CHAPTER 3.
AFFECTED ENVIRONMENT

3 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the existing environment, including the physical environment, natural environment, and human-made resources and uses, which would be affected by the Proposed Action and alternatives.

3.1.1 General Setting of Project Area

The SSEP would be located in the west end of the Little Rainbow Valley, east of SR-85, and south of the Buckeye Hills in Maricopa County, Arizona (see Map 1). SSEP facilities would be located almost entirely on public lands administered by the BLM. The proposed footprint of the facilities and anything that lies within the boundaries of this footprint (hereafter referred to as the Project Area) would occupy approximately 3,620 acres (see Map 2). However, when SSEP's potentially affected environmental elements were first assessed, an area of approximately 3,700 acres was assumed. Therefore, some of the acres presented in this chapter are closer to 3,700 acres. This slightly larger figure remains adequate to describe the current environment in and directly adjacent to the Project Area, and for BLM to make a reasoned and informed decision on this proposal.

3.1.2 Sonoran Solar Energy Project Overview

Boulevard proposes to construct a 375-MW solar thermal plant that would include two proposed power blocks (125 MW and 250 MW), a solar field, evaporation ponds, HTF land-treatment areas, and linear facilities. The SSEP would use a parabolic trough, solar thermal technology to produce electrical power using steam-turbine generators fed by solar-steam generators. The SSEP would also use natural gas-fueled boilers or heaters for additional power generation and HTF freeze-protection heaters. The facility would be designed to accommodate the future use of TES. TES would consist of molten salt and a two-tank design, and it would provide three to four hours of storage for the overall facility. The purpose of gas backup and TES systems is to increase daily hours of operation, shift energy production into peak periods, and makeup production during periods of extended cloud cover. The SSEP would consist of two solar thermal power block units. A 125-MW unit would produce approximately 290,000 MWh per year, and a 250-MW unit would generate approximately 580,000 MWh per year. The entire facility would operate for 30 years or more. Boulevard would phase construction so that the 125-MW unit would be operational as soon as approximately one year before the separate 250-MW unit becomes operational. For more detail on the Proposed Action and each of the alternatives, see Chapter 2.

3.1.3 Resources Values and Uses Brought Forward for Analysis

Based on internal (agency and cooperator) and external (public) scoping, or issue identification, a number of issues and concerns were identified for analysis in this EIS (see Chapter 1, Section 1.4.2). In order to analyze and respond to the issues and concerns, the resource values and uses of the affected environment must be identified and described. For this EIS analysis, the following resources and uses are brought forward for analysis and are presented in this chapter.

- Air Quality
- Climate Change
- Cultural Resources
- Geology and Minerals
- Hazardous Materials and Hazardous and Solid Waste
- Land Use and Access
- Livestock Grazing
- Noise
- Paleontology
- Recreation and Wilderness Characteristics
- Socioeconomics
- Soils
- Special Designations
- Transportation and Traffic
- Vegetation and Special-status Plant Species
- Visual Resources
- Water Resources
- Wildlife and Special-status Species

3.1.4 Analysis Area

The analysis area varies by resource value or use, depending on the geographic extent of the resource or use and the extent of the effects of the Proposed Action and alternatives on a resource or use. In some cases the analysis area is the Project Area (e.g., paleontological resources), because that is the extent of the effects of the project on the resource. In other cases the analysis area is much larger, encompassing larger administrative or natural boundaries (e.g., social and economic conditions, or wildlife and habitat), because the effects on the resource extend beyond the Project Area boundary. The analysis area for each resource value or use is defined in the *Overview* section of each resource discussion that follows.

3.2 Air Quality

3.2.1 Overview

The analysis area for air quality is the Maricopa County PM_{10} nonattainment area, which is the regulatory boundary used for air quality assessment in which the SSEP would reside. The area of analysis and the Project Area are shown in Map 8. The analysis area for visibility of plumes from the Project Area is expanded to include Class II wilderness areas and special designation areas that are within 50 kilometers (km) of the Project Area (Farmer 2010). These areas are summarized in Table 3.1.

Table 3.1 Class II Wilderness Areas and Recreational Areas near the Project Area

Area Name (Managing Agency)	From Project Area to Nearest Boundary	
	Approximate Distance in km (miles)	Direction
Sonoran Desert National Monument (BLM)	2.2 (1.3)	Southeast to south
Signal Mountain Wilderness (BLM)	34.3 (21.3)	West-southwest to west
Woolsey Peak Wilderness (BLM)	22.7 (14.1)	Southwest to west
North Maricopa Mountains Wilderness (BLM)	4.9 (3.0)	Southeast
South Maricopa Mountains Wilderness (BLM)	28.2 (17.5)	Southeast
Sierra Estrella Wilderness (BLM)	22.5 (13.9)	East
Estrella Mountain Regional Park (Maricopa County)	13.8 (8.6)	Northeast to east-northeast
White Tank Mountain Regional Park (Maricopa County)	43.5 (27.0)	North
Buckeye Hills Regional Park (Maricopa County)	8.9 (5.5)	Northwest

The primary factors that influence regional air quality in the area of analysis are the locations of air pollution sources, the amounts and chemical characteristics of the pollutants emitted, the topography of the region, and local meteorological conditions.

3.2.2 Local Topography and Climate

The Project Area is located in an arid region of western Maricopa County, Arizona that is surrounded by mountainous terrain; the Buckeye Hills are directly north, and the North Maricopa Mountains are to the south. About 15 miles east from the Project Area, the Sierra Estrella Mountains run in a northwest-southeast direction. The Gila Bend Mountain range extends 20 miles west from the western side of the Gila River Valley. Elevations in the area range from just over 1,000 feet above mean sea level (amsl) along the valley floor to a peak elevation of 3,170 feet at Woolsey Peak approximately 18 miles west of the Project Area.

The mountainous topography surrounding Maricopa County contributes to the occurrence of surface temperature inversions, especially during the winter months. A surface temperature inversion occurs when the air temperature near the ground is cooler than the air temperature above. Surface inversions form because the ground cools faster than the air above. Inversions can hinder air pollutant dispersion by reducing vertical mixing, trapping pollutants close to the ground, thus increasing the concentration of air pollutants such that they may reach unhealthy levels. In areas where the local topography acts to pool and trap cold air (deep valleys surrounded by steep mountains), cold temperatures associated with stationary

or slow-moving, high-pressure systems can last for days or (rarely) weeks and create inversions that result in poor air quality due to the compression of cold air masses and lack of circulation. In Maricopa County, inversions are most severe during the fall and winter. High concentrations of PM_{10} are observed during these conditions (MAG 2008).

Localized, high-pressure systems conducive to high-surface, daytime temperatures frequently form over the desert Southwest. Temperatures in this region are typical of desert climates, ranging from 30°F to 45°F during the winter, to more than 100°F during the summer. Daily temperatures of 90°F or greater occur approximately 40%–50% of the year. During the summer months, maximum temperatures of 120°F or greater have been reported. Precipitation in the region is sparse and is limited primarily to rainfall, although traces of snow, sleet, or hail have been reported. Rainfall occurs primarily during the monsoon months of July and August. During these months, large amounts of warm, moist air moving from the Gulf of Mexico can create heavy thunderstorms across Arizona. There can also be occasional, heavy-winter rainstorms, typically in December through February. Precipitation amounts are minimal in the region during the remainder of the year. Table 3.2 summarizes the mean temperatures and precipitation levels at three locations that characterize the climatology in the locale of the Project Area. Averaging the temperature and precipitation data for these locations yields an average temperature of approximately 71°F and an average precipitation level of approximately 7 inches for the region.

The hot and dry conditions in the region, especially during the summer months, contribute to windblown dust and fugitive dust. Dust storms are a natural phenomenon in the Sonoran Desert; however, they may be exacerbated by land disturbances that disturb soil crusts and/or result in the removal of vegetation.

Prevailing winds in the Project Area are generally easterly and westerly. There is a consistent, almost daily shift in wind direction. Winds blow generally from the east during the morning hours, and then shift to winds from the west in the afternoon. This pattern is apparent in an annual wind rose for the Phoenix Sky Harbor Airport (Figure 3.1) for 2007.

Table 3.2 Climatology Summary: Mean Temperature and Precipitation for Project Area

	Monthly Average Dry Bulb Temperature (°F)			Average Monthly Total Precipitation (inches)		
	Litchfield Park[1]	Buckeye[2]	Gila Bend[3]	Litchfield Park[1]	Buckeye[2]	Gila Bend[3]
Monthly Mean						
January	51.62	51.22	53.86	0.90	0.82	0.61
February	55.88	55.45	57.76	0.97	0.78	0.63
March	60.71	60.43	63.09	0.82	0.75	0.62
April	68.10	67.50	69.93	0.32	0.28	0.22
May	76.73	75.45	78.29	0.13	0.10	0.13
June	85.51	84.15	87.23	0.08	0.07	0.05
July	91.37	90.74	93.60	0.74	0.87	0.73
August	89.56	89.39	92.09	1.23	1.13	1.01
September	83.65	83.04	86.58	0.85	0.77	0.51
October	71.77	70.94	74.70	0.47	0.50	0.39
November	59.51	58.93	61.96	0.64	0.62	0.51
December	52.25	51.56	53.89	1.05	0.90	0.69
Annual Mean						
	70.54	70.08	73.08	8.11	7.70	6.28

Source: Western Regional Climate Center (2009).

[1] Litchfield Park is a suburban community 16 miles northeast of the Project Area. Period of Record of Litchfield Park Climate Summary 8/1/1917 to 4/3/2009.

[2] The Town of Buckeye is a suburban community approximately 10 miles north of the Project Area. Period of Record of Buckeye Climate Summary 3/1/1893 to 11/30/2003.

[3] The Town of Gila Bend is a suburban/agricultural community approximately 8 miles sou h of the Project Area. Period of Record of Gila Bend Climate Summary 12/1/1892 to 4/3/2009.

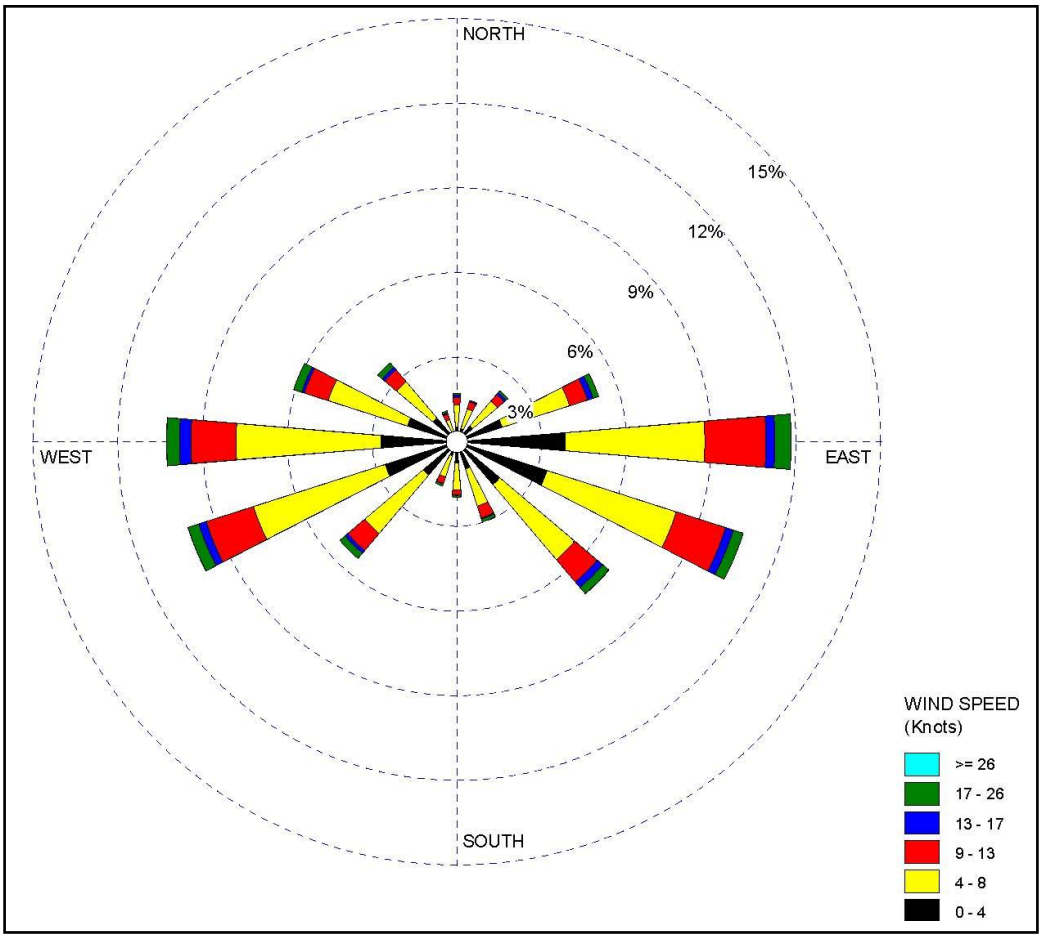

Figure 3.1 Annual wind rose for Phoenix Sky Harbor Airport, 2007.

High summer temperatures, high solar radiation, and emissions from combustion processes (industrial and automotive) contribute to high ozone (O_3) concentrations in the area. O_3 is generally not emitted directly, but forms from a chemical reaction between emissions of volatile organic carbons (VOCs) and nitrogen oxides (NOx) in the presence of heat and sunlight. Sources of VOC emissions are numerous and include automobiles, gasoline stations, and compressor emissions. NOx are emitted from combustion processes in automobiles, power plants, compressors, etc. Although O_3 is produced throughout the year, the highest O_3 concentrations in most urban areas, including the Phoenix metropolitan area, are usually observed in the summer when strong sunlight and high temperatures drive the chemical reactions that form O_3. Stagnant meteorological conditions, such as inversions, can trap the air in the region for several days. O_3 concentrations are generally considered a regional issue. This means that O_3 concentrations in a given area can result from emissions that are transported into the area from distant emissions sources, as well as from local emissions sources.

Atmospheric stability is another important factor of meteorology that contributes to the weather patterns, frequency and intensity of storms, and air pollution concentrations. When the atmosphere is stable, emitted pollutants tend to remain within a few hundred feet of the surface (close to the emission sources), and will begin to diffuse horizontally across the surface. When the atmosphere is unstable, air pollution mixes vertically in the atmosphere and tends to be carried away by the prevailing wind. In south-central Arizona, atmospheric stability varies with the season. The frequency and duration of stable and unstable conditions of the atmosphere are in relative balance during the warmer months. Periods of atmospheric instability are typically manifested in monsoon rain events and dust storms that may occur daily from

early July to early September. When temperatures fall as winter approaches, stability in the atmosphere becomes more prevalent, and mid-latitude, high-pressure conditions tend to be dominant over south-central Arizona and northern Mexico.

3.2.3 Existing Air Quality

3.2.3.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

As directed by the federal CAA, the EPA has established National Ambient Air Quality Standards (NAAQS) for seven "criteria" pollutants (Table 3.3). These standards were adopted by the EPA to protect public health (primary standards) and public welfare (secondary standards). The seven pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2), O_3, inhalable particulate matter (i.e., PM_{10}), fine particulate matter (i.e., $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). States are required to adopt standards that are at least as stringent as the NAAQS. The Arizona ambient air quality standards are identical to the NAAQS (40 CFR §50.4–50.16; and A.A.C. Title 18, Chapter 2, Article 2, Sections 201 to 206).

Table 3.3 NAAQS for Criteria Pollutants

Polluant	Averaging Period	NAAQS Level µg/m³ (ppm)*	
		Primary [1]	Secondary
NO_2 [5]	Annual[3]	100 (0.053)	100 (0.053)
CO[6]	1-hour 8-hour	40,000 (35)[2] 10,000 (9)	n/a
PM_{10} [7]	24-hour	150	150
$PM_{2.5}$ [8]	24-hour (Rev. 2006) Annual[2]	35 15	35 15
SO_2	3-hour [3] 24-hour Annual[2]	No standard 365 (0.14) 80 (0.03)	1,300 (0.50)
Pb and its compounds	3-month average	1.5	1.5
O_3 [9]	1-hour (repealed) 8-hour (new) [4]	235 (0.12) 157 (0.075)	235 (0.12) 157 (0.075)

* Standards are in terms of ambient concentration; µg/m³ is "micrograms per cubic meter," ppm= parts per million by volume

[1] Federal and Arizona short-term standards are not to be exceeded more than once per year except in the case of the PM_{10} and O_3. Compliance is determined by the number of days the PM_{10} and O_3 standards are exceeded; the number of days per year, based on a hree-year running average, is not to exceed one.

[2] Annual arithmetic mean of hourly readings.

[3] Three-hour average determined as successive, nonoverlapping blocks, starting midnight each day.

[4] EPA standard revised to 0.075 µg/m³as of 2008 (NAAQS 2009).

Sources: 40 CFR § 50.4–50.16; and A.A.C. §§ R18-2-201–R18-2-206.

[5] NO_2 NAAQS attainment is demonstrated if he annual average is below the standard value, based on data that are 75% complete for all annual hours.

[6] CO NAAQS attainment is demonstrated for years in which an 8-hour average concentration exceeding the standard value occurs no more than once per year.

[7] Particulate Matter (PM_{10}) NAAQS attainment is demonstrated for years in which a 24-hour sample concentration exceeding the standard value occurs no more than once per year.

[8] Fine Particulate Matter ($PM_{2.5}$) NAAQS attainment is demonstrated when the annual mean is less than the standard value. $PM_{2.5}$ 24-hour NAAQS attainment is demonstrated for years in which the 98th percentile high sample concentration does not exceed the standard value.

[9] O_3 NAAQS attainment is demonstrated in locations where a three-year mean of the fourth highest occurring 8-hour monitored averages is below the standard value.

3.2.4 Clean Air Act Attainment Status

Based on the adopted air quality standards, the CAA requires that states classify air basins (or portions thereof) as either *attainment* or *nonattainment* with respect to the criteria pollutants. The classifications are defined below.

- **Attainment Area:** This is a geographic or politically delineated air basin that meets the NAAQS for criteria pollutants.
- **Nonattainment Area:** This is a geographic or politically delineated air basin that does **not** meet the NAAQS for one or more pollutants. In nonattainment areas, state or local air pollution control districts are required to formulate and submit SIPs for EPA approval that outline those measures the state will implement to attain and maintain the NAAQS.
- **Serious Nonattainment Area:** All PM_{10} nonattainment areas were initially classified as moderate and were assigned an attainment date of December 31, 1994. A *moderate* nonattainment area can subsequently be reclassified as a *serious* nonattainment area if EPA determines the area cannot "practicably" attain the PM_{10} NAAQS by the attainment date, or following the passage of the original attainment date if EPA determines the area has failed to attain the standard. The Maricopa County nonattainment area was reclassified to *serious* on May 10, 1996 due to failure to attain the particulate standard by December 31, 1994.
- **Unclassifiable:** This is an area that lacks sufficient monitoring data. Unclassifiable areas are conservatively managed as though being in attainment, so as to maintain or improve existing air quality.
- **Maintenance Area:** This is an area that was previously a nonattainment area and that has been demonstrated with recent data to have achieved attainment of the NAAQS.

A particular geographic region may be designated an attainment area for some pollutants, and a nonattainment area for others. The ADEQ has designated all of Maricopa County as being either in attainment or unclassifiable with respect to the NAAQS for SO_2 and NO_2. Progress in regional air quality improvement in recent years has allowed the county to be designated a maintenance area with respect to CO and one-hour O_3 NAAQS. In contrast, most of Maricopa County is a serious nonattainment area for PM_{10}. Further, the ADEQ and EPA have designated nearly all of Maricopa County to be in nonattainment of the more recent NAAQS for 8-hour average O_3 and for both short and long-term NAAQS for $PM_{2.5}$. The status of the local air quality designations is summarized in Table 3.4.

Table 3.4 Attainment Status in the Locale of the Project Area

Pollutant	Attainment Status
NO_2	Unclassifiable/attainment
SO_2	Attainment
CO	Attainment, maintenance plan
PM_{10}	Serious nonattainment
$PM_{2.5}$	Nonattainment
Pb	Unclassifiable/attainment
O_3	One-hour average – attainment; (NAAQS superseded by 8-hour average standard) 8-hour – nonattainment

3.2.4.1 RECENT AIR QUALITY MONITORING DATA AND NAAQS EXCEEDANCES

The ADEQ maintains an ongoing, statewide air monitoring program to characterize air quality in several geographic regions; however, the Project Area itself is not intensely monitored for ambient air quality conditions. Selecting representative, local background monitoring data are consequently not possible for all criteria pollutants. The ADEQ monitors that are closest and most representative of local air quality are located in the Town of Buckeye, and two locations are in west Phoenix (ADEQ 2006, 2007, 2008, and 2009). The NAAQS and Arizona primary and secondary standards are presented in Table 3.5 in addition to the most recent monitoring data available for three locations near the Project Area. The Dysart Road monitor (northwest of Phoenix, near the intersection of U.S. Highway 93 [US-93] and Dysart Road) is located in a mostly residential area surrounded by desert and some agricultural activities, and is approximately 32 miles northeast of the Project Area. The monitor location in west Phoenix (39th Avenue and Earll Street) is in a developed, residential area on the west side of Phoenix, approximately 30 miles northeast of the Project Area. The Dysart Road and west Phoenix monitors are in areas that are more developed than the Project Area, and reflect the influences of urban vehicle traffic. The Buckeye monitor is closest to the Project Area, and is the most representative of the current conditions near the Project Area. This monitor is located just south of the intersection of SR-85 and Baseline Road, approximately 10 miles from the Project Area.

3.2.4.1.1 Particulate Matter

Particulate matter refers to dust and other particles in the air and is measured either as particulate matter that is 10 micrometers and smaller (PM_{10}) or fine particulate matter that is 2.5 micrometers in diameter and smaller ($PM_{2.5}$). $PM_{2.5}$ is a subset of PM_{10}. Sources of PM_{10} in the area of analysis include

- stationary point sources, such as fuel combustion and industrial processes;
- fugitive sources, such as roadway dust from paved and unpaved roads, construction areas, and parking lots;
- wind erosion from disturbed vacant lots, construction sites, and agricultural fields;
- fires; and
- transportation sources, such as automobiles.

Recently, the EPA has implemented revised standards for particulate matter. The PM_{10} regulation was established by the CAA for particulates less than or equal to 10 microns in size. The prior standard for PM_{10} was revised, and new standards were added for particles less than 2.5 microns in size ($PM_{2.5}$). The requirement for agencies to demonstrate attainment of the new standards has affected the current emission standards for combustion and fugitive dust sources.

Table 3.5 Regional Monitoring in the Locale of the Project Area

ADEQ Monitoring Station	Carbon Monoxide, CO (ppm) 8-hr Avg.[1]	Nitrogen Dioxide, NO_2(ppm) Annual Avg.[2]	Ozone, O_3 (ppm) 8-hr Avg.[3]	PM_{10} (µg/m^3) Annual Avg.[4]	PM_{10} (µg/m^3) 24-hr Avg.[5]	$PM_{2.5}$ (µg/m^3) Annual Avg.[6]	$PM_{2.5}$ (µg/m^3) 24-hr Avg.[7]
NAAQS Values	**9**	**0.053**	**0.075**	**50** [8]	**150**	**15**	**35**
Monitored Year 2007							
Buckeye	0.8	0.0102	0.064	52.5	166	*	*
Dysart Road	1.3	*	0.065	35.9	94	*	*
W. Phoenix	4.1	0.0209	0.074	47	116	10.9	27.2
Monitored Year 2006							
Buckeye	0.6	0.0111	0.067	53	192	*	*
Dysart Road	0.8	*	0.072	32.3	55	*	*
W. Phoenix	4.6	0.0238	0.082	49.8	122	13.5	28.8
Monitored Year 2005							
Buckeye	0.9	0.0119	0.065	52.7	158	*	*
Dysart Road	1.2	*	0.066	29	68	*	*
W. Phoenix	4.6	0.0235	0.068	44.5	103	12.9	40.5
Three-year Mean Averages Used for NAAQS Conformance							
Buckeye	*	*	0.065	*	*	*	*
Dysart Road	*	*	0.067	*	*	*	*
W. Phoenix	*	*	0.075	*	*	*	*

Source: ADEQ, Air Quality Annual Reports 2008, 2007, 2006. The same monitored parameters are shown in the same numbered tables for each report year.

Notes: ppm = parts per million.

µg/m^3= micrograms per cubic meter.

* No available data.

[1] CO data given as the 2nd highest occurring 8-hour average for the reporting year (ADEQ Annual Reports, Table 13). NAAQS attainment is demonstrated for years in which an 8-hour average concentration exceeding the standard value occurs no more than once per year.

[2] NO_2 data given as the annual mean average of hourly readings (ADEQ Annual Reports, Table 6). NAAQS attainment is demonstrated if the annual average is below the standard value, based on data that are 75% complete for all annual hours.

[3] O_3 data are given as the 4th highest occurring 8-hour average for the reporting year (ADEQ Annual Reports, Tables 9 and 23). NAAQS attainment is demonstrated in locations where a 3-year mean of the 4th highest occurring 8-hour monitored averages is below the standard value.

[4] Particulate Matter (PM_{10}) annual data are given as the annual mean concentration from samples at the monitored location (ADEQ Annual Reports, Table17). NAAQS attainment is demonstrated when the annual mean is less than the standard value.

[5] Particulate Matter (PM_{10}) 4-hour data are given as the 2nd highest occurring sample concentration during the reporting year at the monitored loca ion (ADEQ Annual Reports, Table 10). NAAQS attainment is demonstrated for years in which a 24-hour sample concentration exceeding the standard value occurs no more than once per year.

[6] Fine Particulate Matter ($PM_{2.5}$) annual data are given as the annual mean concentration from samples at the monitored location (ADEQ Annual Reports, Tables 11 and 19). NAAQS attainment is demonstrated when the annual mean is less than the standard value.

[7] Fine Particulate Matter ($PM_{2.5}$) 24-hour data are given as the 98th percentile high sample concentration during the reporting year at he monitored location (ADEQ Reports, Table 20). NAAQS attainment is demonstrated for years in which the 98th percentile high sample concentration does not exceed the standard value.

[8] The 24-hour PM_{10} NAAQS was superseded by the $PM_{2.5}$ short-term standard. ADEQ monitoring still tracks data in comparison to this standard.

Despite adoption of stringent measures and best available control measures, the Maricopa County nonattainment area failed to attain NAAQS for particulate matter by the extended deadline of December 31, 2006 (Maricopa County Air Quality Department [MCAQD] 2010a). This failure triggered a special requirement under the CAA (Section 189(d)) that calls for annual reductions of PM_{10} of not less than 5% of the most recent emissions inventory, until NAAQS is attained. As a result, Maricopa County has adopted more stringent regulations to reduce dust emissions from unpaved roadways, unpaved parking lots and other areas, and construction projects.

PM_{10} concentrations are measured at the ADEQ pollutant monitoring stations listed in Table 3.5. The data from the Buckeye station (the location closest to the Project Area) are consistent with the designation of the PM_{10} nonattainment area that includes those monitoring stations. Data from west Phoenix are very close to the PM_{10} NAAQS; however, data from Dysart Road are well below the standard. Exceedances of the 24-hour PM_{10} NAAQS have occurred at the Buckeye monitoring station between two and four days per year (between 2005 and 2008). Contributing factors to PM_{10} formation and concentrations include temperature inversions during the fall and winter, stagnant air masses, high winds (primarily in the summer), and fine desert soils that are more easily erodible (MAG 2007a; MAG 2008). Windblown dust is an important source of PM_{10} at wind speeds of 6 miles per hour (mph) and greater for the Durango Complex and at wind speeds of 14 mph and greater at the West 43rd street monitor (MAG 2008). The absence of low PM_{10} data points above these wind speed thresholds is evidence of the effect of wind on blowing dust and PM_{10} concentrations (see page 35 and Figures 3-15 and 3-16 in MAG 2008). All NAAQS exceedances recorded at the Buckeye monitoring station in 2005, 2006, 2007, and 2008 occur on days when maximum hourly wind speed at the Phoenix Harbor Airport and the city of Goodyear exceed 6 mph and at least two-thirds of the data exceed 14 mph (Table 3.6). However, temperature inversion is a related contributing factor to the NAAQS exceedances observed during winter months at the Buckeye monitoring station (MAG 2008). The exceedance on July 4, 2008, is likely to be at least partly associated with emissions from fireworks on that day (Table 3.6).

3.2.4.1.2 Ozone

O_3 is not emitted directly into the atmosphere from emission sources. Rather, it is produced through photochemical (light catalyzed) reactions in the atmosphere involving hydrocarbons and NO_x, known generically as "O_3 precursors." Because O_3 formation results from large-scale, atmospheric processes, O_3 formation and transport is more of a regional concern, and is not directly associated with individual, localized sources of pollution.

As listed in Table 3.5, all of the mean annual data for the Buckeye and Dysart Road stations are below the 8-hour O_3 standard of 0.075 ppm. The data for these sites are, however, close to the NAAQS. The highest average annual O_3 concentration for the west Phoenix station is 0.082 ppm; however, the three-year average used for NAAQS conformance at this station is the same as the standard of 0.075 ppm. Additional O_3 formation in the area would therefore contribute to future NAAQS exceedances.

Table 3.6 Exceedances of PM_{10} 24-hour NAAQS at Buckeye Monitoring Station and Paired Wind Data

Date	Buckeye Monitoring Station 24-hr Average PM_{10} (µg/m^3)	Maximum Hourly Wind Speed (mph) at Sky Harbor Airport	Maximum Hourly Wind Speed (mph) at City of Goodyear
06/21/2005	158.0	11.1	8
07/17/2005	152.6	15.0	18.1
11/18/2005	169.7	20.7	26.5
02/13/2006	159.7	11.5	11.5
02/14/2006	272.9	8.1	9.2
02/15/2006	151.3	20.7	23.0
02/17/2006	191.9	10.4	11.5
04/14/2006	212.0	31.1	28.8
04/12/2007	152.5	34.5	23.0
07/19/2007	195.0	33.4	17.3
11/15/2007	166.3	20.7	17.3
03/02/2008	160.2	21.9	23
06/04/2008	204.0	24.2	23
07/01/2008	172.8	31.1	23
07/04/2008	223.8	10.4	28.8
11/09/2008	147.9	25.3	25.3
Average Daily Maximum Wind Speed		**20.6**	**19.8**
Percentage over 6 mph		**100%**	**100%**
Percentage over 14 mph		**69%**	**75%**

Note: µg/m^3 is micrograms per cubic meter.

3.2.4.1.3 Carbon Monoxide

CO is an odorless, invisible gas usually formed as the result of incomplete combustion of organic substances. The primary sources of CO are motor vehicles and stationary combustion sources. Secondary sources include aircraft emissions and agricultural and/or forest burning. CO is more of a localized pollution issue, due to its ability to react in the atmosphere under normal conditions. However, during those periods when the air is stagnant, such as with a ground-based inversion, local levels of CO can increase. In western Maricopa County, observed levels of CO tend to be highest during the winter months when inversions are more frequent.

Atmospheric levels in the analysis area are generally well below the NAAQS for CO, especially because this portion of the county is removed from the extensive vehicular traffic associated with urban areas. As listed in Table 3.5, the monitored average values at the Buckeye, west Phoenix, and Dysart Road stations reflect the designation as an attainment area for the CO NAAQS.

3.2.4.1.4 Sulfur Dioxide

SO_2 is formed during the combustion of sulfur-bearing materials, such as the sulfur in metal ores or fossil fuels. In the library of air quality data reviewed in Maricopa County, SO_2 data are sparse. After the closest copper smelter in Ajo, Arizona was closed in 1985, SO_2 ambient concentrations decreased dramatically

(EPA 2003), and monitoring was discontinued. Levels of SO_2 in the area of analysis are expected to be very low due to the lack of major sources.

3.2.4.1.5 Nitrogen Dioxide

NO_2 and nitric oxide (NO) are the two prevalent forms of NO_X that are emitted as air pollutants. Both forms of NO_X are generated by combustion processes, and NO can be converted to NO_2 by atmospheric oxidation reactions. The NAAQS are specific to NO_2, although total NO_X is usually quantified for emission sources. Like CO and SO_2, levels of NO_2 in the Project Area are expected to be well below the NAAQS, based on data from the monitoring stations in the analysis area. Levels of NO_2 obtained for 2005–2007 at the closest monitoring station in the Town of Buckeye (see Table 3.5) were well below the respective standard. The monitoring station in the more urban setting of west Phoenix also exhibited annual averages below the NAAQS. All areas in the analysis area are in the designated attainment area for the NAAQS established for NO_2.

3.2.4.1.6 Lead

The main sources of Pb emissions are 1) vehicles operating in the analysis area that are fueled with leaded gasoline and 2) any existing Pb smelters in the area. Because no Pb smelters and very few vehicles using leaded fuel remain in Maricopa County, levels of atmospheric Pb are essentially nondetectable and historically well below the NAAQS. Data on Pb emissions are not collected at the monitoring stations located in or near the Project Area.

3.2.5 Visibility

Visibility is "the clarity with which distant objects are perceived" (EPA 2001), and is affected by pollutant concentrations, plume impairment, regional haze, relative humidity, sunlight, and cloud characteristics. In the western states, a typical visual range without any human-made air pollutants would be about 140 miles (EPA 2001). Atmospheric visibility is affected by numerous other factors in an urbanized area located in an arid desert. Certain air pollutants, such as nitrates and sulfates, create a long-lasting, visible haze that can be caused by the interaction of pollutant emissions and by photochemical reactions. Windblown dust from disturbed areas, such as construction sites and agricultural areas, can cause impaired visibility over a shorter timeframe. Different particles and chemical species have differing "extinction efficiencies," that is, the ability to block and obscure transmission of light. Optical methods of visibility monitoring track the level of light scattering or extinction. The unit of measurement is the "inverse megameter" (Mm^{-1}), which can be translated into the "visual range" parameter in miles; a more familiar unit that generally indicates the clear view distance from the measurement location.

ADEQ operates an optical observation station for urban haze at the Estrella Mountain Regional Park, approximately 16 miles west-northwest of the Project Area (ADEQ 2008). To provide context for the analysis of visible plumes in this study, Table 3.7 summarizes the available visibility data in both Mm^{-1} and visual range from this monitoring station.

Table 3.7 Regional Visibility Conditions

Monitored Year	Estrella Mountain Regional Park-Nephelometer Measurements[1]					
	Mean of 20% Highest Impaired Hours		Mean of All Sampled Hours		Mean of the 20% Least Impaired Sampled	
	Mm^{-1}	Visual Range[2] (miles)	Mm^{-1}	Visual Range[2] (miles)	Mm^{-1}	Visual Range[2] (miles)
2005	76	32	35	69	12	202
2006	50	49	23	16	7	347
2007	48	51	21	116	5	486

Source: ADEQ (2008).

[1] Nephelometric measurements track the loss of light transmission across a known distance, and are measured in units of Mm^{-1}.

[2] Conversion of Mm^{-1}data to visual range uses the formula: Range (miles) = 2,431/Visibility Value (Mm^{-1}).

3.2.6 Emissions Status

3.2.6.1 2005 MARICOPA COUNTY EMISSIONS INVENTORY

MCAQD assembles a comprehensive emission inventory for Maricopa County every three years. The most recent compilation in 2005 illustrates the air pollutant emission levels for which the MCAQD gathers data. These data are divided into various source categories:

- Point Sources: Stationary sources that emit a significant amount of pollution into the air such as power plants, industrial processes and large manufacturing facilities.
- Area Sources: Consist of smaller sized, residential and commercial combustion, manufacturing processes not vented to stacks, dust from earthmoving, landscaping, and windblown dust
- Nonroad Mobile Sources: Consist of exhaust emissions from construction, mining and agricultural equipment, and vehicles that do not travel on highways
- Onroad Mobile Sources: Consist of exhaust emissions and fugitive dust associated with vehicles traveling on roads (paved and unpaved)
- Biogenic Sources: Consist of emissions from plants, including crops, indigenous vegetation, and landscaping

Table 3.8 summarizes point sources, area sources, nonroad mobile sources, onroad mobile sources, and biogenic sources. On road vehicle emissions contribute the largest portion of gaseous pollutants to total county air pollutant emissions. Area sources contribute the largest portion of particulate to total county particulate emissions.

Table 3.8 Maricopa County Emissions Inventory for 2005

Emission Source Category	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)	Nitrogen Oxides, NO_x (tons/yr)	VOCs (tons/yr)	Carbon Monoxide, CO (tons/yr)	Sulfur Oxides, SO_x (tons/yr)
Point sources[1]	1,636.3	939.0	1,995.4	3,866.9	1,248.4	244.5
Area sources[2]	174,611.5	74,331.3	6,801.3	66,005.4	546,509.5	435.2
Nonroad mobile sources[3]	2,120.3	1,992.6	28,604.7	15,873.1	216,784.9	760.5
Onroad mobile sources[4]	25,347.0	2,352.0	66,187.0	51,646.2	558,250.3	1,611.0
Biogenic sources[5]	–	–	3,321.0	90,819.3	12,345.8	–
Total MCAQD inventory (2005)	**203,715**	**79,615**	**106,909**	**212,337.7**	**1,118,354.03**	**3,051.2**

Source: MCAQD (2007).

[1] Total point sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory for 2005, Table 1.6-1).

[2] Total area sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory, 2005 for Table 1.6-3).

[3] Total nonroad mobile sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory for 2005, Table 1.6-5).

[4] Total onroad mobile sources in county, as defined by MCAQD (MCAQD Periodic Emission Inventory for 2005, Table 1.6-7).

[5] MCAQD only reports the NOx emissions from biogenic sources. (MCAQD Periodic Emission Inventory for 2005, Table 1.6-9).

3.2.6.2 PERMITTED AIR POLLUTANT SOURCES NEAR THE PROJECT AREA

There are several facilities near the Project Area that have county air permits. Pertinent information on each facility is summarized in Table 3.9. Each facility is considered a minor source, based on their permitted emission limits that are at or below major source thresholds, and based on their actual emissions that are below county significance levels. However, due to applicable federal rules, landfill facilities are required to obtain Title V Major Source permits. The City of Phoenix Municipal Landfill, located west of SR-85 and approximately 7 miles south of the Project Area, is in a relatively early phase of development, and its emissions are predominantly PM_{10}. Wesco Minerals is just 1 mile from the Project Area boundary, and its largest emissions are of NO_X (combination of NO and NO_2) and PM_{10} from silica processing. The Lewis State Prison complex is approximately 2 miles southwest of the Project Area. This facility houses several combustion pollutant sources that contribute emissions of NO_X, CO, and VOC. The Southwest Regional Landfill is located approximately 1.5 miles southwest of the Project Area and contributes similar emission sources as the City of Phoenix Landfill.

Table 3.9 Permitted Facilities and Existing Emissions in the Project Vicinity

Facility Name/Type of Permit and Number	Distance and Direction	Processes Present[1]	Permitted Annual Emissions[2] (Tons/yr)	Recent Actual Emissions[3 a,b] (Tons/yr)	Maricopa County Significance Level[d]
SW REG Municipal Solid Waste Landfill/MCAQD Title V Permit Number V97-023	Approximately 1.5 miles SW	Construction vehicle traffic on paved/unpaved roads, cover operations, landfill gas flaring, stationary IC engines, fuel storage tanks	NO_X = 25 CO = 100 PM_{10} = 25 SOx = 25 VOC = 25	NO_X = 18.2 CO = 3.86 PM_{10} = 17.0 SOx = 1.33 VOC = 1.42	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40
City of Phoenix SR-85 Landfill/MCAQD Title V Permit Number V03-002	Approximately 7 miles SW	Construction vehicle traffic on paved/unpaved roads, cover operations, landfill gas flaring, stationary IC engines, fuel storage tanks	NO_X = 25 CO = 68.3 PM_{10} = n/a SOx = 2.3 VOC = 76	NO_X = 1.83 CO = 1.02 PM_{10} = 17.7 SOx = 0.72 VOC = 0.05	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40
WESCO Minerals, LLC./MCAQD Non-Title V Permit Number 050042	Approximately 1 mile NE	Stone quarrying/processing including, crushing, screening, material transfer/conveying, surge piling/forming, bagging, and truck load out, emergency diesel generator, propane dryer	NO_X = 38.5 CO = 9.96 PM_{10} = 2.55 SOx = 1.18 VOC = 0.83	NO_X = 24.5 CO = 3.28 PM_{10} = 3.60 SOx = 0.38 VOC = 0.34	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40
ASPC-Lewis and SW REG Juvenile Correctional Complex/ MCAQD Non-Title V Permit Number 980078	Approximately 2 miles W	Emergency generators, natural gas generators, fuel burning equipment, aboveground gasoline storage	NO_X = 24.4 CO = 8.99 PM_{10} = 0.82 SOx = 0.21 VOC = 4.93	NO_X = 8.52 CO = 4.28 PM_{10} = 0.15 SOx = 0.07 VOC = 3.08	NO_X = 40 CO = 100 PM_{10} = 15 SOx = 40 VOC = 40

Source: MCAQD (2009).

[1] Significant process types reported on MCAQD air permit application or inventory.

[2] Maximum allowable emissions, from most recent MCAQD air permits for the facilities.

[3] Reported annual emissions from most recently available MCAQD emission inventory.

[a] Juvenile Correctional Complex actual emissions based on the 2005 MCAQD Emissions Inventory (most recent per MCAQD).

[b] Remaining facilities actual emissions based on the 2008 MCAQD Emissions Inventory.

[c] No allowable emission limitation specified for PM_{10} except for fugitive dust emissions not to exceed 20% opacity.

[d] MCAQD Regulation II, Rule 100, Section 200.99.

3.3 Climate Change

3.3.1 Overview

Climate change refers to shifts in Earth's long-term (decades to millennia) weather patterns as a result of changes in the amount of solar energy Earth receives and changes to the concentrations of GHGs in Earth's atmosphere. A GHG is a gas that traps heat when emitted into Earth's atmosphere. GHGs can be emitted when fuels are combusted, vegetation combusts or decays, or when they simply leak into the atmosphere. Increasing atmospheric concentrations of GHGs are leading to an increase in Earth's average temperature and associated changes in Earth's climate and weather patterns. These changes in Earth's climate are happening at the global level and include increasing temperature levels, rising sea levels, increasing severity of drought events, and increasing severity of precipitation events and storm surges. These trends are global in nature and there are regional variations (for example, one region may see increased precipitation levels, whereas another may see reduced precipitation levels) (Karl, T.R., et al. 2009).

The SSEP relates to climate change in a three-tiered manner. The first tier relates to existing Project Area vegetation. The second tier relates to the emissions intensity of existing grid electricity, and focuses on the relevant portion of the national electrical grid. The national electrical grid is split into 26 sub-regions (Figure 3.2). The SSEP would be located in the Arizona New Mexico (AZNM) sub-region. The third tier relates to the regional temperature and precipitation climate characteristics of the Project Area, defined by existing data from communities surrounding the Project Area.

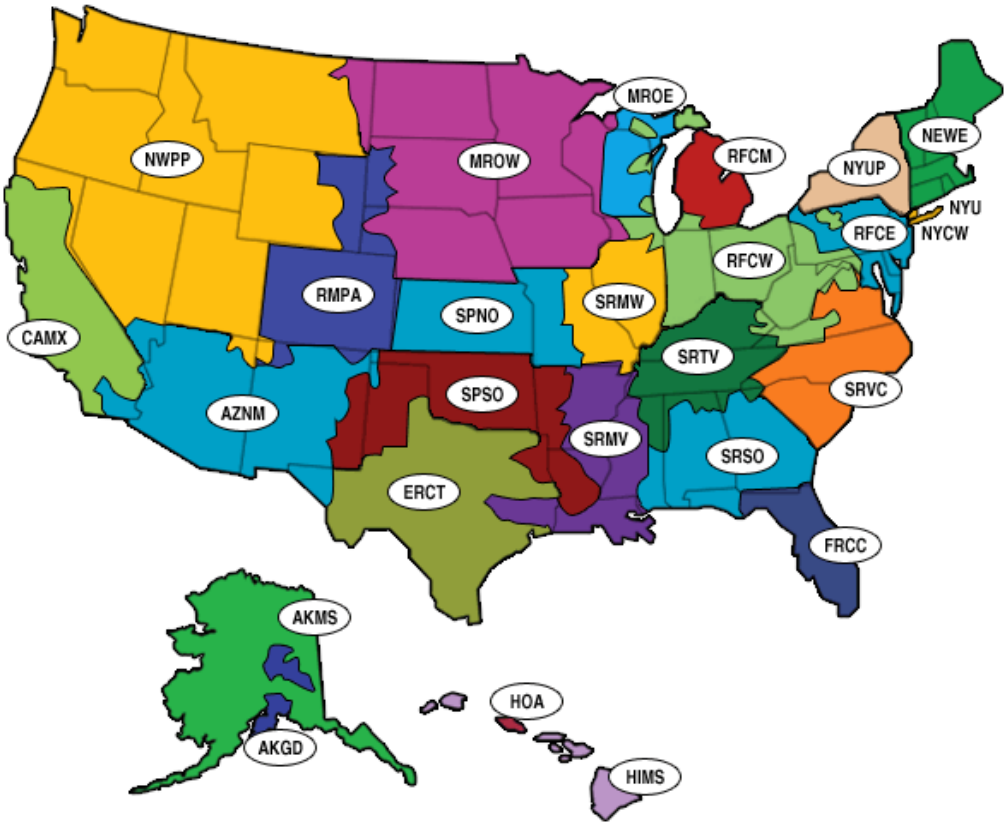

Figure 3.2 Map of EPA Emissions and Generation Resource Integrated Database subregions (EPA 2008).

3.3.2 Laws, Ordinances, Regulations, and Standards

The Project Area is located in an area that falls under the air permitting and jurisdiction of MCAQD. During both the construction and operational phases, the SSEP would be subject to several federal requirements.

However, one rule of particular applicability to GHG emissions and climate change is 40 CFR § 98 (Reporting of GHG Emissions). For the combustion processes at the SSEP facility, this very recent rule requires annual monitoring, recordkeeping, and reporting of GHG emissions. In addition to the CO^2 emissions that are tracked under 40 CFR § 75 (federal Acid Rain Program) this rule requires the calculation of nitrous oxide (N_2O) and methane (CH_4) emissions. The stack monitoring required under 40 CFR § 75, and natural gas fuel analysis and flow metering for 40 CFR § 75 Appendix D, would provide adequate information for the SSEP facility to comply with this rule.

3.3.2.1 GREENHOUSE GAS EMISSIONS

The State of Arizona is committed to the reduction of GHG emissions as a means of limiting the influence of human activities on climate change. In September 2006 the governor enacted Executive Order (EO) 2006-13, which set the goal of reducing statewide GHG emissions to year 2000 levels by the year 2020, and to 50% below the 2000 level by 2040. Further, the state is a member of the Board of Directors for the Climate Registry, a nonprofit collaboration among North American states, provinces, territories, and Native Sovereign Nations that sets consistent and transparent standards to calculate, verify, and publicly report GHG emissions into a single registry; supporting both voluntary and mandatory reporting programs and providing comprehensive, accurate data to reduce GHG emissions. Arizona, along with California and most western states, is also a member of the Western Climate Initiative, a multistate and international program promoting a regional cap and trade market to reduce North American GHG emissions, with a particular focus on the western region of North America.

3.3.3 Existing Carbon Content and Carbon Sequestration Rate of Area Vegetation

Published data that offer insight into the total carbon content of desert vegetation, such as the creosotebush community found in the Project Area, are very limited; the focus of research is on the more carbon-rich forests and tropical jungle ecosystems. However, two recent studies can be used to generate an estimate of the carbon content per acre of vegetation in the Project Area. The Carbon Dioxide Information Analysis Center (CDIAC) provides an average value of total aboveground and belowground biomass carbon from satellite imagery studies for "temperate desert" of 1.5 metric tons of carbon/acre (MtC/acre) (CDIAC 2007). A 2008 study in China identified a comparable "desert steppe" ecosystem aboveground biomass carbon content of 2.68 MtC/acre (Long et al. 2008). According to the Intergovernmental Panel on Climate Change, average belowground biomass in temperate regions can range as high as 46% of aboveground biomass (Intergovernmental Panel on Climate Change [IPCC] 2006). Using this ratio as a conservative assumption yields a total aboveground and belowground biomass carbon value for "desert steppe" of 3.91 MtC/acre.

For the purposes of this assessment of current carbon content in the Project Area the mean of these two values (2.7 MtC/acre) was used (Farmer 2010). It should be noted that these carbon index values are one to two orders of magnitude below comparable values for dense grasslands and forests, indicating that desert land typically supports one to two orders of magnitude less biomass than grasslands or forested land.

Published data regarding the carbon sequestration rate of desert vegetation are even more limited than carbon content information. As plants grow, they consume CO^2 from the atmosphere and use the carbon to build their tissues. Data on carbon sequestration rates of desert vegetation could not be obtained. However, if the assumption is made that carbon sequestration rates scale with carbon content, then a comparison can be made between the carbon content of forest land, the carbon content of desert land, and the carbon sequestration rate of forest land. EPA states that the carbon sequestration rate of forest land can be as high as 1.1 MtC/acre/year (EPA 2006a). The CDIAC states that "Tree Cover" (i.e., forest land) has a typical carbon content of 28 MtC/acre (CDIAC 2007). Assuming a linear relationship between carbon content and carbon sequestration rate, desert land carbon sequestration rate is estimated to be 0.06 MtC/year.

The information and assumptions made in this section are not actual measurements of Project Area vegetation characteristics or of the characteristics of the particular vegetation communities found in the Project Area. They represent the best information available to estimate the carbon content and carbon sequestration rate of Project Area vegetation in the face of limited data.

3.3.4 Existing Emissions Intensity of Grid Electricity

Power plants within the existing electrical grid generate GHGs as they produce electricity. The amount of GHGs generated per unit of electricity produced is referred to as the "emissions intensity" of the grid electricity; for example 1,000 pounds CO_2 equivalents per MWh of electricity. The emissions intensity of existing grid electricity is useful in estimating the grid GHG emissions displaced by the SSEP under all action alternatives.

Regarding the GHG emissions intensity of existing local grid electricity, it is most relevant to examine the emissions intensity of the appropriate EPA Emissions & Generation Resource Integrated Database (eGRID) subregion. EPA defined these subregions to represent portions of the power grid that have similar emissions and generation-resource mix characteristics, and that may be partially isolated by transmission constraints. However, these subregions also reflect the interconnected nature of the electrical grid, which spans county, state, and other geopolitical boundaries.

The Project Area is located in the AZNM Western Electricity Coordinating Council (WECC) southwest subregion (see Figure 3.2). According to EPA (EPA 2008), electricity generation resources in this subregion consist primarily of coal (46% of total generation), natural gas (32%), nuclear (16%), hydro (4%), and geothermal (2%). Renewable energy sources such as hydro, geothermal, wind, and solar make up 6% of the total subregion generation mix, with solar in particular contributing 0.0086% of total generation. Total annual electricity generation in this subregion is 157,546 gigawatt hours (GWh). GHG emissions rates for the AZNM WECC southwest subregion are given in Table 3.10.

Table 3.10 EPA Arizona New Mexico Western Electricity Coordinating Council Southwest eGRID Subregion Annual Output GHG Emissions Rates

eGRID Subregion Acronym	eGRID Subregion Name	Carbon Dioxide (pounds/MWh)	Methane (pounds/GWh)	Nitrous Oxide (pounds/GWh)	Carbon Dioxide Equivalents (pounds/MWh)
AZNM	WECC Southwest	1,311.05	17.45	17.94	1,317.98

Source: EPA (2008).

3.4 Cultural Resources

3.4.1 Overview

A cultural resource is generally defined as a phenomenon associated with prehistory, historical events, or individuals or extant cultural systems. These include archaeological sites, districts, and objects; standing historic structures, districts, and objects; locations of important historic events; and places, objects, and living or nonliving things that are important to the practice and continuity of traditional cultures. Cultural resources may involve historic properties, traditional use areas, and sacred resource areas. Further, cultural resources are nonrenewable scientific and educational resources that are protected by federal and state statutes, as summarized in Table 3.11.

Table 3.11 Federal and State Laws and Regulations for Cultural Resources

Law/Regulation	Description/Summary
Antiquities Act of 1906, 16 U.S.C. §§ 431–433	Established the early framework for federal protection of cultural resources. It authorized permits for legitimate archeological investigations and penalties for persons taking or destroying antiquities without permission.
Archaeological Resources Protection Act of 1979,16 U.S.C. §§ 470aa–470mm	Provides additional protection of archaeological resources from vandalism and unauthorized collecting on federal and Indian lands. Section 4 of the statute and Sections 16.5–12 of the uniform regulations descr be the requirements that must be met before federal authorities can issue a permit to excavate or remove any archaeological resource on federal or Indian lands.
National Historic Preservation Act, 16 U.S.C. §§ 470x–6	Established the Advisory Council on Historic Preservation (ACHP), SHPOs, NRHP, and Section 106 review process. NRHP: The nation's official list of districts, sites, buildings, structures, and objects worthy of preservation. The NRHP is overseen by the National Park Service. To be eligible for listing in the NRHP, a property must meet at least one of four criteria plus have sufficient integrity. The eligibility is established through the Section 106 process. Section 106: Section 106 of the National Historic Preservation Act (NHPA) mandates a review process for all federally funded and/or permitted projects that will impact sites listed in, or eligible for listing in, the NRHP. It allows interested parties an opportunity to comment on projects. The main purpose of the Section 106 review process is to minimize potential harm and damage to historic properties. Section 106 is initiated by the federal agency that is either conducting the project or that has jurisdiction. If the project is determined to have no adverse effect on elig ble historic resources, the applicable agency is required to document this. Consultations with SHPO, Indian tribes, local government, project applicants, and interested citizens are an important aspect of Section 106 compliance through all steps of the process, as follows: identifying historic properties and evaluating their NRHP eligibility; determining if the undertaking will have an adverse effect; and developing actions to avoid, minimize, mitigate, or otherwise resolve adverse effects. Such actions are typically formalized in an agreement document developed in consultation with the consulting parties. Section 110: Section 110 of the NHPA states that activities related to historic preservation are to be carried out in consultation with other federal, state, and local agencies; Indian tribes; and the private sector.
EO 11593, May 13, 1971, 38 *Federal Register* 8921	Requires federal agencies to administer cultural properties under their control and direct their policies, plans, and programs so that federally owned sites, structures, and objects of historical, architectural, or archeological significance are preserved, restored, and maintained. Federal agencies were required to locate, inventory, and nominate to the NRHP all properties under their jurisdiction or control that appear to qualify for listing in the NRHP (ACHP 2009).
Native American Graves Protection and Repatriation Act, 25 U.S.C. §§ 3001–3013	Provides for ownership of Native American graves and objects of cultural inheritance on federal lands. Assigns ownership and disposition of Native American graves, associated artifacts, and items of special cultural significance to appropriate Native American groups. Applies directly to all federal lands or federal undertakings.

Table 3.11 Federal and State Laws and Regulations for Cultural Resources

Law/Regulation	Description/Summary
American Indian Religious Freedom Act, P.L. 95-341; 42 U.S.C. § 1996	Establishes a national policy to protect the right of Native Americans and other indigenous groups to exercise their traditional religions.
EO 13007, Indian Sacred Sites	Designed to protect, when practical, access to Native American sacred sites on federal land.
NEPA	Requires the assessment of potential impacts of a federal action to the human environment, which includes cultural resources.

In the context of the 1966 NHPA, as amended, historic property means any prehistoric district, site building, structure, or object included in or eligible for inclusion in the NRHP. The definition also includes artifacts, records, and remains that are related to such a district, site, building, structure, or object. Historic property also includes properties of religious and cultural importance to an Indian tribe that meet the NRHP criteria. Traditional use area refers to an area identified by a cultural group to be necessary for the perpetuation of the traditional culture. The concept can include areas for the collection of food and nonfood resources, occupation sites, and ceremonial and/or sacred areas. Sacred sites apply to traditional sites and places that Native American tribes or groups, or their members, perceive as having religious significance. Traditional cultural properties (TCP) and sacred sites may be represented by landforms or visual landscapes that continue to be reflected and used by Indian tribes in their cultural practices. These types of resources may be eligible for the NRHP.

In accordance with Section 106 of the NHPA, cultural resources were identified and evaluated within an 8,646-acre survey area that encompasses the Project Area (Map 9). This survey area is the cultural resources analysis area and corresponds directly to the cultural resources APE, which is used in the Section 106 process to consider where direct or indirect effects could occur as a result of implementation of the SSEP (see Map 9). These terms are used interchangeable in the final EIS. No agencies or tribes identified any specific locations of cultural or archaeological significance beyond the APE that could be affected by visual impacts of the proposed project.

3.4.2 Pre-existing Disturbances

The Project Area has been subject to various impacts that have had a direct bearing on the current integrity of cultural resources in the area. Activities such as livestock grazing, primary and secondary dirt roads, fence lines, gas pipelines, and power pole installation and upkeep either have had a direct negative impact through ground disturbance or have encouraged an increase in soil erosion, which damages a site's integrity by displacing artifacts and damaging features. Master plat records at the BLM LSFO also indicate that in 1968, more than 250 hectares (617.8 acres) of the surveyed area were subject to furrowing (which has the same effects as the activities discussed above) to encourage grass and annual growth for cattle forage (BLM 2009b).

3.4.3 Culture History

The following culture history presents a context for the discussion of the cultural resources found in the Project Area, as well as areas of tribal concern. Cultural resources in Arizona are varied in their associations with certain periods and peoples. The following discussion is designed to aid in the interpretation and understanding of the cultural resources found during the survey. In addition, the Native American groups discussed in the Ethnohistoric Period section (Section 3.4.3.4) correspond to the tribes who are being consulted as part of the Section 106 process.

The culture history of the southwestern United States is ordinarily discussed in terms of five divisions that broadly equate to changing adaptations or lifeways (Swanson 2009). The divisions include Paleoindian (Section 3.4.3.1), Archaic (Section 3.4.3.2), Prehistoric Ceramic (Section 3.4.3.3), Ethnohistoric (historic aboriginal) (Section 3.4.3.4), and Historic (historic Euro-American) (Section 3.4.3.5). This summary is adapted from several earlier studies, especially Bruder and Hill (2000), Bruder et al. (2001), and Rogge et al. (2000).

3.4.3.1 PALEOINDIAN PERIOD

The Paleoindian period generally dates from about 10,000 to 6000 B.C. and is identified by the presence of large, often fluted, projectile points, although evidence of such a culture is scarce in the region. Fluted projectile points were recovered from the earliest strata at Ventana Cave and are thought to date to about 9000 to 10,000 years ago. A single Paleoindian projectile point was recovered along the Gila River in the Painted Rocks Reservoir area (Whittlesey et al. 1994). According to Bruder et al. (2001), several points have been located in the interior desert south of Gila Bend on the Barry M. Goldwater Range.

3.4.3.2 ARCHAIC PERIOD

The extinction of Pleistocene large animals is believed to be a contributing factor in the shift from the Paleoindian to the Archaic period, in which the hunting of the large animals gave way to an economy based on hunting smaller game and collecting a broad spectrum of wild plant foods. A series of sleeping circles or camp clearings, trails, shrines, rock alignments, and zoomorphic intaglios identified throughout southern Arizona are believed to date to the Archaic period (Hayden 1982; Rogers 1966).

The end of the Archaic period, most recently termed the Early Agricultural period, is generally seen as a time when sites showed the beginnings of settled village life, and pottery manufacture and farming activities were added to the cultural repertoire. However, this is not a strict dichotomy because brown plain ware ceramics do occur earlier. Additionally, Late Archaic groups in central and southern Arizona are known to have been experimenting with agriculture as one aspect of their subsistence strategy (Huckell 1995).

3.4.3.3 PREHISTORIC CERAMIC PERIOD

The prehistoric Ceramic period in southern Arizona generally refers to two chronologically contemporaneous Ceramic period traditions dating between A.D. 300 and 1400—the Hohokam and the Patayan—which succeed the Archaic in southwestern Arizona.

3.4.3.3.1 Hohokam

Although the Hohokam lived throughout central and southern Arizona, the following discussion is limited to a consideration of the Gila-Salt Basin and the Gila Bend area because these areas encompass both the Project Area and the areas of greatest influence on peoples in the Project Area. Hohokam villages along the Gila River extended as far west as the Gila Bend area; some of the villages along the Gila River were quite large and had public architectural features such as ball courts and platform mounds.

In the Gila-Salt Basin, the Pioneer period (A.D. 300–775) saw the appearance of canal irrigation along the Salt River (Ackerly and Henderson 1989; Dean 1991). Irrigation systems were expanded and became well established during the Pioneer period; people lived primarily in square or rectangular pit houses.

During the Colonial period (A.D. 775–975), domestic architectural units began being arranged into clusters or courtyard groups (Howard 1985; Wilcox et al. 1981). Monumental architecture, in the form of ball courts, is seen at some, but not all, Colonial period villages in the Gila-Salt Basin and the Gila Bend area, where it is believed permanent villages had been established by this time.

The Sedentary period (A.D. 975–1150)—is characterized by further expansion of settlements and canal irrigation systems as well as the development of various alternate agricultural strategies. The construction of ball courts continued, and another form of monumental architecture, the platform mound, took shape.

The Classic period (A.D. 1150–1450) exhibited radical shifts in material culture, architecture, mortuary practices, and settlement patterning. Agricultural intensification occurred in the Gila-Salt Basin, platform mounds become more prevalent, "big houses" were constructed, and ball court construction declined. A change in relations with the Gila-Salt Basin is evident in the Gila Bend area, where architectural styles no longer mirror those observed in the core area, pit houses continue being constructed (in contrast to the aboveground structures that come into favor in the core), and irrigation canals are abandoned.

A Late Classic or post-Classic occupation, labeled the Polverón phase, has been identified at a small number of sites in the Gila-Salt Basin (Crown and Sires 1984; Sires 1983). Researchers are still debating how to interpret this phase (i.e., Chenault 1995; Craig 1995; Hackbarth 1995), which is characterized as having clustered houses, some of which were constructed on top of previously abandoned platform mounds and high quantities of obsidian. Salado Polychromes were the dominant ceramic ware at this time.

3.4.3.3.2 Patayan

Other farming societies along the Lower Colorado River Valley are identified as belonging to the Patayan culture (McGuire and Schiffer 1982). Unlike the Hohokam, the Patayan cultural tradition is poorly understood because it has not been the focus of many research projects, and excavations of Patayan sites have tended to go unreported in detail (McGuire 1982a; Stone 1986, 1991). Nonetheless, the Patayan appear to have practiced floodwater farming rather than build canal systems like the Hohokam. The three phases in the sequence have been assigned ranges of time based on the presence of certain Hohokam ceramic types that are found in association with various Patayan types. Patayan I is generally believed to date from A.D. 700 to 1000. Patayan II extends to about A.D. 1500, and Patayan III continues into the 1800s or even 1900s (Roberts et al. 1996).

Much of the southwestern Arizona Patayan sites appear to be ephemeral, indicating the remains of camps or limited-activity locations; however, larger sites, particularly along the Gila River, represent more permanent villages (McGuire and Schiffer 1982). In addition, fairly substantial Patayan sites that represent repeated visitation over long periods have been reported from the interior desert, south of Gila Bend (Bruder and Hill 2000; Huckell 1979). The Patayan tradition is characterized by plain and decorated ceramics (Rogers 1945; Waters 1982), and subsistence activities are believed to have been focused on floodwater farming along the Colorado River and lower Gila River.

3.4.3.4 ETHNOHISTORIC PERIOD

When Europeans first arrived in the area, they encountered a diversity of Native American groups in what is now southwestern Arizona (McGuire 1982b; Stone 1986, 1991; Whittlesey et al. 1994). Piman speakers (members of the Pima, Tohono O’odham, Sobaípuri, Hia C-ed O’odham, and Kohatk ethnic groups) generally used the east half of the region, whereas Hokan (Quechan, Mohave, Cocopah, Maricopa, and Yavapai) and Shoshonean (Chemehuevi) speakers lived to the west, especially along the lower Colorado River.

3.4.3.4.1 Yavapai

The Yuman-speaking Yavapai inhabited west-central Arizona north of the Salt and Gila rivers. Following a seasonal round, the Yavapai moved from lowland desert to upland chaparral and woodlands to hunt, collect wild plant resources, and tend their fields. They were organized into local groups or camps of up to 10 related households.

Conflicts between the Yavapai and Euro-Americans started with the discovery of gold in the Prescott highlands in the 1860s. Although some Yavapai were convinced to move to the Colorado River Indian Reservation, hostilities between the two groups continued into the late 1860s. By 1871, about 1,000 Yavapai were confined to the military installation at Camp Date Creek (Boles 1994), and by 1873, the Yavapai were defeated militarily, with an estimated loss of 15% to 30% of the tribal population. The survivors were incarcerated at Camp Verde, and in 1874, they were marched to the San Carlos Reservation, where they lived with the Apache for about 25 years.

By 1900, many Yavapai had returned to their homeland along the Verde River, and only about 200 remained at San Carlos. In addition to the Fort McDowell Reservation, established on the lower Verde River in 1903, the Yavapai were given a small, 40-acre parcel near Camp Verde in 1910; they were given subsequent acreage in 1914, 1916, and in the 1950s, for a total of 635 acres. A small 75-acre reservation was created near Prescott in 1935 and enlarged by 1,320 acres in 1956.

3.4.3.4.2 Maricopa

A linguistically related group was the Maricopa, who lived along the lower Gila and Colorado river valleys to the south and west of the Project Area and used the adjacent uplands (Stein 1981). According to limited and inconsistent Spanish accounts, approximately 10 Yuman-speaking groups were identified as living along the lower Colorado and lower Gila rivers and were organized into a series of alliances. Groups residing along the lower Gila River are referred to as the Panya (Bean and Vane 1978).

In the 1700s, the population of the Panya was probably around 5,000, formed from people who lived along the lower Colorado River in dispersed settlements, or *rancherías*, comparable to other Yuman-speaking groups. Their subsistence consisted of hunting game, collecting wild plant foods, fishing, and farming using floodwater techniques. Around 1839, under increased pressure from other indigenous groups, the Panya groups were driven from the lower Colorado and lower Gila river valleys and took up residence in south-central Arizona adjacent to the Pima, who were village-dwelling farmers living above the confluence of the Gila and Salt rivers. This group became known collectively as the Maricopa. They adopted aspects of Hispanic culture, including cattle, horses, mules, wheat, and possibly barley. Some Maricopa served as Spanish interpreters for the Akimel O'odham (Harwell and Kelly 1983).

Today, the Maricopa continue to reside primarily in two communities. A total of 5,400 tribal members lives in the Salt River Pima-Maricopa Indian Community, of which approximately 100 are Maricopa and are concentrated in the Lehi area. Another 600 Maricopa are concentrated in the northwest part of the Gila River Indian Community near Laveen, Arizona.

3.4.3.4.3 O'odham

Desert-dwelling O'odham groups, such as the Tohono O'odham, Akimel O'odham, and the Hia C-ed O'odham, ranged primarily south of the Gila River. The material culture, social organization, and subsistence practices of the O'odham have been relatively well studied, compared with many of the other groups of Native Americans in southern Arizona (Bahr 1983; Castetter and Bell 1942; Fontana 1974, 1983).

The group closest to the Project Area is the Akimel O'odham, formerly known as the Pima. In 1859, the federal government established the first reservation in Arizona for the Akimel O'odham and Maricopa. In 1871, their land was left dry because upstream river flows were diverted via irrigation canals built by farmers settling on the Gila River in the Florence and Safford areas. Some Akimel O'odham and Maricopa moved north to the Salt River, where another reservation was established in 1879, whereas others moved to the confluence of the Salt and Gila rivers (DeJong 1992).

Today, there are O'odham communities across much of southern Arizona. The Tohono O'odham reservation areas are west of Tucson and south of Gila Bend; Akimel O'odham reside primarily on their reservation along the Gila River between its confluence with the Salt River and Florence, Arizona. The small group of people who identify themselves as Hia C-ed O'odham are not federally recognized as a tribe and live primarily in the Ajo, Arizona, area south of the Project Area.

3.4.3.5 HISTORIC PERIOD

The Spanish visited the Gila Bend area in 1699 and claimed authority over the region until 1821, when Mexico won its independence. Prospectors reportedly discovered hematite and other minerals in the local area as early as 1750 (Whittlesey et al. 1994). The more than three decades of Mexican dominion saw virtually no changes. However, in the mid-1800s, a few English- and French-speaking fur trappers made contact with the Piman-speaking groups living along the nearby Gila River. The pace of Euro-American settlement increased markedly once the United States acquired the region through war with Mexico and the subsequent Gadsden Purchase of 1854.

In 1846, during the war with Mexico, American troops of the Mormon Battalion built the Southern Overland Trail (also known as the Gila Trail), a wagon road that followed the Gila River through southwestern Arizona to Yuma. In 1865, settlers started a small community around a stage coach station at Gila Bend, and Daniel Noonan was named its first postmaster. In 1880, a railroad station was built nearby but further from the Gila River. The community of Gila Bend was moved to this new town site to be closer to the railroad (still in this location today), with Daniel Noonan as its first settler (Granger 1983).

In 1877, the founder of the settlement that was to become the Town of Buckeye led a party of six men, three women, and 10 children from Creston, Iowa, bound for Arizona. The leader of this party was Thomas Newt Clanton, whose purpose for coming west was to foster good health. Development in the region was spurred by construction of the Buckeye Canal from 1884 to 1886. In 1887, Clanton and his family moved to the Buckeye area, becoming the first permanent Euro-American residents, and in 1888, the Buckeye town site was laid out on a portion of the Clanton Homestead (Town of Buckeye 2009).

During the twentieth century, agriculture and ranching activities were the primary land uses in the area. Although riverine locations were favored for agriculture, some homesteading occurred in drier areas such as Rainbow Valley during the 1920s and 1930s, after General Land Office (GLO) surveys had occurred. During the 1930s, Works Progress Administration projects for water conservation were constructed in the area to support ranching. During World War II, in conjunction with the construction of what are now called Luke Air Force Base and the Barry M. Goldwater Range, several auxiliary fields were constructed to the north and south of the analysis area. These auxiliary fields were used for training pilots during World War II and into the Cold War.

3.4.4 Known Cultural Resources

3.4.4.1 CULTURAL RESOURCES IN THE PROJECT AREA

Nine archaeological sites were identified in the 8,646-acre analysis area (Swanson 2009). The BLM consulted with the Arizona SHPO to determine the NRHP eligibility of these nine sites. According to the NRHP, historic properties can be archaeological sites, objects, districts, buildings, or structures eligible for the NRHP.

To be eligible for the NRHP, sites must exemplify an important facet of history and maintain integrity of their significant features. The four criteria by which a site's significance is evaluated are as follows: a) association with an important event as part of broad patterns of history, b) association with an important person significant to history; c) representation of a particular style, design, or mode of construction, or the work of a master, or possession artistic value, and d) ability to provide important information about the past (National Park Service 1997).

Sites that fulfill one or more of these criteria and maintain integrity are considered eligible for the NRHP. SHPO concurred with the BLM's determination that three sites in the APE are eligible for the NRHP under Criterion D of 36 CFR § 60.4 for information potential (see Section 5.4 for detail on the SHPO and tribal consultation processes). These three sites—AZ T:10:238 (ASM), T:14:165 (ASM), and T:14:167 (ASM)—are prehistoric artifact scatters associated with the Hohokam Tradition. A description of all nine archaeological sites in the analysis area is provided in the following sections.

3.4.4.1.1 AZ T:10:238 (ASM)

AZ T:10:238 (ASM) is an artifact scatter of lithic and ceramic artifacts on the alluvial flats of Rainbow Valley. The ceramics suggest the site was used during the Classic and possibly pre-Classic periods. Because there are no surface features and a low density of artifacts, the site was likely only used briefly over time. This site is eligible for the NRHP.

3.4.4.1.2 AZ T:14:31 (ASM)

AZ T:13:31 (ASM) consists of a large area of plowed furrows. BLM records indicate that the furrowing was done in 1968 as part of a range improvement project. No other features or artifacts were observed. This site is ineligible for the NRHP.

3.4.4.1.3 AZ T:14:162 (ASM)

AZ T:14:162 (ASM) is a prehistoric linear artifact scatter on an alluvial flat. Artifacts consist of ceramic sherds and a basalt core tool and suggest the site dates to the Preclassic. The site has been heavily disturbed; Riggs Road, several washes, and several small two-track roads cross the site. The site appears to lack depth; no artifacts or features were noted in the road cuts or washes. This site is ineligible for the NRHP.

3.4.4.1.4 AZ T:14:163 (ASM)

AZ T:14:163(ASM) consists of a historic trash scatter dating to the late 1950s. The site is located at the end of an informal two-track road and probably represents a dumping episode. Artifacts include metal food cans, bottles, a part of a cook stove, and parts of kerosene lanterns. The bottles include cosmetic bottles, mayonnaise jars, and a Barq's root beer bottle. This site is ineligible for the NRHP.

3.4.4.1.5 AZ T:14:164 (ASM)

AZ T:14:164 (ASM) consists of a historic earthen water reservoir or tank and diversion dam, two corrals, and a small rip-rap dam in a wash. The tank has a well-defined spillway and a long berm for diverting water. The two corrals are constructed of modern fencing materials. Documents at the LSFO indicate that the water tank was constructed on the Beloat grazing allotment in 1939 with labor provided by the Civilian Conservation Corps (CCC). This site is ineligible for the NRHP.

3.4.4.1.6 AZ T:14:165 (ASM)

AZ T:14:165 (ASM) consists of two prehistoric rock piles and an artifact scatter near a large wash in Rainbow Valley. The rock piles are small and consist of local cobbles. Most of the artifacts are ceramic sherds, but lithic flakes and cores, ground stone, and a hammer stone are also present. The ceramics observed reflect use during the pre-Classic and Classic periods. The site may have functioned as an intermittently occupied temporary or permanent habitation location over a long period. This site is eligible for the NRHP.

3.4.4.1.7 AZ T:14:166 (ASM)

AZ T:14:166 (ASM) is a prehistoric artifact scatter on the alluvial flats of Rainbow Valley. The artifacts consist of ceramic sherds and two lithic flakes and date to the Preclassic and/or Classic period. The site has been minimally disturbed by small washes and animals. Artifacts were only observed on the desert pavement; no artifacts were observed in the small drainages. This site is ineligible for the NRHP.

3.4.4.1.8 AZ T:14:167 (ASM)

AZ T:14:167 (ASM) consists of a partially buried, possible roasting pit, a cluster of local cobbles, and an artifact scatter near a small wash in Rainbow Valley. Artifacts found at the site consist primarily of ceramic sherds and one worked piece of marine shell (Laevicardium sp.) that likely originates from the Gulf of Mexico or southern California. The ceramics observed indicate use during the Late Pioneer–Early Colonial period and during the subsequent Classic period. The site may have functioned as a temporary habitation site. This site is eligible for the NRHP.

3.4.4.1.9 AZ T:15:96 (ASM)

AZ T:15:96 (ASM) is a low-density artifact scatter with three artifact concentrations. Artifacts consist mainly of ceramic sherds that date to the Preclassic and/or Classic periods. Several small washes and informal two-track roads cross the site; artifacts were not present in areas disturbed by the washes and roads. This site is ineligible for the NRHP.

3.4.5 Native American Consultation

Section 101(d)(6)(B) of the NHPA requires consultation with Indian tribes that attach religious and cultural significance to historic properties, including archaeological sites. This consultation is ultimately the responsibility of the federal agency overseeing the undertaking. There is a legal distinction between Indian tribes who are federally recognized and those who are not. Federal recognition signifies that the United States government acknowledges the political sovereignty and Indian identity of a tribe, and from that recognition flows the obligation to conduct dealings with that tribe's leadership on a "government-to-government" basis (ACHP 2009:3). The BLM must make a reasonable and good faith effort to identify such Indian tribes and invite them to be consulting parties. If such Indian tribes have not been invited by the agency to consult, the tribes may request in writing to be consulting parties and must be considered as such by the agency (ACHP 2009:7–8). See Section 5.4 (Government-to-government Consultation) for detail on the tribal consultation process.

The Section 106 regulations state that the agency official shall acknowledge that Indian tribes possess special expertise in assessing the NRHP eligibility of historic properties, including archaeological sites, that may possess religious and cultural significance to them (36 CFR § 800.4(c)(1)). Thus, the agency should consult with Indian tribes to carry out identification efforts and to evaluate the NRHP eligibility of identified properties for proposed undertakings located off tribal lands. The agency should provide Indian tribes with the same information that is provided to the SHPO during consultation, including information on buildings and other standing structures that may be affected by the proposed undertaking. A federal agency should not assume to know what is of significance to a particular tribe unless it has been advised by that tribe (ACHP 2009:18).

Tribal consultation for the SSEP is being conducted by the BLM. Several tribes have been consulted to obtain specific tribal concerns and information about the locations of areas of particular importance to tribes. The following tribes have been consulted:

- Tohono O'odham Nation
- Ak-Chin Indian Community
- Gila River Indian Community
- Hopi Tribe
- Yavapai Prescott Indian Tribe
- Salt River Pima-Maricopa Indian Community
- Fort McDowell Yavapai Nation
- Pascua Yaqui Tribe

These tribes have not identified any specific locations of traditional cultural importance or sacred sites in the Project Area.

3.5 Geology and Minerals

3.5.1 Overview

The analysis area for geological and minerals resources consists of the Project Area and areas of subsidence outside of the Project Area that may be affected by groundwater withdrawals (Map 10). In the analysis area, no unique or sensitive geological features or locatable or leasable minerals have been identified. Likewise, no geological hazards that could result in potential risks to project construction or operation have been identified.

3.5.2 Local Geology

The Project Area is located in the Little Rainbow Valley between the Buckeye Hills and Maricopa Mountains. It is located in the Margie's Peak 7.5-minute quadrangle map. Little Rainbow Valley is a small valley that lies between the Buckeye Hills to the north and the Maricopa Mountains to the south, and connects the much larger Rainbow Valley to the east with the Gila Bend area to the west (Map 11). The Project Area is situated on alluvial-fan deposits that are characteristic of Little Rainbow Valley.

The Buckeye Hills and Maricopa Mountains consist of igneous and metamorphic rocks of Early Proterozoic age. The Project Area is situated primarily on undivided Quaternary alluvium (Q) (Cordiviola 1980; Arizona Geological Survey [AGS] 2000).

Undivided Quaternary alluvium (Q) covers most of the land surface in the Project Area. Demsey (1989) described this unit as consisting of alluvial-fan deposits and being middle to latest Pleistocene in age (250,000 to 10,000 years old). Surficial deposits consist generally of gravel lags; whereas, subsurface deposits are characterized by well-sorted silt, sand, and gravel to cobbles. Approximately 3,699 acres of undivided Quaternary alluvium occur in the Project Area.

Younger Quaternary alluvium (Qy) is present in the extreme eastern part of the Project Area. This geological unit is exposed on broad terrace deposits and young alluvial fans that are inferred to be between 10,000 years old and the present (Demsey 1989). These deposits are typically fine-grained at the surface, but tend to be well-sorted sand and silt with local occurrences of gravel below the surface. Approximately 3 acres of younger Quaternary alluvium occur in the Project Area.

3.5.3 Geological Hazards

There are no recorded earthquakes or active faults in the Project Area, which is reflected in the low frequency or magnitude of earthquake activity (seismicity) of the area. Therefore, earthquakes, general seismicity, landslides, and active faulting are unlikely to occur in the Project Area (Kirby 2009a).

Drawdown of local groundwater in the greater Rainbow Valley for irrigation and other uses has resulted in ground subsidence, the relative downward motion of the local land surface (Schumann and Genauldi 1986; ADWR unpublished map). Schumann and Genauldi (1986) mapped 50 to 150 feet of water drawdown in the Project Area. Using interferometric synthetic aperture radar (InSAR), the ADWR has mapped four subsidence features in the Rainbow Valley Sub-basin (ADWR unpublished map). Two of these subsidence features are in proximity to the Project Area, east of the proposed power plant site (see Map 10).

Earth fissures are often a direct result of ground subsidence caused by groundwater drawdown in areas dominated by alluvium (Schumann and Genauldi 1986). As water is withdrawn from the alluvium, the

formerly water-supported pore spaces collapse, greatly reducing the volume of the alluvium and causing the land surface to sink and/or pull apart creating fissures. Earth fissures pose a danger to construction by completely destabilizing and destroying the land surface over time. Although there has been drawdown of groundwater through alluvium over time, Schumann and Genauldi (1986) mapped earth fissures throughout southern Arizona but did not report any fissures in or near the Project Area.

3.5.4 Mineral Resources

The potential for locatable and leasable mineral resources, such as metallic resources, petroleum, or geothermal deposits, is low to none in or near the Project Area (Kirby 2009a). Salable sand and gravel deposits are available in and outside of the Project Area. Those deposits outside of the Project Area are currently being quarried from a sand-and-gravel pit by Wesco Minerals, LLC. This operation extracts feldspathic white silica sand for use in various construction applications such as cement and playground sand.

3.6 Hazardous Materials and Hazardous and Solid Waste

3.6.1 Overview

The area of analysis for hazardous materials consists of the Project Area (see Section 3.1.1) where hazardous materials would be generated, as well as transportation routes to existing disposal sites in Maricopa County.

Certain chemicals and materials that would be used during the construction and operation of the SSEP are characterized as hazardous materials. In addition, construction and operation activities would generate certain hazardous and nonhazardous solid waste streams. This section discusses the following:

- Federal, state, and local laws, ordinances, regulations, and standards (LORS) that would govern the management of hazardous materials and hazardous and nonhazardous waste from the SSEP
- Existing conditions in the Project Area relevant to hazardous materials and hazardous and nonhazardous waste
- Locations for disposal of hazardous materials and hazardous and solid waste

3.6.2 Laws, Ordinances, Regulations, and Standards

3.6.2.1 LORS APPLICABLE TO WASTES GENERATED AT THE SSEP FACILITY

The LORS applicable to hazardous wastes and regulated, nonhazardous solid wastes that would be generated at the SSEP facility are summarized in Table 3.12. A more complete discussion for each of the summarized LORS can be found in *Hazardous Materials and Hazardous and Solid Wastes* (Parke 2009). Hazardous materials that may be used at the SSEP facility are discussed in Section 4.6 (Hazardous Materials and Hazardous and Solid Waste), and a hazardous material chemical inventory is provided in Table 4.45.

Table 3.12 LORS Applicable to Hazardous and Nonhazardous Wastes generated at the SSEP

LORS	Requirements/Applicability	Administering Agency
Federal		
Resource Conservation and Recovery Act (RCRA) 42 U.S.C. § 6901 et. seq. (1976) 40 CFR §§ 260, 261, 262 Hazardous Waste Management applicable to Generators Hazardous Waste Management, Arizona Revised Statues (A.R.S.) §§ 49-921 to 49-931	Requires hazardous waste generators to obtain an EPA Identification (EPA ID) number and annually register with the ADEQ to accumulate and store hazardous waste for no more than 90 days and ship hazardous waste under a manifest to a licensed disposal site. Requires generator to identify and profile hazardous waste, store hazardous waste in appropriate containers, label containers stored on-site and transported to disposal site, and train operators in hazardous waste management.	EPA Region IX, ADEQ
RCRA 42 U.S.C. § 6901 et. seq. (1976) 40 CFR § 263 Hazardous Waste Transportation, A.R.S. § 49-929	Requires hazardous waste generator to use registered transporters of hazardous waste that have an EPA ID number and to use manifests to accompany waste shipments and proper cleanup of any hazardous waste discharges.	EPA Region IX, ADEQ, ADOT

Table 3.12 LORS Applicable to Hazardous and Nonhazardous Wastes generated at the SSEP

LORS	Requirements/Applicability	Administering Agency
Universal Waste 60 *Federal Register* 25542, May 11, 1995, as amended at 64 *Federal Register* 36488, July 6, 1999; 70 *Federal Register* 45520, Aug. 5, 2005 40 CFR § 273	Requires management and employee training and proper disposal of universal waste that includes batteries, fluorescent lamps, mercury switches, and pesticides.	EPA Region IX, ADEQ
Used Oil Solid Waste Disposal Act, as amended (42 U.S.C. §§ 6905, 6912(a), 6921 through 6927, 6930, 6934, and 6974); and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §§ 9601(37) and 9614(c)). 40 CFR § 279 A.R.S. §§ 49-801–818	Requires generators of used oil to prevent spills and correctly label, store, transport, and dispose/recycle used oil.	EPA Region IX, ADEQ
State		
AZPDES Program (33 U.S.C. § 1251, et seq., 49 A.R.S., Chapter 2, Article 3.1, 18 A.A.C. Chapter 9, Article 9 and 11).	Requires that the facility obtain coverage under the pending AZPDES Multisector General Permit, when issued. Under this permit, the facility would implement an approved SWPPP, and implement appropriate (BMP to, in part, avoid release of stormwater contaminated with hazardous materials or wastes.	ADEQ
Pollution Prevention A.R.S. §§ 49-961–969	Requires facilities that file a Superfund Amendments and Reauthorization Act (SARA) Section 313 Toxic Chemical Release Report to prepare and implement a pollution prevention plan that addresses a reduction in the use of toxic substances and the generation of hazardous wastes. Annual progress reports are also required.	ADEQ
Local		
Solid Waste Program A.R.S. §§ 36-136, 36-183.02, 36-601, 36-184.B4, 36-187.C, 11-251 paragraphs 17 and 31, 49-106, and 49-107, 18 A.A.C. Chapter 13 Maricopa County Health Code Chapters I and II	Requires the property owner to correctly handle, store, and dispose of all refuse accumulated on-site.	Maricopa County Environmental Services Department

3.6.2.2 LORS APPLICABLE TO HAZARDOUS MATERIALS USED AT THE SSEP FACILITY

The SSEP facility would use a number of designated hazardous materials during its construction and operation phases. A summary of the LORS applicable to hazardous materials that may be used at the SSEP facility are summarized in Table 3.13. A more complete discussion for each of the summarized LORS can be found in *Hazardous Materials and Hazardous and Solid Wastes* (Parke 2009).

Table 3.13 LORS Applicable to Hazardous Materials used at the SSEP

LORS	Requirements/Applicability	Administering Agency
Federal		
Emergency Planning & Community Right-to-Know Act (EPCRA), Section 302 (P. L. 99–499), 42 U.S.C. § 11022 Hazardous Chemical Reporting: Community Right-To-Know (40 CFR § 370) A.R.S. §§ 26-341–353	Requires agency notification if extremely hazardous substances are stored in excess of Threshold Planning Quantities.	Arizona State Emergency Response Commission (AZSERC)Maricopa County Local Emergency Planning Committee (LEPC), and the Buckeye Fire Department
EPCRA, Section 311, (P. L. 99–499, 42 U.S.C. § 11021) Hazardous Chemical Reporting: Community Right-To-Know (40 CFR § 370) A.R.S. §§ 26-341–26-353	Requires that either material safety data sheets (MSDS) for all hazardous materials or a list of all hazardous materials be submitted to AZSERC,LEPC, and local fire department.	AZSERC, Maricopa County LEPC, Buckeye Fire Department
EPCRA, Section 313, (P. L. 99–499, 42 U.S.C. § 11023) Toxic Chemical Release Reporting: Community Right-To-Know (40 CFR § 372) A.R.S. §§ 26-341–26-353	Requires annual reporting of releases of hazardous materials.	EPA Region IX, ADEQ, AZSERC Buckeye Fire Department
Hazardous Materials Transportation 49 CFR §§ 171–172	Requires transporters of hazardous materials to properly label, manifest, package, and ship hazardous materials.	ADEQ, ADOT and AZ Department of Public Safety
Chemical Facility Antiterrorism Standard, 6 CFR § 27	Requires facilities that possess any "chemicals of interest" above threshold quantities to register and provide specified information to the U.S. Department of Homeland Security.	Department of Homeland Security
Hazard Communication (HAZCOM) Program 29 CFR § 1910.1200 Safety and Health for Construction 29 CFR § 1926.1 et seq	Requires employers to implement HAZCOM standard that gives workers the right to know the hazards and identities of chemicals in their workplaces (29 CFR § 1910.1200). Requires written procedures and personnel protective equipment for employees working with hazardous materials.	OSHA
State		
Pollution Prevention A.R.S. §§ 49-961–969	Requires facilities that file a SARA Section 313 Toxic Chemical Release Report to prepare and implement a pollution prevention plan that addresses a reduction in the use of toxic substances and the generation of hazardous wastes. Annual progress reports are also required.	ADEQ
Local		
2006 International Fire Code	Requires the preparation of a hazardous material inventory statement and management plan.	Buckeye Fire Department

3.6.2.3 AGENCIES AND AGENCY CONTACTS

Federal, state, and local agencies responsible for administering the LORS that pertain to hazardous materials and hazardous and solid wastes are summarized in Table 3.14.

Table 3.14 Agencies and Agency Contacts

Agency	Contact/Phone/Email	Permit/Issues
EPA Region IX 75 Hawthorne Street Scan Francisco, CA 94105	Toll-free: (800) 300-2193 Telephone: (415) 947-4400	Spill Notification
ADEQ 1111 West Washington Phoenix, AZ 85007	Toll-free: (800) 234-5677 Telephone: (602) 771-2330	Spill Notification, Stormwater, Aquifer Protection Permit, Hazardous Waste Generation, Transportation and Disposal
National Response Center	Toll-free: (800) 424-8802 Telephone: (202) 267-2675	Reportable Quantity Spill or Release
Department of Homeland Security	Telephone: (202) 282-8000	Chemical Anti-terrorism Reporting
Occupational Safety and Health Agency Region IX 90 7th Street, Suite 18100 San Francisco, CA 94103	Telephone: (415) 625-2547	HAZCOM, Worker Safety Handling Hazardous Waste and Materials
Arizona Division of Occupational Safety and Health 800 W. Washington Street, 2nd floor Phoenix, AZ 85007	Darin Perkins, Director Telephone: (602) 542-5795	
Maricopa County Local Emergency Planning Commission 5630 E. McDowell Road Phoenix, AZ 85008	Christina Herrera Executive Director Telephone: (602) 273-1411 cristinaherrera@mail.maricopa.gov	Hazardous Material Usage, Reportable Quantity Spill or Release, Tier II Reports
AZSERC 5636 E. McDowell Phoenix, AZ 85008	Mark Howard, Director Toll-free: (800) 411-2336 Telephone: (602) 464-6346 azserc@azdema.gov	Hazardous Material Usage, Reportable Quantity Spill or Release
ADOT		Transportation of Hazardous Material and Waste
Maricopa County Environmental Services Division 1001 N. Central Ave. Suite 300 Phoenix, AZ 85004	Telephone: (602) 506-6970	Solid Waste Disposal
Arizona Department of Public Safety	Duty Officer (602) 223-2212	Transportation Related Release
Buckeye Fire Department 530 East Monroe Avenue Buckeye, AZ 85236	911 Telephone: (623) 349-6700	Fire, Emergency Response, Hazardous Material Usage, Spill or Release

3.6.3 Project Area Conditions

Primary land uses in and around the Project Area include agriculture, cattle grazing, mining, utilities, dispersed residential, recreation, and transportation. West of the Project Area, land uses include a regional landfill and state prison complex. Approximately 50 residences are located east of the Project Area in addition to two dairies surrounded by areas of agricultural lands. Industrial/commercial uses in the greater Project Area are minimal, consisting of two landfill facilities, a mineral products operation, and a prison facility.

The Project Area is almost entirely undeveloped, though a few areas have had isolated developments. There is no widespread prior use of the Project Area that would suggest that a concentration of hazardous waste is present. Isolated instances of refuse dumping, to the extent found in the Project Area, are household trash, rather than industrial wastes that would be more likely to contain hazardous materials.

The Southwest Regional Landfill is located southwest of the Project Area. This landfill is owned and operated by Allied Waste and includes disposals of municipal solid waste, construction/demolition debris, dead animals, asbestos, noninfectious medical waste, industrial and municipal sludges, petroleum contaminated soils, auto shredder fluff, special waste, and liquid waste.

3.6.4 Hazardous Waste Disposal Sites

Hazardous wastes generated during the construction and operation of the SSEP would be accumulated and contained on-site, in accordance with applicable LORS discussed in Section 3.6.2. The types of wastes that would be generated are disclosed in detail in Section 4.6 in Chapter 4. Under suitable manifest, such materials would be taken off-site by a licensed shipper to a permitted treatment, storage, and disposal facility. Qualified waste disposal sites in Maricopa County are listed in Table 3.15. Sufficient capacity is present at these facilities so that the additional waste materials generated by the SSEP would be accommodated (Parke 2009). The Butterfield Station Landfill is a very large facility that historically accepts much of the industry-generated nonhazardous wastes for the Phoenix metropolitan area. Clean Harbors Arizona operates a large hazardous waste treatment and disposal facility in west Phoenix that could accept most of the hazardous waste generated at the SSEP. Table 3.15 lists all other possibly waste treatment and disposal facilities that could accept the hazardous waste generated at the SSEP; no hazardous waste would be shipped out of state.

Transportation of wastes from the Project Area would use roadway routes that are suitable for hazardous waste transport (Map 12). SR-85 to the west of the Project Area would be the sole route for waste-hauling vehicles leaving the Project Area. These are established routes for commercial highway trucks. Wastes from the SSEP would not be transferred from haul trucks to railcars because the facilities in the region offer sufficient capacity for disposal.

Table 3.15 Waste Management Facilities in Maricopa County

Facility Name	Location	Services/Accepted Wastes	Unacceptable Wastes
Clean Harbors Arizona, LLC	1340 W. Lincoln Street Phoenix, AZ 85007	Full Service hazardous waste transfer and blending station Universal wastes Licensed RCRA treatment, storage and disposal facility	None generated at SSEP
City of Phoenix 7th Avenue Landfill and Transfer Station	3000 S. 7th Avenue Phoenix, AZ 85040	Construction waste, rock, dirt, green waste	Universal waste RCRA hazardous wastes
Butterfield Station	40404 S. 99th Avenue Mobile, AZ 85239	Construction debris, industrial and special wastes, nonhazardous sludges, and nonhazardous liquid wastes Universal waste	RCRA hazardous wastes Pb-acid batteries
White Tanks Transfer Station	18605 W. McDowell Road Buckeye, AZ 85326	Construction debris, industrial wastes, nonhazardous sludges, and wastes for recycle	RCRA hazardous wastes Pb-acid batteries
Belmont Waste Disposal	26403 W. US 85 Buckeye, AZ 85236	Construction debris, industrial wastes, and nonhazardous sludges	RCRA hazardous wastes Pb-acid batteries

3.7 Land Use and Access

3.7.1 Overview

The analysis area for land use and access consists of the Project Area (see Section 3.1.1) and also includes a 2-mile buffer surrounding the Project Area. This 2-mile buffer ensures that all access roads and ROWs that would be affected by the construction and operation of the SSEP are taken into consideration (Duncan 2009).

Current land uses in the analysis area are outlined in Table 3.16. The analysis area is primarily undeveloped land with small pockets of industrial use. It can be characterized as open desert with some agriculture and widely dispersed, low-density residential uses on private parcels.

Table 3.16 Analysis Area Land Uses

Land Use	Acreage
Low density residential	187.0
Industrial	402.0
Airport	6.0
Agriculture	3,384.0
Recreation	7,484.0
Public/quasi-public*	333.0
Vacant	68.0
Mining	2,994.0
Grazing	3,702.0
Land Use	**Mileage**
Utility corridors (power)	38.0
Utility corridors (digitized pipeline)	10.7

*Arizona State Prison Complex.

3.7.2 Laws, Ordinances, Regulations, and Standards

The primary legal basis for authorizing a ROW grant on BLM land is Section 501 of the Federal Land Policy and Management Act of 1976 (FLPMA). Under FLPMA, the Secretary of the Interior is authorized to grant, issue, or renew ROWs over, on, or through such land for utilities, roads, trails, highways, railroads, canals, etc. FLPMA provides the BLM with authority to issue ROW grants for the use, occupancy, and development of the public lands. The regulations establishing procedures for the processing of these grants are found in 43 CFR § 2800.

According to the Arizona statute, Title 14 Public Service Corporations; Corporations; Securities Regulation, Chapter 3 Corporation Commission Rules of Practice and Procedure, the Arizona Corporation Commission requires review of the general land-use plans (LUPs) within 2 miles of the Project Area. In its review of siting factors, the Power Plant and Transmission Line Siting Committee must consider potential impacts to the existing plans of the state, local government, and private entities for other developments.

Federal, state, and local land-use planning data were obtained from planning documents. The management prescriptions for these plans are outlined in Section 3.7.3 (Jurisdiction and Ownership). These plans consist of the following:

- *Final Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Lands in the 11 Western States* (DOE and DOI 2008). This programmatic EIS amends the *Lower Gila South Resource Management Plan (RMP)* to allocate lands to a west-wide system of energy transport corridors for the transmission of energy resources. Corridor 115-208 crosses the LSFO. This programmatic EIS designates the existing utility corridor adjacent to the SSEP as a component of the system of corridors. The energy produced by the SSEP would be transported via this corridor to the grid for consumers in Arizona.
- *Lower Gila South RMP*, as amended (BLM 2005a). This plan was developed to ensure that public lands are managed on a multiple-use and sustained-yield basis and that the quality of natural resources is preserved.
- ADOT. This department is responsible for planning, building, and operating the highway system throughout the state. No specific plan applies to the Project Area; however, specific proposed projects for the Project Area were reviewed.
- *Maricopa County Comprehensive Plan-2020 Eye to the Future* (Maricopa 2002). This plan was developed for controlled development with an effort to conserve resources and protect the environment while still providing an efficient transportation system. It is intended as a guide for decisions concerning growth and development and contains goals, policies, and standards to meet the plan.
- *Maricopa County SR-85 Corridor Area Plan* (2003). This plan was developed for the expansion of infrastructure and services, public recreation, water supply, protection of historic and cultural resources, and preservation of endangered and sensitive species and habitat for the immediate area around the SR-85 corridor and to be used in conjunction with the *Maricopa County Comprehensive Plan*.
- Maricopa Association of Governments. This regional agency is responsible for long-range transportation planning for the Phoenix metropolitan area. The *Interstate 10/Hassayampa Valley Transportation Framework Study* (2007a) and the *Interstate 8/Interstate-10 Hidden Valley Transportation Framework Study* (2009) developed potential transportation corridors throughout the Hassayampa Valley.
- *Town of Buckeye General Plan* (2007). This plan provides policy and decision-making guidelines related to development in the planning area. Designated land uses in the planning area would allow the town to manage growth effectively as it transitions from a small, rural farming community to a commerce center.
- *Town of Buckeye Parks, Trails, and Open Space Master Plan* (2005). This master plan provides principles to establish a comprehensive framework for sensitive areas, create linkages between existing and proposed recreation areas, ensure adequate quality and level of service for future parks, and promote community interaction. Near-term (1–5 years) and long-term (6–8 years) priorities were set and included a specific design evaluation of town trail and bicycle systems and development standards (see the *Town of Buckeye Trails Master Plan*).
- *Town of Buckeye Trails Master Plan* (2008). This master plan was developed to establish a network of trails to the recreational opportunities in the area. Conceptual trail alignments were developed to provide guidance as master-planned communities are built in order to ensure an integrated trail network.

- *City of Goodyear General Plan* (2003–2013). This general plan provides the foundation for the elements and implementation program that will guide growth and development decisions in the city's approximate 247-square mile planning area.

3.7.3 Jurisdiction and Ownership

Land jurisdiction refers to the limits of administrative authority maintained by a federal, state, or local governmental agency or organization. Jurisdiction does not necessarily imply land ownership; however, in some cases the authority that has jurisdiction may also own the land. Five categories of land jurisdiction or ownership, described below, are found in the analysis area (Table 3.17 and Map 11).

Table 3.17 Jurisdictions of Project Area and Analysis Area

Entity	Acres in Project Area	Acres in Analysis Area
BLM	3,702.0	30,470.0
Arizona State Land Department	5.2	5,585.0
Private	0.0	111,001.0
Maricopa (Unincorporated)	39.3	493.0
Town of Buckeye (Incorporated)	3,663.0	27,314.0
City of Goodyear (Incorporated)	0.0	5,928.0

Note: Acreages overlap and are not additive. For example, the acreage for the Town of Buckeye includes all acres of jurisdiction.

3.7.3.1 BUREAU OF LAND MANAGEMENT

Almost the entire Project Area (approximately 3,620 acres) and approximately 30,470 acres of the analysis area are located on public land administered by the BLM LSFO. The LSFO manages 1.4 million acres of public land in south-central Arizona for multiple use and provides opportunities for recreation, mining, wildlife habitat, grazing, and wilderness preservation in addition to other resource values and activities. The *Lower Gila South RMP* guides the management of the Project Area and the analysis area. The plan is designed to guide future management of public lands in the LSFO. A variety of land actions (e.g., ROWs, easements, and permits) is evaluated on a case-by-case basis. The RMP provides opportunities for multiple land uses in the Project Area, and the proposed renewable energy project conforms to the intent of the plan. A revision of the RMP is currently under development. A BLM team completed an LUP conformance analysis on November 21, 2008, and determined that the Proposed Action would not conflict with other decisions throughout the plan. No alternatives that would conflict with the plan have been considered.

The LSFO manages the Sonoran Desert National Monument (487,000 acres) and the North Maricopa Mountains Wilderness (63,200 acres), which are located 1 mile south of the Project Area. The monument is managed under the *Lower Gila South RMP* to protect archaeological, historical, and biological resources. A management plan for the Sonoran Desert National Monument is under development. According to the *Maricopa Complex Wilderness Management Plan* the objectives for managing the North Maricopa Mountains Wilderness are 1) to maintain or enhance the area's natural character; 2) provide a diversity of primitive recreational opportunities and a high degree of solitude; 3) maintain the present vegetation communities; and 4) provide habitat and water for a diversity of fauna (BLM 1995).

There are two 1-mile-wide, BLM-designated utility corridors that contain existing transmission and pipeline facilities north and south of the Project Area. Land-use demands for areas managed under the *Lower Gila South RMP* are mainly for road and utility ROWs. With increased population growth and development, additional uses in the designated utility corridors are expected. Although most of the Project Area is mapped as being in the incorporated Town of Buckeye, the BLM has exclusive jurisdiction over all land-use activities on BLM-managed land. The BLM would nevertheless work with the Town of Buckeye to ensure that the SSEP is constructed and operated in a manner that is consistent with relevant Town of Buckeye standards.

3.7.3.2 ARIZONA STATE LAND DEPARTMENT

Approximately 5,585 acres of dispersed sections of state land are located in the analysis area. Most of these sections are located in the western portion of the analysis area (generally in Township 2 South, Range 4 West) and are leased for grazing. The only project component that would be on state land in the Project Area is the westernmost portion of an access road that would be constructed within an existing transportation/utility corridor. A ROW would be needed from the Arizona State Land Department for that portion of the primary access road crossing state land.

3.7.3.3 UNINCORPORATED MARICOPA COUNTY

Maricopa County encompasses 5.9 million acres of land, consisting of land administered by the BLM, U.S. Forest Service, Arizona State Land Department, private property, and Indian Reservation land. Approximately 39 acres of unincorporated portions of Maricopa County are located in the Project Area and 493 acres in the analysis area. The only project component that would be on land in unincorporated Maricopa County is the easternmost portion of an existing access road.

The Maricopa County Comprehensive *Plan-2020 Eye to the Future* and the *Maricopa County SR-85 Corridor Area Plan* apply to the analysis area. The comprehensive plan designated portions of Maricopa County in the analysis area as rural development. Primary land uses include rural residential and agricultural uses. Designated future land uses within the SR-85 corridor planning area outline desired future development patterns with recognition of existing development activities and established patterns. Future land uses that occur in the analysis area include commercial and industrial development, rural density residential, and proposed open space.

3.7.3.4 TOWN OF BUCKEYE

Approximately 27,314 acres of the incorporated Town of Buckeye are in the analysis area and 3,663 acres are in the Project Area proper. However, the Town of Buckeye does not have jurisdiction on BLM land.

The *Town of Buckeye General Plan* includes the analysis area. Future land uses prescribed by the general plan for the analysis area include commercial and industrial development, low and medium-density residential development, and proposed open space.

3.7.3.5 CITY OF GOODYEAR

The SSEP would not be located in the incorporated City of Goodyear; however, approximately 5,928 acres of the analysis area are located in the incorporated City of Goodyear.

The *City of Goodyear General Plan* includes the eastern portion of the analysis area. Future land uses prescribed by the general plan include commercial and industrial development; and low, medium, and high-density residential development.

3.7.4 Existing Land Use

Land in the analysis area is largely undeveloped and is characterized by vacant open desert and by areas used for grazing, mining, utilities, and widely dispersed low-density residential development. Approximately 50 residences are located east of the Project Area in the analysis area, along with two dairies that are surrounded by agricultural land. Existing land uses are shown on Map 13.

The Southwest Regional Landfill and the Arizona State Prison Complex are located southwest of the Project Area in the analysis area. Both facilities are located adjacent to SR-85. Access to the landfill and prison is provided by SR-85.

Two grazing allotments overlay the Project Area. Please refer to Section 3.8 (Livestock Grazing) for more information on this land use.

OHV) use occurs throughout the analysis area, mostly on existing, unimproved roads and utility corridors. The Buckeye Hills Regional Park and Robbins Butte Wildlife Area are outside the analysis area; however, OHV users access the analysis area from Buckeye Hills Regional Park.

Existing ROWs on Arizona state land and BLM land are listed in Table 3.18 and Table 3.19, respectively. On Arizona state lands, ROWs consist of various transmission, distribution, and communication lines; rain gages, roads, easements; and the Jojoba Switchyard. On BLM land, ROWs consist of pipelines, transmission lines, and roads.

Table 3.18 Arizona State Land Department ROWs and Easements in the Analysis Area

Lease Number	Description	Location
18-105698	Transmission line and access road	Traverses the land-use analysis area west to east along the Komatke Road alignment to the Jojoba Switchyard
18-107441/ 18-109707	Distribution line	Traverses the land-use analysis area southwest to northeast west of the Project Area
18-103071	Communication line	Traverses the land-use analysis area north to south adjacent to SR-85 west of the Project Area
16-110986	Transmission line	Traverses the land-use analysis area east to west from SR-85 to the Jojoba Switchyard west of the Project Area
18-107648	Communication line	Traverses the land-use analysis area north to southwest of SR-85 and the Project Area
23-100009-18	Rain gages	West of the Project Area adjacent to Rainbow Wash
72-011068	Miscellaneous	Traverses the land-use analysis area north to south, west of SR-85 and the Project Area
72-032095	Miscellaneous	Section 23, Township 2 South, Range 4 West
14-105674	Transmission line	Traverses the land-use analysis area south from the Jojoba Switchyard west of the Project Area
14-106487/ 14-107947	Switchyard	West of the Project Area, north of the of the Komatke Road Alignment
18-106512	Road, distribution line, communication line	Traverses the land-use analysis area east from the Southwest Regional Landfill in the BLM-designated utility corridor and north into the Jojoba Switchyard west of the Project Area
72-004287	Gas line	Southwest of the Project Area within BLM-designated Corridor
72-006474	Miscellaneous	Southwest of the Project Area in Section 25, Township 2 South, Range 4 West
72-10350-1	Transmission line	Traverses the land-use analysis area west to east, north of the BLM-designated utility corridor and southwest of the Project Area
72-012160	Slurry pipeline	Traverses the land-use analysis area north to south adjacent to SR-85 west of the Project Area
16-110223	Road	Section 26, Township 2 South, Range 4 West
72-005377	Roadway	Section 23, Township 2 South, Range 4 West
72-007749/ 72-032095	Materials site	Section 23, Township 2 South, Range 4 West
14-088066	Gas transmission line	Section 25, Township 2 South, Range 4 West
14-111212	Gas line/roadway	Section 25,Township 2 South, Range 4 West
14-112025	Power line	Traverses the land-use analysis area south from the Jojoba Switchyard
72-006712	Power line	Section 25, Township 2 South, Range 4 West
72-086067	Gas transmission line	Section 25, Township 2 South, Range 4 West
16-110223	Roadway	Section 26, Township 2 South, Range 4 West
16-112078	Drainage channel	Section 26, Township 2 South, Range 4 West
56-112911	Road egress	Section 26, Township 2 South, Range 4 West

Source: Department of Mines and Mineral Resources (DMMR) (2007).

Table 3.19 ROWs and Other Use Authorizations in the Analysis Area

Serial Number	Description	Location
AZA 4287	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 8446	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 8756	Transmission line	Traverses the land-use analysis area south from Riggs Road and extends beyond the BLM-designated utility corridor
AZA 9002	Transmission line	Traverse north to south along the western portion of the land-use analysis area, and a portion of the Project Area, adjacent to SR-85
AZA 9977	Pipeline facility site	South of the Project Area within the BLM-designated utility corridor
AZA 10350	Transmission line	Traverses the land-use analysis area west to east and then runs northeast within the BLM-designated utility corridor north of the Project Area
AZA 13878	Pipeline facility site	South of the Project Area within the BLM-designated utility corridor
AZA 14739	Transmission line	Traverses the land-use analysis area west to east and then runs northeast within the BLM-designated utility corridor north of the Project Area
AZA 21968	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 29516	Roadway	Riggs Road alignment
AZA 31607	BLM national monument	Section 31, Township 2 South, Range 2 West; Sections 28–30 and 34–36, Township 2 South, Range 3 West; all Sections, Township 3 South, Range 3 West
AZA 32057	Transmission line-FLPMA	Sections 19–24, 29, and 30,Township 2 South, Range 2 West; Sections 29, 30–33, Township 2 South, Range 3 West; Sections 19–23, 26–30, 35, and 36, Township 2 South, Range 4 West
AZA 33063	Surface management plan (Wesco mining)	Sections 20, 29, and 30,Township 2 South, Range 3 West
AZA 33350	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 3335003	Roadway	Sections 27–30 and 34–36, Township 2 South, Range 2 West; Section 31, Township 2 South, Range 3 West
AZA 3335004	Temporary use permits construction access for Transwestern	Sections 27–30 and 34–36, Township 2 South, Range 2 West; Section 31, Township 2 South, Range 3 West
AZA 33585	Transmission line	Northwest of the Project Area within the BLM-designated utility corridor
AZAR 4861	Transmission line	Runs adjacent to Riggs Road west and then turns northwest through a portion of the Project Area, parallel to the L berty to Gila Bend 230-kilovolt transmission line
AZAR 486101	Transmission line	South of the Project Area within the BLM-designated utility corridor
AZPHX 83253	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZPHX 86067	Natural gas pipeline	Traverses the land-use analysis area east to west within the BLM-designated utility corridor along the Komatke Road alignment south of the Project Area
AZA 6263	Transmission line	East of the Project Area and north of Riggs Road
AZA 6728	Transmission line	East of the Project Area and north of Riggs Road
AZA 10028	Transmission line	East of the Project Area and north of Riggs Road
AZA 29997	Roadway	East of the Project Area and north of Riggs Road

Source: BLM (2009).

3.7.4.1 UTILITIES

Electric power lines and natural gas pipelines are located within two BLM-designated utility corridors adjacent to the Project Area. The Jojoba 500-kilovolt (kV) Switchyard, operated and maintained by SRP, is located on the Komatke Road alignment, on the western edge of the Project Area.

Existing power lines in the analysis area include the 1) Hassayampa to Kyrene 500-kV transmission line owned by SRP; 2) the Palo Verde to Pinal West 500-kV transmission line owned by SRP, Arizona Public Service (APS), Santa Cruz Water and Power Districts, and Tucson Electric Power; 3) the Jojoba to Gila River and Jojoba to Panda 500-kV transmission lines; 4) the Liberty to Gila Bend 230-kV transmission line; and 5) two 69-kV transmission lines owned by APS (Table 3.20).

Table 3.20 Existing Power Lines in the Analysis Area

Name	Voltage	Owner	Location
Hassayampa to Kyrene	500 kV	SRP	Traverses the analysis area west to east, connecting into the Jojoba Switchyard, and then runs northeast within a BLM-designated utility corridor
Palo Verde to Pinal West	500 kV	SRP, APS, Santa Cruz Water and Power Districts, and Tucson Electric Power	Traverses the analysis area west to east, connecting into the Jojoba Switchyard, and then runs southeast within a BLM-designated utility corridor
Jojoba to Gila River/Panda	500 kV	APS	Originates at the Jojoba Switchyard and traverses south in the western portion of the analysis areas, adjacent to SR-85
Liberty to Gila Bend	230 kV	APS	Traverse north to south along the western portion of the analysis area, and a portion of the Project Area, adjacent to SR-85
–	69 kV	APS	Runs adjacent to Riggs Road west and then turns northwest through a portion of the Project Area, parallel to the L berty to Gila Bend 230-kV transmission line
–	69 kV	APS	Traverses the western portion of the analysis area and ties into the first 69-kV transmission line adjacent to the Liberty to Gila Bend 230-kV transmission line

Four El Paso natural gas pipelines and one Transwestern Pipeline are located in the BLM-designated utility corridor along the Komatke Road alignment in the southern portion of the analysis area (see Map 13). Three of the El Paso Natural Gas Pipelines are 30 inches in diameter, and the fourth pipeline is 26 inches in diameter. The Transwestern Pipeline is 36 inches in diameter.

The Hassayampa to Kyrene BLM-designated utility corridor is 1 mile wide (0.5 mile on either side of the existing 500-kV transmission line), and traverses the analysis area from the west to the east across the Jojoba Switchyard, and then runs northeast. The Palo Verde to Pinal West BLM-designated utility corridor is 1 mile wide, extending across the southern portion of the analysis area (see Map 13).

3.7.4.2 TRANSPORTATION AND ACCESS

SR-85 runs north and south for approximately 4 miles through the western portion of the analysis area and is called a major road for purposes of this analysis. SR-85 begins at the Mexico border and terminates at I-10 in Buckeye. The portion of SR-85 north of Gila Bend is part of the National Highway System. SR-85 is classified as a rural arterial highway in the Arizona State Highway System and a principal arterial highway on the National Highway System. There are no major roads in the Project Area.

There are 64 miles of primitive roads (including Rainbow Valley and Riggs road) in the eastern portion of the analysis area and 13.1 miles of primitive roads in the Project Area (Map 14). Although there are improved and unimproved roads following some section and half-section lines for access to dispersed agriculture and residential areas throughout the area of analysis, transportation corridors in the area are sparse. Komatke Road and Haul Road are primitive roads used to access the existing Jojoba Switchyard and the Wesco mining facility. Several primitive roads provide access from Komatke Road to the Sonoran Desert National Monument. Primitive roads are located along the BLM-designated utility corridors. The *BLM Approved Amendment Lower Gila North Management Framework Plan and the Lower Gila South RMP and Decision Record* designates the area of analysis as "limited" to OHVs. OHVs are limited to existing roads and vehicle routes. No cross-country vehicle travel is permitted (BLM 2005a). Several primitive roads totaling 13.1 miles cross the Project Area (see Map 14). Each of these routes is available for motorized travel. Refer to Section 3.11 for more information on OHV use. One private airstrip is located in the northeast portion of the analysis area.

3.7.4.3 RESOURCE EXTRACTION

The BLM database for mining claims on BLM-administered property indicates numerous current mineral claims in the northern and southwestern sections of the analysis area. In the Project Area, Wesco Minerals, LLC is quarrying sand and gravel deposits in Sections 12 and 21, Township 2 South, Range 3 West (see Map 13). The Wesco granite mine is located to the north and a processing plant is located to the west of the Project Area. Mine operations encompass 89 acres of land and include an open-pit mine, soil and overburden stockpiles, and a processing plant. The mine project also includes 5.6 miles of improved roads and 3.7 miles of dirt roads (BLM 2005b).

Past mining activities include the Buckeye Hills Mica Mine, which opened in 1949. Workings included a mill with a capacity for processing 6 tons per day of commercial-grade sericite (DMMR 2007). There are no current mining activities for this claim.

The surface and mineral estates on the Project Area are owned by the federal government and are administered by the BLM LSFO. The lands are open to mineral entry under the Mining Law and are open to mineral material sales under 43 CFR § 3602. There are no pre-1955 claims, oil and gas leases, or mineral activity occurring in the area. There is one mineral withdrawal in the area of analysis for the Sonoran Desert National Monument.

The current mineral claims are in conformance with the *Lower Gila South RMP*, approved June 1988. The RMP states:

> "Private industry is encouraged to explore and develop federal minerals to satisfy national and local needs. This policy provides for economically and environmentally sound exploration, extraction, and reclamation practices. Public lands are open and available for mineral exploration and development unless withdrawn or administratively restricted. Mineral development may occur along with other resource uses." (BLM 1985)

A review of the Arizona Department of Mines Land and Mineral Use records indicates that there are no current land claims besides the current transmission and pipeline corridors that are located generally north and south of the Project Area (DMMR 2007).

3.8 Livestock Grazing

3.8.1 Overview

The analysis area for grazing management consists of the project footprint where all vegetation would be removed to accommodate construction and operation of the SSEP. Two BLM grazing allotments intersect the Project Area. The Arnold grazing allotment intersects 1,053 acres of the western portion of the Project Area, and the Beloat grazing allotment intersects 2,649 acres in the eastern portion of the Project Area. The Arnold allotment is managed for ephemeral grazing by livestock, meaning that grazing occurs only when there is sufficient annual forage growth to support grazing. The number of animals authorized for ephemeral use varies greatly between years, depending on forage production, market conditions, and availability of steers. Neither of the grazing allotments in the Project Area is currently being grazed by cattle.

3.8.2 Laws, Ordinances, Regulations, and Standards

The Taylor Grazing Act of 1934, as amended was passed to protect public grazing land from overgrazing and soil deteriorating; "to provide for the orderly use, improvement, and development of public lands; and to stabilize the livestock industry dependent on the public range." (43 U.S.C. § 315–315r).

The Public Rangelands Improvement Act of 1978 (43 U.S.C. § 1901 et seq.) establishes and reaffirms the national policy and commitment to 1) inventory and identify current public rangeland conditions and trends; 2) manage, maintain and improve the condition of public rangelands so that they become as productive as feasible for all rangeland values in accordance with management objectives and the land-use planning process; 3) charge a fee for public grazing use that is equitable; and 4) continue the policy of protecting wild free-roaming horses and burros from capture, branding, harassment, or death, while at the same time facilitating the removal and disposal of excess wild free-roaming horses and burros that pose a threat to themselves, to their habitat, and to other rangeland values.

EO 12548 extends the Public Range Improvement Act of 1978. However, it includes a few minor changes to the Act. These changes specify, among other things, fees for grazing cattle on public lands.

43 CFR § 4100-Grazing Administration is the current guidance for administration of grazing on public lands exclusive of Alaska.

The Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management were developed to achieve the four fundamentals of rangeland health outlined in the grazing regulations (43 CFR § 4180.1). Those fundamentals are 1) properly functioning watersheds; 2) properly cycling water, nutrients, and energy; 3) state-met water quality standards; and 4) protection of habitat for special-status species.

3.8.3 Grazing Management

In the Beloat allotment, 2,988 AUMs of grazing use are currently authorized. In the Arnold allotment, there has been an average ephemeral use of 984 AUMs per year for the period from 1998 to 2007. An AUM refers to the amount of forage necessary to feed one animal unit for a period of one month. An animal unit is defined as one mature cow weighing approximately 1,000 pounds and one calf up to weaning age, usually six months, or their equivalent of other animals. Other than the allotment boundary fence, the CCC stock pond is the only range improvement within the Project Area. No evaluation to determine if the allotments are meeting rangeland standards has been completed. However, based on monitoring data there are no indications that the allotments are not meeting these standards.

3.9 Noise

3.9.1 Overview

This section presents an evaluation of existing sound levels associated with the SSEP (see Section 3.1.1 for Project Area description). The area of analysis for noise is approximately 14,750 acres, including the approximately 3,620-acre Project Area, and is largely vacant desert land managed by the BLM. The area of analysis for noise is the project footprint plus an area extending outward to include adjacent residential areas, the Buckeye Hills Regional Park, Sonoran Desert National Monument, and the North Maricopa Mountains Wilderness. Elevations in and adjacent to the Project Area range from approximately 1,050 to 1,120 feet amsl. Little Rainbow Valley is sparsely populated, with approximately one to two dozen widely separated residences up to 4 miles east of the Project Area. These are the closest known residential properties.

To adequately assess the noise related impacts of a proposed large industrial facility (such as the SSEP), an ambient noise monitoring program is necessary in order to document baseline conditions for later comparison with future noise levels. Such an assessment is typically performed at any nearby noise-sensitive areas (residences, schools, churches, libraries, etc.) that may be affected by project noise (Mantee 2009).

3.9.2 Laws, Ordinances, Regulations, and Standards

3.9.2.1 FEDERAL

3.9.2.1.1 EPA

In 1974 the EPA created guidelines to assist state and local government entities in the development of state and local LORS for noise (EPA 1974). Because local LORS have been adopted and are pertinent to the SSEP, these EPA guidelines are for informational purposes only.

3.9.2.1.2 Occupational Safety and Health Administration

On-site noise levels are regulated by the Occupational Safety and Health Act of 1970 (29 CFR § 1910.95). The noise exposure level of workers is limited to 90 dBA, over a time-weighted average (TWA) eight-hour work shift to protect hearing. If there are workers exposed to a $TWA_{8\text{-hour}}$ above 85 dBA (i.e., the OSHA Action Level), then the regulations call for a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage prevention.

3.9.2.2 STATE

3.9.2.2.1 Arizona Division of Safety and Health

The Arizona Occupational Safety and Health Act of 1972 provides safety and health protection for employees in Arizona. The act requires each employer to furnish his or her employees with a place of employment free from recognized hazards that might cause serious injury or death. The Act further requires that employers and employees comply with all workplace safety and health standards, rules, and regulations promulgated by the Industrial Commission. The Arizona Division of Occupational Safety and Health, a division of the Industrial Commission of Arizona, administers and enforces the requirements of the act.

With respect to noise exposure to workers, the Arizona OSHA regulations closely mirror the federal OSHA regulations described above and, for practical implementation, are herein considered to be equivalent.

3.9.2.2.2 Arizona Vehicle Code

Noise limits for highway and OHVs are regulated under the Arizona Vehicle Code, established in A.R.S. §§ 28-955 and 28-1179. The limits are enforceable on the highways by any authorized law enforcement officer in the state (such as the Arizona Highway Patrol or by County Sheriff Departments).

Section 28-955: "A motor vehicle shall be equipped at all times with a muffler that is in good working order and that is in constant operation to prevent excessive or unusual noise. A person shall not use a muffler cutout, bypass or similar device on a motor vehicle on a highway."

Section 28-1179.3: "Except when operating on a closed course, either a muffler or other noise dissipative device that prevents sound above 96 decibels (dB). The director shall adopt the current sound measurement standard of the society of automotive engineers for all-terrain vehicles and motorcycles and the current sound measurement standard of the international organization for standardization for all other off-highway vehicles."

3.9.2.3 LOCAL

3.9.2.3.1 Maricopa County Ordinance

The Project Area is partially located in an unincorporated area in Maricopa County. The Maricopa County Planning and Development Department has established the following policy statement regarding noise:

At and above certain levels, noise is detrimental to the health and welfare of Maricopa County citizens. As stated in Maricopa County's policy statement regarding noise, "Maricopa County has determined that it is in the best interest of its citizens to control noise in a manner that promotes commerce; the use, value, and enjoyment of property; sleep and repose; and environmental quality. Therefore, it is hereby declared to be the policy of Maricopa County to prohibit excessive, unnecessary, disruptive, and annoying noises from all sources." (Maricopa 2006)

This policy statement is implemented via County Ordinance P-23, "Noise Ordinance." This ordinance, adopted on February 15, 2006, does not incorporate any quantitative noise level limits but rather prohibits "public disturbances," which are defined as "any noise which disturbs the peace or quiet of any neighborhood if such noise can be heard from in closed residential structures located within 500 feet of the boundary of the property from which such noise emanates." (Maricopa 2006)

With respect to the SSEP, there are two notable exemptions. P-23, Section VI, Paragraph 14, of the exemptions section states that "noise emanating from power plant equipment during normal operations" is exempt from the provisions of P-23 (Maricopa 2006). Paragraph 9 states that "noise emanating from construction and repair equipment when used in compliance with existing Maricopa County rules and regulations" is exempt (Maricopa 2006). No Maricopa County ordinances or regulations were found that deal with vibrations or vibration levels, either during construction or operations.

3.9.2.3.2 Town of Buckeye

The business center of the Town of Buckeye is mainly centered at the intersections of the I-10, SR-85, and SR-60 freeways, several miles north of the Project Area. The Town of Buckeye incorporated area is adjacent to the Project Area, and two of the analyzed noise-sensitive receptors are in this area.

Noise issues are included in the Town's General Plan document (as a subsection under the Environmental Planning Element). There is no separate Noise Element as part of the General Plan (which was adopted 1/18/08). There is no specific noise ordinance for the Town; thus, any noise-related concerns would fall under the general provisions regarding dealing with nuisances. Therefore, no quantitative noise limits are currently in place for areas within the town limits.

3.9.2.3.3 City of Goodyear

The incorporated city limits of Goodyear are within approximately 1 mile of the eastern boundary of the Project Area. Goodyear has a planning area that extends beyond the city limits, and this planning area contains one of the analyzed noise-sensitive receptors. There are no known noise-sensitive receptors to the east of the Project Area that are in the incorporated area of the City of Goodyear. As with Buckeye, observed residences are in planning areas only (not within city limits) and would be under Maricopa County jurisdiction for noise-related issues.

3.9.3 Fundamentals of Acoustics

Acoustics is the study of sound, and noise is defined as unwanted sound. To assess sound levels and noise impacts, several descriptors and metrics are used by the acoustical industry. Noise is usually defined as unwanted sound because it interferes with speech communication and hearing, or is otherwise annoying. Under certain conditions, noise may cause hearing loss, interfere with human activities, and in various ways affect people's health and well being.

Technically speaking, airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. These fluctuations create sound waves that our ears are sensitive to. The range of pressures that cause airborne vibrations (i.e., noise) is quite large and would be cumbersome to deal with on an absolute basis. Therefore, noise is measured on a logarithmic scale, expressed in dB, which is the accepted standard unit for measuring sound pressure amplitude using a more manageable range of numbers.[1]

When describing sound and its effect on a human population, A-weighted sound levels are typically used to account for or approximate the response of the human ear. The term A-weighted refers to a filtering of the noise signal in a manner that corresponds to the way the human ear perceives sound. The A-weighted noise level has been found to correlate well with people's judgments of the "noisiness" of different sounds and has been used for many years as a measure of community and industrial noise (Harris 1991). The A-weighted sound level is denoted dBA or dB(A).

Although the A-weighted scale and the energy-equivalent metric are commonly used to quantify the range of human response to individual events or general community sound levels, the degree of annoyance or other response effects also depends on several other perceptibility factors, including the following:

- Ambient (background) sound level
- General nature of the existing conditions (e.g., quiet rural vs. busy urban)
- Difference between the magnitude of the sound event level and the ambient condition

[1] The commonly held threshold of audibility is 20 micropascals, whereas the threshold of pain is on the order of 200 million micropascals; a pressure ratio of 10 million to one. By converting these pressures to a logarithmic scale (in terms of sound pressure levels expressed by dB), the range becomes a more convenient 0 to 140 dB.

- Duration of the sound event
- Number of event occurrences and their repetitiveness
- Time-of-day that the event occurs

Because most people do not routinely work with dB or A-weighted sound levels, it is often difficult to appreciate what a given sound pressure level number means. To help relate noise level values to common experience, Table 3.21 provides examples of typical A-weighted sound pressure levels for various everyday indoor and outdoor noise sources.

Table 3.21 Typical Sound Levels Measured in the Environment and Industry

Example Noise Source or Noise Environment	A-weighted Sound Levels (dBA)	Subjective Impression
Shotgun (at shooter's ear) or on a carrier flight deck	140	Painfully loud
Civil defense siren (100 feet)	130	–
Jet takeoff (200 feet)	120	Threshold of pain
Loud rock music	110	–
Pile driver (50 feet)	100	Very loud
Ambulance siren (100 feet) or in a boiler room	90	–
Pneumatic drill (50 feet) or in a noisy restaurant	80	–
Busy traffic; hair dryer	70	Moderately loud
Normal conversation (5 feet) or in a data processing center	60	–
Light traffic (100 feet); rainfall or in a private business office	50	–
Bird calls (distant) or in an average living room or l brary	40	Quiet
Soft whisper (5 feet); rustling leaves or inside a quiet bedroom	30	–
In a recording studio	20	–
Normal breathing	10	Threshold of hearing

Source: Beranek (1998).

Loud noise can be annoying, and it can have negative health effects (EPA 1978). The effects of noise on people can be listed in three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, learning
- Physiological effects such as startling or temporary and permanent hearing loss

In most cases, environmental noise produces effects in the first two categories only. However, unprotected workers in some industrial work settings may experience noise effects in the last category.

Given the wide variation in individual thresholds of annoyance, habituation to noise, and situational reactions to noisy environments, there is no common standard for assessing the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it with the existing or ambient environment familiar to that person. From an objective, measurable viewpoint, there are several standardized noise-level metrics that are commonly used for qualitatively assessing a given noise

environment or acoustical situation. Common descriptors of environmental noise consist of the equivalent noise level (L_{eq}) and statistical sound levels (L_{90}, L_{50}, and L_{10}). Additional composite descriptors consist of the day-night level (L_{dn}) and community noise equivalent level (CNEL). These descriptors and other acoustical terms are further defined below (also see the glossary).

- Ambient noise level: The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient level is often defined by the L_{eq} level (see below for more information on special noise metrics).
- Background noise level: The underlying, ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically make up the background noise level. The background level is generally defined by the L_{90} percentile noise level.
- Intrusive noise: Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, tonal content, the prevailing ambient or background noise level, and the sensitivity of the receiver. The intrusive level is generally defined by the L_{10} percentile noise level.
- dB: A dB is a dimensionless unit of level which denotes the logarithmic (base 10) ratio between two quantities that are proportional to power; the denominator of this ratio is a reference standard which must be specified to give the dB level any meaning. dBs describe the loudness of sound and noise in terms of sound pressure levels and sound power levels.
- Sound pressure level: The level, expressed in terms of dBs, that is 20 times the logarithm of the given sound pressure over the reference pressure of 20 micropascals = 2×10^{-5} Newtons/m^2 = 0.0002 μbar = 2×10^{-4} dynes/cm^2. Sound Pressure Level, abbreviated SPL or Lp, is dependent on the distance from the source to the receiver.
- Sound power level: The level, also expressed in terms of dBs, that is 10 times the logarithm of the given sound power over the reference power of 1 picowatt. Sound Power Level, abbreviated PWL or Lw, is an inherent characteristic of the noise source and, therefore, is independent of distance from the source.
- dBA: The sound level in dBs as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. Thus, A-weighted sound pressure levels are the most common noise metric used to describe community noise and all sound levels in this report are A-weighted.
- Frequency: The number of times in 1 second that a periodic phenomenon repeats itself. The units of frequency are the hertz (Hz) which corresponds to one cycle per second.
- Band Pressure Level or Band Sound Level: This is the sound pressure level within a specified frequency band. The bandwidth is usually indicated by a descriptive modifier, such as octave band level or third-octave band level. As an example, the octave band level is the sound level within a frequency band corresponding to a specified octave. An octave is the frequency interval between two sounds whose basic frequency ratio is 2 (e.g., 500 Hz and 1,000 Hz are one octave apart). Note that octave band center frequencies and band limits are standardized by international agreement.
- Equivalent noise level (L_{eq}): The energy-equivalent noise level over a specified period of time (e.g., 1 hour). It is an equivalent single value of sound that includes the same acoustic energy as the actual, varying sound levels in a given period of time.

- Percentile noise level or Statistical sound levels (L_{90}, L_{50}, and L_{10}): The noise level exceeded during *n* percent of the measurement period, where *n* is a number between 0 and 100. The most common statistical sound levels used in community noise analyses are the L_{90}, $L_{50,}$ and L_{10} levels. The L_{90} is the sound level exceeded 90% of the time and is often considered the effective background or residual noise level. The L_{50} is the sound level exceeded 50% of the time and is known as the median noise level. The L_{10} is the sound level exceeded 10% of the time, is a measurement of intrusive sounds (such as aircraft flying overhead), and is commonly known as the effective maximum or intrusive sound level.
- Day-night level (L_{dn}): This metric was developed to account for an increased human sensitivity to nighttime noise levels and for the greater potential annoyance of noise during the nighttime hours. The actual nighttime noise levels are adjusted, based on the premise that both exterior and interior noise levels are generally lower than daytime levels and, therefore, nighttime noise can be more noticeable (than daytime conditions at the same location). Also, because most people sleep at night, there is often an increased sensitivity to intrusive noises. The day-night noise level, abbreviate L_{dn}, is the energy-average A-weighted sound level over a 24-hour period with an added 10 dB adjustment (penalty) for sounds that occur between 10 PM and 7 AM
- CNEL: The CNEL is similar to the L_{dn}, but differs in that a 5 dB evening penalty is also added to sounds that occur between 7 PM and 10 PM (as well as the L_{dn} penalty of +10 dB for nighttime sounds). In a large percentage of cases for general community noise, the L_{dn} and CNEL can be considered as equivalent.

3.9.4 Existing Noise Sources in the Area of Analysis

The Sonoran Desert National Monument and the North Maricopa Mountains Wilderness are located south of the Project Area and are composed of undeveloped desert areas with dirt roads for access. There are few daytime noise sources in proximity to the Project Area. SR-85 is nearly 8 miles away from areas with residential land uses. The nearest paved road is Rainbow Valley Road, a north-south, two-lane road that is 4.4 miles to the east of the eastern power block. All other roads in the vicinity of the Project Area, including Riggs Road, Pipeline Road, and all residential access roads, are dirt roads that are generally flat and well maintained.

All these dirt roads were observed to have sporadic traffic (typically less than one or two vph during the daytime). During the midday hours, high-altitude aircraft were observed, primarily military planes traveling to and from Luke Air Force Base. No sonic booms were noted during the survey period from these military aircraft. Other daytime noise sources included natural sounds from birds and insects.

The predominant noise sources during the daytime were general environmental din, rustling vegetation, birds, and occasionally insects, aircraft in the distance, and localized equipment (such as generators or air conditioners). Likewise, during the nighttime hours, the predominant noise sources included general environmental din, insects, aircraft in the distance, and distant barking dogs. There were no periods during which excess wind (i.e., wind velocities above industry standards for outdoor measurements[2]) were noted, so wind noise was not considered to be noteworthy during the field observation sessions.

For all time frames, the noise environment was observed to be extremely quiet. Details of the ambient noise survey are discussed in Section 3.9.5.

[2] For example, the ANSI sets a guideline for wind speeds conducive for making outdoor sound level measurements at ≤ 6 m/sec (or 13.4 mph). This is found in ANSI S1.13, "Methods for the Measurement of Sound Pressure Levels," Section 3.4.2.4, Atmospheric Conditions.

3.9.5 Baseline/Ambient Noise Level

3.9.5.1 SURVEY METHODOLOGY

A baseline noise monitoring program was conducted August 9 through 11, 2009 (Mantee 2009). The ambient noise monitoring program consisted of continuous and simultaneous 25-hour noise measurements at three long-term (LT) monitoring locations (denoted LT-1, LT-2, and LT-3) and short-term (ST) monitoring at three additional locations (denoted ST-1, ST-2, and ST-3). Observations at all the monitoring locations were made at various times of the day and night to document local noise sources and overall environmental conditions. Short-term octave band sound-level measurements also were performed at the six monitoring locations.

During the field survey, local area meteorological conditions were noted and were recorded on a handheld weather instrument. Conditions during the survey can generally be described as hot and dry, with an absence of the monsoonal conditions that often predominate during this time of year. The air temperature (in °F) during the survey was in the mid to upper 80s overnight and in the low 100s during the days. Relative humidity generally ranged between 14% and 45% and barometric pressure was steady around 29.2 (± 0.2) inches of mercury. The skies were noted as generally being clear with some periods of partly cloudiness during both the night and day periods. Winds were noted as calm, or typically in the range of 1 to 3 mph with an occasional short period of breezes up to 6 to 8 mph. All these conditions were well within appropriate ranges for acceptable outdoor measurements per American National Standards Institute (ANSI) S1.13.

3.9.5.2 AMBIENT MEASUREMENT LOCATIONS

Six monitoring locations were chosen to quantify existing baseline noise levels within 7.4 miles of the Project Area (Map 15). There are no permanent, noise-sensitive receptors to the north, west, or south of the Project Area in the area of analysis. There are scattered permanent residential locations to the east of the Project Area, as well as two temporary-use wilderness/recreational areas to the south of the Project Area. One location is to the west, near an institutional (prison) facility.

The locations used for the 2009 ambient noise survey are summarized in Table 3.22. These measurement locations are the closest (from 0.9 to 7.4 miles away) and only noise receptors within several miles of the Project Area.

Table 3.22 Ambient Noise Measurements – Location and Timing

Type	Label	Name	Lat/Long	Monitoring (duration)	Distance to 250-MW (west) Block Centroid	Distance to 125-MW (east) Block Centroid
Long-term Monitors	LT-1	Hayes Rd. [Residential]	N 33° 13.796' W112° 30.470'	8/09/09, 16:58 to 8/11/09, 11:15 (42 hours, 16 min)	2.3 miles (12,295 feet)	1.3 miles (6,983 feet)
	LT-2	Baseline Rd. [Residential]	N 33° 13.508' W112° 28.258'	8/09/09, 19:25 to 8/11/09, 10:35 (39 hours, 10 min)	4.4 miles (23,496 feet)	3.3 miles (17,239 feet)
	LT-3	Sonoran Desert National Monument [Recreational]	N 33° 11.800' W112° 33.114'	8/10/09, 11:24 to 8/11/09, 12:39 (25 hours, 15 min)	3.3 miles (17,386 feet)	3.7 miles (19,598 feet)
Short-term Samples	ST-1	Prison frontage [Institutional]	N 33° 13.069' W112° 38.700'	Daytime: 8/10/09, 09:48 (15:00) Nighttime: 8/11/09, 01:31 (15:00)	6.2 miles (32,537 feet)	7.4 miles (39,061 feet)
	ST-2	Ocotillo Rd. [Residential]	N 33° 14.825' W112° 30.434'	Daytime: 8/10/09, 12:33 (15:00) Nighttime: 8/11/09, 04:02 (15:00)	2.2 miles (11,371 feet)	0.9 miles (4,658 feet)
	ST-3	North Maricopa Mountains Wilderness [Recreational]	N 33° 10.739' W112° 28.948'	Daytime: 8/11/09, 14:09 (15:00) Nighttime: none (see LT-3 data)	5.7 miles (30,269 feet)	5.1 miles (26,736 feet)

Notes: Daytime hours are between noon and 19:00; nighttime hours are between 22:00 and 07:00.

3.9.5.3 LONG-TERM MEASUREMENTS AND RESULTS

Long-term noise measurements (of at least 25 hours' duration) were conducted at three locations near the Project Area. The 24-hour metrics, CNEL and L_{dn}, were calculated from the sampled energy-average, L_{eq} values, starting at the sample period nearest the first whole hour. The results of these calculations are given in Table 3.23.

Table 3.23 Summary of Ambient 24-hour Noise-level Metrics

Location	Brief Description	24-hour L_{eq}, dBA	L_{dn}, dBA	CNEL, dBA
LT-1*	Hayes Road	47.6	49.7	49.8
LT-2*	Baseline Road	46.4	49.8	50.0
LT-3	Sonoran Desert National Monument	39.7	45.4	45.4

Source: Mantee (2009).

Note: 24-hour L_{eq}, L_{dn}, dBA, and CNEL are defined above in Section 3.9.3 (Fundamentals of Acoustics).

* 24-hour metrics were calculated from 7 AM to the following 7 AM for these locations.

The time-history records for the surveyed sound levels over the 25-hour monitoring period are shown in Figures 3.3–3.5 for LT-1, LT-2, and LT-3, respectively.

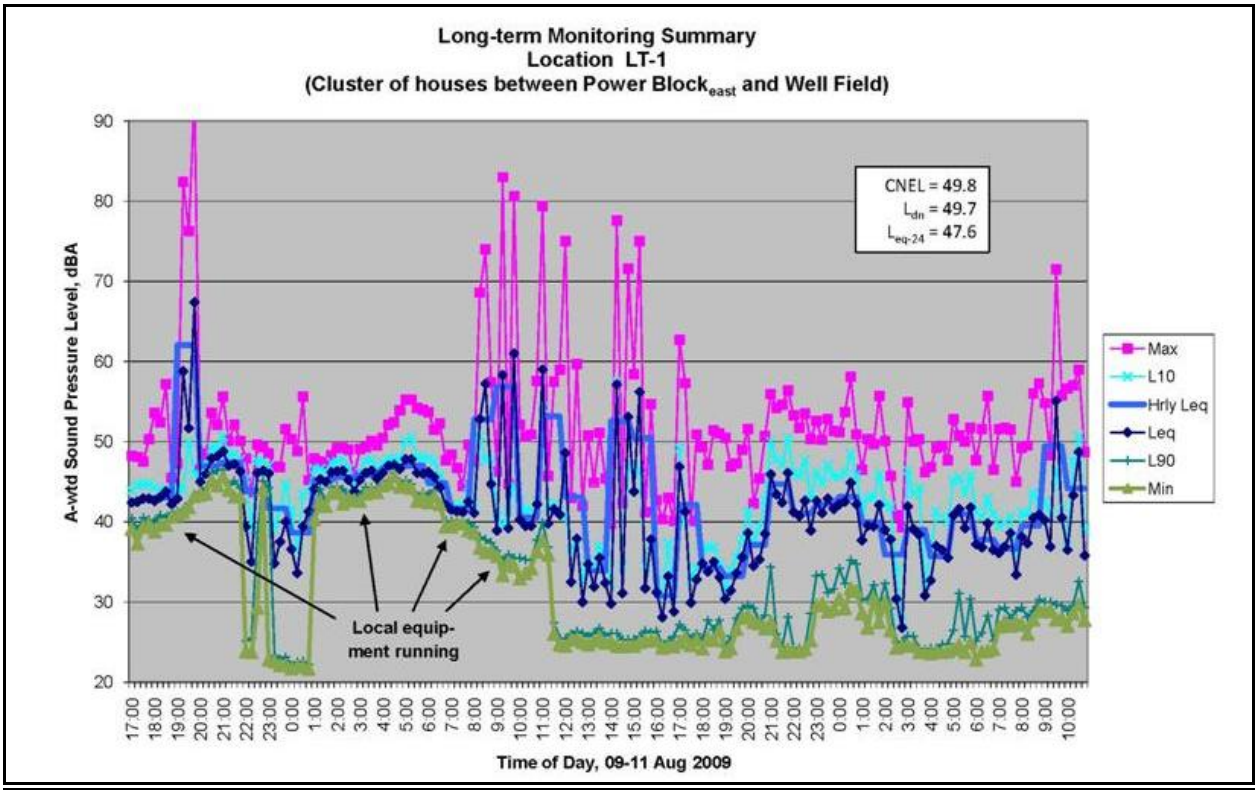

Figure 3.3 Ambient noise record for location LT-1.

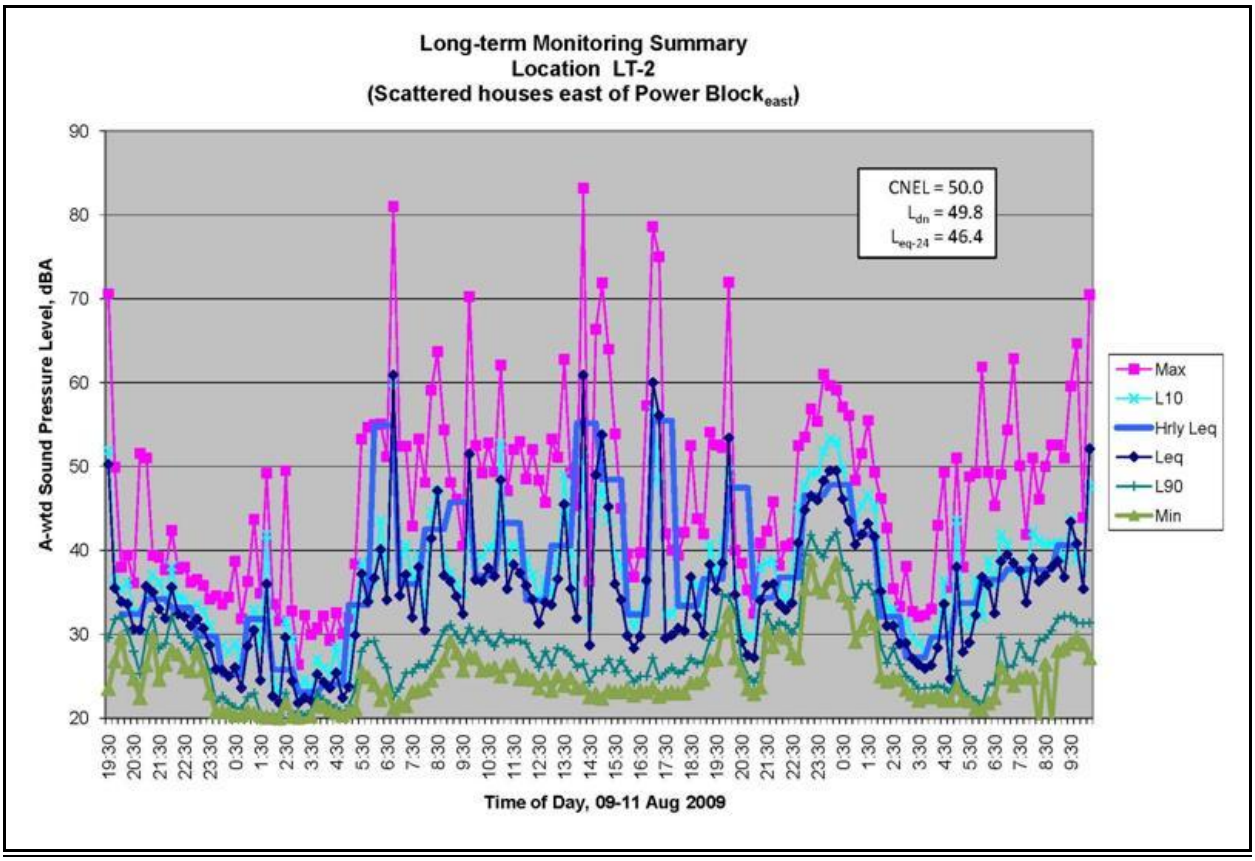

Figure 3.4 Ambient noise record for location LT-2.

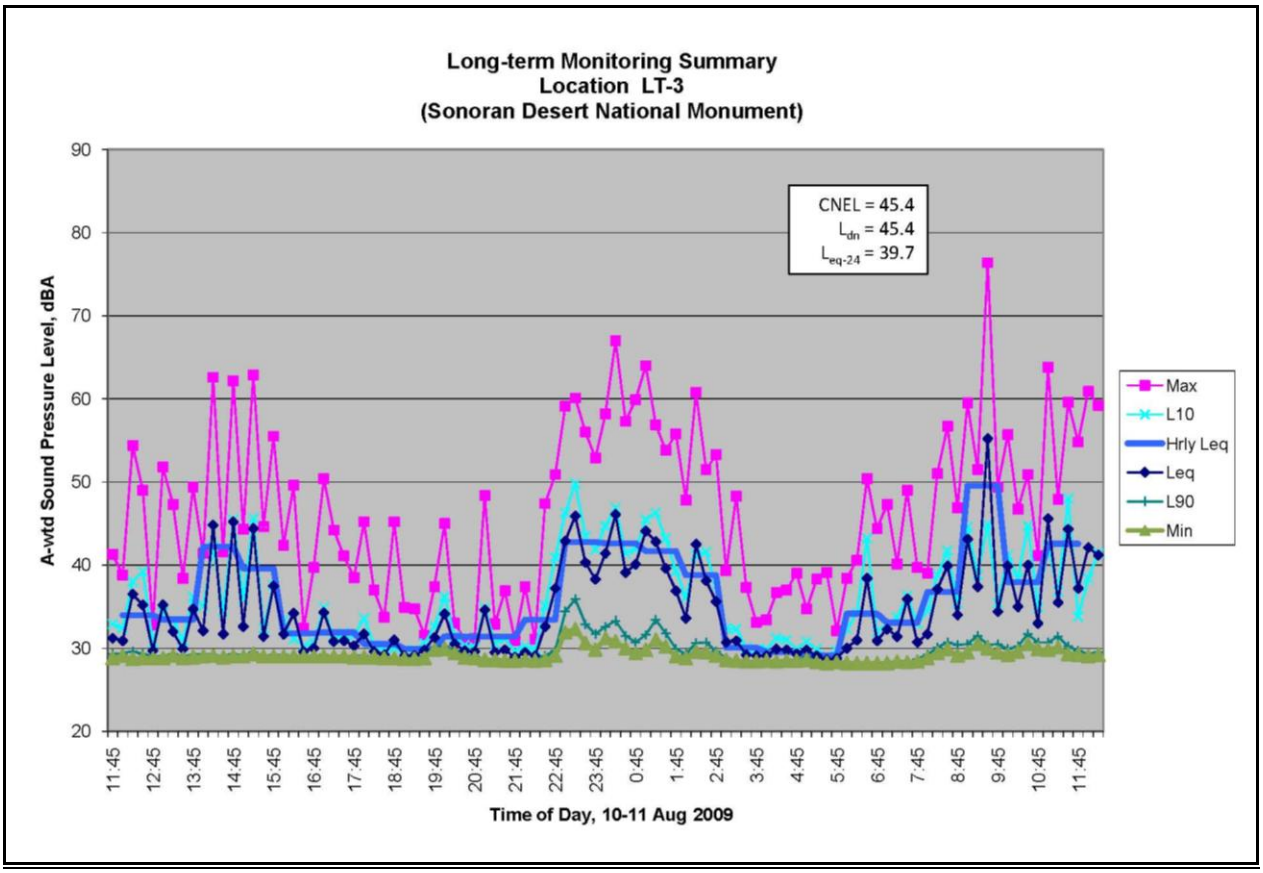

Figure 3.5 Ambient noise record for location LT-3.

Generally speaking, these long-term noise metrics indicate a very quiet environment, as would be expected for a sparsely populated, rural area with few noise sources. Besides the general low level din of these areas, other noise sources included aircraft flyovers (mostly military jets), sporadic dog barking and bird chirping, and localized events (such as running generators or air conditioning units). Very few cars or trucks were observed on Riggs Road, and even less local traffic was observed on the other access roads. The quietness of the overall environment is evidenced by the low levels (i.e., minimum sound pressure levels in the mid to low 20s dBA) during the late-night hours.

3.9.5.4 SHORT-TERM MEASUREMENTS AND RESULTS

To supplement the long-term monitoring, short-term noise readings were made at three locations around the Project Area. These short-term data acquisition sessions were each of 15 minutes' duration and were conducted at two different times of the day and night (nominally, daytime and nighttime) to gather additional information about the character and daily changes of the noise environment. Short-term sound levels are summarized in Table 3.24.

Table 3.24 Ambient Noise Measurements – Summary of Short-term Data

Location	Period	Date	Time	A-weighted Sound Level			A-weighted Statistical Sound Levels				
				Min(A)	L_{eq}(A)	Max(A)	L1	L10	L50	L90	L99
ST-1	Daytime	8/10/09	09:08	39.2	62.7	76.8	74.1	66.0	56.3	43.7	39.9
	Nighttime	8/11/09	01:31	39.5	56.3	73.4	70.3	57.9	44.3	41.2	39.8
ST-2	Daytime	8/10/09	12:33	24.4	33.8	45.9	43.1	37.4	30.2	26.3	24.4
	Nighttime	8/11/09	04:02	25.3	29.7	50.5	37.9	30.2	27.2	25.7	24.7
ST-3	Daytime	8/11/09	15:30	21.6	28.2	46.8	38.2	29.5	25.1	22.1	20.7
	Nighttime*			25.2	36.2	49.3	45.1	39.6	33.0	28.7	25.9

Notes: Daytime hours are between noon and 19:00; nighttime hours are between 22:00 and 07:00.

* Considered similar to location LT-3; data for ST-3 night are taken from a short-term measurement at LT-3.

As with the long-term data results, the lack of roadway, railway, industrial, or even farming sound sources results in a very quiet noise environment. Daytime L_{eq} levels in residential or recreational areas were typically in the upper 20s to mid 30s dBA (for locations away from SR-85 traffic). At night, the short-term measurements exemplified the extremely quiet characteristics of the residential/recreational areas, with L_{eq} values in the low 20s dBA. Other than barking dogs and insect activity, there were no observed noise sources at night. Even with the extremely quiet conditions, SR-85 traffic was not audible at the locations to the east of the Project Area, and there was no local vehicular traffic observed.

3.9.5.5 FREQUENCY-BAND MEASUREMENTS AND RESULTS

Third-octave band data measurements were also conducted at each of the six monitoring locations during selected periods of the daytime and nighttime. These data were very similar in their spectral shape and general lack of tonal components. The nontraffic spectra (i.e., other than location ST-1) have the same general downward trend with increasing frequency, which is typical for an outdoor ambient environment, because higher frequency noises are more readily absorbed in the atmosphere, as compared to low-frequency noises.

Examples of these representative spectra are given on Figure 3.6, which shows typical samples for the daytime, nighttime, desert, and traffic-related environments.

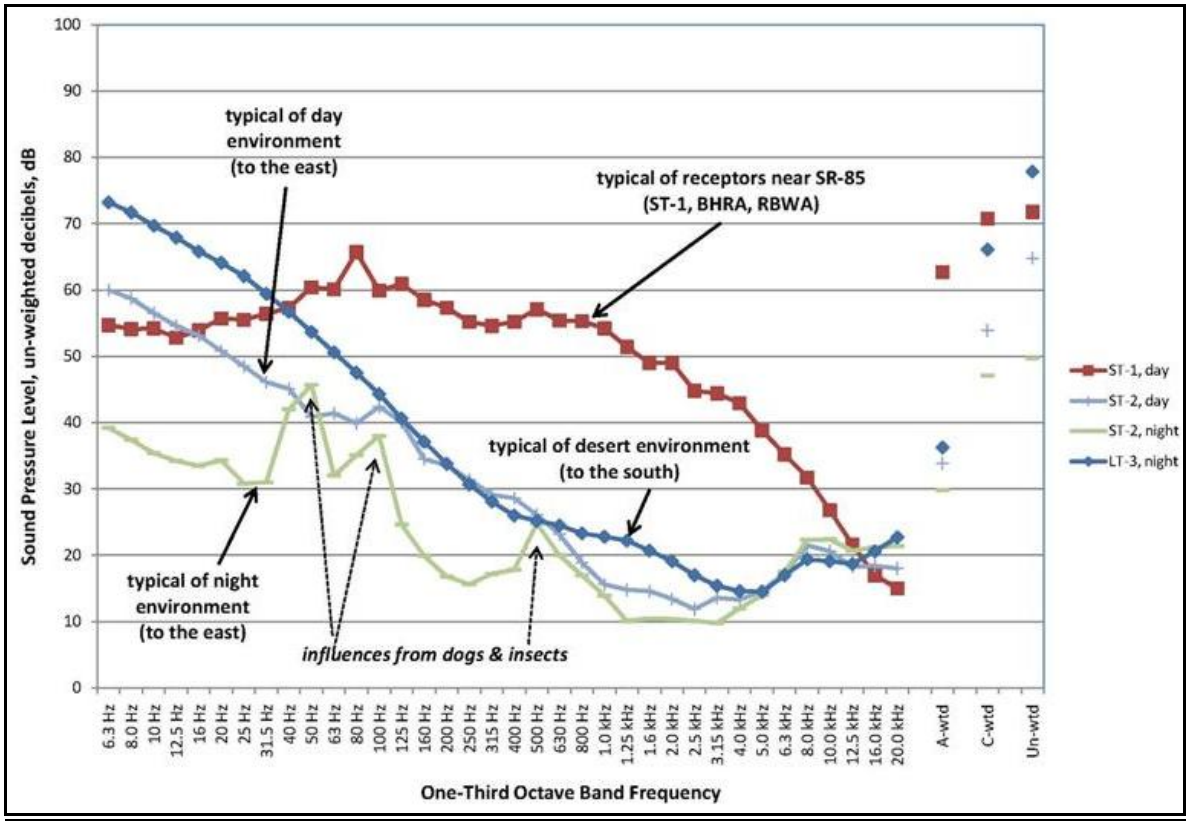

Figure 3.6 Typical ambient noise spectra.

Note: BHRA is referred to in the text as BHRP, or Buckeye Hills Regional Park.

3.9.6 Ambient Noise Summary

Field observations indicated that there are very few area-wide noise sources that are noteworthy (such as local traffic, industrial, commercial, or agricultural sources). The noise environments at the five residential/recreational measurement locations were very similar and are dominated by the general background noise effects during the majority of daytime hours. Typically, the lack of noise sources makes for the analysis area an extremely quiet environment. Even during these very quiet periods, the traffic on SR-85 (as exemplified by Location ST-1) was not audible, and the noise environment was mainly influenced by insects and distant dogs.

3.10 Paleontology

3.10.1 Overview

The SSEP would be located almost entirely on BLM-administered land south of the Buckeye Hills and the Town of Buckeye in Maricopa County, Arizona. The analysis area for paleontological resources lies in the Project Area boundary (see Section 3.1.1), because surface-disturbing activities that would affect fossils are limited to the Project Area.

3.10.2 Paleontological Potential

Information from the geological units and known fossil localities in the Phoenix metropolitan area were used to identify the paleontological potential in the Project Area. Paleontological potential levels have been assigned to each geological formation, based on discussions with paleontologists familiar with this area. The PFYC system was adopted by the BLM in 2007 for assessing paleontological potential on federal land (BLM 2007b). The PFYC system classifies geological units based on 1) the relative abundance of vertebrate fossils or of scientifically significant invertebrate and plant fossils and 2) the potential of these fossils to be adversely impacted. A higher class number indicates a higher potential for the presence of paleontological resources. This PFYC classification system is applied to the geological formation, member, or other distinguishable map unit, preferably at the most detailed mappable level. This system was followed in recognition of the direct relationship that exists between paleontological resources and the geological units in which fossils are entombed. Each PFYC class is defined in Table 3.25.

Table 3.25 Potential Fossil Yield Classification

Classification	Description
Class 1: Very Low Potential	These are geological units that are not likely to contain recognizable fossil remains. These units include igneous, metamorphic, and Precambrian rocks.
Class 2: Low Potential	These are sedimentary geological units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. These units include aeolian, diagenetically altered, and Holocene sediments.
Class 3: Moderate or Unknown Potential	These are fossil-bearing sedimentary geological units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.
Class 3a: Moderate Potential	These are units known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area.
Class 3b: Unknown Potential	These are units that exhibit geological features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or area is known. This may indicate the unit or area is poorly studied and field surveys may uncover significant fossils.
Class 4: High Potential	These are geological units that contain a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability.
Class 5: Very High Potential	These are highly fossil-bearing geological units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils.

Source: BLM (2007).

The Project Area is situated primarily on alluvial-fan deposits that are characteristic of the Little Rainbow Valley. The only geologic unit found in the Project Area is undivided Quaternary alluvium (Q). The likely source of this alluvial Quaternary-aged deposit is the Early Proterozoic granitic rock (Xg), which consists of igneous and metamorphic rocks that compose the core of the adjacent Buckeye Hills and Maricopa Mountains (AGS 2000; Cordiviola 1980). Additional information with respect to the geological unit in the Project Area is presented in Section 3.5 (Geology and Minerals).

The paleontological potential in the Project Area can be determined by integrating information from the Project Area's geological units with the paleontological resources inventory. To assess paleontological potential, the PFYC for each geological unit present in the Project Area is used. The only unit present is listed in Table 3.26 and illustrated on Map 16. Geological units with a PFYC of 3 to 5 would require monitoring during construction-related activities. Geological units with a PFYC of 1 or 2 would not require monitoring during construction-related activities. The entire Project Area has a PFYC 2 (Table 3.26) and a low paleontological potential rating (Kirby 2009b).

Table 3.26 Geological Units in the Project Area and their Potential Fossil Yield Classification and Paleontological Potential Rating

Geological Unit	Age	Acres	PFYC	Paleontological Potential Rating
Undivided Quaternary Alluvium (Q)	Pleistocene	3,702	2	Low

Undivided Quaternary alluvium is the principal valley-forming deposit in the Project Area. This deposit is middle to latest Pleistocene in age, or 250,000 years before present (B.P.) to 10,000 years B.P. (Demsey 1989). Surficial deposits generally consist of gravel lags, whereas subsurface deposits are characterized by well-sorted silt, sand, and gravel to cobbles. The undivided Quaternary deposits are assigned a PFYC level of 2 and are regarded as having low paleontological potential as the alluvial materials that comprise the geologic unit tends to move and do not bind to hold fossils in place. Intermittent deposits of cobble material would only require monitoring if they are encountered during construction activities.

3.11 Recreation and Wilderness Characteristics

3.11.1 Overview

The Project Area's limited recreational use includes mostly hiking, horseback riding, hunting, and motorized travel. However, the surrounding landscape accommodates many recreational uses. The Buckeye Hills Regional Park, the Sierra Estrella Wilderness, the Sonoran Desert National Monument, and the North Maricopa Mountains Wilderness are all located within 10 miles of the Project Area. The area of analysis for recreation and wilderness characteristics is not a defined polygon but rather any topographic point in these recreational areas where sights or sounds from the Project Area may be experienced by a visitor. Details about the area of analysis can be found in Chapter 4.

Although they are outside of the Project Area, these recreational areas or areas with wilderness characteristics may be impacted by project activities and would be considered in this analysis. Access to the analysis area could be affected by the construction and improvement of roads for the SSEP. There may also be visual and auditory impacts that could affect the visitor experience outside of the Project Area.

3.11.2 Laws, Ordinances, Regulations, and Standards

FLPMA (43 U.S.C. § 1701 et seq.) provides the authority for BLM land-use planning. It requires that public lands be managed in a manner that would protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, [the BLM] would preserve and protect certain public lands in their natural condition.

Section 201 of FLPMA requires BLM to prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values, which includes wilderness characteristics. Section 202 of FLPMA authorizes BLM to manage, as established through the land-use planning process, for the protection of recreational and wilderness values.

3.11.3 Recreation

For the purpose of recreation management, the BLM identifies public lands as either special recreation management areas (SRMA) or as ERMAs. SRMAs are areas where more intensive recreation management is needed because of their high usage, and where recreation is a principal management objective. ERMAs constitute all public lands outside of SRMAs and other special designation areas. ERMAs are areas where recreation is nonspecialized, dispersed, and does not require intensive management or developed facilities. Recreation may not be the primary management objective in ERMAs, and recreational activities are subject to few restrictions.

The BLM manages land in the Project Area as an ERMA. The Lower Gila South RMP (BLM 1985) describes recreational uses in the ERMA as providing dispersed, recreational opportunities such as rock climbing, hiking, hunting, camping, sightseeing, rock collecting, and OHV use (BLM 1988).

In addition, the BLM uses the ROS classifications to set recreation objectives for recreation management areas (Duncan 2009). Objectives are established to provide opportunities for desired recreation activities and to guide management of the setting needed to support those activities and the desired recreation experience.

The entire Project Area (approximately 3,620 acres) and the portions of the Sonoran Desert National Monument that are not designated wilderness (337,989 acres) are in the semiprimitive motorized category. The semiprimitive motorized objectives are established for areas typically characterized by a predominately unmodified, natural setting of moderate to large size. Activities include camping, hiking, climbing, photography, spelunking, hunting, and OHV use. The experience objective for this type of area provides for isolation from human civilization, a high degree of interaction with the natural environment, and a moderate degree of personal risk and challenge.

The Sierra Estrella Wilderness and the North Maricopa Mountains Wilderness are managed as primitive under ROS. The primitive management objective is given to areas typically characterized by a large area of about 5,000 acres or more, located at least 3 miles from the nearest point of motor vehicle access. It is essentially an unmodified natural landscape with little evidence of others and almost no on-site management controls. Activities include overnight backpack camping, nature study and photography, back-country hunting, horseback riding, wildlife observation, and hiking. The experience provides visitors with a chance to achieve solitude and isolation from human civilization, feel close to nature, and encounter a greater degree of personal risk and challenge (BLM 1995). The Buckeye Hills Regional Park, northwest of the Project Area is managed by Maricopa County. There are currently no designated trails in the park, although the *Buckeye Trails Master Plan* identifies multiple future trail corridors. The park is open to nonmotorized use, including hiking, bicycling, camping, and horseback riding. There is also a shooting range located in the park (Maricopa 2010).

3.11.4 Wilderness Characteristics

Section 201 of FLPMA requires BLM to prepare and maintain, on a continuing basis, an inventory of all public lands and their resource and other values, which includes wilderness characteristics (43 U.S.C. § 1711(a)). Inventories are completed to identify lands with wilderness characteristics and to provide consideration of those values in land-use planning. Inventories may also be completed to provide an assessment of the effects of an action on lands with wilderness characteristics. Areas with wilderness characteristics are lands outside of existing wilderness and WSAs that have been inventoried by BLM and found to have wilderness characteristics, as defined by Section 2(c) of the Wilderness Act or agency inventory policies. These areas are managed according to the prescriptions of the agency LUPs. For an area to have wilderness characteristics, it must meet the following criteria:

- **Naturalness**: The area must be in a generally natural condition.
- **Size**: The area must be at least 5,000 contiguous, roadless acres or large enough to preserve as wilderness.
- **Opportunities for solitude or primitive recreation**: The area must provide outstanding opportunities for solitude or a primitive or unconfined type of recreation.
- **Special features**: The area may contain ecological, geologic, or other features of scientific, scenic, or historic value.

The Project Area does not possess wilderness characteristics. BLM lands of sufficient size to meet the wilderness characteristics size criteria are not present due to roads that cross the BLM lands in and surrounding the Project Area. The Arizona Wilderness Coalition submitted a proposal in 2004 to the BLM LSFO to consider an area around Margie's Peak in the northwest part of the Sonoran Desert National Monument (southwest of the Project Area) as having wilderness character. The BLM has conducted a wilderness characteristics field inventory or assessment of this area and independently confirmed the presence of wilderness characteristics (BLM 2011). How the unit (13,427 acres) will be managed is currently under consideration in the revision of the LSFO's LUP.

3.12 Socioeconomics

3.12.1 Overview

The SSEP would be constructed in southwestern Maricopa County, as depicted in Map 17. Because the socioeconomic impacts would occur in both Maricopa County and the adjoining Pinal County, both counties are included in area of analysis for socioeconomics, hereafter referred to as the Socioeconomic Study Area (SESA) for the SSEP. A number of the closest communities are also addressed in the analysis, including the Town of Gila Bend, the City of Goodyear, and the Town of Buckeye. The Town of Buckeye has annexed the land on which most of the project facilities would be located.

3.12.2 Socioeconomic Conditions

3.12.2.1 POPULATION

Population estimates and projections for Pinal and Maricopa counties, and the closest towns and cities to the Project Area were collected from the U.S. Census Bureau (U.S. Census) and Maricopa Association of Governments (MAG 2007b), respectively. Table 3.27 summarizes these population figures. Maricopa County is the most populous county of Arizona's 15 counties, whereas Pinal County is the third most populous county in the state. These two counties comprise the Phoenix-Mesa-Scottsdale Metropolitan Statistical Area (Phoenix MSA). There have been no updates to these projections since 2007, and at this time, there are no other sources of population estimates and projections (personal communication, Anubhav Bagley 2009).

MAG assessed these population projections in 2007, prior to the current and recent economic downturn. Although the population projections were based on the best data available at the time, their accuracy is limited by three factors (Berger 2009). First, economic conditions in the area affect population totals. Second, migration (both domestic and international) to or from the area would affect the accuracy of population projections, which is often influenced by changing economic conditions. Finally, because the projections are based on the cities' LUPs, unforeseen changes in those LUPs might render the projections inaccurate (personal communication, Anubhav Bagley 2009). Population growth across the state has been slowing as a result of the economic downturn (Arizona Department of Commerce 2009c).

Table 3.27 Population Estimates and Projections

Area	2000	2005	2008	2010[2]	2020[2]	2030[2]
Phoenix MSA	3,251,876	3,883,892	4,281,899	–	–	–
Pinal County[1]	179,727	237,323	327,301	–	–	–
Maricopa	1,040	–	–	–	–	–
Casa Grande	25,224	–	–	–	–	–

Table 3.27 Population Estimates and Projections

Area	2000	2005	2008	2010[2]	2020[2]	2030[2]
Maricopa County[1]	3,072,149	3,646,569	3,954,598	4,216,499	5,230,300	6,135,000
Avondale	35,883	70,160	–	83,856	105,989	123,265
Buckeye	6,537	32,735	–	74,906	218,591	419,146
Gila Bend	1,980	2,118	–	2,575	3,950	9,074
Goodyear	18,911	47,520	–	71,354	174,521	299,397
Litchfield Park	3,810	6,787	–	8,587	10,305	10,510
Phoenix	1,321,045	1,510,177	–	1,695,549	1,990,450	2,201,843
Tolleson	4,974	6,491	–	7,748	9,646	10,193

[1] Data from U.S. Census (2009a, 2009b).

[2] The population projections for 2010, 2020, and 2030 are from MAG 2007b; he population estimate for the towns in Maricopa County for the year 2005 and for the projections into 2010 and beyond also come from MAG 2007b.

The population in Maricopa County was 3.1 million and grew 28% between 2000 and 2008, gaining nearly 900,000 residents over this period. The population of Pinal County was 179,727, growing 82% from 2000 to 2008, adding an additional 150,000 in population. Population growth rates for communities and counties in the SESA are summarized in Table 3.28. The communities of Buckeye, Goodyear, and Gila Bend are projected to grow substantially in population over the next 25 years; however, these population projections may be overestimated due to recent shifts in the economic vitality of the nation and region.

The communities closest to the Project Area are much smaller in population and more rural in nature than communities closer to Phoenix. For instance, Buckeye is less densely populated (92.9 people per square mile) compared to Goodyear, northeast of the site, which is much closer to the Phoenix metropolitan area (407.9 people per square mile).

Table 3.28 Population Growth Rates

Area	2000–2005	2005–2008	2005–2010	2010–2020	2020–2030
Phoenix MSA	19.4%	10.3%	–	–	–
Pinal County[1]	32.1%	37.9%	–	–	–
Maricopa	–	–	–	–	–
Casa Grande	–	–	–	–	–
Maricopa County[1]	18.7%	8.5%	15.6%	24.0%	17.3%
Avondale	95.5%	–	19.5%	26.4%	16.3%
Buckeye	400.8%	–	128.8%	191.8%	91.8%
Gila Bend	7.0%	–	21.6%	53.4%	129.7%
Goodyear	151.3%	–	50.2%	144.6%	71.6%
Litchfield Park	78.1%	–	26.5%	20.0%	2.0%
Phoenix	14.3%	–	12.3%	17.4%	10.6%
Tolleson	30.5%	–	19.4%	24.5%	5.7%

[1] Data from U.S. Census (2009a, 2000b) and MAG (2007b).

3.12.2.2 HOUSING

In 2000 there were 1,250,231 housing units in Maricopa County, 9.4% of which were vacant (U.S. Census 2009c). Between 2005 and 2007 the vacancy rate increased to 11.7% with approximately 174,000 units available in the county. In Pinal County during this period, there were 21,751 vacant housing units available. In Goodyear and Buckeye there were 1,929 and 865 housing units available on average between 2005 and 2007, respectively. Table 3.29 summarizes the housing characteristics of major population centers in the SESA during these two time periods.

In addition to local housing availability, there is ample short-term housing availability in the region in the form of hotels and motels. In 2009 there were 9, 21, and 10 hotels and motels in the communities of Buckeye, Goodyear, and Gila Bend, respectively, with many more hotel and motel accommodations available in the Phoenix metropolitan area.

There are approximately 30 widely dispersed parcels of low-density residential property that collectively contain approximately 50 individual residential units located within 2.0 miles east of the Project Area (see Section 3.7. Sixteen parcels are located within 1.0 mile of the eastern boundary of the Project Area. One of these is located within 0.1 mile of the Project Area boundary. Two dairies are located approximately 2.0 miles from the eastern Project Area boundary and are surrounded by agricultural lands.

Table 3.29 Housing Characteristics

Area	2000 Number of Units	2000 Vacant Units	2000 Percent Vacant	2005–2007 Number of Units	2005–2007 Vacant Units	2005–2007 Percent Vacant
Arizona State	2,189,189	287,862	13.1%	2,189,189	287,862	13.1%
Maricopa County	1,250,231	117,345	9.4%	1,492,572	173,949	11.7%
Avondale	11,419	779	6.8%	21,946	2,441	11.1%
Buckeye	2,344	186	7.9%	8,222	865	10.5%
Gila Bend	766	107	14.0%	n/a	n/a	n/a
Goodyear	6,771	592	8.7%	17,961	1,929	10.7%
Litchfield Park	1,633	125	7.7%	n/a	n/a	n/a
Phoenix	495,832	29,998	6.1%	543,568	5,653	11.0%
Tolleson	1,485	53	3.6%	n/a	n/a	n/a
Pinal County	81,154	19,790	24.4%	124,399	21,751	17.5%
Casa Grande	11,041	2,121	19.2%	18,956	2,572	13.6%
Maricopa City	329	37	11.2%	9,378	1,887	20.1%

Source: U.S. Census (2009c, 2009d).

Housing values, monthly mortgage costs, and monthly rental costs are generally lower in Gila Bend than in other communities near the Project Area. Buckeye generally has slightly lower housing values and costs when compared to Maricopa County, whereas Goodyear has slightly higher housing values and costs than those of the county. Pinal County's housing values are generally lower than those of Maricopa County. Table 3.30 summarizes these housing values and costs across the SESA. It should be noted that nationwide housing values have decreased since their peak in 2006. From 2007 to 2009, the median price of an existing home in Arizona decreased by 8% and up to 30% in some housing jurisdictions within the state (Arizona Department of Housing 2009).

Table 3.30 Housing Values and Costs

Area	2000 Median Housing Values	2005–2007 Median Housing Values	2000 Average Monthly Mortgage Costs	2005–2007 Average Monthly Mortgage Costs	2000 Median Monthly Gross Rental Costs	2005–2007 Median Monthly Gross Rental Costs
Arizona State	$121,300	$221,800	$1,039	$1,371	$786	$619
Maricopa County	$129,200	$248,800	$1,095	$1,470	$666	$845
Avondale	$129,200	$243,100	$1,141	$1,484	$583	$1,066
Buckeye	$86,400	$235,100	$919	$1,491	$433	$899
Gila Bend	$55,900	n/a	$663	n/a	$379	n/a
Goodyear	$156,800	$325,500	$1,195	$1,663	$793	$1,181
Litchfield Park	$169,400	n/a	$1,285	n/a	$795	n/a
Phoenix	$112,600	$230,300	$1,021	$1,402	$622	$778
Tolleson	$79,100	n/a	$986	n/a	$486	n/a
Pinal County	$93,900	$177,600	$894	$1,280	$509	$697
Casa Grande	$86,600	$166,900	$882	$1,260	$541	$736
Maricopa	$80,500	$261,000	$905	$1,671	$349	$1,322

Source: U.S. Census (2009c, 2009d); figures are in nominal dollars.

3.12.2.3 WAGES AND EMPLOYMENT

This section includes information on wages and employment for the State of Arizona, Maricopa County, Pinal County, and the Phoenix MSA. Table 3.31 shows the annual average wages by industry in the Phoenix MSA. The highest paying industries in 2008 in the Phoenix MSA were mining, real estate/rental/leasing, and professional, scientific, and technical services. The lowest annual average wages were in the following industries: accommodation and food services; arts, entertainment and recreation; and management of companies and enterprises.

Table 3.31 Annual Average Wages by Industry, Phoenix MSA 2008

Industry	Annual Average Wage
Accommodation and food services	$22,138
Administrative and Support and waste management	$40,323
Agriculture, forestry, fishing, and hunting	$41,835
Arts, entertainment, and recreation	$30,531
Construction	$48,399
Educational services	$40,323
Finance and insurance	$39,620
Health care and social assistance	$44,982
Information	$50,219
Management of companies and enterprises	$28,974
Manufacturing	$48,654
Mining	$70,334
Other services (except public administration)	$33,206
Professional, scientific, and technical services	$52,233
Public administration	$48,050
Real estate and rental and leasing	$57,820
Retail trade	$44,211
Transportation and warehousing	$47,914
Utilities	$40,861
Wholesale trade	$30,971

Source: Arizona Department of Commerce (2009a).

Table 3.32 and Table 3.33 summarize the employment by industry for Maricopa and Pinal counties, respectively. As of 2009 total employment in Maricopa County was 1.7 million, rising approximately 9% between 2001 and 2009. This was driven by growth in education and health services, other services, and leisure and hospitality industries. Declining employment during this period was in information, manufacturing, mining, and construction industries. The largest industries in Maricopa County were professional and business services and government.

Total 2009 employment was 49,625 in Pinal County, up 30% from 2001. Since 2000 all sectors in Pinal County have experienced growth in employment, with the largest growth over this time period in financial activities (73%); trade, transportation, and utilities (35%); mining and construction (33%); and educational and health services (33%). From 2001 to 2007 almost all of these industries experienced employment declines, with the exception of government and professional and business services. The government sector in Pinal County is the largest employer in the region, accounting for 39% of employment.

Table 3.32 Nonfarm Employment by Industry for Maricopa County, 2001–2009

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2009 Percent Employment	2001–2009 Percent Change
Educational and health services	140.8	149.6	156.7	169.6	180.0	192.2	201.9	212.9	212.0	13%	51%
Financial activities	128.8	130.4	132.9	137.7	146.0	152.2	152.1	146.2	140.5	8%	9%
Government	188.6	197.1	200.6	204.5	208.8	211.7	219.9	225.2	219.4	13%	16%
Information	41.3	39.1	37.2	34.3	33.0	32.0	30.8	31.2	30.2	2%	-27%
Leisure and hospitality	149.5	150.5	152.9	158.3	166.6	176.2	181.6	180.9	177.2	10%	19%
Manufacturing	150.3	135.0	128.3	129.0	133.1	136.2	133.3	127.4	120.6	7%	-20%
Mining and construction	127.8	125.7	128.9	140.9	163.2	179.2	168.4	140.0	106.1	6%	-17%
Other Services	58.0	60.4	61.3	62.9	64.7	69.4	70.4	72.5	69.3	4%	19%
Professional and business services	256.2	250.3	255.6	270.8	293.4	315.9	321.4	304.4	272.3	16%	6%
Trade, transportation, and utilities	318.2	319.0	321.5	333.2	354.4	371.1	383.0	374.0	350.0	21%	10%
Total	**1,559.5**	**1,556.9**	**1,575.8**	**1,641.2**	**1,743.0**	**1,836.0**	**1,862.8**	**1,814.7**	**1,697.6**	**100%**	**9%**

Source: Arizona Department of Commerce (2009b).

Note: Data in this table are in thousands, rounded to the nearest hundred.

Table 3.33 Nonfarm Employment by Industry for Pinal County, 2001–2009

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2009 Percent Employment	2001–2009 Percent Change
Educational and health services	2,875	3,450	3,825	4,000	4,025	4,100	4,200	3,950	3,825	8%	33%
Financial activities	825	850	850	900	1,025	1,200	1,500	1,525	1,425	3%	73%
Government	14,850	15,575	15,925	16,200	16,775	17,575	19,050	20,175	19,275	39%	30%
Information	300	300	300	300	300	325	375	375	350	1%	17%
Leisure and hospitality	2,975	2,950	3,175	3,550	3,850	4,225	4,575	4,025	3,600	7%	21%
Manufacturing	2,850	2,525	2,600	2,925	3,400	3,700	3,950	3,825	3,525	7%	24%
Mining and construction	2,900	2,650	2,400	2,675	2,850	3,650	4,225	4,450	3,850	8%	33%
Other services	1,275	1,225	1,250	1,275	1,350	1,575	1,625	1,625	1,375	3%	8%
Professional and business services	3,200	3,200	2,975	2,975	3,475	3,325	3,900	4,425	4,100	8%	28%
Trade, transportation, and utilities	6,150	6,500	7,150	7,425	7,675	8,400	8,775	9,025	8,300	17%	35%
Total	**38,200**	**39,225**	**40,450**	**42,225**	**44,725**	**48,075**	**52,175**	**53,400**	**49,625**	**100%**	**30%**

Source: Arizona Department of Commerce (2009b).

Employment figures for the communities in Maricopa County are shown in Table 3.34. Of the three closest cities or towns to the Project Area, Goodyear had the largest employment base in 2005 (15,794). For Goodyear, 27% of the employment is classified as "other" (primarily construction employment), followed by 26% in retail, and 24% in industrial occupations. Total employment in Buckeye in 2005 was 8,672, which consisted of 42% "other" (primarily construction), 29% public (e.g., government), and 15% industrial employment. Employment in Gila Bend was 1,077 in 2005, which consisted of 36% retail and 30% public employment.

Table 3.34 2005 Employment by Sector for Selected Cities in Maricopa County

Area	Total	Retail	Office	Industrial	Public	Other*
Avondale	12,315	5,656 (46%)	312 (3%)	537 (4%)	3,371 (27%)	2,439 (20%)
Buckeye	8,672	1,124 (13%)	78 (1%)	1,259 (15%)	2,537 (29%)	3,674 (42%)
Gila Bend	1,077	388 (36%)	0 (0%)	231 (21%)	319 (30%)	139 (13%)
Goodyear	15,794	4,029 (26%)	233 (1%)	3,838 (24%)	3,497 (22%)	4,197 (27%)
Litchfield Park	1,710	257 (15%)	34 (2%)	4 (0%)	466 (27%)	949 (55%)
Phoenix	811,513	168,457 (21%)	241,904 (30%)	169,419 (21%)	106,852 (13%)	124,881 (15%)
Tolleson	12,340	1,520 (12%)	53 (0%)	8,302 (67%)	1,707 (14%)	758 (6%)

Source: MAG (2007b).
*Other employment includes work-at-home and construction employment.

Maricopa County has been especially hard hit by the economic downturn, leading the nation in job losses and housing foreclosures, along with Las Vegas, Nevada and Riverside, California (Hoffman and McPheters 2009). Turmoil in the financial markets has severely affected the cost and availability of credit to both households and businesses, affecting the housing market and construction industries (Bernanke 2009).

Historical and projected employment is provided for the Phoenix MSA in Table 3.35. Between 2008 and 2010 the construction industry is expected to lose approximately 32,500 jobs. The financial activities sectors are estimated to lose 6,700 jobs during this time period. Total employment in the Phoenix MSA is between 2008 and 2010 and is expected to decrease by 128,300 jobs. Similarly, the unemployment rate (the percentage of people who are unemployed and seeking work) has risen in the Phoenix MSA from 5.1% in July 2008 to 8.4% in July 2009 (Arizona Department of Commerce 2009c).

Table 3.35 Employment by Industry for the Phoenix MSA, 2001–2009 (annual percentage change in parentheses)

Industry	2006	2007	2008	2009 Projected	2010 Projected
Construction	180.1 (9.9%)	169.4 (-5.9%)	140.7 (-16.9%)	110.5 (-21.5%)	108.2 (-2.0%)
Educational and health services	196.3 (6.6%)	206.2 (5.0%)	216.9 (5.2%)	219.5 (1.2%)	222.4 (1.3%)
Financial activities	153.4 (4.4%)	153.6 (0.1%)	147.8 (-3.8%)	142.6 (-3.5%)	141.1 (-1.1%)
Government	229.2 (1.6%)	238.7 (4.1%)	245.5 (2.8%)	240.2 (-2.1%)	238.6 (-0.7%)
Information	32.4 (-2.7%)	31.2 (-3.7%)	31.6 (1.3%)	30.1 (-4.6%)	29.6 (-1.8%)
Leisure and hospitality	180.5 (5.9%)	186.2 (3.2%)	184.9 (-0.7%)	178.2 (-3.6%)	177.0 (-0.7%)
Manufacturing	139.9 (2.5%)	137.2 (-1.9%)	131.2 (-4.4%)	129.9 (-5.6%)	121.4 (-2.0%)
Natural resources and mining	2.7 (22.7%)	3.2 (18.5%)	3.7 (15.6%)	3.5 (-6.0%)	3.4 (-2.0%)
Other services	71.0 (7.6%)	72.1 (1.5%)	74.1 (2.8%)	71.1 (-4.0%)	71.8 (1.0%)
Professional and business services	319.2 (7.5%)	325.3 (1.9%)	308.9 (-5.0%)	283.9 (-8.3%)	278.6 (-1.7%)
Trade, transportation, and utilities	379.5 (4.8%)	391.7 (3.2%)	383.0 (-2.2%)	354.8 (-7.4%)	347.8 (-2.0%)
Total nonfarm employment	**1,884.1 (5.4%)**	**1,914.9 (1.6%)**	**1,868.3 (-2.4%)**	**1,757.8 (-5.9%)**	**1,739.9 (-1.0%)**

Note: Data in this table are in thousands, rounded to the nearest hundred.

Source: Arizona Department of Commerce (2009c).

3.12.2.4 INCOME

In 2000 the Town of Gila Bend and the City of Maricopa had the lowest median household and per-capita income levels compared to other communities in Maricopa and Pinal counties. The City of Goodyear had a higher median household income compared to the two counties and to the state, although the city's per-capita income levels were fairly consistent with those of Maricopa County. In 2000 Litchfield Park had much higher income levels compared to adjacent communities in the SESA. The Town of Buckeye had lower per-capita income levels compared to those of Maricopa County, but had consistent median household income levels with the county in 2007. These figures are summarized in Table 3.36.

Table 3.36 Median Household Income and Per Capita Income (2009$)

Area	2000 Median Household Income	2005–2007 Median Household Income*	2000 Per Capita Income	2005–2007 Per Capita Income*
Arizona State	$51,888	$49,968	$25,939	$25,274
Maricopa County	$58,029	$55,046	$28,467	$27,251
Avondale	$62,884	$60,277	$21,645	$21,446
Buckeye	$45,267	$56,392	$19,992	$20,149
Gila Bend	$34,408	n/a	$13,808	n/a
Goodyear	$73,552	$76,224	$28,793	$28,278
Litchfield Park	$91,953	n/a	$48,350	n/a
Phoenix	$52,718	$48,543	$25,373	$24,022
Tolleson	$49,604	n/a	$17,587	n/a
Pinal County	$45,872	$46,293	$20,502	$21,407
Casa Grande	$47,607	$42,669	$20,363	$20,427
City of Maricopa	$39,180	$70,323	$11,738	$31,880

Source: U.S. Census (2009e, 2009f).

Note: Figures were adjusted for inflation using the Consumer Price Index published by the U.S. Bureau of Labor Statistics and are reported in 2009 dollars.

*The 2005–2007 American Community Survey 3-year estimates are based on data collected between January 2005 and December 2007.

3.12.2.5 QUALITY OF LIFE CONDITIONS

Population, housing, and income statistics provide a cursory glimpse of the sociologic conditions in any given area. In order to gain a deeper sense of the communities closest to the Project Area (those likely to be most directly impacted by the SSEP), it is necessary to look at additional, local, long-range planning documents, the public scoping report, and other affected environment resource sections in this document.

The communities closest to the Project Area, Buckeye and Goodyear, have historically been considered rural with a farming and ranching-based economy (Town of Buckeye 2008a, City of Goodyear 2003; see Map 11). However, with tremendous population growth in the past decade, these rural to moderately developed communities are poised to become socially and economically diverse bedroom communities of the Phoenix metropolitan area. According to each communities' general plan, the local residents are interested in maintaining the traditional values of a rural western community (e.g., independence, free enterprise, community involvement) while fostering sustainable growth and constructive values. Although the communities would like to invite a multifaceted economic base to the area that would allow residents to live, work, and recreate in these cities, they would also like to maintain the historical connections to the agricultural, visual, and physical landscape characteristics of the past.

The 2005 *Buckeye Parks, Trails and Open Spaces Master Plan* suggests an active population that considers recreation, parks, and trails as important components in their community. The Town of Buckeye has emphasized the importance of viewsheds and connectivity to regional parks, national monuments, and riverways and identifies them as important features of their community (Town of Buckeye 2005). Nearby opportunities for recreation include the 487,000-acre Sonoran Desert National Monument. It is located 1 mile south of the Project Area and is home to recreational activities, including hiking, backpacking, star-gazing, camping, hunting, motor touring, sightseeing, photography, and horseback riding. The North Maricopa Mountain Wilderness is located approximately 3 miles south of the

Project Area and the Buckeye Hills Recreation Area and Robbins Butte Wildlife Area are located northwest of the Project Area. For more information on the recreation opportunities of the area, see Section 3.11.

Current traffic and noise conditions also provide a snapshot of local community characteristics. A recently completed traffic study of the area around the Project Area found that there is little to no traffic during morning and afternoon peak hours. The lack of congestion, even at unsignalized intersections, reflects the rural sense of community. For more detail on traffic and transportation see Section 3.15. To further emphasize the rural nature of the Project Area, recent noise studies conducted in and near the Project Area found the noise environment to be extremely quiet (see Section 3.9).

3.12.3 Fiscal Conditions

Maricopa County: There are three funds that Maricopa County uses for its operations: General Operations Fund; the Detention Operations Fund; and the County Improvement Debt Fund. Table 3.37 shows the total revenues, by category, associated with each fund at the end of the 2007–2008 fiscal year. The significant revenue sources for these funds include taxes (65%) (county-levied, general sales, and vehicle license taxes), charges for services (14%), and operating grants (13%) of total governmental revenues for Fiscal Year 2008.

Table 3.37 2007–2008 Maricopa County Revenues (thousands)

Revenue	General Operations Fund	Detention Operations Fund	County Improvement Debt Fund
Charges for services	$42,716	$33,047	$3,055
Fines and forfeits	$16,902	–	–
Intergovernmental	$614,212	$2,926	–
Licenses and permits	$1,668	–	–
Miscellaneous	$32,663	$9,944	$2,201
Special assessments	–	–	–
Taxes	$439,936	$138,064	–
Total revenues	**$1,148,097**	**$183,981**	**$5,256**

Source: Maricopa County Department of Finance (MCDF) (2008).

Table 3.38 shows the expenses associated with these accounts for the 2007–2008 fiscal year (July 1 through June 30). Public safety, and health, welfare, and sanitation comprise the largest expenditure items in Maricopa County.

Table 3.38 Maricopa County Expenditures for 2007–2008 Fiscal Year (thousands)

Expense	General Operations Fund	Detention Operations Fund	County Improvement Debt Fund
Current			
General government	$166,959	–	–
Public safety	$445,647	$299,735	–
Highways and streets	–	–	–
Health, welfare, and sanitation	$239,742	–	–

Table 3.38 Maricopa County Expenditures for 2007–2008 Fiscal Year (thousands)

Expense	General Operations Fund	Detention Operations Fund	County Improvement Debt Fund
Culture and recreation	$1,761	–	–
Education	$2,273	–	–
Debt Service			
Principal	–	–	$12,621
Interest	–	–	$8,972
Other expenditures	–	–	$4
Capital outlay	$45,756	$10,441	–
Total expenditures	**$902,138**	**$310,176**	**$21,597**
Difference Between Revenue (Table 3.37) and Expenditures (Table 3.38)	$245,960	-$126,195	-$16,341

Source: MCDF (2008).

Pinal County: The Pinal County Finance Department describes county governmental revenues and expenditures within five funds. The General Fund is the primary operating fund for Pinal County (Pinal County 2009). The Public Works Highway Fund was established to fund road maintenance and operations, pavement preservation, and fleet services. The Road Tax Districts Fund exists on revenues generated via the Pinal County Transportation Excise Tax and funds construction, maintenance, repair, and development of county roads, streets, and bridges. Development impact fees assessed on all new developments in unincorporated areas in the county support parks, streets, and public safety programs, and contribute to the Development Impact Fee fund. In addition, there are other governmental funds, such as major enterprise funds, internal service funds, investment trust funds, and agency funds (Pinal County 2009). Table 3.39 and Table 3.40 summarize the Pinal County revenues and expenditures, respectively.

Table 3.39 Pinal County Revenues for the 2007–2008 Fiscal Year (thousands)

Revenue	General Fund	Public Works Highway Fund	Road Tax Districts Fund	Development Impact Fee Fund	Other Governmental Funds	Total
Charges for services	$17,666	$1	–	$10,122	$7,496	**$35,285**
Contr butions	$20	$10	$80	–	$2,498	**$2,608**
Fines and forfeits	$2,087	–	–	–	$1,377	**$3,464**
Intergovernmental	$37,209	$22,505	$143	–	$32,257	**$92,114**
Investment earnings	$1,844	$481	$835	$629	$2,795	**$6,584**
Licenses	$3,544	–	–	–	$2,252	**$5,796**
Miscellaneous	$594	$153	–	–	$4,301	**$5,048**
Rentals	$40	–	–	–	$751	**$791**
Taxes	$92,540	–	$6,308	–	$10,594	**$109,442**
Total revenues	**$155,544**	**$23,150**	**$7,366**	**$10,751**	**$64,321**	**$261,132**

Source: Pinal County (2009).

Table 3.40 Pinal County Expenditures for the 2007–2008 Fiscal Year (thousands)

Expense	General Fund	Public Works Highway Fund	Road Tax Districts Fund	Development Impact Fee Fund	Other Governmental Funds	Total
Current						
General government	$71,154	–	–	–	$1,807	**$72,961**
Public safety	$60,880	–	–	–	$21,443	**$82,323**
Highways and streets	–	$25,230	$3,809	–	$7,220	**$36,259**
Sanitation	$486	–	–	–	$415	**$901**
Health	$19,864	–	–	–	$10,608	**$30,472**
Welfare	$932	–	–	–	$5,028	**$5,960**
Culture and recreation	$128	–	–	–	$1,269	**$1,397**
Education	$747	–	–	–	$9,624	**$10,371**
Debt Service						
Principal retirement	$10	$712	–	–	$6,898	**$7,620**
Interest	$2	$145	–	–	$7,486	**$7,633**
Costs of issuance	$86	–	–	–	–	**$86**
Miscellaneous	–	–	–	–	$11	**$11**
Capital outlay	–	–	–	–	$19,760	**$19,760**
Total expenditures	**$154,289**	**$26,087**	**$3,809**	**–**	**$91,569**	**$275,754**
Difference Between Revenue (Table 3.39) and Expenditures (Table 3.40)	$1,255	$-2,937	$3,557	$10,751	$-27,248	-$14,622

Source: Pinal County (2009).

3.12.4 Public Services and Utilities

3.12.4.1 EMERGENCY SERVICES

Fire and medical emergencies in the Project Area would be serviced by the Town of Buckeye Fire Department. The department has six fire stations, each having its own fire truck. The department does not own any ambulances; however, paramedics are always sent out as part of the team responding to calls.

In the event that an ambulance is needed, the main dispatch center (in Phoenix) would dispatch an ambulance from the Buckeye Valley Fire District (separate from the Buckeye Fire Department). In most cases, patients needing hospitalization would be taken to the closest hospital, the West Valley Hospital in Goodyear, approximately 38 miles from the Project Area. Patients may also be taken to the Estrella Hospital in Phoenix. For most medical emergencies in the Project Area, dispatchers would immediately send an ambulance along with the fire truck, due to the distance from Buckeye (personal communication, Erica Van Valkenburg 2009).

Law enforcement services for the SSEP would be provided by the Buckeye Police Department, which currently has one main station and 70 officers (personal communication, Don Homan 2009).

3.12.4.2 ELECTRICITY AND NATURAL GAS

APS is Arizona's largest electricity utility, and it serves more than one million customers in 11 of the state's 15 counties; this includes service in Goodyear, Gila Bend, and Buckeye. Southwest Gas Corporation provides natural gas to customers in this region.

3.12.4.3 WATER AND WASTEWATER

Gila Bend, Goodyear, and Buckeye each have their own water departments that oversee water supply and wastewater services. The Gila Bend Municipal Water Department oversees the provision of water supply and the treatment of wastewater. The total number of water supply service connections is approximately 800 for approximately 1,800 people. Gila Bend pumps its own water, sends it to a treatment plant that reduces the water's naturally high fluoride content, and then distributes it to consumers.

The Goodyear Public Works and Water Resources Department oversees water supply and wastewater services in Goodyear, supporting 50,000 individuals. There are three wastewater treatment plants, for which the total capacity is 5.5 million gpd (personal communication, Reuben Zaloz 2009).

Buckeye's Department of Water Resources oversees water production, treatment, and distribution, as well as wastewater treatment. Buckeye's water is supplied by groundwater pumped from the West Salt River Valley Sub-basin and the Hassayampa Sub-basin (Town of Buckeye 2008b). Storage reservoirs supply water to over 9,000 customers. The town also provides flood irrigation to 460 customers. Buckeye has four wastewater treatment facilities, with a capacity of 7.2 million gpd (Town of Buckeye 2009).

3.12.4.4 SOLID WASTE

Solid waste services in Gila Bend are overseen by the Gila Bend Municipal Water Department. Trash generated in Gila Bend is delivered to a landfill in Buckeye, Arizona. This sanitary landfill, the Southwest Regional Landfill, is located directly west of SR-85 and the Project Area. Gila Bend does not have recycling, hazardous waste, or any other types of special solid waste programs (personal communication, Joanne Carpenter 2009).

In Goodyear, solid waste services are managed by the Goodyear Public Works and Water Resources Department and contracted to Waste Management Services, which owns eight garbage trucks. These trucks serve approximately 20,000 households and businesses. Trash is taken to a landfill in Surprise, Arizona approximately 50 miles north of the Project Area; recycling services are also overseen by Waste Management (using two recycling trucks), and the recycling facilities are located in downtown Phoenix.

The Goodyear Public Works and Water Resources Department had a hazardous waste management program, but did not have the budget to support it. Households with hazardous waste now make their own arrangements with contractors (personal communication, Willy Alizondo 2009).

The Southwest Regional Landfill, located approximately 3 miles west of the Project Area, is the closest landfill to the Project Area and the only landfill in the Town of Buckeye. The landfill currently has abundant capacity to accommodate additional debris (personal communication, Kathy Lugo 2009).

3.12.4.5 SCHOOLS

There are a number of school districts in the communities of Buckeye, Gila Bend, and Goodyear. The Project Area is located in the Buckeye Union High School District of Maricopa County, which has four high schools. Buckeye Academy is a special learning center for which students from the other three schools must apply independently. For this reason, the total number of students enrolled in the Buckeye

Academy is inclusive of the total number of students enrolled in the other three schools, and no student figures are given for the Buckeye Academy. This district encompasses the elementary school districts of Arlington, Buckeye, Liberty, and Palo Verde. Between the four elementary school districts, there are 14 elementary schools, which host kindergarten through eighth grade. A summary of school information and enrollment for the Buckeye schools is provided in Table 3.41.

Table 3.41 Summary of Schools in the Buckeye Union High School District

District	Schools	Grades Provided	Number of Students for 2009–2010 School Year	Notes on Enrollment
Buckeye Union High School District	Buckeye Union	9–12	1,504	Enrollment in these schools is growing; however, this enrollment growth is lower than rates experienced in previous years. Growth has been 18% per year in the past, but for 2009 to 2010 it was approximately 7%. School officials believe this is due to residents leaving the district.
	Estrella Foothills	9–12	988	
	Youngker High School	9–11	1,127	
	Buckeye Academy	9–12	n/a	
Arlington Elementary School District	Arlington Elementary	Kindergarten –8 (K–8)	280	Enrollment is increasing in this school, with 2009–2010 school year showing growth that has been typical of the past 5 years.
Buckeye Elementary School District	Buckeye Primary	K–4	610	Enrollment for the 2009–2010 school year is approximately the same as that of the 2008–2009 school year, indicating no growth in student enrollment. In recent years, there have been increases in enrollment. Enrollment growth is expected to occur as the school year progresses.
	Buckeye Middle	5–8	330	
	Bales Elementary	K–8	704	
	Steven R. Jasinski	K–8	768	
	Inca Elementary	K–8	647	
	Sundance Elementary	K–8	836	
	West Park Elementary	K–8	584	
Liberty Elementary School District	Estrella Mountain Elementary	K–8	Approx. 700 students per school	Enrollment for the 2009–2010 school year in this district has declined by approximately 180 students. In recent years, enrollment has grown by 5% to 10% per year.
	Freedom Elementary	K–8		
	Liberty Elementary	K–8		
	Rainbow Valley Elementary	K–8		
	Westar Elementary	K–8		
Palo Verde Elementary School District	Palo Verde Elementary	K–8	500	Enrollment for the 2009–2010 school year has been higher than average (30%–35% new students, whereas 20% would be typical)

Source: Personal communication, Marsha Conner (2009); Nancy Eaton (2009); Jodi Obenstein (2009); Candy Rio (2009); and Chad Turner (2009).

The City of Goodyear is served by two school districts: the Agua Fria Union High School District and the Avondale Elementary District. Both of these districts include schools that are in Goodyear, as well as Avondale and Buckeye. High schools in the Agua Fria Union High School District are also fed by graduates from the Litchfield Park Elementary District; for this reason, Table 3.42 includes a description of the schools in Litchfield Park, as well as those in the City of Goodyear.

Table 3.42 Summary of Schools in the Agua Fria Union High School District

District	Schools	Grades Provided	Number of Students for 2009–2010 School Year	Location of School
Agua Fria Union High School District	Agua Fria High School	9–12	1,798	Avondale
	Desert Edge High School	9–12	1,597	Goodyear
	Millennium High School	9–12	1,751	Goodyear
	Verrado High School	9–12	294	Buckeye
Avondale Elementary District	Centerra Mirage	K–8	800	Goodyear
	Desert Star	K–8	981	Goodyear
	Desert Thunder	K–8	937	Goodyear
	Eliseo C Felix School	K–8	665	Goodyear
	Lattie Coor School	K–8	1,232	Avondale
	Michael Anderson	K–8	873	Avondale
	Wildflower School	K–8	618	Goodyear
Litchfield Elementary District	Barbara B. Robey Elementary School	PreK–5	780	Litchfield Park
	Corte Sierra Elementary School	PreK–6	854	Litchfield Park
	Litchfield Elementary School	K–5	869	Litchfield Park
	Palm Valley Elementary	PreK–6	881	Litchfield Park
	Rancho Santa Fe Elementary School	K–8	881	Litchfield Park
	Scott L. Libby Elementary School	K–6	710	Litchfield Park
	Verrado Middle School	K–8	1,102	Litchfield Park
	Western Sky Middle School	6–8	927	Litchfield Park
	White Tanks Learning Center	K–8	20	Litchfield Park
	Wigwam Creek Middle School	6–8	1,111	Litchfield Park

Source: Personal communication, Rita Hagen (2009); National Center for Education Statistics (2009).

All of the schools in the Gila Bend Unified High School District and the Paloma Elementary District are located in Gila Bend. Graduates from the Paloma Elementary District attend Gila Bend High School. Gila Bend school information and enrollment is summarized in Table 3.43.

Table 3.43 Summary of School Districts in Gila Bend

District	Schools	Grades Provided	Number of Students for 2009–2010 School Year
Gila Bend Unified District	Gila Bend High School	9–12	167
	Gila Bend Elementary	K–8	331
Paloma Elementary District	Paloma Elementary School	K–8	79

Source: Personal communication, Burma Garcia (2009); personal communication, Peggy Carey (2009).

3.12.5 Environmental Justice

Consideration of environmental justice (EJ) issues is mandated by EO 12898, which was published on February 11, 1994. This EO requires that all federal agencies incorporate EJ into their mission by "identifying and addressing…disproportionately high and adverse human health or environmental effects of [their] programs, policies and activities on minority and low-income populations in the United States" (EPA 1994). The goal of the EO is to ensure that 1) all people are treated fairly with respect to the development and enforcement of protective environmental laws, regulations, and policies; and 2) potentially affected community residents are meaningfully involved in the decisions that would affect their environment and/or their health. Conversely, allegations of environmental injustice refer to situations in which these social justice goals have not been met, indicating a perceived disproportionate exposure to environmental harms and risks. Examples of such risks may include health concerns (such as those associated with indoor and outdoor air quality issues, water quality issues, noise, and others), impacts to livelihood and subsistence, and/or other impacts to human health and prosperity.

The EPA defines a community with potential EJ populations as one that has a greater percentage of minority or low-income populations than does an identified reference community. Minority populations are those populations having 1) 50% minority population in the affected area or 2) a significantly greater minority population than the reference area (EPA 1998a). The EPA has not specified what percentage of the population can be characterized as "significant" in order to define EJ populations. Therefore, for the purposes of this analysis, a conservative approach is used to identify potential EJ populations; it is assumed that if the affected area minority and/or poverty status populations are more than 10 percentage points higher than those of the reference area, there is likely an EJ population of concern. Low income populations were defined as those individuals that are considered living below poverty levels. The U.S. Census Bureau defines poverty level thresholds for individuals and a family of four as income levels below $8,501 and $17,029, respectively (U.S. Census 2003).

Typically, the EJ analysis is undertaken at the census block group level, which allows an assessment of both poverty and minority populations. However, due to the rural nature of the region, the census block groups encompass a large area and do not provide the detail needed to understand the potentially affected populations near the Project Area. Therefore, it was necessary to analyze populations in census blocks, which provides a more-detailed assessment on populations closest to the Project Area. A census block group is made up of census blocks. However, at the census block level only minority information was available, whereas poverty data were not available. Therefore, the EJ populations identified for this analysis were based solely on minority statistics.

The reference areas were determined to be Maricopa County and the State of Arizona, which are larger geographic areas with which to compare the census blocks. Relevant ethnicity data for the census blocks were used to determine whether populations residing in the affected area constitute a potential EJ population. This was done by comparing minority statistics for the blocks with those reported for

Maricopa County and the State of Arizona. The most current data available at the census block level were from 2000.

A potential EJ population was determined to exist in certain census blocks if the minority population (i.e., a nonwhite population) is more than 10 percentage points higher than the minority population in one of the reference communities (Maricopa County or the State of Arizona). Map 18 shows the potential EJ populations based on minority population percentages in the census blocks within the 5-mile radius of the Project Area. This includes census blocks that had more than 20 residents as measured by the 2000 Census. Within each census block, the minority populations range from 31 to 125 residents, and there are a total of 612 minority residents within the 5-mile radius of the Project Area. Table 3.44 summarizes these racial proportions for the relevant census blocks.

As shown in Map 18, the potential EJ populations located closest to the Project Area are directly north and slightly east of the Project Area. There are nine census blocks with potential EJ populations within 5 miles of the Project Area. These potential EJ populations have larger proportions of African American, Hispanic or Latino, Native American, or some other race when compared to populations in Maricopa County and the State of Arizona (U.S. Census 2009g). The purple and red highlighted census blocks indicate a greater proportion of minority residents or the existence of more than one minority group (e.g., Hispanic or Latino and Native American). The closest census block with a potential EJ population is approximately 2 miles north of the Project Area.

Table 3.44 2000 Ethnicity Percentages for Blocks of Potential Environmental Justice Populations

Race or Population	United States	State of Arizona	Maricopa County	Census Block 1055	Census Block 1051	Census Block 1054	Census Block 1077	Census Block 1029	Census Block 1030	Census Block 1045	Census Block 1053	Census Block 1037
White	75.10%	75.46%	77.32%	38.84%	64.17%	78.04%	61.95%	76.92%	82.50%	70.00%	69.23%	67.24%
Black or African American	12.21%	3.01%	3.63%	14.05%	0.00%	0.00%	1.09%	0.00%	0.00%	26.67%.	0.00%	0.00%
American Indian and Alaska Native	0.87%	4.94%	1.80%	5.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.08%	13.79%
Asian	3.61%	1.78%	2.16%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Native Hawaiian and other Pacific Islander	0.13%	0.12%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Some other race	5.49%	11.64%	11.89%	41.32%	35.82%	21.95%	36.96%	23.08%	17.50%	3.33%	27.69%	18.97%
Hispanic or Latino	12.52%	25.25%	24.85%	46.40%	35.82%	46.34%	65.31%	30.59%	35.71%	19.35%	33.85%	20.69%
Total population	**281,421,906**	**5,130,632**	**3,072,149**	**125**	**67**	**41**	**98**	**85**	**42**	**31**	**65**	**58**

Note: According to the 2000 Census, a person may identify themselves as falling within one of six race categories shown in the table above. People who identify with the terms "Hispanic" or "Latino" are identifying their origin, heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States. Someone who identifies themselves as Spanish, Hispanic, or Latino can be of any race.

Source: U.S. Census (2009h).

As indicated above, the most recent population data available at the census block level are from the 2000 Census. Recent changes in ethnicity around the Project Area were assessed by comparing 2000 Census data and 2008 data from the Census Bureau's Population Estimates Program in Maricopa County. Table 3.45 highlights the percentage changes in ethnicity.

Table 3.45 2000 and 2008 Ethnicity Percentages in Maricopa County

Race or Population	2000	2008
White	77.32%	80.4%
Black or African American	3.63%	4.30%
American Indian and Alaska Native	1.80%	1.80%
Asian	2.16%	2.90%
Native Hawaiian and other Pacific Islander	0.12%	0.20%
Some other race	11.89%	8.20%
Hispanic or Latino	24.85%	30.30%
Total population	**3,072,149**	**3,774,848**

Source: U.S. Census (2010).

3.13 Soils

3.13.1 Overview

The analysis area for soils consists of areas in the Project Area where soils would be directly impacted by construction and operation of the SSEP. Soils in the Project Area are generally deep and well drained to excessively drained (Johnson 1997). Furthermore, the soils range from sandy-skeletal to loamy-skeletal with extensive pebble cover at the land surface. Nearly all of these soils exhibit some level of illuviated carbonate, which is common in soils that develop in arid environments (Birkeland 1999). Some soils in the Project Area are susceptible to moderately high levels of wind erosion; others are susceptible to levels of water erosion ranging from slight to moderate.

Six soil complexes have been identified in the Project Area (Table 3.46). Of these six, three dominate the Project Area: 1) Denure-Rillito-Why, 2) Dateland-Cuerda, and 3) Gunsight-Rillito-Carrizo (Map 19). Denure-Rillito-Why Complex is the most dominant soil complex in the Project Area (Kirby 2009a). It is generally present on fan terraces with low slope angles. Gunsight-Rillito-Why Complex is restricted to fan terraces of very low slope angles, and is present mostly along the eastern edge of Project Area. Dateland-Cuerda generally occurs on fan terraces with low slope angles and is present mostly in the central portion of the Project Area. The additional three soils complexes make up less than 1% of the soils that occur in the Project Area (Table 3.46).

Table 3.46 Summary of Soils

Map Unit	Description	Water Erosion Potential	Wind Erosion Potential	Acres Occurring in the Project Area
Dateland-Cuerda	0%–3% slopes on fan terraces and flood plains	Very slight to slight	Moderate to moderately high	770.8
	Dateland-60%, Cuerda-30%			
	Well drained			
	Medium runoff			
	Moderate permeability Topsoil depth 0"–9"			
Denure-Rillito-Why	1%–5% slopes on fan terraces dissected by flood plains	Slight	Slight (Denure/Rillito) to Moderately High (Why)	2,657.0
	Denure-40%, Rillito-25%, Why-15%			
	Somewhat excessively drained			
	Medium runoff			
	Moderate (Denure/Why) to rapid (Rillito) permeability Topsoil depth 0"–2"			

Table 3.46 Summary of Soils

Map Unit	Description	Water Erosion Potential	Wind Erosion Potential	Acres Occurring in the Project Area
Gunsight-Rillito-Carrizo	1%–15% slopes on fan terraces dissected by flood plains	Very slight (Carrizo) to moderate (Gunsight)	Slight	271.3
	Gunsight-45%, Rillito-35%, Carrizo-15%			
	Somewhat excessively drained			
	Slow (Carrizo) to medium (Gunsight/Rillito) runoff			
	Moderate (Gunsight) to rapid (Rillito/Carrizo) permeability Topsoil depth 0"–2"			
Denure-Coolidge	0%–7% slopes on relict basin floors, stream terraces or fan terraces	Slight	Moderately high (Coolidge)	2.5
	(percentage in complex pending geographic information system [GIS] numbers)		Slight (Denure)	
	Well drained to somewhat excessively drained			
	Medium runoff			
	Moderate to moderately rapid permeability			
	Topsoil depth 0"–13"			
Gilman Fine Sandy Loam	<0.5% slopes	Moderate	None	0.4
	Well drained			
	Slow runoff			
	Medium permeability			
Torriofluvents	1%–5% slopes			0.4
		Total Acres		**3,702.4**

3.13.2 Prime and Unique Farmlands

There are no ongoing agricultural operations in the Project Area. However, agricultural activities are ongoing east of the Project Area in the main body of Rainbow Valley. The Dateland-Cuerda complex is considered prime farmland soils based on properties of the soil types, a favorable growing season, and moisture supply (from precipitation or irrigation) that allow these soils to produce large quantities of food or fiber (Johnson 1997). There are approximately 770.8 acres of Dateland-Cuerda in the Project Area.

3.14 Special Designations

3.14.1 Overview

Special designation areas that the BLM manages under the National Landscape Conservation System consist of national monuments, national conservation areas, wilderness areas, WSAs, wild and scenic rivers (WSR) and national scenic and historic trails (NSHTs). Special designation areas are managed to protect their unique values and uses. These areas typically require a more intensive management emphasis than is applied to surrounding public lands. There are no wilderness areas, WSAs, WSRs or NSHTs in the Project Area; however, the Sierra Estrella Wilderness and the Sonoran Desert National Monument (including the North Maricopa Mountains Wilderness) fall in the viewshed and soundscape of the Project Area. The area of analysis for special designations is not a defined polygon but rather any topographic point in the wilderness areas or monument where sights or sounds from the Project Area may be experienced by a visitor. Details about the area of analysis can be found in Chapter 4.

3.14.2 Laws, Ordinances, Regulations, and Standards

Wilderness areas are managed in accordance with the Wilderness Act of 1964 and FLPMA of 1976. This legislation directs the BLM to manage wilderness for the public's use and enjoyment in a manner that would leave these areas unimpaired for future use and enjoyment as wilderness by providing for protection of these areas and preservation of wilderness character (43 CFR § 6300). Wilderness areas are also managed in accordance with the congressional acts that designate the wilderness area, such as the Arizona Desert Wilderness Act of 1990 that designated the North Maricopa Mountains Wilderness and the Sierra Estrella Wilderness.

3.14.3 Wilderness Areas

The North Maricopa Mountains Wilderness encompasses 63,200 acres and is located approximately 3 miles south of the Project Area. The Sierra Estrella Wilderness encompasses 14,400 acres and is located 10 miles east of the Project Area. The objectives for managing the wilderness areas are to maintain or enhance the natural character; 2) provide a diversity of primitive recreational opportunities and a high degree of solitude; 3) maintain the present vegetation communities; and 4) provide habitat and water for a diversity of fauna (BLM 1995). Recreation objectives for these wilderness areas provide for primitive settings and experiences that do not include OHV use (BLM 2005a). The recreation setting is characterized by an unmodified natural environment greater than 5,000 acres where a high degree of challenge and risk are present. Recreational activities include hiking, backpacking, back-country hunting, horseback riding, camping, wildlife observation, and photography (BLM 1995).

3.14.4 National Monuments

The Antiquities Act of 1906 grants the President authority to designate national monuments to protect objects of historic or scientific interest. The Sonoran Desert National Monument was established by Presidential Proclamation 7397 in 2001. The proclamation provides management for an "array of biological, scientific, and historic resources." A monument management plan is being prepared to establish management goals, objectives, and actions to accomplish the intent of the proclamation.

The Sonoran Desert National Monument encompasses 487,000 acres and is located approximately 1 mile south of the Project Area. It is managed by the BLM LSFO. According to the proclamation, the monument's biological resources are spectacular and diverse. Saguaros (*Carnegiea gigantea*), cholla (*Cylindropuntia* spp.), and the endangered acuna pineapple cactus (*Echinomastus erectocentrus* var. *acunensis*) are just a few of the plant species found in the monument. The monument is also home to the desert tortoise and many significant archaeological and historic sites, and it is managed to protect these resources. Recreational opportunities in the monument are undeveloped and visitor activities include camping, hiking, biking, and four-wheel driving.

3.15 Transportation and Traffic

3.15.1 Overview

The SSEP would be constructed and operated on currently undeveloped BLM land near the west end of Rainbow Valley. The main access to the SSEP would be located on the west end of the Project Area, approximately 5 miles east of the intersection of SR-85/Riggs Road. It is anticipated that the SSEP would entail construction of a two-lane paved roadway between the main gate and the intersection of SR-85 northbound ramps/Riggs Road, where it would form the new east leg of the intersection (see Map 14).

Because of the layout of the existing roadway network in the Project Area, most traffic to and from the SSEP is expected to pass through the intersection of SR-85/Riggs Road. The secondary access road along the Riggs Road alignment is meant to provide an alternative access (Smigelski 2009). The secondary access via Riggs Road would have only limited use for well field maintenance and would have limited operational employee access. The secondary road would not be used for construction access.

The Riggs Road extension between the SSEP main gate and the intersection of SR-85 northbound ramps/Riggs Road would form a new four-way intersection. Whereas the existing T-intersection at SR-85 northbound ramps/Riggs Road is controlled by a stop sign on the eastbound approach, the addition of the east leg and associated construction traffic would necessitate relocating the stop control to the northbound and southbound approaches. In turn, this would allow eastbound and westbound traffic on Riggs Road, east of SR-85, to be free flowing. In addition, the pavement marking for the eastbound approach would require modification to allow for an exclusive through-lane and an exclusive right-turn lane.

Based on construction and operational considerations described above, the area of analysis for transportation and traffic includes the Project Area (footprint) and extends to the access routes that are anticipated to be used for SSEP construction and operation, including SR-85/Riggs Road and Riggs Road. These intersections would constitute the primary and secondary access to the site, respectively.

3.15.2 Laws, Ordinances, Regulations, and Standards

The *ADOT Traffic Engineering Policies, Guides, and Procedures Section 240, Traffic Impact Analyses* stipulate that a traffic impacts analysis (TIA) be conducted for all new developments and for additions to existing developments that generate 100 or more trips during any one hour of the day.

A TIA was completed for the Project Area. Because of the expected high levels of traffic during the peak construction of the SSEP, a modified Category IIa TIA was completed and includes the peak construction year of the SSEP (assumed to be 2012) and the opening year (2014) of the SSEP. The results of this analysis are discussed in Chapter 4, Environmental Consequences in Section 4.15 (Transportation and Traffic).

3.15.3 Existing Conditions

SR-85 is an ADOT-administered, four-lane, rural, median-divided highway located approximately 5 miles west of the Project Area. The portion of SR-85 directly west of the Project Area was upgraded in 2005 from a two-lane highway to its current condition. Although portions of the road heading south toward Gila Bend have not been upgraded from Interstate (I)-10 south to the Riggs Road intersection, SR-85 is a median-divided, four-lane highway (ADOT 2005). It provides north-south access in the area and serves as a truck bypass route around Phoenix, Arizona, by way of links to I-8 and I-10. SR-85 also serves a

connection route for travelers between the greater Phoenix area and San Diego, California; it also connects Puerto Peñasco, Mexico, with the Town of Gila Bend, Arizona. In addition, SR-85 offers direct access to the Robbins Butte Wildlife and Buckeye Hills Recreation areas and the Arizona State Prison Complex. The posted speed limit on SR-85 is 65 mph. The road itself consists of two lanes in each direction and has wide shoulders; it does not have any curb, gutter, or sidewalk facilities.

Primary transportation corridors (local two-lane roadways) in the eastern portion of the area of analysis consist of Rainbow Valley and Riggs roads. Although there are improved and unimproved roads following some section and half-section lines for access to dispersed agriculture and residential areas throughout the area of analysis, transportation corridors in the area are sparse. The Komatke Road alignment and Haul Road are unimproved roadways used as access to existing utility facilities (i.e., switchyard) and the Wesco Mining Facility. Several unimproved roads provide access from the Komatke Road alignment to the Sonoran Desert National Monument. Primitive roads are located along the BLM-designated utility corridors. In the area of analysis, the BLM *Approved Amendment Lower Gila North Management Framework Plan and the Lower Gila South RMP and Decision Record* designates the area as "limited." OHVs and special recreation vehicles are limited to existing roads and vehicle routes. No cross-country vehicle travel is permitted (BLM 2005a). Several primitive roads, totaling 13.1 miles, cross the Project Area (see Map 14). These roads are available for public use. One private airstrip is located in the northeast portion of the area of analysis.

Data for 2008 daily traffic volumes on roadways that provide access to the Project Area were acquired from ADOT and the Maricopa County Department of Transportation (MCDOT). This 2008 data represent the most current available data. According to ADOT (2008), SR-85 currently accommodates an average annual daily traffic volume of approximately 11,370 vehicles from Land Fill Entrance Road to Buckeye Road. According to MCDOT, Rainbow Valley Road, at the intersection of Queen Creek Road, currently accommodates an average daily traffic count of 399 vehicles (MCDOT 2008). Riggs Road contains a Maricopa County ROW that crosses private and BLM land in a portion of the area of analysis south of the Project Area. The Maricopa County ROW is 65 feet wide and 8.25 miles long. No traffic counts have been conducted for Riggs Road.

Until recently, Riggs Road was a small dirt road located approximately 2 miles north of Patterson Road near milepost 141; it served the APS Jojoba Switchyard and Wesco Minerals Rainbow Valley Plant. With the construction of the Southwest Regional Landfill, a new paved intersection was completed at the Riggs Road alignment. The new intersection was constructed at the future location of a grade-separated traffic interchange that would be constructed as the SR-85 facilities are developed. There are no plans or funding in place in the 2011–2014 ADOT *State Transportation Implementation Program* (ADOT 2011) for a traffic interchange at SR-85 and Riggs Road. As part of the interim operation of the intersection, the final on-ramp/off-ramp locations of the future traffic interchange were constructed approximately 750 feet east and west of the SR-85 alignment, and Riggs Road was widened and paved to a four-lane roadway with a wide median. Located in this median, there would be a two-way, center lane between the future on-ramp/off-ramp locations. The median crossing of Riggs Road between the northbound and southbound lanes of SR-85 extends for approximately 100 feet. There is no posted speed limit on Riggs Road.

The SR-85/Riggs Road junction currently consists of four intersections. The first two are unsignalized intersections that are located at the existing alignments of northbound/southbound SR-85 (SR-85 northbound mainline/Riggs Road and SR-85 southbound mainline/Riggs Road). The eastbound and westbound approaches of Riggs Road to SR-85 provide a through lane and shared through/right-turn lane and are controlled by stop signs at SR-85. To turn left onto SR-85 from each approach, a vehicle must 1) enter the median where exclusive, "back-to-back," left-turn lanes are provided; 2) stop and wait for an acceptable gap in SR-85 traffic; and 3) complete the left turn. With approximately 100 feet of median space available, these left-turn lanes are relatively short, providing storage capacity for only two vehicles

at a time. The northbound approach to this intersection provides an exclusive left-turn lane, two through lanes, and an exclusive right-turn lane. Both the northbound left- and right-turn lanes provide approximately 680 feet of storage capacity. The southbound approach to this intersection offers an exclusive left-turn lane, a through lane, and a shared through/right-turn lane. The southbound left-turn lane extends to Rainbow Valley Wash north of the intersection and provides approximately 800 feet of storage capacity.

The third intersection of SR-85/Riggs Road (SR-85 northbound ramps/Riggs Road) is located approximately 750 feet east of the northbound lanes of SR-85. This unsignalized "T" is controlled by a stop sign on the eastbound approach. The south leg of the intersection serves the Southwest Regional Landfill, and the north leg ends less than 100 feet north of the intersection, where several end-of-roadway barriers exist. Located right before the barriers, the Wesco Minerals Rainbow Valley Plant dirt access road begins and travels to the east. The Southwest Regional Landfill road is posted at 45 mph. The northbound approach to the T-intersection provides for a shared left-turn/through lane, and the southbound approach offers a shared through/right-turn lane. The eastbound approach has an exclusive left-turn and an exclusive right-turn lane.

The final intersection of SR-85/Riggs Road is located approximately 750 feet west of the southbound alignment of SR-85, where the paved section of Riggs Road ends. This is the location of the future southbound on-ramps and off-ramps of the traffic interchange. Currently, a narrow dirt access road extends to the south to provide access to the Desierto Verde area. Figure 3.7 shows existing lane configurations and traffic controls.

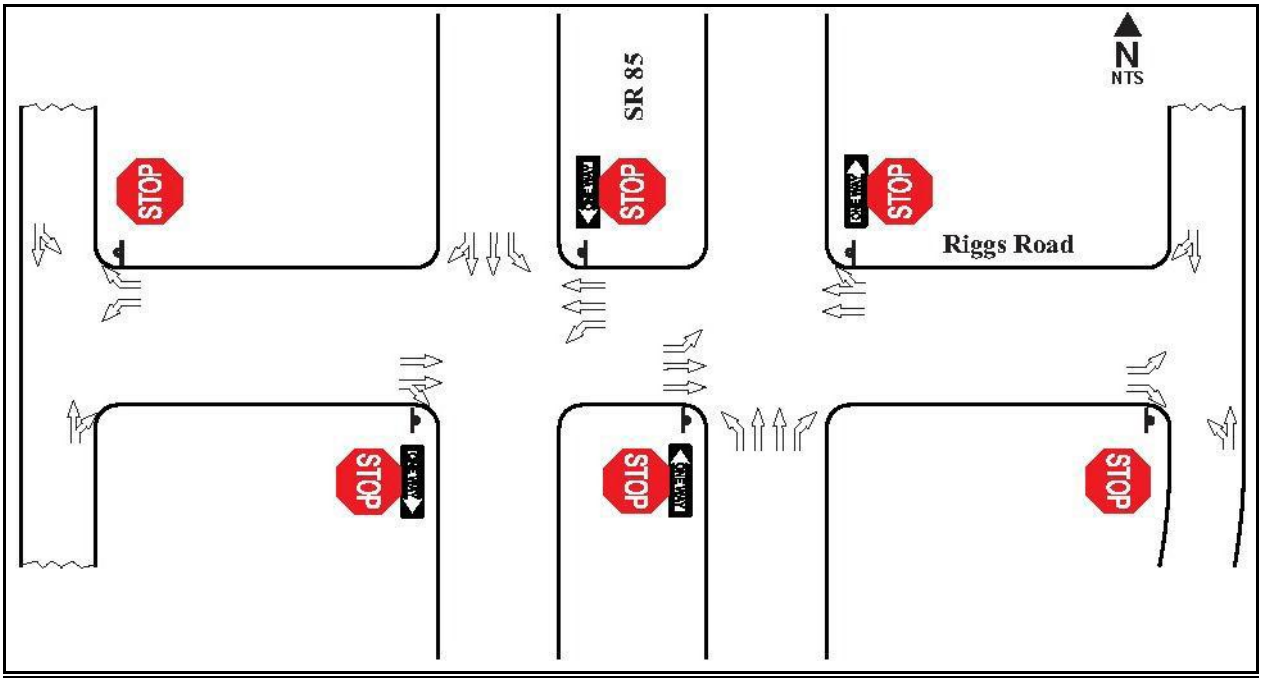

Figure 3.7 Existing lane configurations and traffic control.

3.15.3.1 EXISTING TRAFFIC DATA

To form a basis for analysis of the traffic related impacts of the SSEP, weekday AM and PM peak hour turning movement counts were conducted at the intersection of SR-85/Riggs Road at the mainline of SR-85.

The weekday turning movement counts were conducted from 7:00 to 9:00 AM and from 4:00 to 6:00 PM. The traffic counts were conducted in November 2009.

The existing weekday AM and PM peak hour traffic volumes are shown in Figure 3.8. The traffic counts show the traffic on Riggs Road to be very low volume and uncongested. Traffic on SR-85 would be considered moderate to low.

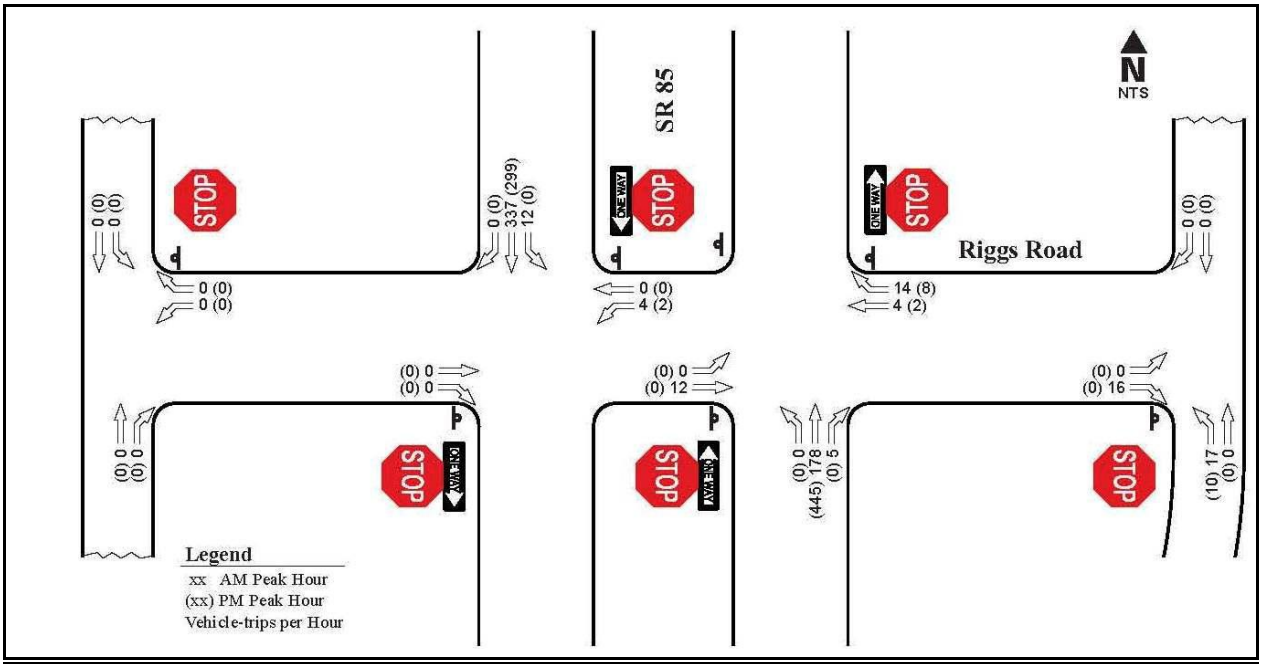

Figure 3.8 Existing weekday peak hour traffic volumes.

3.15.3.2 EXISTING TRAFFIC OPERATIONS

Analysis of current intersection operations was conducted for the weekday AM and PM peak hours using the nationally accepted methodology set forth in the Highway Capacity Manual (Transportation Research Board 2004). The computer software Highway Capacity Software was used to calculate the levels of service for individual movements, approaches, and the intersections as a whole.

Level of service (LOS) is a qualitative measure of the traffic operations at an intersection or on a roadway segment. LOS is ranked from LOS A, which signifies little or no congestion and is the highest rank, to LOS F, which signifies congestion and jam conditions. LOS C or better is typically considered adequate operation (limited to no congestion) at signalized and unsignalized intersections in rural areas.

At unsignalized intersections, LOS is calculated for those movements that must either stop for or yield to oncoming traffic and is based on average control delay for the particular movement. Control delay is the portion of total delay attributed to traffic control measures such as stop signs and traffic signals. Table 3.47 gives the criteria for LOS at unsignalized intersections.

Table 3.47 LOS Criteria at Unsignalized Intersections

LOS	Delay
A	≤ 10 seconds
B	> 10 and ≤ 15 seconds/vehicle
C	> 15 and ≤ 25 seconds/vehicle
D	> 25 and ≤ 35 seconds/vehicle
E	> 35 and ≤ 50 seconds/vehicle
F	> 50 seconds/vehicle

Existing LOSs were calculated for the adjacent SSEP intersections in the area of analysis. A heavy vehicle percentage of 25% was assumed in the calculations. As shown in Table 3.48, the intersections currently operate at an adequate LOS in the weekday AM and PM peak hours—LOS A or LOS B.

Table 3.48 Existing Peak Hour Levels of Service

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds/vehicle)	LOS	Delay (seconds/vehicle)
SR-85 Southbound Mainline/Riggs Road				
Southbound left	A	7.4	A	7.4
Eastbound through	B	11.7	B	11.1
Eastbound through/right	A	0.0	A	0.0
Westbound left	B	10.2	A	9.8
Westbound through	B	11.7	B	11.1
Westbound approach	B	10.2	A	9.8
SR-85 Northbound Mainline/Riggs Road				
Northbound left	A	7.2	A	7.2
Eastbound left	A	9.2	A	10.2
Eastbound through	B	10.7	B	12.5
Eastbound approach	B	10.7	B	12.5
Westbound through	B	10.6	B	13.1
Westbound through/right	A	9.3	B	10.3
Westbound approach	A	9.4	B	10.5
SR-85 Northbound Ramps/Riggs Road				
Northbound left	A	7.5	A	7.4
Eastbound left	A	8.8	A	8.6
Eastbound right	A	8.6	A	8.3
Eastbound approach	A	8.6	A	8.6

3.15.4 Future Traffic Operations without SSEP

To assess the impacts of the SSEP on future traffic operations, traffic projections were made for 2012 and 2015. Year 2012 represents the assumed peak construction year, whereas 2015 is the expected build-out year.

Because of the lack of detailed historic traffic data in the analysis area, a growth rate could not be calculated. In light of this, a 3% growth rate was used to estimate traffic growth in the analysis area. A 3% growth rate is lower than the normal 5% growth rate historically used in traffic growth analysis due to the economic recession experienced in 2008 and 2009. Using the compounded yearly traffic growth rate, 2012 and 2014 weekday peak hour traffic volumes without the SSEP were estimated, as shown in Figures 3.9 and 3.10.

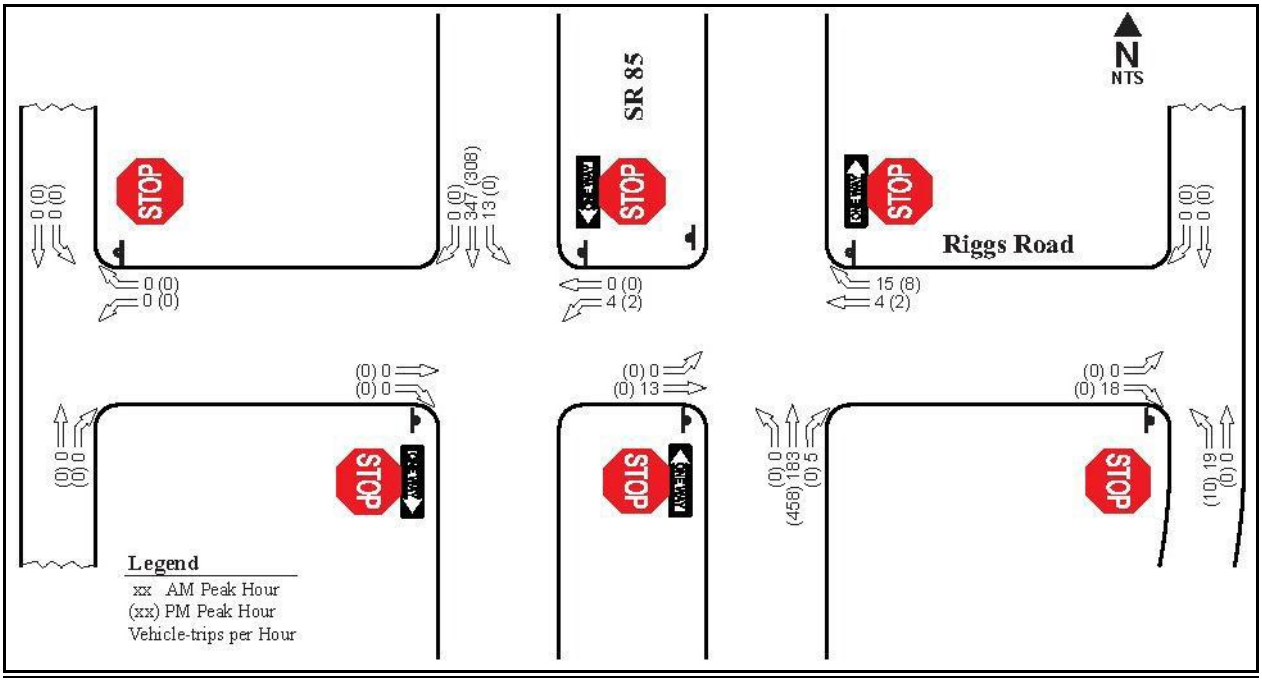

Figure 3.9 2012 Weekday peak hour traffic volumes without the SSEP.

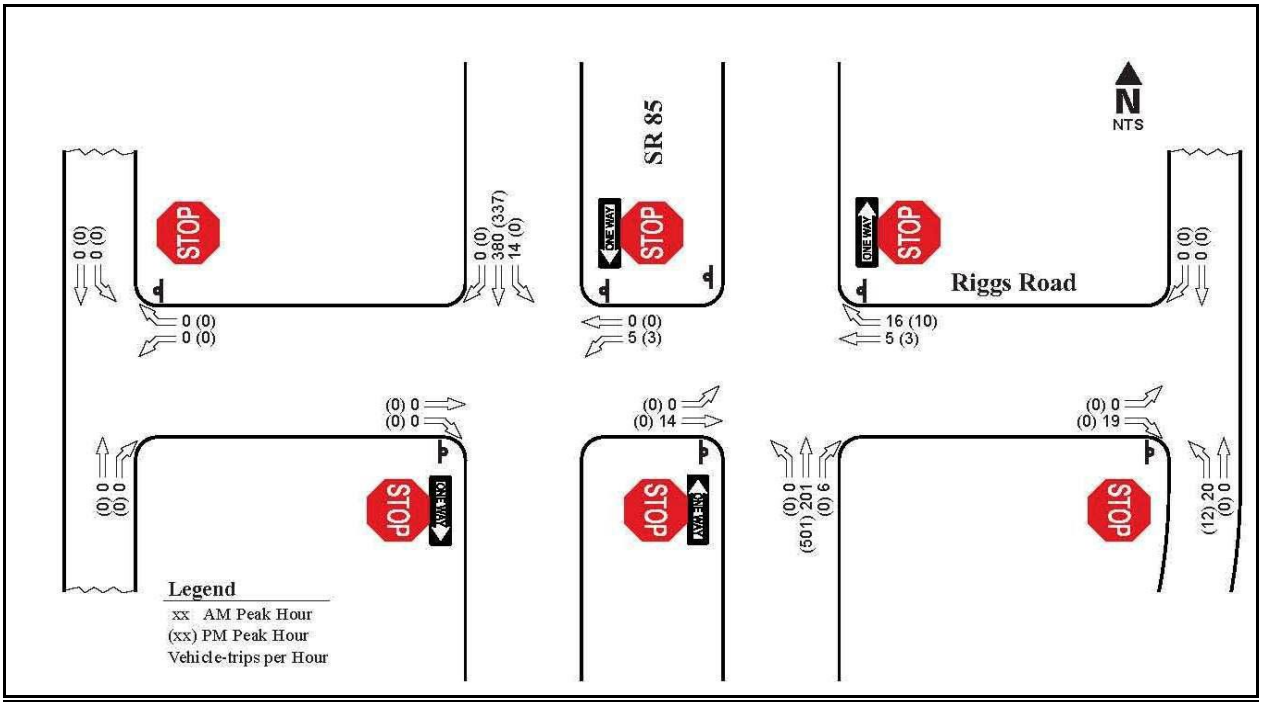

Figure 3.10 2015 weekday peak hour traffic volumes without the SSEP.

As with the current volumes, LOSs were calculated for each of the intersections in the area of analysis for 2012 and 2015, without the SSEP.

Based on ADOT (2000) guidelines, future peak hour factors (PHFs) for the SSEP were employed as directed under the *ADOT Traffic Engineering Policies Guidelines and Procedures*, Section 240, Traffic Impact Analyses. They are as follows:

- PHF = 0.80 for <75 vph per lane
- PHF = 0.85 for 75 to 300 vph per lane
- PHF = 0.90 for >300 vph per lane

As shown in Tables 3.49 and 3.50, the Project Area intersections are predicted to continue operating at an adequate LOS B or better in 2012 and 2015, without traffic from the SSEP.

Table 3.49 2012 Peak Hour Levels of Service without SSEP

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)
SR-85 Southbound Mainline/Riggs Road				
Southbound left	A	7.5	A	7.4
Eastbound through	B	11.9	B	11.2
Eastbound through/right	A	0.0	A	0.0
Westbound left	B	10.3	A	9.9
Westbound through	B	11.9	B	11.2
Westbound approach	B	10.3	A	9.9
SR-85 Northbound Mainline/Riggs Road				
Northbound left	A	7.2	A	7.2
Eastbound left	A	9.2	B	10.2
Eastbound through	B	10.8	B	12.6
Eastbound approach	B	10.8	A	10.2
Westbound through	B	10.6	B	13.3
Westbound through/right	A	9.3	B	10.3
Westbound approach	A	9.4	B	10.6
SR-85 Northbound Ramps/Riggs Road				
Northbound left	A	7.5	A	7.4
Eastbound left	A	8.8	A	8.6
Eastbound right	A	8.6	A	8.3
Eastbound approach	A	8.6	A	8.6

Table 3.50 2015 Peak Hour Levels of Service without SSEP

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)
SR-85 Southbound Mainline/Riggs Road				
Southbound left	A	7.5	A	7.4
Eastbound through	B	12.2	B	11.3
Eastbound through/right	A	0.0	A	0.0
Westbound left	B	10.5	A	10.0
Westbound through	B	12.2	B	11.4
Westbound approach	B	10.5	A	10.0
SR-85 Northbound Mainline/Riggs Road				
Northbound left	A	7.2	A	7.2
Eastbound left	A	9.3	B	10.4
Eastbound through	B	11.0	B	13.1
Eastbound approach	B	11.0	A	0.0
Westbound through	B	10.8	B	13.8
Westbound through/right	A	9.5	B	10.5
Westbound approach	A	9.6	B	10.7
SR-85 Northbound Ramps/Riggs Road				
Northbound left	A	7.5	A	7.4
Eastbound left	A	8.8	A	8.7
Eastbound right	A	8.6	A	8.3
Eastbound approach	A	8.6	A	8.7

3.16 Vegetation and Special-status Plant Species

This section describes the dominant vegetation communities and special-status plant species, including federally protected and state-protected species, and invasive and noxious weed species.

3.16.1 Overview

The Sonoran Desert ecoregion extends from southeastern California across the western two-thirds of southern Arizona and south into Baja California and Sonora, Mexico (MacMahon 2000). The Sonoran Desert has the highest diversity of plant growth forms of any desert in the world, and is the most biologically diverse of North American deserts (MacMahon 2000). The Sonoran Desertscrub Biome, as described by Turner and Brown (1994), is subdivided into six major subdivisions based on climate and species composition. The Project Area and surrounding vegetation are located entirely in the Lower Colorado River Valley Subdivision, which is the largest and driest subdivision of the Sonoran Desert (MacMahon 2000). This subdivision is dominated by burrobush (*Ambrosia dumosa*) and creosotebush (*Larrea tridentata*) and has comparatively low species diversity and structural complexity compared to other subdivisions of the Sonoran Desert (MacMahon 2000).

Vegetation resources in and adjacent to the Project Area provide cover, browse, nesting, and brooding habitats for a variety of wildlife species (see Section 3.19). Sonoran Desert vegetation also functions as a dynamic interface between the soil and atmosphere, where it intercepts precipitation, captures overland water flow, retains and transports soil, water, and nutrients in plant roots, and transports water and nutrients back to the atmosphere through loss of water vapor from leaves and stems.

Biological field reconnaissance surveys in 2008 and 2009 were conducted in the Project Area and within an approximately 2-mile buffer around the Project Area (Pape 2009). The surveys encompassed all ecologically similar portions of the Little Rainbow Valley to the pediment at the base of the Buckeye Hills and North Maricopa Mountains. Because surveys were conducted for the 2-mile buffer surrounding the Project Area (as well as in the Project Area), we assume that the plant species identified in the survey area occur in the Project Area. The analysis area for vegetation communities and special-status plant species is limited to the Project Area, because surface-disturbing activities that would remove vegetation are limited to the Project Area. The analysis area for invasive and noxious plant species consists of the perimeter of the Project Area, including linear facilities and transportation corridors. This perimeter represents the interface between long-term and temporary surface disturbances and native vegetation communities, which is where noxious and invasive plant species would be most likely to become established and spread into adjacent habitats.

3.16.2 Laws, Ordinances, Regulations, and Standards

Ground-disturbing activities or placement of structures may impact special-status plant species or their habitats. As such, laws have been developed for their protection; and where applicable, they are considered during SSEP resource reviews. The following laws are applicable to vegetation resources in the Project Area.

3.16.2.1 ENDANGERED SPECIES ACT SECTION 7 (16 U.S.C. § 1531, AND 50 CFR § 17.1)

The ESA was passed by the United States Congress in 1973. The ESA directs all federal agencies to work toward conserving endangered and threatened species and to use their authority to further the purposes of the act. Section 7 of the ESA is the mechanism by which federal agencies ensure the actions they take,

including those they fund or authorize, do not jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat of any listed species.

Only species listed by the USFWS are afforded protection under the ESA. The BLM has initiated informal consultation with the USFWS for the SSEP. A biological assessment (BA) has been prepared for the SSEP to determine if there would be any project-related impacts to any federally listed species and/or their designated critical habitat. The BA has been submitted to the USFWS, who has concurred with a "no effect" determination to any listed species. No federally listed plant species are known to occur in the Project Area or in the approximately 2-mile buffer surrounding the Project Area.

3.16.2.2 BLM SENSITIVE SPECIES REGULATIONS

BLM Manual Section 6840 is a federal guidance document that outlines the criteria for listing species as sensitive on BLM-administered lands and provides direction on management of those species. BLM sensitive species are species that the USFWS currently has under status review; species whose populations are declining rapidly and may warrant federal protection in the future; species that have small, widely distributed populations; and species that are located in special or unique habitats. Additionally, IM No. AZ-2006-002, Change 1, dated September 30, 2006, provides a current updated list of the species designated as sensitive by the BLM in Arizona. In compliance with BLM Manual Section 6840, the BLM sensitive species list (BLM 2005c) for the LSFO was consulted to evaluate the potential for sensitive plant species to occur in the Project Area (see Section 3.16.4).

3.16.2.3 ARIZONA NATIVE PLANT LAW

The ADA oversees native plant resources in the State of Arizona, and impacts to native plants are regulated under applicable State of Arizona Revised Statutes and Administrative Codes (A.A.C. Article 11: Arizona Native Plants; R3-3-1101 through R3-3-1111; and A.R.S. §§ 3-901 through 3-916) (ADA 2009a). These laws state that protected plants cannot be removed from any lands, including private lands, without permission and a permit from the ADA. Proponents of projects that would impact 40 acres or more must notify the ADA 60 days prior to removal of plants. Landowners may sell or give away native plants on their land, but plants may not be legally possessed, taken, or transported from the growing site without a permit from the ADA. The ADA classifies protected native plant species into four categories: 1) highly safeguarded, 2) salvage restricted, 3) salvage assessed, and 4) harvest restricted.

Plants in the highly safeguarded category are those species that are in danger of extinction or whose prospects for survival in Arizona are in jeopardy. No collection is allowed for highly safeguarded plant species; however, salvage may be allowed for conservation or scientific purposes. Salvage restricted plant species are those that are subject to damage by theft or vandalism, and include most native Arizona cacti species and other specimen plants such as ocotillo (*Fouquieria splendens*). Salvage assessed plant species are those species that have sufficient value if salvaged, such as common desert trees. Harvest restricted plant species are those that tend to be subject to locally excessive harvesting or overcutting because of their intrinsic value, but may not be considered threatened range wide. All plant species identified during reconnaissance surveys are listed in the final technical report (Pape 2009). All native plants in the Project Area would be managed according to ADA protocols (see Section 3.16.4, below).

3.16.2.4 INVASIVE AND NOXIOUS PLANT SPECIES REGULATIONS

Federal agencies are required by EO 13112, Invasive Species, to consider which agency actions may affect the status of invasive species and shall, to the extent practicable and permitted by law, do the following:

- Identify such actions.
- Subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.
- Not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

The Plant Protection Act of 2000 (P.L. 106-224) replaced the Federal Noxious Weed Act of 1975 (P.L. 93-629) and is administered by the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA). This federal program was enacted to protect the health and value of American agriculture and natural resources, and authorizes APHIS to take both emergency and extraordinary emergency actions to address incursions of noxious weeds.

State of Arizona Regulated, Restricted, and Prohibited Noxious Weeds regulations (A.A.C. §§ R3-4-244 and R3-4-245) address the control and eradication of noxious weeds and identifies specific species that fall under three noxious weed categories: regulated, restricted, and prohibited. The Plant Services division of the ADA is responsible for implementing these noxious weed regulations. Definitions of these three weed classes are as follows: 1) regulated noxious weeds are exotic plant species that are well established and generally distributed throughout Arizona; 2) restricted noxious weeds are exotic plant species that occur in Arizona in isolated infestations or very low populations; and 3) prohibited noxious weeds are exotic plant species with known qualities that do not currently exist in Arizona.

3.16.2.5 ARIZONA DEPARTMENT OF TRANSPORTATION GUIDELINES

The ADOT guidelines for highways on BLM and U.S. Forest Service Lands (ADOT et al. 2008) manual provides specific guidance for the design, construction, maintenance, and landscape restoration for road development on lands managed by BLM and the USFS.

3.16.3 Vegetation Communities

As previously stated, vegetation in the Project Area is typical of the Lower Colorado River Valley Subdivision of the Sonoran Desertscrub Biome, as defined by Brown (1994). The surrounding desert mountains (outside of the Project Area) are in the Arizona Upland subdivision of the Sonoran Desert and are dominated by the Sonoran Palo Verde-Mixed Cacti vegetation community. The entire Project Area is in the Sonoran Creosotebush-Bursage Scrub series, which is most typical of the Lower Colorado River

Valley Subdivision vegetation community. Most of the Project Area is dominated by creosotebush, which occurs as pure stands or in association with microphyllous (small-leaved) legume tree species such as yellow palo verde (*Parkinsonia microphylla*) and desert ironwood (*Olneya tesota*) along xeroriparian washes[3].

Two vegetation communities were identified in the Project Area: Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. The Xeroriparian Wash community (as described in Section 3.16.3.2, below) contains generally the same plant species as the surrounding Sonoran Creosotebush-Bursage Scrub community, but plants occur at higher densities due to ephemeral water availability in the washes. For this reason, the entire Project Area comprises the Sonoran Creosotebush-Bursage Scrub with increased density of vegetation in the wash areas. The Xeroriparian Wash community is treated as a distinct vegetation community because higher densities of plants would be affected by proposed activities in the linear washes than in upland Sonoran Creosotebush-Bursage Scrub. Table 3.51 provides the acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash in the Project Area. Map 20 shows the distribution of vegetation communities in the Project Area. Individual cactus numbers and overall species diversity are low, except in and adjacent to the northwestern portion of the Project Area, where saguaros and chollas occur in moderate density. Saguaros are few and widespread in the Project Area.

Table 3.51 Vegetation Community Acreages/Linear Feet in the Project Area

Vegetation Community	Acres/Linear Feet
Sonoran Creosotebush-Bursage Scrub	3,702.4 acres
Xeroriparian Wash	39,552.5 feet

In addition to the two vegetation communities listed in Table 3.51, which both occur in and adjacent to the Project Area, the Sonoran Palo Verde-Mixed Cacti/Sonoran Creosotebush-Bursage vegetation community type occurs north and south of the Project Area. Vegetation north and south of the Project Area typically includes a few creosotebushes with an occasional cholla cactus, saguaro, or ocotillo, and small to moderate numbers of devil's spineflower (*Chorizanthe rigida*) and/or sandmat (*Chamaesyce* sp.). Areas of desert pavement, which support almost no plant species, are common approximately 2 miles north of the Project Area.

Biological soil crusts (BSCs) consist of blue and green algae, lichens, mosses, fungi, and bacteria that bind the surface of the soil (Belnap et al. 2001). These soil crusts are a major component of vegetation communities in the Sonoran Desert, and are recognized as important features of desert ecosystems due to their ability to stabilize the soil, capture and retain atmospheric moisture and rainfall, facilitate seed germination, and increase nutrient availability for plant growth (Belnap et al. 2001). There is reasonable expectation that BSCs occur in the Project Area, either intact or as remnants due to historic soil disturbances.

3.16.3.1 SONORAN CREOSOTEBUSH-BURSAGE SCRUB

The dominant vegetation community in the Project Area is Sonoran Creosotebush-Bursage Scrub. This vegetation community occupies approximately 3,620 acres (100%) of the Project Area and is dominated by creosotebush, which occurs in pure stands over relatively large portions of the Project Area. Triangle

[3] Xeroriparian washes are ephemeral washes that serve as dispersal corridors for plants and animals.

bur ragweed (*Ambrosia deltoidea*) and/or burrobush are commonly co-dominant with creosotebush in the Lower Colorado River Valley Subdivision, but do not occur at high enough densities to be considered co-dominants in the Project Area.

3.16.3.2 XERORIPARIAN WASH

The Xeroriparian Wash vegetation community is typically associated with an ephemeral water supply and contains a similar species composition as surrounding upland areas, but at higher densities. This vegetation community comprises approximately 39,500 linear feet of ephemeral washes in the Project Area. Xeroriparian Wash is dominated by desert ironwood and palo verde (*Parkinsonia* spp.). This community also contains several shrub species, including wolfberry (*Lycium* spp.), catclaw acacia (*Acacia greggii*), and white ratany (*Krameria grayi*).

The technical report (Pape 2009) contains a list of all plant species observed in the Project Area.

3.16.4 Special-status Species

One BLM sensitive plant species and 12 plant species that are protected under Arizona Native Plant Law are known to occur in the Project Area. No federally listed, candidate, or proposed plant species were identified during field reconnaissance surveys. Further, none are likely to occur in the Project Area or surrounding vegetation communities because there is no suitable habitat for the species in the Project Area and/or the Project Area is outside of the known range of the species (Pape 2009). There are no designated critical habitats for any federally listed plant species in the Project Area or surrounding vegetation communities. There are no federal plant species of concern or ADA highly safeguarded plant species known or likely to occur in the Project Area or surrounding vegetation communities. The final technical report (Pape 2009) lists the federal, BLM sensitive, and ADA highly safeguarded plant species that were reviewed for potential to occur in the Project Area.

3.16.4.1 ARIZONA NATIVE PLANT LAW PROTECTED SPECIES

The saguaro cactus is protected under Arizona Native Plant Law (ADA 2009a). The species occupies desert slopes and well-drained flats, especially rocky bajadas (Epple and Epple 1995) in the Sonoran Desert. The species' range is limited to below 4,000 feet in elevation and to areas with above-freezing temperatures in the winter. Saguaro may be found growing above 4,000 feet on south-facing slopes. Under the Arizona Native Plant Law, saguaros are protected as salvage restricted, which requires a permit for any impacts to the species. Any crested saguaros (saguaro cacti with a fan-shaped top) found in the Project Area would be considered highly safeguarded under the Arizona Native Plant Law. Saguaro cacti are few and widespread in the approximately 3,620-acre Project Area. No crested saguaro cacti are known to occur in the Project Area or surrounding vegetation communities. Table 3.52 identifies other ADA-protected plant species that are also known to occur in the Project Area.

Table 3.52 Arizona Native Plant Law Protected Species Known to Occur in the Project Area

Scientific Name	Common Name	ADA Status†
Carnegiea gigantean	Saguaro	Salvage Restricted
Castela emoryi	Crucifixion thorn	Salvage Restricted
Cylindropuntia bigelovii	Teddybear cholla	Salvage Restricted
Echinocereus engelmannii	Engelmann's hedgehog cactus	Salvage Restricted
Ferocactus wislizeni	Candy barrelcactus	Salvage Restricted
Fouquieria splendens	Ocotillo	Salvage Restricted
Hesperocallis undulata	Desert lily	Salvage Restricted
Mammillaria grahamii	Graham's nipple cactus	Salvage Restricted
Olneya tesota	Desert ironwood	Salvage Assessed; Harvest Restricted
Parkinsonia florida	Blue palo verde	Salvage Assessed
Parkinsonia microphylla	Yellow palo verde	Salvage Assessed
Prosopis glandulosa	Honey mesquite	Harvest Restricted; Salvage Assessed
Prosopis velutina	Velvet mesquite	Harvest Restricted; Salvage Assessed

† Salvage Restricted = collection or destruction by permit only; Salvage Assessed = plants have significant value if salvaged; and Harvest Restricted = permit required to remove plant/plant by-products (fuel wood).

3.16.5 Invasive and Noxious Plant Species

Federal regulations (including the EO on Invasive Species and the Plant Protection Act) and state regulations (including the ADA regulations on noxious weeds) require that the BLM address proposed actions on their lands throughout the LSFO in regard to noxious weeds and their potential effects (Harper-Lore 2007). Even though most of the non-native plant species addressed here were not observed in the Project Area, these species are known to exist in the region; thus, the activities proposed under the action alternatives could allow the introduction of these species through soil disturbances.

The invasion and establishment of non-native plant species are a threat to the overall health of the Sonoran Desert ecosystem. Not only do these species outcompete the native flora for resources, but also the presence of these invasive, non-native plants increases the fuel load for wildfires. The flora present in the Sonoran Desert did not evolve with these non-native plants; thus, competition for resources, such as soil, water, and nutrients, is severe, and often the non-natives replace the natives throughout the landscape. In addition, invasive plant species increase fine-fuel loads, which increases the areal extent of fires and fire frequencies (Arizona Wildlands Invasive Plants Working Group [AZ-WIPWG] 2005).

Two invasive plant species were observed in the Project Area during reconnaissance surveys: Saharan mustard (*Brassica tournefortii*) and redstem stork's bill (*Erodium cicutarium*). In addition, two invasive grass species, buffelgrass (*Pennisetum ciliare* [syn. *Cenchrus ciliaris*]) and red brome (*Bromus rubens*), and Mediterranean grass (*Schismus arabicus* and *S. barbatus*) are addressed here. Buffelgrass and red brome are not known to occur in or adjacent to the Project Area, but Mediterranean grass has been reported in the Project Area. All three grass species are aggressive invaders with widespread distributions in the Sonoran Desert. There is high potential for the introduction of these species into the Project Area or adjacent habitats through transportation corridors or other project-related infrastructure where vehicle use facilitates the movement of seeds or root fragments. Buffelgrass is currently distributed along nearby transportation corridors, including SR-85, SR-86 and I-10 (Arizona-Sonora Desert Museum [ASDM] 2010). All five invasive and noxious plant species addressed here possess growth and dispersal strategies

that give them a competitive advantage over native plant species, due to their rapid growth and ability to produce large amounts of seed (Sakai et al. 2001). In addition, some of these species produce toxic or inhibitory chemicals that alter surrounding soil conditions and inhibit the growth of native species. Because of the potential for invasive and noxious plant species to be moved into the area through roads and other vehicle routes, the analysis area for noxious and invasive plant species consists of the perimeter of the Project Area where noxious and invasive plant species are most likely to become established and spread into adjacent habitats.

3.16.5.1 SAHARAN MUSTARD

Saharan or Asian mustard is an introduced, annual forb species in the mustard family (Brassicaceae). The species is highly invasive and is cited as a "major management concern" for Maricopa County, Arizona (California Invasive Plant Council [Cal-IPC] 2005). Saharan mustard is ranked as a medium-level threat to Arizona wildlands due to its impacts to plant and animal communities, moderate to high rates of dispersal that are enhanced by disturbance, and broad ecological tolerance (AZ-WIPWG 2005). The species competes with native plant species and ultimately excludes native plants, thereby altering the composition and structure of vegetation communities (Cal-IPC 2005). Saharan mustard infestations alter the structure and composition of wildlife habitat by outcompeting native shrubs and forbs, reducing the availability and quality of forage, and by increasing the fuel load and associated fire potential. Dense stands of Saharan mustard promote the spread of fire across desert habitats in which the native plants and animals are not adapted to fire. Saharan mustard is also high in oxalic acid, which is potentially toxic to desert tortoise and other native herbivores (Cal-IPC 2005). Each mustard plant can produce large numbers of seeds, which are rapidly and widely dispersed through "tumbleweed" dispersal, in which portions of plants containing seed pods and seeds break off the plant and are moved by wind. The seeds' sticky coating allows them to be dispersed long distances by animals or vehicles (Cal-IPC 2005). Saharan mustard seeds are known to live three or more years in the soil, and soil disturbance can promote germination of seeds (Cal-IPC 2005).

Saharan mustard, like other annual weeds, is difficult to control due to its rapid spread, rapid growth and reproduction, long period of seed viability, and its ability to produce multiple seed crops in a single year (Cal-IPC 2005). Controls for Saharan mustard may be effective in controlling other weed species, including redstem stork's bill. However, control of Saharan mustard in particular should focus on stopping seed production. Seed germination can be promoted by supplemental watering followed by a pre-planned treatment with herbicide (Cal-IPC 2005). Hand pulling is effective if plants are removed before seed set and if ongoing monitoring and follow-up treatments are practiced. There are multiple effective herbicides for mustards (e.g., Telar, Escort, Plateau, Habitat, and Velpar) (Cal-IPC 2005). Other herbicides may also be effective. Spot application is the most effective, but broadcast, nonselective herbicides can be used in disturbed areas, roadsides, and other bareground areas. Grading with heavy equipment has been identified as a source of weed spread, with timing of disturbance prior to seed development essential for reducing spread of viable seed. Washing or decontamination of excavation and personal equipment before it is brought to the project site and before it is moved from the site prevents transport of seed (Cal-IPC 2005). Revegetation immediately following disturbance is also effective in reducing weed infestation. Monitoring of disturbed sites with follow-up treatments is necessary to limit the establishment or spread of Saharan mustard and other invasive species.

3.16.5.2 REDSTEM STORK'S BILL

Redstem stork's bill is an introduced, annual forb species in the geranium family (Geraniaceae). The species tolerates a very wide range of ecological conditions and is distributed throughout North America (Howard 1992). Redstem stork's bill is widespread in Arizona and occupies nearly all vegetation community types in the state (Newman 2001). The species flowers early and can produce seed throughout the growing season. The species is dispersed via hooked seeds that are easily moved long distances when they become attached to clothing, animal fur, or vehicles. The species has the potential to spread rapidly and can crowd out native plant

species where it occurs in high densities (Whitson et al. 1996). Redstem stork's bill is ranked as a medium-level threat to Arizona wildlands due to its impacts to plant and animal communities, moderate to high rates of dispersal that are enhanced by disturbance, and broad ecological tolerance (AZ-WIPWG 2005). Like the other weed species addressed here, dense, continuous stands of this species can contribute to fuel loading and increased fire frequency in areas not adapted to fire (Howard 1992). Redstem stork's bill does not currently occur at high densities anywhere in the Project Area. The species is used as forage by wildlife, including mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*) and desert tortoise, but its value as forage is negated by the exclusion of native plant species, alteration of vegetation community composition and structure, and reduced availability of forage species to which native wildlife are adapted (AZ-WIPWG 2005).

3.16.5.3 BUFFELGRASS

Buffelgrass is a highly drought tolerant, perennial in the grass family (Poaceae). The species is native to Africa, the Middle East, Indonesia and tropical Asia (ASDM 2010). It was introduced to the United States in the 1930s and its range has expanded rapidly since the 1980s (ASDM 2010). Buffelgrass is now common in southern Arizona and listed as a noxious weed by the State. It is also ranked as a high-level threat to Arizona wildlands due to its severe ecological impacts on plant and animal communities, alteration of vegetation structure, high rates of dispersal and establishment, and unusually broad distribution and ecological range (AZ-WIPWG 2005). The species' dense growth habit crowds out native plants and it can weaken and kill larger desert plants by competing aggressively for available water. Dense concentrations of buffelgrass can contribute to fuel loading and increased fire frequency in Sonoran Desert habitats that are not adapted to fire. A buffelgrass invasion may only persist for 10 to 15 years (AZ-WIPWG 2005), during which time it impoverishes the soil. The plant dies once the soil has been depleted of nutrients and leaves sterile soil that requires costly treatments to restore. Buffelgrass can be controlled by manual pulling and herbicides, which should be focused on roadside infestations outside of urban zones and other transportation corridors that facilitate transport of seed into native habitats.

3.16.5.4 MEDITERRANEAN GRASS

The Mediterranean grass species are annual grasses (family Poaceae) native to southern Europe, northern Africa, and the Near East. Like buffelgrass and red brome, this invasive grass contributes to the conversion of desert shrublands into annual grasslands, and forms dense stands that can increase fuel loads and fire frequency in desert vegetation communities (Cal-IPC 2010). Mediterranean grass invades areas disturbed by grazing, offroad-vehicle use, and construction (Cal-IPC 2010). The species are spread by seed dispersed by wind and floods and are not spread through horizontal runners or root fragments. Seeds germinate in open habitats in early spring and mature very quickly, with plants potentially flowering and producing seed in two weeks (Cal-IPC 2010). Mediterranean grass does not tolerate shading and usually occupies open areas between desert shrub cover (Cal-IPC 2010). Dense concentrations of Mediterranean grass species can contribute to fuel loading and increased fire frequency in Sonoran Desert habitats that are not adapted to fire.

3.16.5.5 RED BROME

Red brome is a cool season annual in the grass family (Poaceae) that germinates in the fall with a slow winter growth period and rapid growth and flowering in early spring (Newman 2001). Red brome occurs at elevations below 5,000 feet in deserts, chaparral, roadsides, waste places and other vegetation communities with low plant density and minimal competition (Newman 2001). The species is not able to compete with established plants due to its very shallow root system and inability to tolerate shade (Newman 2001). The awns and other floral structures of the plant can damage intestinal and other sensitive tissues of livestock and native fauna (Newman 2001). The species decays very slowly over up to two years, which results in the accumulation of dead stalks and can increase fire frequency and intensity (Newman 2001). Dense infestations of red brome can contribute to fuel loading and increased fire frequency in Sonoran Desert habitats that are not adapted to fire.

3.17 Visual Resources

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of these elements there is in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes for varying levels of protection and modification, giving consideration to other resource values and uses and the scenic quality of the landscape. The BLM uses the Visual Resource Management (VRM) system to manage visual resources within its jurisdiction. The system uses four visual management classes:

- **Class I.** The objective is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and should not attract attention.
- **Class II.** The objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- **Class III.** This objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Class IV.** The objective is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and may be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic elements of the landscape. (BLM 1986).

Under the BLM's current plan, the Lower Gila South RMP, the Project Area and adjacent landscapes are designated as VRM Class IV (BLM 1985).

The SSEP's area of potential visual effects (hereafter referred to as the visual analysis area) includes lands where potential changes to the landscape from the SSEP may be visible to travelers, residents, and those working or recreating and sightseeing in the visual analysis area. The visual analysis area consists of the Project Area and a 15-mile buffer surrounding the Project Area (see Map 21). The 15-mile buffer used to define the visual analysis area was determined after consultation (Johnson 2011) with the BLM and is based on the BLM's definition of background distance zone: the BLM has defined 15 miles as the farthest background distance for visual resource inventories and for visual contrast analysis; these concepts are discussed below.

A viewshed analysis was conducted using geographical information system (GIS) data to assess where the SSEP would be visible within the landscape, and this analysis was verified in the field. The viewshed analysis is a computer-generated map that shows those areas within the surrounding landscape where the project structures and surface disturbances could be visible. The concept underlying the viewshed analysis is that the topography surrounding the Project Area would partially obscure or screen the project from

public view. By generating a computer map that shows where the project would be visible and would not be visible, it becomes possible to define the extent of the impacts and to select representative places where the effects of the project on scenic quality could be assessed. The results of the viewshed analysis were used to further refine the visual analysis area (see Maps 21 and 22). Using the results of the viewshed analysis, 19 KOPs were selected that represent typical viewing conditions of the SSEP (see Section 4.17 for a more detailed explanation of KOPs). The KOPs were located along major travel routes and access roads, in recreational areas, and near residences and communities within the visual analysis area (i.e., places where large numbers of people would potentially have clear views of the Project Area). KOP locations are shown on Maps 21 and 22; existing views can be found in the visual simulations in Appendix H. The KOPs were then used to inventory existing scenic quality and to analyze the potential impacts from the SSEP. Eighteen of the KOPs lie in the visual analysis area; the nineteenth lies outside of the area (the Quartz Peak KOP) because it was added later at the request of recreational user groups.

3.17.1 Visual Resource Inventory

The Visual Resource Inventory (VRI) process provides the BLM with a means for determining visual values based on scenic quality, viewer sensitivity, and a delineation of distance zones (BLM 1986a). The inventory establishes the baseline, current scenic quality in the visual analysis area, which is used to measure the potential changes to scenic quality caused by SSEP construction and operation. The purpose of a VRI classification is different from VRM class objectives; VRI classes are a tool for portraying the relative value of visual resources and are used to consider visual values in the RMP process. VRM classes are a management tool used to portray visual management objectives. As mentioned above, the Lower Gila South RMP (BLM 1985) identifies VRM classifications in the Project Area.

BLM IM No. 2009-167 states that "All field offices are required to have current VRIs in place and to have VRM classes designated within its LUPs. Both the inventory and management class determinations are critical for baseline NEPA visual impact analysis and compliance evaluation with VRM objectives and for facilitating appropriate advancement of all surface disturbing, land use activities, including renewable energy projects."

To comply with IM No. 2009-167 requirements to provide a current VRI (because an outdated one was conducted in 1985 during the RMP process), an interim VRI process for the SSEP was conducted in and adjacent to the Project Area. The inventory was conducted in November 2009 (Johnson 2009) in the interim VRI area, which is based on the Project Area and an approximately 2-mile buffer. The inventory was based on BLM VRM methodology, which consists of three primary components: 1) a scenic quality evaluation, 2) a sensitivity level analysis, and 3) a delineation of distance zones (BLM 1986a). The interim VRI represents the existing visual environment in and adjacent to the Project Area. The total area (of BLM land) inventoried within the interim VRI Area is 26,881 acres.

3.17.1.1 SCENIC QUALITY EVALUATION

Scenery, defined as scenic quality, is a measure of the inherent aesthetic value of the landscape based on existing landscape features, including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (BLM 1986a). Generally, landscapes with a greater diversity of these features tend to receive a higher scenic quality rating. Under the inventory process, the BLM applies three ranks to landscape scenic quality: Class A (outstanding), B (above average), and C (common). The Project Area is located on terrain and vegetation typical of Class C scenery and is characterized by flat to low desert hills and plains, with the low vegetative diversity associated with creosotebush flats. Most of the area is associated with Class C scenery that extends east to west from SR-85 to Rainbow Valley Road and north to south from the Buckeye Hills and the foothills associated with the Sonoran Desert National Monument. Landscapes adjacent to the Project Area include limited Class B scenery associated with agricultural land,

the Buckeye Hills, and the mountain ranges of the Sonoran Desert National Monument (see Map 23). Regionally, several large-scale projects have modified the landscape, including the landfill, tree nursery, minerals plant, agricultural fields, roadways, and utilities (electrical transmission lines and pipelines) within BLM-designated utility corridors (Map 13). Within the interim VRI area, the interim VRI determined that there are 4,474 acres of Class B scenic quality and 22,407 acres of Class C scenic quality (see Map 23). There is no area with Class A scenic quality.

3.17.1.2 SENSITIVITY LEVEL ANALYSIS

Under the VRI process, sensitive viewing locations, or interim observation points (IOPs) (e.g., residences, roads, or trails) are examples of viewpoints that may be affected by visual modifications of the landscape. Under the VRI process, the observation points are called IOPs; during contrast analysis and analysis of project impacts (see section 4.17), these points are called KOPs. The IOPs represent a critical viewpoint or typical viewing condition associated with a sensitive viewer or viewing location. Potential IOPs for the SSEP were identified and field verified (Johnson 2009). The identification of IOPs was based on a review of aerial photography, a review of topographic maps, agency input, suggestions from special interest groups, and field investigations that include photodocumentation using high-resolution photography and global positioning system (GPS) data. Additionally, the selected IOPs are representative of the range of viewing conditions (e.g., elevation) and distance zones for sensitive locations in the visual analysis area. For the SSEP, each IOP was also used as a KOP (see Map 21).

Within the 26,881-acre area inventoried, the interim VRI determined that there are 19,333 acres of landscape with low visual sensitivity, 528 acres with medium sensitivity, and 7,021 acres with high sensitivity (Map 24).

3.17.1.3 DISTANCE ZONES

Distance zones are the viewing distances from IOPs and are defined as foreground/middleground (0–5 miles), background (5–15 miles), and seldom seen (screened within foreground/middleground or beyond background). A total of 19 IOPs was selected to represent "typical" viewing conditions for each of the three sensitive viewing locations (see Map 21): travel routes (five IOPs), recreation areas (eight IOPs), and residences (six IOPs); these are described as follows:

- **Travel Routes**: highways and roads used by origin/destination travelers and designated scenic or historic byways and recreation destination roads (i.e., roads that provide access to designated recreation areas). Travel routes in the visual analysis area include SR-85, Komatke Road, Riggs Road, Estrella Parkway, and Rainbow Valley Road.
- **Recreation Areas**: existing recreation sites used for picnicking, camping, hiking, scenic overlooks, rest areas, or other recreational activities. Viewpoints in the Sonoran Desert National Monument, North Maricopa Wilderness, Sierra Estrella Wilderness, and Buckeye Hills Recreation Area were included.[4]
- **Residences**: single-family structures and permanent mobile homes or mobile home parks. Residences in Goodyear and Rainbow Valley were selected to represent typical residential views of the Project Area. Residences in the background distance zone that would be screened by topography occur in Buckeye, Estrella Mountain Ranch, Palo Verde, Cotton Center, Arlington, Liberty, and Perryville.

[4] Visibility analyses were conducted from Woolsey Peak located in the Woolsey Peak Wilderness, as suggested during a special interest group meeting. Based on the results of the visibility analysis and its distance from the project (approximately 20 miles), Woolsey Peak may have isolated long-distance views for dispersed recreation viewers.

The entire 26,881-acre area inventoried is considered to be within the foreground/middleground distance zone (0–5 miles) (Map 25).

3.17.2 Characteristic Landscape

The Project Area is located in the Basin and Range Province (Fenneman 1931). The Basin and Range Province is distinguished by isolated, roughly parallel mountain ranges separated by closed desert basins. Mountain ranges trend north-south and have distinctive alluvial areas known as bajadas. A subdivision of the Basin and Range Province, the Sonoran Desert, encompasses the entire Project Area and adjacent lands. The Sonoran Desert is characterized by mountains with intervening plains. Vegetation communities that are associated with the Project Area include two subdivisions of the Sonoran Desert (Brown and Lowe 1994), the Arizona Upland and Lower Colorado River Valley.

The Project Area is located in a basin loosely surrounded by the Buckeye Hills to the north, the Estrella Mountains to the east, the Maricopa Mountains to the south, and the Gila Bend Mountains to the west (see Map 21). The landscape of the Project Area is characterized by flat to low desert hills and plains with low vegetative diversity typical of creosotebush flats. Landscapes adjacent to the Project Area include agricultural land, the Buckeye Hills, and the mountain ranges of the Sonoran Desert National Monument. The landscape types in the Buckeye Hills and Sonoran Desert National Monument areas have more visual interest, with increased landform and vegetative diversity, saguaro cacti, and boulder outcroppings.

Cultural modifications contribute to the overall visual character of the Project Area and visual analysis area. Conditions range from natural to completely modified and include pipelines, transmission lines, transportation routes, and other structural features that modify the natural setting (see Map 13). Modifications in the Project Area are limited to dirt surface tracks and roads. Modifications that directly modify the local project setting are located within the BLM-designated utility corridors. The southern utility corridor, which borders the Sonoran Desert National Monument, contains two parallel 500-kV transmission lines and four parallel buried natural gas pipelines adjacent to Komatke Road. The Jojoba Switchyard is located within this utility corridor and connects two 500-kV transmission lines that cross SR-85 from the west and two additional 500-kV transmission lines that approach from the south. The second utility corridor, which includes a 500-kV transmission line, diverges to the northeast at the junction of Haul Road. The visual simulations in Appendix H show the appearance of the utility corridors on the landscape. In addition to the designated utility corridors, a granite mine and processing plant, a large-scale tree nursery, a municipal land fill, and a state prison complex are located west of the Project Area. Several agricultural areas are located in Rainbow Valley east of the Project Area.

The results of the interim VRI process indicate that based on the combination of scenic quality rating units, sensitivity level rating units, and distance zones, the Project Area is in VRI Class IV. This VRI classification is consistent with the current RMP VRM objectives for the Project Area (BLM 1985). Within the interim VRI area, VRI Class IV encompasses 19,332 acres; VRI Class III encompasses 528 acres; and VRI Class II encompasses 7,021 acres.

3.17.3 Visual Resource Management Objectives

Through the land-use planning process, BLM sets objectives for the management of landscape preservation and change. All lands under BLM management jurisdiction are placed into one of four VRM classes that identify the degree of acceptable landscape change or alteration, giving consideration to the scenic value of the landscape and other resource values and uses of the land. Class I objectives are established in areas where no landscape change is desired. Class IV objectives are set for landscapes where BLM manages for uses that would result in substantial landscape changes (e.g., mining, energy

development, wind farms). Classes II and III allow for varying degrees of landscape preservation and change between Classes I and IV.

The VRM objectives for the Project Area were established in the Lower Gila South RMP (BLM 1985). Lands in the Project Area have been allocated to VRM Class IV objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be a major focus of viewer attention.

3.17.4 Nighttime Lighting and Extent of Skyglow

Amateur astronomers are able to qualitatively rank the brightness of the night sky using the Bortle Dark-Sky Scale, a numeric nine-level measure of the night sky brightness at a specific location (Bortle 2008). Under optimal conditions, the Project Area is assumed to have a Bortle Dark-Sky rating Class 5, equaling that of a typical, suburban sky.

Existing or potential sources of nighttime light in the area include the residences of Rainbow Valley and several industrial or commercial operations, including the landfill, tree nursery, minerals plant, prison, and agricultural fields. Phoenix is the largest source of nighttime light and skyglow in the region and is approximately 30 miles from the Project Area. Other developments associated with Buckeye, Goodyear, and I-10 are approximately 12 miles from the Project Area.

Only hints of zodiacal light are seen on the clearest nights; the Milky Way is very weak or invisible near the horizon and looks washed out overhead; light sources are visible in most, if not all, directions; and clouds are noticeably brighter than the sky.

3.18 Water Resources

3.18.1 Surface Water

3.18.1.1 OVERVIEW

The Project Area is located in the Little Rainbow Valley in portions of the middle Gila River watershed and Lower Gila River Watershed. The Project Area is located south and east of the Gila River between Buckeye and Gila Bend, Arizona and is located on a surface water drainage divide between two tributaries to the Gila River. The western portion of the Project Area is in the Rainbow Wash watershed and drains to small ephemeral tributaries to Rainbow Wash. The eastern portion of the Project Area is in the Waterman Wash watershed and drains to an unnamed tributary that flows to Waterman Wash (Moody and Frazee 2009). This section addresses the surface water resources for the Project Area; the applicable LORS for surface water in the Project Area; as well as the current and proposed drainage patterns across the Project Area.

The analysis area for surface water includes the Rainbow Wash watershed, the Waterman Wash watershed, Rainbow Wash, Waterman Wash, an unnamed tributary that flows to Waterman Wash, and the Gila River reach between Waterman Wash and Rainbow Wash. This analysis area is defined for surface water because a portion of the precipitation that falls on these watersheds flows in washes across the Project Area and discharges to either Rainbow Wash or Waterman Wash, and to the Gila River.

3.18.1.2 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

3.18.1.2.1 Section 404 of the Clean Water Act of 1972

Under Section 404, the United States Congress gave the U.S. Army Corps of Engineers (USACE) authority to regulate the discharge of dredged or fill material into the waters of the U.S. USACE evaluated the Project Area for waters of the U.S. This evaluation included a Field Survey of Washes and a Significant Nexus Analysis. The Field Survey of Washes identifies potentially jurisdictional washes in the Project Area. The Significant Nexus Analysis is used to determine if there is a significant hydrological, chemical, or ecological connection between on-site washes and the nearest downstream Traditional Navigable Waters (TNW). The USACE determined that a significant nexus does not exist between the washes on-site and the nearest TNW; therefore, there are no waters of the U.S. in the Project Area (Appendix B).

3.18.1.2.2 Federal Emergency Management Agency Floodplains

The current Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map identifies a portion of Rainbow Wash, approximately one mile downstream of the Project Area, as being the only FEMA-regulated floodplain near the Project Area (see Map 7). There are no FEMA-regulated floodplains in the Project Area. However, the FCDMC has recently completed a study of the area that identifies two pending floodplains in the Project Area (see Map 7). These pending floodplains make up approximately 222 acres in the Project Area. A delineation of these floodplains has been submitted to FEMA, which has subsequently issued a letter of "Best Available Data." This Best Available Data letter indicates that the floodplains have been approved and accepted by FEMA; however, they have not been published and therefore are not currently being regulated by FEMA.

Development in existing FEMA-regulated floodplains requires coordination with FEMA through a Letter of Map Change process. A CLOMR must be requested following the design stages of a project, but prior to construction. The CLOMR serves as an assurance from FEMA that any proposed modifications to mitigate a flood hazard meet FEMA's requirements. Following construction, a LOMR must be requested to remove the identified flood hazard areas from FEMA maps. FEMA must issue its own LOMR when pending floodplains are accepted. Development in pending floodplains also requires coordination with FCDMC.

In accordance with the Maricopa County Floodplain Regulations, a Floodplain Use Permit would be required for any development in regulated and pending floodplains located in the Project Area. Most of the Project Area is in the Town of Buckeye and the remainder is in the unincorporated areas of Maricopa County. The Town of Buckeye has entered into an intergovernmental agreement with the FCDMC, which allows the FCDMC to provide floodplain management for the Town of Buckeye. Consequently, FCDMC has jurisdiction to issue a Floodplain Use Permit for the entire Project Area.

3.18.1.2.3 Stormwater National Pollutant Discharge Elimination System/Arizona Pollutant Discharge Elimination System

The EPA National Pollutant Discharge Elimination System (NPDES) regulates stormwater discharge from a large group of industrial activities, including construction. As of December 5, 2002, ADEQ administers the NPDES Program in the State of Arizona under the AZPDES. Where discharges have a potential to enter waters of the U.S. or a storm drain system, an AZPDES permit is required from ADEQ. The SSEP would require an AZPDES Construction General Permit for construction operations.

3.18.1.2.4 Maricopa County

The Maricopa County Department of Planning and Development does not have jurisdiction over federal lands, which include the BLM land on which most of the Project Area is sited. Consequently, the Project would not require a Maricopa County Grading and Drainage Permit or a Drainage Facilities Permit for development on BLM lands. However, the Maricopa County Department of Planning & Development does have jurisdiction over the portion of the access road that crosses state land.

The FCDMC issues Floodplain Use Permits through a cooperative agreement with FEMA. The FEMA requirement includes federal lands and therefore, development on BLM land is not exempt from this process. The SSEP requires a Floodplain Use Permit from FCDMC.

3.18.1.2.5 Town of Buckeye Storm Drainage and Grading Standards and Policies

The Project Area is in the Town of Buckeye's incorporated areas. However, Buckeye does not have jurisdiction over development on federal (BLM) lands. In an effort to foster cooperation, Boulevard would consider the Buckeye's drainage requirements through the development process, except in cases where they conflict with AZPDES or other permit requirements.

The Town of Buckeye requires the following:

- All stormwater that falls within a development, including the respective one-half of all abutting streets, shall retain a minimum of the 100-year, two-hour stormwater runoff within the boundaries of said development. Predevelopment runoff versus post development runoff retention is not acceptable; except for a first flush facility or an approved designated drainage outfall, and shall be approved by the Public Works Department.

- Drainage retention/detention and conveyance systems shall be designed to eliminate and reduce stormwater runoff impact of adjacent or downstream properties. No stormwater drainage system shall be approved if the effect may cause an increase in peak discharge, volume, or velocity of runoff or change the point of entry of drainage onto another property during the runoff event.
- Off-site flows entering the development as a result of the 100-year storm shall be accounted for in flow calculations of entry and exit points on the grading and drainage plans that are to be routed through the development and kept at the original historic points of entry and exit. Off-site flows exiting a development shall not exceed predevelopment flows. If off-site flow terminates within the development, increased amounts of retention would be required. Routing of off-site flows within Town of Buckeye rights of ways are not allowed, except where crossings (culverts, bridges) are permitted by the Public Works Department.
- The site shall provide sufficient stormwater facilities to insure
    - regional stormwater drainage solutions are in accordance with stormwater management programs set forth by the town;
    - the protection of the health, safety and welfare of citizens, their property, the environment, and shall not jeopardize the quality of groundwater resources;
    - minimal adverse impacts of development to existing downstream properties;
    - that all structures, including existing adjacent structures, would be free from flooding and that there is reasonable access for emergency and public service vehicles; and
    - such facilities shall include separate and distinct parcels within the development and shall be planned for accordingly (i.e., retention).

3.18.1.2.6 Arizona Department of Transportation

The primary access to the Project Area is from SR-85. An existing interchange off SR-85 is located near Rainbow Wash and a FEMA designated floodplain. Connection of the primary access road to SR-85 or the existing interchange would require coordination with ADOT for general drainage and FEMA floodplain work. Any portion of the Project Area that falls within the jurisdiction of ADOT would follow the standards and guidelines of ADOT.

3.18.1.3 SURFACE WATER AND CURRENT DRAINAGE CONDITIONS

The most prominent surface water features near the Project Area are the Gila River, Rainbow Wash, and Waterman Wash (Map 26). The western portion of the Project Area drains to Rainbow Wash, whereas the eastern portion drains to an unnamed tributary that flows to Waterman Wash.

The Project Area slopes gently to the north with a grade of approximately 1%. All washes in the watersheds are ephemeral in nature and therefore only flow during, or immediately after, a significant rainfall event. Most of these washes are small erosion features that are less than 5 feet wide. There are no perennial or intermittent watercourses in the Project Area. Within the Project Area there are approximately 41 linear miles of small ephemeral washes. The USACE has evaluated these washes and has determined that they are not waters of the U.S. (see Appendix B).

The topography of the Project Area forms two distinct watersheds; the Rainbow Wash watershed and the Waterman Wash watershed. The Rainbow Wash watershed covers 49 square miles and extends south into the North Maricopa Mountains with elevations ranging from approximately 990 to 1,360 feet above sea level. The Waterman Wash watershed covers 422 square miles. The portion of the Waterman Wash watershed that passes through the Project Area also extends south into the North Maricopa Mountains, with elevations ranging from approximately 800 to 2,813 feet amsl.

3.18.1.3.1 Gila River

The Gila River has its origin in the Mogollon Mountains of west-central New Mexico and eventually joins the Colorado River at Yuma, Arizona. The Gila River watershed drains an area of approximately 58,000 square miles. The Gila River between the confluence of Waterman Wash and the Gillespie Dam contains segments of ephemeral, intermittent, and perennial waters; and a 6.9-mile segment immediately north of the dam that is considered a TNW by USACE (USACE 2008). Agricultural return waters and treated wastewater effluent support intermittent flows in the Gila River in the Southwest Valley (Phoenix) and flows downstream to the Gillespie Dam. The Gila River north of the Project Area only flows as a result of effluent discharges from the 91st Avenue wastewater treatment plant.

3.18.1.3.2 Rainbow Wash

Rainbow Wash is the major water feature in the Little Rainbow Valley. The headwaters of Rainbow Wash are on the north slope of the Maricopa Mountains in the Sonoran Desert National Monument. The western half of the Project Area is drained by Rainbow Wash that flows west and eventually connects with the Gila River approximately 5 miles below the Gillespie Dam.

Rainbow Wash is ephemeral, flowing only during and immediately following large precipitation events. The wash collects sheet flows from the surrounding areas including the western portion of the Project Area and directs them southwest into the Gila River. There are numerous washes in the Rainbow Wash watershed that range in size from small (4 feet wide or less) washes to a few larger washes that are 10 feet wide or more. The washes in this watershed tend to be shallow with depths ranging from 2 feet or less. A few of the larger washes have depths of 3 feet or more. The washes in the Project Area that are in the Rainbow Wash watershed are small ephemeral washes that tend to have long narrow sub-basins ranging from less than 0.33 mile, to a little more than 3.0 miles, before they enter Rainbow Wash. The larger washes in the watershed tend to have higher amounts of vegetation along their banks, and that vegetation tends to be larger in size. The smaller washes tend to have sparser, smaller vegetation along their banks.

Rainbow Wash generally drains from east to west and provides a collection point for stormwater runoff from the north and south sides of the wash. The drainage outfall for Rainbow Wash is the Gila River just downstream of Gillespie Dam.

3.18.1.3.3 Waterman Wash

Waterman Wash is northeast of the Project Area. Waterman Wash is an ephemeral tributary to the Gila River that flows north from the higher elevations southeast of the Project Area and terminating at the Gila River. The unnamed tributary to Waterman Wash is located northeast of the Project Area and flows northeast into Waterman Wash. Numerous small ephemeral washes on the Project Area drain to the unnamed tributary to Waterman Wash. There are numerous washes in the Waterman Wash watershed ranging in size from small (4 feet wide or less) washes to a few larger washes that are 10 feet wide or more. These washes all tend to be shallow with depths ranging from 2 feet or less to depths a little over 3 feet. The washes in the Project Area that are in the Waterman Wash watershed tend to have long narrow sub-basins with lengths ranging from less than 0.33 mile to a little over 9.0 miles before entering into the unnamed tributary to Waterman Wash. The larger washes in the watershed tend to have higher amounts of vegetation along their banks and that vegetation tends to be larger in size. The smaller washes tend to have sparser and smaller vegetation along their banks. A portion of the Waterman Wash watershed drains toward an existing stock pond approximately 1.5 miles before the wash enters the unnamed tributary to Waterman Wash.

The unnamed tributary to Waterman Wash generally drains from southwest to northeast, and provides a collection point for stormwater runoff from the north and south sides of the wash. Waterman Wash, itself, outfalls downstream into the Gila River, upstream of the Gillespie Dam.

3.18.1.4 WATER QUALITY

Every two years, the ADEQ is required by the federal CWA to conduct a comprehensive analysis of water quality data associated with Arizona's surface waters to determine whether state water quality standards are being met and designated uses are being supported. The integrated surface water assessment and impaired waters listing report (2006/2008 Assessment Report) serves to fulfill a national reporting requirement of the CWA, and is submitted to the EPA, and used to report on national water quality issues and concerns. For ADEQ, the assessment provides a mandate to compile environmental data and information from ADEQ's surface water quality protection programs, as well as from other agencies, organizations, and individuals. This comprehensive evaluation of quality of water in Arizona is used to set priorities, allocate resources, and make decisions about land-use activities, discharges to the water, future monitoring, and program initiatives. For the public, the assessment provides an opportunity to learn about and comment on the status of surface water quality in the state.

ADEQ indicates in the assessment that some reaches of the Gila River in the vicinity of the Project Area have been identified as impaired. Several reaches of the Gila River downstream of the Project Area are impaired by low dissolved oxygen, selenium, boron, dichlorodiphenyltrichloroethane (DDT) metabolites, toxaphene in fish tissue, and chlordane in fish tissue. There are no data available in this report specific to Waterman Wash or Rainbow Wash. Additionally; there are no sediment load data available for these reaches of the Gila River.

The elements boron and selenium as a pollutant are typically associated with agricultural irrigation practices. Pesticide residues such as DDT metabolites, toxaphene, and chlordane are also a result of agricultural practices. The low dissolved oxygen is typically the result of biodegradable organic compounds that come from agricultural operations or urban areas. Low dissolved oxygen primarily results from excessive algae growth caused by phosphates and nitrates (the ingredients in fertilizers). As the algae die and decompose, the process consumes dissolved oxygen. Therefore, due to the lack of agricultural operations or urbanization in the watershed of the washes on-site, these washes do not have a significant potential to contribute to the further impairment of these waters.

3.18.1.5 STREAM FLOW DATA

Stream flow measurement gages are not present in the Project Area. However, FCDMC has installed two gages in the area as a part of its Automated Local Evaluation in Real Time (ALERT) stream and weather gage network. Both gages are equipped to measure stream flow in terms of stages in the watercourse. These gages are located on Rainbow Wash and Waterman Wash (see Map 26). The stream gage on Rainbow Wash is located approximately 4 miles downstream (east) of the main solar field. The stream gage on Waterman Wash is located approximately 4 miles above its confluence with the unnamed tributary to Waterman Wash.

The FCDMC Rainbow Wash gage identification (ID) is No. 6953 and the Waterman Wash at Rainbow Valley Road, ID is No. 6833. The Rainbow Wash gage has available data from November 2000 to the present and has a drainage area of 17.6 square miles. The Waterman Wash at Rainbow Valley Road gage has available data from March 1999 to present and has a drainage area of 362 square miles. Drainages areas for each gage were obtained from the FCDMC (Maricopa 1998–2007).

The Waterman Wash gage records stream flow from 362 square miles of the Waterman Wash and is not representative of flow in the small washes in the Project Area. Therefore, the Rainbow Wash flow data are the best source of hydrologic data to estimate the stream flows from both watersheds. Furthermore, the Rainbow Wash watershed's proximity and other similarities of hydrologic characteristics, such as elevation, slope, vegetation, and soil types make this a relevant comparison.

FCDMC lists 31 storm runoff events at the Rainbow Wash gage occurring between March 7, 2001 and August 13, 2009. The mean number of storm runoff events over this period of time at the Rainbow Wash gage is approximately four storm events per year (31 storm events, divided by eight years). Of these 31 runoff events, the maximum flow was 1,827 cfs and the minimum flow was 37 cfs. The total duration of flow over the eight years was 228 hours with an average storm event of 7 hours. The average mean annual flow for these eight years of data, as reported by FCDMC is 0.22 cfs. The Rainbow Wash watershed contributing to the gage is 17.6 square miles.

3.18.1.6 DRAINAGE AREA DELINEATION METHODOLOGY

Drainage areas and boundaries were estimated using existing topographic mapping, aerial photography, and field visits. Where detailed topographic information was available, 2-foot contours were used to estimate the drainage boundaries. Where detailed topographic information was unavailable, the U.S. Geological Survey (USGS) 7.5-minute quadrangle maps were used.

3.18.1.6.1 Existing Drainage Studies

Several surface water studies have been prepared for the watersheds. These studies have been collected and used to better understand the existing drainage condition of the watersheds. A brief synopsis of these studies and how they are used in the drainage analysis is presented below.

An area drainage master plan is currently being prepared for FCDMC by URS Corporation and includes portions of the Project Area that drains toward Waterman Wash. Selected parameters from the study have been used as part of the hydrologic study of the Project Area. These parameters include percent vegetation cover, soils data, land-use type, distributary-flow rating curves, and Manning's n values for the washes. Some of the sub-basins were broken into smaller sub-basins where a greater level of hydrologic detail was needed.

The FCDMC has recently mapped some of the floodplains on the Project Area in the Waterman Wash and Tributaries Floodplain Delineation Study by Engineering and Environmental Consultants Inc. (EEC) and submitted these maps to FEMA. The pending FEMA floodplains in the EEC study would be used as the best available data for the washes that were mapped as part of the study. In addition the currently mapped FEMA floodplain for portions of Rainbow Wash downstream of the Project Area would also be used.

3.18.2 Groundwater Resources

3.18.2.1 OVERVIEW

Groundwater would be required to supply water for the project due to the unavailability or insufficient supply of water from alternative sources, including surface water and reclaimed water. Groundwater to supply the SSEP would be pumped from an on-site well field under a GIU groundwater withdrawal permit.

The analysis area for groundwater is the Rainbow Valley Sub-basin. Because the groundwater resource available to supply the SSEP is contained within the Rainbow Valley Sub-basin, the groundwater resource evaluation focused exclusively on Rainbow Valley Sub-basin.

3.18.2.2 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Groundwater resources in Arizona are regulated under the Arizona Groundwater Code (A.R.S. Title 45, Chapter 2) through the ADWR. Under the Groundwater Code, groundwater development is restricted and intensively managed within five AMAs: Phoenix, Pinal, Prescott, Tucson and Santa Cruz. The groundwater resource that would be used to supply water for the SSEP is contained in the Rainbow Valley Sub-basin of the Phoenix AMA. The key regulatory requirements imposed by the Groundwater Code that apply to groundwater development for the SSEP are the need to obtain either a groundwater right or a groundwater withdrawal permit to pump groundwater, and compliance with ADWR well spacing and well impact requirements, as described in the following subsections.

There are no specific federal laws, Maricopa County ordinances or local ordinances that regulate the development of groundwater resources for the SSEP. All AMA-specific requirements under the Groundwater Code are applicable to all jurisdictions within an AMA, including land controlled by the BLM.

3.18.2.2.1 Grandfathered Groundwater Rights

A well owner must have either a grandfathered right (GFR) or a groundwater withdrawal permit to legally pump groundwater within an AMA at a rate in excess of 35 gpm. GFRs are authorized under A.R.S. Title 45, Chapter 2, Article 5, and are classified as follows:

- Irrigation GFRs: Irrigation GFRs allow groundwater to be used only for irrigation purposes on the land where the groundwater is pumped.
- Type 1 Nonirrigation GFRs: A Type 1 Nonirrigation GFR can be obtained by converting an Irrigation GFR to a Type 1 Nonirrigation GFR; however, the water is still appurtenant to the land and must be used on the land where the groundwater is pumped.
- Type 2 Nonirrigation GFRs: Type 2 Nonirrigation GFRs can be used anywhere within an AMA, and can be purchased or leased.

Given that there is no irrigated land in the Project Area, a Type 2 GFR is the only type of grandfathered water right potentially available in the Project Area.

3.18.2.2.2 Groundwater Withdrawal Permits

Groundwater withdrawal permits are authorized under A.R.S. Title 45, Chapter 2, Article 7. There are seven categories of groundwater withdrawal permits that can be obtained from ADWR. Of these, the only type of permit applicable to the SSEP is a GIU permit (A.R.S. § 45-515), which allows groundwater to be withdrawn "from a point outside of the exterior boundaries of the service area of a city, town or private water company for a GIU outside of the exterior boundaries of such service area", subject to the following conditions (as paraphrased from A.R.S. § 45-515):

- Uncommitted municipal and industrial CAP water is not available at the point where the operator’s wellhead or distribution system would otherwise be, at a cost which does not exceed the current municipal and industrial CAP rates.

- Other surface water of adequate quality or effluent of adequate quality is not available at the point where the operator's wellhead or distribution system would otherwise be, at a cost, including treatment costs, which does not exceed by 25% of the cost the operator would otherwise incur in withdrawing groundwater.
- Irrigation GFRs appurtenant to acres of land in reasonable proximity to the intended GIU are not available for purchase at a reasonable price or cannot be acquired by eminent domain and the applicant does not own or lease GFRs that the applicant is not using or leasing, that may be used for the intended GIU and that can be used for the intended GIU without imposing an unreasonable economic burden on the applicant.
- The intended GIU, if located within 3 miles of the exterior boundaries of the service area of a city, town or private water company, has been denied service by the city, town or private water company at the customary rate in the customary manner.
- The management plan for the AMA can be adjusted to accommodate the intended GIU consistent with the achievement of the management goal for the AMA.
- There is an assured water supply for the intended use at the intended point of withdrawal. For purposes of this section, "assured water supply" means that sufficient groundwater of adequate quality would be available to satisfy the projected GIU for the duration of the permit.
- The assured water supply demonstration is not specifically listed on the GIU application form, but is referenced in the statute (A.R.S. § 45-515.6). The applicant must demonstrate that pumping to supply the project would not cause the water level to decline to more than 1,000 feet below land surface (bls) over the planned life of the project, which is consistent with ADWR's assured water supply requirements for subdivisions. This demonstration has been made for the SSEP through the development, calibration and application of a groundwater flow model, as described in Section 4.15. The SSEP meets all of the conditions listed above; therefore, groundwater to supply the SSEP would be pumped under a GIU permit. The SSEP GIU permit application has been approved by ADWR and includes stipulations to monitor and report groundwater withdrawals.

3.18.2.2.3 Well Spacing and Well Impact

New groundwater production wells that would pump more than 35 gpm must meet ADWR's well spacing and well impact requirements prescribed under 12 A.A.C. Chapter 15, Article 13. To meet the requirements, an applicant must demonstrate that pumping the new wells would not cause the water level in any neighboring well of record to decline by more than 10 feet over five years. This demonstration has been made for the SSEP groundwater production well field through the use of the same groundwater flow model developed for the GIU, as described in Section 4.18. The SSEP GIU permit application is pending, and is currently under review by ADWR.

3.18.2.3 EXISTING CONDITIONS

3.18.2.3.1 Physical Geographic Setting

The analysis area is located in the Basin and Range Province, a region characterized by generally north- to northwest-trending, fault-bounded mountain ranges and broad, interconnected alluvial basins that form regional aquifers. Of the total Project Area (3,620 acres), approximately 3,601 acres (approximately 97%) are in the northwestern part of the analysis area (Map 27). Because the groundwater resource available to supply the SSEP is contained in the Rainbow Valley Sub-basin, the groundwater resource evaluation focused exclusively on Rainbow Valley Sub-basin (the analysis area).

The Rainbow Valley Sub-basin encompasses an area of about 420 square miles and consists primarily of agricultural land in the north and undeveloped desert land in the south. Developed and privately owned agricultural land lies east and south of the undeveloped Project Area. The boundaries of the sub-basin are defined on the north by the Buckeye Hills and the northern part of the Sierra Estrella, on the west and southwest by the Maricopa Mountains, on the southeast by the Haley Hills, Booth Hills and Palo Verde Mountains, and on the east by Sevenmile Mountain and the southern part of the Sierra Estrella (see Map 27). The sub-basin is drained by Waterman Wash, an ephemeral stream that flows northwest and joins the Gila River near Buckeye (ADWR 1994).

3.18.2.3.2 Geologic Setting

The mountains that form the boundaries of the Rainbow Valley Sub-basin are composed of Precambrian granitic rocks ranging in composition from granite to gabbro, and metamorphic rocks that include metasedimentary, metavolcanic, and granitic gneissic rocks (Richard et al. 2000; Reynolds and Skotnicki 1997; Skotnicki 2002a and 2002b). The Precambrian bedrock outcrops are shown on Map 10. Granitic and metamorphic rocks typically yield little groundwater and effectively form barriers to groundwater flow. The regional aquifer is contained in the intermontane basin-fill deposits, which consist of poorly sorted gravel, sand, silt and clay (White 1963). Depth to bedrock ranges from a few feet near the sub-basin margins to more than 1,260 feet in the north-central part of the sub-basin (White 1963) and may exceed 9,600 feet in the deepest part of the sub-basin (Oppenheimer and Sumner 1980; Richard et al. 2007). The northern and western parts of the analysis area are characterized by exposed or shallow bedrock.

3.18.2.3.3 Groundwater Elevations and Flow Directions

Groundwater elevations in the Rainbow Valley Sub-basin are illustrated on Map 27. The groundwater elevation contours shown on the map were prepared using 2002 and 2003 water level data obtained from the Groundwater Site Inventory (GWSI) database (ADWR 2009a). The GWSI database contains records for thousands of wells in Arizona that have been physically located and inventoried in the field by ADWR or USGS. There are no well records in GWSI database for the Project Area. However, there are wells within the analysis area as discussed below in "Groundwater Development and Current Uses,"

Groundwater flow in the Rainbow Valley Sub-basin is generally northwest, parallel to the mountains that form the sub-basin boundaries. In the northern part of the sub-basin, east of the Project Area, groundwater flows toward a cone of depression in T2S, R2W, created by groundwater pumping for agricultural irrigation (ADWR 1994). Groundwater elevations range from approximately 1,000 feet amsl in the southeast, between the Palo Verde Mountains and Haley Hills, to less than 750 feet amsl within the cone of depression in the north. The average hydraulic gradient of the groundwater surface is approximately 0.002 feet per foot in the central and southern parts of the sub-basin, and about 0.01 feet per foot at the edge of the cone of depression.

Groundwater elevations and flow directions across most of the Project Area are not well defined due to a lack of reliable water level data. However, reported water level data from the Well Registry Database (ADWR 2009b) indicate that the groundwater surface across the Project Area is relatively flat. Groundwater elevations in the northwestern part of the Project Area are lower than in the southeastern part of the Project Area, indicating that groundwater in the Project Are is flowing west, toward the Gila Bend Basin. Based on the limited depth to groundwater data in the Project Area, the average depth to groundwater across the Project Area is estimated to be slightly greater than 300 feet bls.

3.18.2.3.4 Depth to Groundwater

The depth to groundwater in the northern part of the analysis area ranges from less than 100 feet bls on the shallow pediment near the Buckeye Hills to approximately 350 feet bls in the adjacent cone of depression. Elsewhere in the analysis area the depth to groundwater ranges from about 350 to 450 feet bls, and is approximately 400 feet bls in the southern part of the analysis area, near Mobile (Rascona 2005).

3.18.2.3.5 Sources of Groundwater Recharge and Discharge

Groundwater recharge to the Rainbow Valley Sub-basin (analysis area) consists of infiltration from agricultural irrigation occurring primarily in the northern part of the sub-basin, mountain front recharge, and stream channel recharge from flood-stage flows in Waterman Wash. Groundwater recharge in the vicinity of the Project Area is believed to be minimal due to the lack of agricultural irrigation, a primary stream channel or a mountain front capable of providing recharge, and significant loss of water vapor. Groundwater pumping is the primary source of discharge from the Rainbow Valley Sub-basin (ADWR 1994), but is relatively insignificant in the Project Area.

3.18.2.3.6 Groundwater Development and Current Uses

Groundwater development for agricultural irrigation in the northern part of the Rainbow Valley Sub-basin began in the early 1950s and expanded rapidly until about 1960. In 1961, a total of 16,000 acres of land was under irrigation (ADWR 1994). Groundwater pumping for irrigation increased substantially through the 1950s, remained relatively constant from about 1960 until the early 1980s, and then began declining in the early 1980s as agricultural land was taken out of production. Most of the groundwater production wells in the northern part of Rainbow Valley are currently used for agricultural irrigation, although total groundwater withdrawals from pumping for agricultural irrigation are now substantially less than they were in the 1960s and 1970s. A few wells in the northern part of Rainbow Valley are used for domestic supply. Registered wells in the analysis area are listed in Appendix C. The table was prepared from the ADWR Well Registry Database (ADWR 2009b) and includes all wells registered with ADWR after 1980.

3.18.2.3.7 Water Level Trends

ADWR maintains a statewide network of water level index wells for monitoring groundwater conditions. Static water levels are measured annually in the index wells, with the new data added to the water level file in the GWSI database (ADWR 2009a). A total of 24 index wells is located in the Rainbow Valley Sub-basin; 12 of the index wells are located in the northwestern part of the sub-basin, within approximately 7 miles of the proposed groundwater production well field. Index well locations are shown on Map 27.

Water level data with long-term periods of record, some of which extend as far back as the 1950s, show steadily declining water levels from about 1950 to 1980 as a result of groundwater development for agricultural irrigation. Water levels in the northern part of the sub-basin have risen or stabilized since the 1980s due to decreased groundwater pumping for agricultural irrigation, but have continued to decline in the south. The average, long-term water level decline rate for the Rainbow Valley Sub-basin is about 1 foot per year. The average decline rate for the northwestern part of the sub-basin is approximately 0.75 foot per year, based on historic water level data from the 12 index wells located closest to the proposed groundwater production well field.

3.18.2.3.8 Existing Well Yield

Existing high capacity production wells in the northern and central parts of the Rainbow Valley Sub-basin have reported pumping capacities that range from about 500 gpm to as high as 3,690 gpm, with most wells ranging from about 1,200 to 2,000 gpm (ADWR 2009a). There are no pumping data in the GWSI database for wells located in the southern part of the sub-basin; however, reported data from other sources indicate that existing high capacity production wells in the area typically yield less than 1,000 gpm (Clear Creek Associates 2005). The few wells that have been constructed in the Project Area are all exempt wells designed to pump less than 35 gpm; therefore, the potential well yield for most of the area is unknown.

3.18.2.3.9 Specific Capacity and Aquifer Transmissivity

Specific capacity data are obtained from short-term aquifer tests by dividing the pumping rate (Q) in gpm by the total drawdown (s) in feet, which yields specific capacity (Q/s) in gpm per foot (gpm/ft). Specific capacity can be used to estimate aquifer transmissivity (T) by multiplying specific capacity by a conversion factor of 2,000 for unconfined conditions to obtain T in gallons per day per foot (gpd/ft) (Driscoll 1986, Appendix 16.D). Hydraulic conductivity (K) in feet per day (ft/d) is calculated by dividing T by the screened interval of the well (b) in feet.

There are 31 wells located in the northern and central parts of the analysis area (T2S, R2W) with specific capacity data available from the GWSI database (ADWR 2009a); 12 of the wells are located in the northwestern part of the analysis area, within approximately 4 miles of the Project Area. There are no wells in the southern part of the analysis area with specific capacity data in GWSI. The specific capacity data from GWSI are listed in Appendix D, along with their respective estimated T and K values. Estimated T values for the 12 wells near the Project Area range from approximately 18,000 to 141,000 gpd/ft, and the corresponding K values range from about 4 to 33 ft/d.

3.18.2.3.10 Groundwater Quality

Published groundwater quality data indicate that groundwater in the northern agricultural part of the Rainbow Valley Sub-basin (analysis area) is unsuitable for potable use (ADWR 1994). TDS concentrations range from about 400 milligrams per liter (mg/L) to more than 2,700 mg/L; fluoride concentrations range from 1.0 to 10.0 mg/L (Stulik 1982). There is no primary drinking water standard for TDS; the secondary maximum contaminant level (SMCL) for TDS (secondary drinking water standard) is 500 mg/L. The Maximum Contaminant Level for fluoride is 4.0 mg/L; the SMCL is 2.0 mg/L.

3.18.2.4 GROUNDWATER AVAILABILITY

A groundwater resource evaluation was conducted for the SSEP to characterize the physical availability of groundwater to meet the water supply requirements of the SSEP. The scope of the evaluation consisted initially of preliminary (desktop) investigations based on publicly available data. The results of the preliminary investigations indicated that most of the Project Area is not suitable for groundwater development due to exposed or shallow bedrock and limited aquifer thickness, but that a sufficient groundwater supply could be present in the southeastern part of the area, subject to confirmation through exploratory drilling and aquifer testing (Golder 2008a; 2008b). A gravity survey of a portion of the analysis area was first completed to identify a suitable target area for drilling (Golder 2009a), followed by exploratory drilling and testing to characterize the groundwater resource.

3.18.2.4.1 Gravity Survey

A gravity survey was conducted to characterize the depth to bedrock and geometry of the northwestern part of the analysis area to focus the exploratory drilling and testing program on the area of highest groundwater development potential (Golder 2009a). The scope of work consisted of the planning, acquisition, reduction, presentation, and interpretation of gravity data for a portion of the analysis area. One hundred seventy-seven gravity measurements were collected in the field and processed in conjunction with 15 existing and publicly available gravity data points. The data were used and modeled to produce an interpreted depth-to-bedrock map of a portion of the analysis area.

The gravity modeling results indicate that depth to bedrock in a portion of the analysis area ranges from 0 to approximately 2,800 feet, with the greatest depths occurring east of the Project Area boundary, within the eastern third of the area of investigation. The thickest basin-fill deposits, as determined by the gravity survey (Carr 2010), are located in a portion of the analysis area within parts of Sections 24 and 25 (T2S, R3W), and Sections 29 and 30 (T2S, R2W), at the eastern Project Area boundary.

The average depth to groundwater in the northern part of the analysis area is approximately 400 feet. Assuming the depth to groundwater is approximately 400 feet across the eastern part of the analysis area, a bedrock depth of 1,000 feet would equate to a saturated basin-fill aquifer thickness of 600 feet, a suitable thickness for groundwater development provided that the aquifer transmissivity is sufficiently high.

3.18.2.4.2 Groundwater Exploratory Drilling and Testing

Based on the results of the gravity survey, a groundwater exploratory drilling and testing program was conducted to acquire hydrogeologic data to characterize the physical availability of groundwater to supply the SSEP. The methodology of the program was provided to BLM prior to drilling and comments from the BLM were incorporated into the program. Details of the program can be found in the *Groundwater Resource Evaluation* (Carr 2010) and are summarized briefly below. The main components of the exploratory program included exploratory boring drilling and logging; depth-specific (zonal) testing and analysis; monitoring well installation and development; test well installation and development; and aquifer testing and analysis.

3.18.2.4.3 Exploratory Borings and Wells Completed

Four exploratory borings (EB-1 through EB-4), one monitoring well (MW-1) and one test well (TW-1) were completed during the exploratory drilling and testing program. All of the exploratory borings and wells are located in Section 29 (T2S, R2W) and are shown on Map 28. The legal locations of the exploratory borings and wells are listed in Table 3.53.

Table 3.53 Locations of Exploratory Borings and Wells

Drilling Location	Section	Township	Range	160-acre	40-acre	10-acre	Cadastral Location
EB-1	29	2S	2W	NE	NW	NE	C(2-2)29aba
EB-2	29	2S	2W	NW	SE	SW	C(2-2)29bdc
EB-3	29	2S	2W	NW	NE	NW	C(2-2)29bab
EB-4	29	2S	2W	NE	SE	SW	C(2-2)29adc
MW-1	29	2S	2W	NE	NW	NE	C(2-2)29aba
TW-1	29	2S	2W	NE	NW	NE	C(2-2)29aba

3.18.2.4.4 Exploratory Boring Drilling and Logging

The four exploratory borings (EB-1 through EB-4) were drilled and logged to characterize subsurface lithology and verify depth to bedrock (if encountered). The boreholes were advanced to total depths ranging from approximately 1,100 to 1,500 feet bls and never encountered bedrock. Drill cuttings were logged in the field and the completed boreholes logged by a geophysical logging contractor.

Three distinct hydrogeologic units were noted in the exploratory borings: an upper unit consisting of sand and gravel, a middle unit consisting mainly of clay and silty clay, and a lower, highly consolidated conglomerate. Based on observations made during the SSEP exploratory drilling program, the upper unit near the Project Area consists primarily of gravel, sand, and silt, and occurs from 0 to approximately 920 feet bls. The middle unit consists of clay, silt, mudstone, and very-fined grained sand with some interbedded sand and gravel, and occurs from about 920 to 1,100 feet bls. The lower unit consists of conglomerate, gravel, decomposed metamorphic rocks, and alluvium, and occurs from about 1,100 feet bls to bedrock.

3.18.2.4.5 Depth-specific (zonal) Testing and Analysis

Five intervals were selected from each exploratory boring for depth-specific (zonal) testing using information from the lithologic and geophysical logs. The testing of each interval consisted of groundwater sampling, followed by the completion of falling head tests. The zonal testing results provided depth-specific information on groundwater quality and aquifer production potential, and were used to develop an appropriate test well design.

Zonal sampling and testing was performed using a perforated eductor pipe, placement of a sand envelope around the perforated zone, and isolation of the zone with bentonite seals. Each interval was purged by airlifting prior to sample collection. Each zonal sample was analyzed for major ions, indicator parameters and selected metals by an Arizona-certified analytical laboratory. After each sample was collected, a falling head test was performed to estimate depth-specific K using an electronic pressure transducer (i.e., pressure sensor) and a laptop computer. Data from the pressure transducer were evaluated using the Unconfined Bouwer-Rice Solution (Bouwer and Rice 1976) to calculate a value of K in ft/d for each zone.

3.18.2.4.6 Zonal Groundwater Sampling Results

The analytical methods and results for the groundwater samples are found in the Groundwater Resource Evaluation (Carr 2010) and are summarized in this paragraph. TDS values range from 800 to 7,900 mg/L. However, the sample with the highest TDS value (7,900 mg/L), obtained from the lowermost zone at EB-3, is thought to have been impacted by residual drilling fluid and is therefore not representative of groundwater quality conditions. The remaining TDS values range from 800 to 2,500 mg/L. Most of the higher values (1,200 to 2,500 mg/L) were observed in the samples collected from either the middle or the lower unit, below the productive part of the aquifer. Most of the TDS values from the zones completed in the upper unit range from 800 to 1,200 mg/L, with a single outlier (1,700 mg/L) from the middle zone at EB-3.

3.18.2.4.7 Falling Head Test Results

The falling head test results were used to calculate values for K and T for each zone by multiplying K by the screened interval (b) represented by the zone. Each T value was converted into a specific capacity value, then into an estimated well capacity value assuming a drawdown of 100 feet. The falling head test results indicate that the estimated K of the upper unit is substantially higher than the estimated K of the underlying middle and lower units; therefore, the total well capacity for each drilling site was estimated using only the test results from zones completed in the upper units. The well capacities estimated using this method range from 1,000 to 2,400 gpm.

3.18.2.4.8 Test Well and Monitoring Well Installation and Development

In order to perform tests on the aquifer to confirm the results of the exploratory program, a test well and a monitoring well were installed and developed. Exploratory boring EB-1 was selected for completion as a test well, which was designated TW-1. The EB-1 site was selected for the test well based primarily on its location, which is slightly closer to the center of the analysis area than the other three sites. The site was also selected based on the logs and zonal testing results from the exploratory boring, which indicated the presence of a productive aquifer to a depth of 920 feet. The design of TW-1 was finalized using the data collected during the logging and testing of EB-1. A monitoring well (MW-1) was installed approximately 35 feet from the test well (TW-1) to allow water level data to be collected during the aquifer tests.

Well TW-1 was installed to a depth of 940 feet and constructed with 16-inch diameter steel casing to accommodate the installation of a high-capacity pump for testing. Monitoring well MW-1 was installed to a depth of 600 feet and constructed with 4-inch diameter polyvinyl chloride casing. Details on the installation and development of wells TW-1 and MW-1, including as-built diagrams, are provided in the Groundwater Resource Evaluation (Carr 2010).

3.18.2.4.9 Aquifer Testing and Analysis

Aquifer testing consisted of a 10-hour, step-rate pumping test to evaluate well yield, specific capacity and well efficiency followed by a 72-hour, constant-rate aquifer test to estimate the transmissivity and storativity of the aquifer, confirm the well yield and specific capacity obtained from the step-rate pumping test, and evaluate conditions that could affect the well's discharge capacity after an extended period of pumping. Testing activities are extensively documented in the Groundwater Resource Evaluation (Carr 2010). The water level drawdown and recovery data from the constant-rate aquifer test were analyzed using the Cooper-Jacob (1946) method for analysis of the early time drawdown data, the Moench (1997) method for analysis of the late time drawdown data, and the Theis (1935) recovery method.

The results of the step-rate pumping test indicate that the well efficiency is relatively high and declines only slightly, from 93% to 87%, between 800 and 1,600 gpm. Similarly, specific capacity declines slightly over the same pumping range, from about 20 to 19 gpm/foot. A pumping rate of 1,400 gpm was selected for the constant-rate test based on the results of the step-rate test. The water level drawdown from the constant rate test at the end of 72 hours of pumping was 73.8 feet in well TW-1, with a pumping water level of about 435.5 feet bls. This translates to a specific capacity of 19.1 gpm/foot of drawdown at an average discharge rate of 1,411 gpm. The water level in well MW-1 at the end of the test was 27.9 feet, corresponding to a water level of 389.3 feet bls. At the end of 30 hours of recovery, the residual drawdown in the test well was approximately zero, a recovery of 100%. Groundwater was also sampled during this process and was found to have a TDS concentration of 800 mg/L.

3.18.2.5 SUMMARY OF GROUNDWATER AVAILABILITY

The results of the groundwater resource evaluation indicate that there is a sufficient supply of groundwater at the location of the proposed groundwater production well field in Section 29 (T2S, R2W) to meet the water supply requirements of the SSEP. Groundwater exploratory drilling verified that the basin-fill aquifer is productive to a depth of approximately 920 feet bls with a saturated thickness of about 560 feet, and that subsurface conditions are similar at all four drilling sites. The results of the step-rate pumping test at well TW-1 indicate that the well can be pumped at a rate of 1,400 gpm with a water level drawdown of about 75 feet. The results of the constant-rate aquifer test at well TW-1 resulted in estimated T values ranging from approximately 44,000 to 59,000 gpd/ft, estimated K values ranging from 15 to 20 ft/d, and an S value of 0.12.

3.19 Wildlife and Special-status Species

3.19.1 Overview

The area of analysis for wildlife resources consists of the Project Area (see Section 3.1.1) and includes portions of the Buckeye Hills and the North Maricopa Mountains. The analysis area includes these hills and mountains because certain wildlife species may pass through the Project Area while in transit between these areas. The analysis area also includes portions of the Gila River, Rainbow Wash, and an unnamed tributary to Waterman Wash. Wash habitat is included in the analysis area due to the potential for high wildlife species richness and the potential for use as wildlife travel corridors.

3.19.2 Laws, Ordinances, Regulations, and Standards

Developments that include ground-disturbing activities or placement of structures may impact special-status species or their habitats. As such, laws have been developed for their protection, and where applicable, are considered during project resource reviews. The following LORS are applicable to the wildlife related aspects of the SSEP.

3.19.2.1 ENDANGERED SPECIES ACT SECTION 7 (16 U.S.C. § 1531, AND 50 CFR § 17.1)

The ESA of 1973 directs all federal agencies to work toward conserving endangered and threatened species and to use their authority to further the purposes of the act. Section 7 of the act is the mechanism by which federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the continued existence of any listed species.

The BLM has initiated informal consultation with USFWS for the SSEP. A BA was completed for the SSEP and has determined that there would not be any project-related impacts to any federally listed species and/or their designated critical habitat because suitable foraging and/or breeding habitat is not present in the Project Area (EPG 2009). The USFWS has provided concurrence for this determination (USFWS 2010).

The federal Migratory Bird Treaty Act of 1918 (MBTA) provides protection for 836 bird species present in the United States, most of which are migratory. The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell most birds listed under the act. The legal take of game bird species is allowed. The statute is described in more detail in Section 3.19.4.1 below along with the migratory birds present in the Project Area.

3.19.2.2 BALD AND GOLDEN EAGLE PROTECTION ACT (16 U.S.C. § 668; 50 CFR § 22 ET SEQ.)

The Bald and Golden Eagle Protection Act (Eagle Act) prohibits any form of possession or taking of bald eagles (*Haliaeetus leucocephalus*) or golden eagles. A 1962 amendment to the MBTA created a specific exemption for possession of an eagle or eagle parts (e.g., feathers) for religious purposes of Indian tribes. The amendment provided for not only the preservation of the golden eagle, but also the preservation of Native American cultural practices.

The USFWS finalized new permit regulations authorizing the limited take of bald eagles and golden eagles under the Eagle Act on September 11, 2009. The rules, which went into effect November 10, 2009, established a regulatory mechanism to permit take comparable to incidental take permits under the ESA.

The rules allow the USFWS to authorize take associated with otherwise lawful activities where the take is compatible with preservation of the bald and golden eagle and cannot practicably be avoided. The Eagle Act defines "take" to include a broad range of actions, including disturbing eagles. Notably, the new rules were developed because "many actions that are considered likely to incidentally take (harm or harass) eagles under the ESA will also disturb or otherwise take eagles under the Eagle Act."

A regional bald and golden eagle nest location survey was conducted by the AZGFD in 2011. No suitable habitat is present in the Project Area for bald eagles. The nearest documented bald eagle breeding area is located 17 miles away. However, recognition of the existing law is included in the project review process to ensure complete compliance with the Eagle Act.

3.19.2.3 BLM SENSITIVE SPECIES

The BLM manages habitat for wildlife on public lands, and the AZGFD maintains and manages the state's wildlife resources. The BLM sensitive species list for the LSFO consists of species that are federally protected under the ESA and MBTA and species that are protected by state laws, including plant and animal species, game species, and migratory birds. These species need to be addressed because BLM policy (Manual Section 6840) dictates that the BLM must carry out management for the conservation of state-listed plants and animals in addition to species protected under the ESA. BLM Manual Section 6840 is a federal guidance document that outlines the criteria for listing species as sensitive on BLM-administered lands and provides direction on management of these species. BLM sensitive species are species that the USFWS currently lists under status review; species whose populations are declining rapidly and may warrant federal protection in the future; species that have small, widely distributed populations; and species that are located in special or unique habitats. IM No. AZ-2006-002, Change 1, dated September 30, 2006, provides a current update of the species list designated as sensitive by the BLM in Arizona.

3.19.2.4 AZGFD WILDLIFE OF SPECIAL CONCERN

A.R.S. Title 17 directs the responsibility for maintaining and managing the state's wildlife resources to the AZGFD and Commission. According to A.R.S. § 17-102, most wildlife in Arizona is the property of the state. A.R.S. § 17-231 allows the commission, among other things, to 1) establish policies and programs for the management, preservation and harvest of wildlife; 2) establish hunting, trapping and fishing rules and prescribe the manner and methods that may be used in taking wildlife; 3) enforce laws for the protection of wildlife and wildlife habitat; and 4) develop and distribute information about wildlife and activities of the department.

The AZGFD lists various species as wildlife of special concern (WSC). WSC are wildlife species that are or may be in jeopardy in Arizona or with known or perceived threats or population declines. AZGFD manages all wildlife species in Arizona. AZGFD maintains a statewide database, the Heritage Data Management System (HDMS), which tracks records for federally listed species and other species of special concern. The HDMS was accessed through the Arizona Heritage Geographic Information System (AZHGIS) online environmental review tool to determine whether any federally proposed or designated critical habitat or special-status species have been documented in or near the Project Area (AZHGIS 2009). The response letter provides information on special-status species, the presence or absence of designated critical habitat, special handling guidelines for wildlife, and preliminary project-type recommendations, as given by the AZGFD.

3.19.2.5 USFWS BIRDS OF CONSERVATION CONCERN

The 1988 amendment to the Fish and Wildlife Conservation Act, Birds of Conservation Concern (BCC), mandates the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA." The overall goal is to accurately identify the migratory and nonmigratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities of the USFWS. This assessment is derived from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the U.S. Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. Bird species considered include nongame birds, gamebirds without hunting seasons, and ESA candidate, proposed endangered or threatened, and recently delisted species. Assessment scores from all three bird conservation plans are based on several factors, including population trends, threats, distribution, abundance, and relative density. The goal of the USFWS regarding BCC species is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions. The USFWS recommends that these lists be consulted in accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (USFWS 2008).

3.19.3 Field Reconnaissance

Biological field reconnaissance surveys were conducted to support the information in this document (Pape 2009). These surveys were conducted and were consistent with input received from the USFWS, AZGFD, and BLM in pre-survey coordination meetings. Due to the absence of endangered species or suitable habitat in the Project Area, no "protocol" surveys were deemed necessary. Reconnaissance surveys were conducted in the Project Area and within a 2-mile buffer around the Project Area boundaries. Reconnaissance surveys included an initial visit on January 22, 2008 to assess vegetation communities and plant and wildlife species that potentially occur in the Project Area. Additional reconnaissance consisted of 1) siting for a meteorological station on October 9 and November 19, 2008; 2) a BLM sensitive species review on January 28, 2009 (for the western burrowing owl, Sonoran population of the desert tortoise, Le Conte's thrasher [*Toxostoma lecontei*], and Tucson shovelnose snake [*Chionactus occipitalis klauberi*]); 3) biological clearance for proposed groundwater exploration sites on March 30, 2009; 4) a reconnaissance for potentially suitable habitat for the Tucson shovelnose snake on September 9, 2009; 5) and a biological review in support of the CWA Section 404 Significant Nexus Analysis on July 29, 2009. Technical memoranda for the BLM sensitive species review and the Tucson shovelnose snake habitat survey are included in field survey documentation (Pape 2009).

3.19.4 General Wildlife

The Project Area is situated south of the Gila River, east of a major bend in the river (Map 29), between the Buckeye Hills to the north and the Maricopa Mountains to the south. It is generally level, with nominal variation in elevation within its limits. The Project Area is bounded on the south by an existing utility corridor, which separates it from the Sonoran Desert National Monument. SR-85 is approximately 4.5 miles west of the proposed power plant site. Elevations in the Project Area vary between 1,007 and 1,138 feet amsl.

Habitat for wildlife is defined by the presence or absence of a species in an area in a particular vegetation community type. Areas that appear suitable for a species but that have not been surveyed are considered possible habitat. Wildlife habitat in the Project Area corresponds with the Sonoran Creosotebush-Bursage Scrub vegetation community series, as described in Section 3.16 (Vegetation and Special-status Plant Species. There are approximately 3,620 acres of this vegetation community in the Project Area. Additional wildlife habitat in the analysis area includes the Sonoran Palo Verde-Mixed Cacti/Sonoran Creosotebush-Bursage

vegetation community series, and the high elevation Sonoran Desert mountain vegetation community, which occurs in the Buckeye Hills and the North Maricopa Mountains as described in Section 3.16 (Brown 1994).

There are no perennial or intermittent streams, washes, or wetlands in the Project Area. All washes are ephemeral and flow only after heavy rainfall events. There may be temporary puddles after storms in low depressions, but these are unlikely to last more than a few hours or a few days. There are no rocky outcrops that support tinajas (natural bedrock features that retain rainfall as pools of water) in the Project Area. Surface hydrology in the Project Area is controlled by a north-south drainage divide, which divides the Project Area roughly in half (see Map 26). Xeroriparian washes in the western portion of the Project Area drain to the Rainbow Wash, which empties into the Gila River approximately 8.5 miles to the southwest of the Project Area (approximately 5 miles downstream of the Gillespie Dam). The eastern portion of the Project Area drains into an unnamed tributary to Waterman Wash that is the complement of the Rainbow Wash, and directs Project Area waters to the Waterman Wash approximately 2.5 miles to the northeast. These washes do not support true riparian vegetation, but allow for a semi-dense growth of shrubs and bushes, which is defined as the xeroriparian vegetation.

An ephemeral CCC stock pond is located in the eastern portion of the Project Area, near Ocotillo Road (see Map 23). This stock pond supports semi-dense, brushy vegetation for most of the year. It is unknown how often wildlife use this stock pond for watering, but a network of trails leading to the pond from both the north and south are evident in fall 2005 satellite imagery, implying that wildlife use is relatively high.

Existing noises in the analysis area are generally low and are produced from localized equipment in suburban development (i.e., generators and air conditioners), sporadic traffic, and high-altitude aircraft. A complete description of existing and background noise in the analysis area can be found in Section 3.9.4 (Existing Noise Sources in the Area of Analysis).

The following sections discuss wildlife species that are either commonly found in these vegetation communities, or were observed in the Project Area during reconnaissance for this project.

3.19.4.1 MIGRATORY BIRDS, RAPTORS, AND GAME BIRDS

Most of the bird species occurring in the United States are protected under the MBTA of 1918 (amended in 1936, Mexico, and 1972, Japan). Species protected under this act include neotropical migrants and raptors. The MBTA prohibits the taking, killing, or possessing of migratory birds, unless authorized by the Secretary of the Interior. Take is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect." EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) requires the United States to oblige significant responsibility to provide for the conservation of migratory birds and their habitats, with an emphasis on species of concern. Federal agencies are also required to support the objective of the migratory bird conventions by incorporating bird conservation values, standards, and practices when engaging in activities and would attempt to minimize adverse impacts on migratory birds when conducting agency acts. Some of these species are also considered BCCs by the USFWS (2008). These species are discussed further in Section 3.19.5.

Foraging and nesting raptor populations are often surveyed for use as indicators of habitat health due to their place at the top of the food chain (Romin and Muck 2002). There is evidence that destruction and degradation of both nesting and foraging habitat can strongly alter raptor nesting success and, ultimately, affect populations (Romin and Muck 2002). Additionally, raptors can often be slow to recover from habitat degradation due to certain life history traits such as long life spans, slow reproductive rates, and specific habitat requirements (McCallum 1994, Kaufman 1996, Romin and Muck 2002). Raptors also show a high fidelity to nesting sites and territories and many species have narrow habitat requirements for nesting and nest placement. In short, raptors are especially vulnerable to habitat degradation and disturbance. Raptors, as well as their nests and eggs, are protected by the MBTA.

Much of the Sonoran Creosotebush-Bursage Scrub vegetation community in the Project Area consists of pure stands of creosotebush. There are no wildlife species that are solely dependent on creosotebush habitat (Raitt and Maze 1968; Tomoff 1974), and most birds, including raptors, use this community for cover and foraging, and not for nesting. Most of the xeroriparian washes in the analysis area provide more cover or forage for birds and other wildlife than the Sonoran Creosotebush-Bursage Scrub vegetation community. However, because of the lack of perennial water, these washes do not support the diverse species typically found in true riparian habitat. Migratory bird species that were observed in the Project Area during reconnaissance surveys are listed in Table 3.54. The Gila woodpecker (*Melanerpes uropygialis*) and loggerhead shrike (*Lanius ludovicianus*) are priority species for the LSFO. These species are discussed further in Section 3.19.5.2 (Special-status Species).

Table 3.54 Migratory Bird Species Observed in the Project Area during Reconnaissance Surveys, 2009

Common Name	Scientific Name
American kestrel	*Falco sparverius*
American pipit	*Anthus rubescens*
Ash-throated flycatcher*	*Myiarchus cinerascens*
Black-chinned hummingbird	*Archilochus alexandri*
Black-tailed gnatcatcher*	*Polioptila melanura*
Black-throated sparrow*	*Amphispiza bilineata*
Cactus wren*	*Campylorhynchus brunneicapillus*
Canyon towhee*	*Pipilo fuscus*
Gambel's quail	*Callipepla gambelii*
Gila woodpecker*	*Melanerpes uropygialis*
Horned lark	*Eremophila alpestris*
Ladder-backed woodpecker	*Picoides scalaris*
Loggerhead shrike	*Lanius ludovicianus*
Mourning dove*	*Zenaida macroura*
Northern flicker*	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Phainopepla*	*Phainopepla nitens*
Red-tailed hawk	*Buteo jamaicensis*
Rock wren	*Salpinctes obsoletus*
Say's phoebe	*Sayornis saya*
Turkey vulture	*Cathartes aura*
Verdin*	*Auriparus flaviceps*
Western burrowing owl	*Athene cunicularia*
Western meadowlark	*Sturnella neglecta*
White-crowned sparrow	*Zonotrichia leucophrys*
Yellow-rumped warbler	*Dendroica coronata*

*Denotes bird species commonly observed in the Project Area.

The AZGFD manages many bird species as game birds, three of which are also listed as priority species by the LSFO. These consist of the mourning dove, white-winged dove (*Zenaida asiatica*), and Gambel's quail. All of these species have the potential to occur in the Project Area and analysis area. Native members of the dove family (Columbidae) are covered under the MBTA, and management is cooperative between states and the USFWS. Members of the quail family (Odontophoridae) are not covered by the MBTA, and are managed by the states.

3.19.4.2 MAMMALS

3.19.4.2.1 Big Game

Big game species with the potential to occur in the Project Area and analysis area consist of bighorn sheep (*Ovis canadensis*), mule deer, mountain lion (*Puma concolor*), and javelina (*Pecari tajacu*). Populations of these species are managed for hunting by the AZGFD by establishing seasonal hunting dates and permit numbers for each species. These species are also listed as priority species by the LSFO. The Project Area falls in AZGFD Game Management Unit 39 (AZGFD 2009).

Bighorn Sheep

Bighorn sheep require access to water, suitable forage, and steep escape terrain for predator avoidance. AZGFD suspects that most of the bighorn sheep in the southwestern corner of Arizona are a single metapopulation (personal communication, Dana Warnecke 2011). This means that there are isolated small populations in pockets of habitat within the range of the larger metapopulations, and genetic mixing occurs through dispersal of individuals from one population to another. Furthermore, AZGFD transplants individuals from regions with stable and growing populations into local populations to enhance genetic mixing. It is currently unknown which routes bighorn sheep use to travel between populations both historically and currently, but it is suspected that genetic mixing occurs among the Buckeye Hills (east and west), Sierra Estrella, Maricopa, and Gila Bend mountains, as well as habitat patches located further west and north of the analysis area (personal communication, Dana Warnecke 2011). A bighorn sheep roadkill found near the proposed Project Area on Rainbow Valley Road in 1997 suggests that some movement occurs between the Buckeye Hills and North Maricopa mountains (AZGFD 2011a).

A census was completed on bighorn sheep populations in the analysis area in 2009, with the following results. Eight bighorn sheep are estimated to exist in the North Maricopa Mountains, with a total estimate of 23 bighorn sheep in the entire Maricopa range. Sixteen bighorn sheep are estimated to exist in the Sierra Estrella Mountains. The population is estimated to be 113 individuals for the Gila Bend Mountains. No bighorn sheep have been found in the Buckeye Hills since 1999. Because of this, AZGFD transplanted five bighorn sheep into the west Buckeye Hills (i.e., west of SR-85) in November 2009 to augment this population, and two more individuals were transplanted in 2010 (AZGFD 2011a).

Although bighorn sheep prefer to live in mountainous habitat, they may cross through the lowland Project Area habitat while traveling to more appropriate habitat. Wildlife linkage corridors for this species are discussed further in Section 3.19.6 (Wildlife Linkages). SR-85 in its current configuration may act as an effective barrier to bighorn movements, limiting movements of bighorn sheep between the Gila Bend Mountains and either the east Buckeye Hills or the North Maricopa Mountains.

No bighorn sheep have been detected in the east Buckeye Hills in recent years (Henry 2009). The apparent absence of bighorn sheep in the east Buckeye Hills may be due to inadequate resources (e.g., water) to independently support them. Historic use of the east Buckeye Hills by bighorns may have been dependent on access to the Gila Bend Mountains prior to the movement-inhibiting impacts of SR-85 in its current multilane configuration. No bighorn sheep or their sign have been observed during any site reconnaissance surveys or other Project Area visits.

Mule Deer

Mule deer inhabit a wide range of elevations and habitats, often preferring areas that provide a balance of both cover and visibility. They require cover and suitable forage, which typically includes a variety of subshrubs, shrubs, and tree species. The mule deer populations in Arizona are not declining and are considered secure. The presence and activity of mule deer in the analysis area may occur throughout the Sonoran Creosotebush-Bursage Scrub habitat of the analysis area, and is also associated with Xeroriparian Wash habitat such as the Rainbow Wash and the unnamed tributary to Waterman Wash. Xeroriparian Wash habitat would be used by the species for movement through the valley. Mule deer have also been documented using stock tanks as a water source, and may use the CCC stock tank when water is present. No mule deer or their sign have been observed in the Project Area. Wildlife linkage corridors for this species are discussed further in Section 3.19.6 (Wildlife Linkages).

Mountain Lion

Mountain lions inhabit a wide elevation range and typically occur in habitats that support their primary prey (i.e., deer), or other prey species, including javelina, jackrabbits, rodents, and occasionally cattle or bighorn sheep (Hoffmeister 1986; Valdez and Krausman1999). Their numbers in the analysis area are likely low, and their presence in the analysis area would be most likely in the mountains north or south of the Project Area. Mountain lions may be present throughout the Project Area. Xeroriparian Wash habitat would likely be used by individuals' movements between mountain ranges, or along major valley washes in pursuit of prey. See Section 3.19.6, below, for further discussion on wildlife linkage corridors.

Javelina

Javelina are primarily residents of lower elevation desertscrub habitat, but will range up to juniper, and occasionally lower oak elevations (Hoffmeister 1986). They usually inhabit areas of dense scrub that includes prickly pear cacti (*Opuntia* spp.), which is their primary source of food. Javelina are likely to occur in the Project Area in small numbers. Although they may be present in the Project Area, they would most likely use the Xeroriparian Wash habitat.

3.19.4.2.2 Predators, Furbearers, and Small Game

Predatory, furbearing, and small game species populations are monitored and managed for hunting by the AZGFD by setting seasonal hunting dates, bag limits, and regulated practices for predator control. Predatory species with the potential to occur in the analysis area consist of bobcat (*Lynx rufus*), kit fox, gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), American hog-nosed skunk (*Conepatus leuconotus*), western spotted skunk (*Spilogale gracilis*), and hooded skunk (*Mephitis macroura*). Furbearers with the potential to occur in the analysis area consist of ringtail (*Bassariscus astutus*), raccoon (*Procyon lotor*), and badger. Small game with the potential to occur in the analysis area consists of the desert cottontail (*Sylvilagus audubonii*). Black-tailed jackrabbit (*Lepus californicus*) also occur in the analysis area. Evidence of kit fox and coyote were observed on the Project Area during reconnaissance surveys in 2009.

3.19.4.2.3 Small Mammals

Small mammal populations are not monitored by the AZGFD or the BLM LSFO; however, they are often used as an indicator for habitat health because of the importance of small mammal populations as a prey base for other species, such as raptors, predatory mammals, and snakes. For this reason, some small-mammal species are listed as priority species by the LSFO. Small mammals with the potential to occur in the Project Area and analysis area consist of desert pocket mouse (*Chaetodipus penicillatus*), rock pocket mouse (*Chaetodipus intermedius*), Arizona pocket mouse (*Perognathus amplus*), woodrat (*Neotoma* sp.),

kangaroo rat (*Dipodomys* sp.), American deer mouse (*Peromyscus maniculatus*), and southern grasshopper mouse (*Onychomys torridus*). Round-tailed ground squirrels (*Spermophilius tereticaudus*) as well as pocket mouse burrows and woodrat middens were observed on the Project Area during site reconnaissance surveys in 2009.

3.19.4.3 REPTILES AND AMPHIBIANS

All reptile and amphibian species with potential to occur in the Project Area are managed by the AZGFD as nongame species, and may be taken, with the exception of the Gila monster (*Heloderma suspectum*) and the Sonoran desert tortoise.

Reptile species observed in the Project Area during site reconnaissance surveys in 2009 consisted of common side-blotched lizard (*Uta stansburiana*), western whiptail lizard (*Aspidoscelis tigris*), desert iguana (*Dipsosaurus dorsalis*), long-tailed brush lizard (*Urosaurus graciosus*), and sidewinder (*Crotalus cerastes*). The zebra-tailed lizard (*Callisaurus draconoides*) has also been observed in the analysis area.

The potential for the desert tortoise to occur in the analysis area is discussed further in Section 3.19.5. The Gila monster is discussed in Section 3.19.6 (Wildlife Linkages).

The only amphibian breeding habitat in the Project Area is located at the CCC stock pond. The waters of this pond are ephemeral, therefore only species adapted to breeding in temporary pools may be found there. The AZGFD has observed Sonoran desert toad (*Bufo alvarius*) sign and tadpoles in ephemeral stock tanks in the analysis area, and suspects that this species also breeds in the CCC stock pond. Other species with potential to breed in the CCC stock pond include the southern spadefoot (*Scaphiopus multiplicatus*) and Great Plains toad (*Bufo cognatus*).

3.19.5 Threatened, Endangered, and Special-status Species

Threatened, endangered, and special-status wildlife species that were reviewed for the potential to occur in the Project Area are listed in Appendix E. Only species with the potential to occur in the Project Area are further discussed in this document. Table 3.55 lists these species, their conservation status, and their potential to occur in the Project Area.

Table 3.55 Conservation Status of Wildlife Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Status*	Habitat	Known Occurrences	Potential for Occurrence
Birds					
Ferruginous hawk	*Buteo regalis*	WSC BCC	Open grasslands, prairies, and desertscrub	No	Moderate
Golden eagle	*Aquila chrysaetos*	BGEPA	Nest on cliffs, trees, or artificial structures. Diverse foraging habitat	No	Very low; foraging only
Peregrine falcon	*Falco peregrinus anatum*	BLMS WSC BCC	Open habitats in rugged country, usually near lakes, rivers, or streams and with rocky outcrops or cliffs nearby	No	Low
Western burrowing owl	*Athene cunicularia hypugaea*	BLMS BCC	Open areas of low slope where low vegetation provides good visibility. Usually associated with colonial burrowing rodents	Yes	Present

Table 3.55 Conservation Status of Wildlife Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Status*	Habitat	Known Occurrences	Potential for Occurrence
Elf owl	*Micrathene whitneyi*	BCC	Nests in tree holes and columnar cacti in desert into middle-elevation woodlands	No	Moderate
Costa's hummingbird	*Calypte costae*	BCC	Desertscrub, thorn scrub, and other arid brushy areas	No	High
Gila woodpecker	*Melanerpes uropygialis*	BCC	Sonoran desertscrub and riparian woodlands	Yes	High
Gilded flicker	*Colaptes chrysoides*	BCC	Low-elevation Sonoran desertscrub with saguaros present for nest cavities	No	High
Loggerhead shrike	*Lanius ludovicianus*	BLMS BCC	Open, brushy areas with scattered trees used for hunting patches	Yes	High
Crissal thrasher	*Toxostoma crissale*	BCC	Dense vegetation associated with desert washes	No	Very low
Le Conte's thrasher	*Toxostoma lecontei*	BCC	Very low, hot, open desertscrub with scattered bushes or cholla	No	Moderate
Lucy's warbler	*Vermivora luciae*	BCC	Brushy washes and riparian areas within desertscrub	No	Moderate
Chestnut-collared longspur	*Calcaruis ornatus*	BCC	Winters in the southwest in grassland and desert habitats	No	Low
Lawrence's goldfinch	*Carduekus lawrencei*	BCC	Winters in open, brushy deserts and grasslands	No	Moderate
Mammals					
California leaf-nosed bat	*Macrotus californicus*	BLMS WSC	Desertscrub with caves or mines for colonies	No	Foraging only
Cave myotis	*Myotis velifer*	BLMS	Roosts in colonies in mines and caves at lower elevations within a couple miles of water	No	Foraging only
Western red bat	*Lasiurus blossevillii*	BLMS WSC	Riparian or desert shrub habitat at various elevations; roosts in large trees	No	Foraging only
Southern yellow bat	*Lasiurus ega*	BLMS WSC	Primarily associated with its preferred roost the desert fan palm at natural oases or in landscape situations; often near water; other records in Arizona and New Mexico from broad-leaf riparian habitats	No	Foraging only
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	BLMS	Low desert habitats with rocky cliffs that provide roosting habitat for small colonies; human structures	No	Foraging only
Greater mastiff bat	*Eumops perotis californicus*	BLMS	Roost in groups in crevices and shallow caves on the sides of cliffs and high rock walls	No	Foraging only
Spotted bat	*Euderma maculatum*	BLMS WSC	Roosts in crevices and caves in rocky cliffs from below sea level to pine forests	No	Foraging only

Table 3.55 Conservation Status of Wildlife Species with Potential to Occur in the Project Area

Common Name	Scientific Name	Status*	Habitat	Known Occurrences	Potential for Occurrence
Amphibians					
Great plains toad	*Bufo cognatus*	BLMS	Inhabits flats and low valleys from Lower Colorado Subdivision Sonoran Desert up to grassland elevations	No	Moderate
Reptiles					
Sonoran desert tortoise	*Gopherus morafkai* (formerly *G. agassizii)*	C WSC	Rocky foothills in desertscrub and Semi-desert Grassland habitats	No	Very low

*** Status Acronym Legend:**
C = Federal Candidate for listing under the ESA.
BCC = Birds of Conservation Concern.
BLMS = BLM Sensitive Species.
WSC = Wildlife of Special Concern.
BGEPA = Protected under Bald and Golden Eagle Protection Act.

3.19.5.1 FEDERALLY LISTED (ESA) SPECIES

The only federally listed, candidate, or proposed wildlife species that is likely to occur in the Project Area is the Sonoran desert tortoise (*Gopherus morafkai*; candidate). There is no designated critical habitat for any federal wildlife species in the Project Area. The BLM has initiated informal consultation with the USFWS for the SSEP. A BA has been prepared for the SSEP and has determined that there would be no project-related effects to any federally listed species and/or their designated critical habitat. The USFWS has provided concurrence for this determination (USFWS 2010). When the BA was completed in 2009, the Sonoran desert tortoise was undergoing a 12-month review to determine whether listing was warranted; therefore, the effects of the project were not determined for this species in the BA. The review was completed in December 2011 and found that the Sonoran desert tortoise species warrants federal protection, but precludes listing due to higher priorities, and is currently listed as a candidate species (75 *Federal Register* 78,094, Dec. 14, 2010).

Sonoran Desert Tortoise

The Sonoran desert tortoise was recently described as a species distinct from the Mojave desert tortoise (*G. agassizii*) (Murphy et. al 2011). Until this description was published, the Sonoran and Mojave desert tortoises were considered to be distinct population segments of the same species. For the purposes of this analysis, this species is considered to be distinct; however, note that many referenced documents (including USFWS publications) refer to the Sonoran population of the species. A 12-month review was completed by the USFWS in December 2011 and found that the Sonoran desert tortoise warrants federal protection, but precludes listing due to higher priorities, and is currently listed as a candidate species (75 *Federal Register* 78,094, Dec. 14, 2010). The Sonoran desert tortoise is also given special attention by most agencies due to its similarity in appearance to the threatened Mohave population of the same species. It is considered a sensitive species by the BLM Arizona State Office and a WSC by the AZGFD (AZGFD 2009a).

The Sonoran desert tortoise is found in southern and western Arizona, south and east of the Colorado River, and is also found across the border in much of western Sonora, Mexico (AZGFD 2001a). Sonoran desert tortoises may be found in Mohave and Sonoran desertscrub vegetation communities. They may be found in palo verde and saguaro communities in the Sonoran Desert (Lawler 2009). These tortoises prefer rocky slopes

and bajadas at the base of desert mountain ranges (AZGFD 2001a). They may be found at elevations between approximately 510 feet in Mohave desertscrub and 5,300 feet in semi-desert grassland and interior chaparral (AZGFD 2001a). Sonoran desert tortoises are primarily herbivores, consuming a wide variety of plant materials. They are known to feed on flowering annuals, grasses, leafy perennials, trees and shrubs, subshrubs and woody vines, and succulents (AZGFD 2001a). They also ingest rocks, bones, and soil, possibly to maintain intestinal bacteria, to provide additional minerals, or as gastroliths to aid digestion (Ivanyi et al. 2000; Lawler 2009).

This species has one clutch of eggs per season. Hatchling and juvenile mortalities are very high, and it has been estimated that only one hatchling for every 15 to 20 nests will survive to reach sexual maturity (Lawler 2009). Sonoran desert tortoises face numerous threats to their survival. Livestock grazing, recreational OHV use, military training activities, urban development, road construction, agriculture, and mineral development are all factors that can alter or destroy their habitat (Lovich 1999). An increase in common predators, such as the common raven (*Corvus corax*), coyote, and domestic dog, may increase the mortality of hatchlings and juvenile tortoises (Boarman 2002). Sonoran desert tortoises will urinate in response to harassment, which is especially harmful because of the limited water resources in their habitat and the inability to easily replenish lost water. Decreasing numbers of Sonoran desert tortoises are often the result of illegal removal of adult tortoises (for pets or commercial sale), vehicle mortality (Lovich 1999), vandalism (shooting, crushing, or mutilation) (Berry 1986; Howland and Rorabaugh 2002), and the use of them as a food source (USFWS 1994).

Invasion by exotic plants can have a significant, negative impact on tortoises due to resultant changes in the native vegetation community. Red brome, a European import, competes with native perennial grasses, shrubs, and annuals. This weed species has a high potential to invade the Project Area and analysis area. Red brome is highly flammable and promotes wildfires in desert vegetation communities; recurrent fires directly increase tortoise mortality and reduce the abundance and diversity of native forbs on which they depend (National Park Service 2001).

Three categories of desert tortoise habitat are designated by the BLM: Categories I, II, and III. Category I habitat is intended to maintain stable, viable populations of the tortoise, protect existing tortoise habitat, and increase populations where possible. Category II habitat should maintain stable, viable populations and halt further tortoise declines. Category III habitat should limit tortoise habitat and population declines to the extent possible by mitigating impacts. Category I, II, and III habitats exist in the analysis area. Category I habitat is designated 0.65 mile south of the Project Area in the North Maricopa Mountains. Category II habitat is designated in the west Buckeye Hills, 1.3 miles northwest of the Project Area, Category III habitat is designated in the eastern Buckeye Hills, 1.15 miles north of the Project Area (see Map 29). The Project Area does not include any designated tortoise habitat.

BLM tortoise habitat is delineated along the base of the Buckeye Hills and the North Maricopa Mountains, incorporating the foothill areas, but not containing substantial portions of the upper bajada below the mountain pediment. Sonoran desert tortoises typically inhabit foothills and upper bajada slopes associated with desert mountain ranges, and are much less common in the lower portions of interior valleys (Averill-Murray and Averill-Murray 2005), which is where the Project Area is located. Although tortoises have the potential to occur anywhere in the Project Area and lowland valleys while in transit between suitable habitat patches such as the surrounding mountains, any use of the Project Area as habitat for residency, foraging, or reproduction is not anticipated. Linkages between these foothill habitats are discussed in further detail in Section 3.19.6.

During site reconnaissance surveys in 2009, Sonoran desert tortoises or their sign were not found in the Project Area or analysis area (Pape 2009). A lack of tortoise sign in the area indicates that local populations of the desert tortoise may be low. Additionally, although tortoises have been observed traveling across desert valleys, dispersal rates have been low (Edwards et al. 2004). The combination of low local population levels and low natural dispersal suggests a very low probability of tortoises using the Little Rainbow Valley over the project lifetime.

3.19.5.2 SPECIAL-STATUS SPECIES

Special-status wildlife species are those that are recognized by various agencies as being in need of protection and/or management due to significant reductions in species populations, contractions of their total range, or other aggravating factors that may ultimately place the continued existence of the species in jeopardy. These species are listed by the AZGFD as wildlife of Special Concern (WSC), by the BLM as sensitive species, and/or by the USFWS as BCC. These species are often given legal protection under applicable laws.

3.19.5.2.1 Special-status Birds

Ferruginous Hawk

The ferruginous hawk is a BLM sensitive species and an AZGFD WSC (AZGFD 2009a). It occurs throughout the western Great Plains, Intermountain West, and California's Central Valley (Sibley 2000). It is an arid land specialist, and occurs in habitats such as shortgrass prairie, sagebrush, semi-desert grassland, and open desertscrub. This species is migratory, breeding in parts of the Great Basin and Great Plains, and winters primarily in low elevation grasslands and deserts in the United States and into northern Mexico. The most important prey species for the ferruginous hawk are small mammals, including rabbits, ground squirrels, and prairie dogs. Hunting is done from either perches or in flight. Ferruginous hawks are the largest species of Buteo in North America, and build nests in trees or power poles present in open habitat (Woffinden and Murphy 1983).

Populations of this species have declined in Arizona over the past decade (AZGFD 2001a). In some cases, loss of habitat appears to be a threat to the species. Land manipulation through development, conversion to agriculture, and grazing may all have negative effects. Invasive plant species may also be an indirect factor in population declines due to reductions in prey populations (Woffinden and Murphy 1989). Disturbance of nests may result in abandonment or decreased reproductive success (White and Thurow 1985). The valley and agricultural habitats of the analysis area are suitable winter foraging habitat for ferruginous hawks (Wheeler 2003).

The Project Area and analysis area are suitable winter foraging habitat for ferruginous hawks. It is likely, though, that suitable winter foraging habitats is not abundant in these areas. This is because in Arizona, this species most often winters in semi-desert grasslands, and not in the Lower Colorado desert, which is where the Project Area is located (Wheeler 2003). Furthermore, this species often winters near colonies of prairie dogs or pocket gophers (Bechard and Schmutz 1995), neither of which occurs in abundance in the Project Area.

Golden Eagle

The golden eagle ranges throughout western North America in open, mountainous county. They are widely distributed throughout the state of Arizona. The breeding season occurs from late February to March. In southern Arizona, nests are primarily constructed on cliffs and secondarily constructed on artificial structures and trees. The species is sensitive to disturbance to its nesting area; nests are usually a

minimum of 0.5 mile apart, and average territory size is approximately 20–55 square miles (NatureServe 2010). The species primarily eats rabbits, marmots, and ground squirrels, but may also eat insects, snakes, birds, juvenile ungulates, and carrion (NatureServe 2010). It typically forages in open areas and habitats where prey species occur.

A survey of golden eagle nest locations in areas surrounding and including the Project Area (excluding the Sierra Estrella Mountains) was conducted by AZGFD in 2011 (personal communication, Kevin Grove 2011). The results of this survey found no nests resembling golden eagle nests within a 10-mile radius of the Project Area. The nearest known golden eagle territory is located over 69 miles from the Project Area (AZGFD 2011b). The habitat potential of the surrounding area for golden eagle nesting is negligible, given a lack of cliff habitat in the analysis area.

The Project Area has the potential to be used by golden eagles as foraging habitat, but there is no known or documented use of the area. During the 2011 AZGFD survey, the nearest golden eagle sighting was 45 miles from the Project Area. Due to the lack of suitable nesting habitat within a typical 10-mile nesting range of the Project Area, foraging use would most likely be limited to migratory and nonbreeding golden eagles.

Peregrine Falcon

The peregrine falcon is a BLM sensitive species and an AZGFD WSC (AZGFD 2009a). This species was federally listed as endangered in October 1970, and it was delisted in August 1999 after showing significant recovery (USFWS 2009). The peregrine falcon has a nearly global distribution and ranges from tropical habitats to tundra (White et al. 2002). Peregrine falcons inhabit open country where prey is abundant (Ehrlich et al. 1988; Glinski 1998). Their diet primarily includes birds, particularly rock pigeons (Columba livia), but also many aquatic bird species, game birds, passerines, rodents, bats, and occasionally flying insects (Glinski 1998; Terres 1980; White et al. 2002). Peregrine falcons hunt in flight, often as a pair (Glinski 1998). They do not construct their own nests, but modify old nests of raptors and corvids. In Arizona, nests are primarily on cliff ledges; elsewhere, peregrine falcons nest in trees (Glinski 1998; Terres 1980).

Historically, the primary threat to peregrine falcons has been from pesticides that accumulate in the birds. Pesticides also cause egg shell thinning, which results in nest failure (AZGFD 2002). In addition, people rock climbing near nests can disturb peregrine falcons.

Peregrine falcons are likely to forage in the winter along the Gila River and prey on larger bird species such as waterfowl, shore, and wading birds (Glinski 1998; Wheeler 2003). There is a potential for falcons to forage over any part of the Project and analysis areas; however, prey would be limited to native doves, passerine bird species, and bats (Glinski 1998; Wheeler 2003). Peregrine falcons may occur in the Project Area, but are expected to occur very infrequently because preferred, large avian prey is uncommon in the dominant Sonoran Creosotebush-Bursage Scrub vegetation community.

Western Burrowing Owl

The western burrowing owl is considered a BLM sensitive species (AZGFD 2009a). This species breeds in North America from southern Alberta, Saskatchewan, and Manitoba, south to Baja California and central Mexico, and east to western Minnesota, western Kansas, and western Texas (American Ornithologists' Union 1998). Western burrowing owls can be found in suitable habitat throughout Arizona (deVos 1998), which is an important wintering area in the United States (NatureServe 2009).

Western burrowing owls inhabit open areas in deserts, grasslands, and agricultural and range lands. They use well-drained areas with gentle slopes and sparse vegetation, and may occupy areas near human habitation, such as golf courses and airports (Dechant et al. 2003; Ehrlich et al. 1988; Terres 1980). Western

burrowing owls often select burrows where surrounding vegetation is kept short by grazing, dry conditions, or burning (Hjertaas et al. 1995; Dechant et al. 2003). In Arizona, western burrowing owls prefer grasslands, Creosotebush-Bursage Scrub communities, and agricultural lands (deVos 1998).

Western burrowing owls are semicolonial and usually occupy burrows excavated by small mammals, often at the edges of active colonies of prairie dogs (*Cynomys* spp.) or ground squirrels (*Spermophilus* spp.). In areas that lack colonial burrowing mammals, western burrowing owls use excavations made by other mammals such as badgers, woodchucks (*Marmota monax*), skunks, foxes, armadillos (*Dasypus novemcinctus*), and coyotes. In addition to the nest burrow, these owls may also use several satellite burrows. Satellite burrows may serve as protection from predators and parasites (Dechant et al. 2003). Occasionally they may excavate their own burrows.

Western burrowing owls are opportunistic feeders, preying on a variety of arthropods and small vertebrates (Dechant et al. 2003; Hjertaas et al. 1995). They may forage during the day or night, but tend to forage closer to the nest during the day. Foraging habitat is variable, depending on prey availability and abundance. In the southern portions of their range (primarily Arizona and southern California), western burrowing owls are mostly nonmigratory (AZGFD 2001b; Haug et al. 1993).

The single greatest range-wide cause of burrowing owl declines is the reduction in populations of burrowing mammals through control programs, an activity frequently coupled with conversion of grassland habitat to agriculture or pasture (Klute et al. 2003). Widespread declines in the range and abundance of western burrowing owls have also been attributed to habitat loss and fragmentation. Additionally, the control and extermination of colonial burrowing mammals has also led to declines, because burrowing animals are not present to create suitable nesting habitat (Dechant et al. 2003; Hjertaas et al. 1995).

Potential nesting habitat for western burrowing owls has also been reduced throughout their range by converting land to agricultural and urban uses (Hjertaas et al. 1995). In addition to removing potential nest sites, habitat fragmentation may increase the density of predators such as foxes and coyotes and may make it more difficult for unpaired burrowing owls to find mates (NatureServe 2009). Increased urbanization may increase their predation by domestic dogs and cats. Pesticides may harm burrowing owls through direct toxicity, secondary toxicity from ingesting poisoned prey, and from a reduction in the abundance of prey due to pesticide toxicity (Dechant et al. 2003).

During site reconnaissance surveys in 2009, two western burrowing owls and sign in the form of scat, pellets, and burrows, were observed in the Project Area (Pape 2009). A reconnaissance-level survey was conducted again in 2011 to determine burrowing owl presence/absence and the status of the species in the Project Area. During the two surveys, a total of six burrowing owl individuals, 17 burrows, and sign[5] were found throughout the Project Area.

Because western burrowing owls require good visibility close to their nests for hunting and predator avoidance (deVos in: Glinski 1998; McDonald et al. 2004), the creosotebushes in many sections of the Project Area and analysis area are too dense for western burrowing owl habitat. The location of burrowing owls is likely dependent on the abundance of their prey (small mammals, amphibians, reptiles, insects, and/or birds) in proximity to the CCC stock tank as well as other ephemeral water sources. The burrows that were found during field reconnaissance are located within creosotebush habitat that is nearly identical to the creosotebush habitat further west in the Project Area. It is likely that the number of burrowing owls that use the Project Area is higher than the numbers found in the 2009 and 2011 field surveys.

[5] The presence of sign suggests that this species is breeding in the Project Area.

Loggerhead Shrike

The loggerhead shrike can be found in open country with scattered trees and shrubs, savanna, desertscrub, and occasionally open woodland. It is often found on poles, wires, fence posts, or on trees. This species usually nests in trees, but can be found in shrubby and tree-less habitats in the winter. A loggerhead shrike was seen in the Project Area during site reconnaissance in the fall of 2009. Individuals of this species would most likely be present in the Project Area during nonbreeding months.

3.19.5.2.2 Birds of Conservation Concern

USFWS BCC that have the potential to occur in the Project Area and analysis areas are listed in Table 3.55. These species have been identified by the USFWS as species that may become candidates for listing under the ESA if additional conservation actions are not carried out (USFWS 2008). BCC are protected under the MBTA, described above.

3.19.5.2.3 Special-status Bats

Table 3.55 includes seven species of bats that may occur in the Project Area and analysis area. As foraging habitat requirements and potential for occurrence in the area are similar for all bat species listed, they are discussed here as a group.

Roost habitat can be a primary determinant for the local presence of most bat species in their overall range. Roosts vary across species, but include large trees, caves, and rock crevices as natural roosts and buildings, bridges, and mines as frequently used human-made roosts. Bats may hibernate in winter, go into short-term torpor, or may be migratory.

All bat species with potential to occur in the analysis area are insect eaters. Most detect prey through echolocation while flying (AZGFD 2009a). Most desert bat species require a water source in their foraging range, both for drinking and as a source of flying insects. Threats are similar for all bat species discussed here. Roost habitat loss and human disturbance of roosting bats are generally the greatest threats, although pesticide accumulation in or near agricultural areas (Clark 1988) and habitat degradation that reduces drinking water locations and prey populations can also affect bats.

No suitable roosting habitat for any bat species occurs in the Project Area, because no rocky habitat, mines, caves, or large trees are present. The greatest food sources for foraging bats in the analysis area are located near water such as the CCC stock pond, Gila River, or near agricultural fields east of the project.

3.19.5.2.4 Special-status Amphibians

Great Plains Toad

In Arizona, the Great Plains toad is widespread, except for in the higher mountains and lowest and driest portions of the Sonoran Desert. This species is found primarily in valleys, mesas, and flats characterized by Sonoran, Chihuahuan, or Great Basin desertscrub; grasslands; and sparingly into montane woodlands. In these areas, this species can often be found in cattle tanks, roadside ditches, and canals in agricultural areas, and in the floodplains of rivers and streams, ciénegas, and other wetland types (Arizona Partners in Amphibian and Reptile Conservation 2008).

In the Project Area, this species would most likely be found in the CCC stock pond when water is present. The Great Plains toad has been found in the Vekol Valley, which is approximately 15 miles to the southeast of the Project Area (Enderson and Bezy 2005).

3.19.6 Wildlife Linkages

A wildlife linkage is a continuous swath of land in the natural landscape that provides suitable habitat for short-and/or long-term movements of wildlife and plants between population cores. Additionally, such linkages provide flexibility of movement for populations in larger areas of suitable habitat in response to changes in the local environment or natural chance or catastrophic events. Linkages may also serve as refugia for subsequent recolonization of adjacent disturbed habitats (Beier and Loe 1992). A collaborative effort between ADOT, AZGFD, and other agencies initiated a statewide project in 2004 to delineate areas with potential value as wildlife linkages. Preliminary results were released in 2006, with over 150 linkage zones described (Nordhaugen et al. 2006).

A 2008 wildlife linkage study (Beier et al. 2008) analyzed potential wildlife habitat linkages on BLM land between wildland blocks in the Gila Bend, Sierra Estrella, and North Maricopa Mountains. The study used a species-level (focal species) approach, which means certain species were selected and information was attained to better predict the movements of these selected wildlife species through an area. The focal species were selected because they have ecological needs that represent a suite of other species. Species' characteristics that were identified for focal species selection include habitat specialists; species sensitive to human-caused barriers; species that require well connected landscapes; ecologically important species; and rare species. For example, the modeled movement for a focal species such as a bobcat would represent probable movement for other mid-level predators and their prey. Also, the modeled movement for a focal species such as the bighorn sheep would represent probable movement for other species that require large blocks of habitat and are susceptible to habitat fragmentation due to human-caused barriers.

Other goals of establishing the linkage included 1) providing areas adequate to support long-term movements between metapopulations of less mobile species (e.g., Gila monster and desert tortoise); 2) protecting aquatic resources from pollutants; 3) allowing for movements of species over time in response to climate change; and 4) acting as a buffer against edge effects, including invasive species, noise, pets, and others (Beier et al. 2008). Edge effects may be naturally occurring or human induced, and may adversely impact the quality of wildlife habitat in areas where they occur. Changes can include permanent alteration of landscapes, such as encroachment by invasive plant species, persistent effects such as the presence of feral cats or dogs, or one-time events. Edge effects have been recognized as significant in terrestrial ecosystems up to 300 m (Beier et al. 2008).

The AZGFD, in collaboration with Northern Arizona University, released the report for the Gila Bend-Sierra Estrella Linkage (Beier et al. 2008). Subsequently, the AZGFD proposed an additional linkage, the Buckeye Hills-Sonoran Desert National Monument linkage, in the analysis area (see Map 29). The purpose of this linkage is to connect habitat blocks within the Buckeye Hills, Maricopa Mountains, Gila River corridor, and State Wildlife Areas (Robins/Powers Butte and Arlington). The Buckeye Hills-Sonoran Desert National Monument linkage is an important component of AZGFD's regional linkage plan because it provides a second linkage between the Gila River corridor and state wildlife areas (Robins/Powers Butte and Arlington), the first being the Gila Bend-Sonoran Desert National Monument linkage. To develop these linkages, AZGFD used the modeling technique and tools used by Beier et al. 2008. Although the final report (with model parameters) has not been released for the Buckeye Hills-Sonoran Desert National Monument linkage, in most cases where species were modeled for both linkages, parameters are identical to the published report on the Gila Bend-Sierra Estrella linkage.

As proposed, the Project Area overlaps 1,204 acres of the Buckeye Hills-Sonoran Desert National Monument linkage. The Gila Bend-Sierra Estrella Linkage is broken into two distinct pieces: Gila Bend-Sonoran Desert National Monument, and Sonoran Desert National Monument-Sierra Estrella. The Project Area overlaps 18.8 acres with the Gila Bend-Sonoran Desert National Monument linkage. The Sonoran Desert National Monument-Sierra Estrella Linkage is not located in the analysis area and is not discussed further in this document.

3.19.6.1 GILA BEND-SONORAN DESERT NATIONAL MONUMENT LINKAGE

The Gila Bend-Sonoran Desert National Monument linkage encompasses approximately 47,000 acres and extends approximately 3 miles into the Sonoran Desert National Monument. Focal species used for the development of this model consist of bighorn sheep, mule deer, mountain lion, bobcat, javelina, Sonoran desert tortoise, and Gila monster (Beier et al. 2008). The Gila Bend-Sonoran Desert National Monument linkage is the only wildlife corridor between the monument and the Gila River that avoids existing suburban development (Beier et al. 2008).

3.19.6.2 PROPOSED BUCKEYE HILLS-SONORAN DESERT NATIONAL MONUMENT LINKAGE

The Buckeye Hills-Sonoran Desert National Monument linkage is approximately 1.4 miles east of SR-85. This linkage encompasses 17,663 acres of land extending from the southern reaches of the eastern Buckeye Hills to the northernmost boundary of the Sonoran Desert National Monument. The area immediately adjacent to SR-85 was not included in the linkage due to the disruptive effects of the highway. A small corridor approximately 1 mile wide extends southeast approximately 3 miles into the Sonoran Desert National Monument. During development of this linkage, it was assumed that the area enclosed by this linkage was relatively equal in habitat quality throughout. All criteria used in development of this linkage were identical to those used by Beier (2008).

Focal species used for the development of this model consist of bighorn sheep, mule deer, badger, kit fox, Sonoran desert tortoise, Gila monster, Tucson shovelnose snake, and Sonoran desert toad (personal communication, Ginger Ritter 2010; AZGFD 2009b). As mentioned above, the report documenting the importance of this linkage has not been released to date. The focal species used for the development of this linkage are described below, along with the known use of each species in the Project Area.

3.19.6.3 WILDLIFE LINKAGE VALUES IN THE PROJECT AREA

The following discussion applies to wildlife species that were used as focal species in developing the linkage models discussed above. Discussion of wildlife linkage values in the Project Area addresses the currently known presence or absence of each focal species in the linkages and Project Area, and the level (robustness) of species' presence. The discussion below divides the focal species into two groups: highly mobile species and less mobile species. Beier et al. (2008; pp 21 and 64) refers to these groups as "species that need the corridor (highly mobile species), and "species the corridor needs" (less mobile species). For both groups, linkages provide important routes of connectivity for gene flow; however, what separates these groups is the time scale during which this gene flow occurs.

Highly mobile species move long distances to access suitable breeding or foraging sites. Focal species of this type consist of bighorn sheep, mule deer, mountain lion, bobcat, and desert tortoise. Individuals of these species need corridors that link large blocks of habitat, and individuals may travel these linkages in a single season. Some species, such as mountain lion and bighorn sheep, may take a few days to travel through this habitat to reach more suitable habitat. Other species, such as the desert tortoise, may take weeks to get across the linkage into more suitable habitat.

These linkages have the potential to encompass breeding habitat and entire populations of less mobile species, which are often habitat specialists. Less mobile species are those that stay within limited home ranges for the entirety of their lives. Focal species of this type consist of the badger, kit fox, javelina, Gila monster, Sonoran Desert toad, and Tucson shovelnose snake. Although some of these species may not occur in the wildland blocks for which the linkage was designed, they are important to the functioning of an ecosystem within the linkage. Managing for these species ensures that linkages are managed as a

fully-functioning ecosystem. For these species, linkages are an important route for genetic flow in the long term, a time period that can span multiple generations. Linkages are also important for less mobile species to allow populations to shift their range in response to climate change, and to allow for recolonization after fire or epidemics (Beier et al. 2008).

3.19.6.3.1 Highly Mobile Species

Bighorn Sheep

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. Bighorn sheep require access to water, suitable forage, and steep escape terrain for predator avoidance. The description of the status of bighorn sheep in the analysis area can be found in Section 3.19.4.2.1 (Big Game).

The apparent absence of bighorn sheep in the east Buckeye Hills may be due to inadequate resources (e.g., water) to independently support them. Historic use of the east Buckeye Hills by bighorns may have been dependent on access to the Gila Bend Mountains prior to the movement-inhibiting impacts of SR-85 in its current multilane configuration. No bighorn sheep or their sign have been observed during any site reconnaissance surveys or other project site visits.

According to Beier et al. (2008a), the portion of the Project Area analyzed for the Gila Bend-Sonoran Desert National Monument linkage would be "strongly avoided" by bighorn sheep. It is suggested that the Project Area may be used for occasional travel between better suited habitat patches in the Buckeye Hills, Gila River corridor (state wildlife areas), and the Sonoran Desert National Monument.

Mule Deer

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. Mule deer inhabit a wide range of elevations and habitats, often preferring areas that provide a balance of both cover and visibility. They require cover and suitable forage, which typically includes a variety of subshrubs, shrubs, and tree species. Adult mule deer are known to disperse long distances, between 97 and 217 km (Anderson and Wallmo 1984 as cited in Beier et al. 2008). According to Beier et al. (2008), land cover is the most important influence over mule deer distribution, and was weighted at 80% of the model. The Rainbow Wash and the unnamed tributary to Waterman Wash would often be used for movements by the species through the valley. However, all habitat within this linkage would likely be used by mule deer to some degree. Although no mule deer or their sign have been observed in the Project Area, it is known that they use the Gila River corridor and other nearby AZGFD-managed lands extensively.

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "occasionally used" by mule deer (Beier et al. 2008), suggesting that the Project Area may be used for travel between better suited habitat patches in the Buckeye Hills, Gila River corridor (State Wildlife Areas), and the Sonoran Desert National Monument.

Mountain Lion

This species was chosen as a focal species for the Gila Bend-Sonoran Desert National Monument linkage. Mountain lions require large tracts of habitat to maintain viable sustainable populations. One study in New Mexico found that annual home range size averaged 193.4 km^2 for males and 69.9 km^2 for females (Logan and Sweanor 2001 as cited in Beier et al. 2008). Dispersal rates varied from an average of 102.6 km for males and 34.6 km for females. According to Beier et al. (2008a), land cover was weighted as the most important factor influencing mountain lion dispersal patterns (70%), with the distance from roads weighted at 20%.

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be occasionally used by mountain lion, suggesting that the Project Area may be used for occasional travel between better suited habitat patches in the Buckeye Hills, Gila River corridor (state wildlife areas), and the Sonoran Desert National Monument.

Bobcat

This species was chosen as a focal species for the Gila Bend-Sonoran Desert National Monument linkage. In Arizona, it is found in a range of habitats, including open deserts, juniper woodland, and in most desert mountain ranges (Beier et al. 2008). Home ranges for this species range from 2 km^2 to over 50 km^2. Dispersal distances for young bobcats average 25 km. According to Beier et al. (2008a) land cover was strongly weighted as the most important factor influencing dispersal patterns (95%).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "suboptimal but used" by bobcat. This species has such broad habitat requirements that most of the area analyzed by Beier et al (2008a) was found to be "suboptimal but used" core habitat.

Desert Tortoise

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. A 12-month review was completed by the USFWS in December 2011 and found that the Sonoran desert tortoise warrants federal protection, but precludes listing due to higher priorities, and is currently listed as a candidate species (75 *Federal Register* 78,094, Dec. 14, 2010). See Section 3.19.5.2.4 for a description of BLM-determined habitat for this species in the analysis area and a description of desert tortoise natural history and ecological needs.

No tortoises or their sign were observed during biological reconnaissance surveys and other site visits conducted in the Project Area and analysis area. A total lack of observed tortoise sign indicates that local populations may be low. These observations are supported by observed declines in the Maricopa Mountain population of nearly 90% beginning in 1987 (Western Watersheds Project 2008). There is no suitable habitat for resident tortoises in the Project Area, and tortoises would occur in the Project Area only as infrequent individuals dispersing from the adjacent mountains.

Tortoise home range size estimates range from 7 to 23 ha (approximately 17 to 57 acres); however, home ranges overlap. The densities of tortoise populations range from 20 to 150 individuals per square mile (Averill-Murray et al. 2002 as cited in Beier et al. 2008). Tortoise dispersal across valleys between desert mountains is estimated to occur approximately once per generation (Edwards 2003), but seems to be very important for the long-term maintenance of populations (Edwards 2004). Causes of dispersal are not known, but tortoise movement probably provides gene flow between populations, may augment declining populations, and allows recolonization of extirpated populations (Howland and Rorabaugh 2002). Due to the observed Maricopa Mountain population decline in the 1990s and resultant low population densities of the tortoise near the Project Area, dispersal rates are expected to be unusually low. For the linkage model, land cover was weighted as the most important factor influencing dispersal patterns (50%), with topography weighted at 35% (Beier et al. 2008).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "suboptimal but used" habitat for desert tortoises.

3.19.6.3.2 Less Mobile Species

Badger and Kit Fox

Both the badger and kit fox were chosen as focal species for the Buckeye Hills-Sonoran Desert National Monument linkage. These species are known to occur in the Project Area and analysis area. The badger is a burrowing animal that is capable of excavating burrows even in very rocky terrain. Kit foxes require more brittle soils for burrow construction, but not so loose that they will not support burrows. Kit fox populations are managed for hunting by the AZGFD as a predator (AZGFD 2009a), and their populations are considered secure. Burrows attributed to both species were observed during site reconnaissance surveys, but not in very high densities.

Javelina

This species was chosen as a focal species for the Gila Bend-Sonoran Desert National Monument linkage. It is found in dense vegetation, and prefers habitats such as desertscrub and thickets along creeks and washes. It is often found in habitats containing prickly pear cactus, palo verde, jojoba (*Simmondsia chinensis*), and ocotillo (Ticer et al. 2001 and Hoffmeister 1986 as cited in Beier et al 2008a). This species travels in herds, with home range estimates of between 1.9 km^2 and 5.5 km^2. Dispersal distances have not been adequately studied, but they are capable of movements of up to several kilometers (Beier et al. 2008). Land cover was weighted as the most important factor influencing dispersal patterns (50%), with elevation second at 30% (Beier et al. 2008).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "optimal" habitat for javelina. This species has such broad habitat requirements that most of the area analyzed by Beier et al (2008a) was found to be "optimal" core habitat.

Gila Monster

This species was chosen as a focal species for both the Buckeye Hills-Sonoran Desert National Monument and Gila Bend-Sonoran Desert National Monument linkages. Although the banded Gila monster (*H. s. cinctum*) is a BLM sensitive species, the subspecies whose range includes the analysis area is the reticulated Gila monster (*H. s. suspectum*), which may not be collected but is not otherwise considered sensitive by the AZGFD (AZGFD 2009a, Beck 2005). Gila monsters are most often associated with rocky, brushy ravines and low foothills of desert mountains. Areas of high cover, preferably rocks, are important (Beck 2005). They occur on valley floors, often using drainages as avenues of travel, but require animal burrows as shelter in the absence of rocks. The Sonoran Creosotebush-Bursage Scrub vegetation community dominating the Project Area is not preferred Gila monster habitat, due in part to the low food resources available. Home ranges of Gila monsters vary from 32 to 173 acres and up to 2.5 miles in length (Beck 2005). They are assumed to be capable of dispersing up to 8 km or more (Beier et al. 2008). The linkage may be important for long-term viability of the regional metapopulation of the Gila monster. To date, no Gila monsters have been observed in the Project Area. For the linkage model, topography was weighted as the most important factor influencing dispersal patterns (45%), with elevation second at 35% (Beier et al. 2008).

Within the Gila Bend-Sonoran Desert National Monument linkage, the portion of the Project Area that overlaps with the linkage would be "suboptimal but used" habitat for Gila monsters.

Sonoran Desert Toad

This species was chosen as a focal species for the Buckeye Hills-Sonoran Desert National Monument linkage. The Sonoran Desert toad (*Ollotis* [*Bufo*] *alvarius*) may be present in the analysis area, but is not likely to occur in large numbers. Because of their large size this species requires a longer development time to reach adulthood after metamorphosis, and unlike most desert toads, this species will emerge prior to the onset of the

monsoon and use semipermanent water sources for breeding (Fouquette et al. 2005). In the analysis area, they would likely occur in human-made water developments such as agricultural irrigation ditches and earthen livestock ponds.

Regional populations of this species are considered secure. The Sonoran Desert toad normally breeds in valley interiors in temporary catchments in response to significant rainfall events, but will breed in rocky canyons with significant tinajas (semipermanent pools), which may occur in the Buckeye Hills and North Maricopa Mountains in the analysis area. Although dispersal capabilities and patterns of Sonoran Desert toads are not fully known, dispersal distances greater than 2.6 km have not been documented in Nearctic bufonid populations (Bradford et al. 2003; Sinsch 1992). They have not been observed in the Project Area, although surveys designed to observe this species have not been conducted. The CCC stock pond located in the Project Area is within the Buckeye Hills-Sonoran Desert National Monument linkage, and is the most likely place in the Project Area for Sonoran Desert toad breeding and movement to take place.

Tucson Shovelnose Snake

This species was chosen as a focal species for the Buckeye Hills-Sonoran Desert National Monument linkage. In 2010, listing the Tucson shovelnose snake as threatened or endangered under the ESA was found to be warranted, but precluded by higher priority actions (75 *Federal Register* 16,050). It is currently listed as a candidate species. A field review was conducted in September of 2009 that revealed a lack of suitable habitat in the Project Area for the Tucson shovelnose snake (Pape 2009). Project Area soils are dense and are not brittle or sandy enough to be suitable for shovelnose snakes. Further, soils suitable for the Tucson shovelnose snake would not occur in either the Buckeye Hills or the North Maricopa Mountains.