year)	Long-term Direct Emissions from ROW Maintenance (Tonnes of Carbon Dioxide Equivalent per year)	Long-term Indirect Emissions from Groundwater Pumping (Tonnes of Carbon Dioxide Equivalent per year)
No Action	0	0	0
Proposed Action	23,896	8	327,000
Alternative A	23,896	8	250,000
Alternative B	23,896	8	327,000
Alternative C	23,896	8	250,000
Alternative D	23,896	5	182,000
Alternative E	23,896	7	185,000
Alternative F	23,896	8	185,000

The power requirements, and therefore the greenhouse gas emissions, for all alternatives would be offset by electrical generation as part of the project via installation of hydroturbines and solar panels (detailed in **Appendix E**) to the extent possible. It is estimated that as much as 40 percent of the project's power requirements could be provided by the installation of hydroturbines at the three pressure reducing stations.

Climate Change Effects to Air Resources

Climate change is not shown to have a direct effect on any criteria pollutants other than ozone. It has been found that concentrations of ground level ozone are likely to increase due to increasing temperatures (Wise 2009). This indicates that areas currently designated as "maintenance" status for ozone are likely to have added difficulty maintaining levels below the ozone standard. Although no other criteria pollutants have been shown to be directly impacted by climate change, potential future regulations aimed to reduce greenhouse gas emissions may have an indirect effect on other pollutants (such as nitrogen dioxide [NO_2] or SO_2) co-emitted with greenhouse gas. Increases in wildland fire, described below, also will contribute in increased emissions of air pollutants.

Climate Change Effects to Other Resources

While air resources has the potential to directly affect climate change with the emissions of greenhouse gases, alterations to regional climate could potentially affect other resources such as vegetation, wildfires, etc. The potential effects of climate change on other resources are described in detail in the relevant resource sections. **Table 3.1-38** shows the resources predicted to be affected by climate change, the potential affects, and the reference section of this document that provides additional information.

Table 3.1-38 Summary of Potential Climate Change Effects to Resources

Resource	Summary of Potential Climate Change Effects to Resources in the Project Area	Reference Section
Air	• Increased ozone concentrations in areas predicted to have increased temperature. • Increased air quality impacts from increased wildfires.	3.1.3.1
Geology	• Climate change effects were not evaluated for this resource because potential effects to Geology as a result of climate change cannot be directly quantified.	3.2.3.1
Water	• Altered patterns, timing and amounts of precipitation • Altered surface hydrology (volume and timing of surface flows, rainfall-runoff response, flood events, water quality, sediment and contaminant transport). • Altered vadose zone hydrology (runoff, ET, infiltration, groundwater recharge). • Altered hydrogeology (groundwater flow).	3.3.3.1
Soils	• Soil moisture: projections of decreasing or more variable precipitation could lead to lower soil moistures, potentially affecting agriculture, regional plant and animal species composition, and regional weather patterns. • Erosion: projections of increasing rates or amounts of precipitation and/or changes in vegetation as a result of synergistic climate changes could lead to significant increases in erosion rates.	3.4.3.1
Vegetation and Wildland Fire	• Altered distribution of vegetation at local spatial scales. • Altered vegetation types and spatial arrangements (i.e., woody vs. herbaceous species). • Altered amounts, spatial arrangement, connectivity, and types of surface fuels. • Altered precipitation patterns, which could lead to prolonged drought, exacerbating the risk of wildland fire. • Altered species' phenology	3.5.3.1
Wildlife	• Altered or restricted physical ranges of species present. • Altered disease dynamics and the introduction of novel pathogens. • Modification, shifting, or elimination of habitats. • Altered species' phenology.	3.6.3.1
Aquatic	• Modified or altered aquatic habitats due to changes in precipitation. • Altered water quality parameters such as water temperature and dissolved oxygen. • Altered aquatic species abundance, distribution, phenology, and community composition in response to habitat and water quality changes.	3.7.3.1

Table 3.1-38 Summary of Climate Change Effects to Resources (Continued)

Resource	Summary of Potential Climate Change Effects to Resources in the Project Area	Reference Section
Land Use	• Temperature and atmospheric CO_2: while some crops show positive responses to elevated CO_2 and lower levels of warming, higher levels of warming often negatively affect growth and yields. • Precipitation: extreme events such as heavy downpours and droughts are likely to reduce crop yields because excesses or deficits of water have negative impacts on plant growth. • Invasive species: weeds, diseases, and insect pests benefit from warming and weeds also benefit from a higher CO_2 concentration, increasing stress on crop plants and requiring more attention to pest and weed control.	3.8.3.1
Recreation	• Climate change effects were not evaluated for this resource because potential effects to Recreation as a result of climate change cannot be directly quantified.	3.9.3.1
Transportation	• Climate change effects were not evaluated for this resource because potential effects to Transportation as a result of climate change cannot be directly quantified.	3.10.3.1
Mineral	• Climate change effects were not evaluated for this resource because potential effects to Minerals as a result of climate change cannot be directly quantified.	3.11.3.1
Range and Grazing	• Temperature and atmospheric CO_2: while some forage species may have positive responses to elevated CO_2 and lower levels of warming, higher levels of warming may negatively affect growth and yields of rangeland plants. • Precipitation: extreme events such as heavy downpours and droughts are likely to reduce forage yields because excesses or deficits of water have negative impacts on plant growth. • Invasive species: weeds, diseases, and insect pests benefit from warming and weeds also benefit from a higher CO_2 concentration, increasing stress on crop plants and requiring more attention to pest and weed control. • Forage: quality in pasture and rangeland generally declines with increasing CO_2 concentration because of the effects on plant nitrogen and protein content, reducing the land's ability to supply adequate livestock feed.	3.12.3.1
Wild Horses	• Altered vector and pathogen distribution. • Altered thermal extremes. • Modification, shifting, or elimination of habitats. • Forage: quality in pasture and rangeland generally declines with increasing CO_2 concentration because of the effects on plant nitrogen and protein content, reducing the land's ability to supply adequate livestock feed.	3.13.3.1
Special Designation	• Climate change effects were not evaluated for this resource because potential effects to Special Designation as a result of climate change cannot be directly quantified.	3.14.3.1
Visual	• Climate change effects were not evaluated for this resource because potential effects to Visual Resources as a result of climate change cannot be directly quantified.	3.15.3.1
Cultural	• Climate change effects were not evaluated for this resource because potential effects to Cultural Resources as a result of climate change cannot be directly quantified.	3.16.3.1
Native American	• Climate change effects were not evaluated for this resource because potential effects to Native American Resources as a result of climate change cannot be directly quantified.	3.17.3.1
Socioeconomics	• Climate change effects were not evaluated for this resource because potential effects to Socioeconomics as a result of climate change cannot be directly quantified.	3.18.3.1
Public Safety and Health	• Climate change effects were not evaluated for this resource because potential effects to Public Safety and Health as a result of climate change cannot be directly quantified.	3.19.3.1

3.1.3.2 Issues

Rights-of-way and Groundwater Development Area Construction and Maintenance

- Short-term air pollutants emitted from the tailpipes of construction equipment, including criteria pollutants, ozone precursors, and greenhouse gas emissions.
- Short-term fugitive dust generated during construction and long-term fugitive dust generated during facility maintenance.
- Short-term and long-term windblown dust generated due to wind erosion of surfaces disturbed during construction and maintenance.
- Entrainment and transport of radioactive material and erionite due to wind erosion of disturbed surfaces.

Groundwater Pumping

- Short-term, long-term, and permanent windblown dust generated due to wind erosion of surfaces disturbed due to groundwater drawdown.
- Short-term, long-term, and permanent impairment of visibility conditions at GBNP due to wind erosion of surfaces disturbed from groundwater pumping.
- Changes in Salt Lake City's PM_{10} air emissions due to the effects of groundwater pumping on soils and vegetation.

3.1.3.3 Assumptions

Assumptions regarding compliance with regulatory requirements, detailed project operations, inputs for emission factors, and future conditions are required to estimate impacts to air quality and climate.

Key assumptions regarding compliance with regulatory and the BLM requirements include:

- All state and local air quality construction permits will be received prior to initiation of project construction.
- Any operating permits or dust control plans required in nonattainment areas will address any conformity requirements (although no groundwater development activities are planned in nonattainment areas at this time) or demonstrate that total emissions in nonattainment areas will be below applicable thresholds.
- The Ely and Las Vegas RMP management actions and best management practices would be applied to all proposed construction activities, based on the most current RMPs – Ely 2008; Las Vegas 1998 (BLM 2008, 1998).
- The ACMs included in the SNWA POD to manage surface disturbance effects for ROWs provide a basis for appropriate measures that may be submitted in future SNWA ROW applications. For purposes of impact analysis, it has been assumed that measures appropriate for ROW construction would be applied to construction in groundwater development areas.

Rights-of-way and Groundwater Development Area Construction and Maintenance

- Construction and maintenance impacts for the groundwater development phase are assumed to be qualitatively similar to the ROW construction and maintenance impacts. This implies that the assumptions made in the estimation of ROW construction and maintenance emissions are appropriate for groundwater development maintenance emissions.
- Total construction and maintenance emissions are such a negligible fraction of total emissions in the project area that the project has a negligible contribution to cumulative air quality.

Groundwater Pumping

- The cumulative surface disturbance effects were estimated by overlaying the existing surface disturbances for PPAs, RFFAs, and the development areas for the project alternative being evaluated (**Figure 3.1-6**). The expected cumulative changes in vegetation communities and soil surface conditions are used to estimate future fugitive dust impacts for each alternative due to groundwater drawdown. Surface conditions were categorized based on ET units defined for the groundwater modeling analysis in the manner identical to the estimation of project-specific

windblown dust due to groundwater pumping in Section 3.1.2.2. Impacts are reported for the total cumulative impact due to the project alternative and any past and present actions and RFFAs.

3.1.3.4 Methodology for Analysis

For the estimation of air quality related impacts, the methodology depends on the activity (construction, pumping, etc.) and the type of air impacts (criteria emissions, greenhouse gases, etc.). The activity/air impact combinations are grouped based on the methodology used to estimate impacts. The calculation methodology for each category is described below.

The different methodologies for developing air impacts are grouped into the following categories:

- Groundwater Development Area Construction and Operational Maintenance
  - Tailpipe emissions
  - Fugitive dust
  - Greenhouse gases
- Groundwater Pumping
  - Windblown dust from soils exposed as a result of groundwater pumping
  - Windblown dust impacts to Utah

Rights-of-way and Groundwater Development Area Construction and Maintenance

Estimated project air quality impacts are presented in the form of total estimated ROW and groundwater field development construction and operational maintenance emissions for each alternative. For every alternative, the construction emissions are temporary and transient. The emissions from maintenance are minimal. Total project emissions for each alternative are predicted to be much less than 1 percent of total future emissions in the project area. Therefore, the cumulative impacts to air quality due to ROW and groundwater development construction and maintenance are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change as a result of ROW and groundwater field development construction and maintenance activities. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operating permits.

Groundwater Pumping

Windblown Dust Emissions from Groundwater Drawdown

Methods described for calculating the project-specific impacts from groundwater pumping (described in Section 3.1.2.7) are identical for estimating the total impacts from groundwater pumping. The only difference is that the cumulative estimates include all known past and present actions and RFFAs in addition to the Proposed Alternative.

Future fugitive dust estimates are based on the primary ET units that were used for estimating water losses from the groundwater system via evaporation from soils and playas and via vegetation transpiration.

The area for each ET unit affected by a 10-foot groundwater drawdown contour is estimated for each alternative with all known past and present actions and RFFAs. The estimated area is projected for three model time frames: at full build out, at full build out plus 75 years, and at full build out plus 200 years. The percent of the area that will become susceptible to wind erosion is calculated for each ET unit and WEG. The total area that is susceptible to wind erosion is multiplied by the emission factor for wind erosion from the Clark County Wind Tunnel Study (Wacaser et al. 2006) to estimate hourly PM_{10} emissions of windblown dust for a specific wind band. The PM_{10} emission rate is then converted from units of tons per hour per windband into estimates of tons per year using the wind speed frequency distribution for Ely, Nevada. The $PM_{2.5}$ size range is estimated based on USEPA guidance (USEPA 1998; WRAP 2005, 2006), whereby 10 percent of the PM_{10} is in the $PM_{2.5}$ size range.

3.1.3.5 Proposed Action

Past and present actions consist primarily of existing roads, energy utility corridors, mining districts, and recent wildfires (**Figures 2.9-1** and **2.9-2**). Other activities that have influenced vegetation community composition and area

include livestock grazing over nearly all public lands, and the development of towns and rural communities (Ely, McGill, Baker, Garrison, Pioche, Panaca). The primary future actions consist of construction of new utilities (pipelines and electrical distribution lines), roads and turbine pads for wind energy projects, and collector fields for solar energy projects, which would be located in Spring, Dry Lake, Muleshoe, Delamar, and Coyote Springs valleys.

Groundwater Development Area

The cumulative impacts to air quality due to ROW and groundwater field development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operating permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-39**). After full build out, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 119 percent more than the project-specific windblown dust emissions. A majority of this increase is attributable to cumulative impacts from other projects (see Section 3.1.3.12, No Action Cumulative Impacts). In full build out plus 75 years, emissions are predicted to be 29 percent more than project-specific emissions. In full build out plus 200 years, emissions are predicted to be 21 percent more than project-specific emissions.

Table 3.1-39 Proposed Action, Estimated Cumulative Increases in Windblown Dust From Evapotranspiration Affected By 10-foot Or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown Dust (tons per year)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	20,391	108,370	129,876	890	5,244	6,437
Phreatophyte/ Medium Vegetation	24,417	79,517	87,620	3,018	9,853	10,717
Wetland/Meadow	1,755	7,789	11,136	968	3,075	4,364
Total Cumulative (tons per year)				**4,876**	**18,173**	**21,518**
Percent Change Relative to Project-specific Emissions (%)				**119**	**29**	**21**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Similar to the approach used in the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7) the project-specific emissions associated with groundwater drawdown were modeled for Alternatives A, E, F and the No Action Alternative. The estimated cumulative impacts are assessed qualitatively relative to the alternatives explicitly modeled. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for all Alternatives (**Tables 3.1-20, 3.1-27**, and **3.1-30**). Since the emissions for the cumulative Proposed Action are approximately 54 percent greater than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Proposed Action would be moderately higher than project-specific emissions for impacts for Alternative A. However, even with an increase in the emissions, it is anticipated that the cumulative Proposed Action impacts would also be

insignificant at Clark County and the Wasatch Front and no further analyses are required for Clark County and the Wasatch Front since the project and RFFAs would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). Since the emissions for the cumulative Proposed Action are approximately 54 percent greater than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future cumulative impacts from the Proposed Action would be moderately higher than project-specific impacts for Alternative A. Even with an increase in impacts, the cumulative Proposed Action impacts are anticipated to be in compliance with applicable National and State AAQS at GBNP.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). Since the emissions for the cumulative Proposed Action are approximately 54 percent greater than project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative Proposed Action would be moderately higher than project-specific impacts for Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. After full build out, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 119 percent more than the project-specific windblown dust emissions. In full build out plus 75 years, emissions are predicted to be 29 percent more than project-specific emissions. In full build out plus 200 years, emissions are predicted to be 21 percent more than project-specific emissions. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

3.1.3.6 Alternative A

Rights-of-way and Groundwater Development Area Construction and Maintenance

The cumulative impacts to air quality due to ROW and groundwater development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operation permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-40**). At build out, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 167 percent more than the project-specific windblown dust emissions. At full build out plus 75 years, emissions are predicted to be 33 percent more than project-specific emissions. At full build out plus 200 years, emissions are predicted to be 38 percent more than project-specific emissions.

Table 3.1-40 Alternative A. Estimated Cumulative Increases in Windblown Dust from Evapotranspiration Affected By 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown Dust (tons per year)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	17,808	86,386	99,359	684	4,085	4,800
Phreatophyte/ Medium Vegetation	21,707	72,144	80,691	2,541	8,902	9,829
Wetland/Meadow	1,525	6,881	9,567	834	2,797	3,797
Total Cumulative (tons per year)				**4,058**	**15,784**	**18,426**
Percent Change Relative to Project-specific Emissions (%)				**167**	**33**	**38**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Similar to the approach used during the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7), the project-specific emissions associated with groundwater drawdown were modeled for Alternative A and the estimated cumulative impacts for are assessed qualitatively. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for Alternative A (**Table 3.1-20**). Since the emissions for the cumulative Alternative A are approximately 33 percent greater than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Alternative A would be moderately higher than project-specific impacts for Alternative A. Even with a moderate increase to impacts, the cumulative Alternative A impacts are anticipated to be insignificant at Clark County and the Wasatch Front and no further analyses are required for Clark County and the Wasatch Front since the project with RFFAs would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). Since the emissions for the cumulative Alternative A are approximately 33 percent greater than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future cumulative impacts from the Alternative A would be moderately higher than project-specific impacts for Alternative A. Even with a moderate increase , the cumulative Alternative A impacts would also be in compliance with applicable National and State AAQS at GBNP.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). Since the emissions for the cumulative Alternative A are approximately 33 percent greater than Alternative A at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative Alternative A would be moderately higher than project-specific impacts for Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. At full build out, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 167 percent more than the project-specific windblown dust emissions. At full build out plus 75 years, emissions are predicted to be 33 percent more than project-specific emissions. At full build out plus 200 years, emissions are predicted to be 38 percent more than project-specific emissions. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

3.1.3.7 Alternative B

Rights-of-way and Groundwater Development Area Construction and Maintenance

The cumulative impacts to air quality due to ROW and groundwater development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operation permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-41**). At full build out, emissions are predicted to be 123 percent more than project-specific emissions. At full build out plus 75 years, emissions are predicted to be 111 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 19 percent greater than the project-specific windblown dust emissions.

Table 3.1-41 Alternative B, Estimated Cumulative Increases in Windblown Dust from ET Units Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown Dust (tons per year)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	19,806	74,151	86,640	839	3,658	3,860
Phreatophyte/ Medium Vegetation	26,546	78,377	85,005	3,047	17,114	10,424
Wetland/Meadow	2,167	9,008	12,187	1,099	4,765	4,705
Total Cumulative (tons per year)				**4,984**	**25,537**	**18,988**
Percent Change Relative to Project-specific Emissions (%)				**123**	**111**	**19**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Similar to the approach used in the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7) the project-specific emissions associated with groundwater drawdown were modeled for Alternatives A, E, F and the No Action Alternative. The estimated cumulative impacts are assessed qualitatively relative to the alternatives explicitly modeled. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for all Alternatives (**Tables 3.1-20**, **3.1-27**, and **3.1-30**).Since the emissions for the cumulative Alternative B are approximately 116 percent greater than the project-specific impacts for Alternative A at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Alternative B would be moderately higher the project-specific emissions for Alternative A. However, even with an increase in the emissions, it is anticipated that the cumulative Alternative B impacts would also be insignificant at Clark County and the Wasatch Front and no further analyses are required for Clark County and the Wasatch Front since the project with RFFAs would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). Since the emissions for the cumulative Alternative B are approximately 116 percent greater than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future cumulative impacts from the Alternative B would be moderately higher than the project-specific impacts for Alternative A. Even with an increase in impacts, the cumulative Alternative B impacts would also be in compliance with applicable National and State AAQS at GBNP.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). Since the emissions for the cumulative Alternative B are approximately 116 percent greater than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative Alternative B would be moderately higher than project-specific impacts for Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. At full build out, emissions are predicted to be 123 percent more than project-specific emissions. At full build out plus 75 years, emissions are predicted to be 111 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 19 percent greater than the project-specific windblown dust emissions. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

3.1.3.8 Alternative C

Rights-of-way and Groundwater Development Area Construction and Maintenance

The cumulative impacts to air quality due to ROW and groundwater development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operation permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-42**). After full build out, cumulative emissions are predicted to be 174 percent more than project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 88 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 99 percent the project-specific windblown dust emissions.

Table 3.1-42 Alternative C, Estimated Cumulative Increases in Windblown Dust from Evapotranspiration Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown (tons per year)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	17,808	49,665	63,009	785	2,423	2,970
Phreatophyte/ Medium Vegetation	21,707	47,246	58,774	2,577	5,800	7,175
Wetland/Meadow	1,525	4,718	8,123	790	1,961	3,192
Total Cumulative (tons per year)				**4,152**	**10,185**	**13,337**
Percent Change Relative to Project-specific Emissions (%)				**174**	**88**	**99**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Similar to the approach used in the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7) the project-specific emissions associated with groundwater drawdown were modeled for Alternatives A, E, F and the No Action Alternative. The estimated cumulative impacts are assessed qualitatively relative to the alternatives explicitly modeled. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for all Alternatives (**Tables 3.1-20, 3.1-27**, and **3.1-30**). Since the emissions for the cumulative Alternative C are approximately 14 percent less than the project-specific impacts for Alternative A at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Alternative C would be somewhat less than the project-specific emissions for Alternative A. With a decrease in the emissions, it is anticipated that the cumulative Alternative C impacts would also be insignificant at Clark County and the Wasatch Front and no further analyses are required for Clark County and the Wasatch Front since the project and RFFAs would not cause or contribute to an exceedance of applicable AAQS.

Model-predicted concentrations for Alternative A at 75 years after full build out are above the SILs at GBNP. Therefore, a more refined analysis was conducted to assess the total air quality impacts at GBNP. The model-predicted total concentrations at GBNP show compliance with applicable National and State AAQS (**Table 3.1-21**). Since the emissions for the cumulative Alternative C are approximately 14 percent less than the project-specific emissions for Alternative A at 75 years after full build out, then it can be inferred that the future cumulative impacts from the Alternative C would be somewhat less than the project-specific impacts for Alternative A. Even with an increase in impacts, the cumulative Alternative C impacts are anticipated to be in compliance with applicable National and State AAQS at GBNP.

The modeled visibility impacts indicate that Alternative A has the potential to contribute to visibility impairment at GBNP (**Table 3.1-22**). Since the emissions for the cumulative Alternative C are approximately 14 percent less than Alternative A at 75 years after full build out, then it can be inferred that the future visibility impacts from the

cumulative Alternative C would be somewhat less than the project-specific impacts for Alternative A. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. After full build out, cumulative emissions are predicted to be 174 percent more than project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 88 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 99 percent more than project-specific windblown dust emissions. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

3.1.3.9 Alternative D

Rights-of-way and Groundwater Development Area Construction and Maintenance

The cumulative impacts to air quality due to ROW and groundwater development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operation permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-43**). At full build out, cumulative emissions are predicted to be approximately the same as project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 189 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be approximately 50 percent more than the project-specific windblown dust emissions.

Similar to the approach used in the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7) the project-specific emissions associated with groundwater drawdown were modeled for Alternatives A, E, F and the No Action Alternative. The estimated cumulative impacts are assessed qualitatively relative to the alternatives explicitly modeled. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in Clark County and in the Wasatch Front are insignificant for all Alternatives (**Tables 3.1-20, 3.1-27**, and **3.1-30**). Since the emissions for the cumulative Alternative D are approximately 4 percent less than the project-specific emissions for Alternative E at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Alternative D are approximately the same as the project-specific impacts for Alternative E. Therefore, it is anticipated that the cumulative Alternative D impacts would also be insignificant at Clark County, GBNP, and the Wasatch Front and no further air quality analyses are required since the project with RFFAs would not cause or contribute to an exceedance of applicable AAQS.

The modeled visibility impacts for Alternative E (**Table 3.1-28**) indicate that the eighth highest day would have less than a 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010).Since the emissions for the cumulative Alternative D are approximately 4 percent less than the project-specific emissions for Alternative E at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative Alternative D would be

approximately the same as the project-specific impacts for Alternative E (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Table 3.1-43 Alternative D, Estimated Cumulative Increases in Windblown Dust from ET Units Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown (tons per year)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	10,322	36,131	51,043	427	1,420	2,132
Phreatophyte/Medium Vegetation	6,147	35,406	61,272	569	3,969	7,089
Wetland/Meadow	1,157	4,067	7,584	654	1,763	3,084
Total Cumulative (tons per year)				**1,651**	**7,151**	**12,305**
Percent Change Relative to Project-specific Emissions (%)				**--**	**189**	**49**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feeet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. At full build out, cumulative emissions are predicted to be approximately the same as project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 189 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be approximately 50 percent more than the project-specific windblown dust emissions. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met visibility conditions at the GBNP are unlikely to be impaired. The extent of possible visibility impairment is highly uncertain.

3.1.3.10 Alternative E

Rights-of-way and Groundwater Development Area Construction and Maintenance

The cumulative impacts to air quality due to ROW and groundwater development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operation permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-44**). At full build out, cumulative emissions are predicted to be 178 percent more than project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 55 percent more than

project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 61 percent more than the project-specific windblown dust emissions.

Table 3.1-44 Alternative E, Estimated Cumulative Increases in Windblown Dust from ET Units Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown Dust (tons per year)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	17,808	63,455	73,554	785	2,673	3,022
Phreatophyte/ Medium Vegetation	21,707	59,349	68,013	2,577	6,882	7,756
Wetland/Meadow	1,525	4,805	7,492	854	2,033	3,004
Total Cumulative (tons per year)				**4,217**	**11,588**	**13,783**
Percent Change Relative to Project-specific Emissions (%)				**178**	**55**	**61**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Similar to the approach used during the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7), the project-specific emissions associated with groundwater drawdown were modeled for Alternative E and the estimated cumulative impacts for are assessed qualitatively. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in are insignificant for Alternative E for all areas analyzed (**Table 3.1-27**). Since the emissions for the cumulative Alternative E are approximately 55 percent greater than the project-specific emissions for Alternative E at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Alternative E would be moderately higher than project-specific impacts for Alternative E. Even with a moderate increase to impacts, the cumulative Alternative E impacts are anticipated to be insignificant at Clark County, GBNP, and the Wasatch Front and no further air quality analyses are required since the project with RFFAs would not cause or contribute to an exceedance of applicable AAQS.

The modeled visibility impacts for Alternative E (**Table 3.1-28**) indicate that the eighth highest day would have less than a 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010). Since the emissions for the cumulative Alternative E are approximately 55 percent greater than the project-specific impacts for Alternative E at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative Alternative E would be moderately higher than project-specific impacts for Alternative E and cumulative impacts could cause some small level of visibility impairment. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. At full build out, cumulative emissions are predicted to be 178 percent more than project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 55 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 61 percent more than the project-specific windblown dust emissions. At these levels, air quality impacts are not anticipated to

contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

3.1.3.11 Alternative F

Rights-of-way and Groundwater Development Area Construction and Maintenance

The cumulative impacts to air quality due to ROW and groundwater development construction and maintenance and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably. A formal cumulative air quality impact analysis to demonstrate compliance with applicable AAQS will be conducted with project-specific emissions as part of any required operation permits.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-45**). At full build out, cumulative emissions are predicted to be 245 percent more than project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 46 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 33 percent more than the project-specific windblown dust emissions.

Table 3.1-45 Alternative F, Estimated Cumulative Increases in Windblown Dust from ET Units Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown Dust (tons per year)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	16,263	75,011	88,552	738	3,259	3,820
Phreatophyte/Medium Vegetation	19,381	64,772	74,168	2,199	7,482	8,464
Wetland/Meadow	1,509	5,278	8,447	753	2,013	3,150
Total Cumulative (tons per year)				**3,689**	**12,754**	**15,434**
Percent Change Relative to Project-specific Emissions (%)				**245**	**46**	**33**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

Similar to the approach used during the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7), the project-specific emissions associated with groundwater drawdown were modeled for Alternative F and the estimated cumulative impacts for are assessed qualitatively. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in are insignificant for Alternative F for all areas analyzed (**Table 3.1-30**). Since the emissions for the cumulative Alternative F are approximately 46 percent greater than the project-specific emissions for Alternative F at 75 years after full build out, then it can be inferred that the future impacts from the cumulative Alternative F would be moderately higher than project-specific impacts for Alternative F. Even with a moderate increase to impacts, the cumulative Alternative F impacts are anticipated to be insignificant at Clark County, GBNP, and the Wasatch Front and no further air quality analyses are required since the project with RFFAs would not cause or contribute to an exceedance of applicable AAQS.

The modeled visibility impacts for Alternative F (**Table 3.1-31**) indicate that the eighth highest day would have less than a 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010). Since the emissions for the cumulative Alternative F are approximately 46 percent greater than the project-specific impacts for Alternative F at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative Alternative F would be moderately higher than project-specific impacts for Alternative F and cumulative impacts could cause some small level of visibility impairment. However, these results are conservatively high and further evaluation of visibility impacts would be required to definitively assess the potential visibility impacts to GBNP (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably due to ROW and groundwater field development construction and maintenance activities.
- The level and extent of air impacts from groundwater drawdown of 10-feet and greater are highly uncertain and estimated impacts should be used for comparison purposes only. At full build out, cumulative emissions are predicted to be 245 percent more than project-specific emissions. At full build out plus 75 years, cumulative emissions are predicted to be 46 percent more than project-specific emissions. At full build out plus 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown are predicted to be 33 percent more than the project-specific windblown dust emissions. At these levels, air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met. However, it is possible that windblown dust emissions from groundwater drawdown could impair visibility conditions at the GBNP. The extent of possible visibility impairment is highly uncertain.

3.1.3.12 No Action

Groundwater Development Area

The cumulative impacts to air quality due to already authorized activities, and known past and present actions and RFFAs are anticipated to be negligible. Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably.

Groundwater Pumping Effects

Windblown Dust Emissions from Groundwater Drawdown

It is predicted that increased dust may be generated as the result of cumulative drawdown over different pumping time frames (**Table 3.1-46**). This table shows that approximately 2,027 tons of PM_{10} per year, 3,827 tons of PM_{10} per year, and 5,291 tons of PM_{10} per year are due to non-project impacts at the full build out timeframe, full build out plus 75 years timeframe and at full build out plus 200 years timeframe, respectively. In 200 years, windblown dust emissions due to the cumulative effects of groundwater drawdown without the project are predicted to be 64 percent more than the No Action alternative, shown in Section 3.1.2.6, which doesn't include past and present actions and RFFAs, but does include authorized pumping quantities.

Similar to the approach used during the assessment of project impacts from groundwater pumping (described in Section 3.1.2.7), the project-specific emissions associated with groundwater drawdown were modeled for the No Action Alternative and the estimated cumulative impacts for are assessed qualitatively. The modeling analysis shows that the predicted concentrations of PM_{10} and $PM_{2.5}$ in are insignificant for Alternative E for all areas analyzed (**Table 3.1-33**). Since the emissions for the cumulative No Action Alternative are approximately 105 percent greater than the project-specific emissions for No Action Alternative at 75 years after full build out, then it can be inferred that the future impacts from the cumulative No Action Alternative would be moderately higher than project-specific impacts for No Action Alternative. Even with a moderate increase to impacts, the cumulative No Action Alternative impacts are anticipated to be insignificant at Clark County, GBNP, and the Wasatch Front and no further air quality analyses are required since the project with RFFAs would not cause or contribute to an exceedance of applicable AAQS.

Table 3.1-46 No Action, Estimated Cumulative Increases in Windblown Dust from ET Units Affected by 10-foot or Greater Pumping Drawdown Over Different Time Periods

Cumulative ET Unit[1]	Acres Affected (full build out)	Acres Affected (full build out plus 75 years)	Acres Affected (full build out plus 200 years)	Total PM_{10} Emissions from Windblown Dust (tons per year)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	Total PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
Bare Soil/Sparse Vegetation	13,047	26,802	31,913	510	959	1,129
Phreatophyte/ Medium Vegetation	9,174	20,556	26,579	814	1,856	2,435
Wetland/Meadow	1,240	1,840	3,801	703	1,013	1,727
Total Cumulative without Project (tons per year)				**2,027**	**3,827**	**5,291**
Percent Change Relative to No Action (%)				**284**	**105**	**64**

[1] ET units are defined based on vegetation cover type (see Section 3.5, Vegetation Resources).

The modeled visibility impacts for No Action Alternative (**Table 3.1-34**) indicate that the eighth highest day would have less than a 5 percent change in light extinction and visibility at GBNP would be unlikely to be impaired. The eighth highest percent change in visibility is a threshold used by the FLMs (FLAG 2010). Since the emissions for the cumulative No Action Alternative are approximately 105 percent greater than the project-specific impacts for No Action Alternative at 75 years after full build out, then it can be inferred that the future visibility impacts from the cumulative No Action Alternative would be moderately higher than project-specific impacts for No Action Alternative. Even with a moderate increase in impacts, it is unlikely that visibility at GBNP would be impaired under the No Action Alternative (see **Appendix F3.1.2** for more information regarding limitations of the modeling analysis).

Cumulative Effects

- Current air quality conditions, as presented in Section 3.1.1.1, are not expected to change appreciably in the future with cumulative impacts from other projects.
- Current groundwater pumping for agricultural and municipal purposes would continue. At current levels of groundwater pumping and the addition of other projects, there would be an increase in current levels of windblown dust generation due to changes in vegetation and groundcover. Air quality impacts are not anticipated to contribute to nearby PM_{10} or $PM_{2.5}$ nonattainment area such as Clark County or the Wasatch Front. Model-predicted impacts indicate that applicable AAQS at GBNP would be met and visibility conditions would be unlikely to be impaired. The level and extent of these impacts are highly uncertain and estimated impacts should be used for comparison purposes only.
- Under the No Action Alternative, no monitoring or mitigation measures would be enacted.

3.1.3.13 Alternatives Comparison

Generally, the cumulative impacts to air quality vary considerably between the alternatives. The Proposed Action is predicted to have the highest cumulative, long-term impact to air quality. The cumulative air quality impacts due to the Proposed Action may be as much as approximately 20 percent more than any other alternative. Alternative D is predicted to have the lowest cumulative impacts out of the project alternatives; however, the impacts for full build out plus 200 years could still be approximately 250 percent more than the No Action Alternative. **Table 3.1-47** shows the estimated cumulative windblown dust emissions that would result from groundwater drawdown for each alternative combined with currently approved activities, past and present actions, and RFFAs.

Table 3.1-47 Estimated Cumulative Windblown Dust Emissions from Cumulative Groundwater Drawdown for the Proposed Action and Alternatives A through F

Alternative	PM_{10} Emissions from Windblown Dust (tons per year) (full build out)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	PM_{10} Emissions from Windblown Dust (tons per year) (full build out plus 200 years)	$PM_{2.5}$ Emissions from Windblown Dust (tons per year) (full build out)	$PM_{2.5}$ Emissions from Windblown Dust (tons per year) (full build out plus 75 years)	$PM_{2.5}$ Emissions from Windblown Dust (tons per year) (full build out plus 200 years)
No Action	2,027	3,827	5,291	203	383	529
Proposed Action[1]	4,876	18,173	21,518	488	1,817	2,152
Alternative A[1]	4,058	15,784	18,426	406	1,578	1,843
Alternative B[1]	4,984	25,537	18,988	498	2,554	1,899
Alternative C[1]	4,152	10,185	13,337	415	1,018	1,334
Alternative D[1]	1,651	7,151	12,305	165	715	1,231
Alternative E[1]	4,217	11,588	13,783	422	1,159	1,378
Alternative F[1]	3,689	12,754	15,434	369	1,275	1,543

[1] Project-alone impacts are shown for each alternative. Total impacts for each alternative are the No Action impacts plus the Alternative's impact.

For comparison purposes, the estimated potential impacts to PM_{10} and $PM_{2.5}$ are presented for each alternative in **Figures 3.1-7** and **3.1-8**, respectively. **Figures 3.1-7** and **3.1-8** show the impacts estimated to occur at full build out (FBO), after full build out plus 75 years (FBO+75), and after full build out plus 200 years (FBO+200) for each alternative. The impacts in blue are the estimated impacts due to the currently approved activities (i.e., No Action Alternative) with all past and present actions and RFFAs. The estimated incremental impact due to the project alternatives are shown in red, and the green bars represent the total cumulative impact with all approved activities, past and present actions, RFFAs and the project alternative.

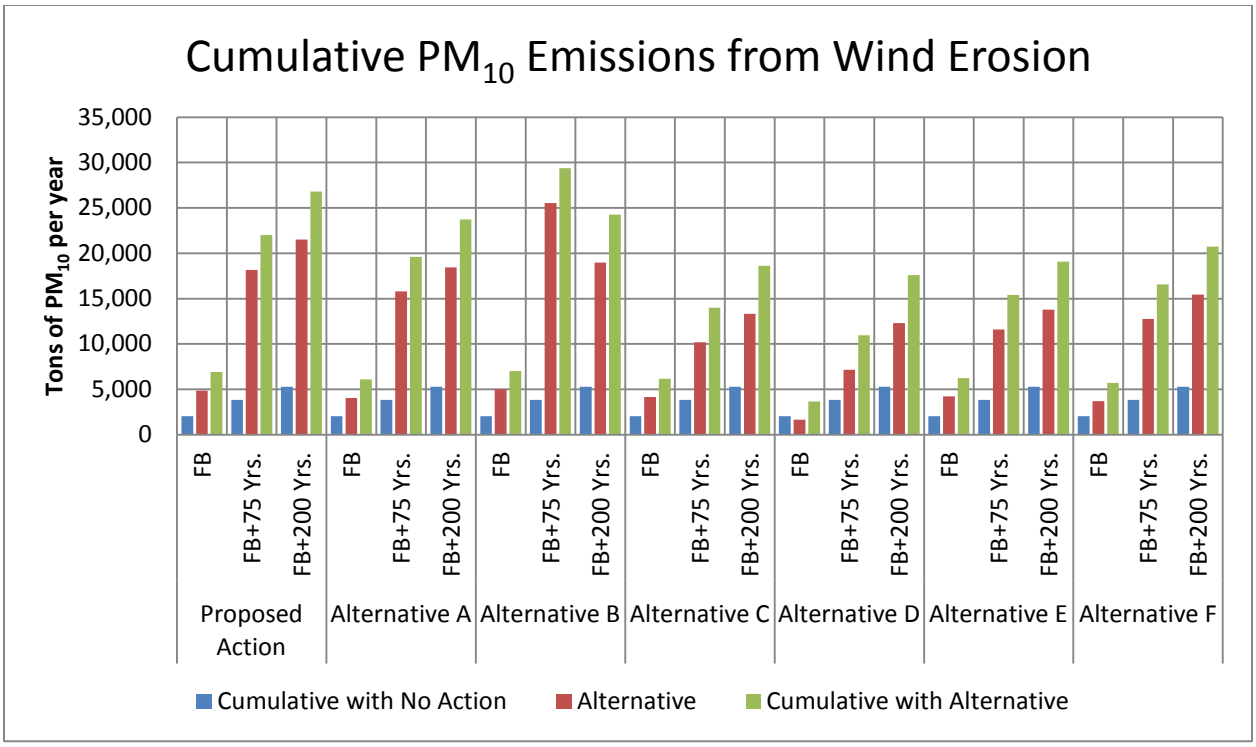


Figure 3.1-7 **Comparison of Estimated PM_{10} Emissions from Cumulative Groundwater Drawdown Windblown Dust for the Proposed Action and Alternatives A through F for Three Timeframes**

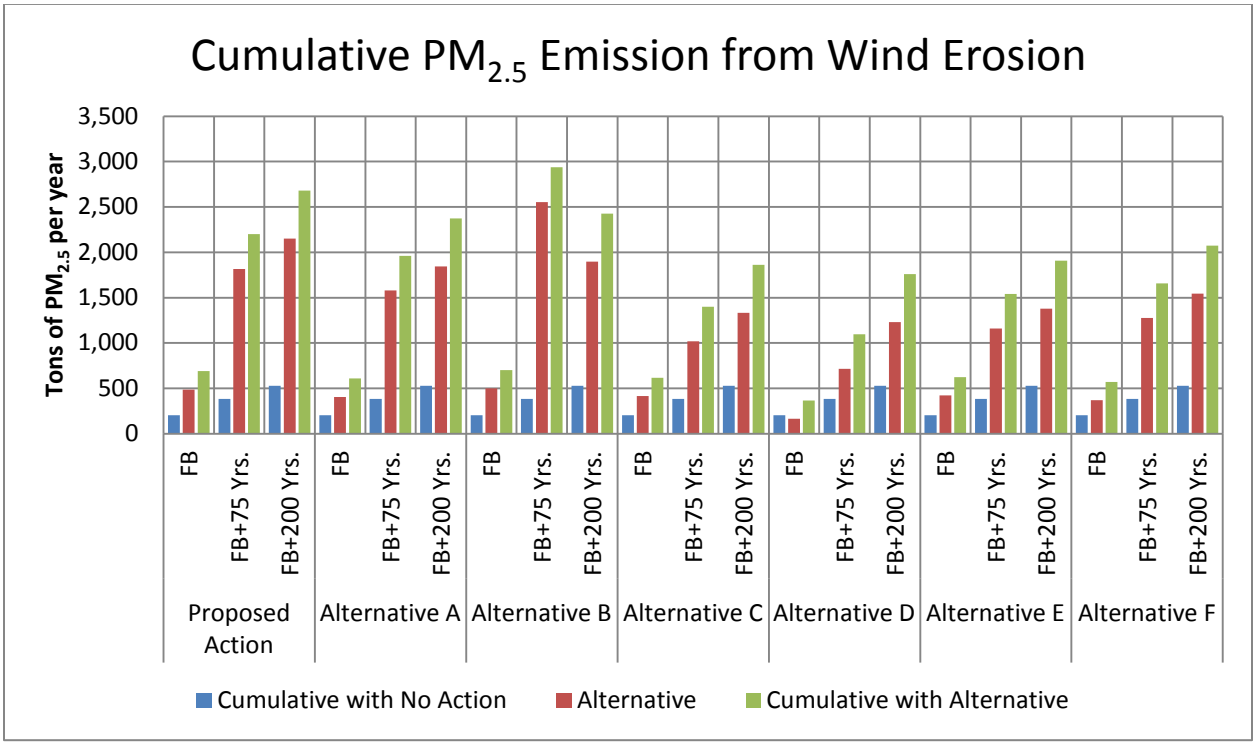


Figure 3.1-8 **Comparison of Estimated $PM_{2.5}$ Emissions from Cumulative Groundwater Drawdown Windblown Dust for the Proposed Action and Alternatives A through F for Three Timeframes**