Chapter Four

AIRPORT FACILITY REQUIREMENTS

Sustainable Airport Master Plan

Chapter Four

AIRPORT FACILITY REQUIREMENTS

To properly plan for the future of Albuquerque International Sunport (ABQ), it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve the identified demand. This chapter uses the results of the forecasts presented in Chapter Two, as well as established planning criteria, to determine the airside (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, aircraft parking apron, and automobile parking) facility requirements.

The objective of this effort is to identify the adequacy of existing airport facilities and outline what new facilities may be needed, and when these may be needed, to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in the next chapter.

PLANNING HORIZONS

An updated set of aviation demand forecasts for the Sunport has been established, with a summary of the primary forecasting elements presented on Exhibit 2N. These activity forecasts include commercial passenger enplanements, annual operations, based aircraft, fleet mix, and air cargo. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more upon actual demand than on a time-based forecast figure. In order to develop a master plan that is demand-based rather than time-based, a series of planning horizon milestones have been established that take into consideration the reasonable range of aviation demand projections. The planning horizons presented in **Table 4A** are segmented as the Short-Term (approximately years 1-5), the Intermediate-Term (approximately years 6-10), and the Long-Term (years 11-20 and possible beyond).

TABLE 4A
Planning Horizon Activity Levels
Albuquerque International Sunport

		PLANNING HORIZON		
	Base Year	**Short-Term**	**Intermediate-Term**	**Long-Term**
Demand Indicators				
Enplaned Passengers	2,446,388	2,490,000	2,750,000	3,330,000
Total Air Cargo (tons)	55,702	60,043	61,534	63,043
Total Based Aircraft	165	170	190	220
Annual Operations				
Air Carrier	57,172	56,600	61,000	70,000
Air Cargo	10,202	10,500	10,900	11,600
General Aviation	31,478	32,400	34,800	39,700
Air Taxi	12,304	13,200	13,900	15,800
Military	18,913	18,900	18,900	18,900
Total Annual Operations	130,069	131,600	139,500	156,000

It is important to consider that actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important for the plan to accommodate these changes so that airport officials can respond to unexpected changes in a timely fashion.

The most important reason for utilizing milestones is it allows airport management the flexibility to make decisions and develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program.

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods. The periods used in developing facility requirements for this study are as follows:

- **Peak Month** – The calendar month when peak aircraft operations occur.

- **Design Day** – The average day in the peak month. This indicator is derived by dividing the peak month operations by the number of days in a month.

- **Busy Day** – The busy day of a typical week in the peak month.

- **Design Hour** – The peak hour within the design day.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive. **Table 4B** outlines the peak baseline and forecast peaking characteristics for the Sunport.

TABLE 4B
Peaking Characteristics
Albuquerque International Sunport

	Baseline (2014)	Short-Term	Intermediate-Term	Long-Term
AIRLINE ENPLANEMENTS				
Annual Enplanements	2,446,388	2,490,000	2,750,000	3,330,000
Peak Month	240,690	237,638	262,214	317,791
Design Day	7,764	7,728	8,527	10,335
Design Hour	1,250	1,250	1,390	1,680
AIRLINE OPERATIONS				
Annual Operations	57,172	53,600	57,200	65,400
Peak Month	5,260	4,931	5,262	6,017
Design Day	157	147	157	179
Design Hour	15	14	15	17
GENERAL AVIATION OPERATIONS				
Annual Operations	31,478	32,400	34,800	39,700
Peak Month	3,141	3,208	3,446	3,931
Design Day	105	107	115	131
Design Hour	10	10	11	12
TOTAL AIRPORT OPERATIONS				
Annual Operations	130,069	128,600	135,700	151,400
Peak Month	11,850	11,574	12,213	13,626
Design Day	395	373	394	440
Busy Day	486	459	485	541
Design Hour	31	29	31	35

AIRLINE PEAKING CHARACTERISTICS

In general, airport capacity and facility needs related to specific activity types will typically consider the levels of activity during a peak or design period. Determination of peaking characteristics related to airline activity is important for the planning and design of the passenger terminal building as well as associated facilities and services. The analysis is commonly utilized as a basis for determining the appropriate size of the terminal building and the functional areas therein, including hold rooms, security checkpoints, concessions, restrooms, baggage claim area, etc. The airline peaking characteristics also relate to aircraft gates, ramp apron space, and overnight parking.

For nine of the last 10 years, the peak month enplanement total occurred in July and has averaged 9.7 percent of the annual enplaned passengers. This is anticipated to remain relatively constant in the future as it has been for the last decade.

The design day enplanement level for the peak month is the average weekday enplanements of the peak month. This is derived by dividing the peak month enplanement level by the number of days in the month. The design day for enplanements is obtained by dividing by a factor of 31.

The design hour enplanement and deplanement levels are estimated utilizing the Airport Cooperative Research Program (ACRP), Report 25, *Airport Passenger Terminal Planning and Design, Spreadsheet Models*. The primary model inputs are the airline schedule and aircraft utilization mix for an average weekday of the peak week of the peak month for operations (Tuesday, June 10, 2014). The model output is a rolling total of available seats in 10 minute increments. The peak hour for arriving seats is 14 percent of the day's total arriving seats. The peak hour for departing seats is 16.1 percent of the day's total departing seats. The arrival peak occurs late in the evening between 11:00 pm and 12:00 am. The departing peak occurs in the morning between 5:00 am and 6:00 am. **Exhibit 4A** graphically shows the rolling arrival and departing peak hour enplanement levels.

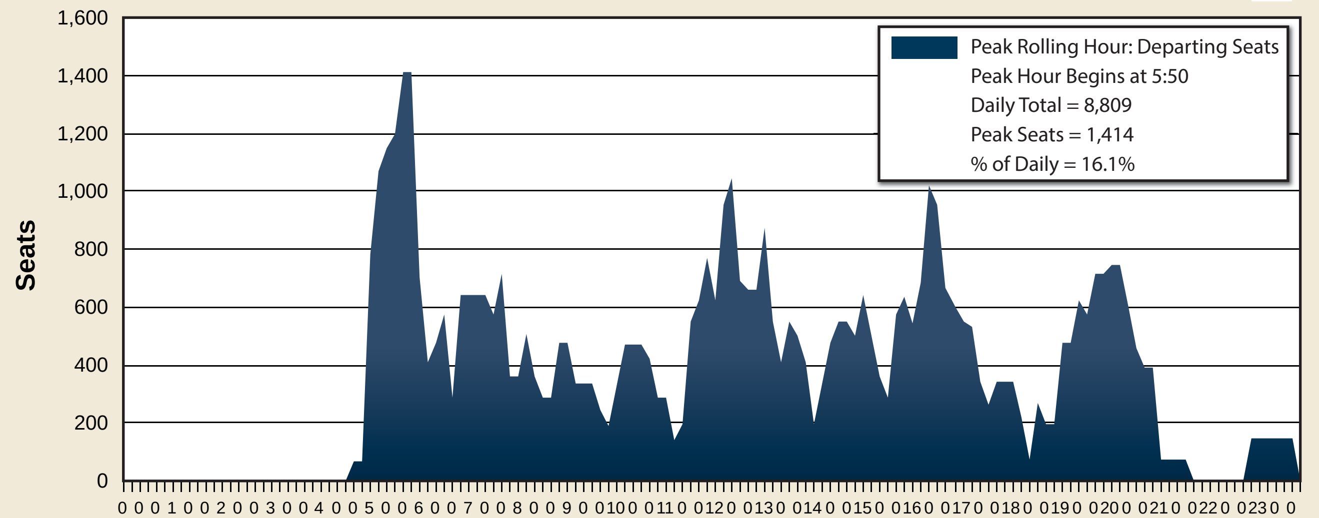
The arrival peak occurs late in the evening between 11:00 pm and 12:00 am. The departing peak occurs in the morning between 5:00 am and 6:00 am.

The total airline operations are known from tower and airport records. The peak month varies from year to year, but has typically been in the summer months. As previously outlined in Table 2M, the forecast commercial operation level is derived by taking into consideration the future aircraft fleet mix. The peak month for airline operations has averaged 9.2 percent of annual airline operations. This factor is carried forward to estimate the future peak month for airline operations. The design day for airline operations is arrived at by dividing the annual airline operations by the number of days in the year. The ACRP model, utilizing the airline schedule, was also utilized to confirm the reasonableness of the current and forecast design day airline operations estimates. The design hour for airline operations is derived from the flight schedules.

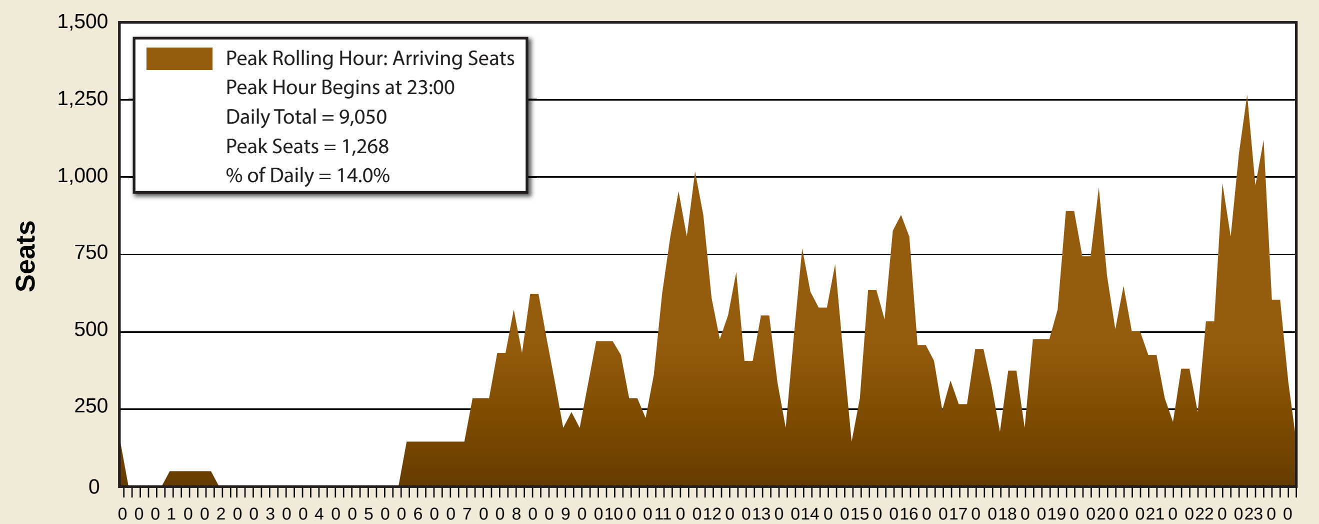
GENERAL AVIATION PEAKING CHARACTERISTICS

The peak month for general aviation operations at the Sunport has averaged 9.9 percent of yearly general aviation operations since 2007. The peak month for general aviation operations at the Sunport typically occurs during one of the summer months. The design day for general aviation operations are derived by dividing the peak month by the number of days in the month. For general aviation operations the peak month has typically been one with 30 days.

DESIGN DAY DEPARTING SEATS ROLLING 60 MINUTE PERIODS



DESIGN DAY ARRIVING SEATS ROLLING 60 MINUTE PERIODS



DESIGN DAY TOTAL SEATS (DEPARTING AND ARRIVING) ROLLING 60 MINUTE PERIODS

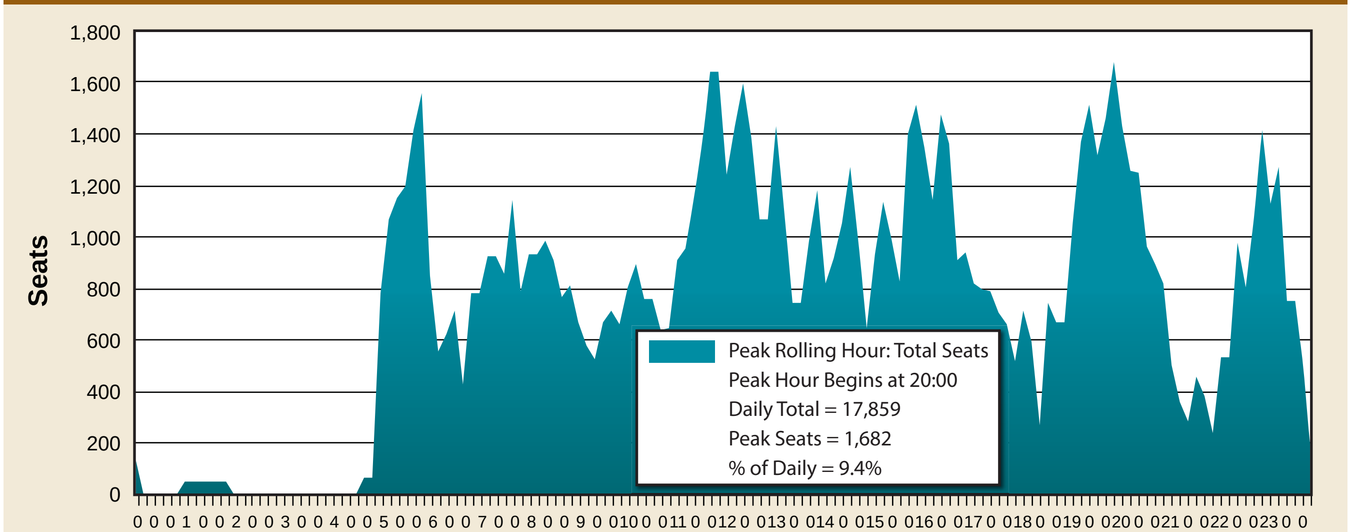


Exhibit 4A
PEAK ENPLANEMENT PERIODS

The tower provided hourly operations for the peak month (June) of the base year (2014). The peak day of each week was identified and the peak hour of each of those days was identified. The average peak hour is 9.4 percent of total operations for the average day of the week. Design hour general aviation operations are estimated as 9.4 percent of total operations for the day.

TOTAL OPERATIONS PEAKING CHARACTERISTICS

The total operations peak periods are utilized in examining the capacity of the airfield. The peak month of total operations has averaged 9.0 percent of annual operations since 2007, and it typically occurs during the summer months. The busy day was calculated by averaging the four busiest days in each week of the peak month. This represents 17.6 percent of peak month operations.

AIRFIELD CAPACITY

Airfield capacity is measured in a variety of different ways. The **hourly capacity** measures the maximum number of aircraft operations that can take place in an hour. The **annual service volume (ASV)** is an annual level of service that may be used to define airfield capacity needs. **Aircraft delay** is the total delay incurred by aircraft using the airfield during a given timeframe. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes. This analysis takes into account specific factors about the airfield. These various factors are depicted in **Exhibit 4B**. The following describes the input factors as they relate to the Sunport:

- **Runway Configuration** – The Sunport has three runways configured with the primary Runway 8-26, a secondary Runway 3-21, and an additional crosswind Runway 12-30. Each runway is served by either a full-length or partial parallel taxiway. Runways 8 and 3 are equipped with an instrument landing system (ILS) for minimums down to 200 feet and ½ mile. Runways 3-21 and 8-26 also have GPS based RNAV (area navigation) and RNP (required navigation performance) instrument approaches. Runway 12-30 has no direct instrument approaches.

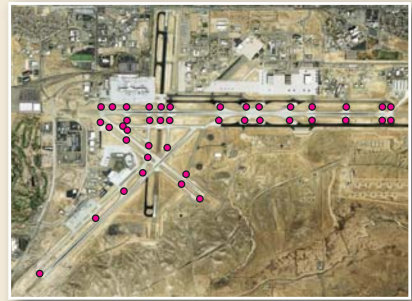
- **Runway Use** – Runway usage is affected by several factors. Safe operations are the highest priority, so the runway's ability to accommodate a variety of aircraft is first and foremost. For example, at 6,000 feet in length, Runway 12-30 will not be as capable of accommodating the full variety of aircraft that operate at the Sunport. Wind direction is another operational factor for runway selection. The location of the runway in proximity to users and the ability to use runways simultaneously can also be a factor into runway use. During active periods when delay can be a factor, air traffic control will operate runway combinations that can safely provide adequate capacity to minimize delays. **Exhibit 4C** presents the various runway use scenarios, their hourly capacities, and likely percentage use based upon wind conditions and maximizing capacity.

AIRFIELD LAYOUT

Runway Configuration

Runway Use

Number of Exits



WEATHER CONDITIONS

VMC
Visual Meteorological Conditions

IMC
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions

AIRCRAFT MIX

Category A & B Aircraft

Category C Aircraft

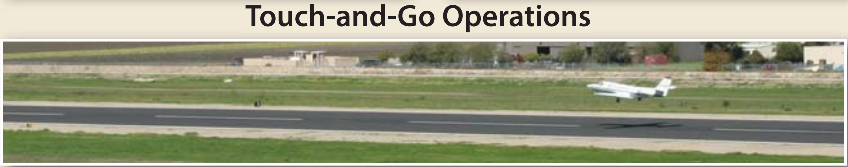
Category D Aircraft

OPERATIONS

Arrivals

Departures

Touch-and-Go Operations



Total Annual Operations

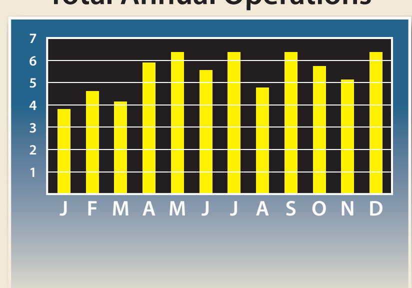
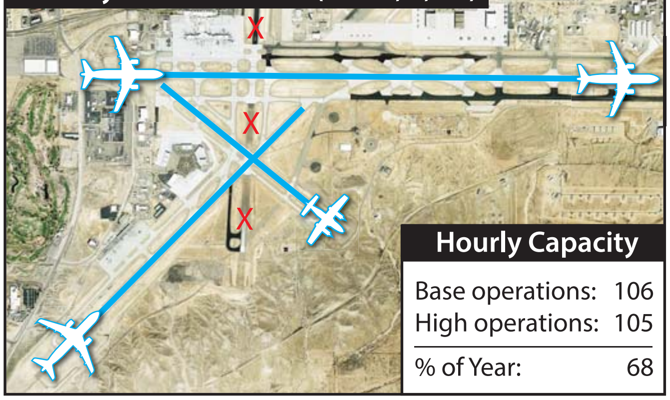


Exhibit 4B
AIRFIELD CAPACITY FACTORS

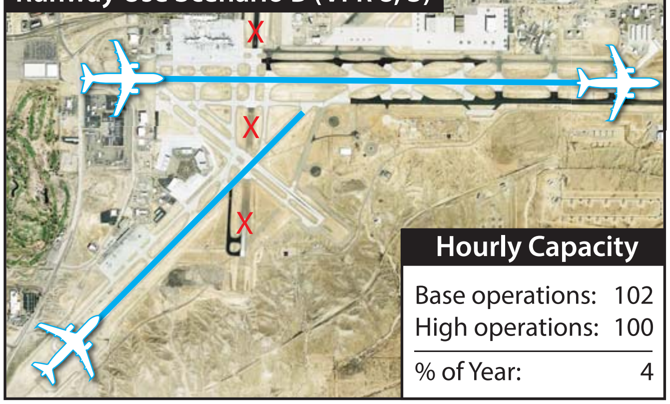
Runway Use Scenario A (VFR 8, 3, 12)



Hourly Capacity

Base operations:	106
High operations:	105
% of Year:	68

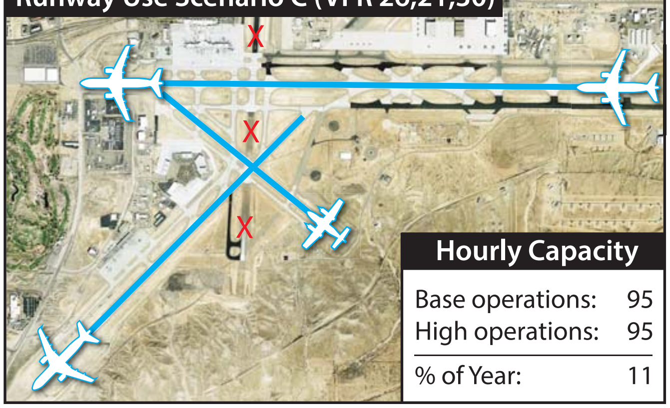
Runway Use Scenario B (VFR 8, 3)



Hourly Capacity

Base operations:	102
High operations:	100
% of Year:	4

Runway Use Scenario C (VFR 26,21,30)



Hourly Capacity

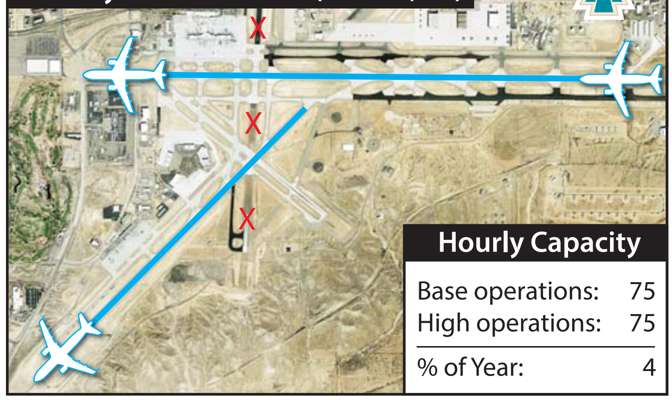
Base operations:	95
High operations:	95
% of Year:	11

Runway Use Scenario D (VFR 26, 30)

Hourly Capacity

Base operations:	79
High operations:	78
% of Year:	6

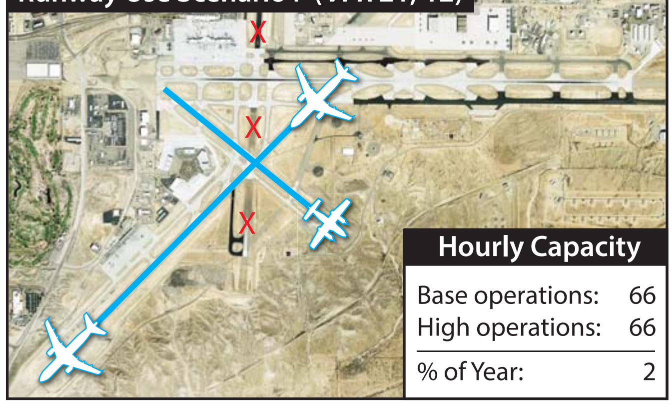
Runway Use Scenario E (VFR 26, 21)



Hourly Capacity

Base operations:	75
High operations:	75
% of Year:	4

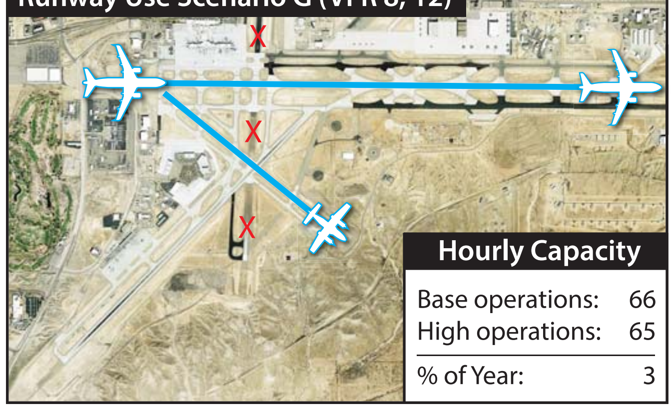
Runway Use Scenario F (VFR 21, 12)



Hourly Capacity

Base operations:	66
High operations:	66
% of Year:	2

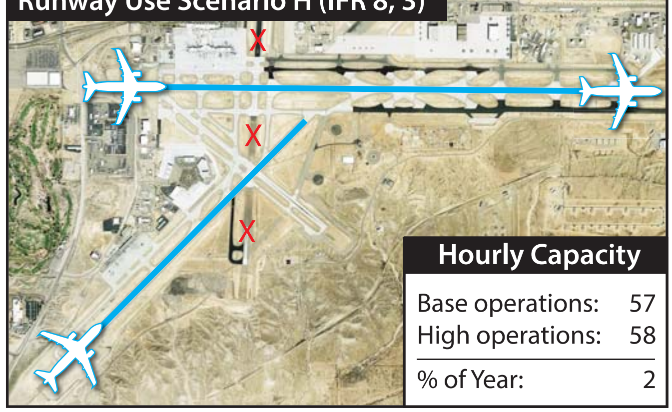
Runway Use Scenario G (VFR 8, 12)



Hourly Capacity

Base operations:	66
High operations:	65
% of Year:	3

Runway Use Scenario H (IFR 8, 3)



Hourly Capacity

Base operations:	57
High operations:	58
% of Year:	2

Exhibit 4C: RUNWAY USE SCENARIOS/HOURLY CAPACITY

- **Exit Taxiways** - Based upon the aircraft mix using the Sunport, taxiways located between 3,500 and 6,500 feet from the landing threshold count in the exit rating for the airfield. Runway 26 has three runway exits within the range for an exit rating of three. Each of the other runways has an exit rating of two.

- **Weather Conditions** – Visual meteorological conditions (VMC) are defined as conditions when cloud ceilings are 1,000 feet or above and/or visibility is at least three statute miles. Instrument meteorological conditions (IMC) occur when cloud ceilings are between 500 and 1,000 feet and visibility is between one and three statute miles. Poor visibility conditions (PVC) apply for minimums below 500 feet and one mile.

  Weather data indicates that the Sunport is in VMC approximately 98 percent of the year, IMC approximately one percent of the year, and PVC another one percent of the year.

- **Aircraft Mix** - Descriptions of the classifications and the percentage mix for 2014 and a high range planning horizon are presented in **Table 4C**. The high range is based upon enplanement and operational levels approximately 15 percent above the long-term planning horizon.

TABLE 4C
Aircraft Operational Mix – Capacity Analysis
Albuquerque International Sunport

Aircraft Classification	Base Year-2014	High-Range
VMC – Visual Meteorological Conditions		
Classes A & B	39%	37%
Class C	57%	59%
Class D	4%	4%
IMC – Instrument Meteorological Conditions		
Classes A & B	22%	20%
Class C	73%	75%
Class D	5%	5%
Touch-and-Go's	4%	4%

Definitions:
Class A: Small single-engine aircraft with gross weight of 12,500 pounds or less.
Class B: Small twin-engine aircraft with gross weight of 12,500 pounds or less.
Class C: Large aircraft with gross weights over 12,500 pounds up to 300,000 pounds.
Class D: Large aircraft with gross weights over 300,000 pounds.

- **Percent Arrivals** - Generally follows the typical 50-50 percent split.
- **Touch-and-Go Activity** - Percentages of touch-and-go activity are presented in **Table 4C**.
- **Operational Levels -** Operational planning horizons were outlined in the previous section of this chapter. The peak month averages approximately 9.0 percent of the year. The design hour averages approximately 7.9 percent of the operations in a day.

HOURLY RUNWAY CAPACITY

Based upon the input factors, current and future hourly capacities for the various operational scenarios at the Sunport were determined. The base year and high range hourly capacities are depicted in **Table 4D**. The base year weighted hourly capacity was 81.9 operations. This capacity is expected to decline slightly to 81.4 operations by the high range horizon as the mix of larger commercial and business jet aircraft at the Sunport is expected to increase over time. Forecast hourly demand will reach 49 percent of weighted hourly capacity by the high range horizon.

TABLE 4D
Airfield Demand/Capacity Summary
Albuquerque International Sunport

	PLANNING HORIZON	
	Base Year-2014	**High-Range**
Operational Demand		
Annual	130,069	175,800
Design Hour	31	35
Capacity		
Annual Service Volume	342,000	356,000
Weighted Hourly Capacity	81.9	81.4
Demand/Capacity Ratio	38.00%	49.40%
Delay		
Per Operation (Minutes)	0.3	0.5
Total Annual (Hours)	650	1,465

ANNUAL SERVICE VOLUME

The weighted hourly capacity is utilized to determine the annual service volume in the following equation:

Annual Service Volume (ASV) = C x D x H
C = weighted hourly capacity
D = ratio of annual demand to the average daily demand during the peak month
H = ratio of average daily demand to the design hour demand during the peak month

The ratio of annual demand to average daily demand (D) at the Sunport was determined to remain relatively constant in the future between 329 and 344. The ratio of average daily demand to average peak hour demand (H) was determined to be 12.7 in 2014. This ratio will also remain relatively constant over the forecast period.

The base year ASV was determined to be 342,000 operations. Changes in the demand ratios result in a slight increase in ASV to 356,000 at the high range.

Annual operations for the high range planning horizon are 175,800, which would be 49.4 percent of the Sunport's ASV. **Exhibit 4D** summarizes and compares the Sunport's ASV and the projected annual operations over the planning horizons.

AIRCRAFT DELAY

As the number of annual aircraft operations approaches the airfield's capacity, increasing amounts of delay to aircraft operations begin to occur. Delays occur to arriving and departing aircraft in all weather conditions. Arriving aircraft delays result in aircraft holding outside of the airport traffic area. Departing aircraft delays result in aircraft holding at the runway end until released by air traffic control.

Table 4D summarizes the aircraft delay analysis conducted for the Sunport. The delay per operation represents an average delay per aircraft. It should be noted that delays of five to ten times the average could be experienced by individual aircraft during peak periods. In the Base Year of 2014, total annual aircraft delay was 650 hours. As an airport's operations increase toward the annual service volume, delay increases exponentially. Analysis of delay factors for the high range planning horizon indicates that annual delay can be expected to exceed 1,465 hours. Delays are not considered significant below 20,000 hours.

CAPACITY ANALYSIS CONCLUSIONS

Exhibit 4D compares annual service volume to existing and forecast operational levels at Albuquerque International Sunport. The 2014 operations level equated to 38 percent of the airfield's annual service volume. Even at the high range planning horizon, total annual operations are expected to represent only 49 percent of the annual service volume.

The 2014 operations level equated to 38 percent of the airfield's annual service volume.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. Since this range is not anticipated to be reached at the Sunport with even the high range activity, major capacity improvements such as new runways should not be considered necessary over the course of the planning horizons.

AIRFIELD REQUIREMENTS

As indicated earlier, airport facilities include both airfield and landside components. Airfield facilities include those facilities that are related to the arrival, departure, and ground movement of aircraft. The FAA has established various dimensional design standards related to the airfield to ensure the safe operations of aircraft. **Exhibit 4E** presents these dimensional standards.

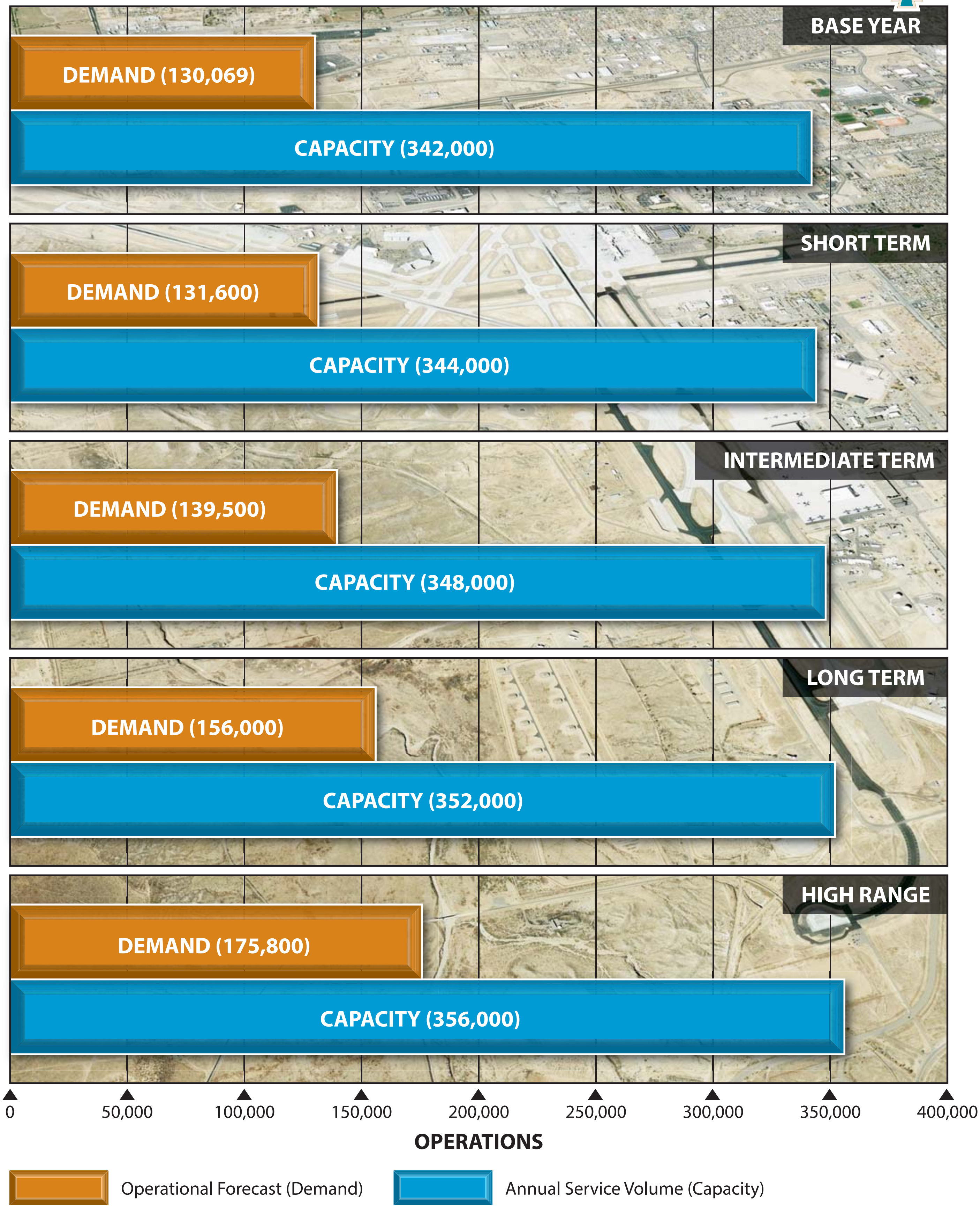


Exhibit 4D
AIRFIELD DEMAND VS. CAPACITY

	Runway 8-26		Runway 3-21		Runway 12-30
Runway Design Code (RDC)	D-IV-1600		D-IV-2400		B-III-VIS
Visibility Minimums (in miles)	3/8-mile (8)	1¼-mile (26)	½-mile (3)	1½-mile (21)	VIS
Existing Runway Dimensions	13,973 x 150		10,000 x 150		6,000 x 150
RUNWAY DESIGN STANDARDS					
Runway Width	150		150		100
Runway Shoulder Width	25		25		20
Blast Pad Length/Width	200 x 200		200 x 200		200 x 140
RUNWAY PROTECTION STANDARDS					
Runway Safety Area (RSA)					
Width	500		500		300
Length Beyond Departure End	1,000		1,000		600
Length Prior to Threshold	600		600		600
Runway Object Free Area (ROFA)					
Width	800		800		800
Length Beyond Departure End	1,000		1,000		600
Length Prior to Threshold	600		600		600
Runway Obstacle Free Zone (ROFZ)					
Width	400		400		400
Length Beyond Runway End	200		200		200
Precision Obstacle Free Zone (POFZ)	**Rwy 8**	**Rwy 26**	**Rwy 3**	**Rwy 21**	
Width	800	NA	800	NA	NA
Length Beyond Runway End	200	NA	200	NA	NA
Approach Runway Protection Zone	**Rwy 8**	**Rwy 26**	**Rwy 3**	**Rwy 21**	
Length	2,500	1,700	2,500	1,700	1,000
Inner Width	1,000	500	1,000	500	500
Outer Width	1,750	1,010	1,750	1,010	700
Departure Runway Protection Zone					
Length	1,700		1,700		1,000
Inner Width	500		500		500
Outer Width	1,010		1,010		700
RUNWAY SEPARATION STANDARDS					
Runway Centerline to:					
Holding Position	250		250		200
Parallel Taxiway	400		400		300
Aircraft Parking Area	500		500		400

Note: All dimensions in feet unless otherwide noted
Source: *FAA AC 150/5300-13A, Airport Design*

Example of D-IV Design Standards

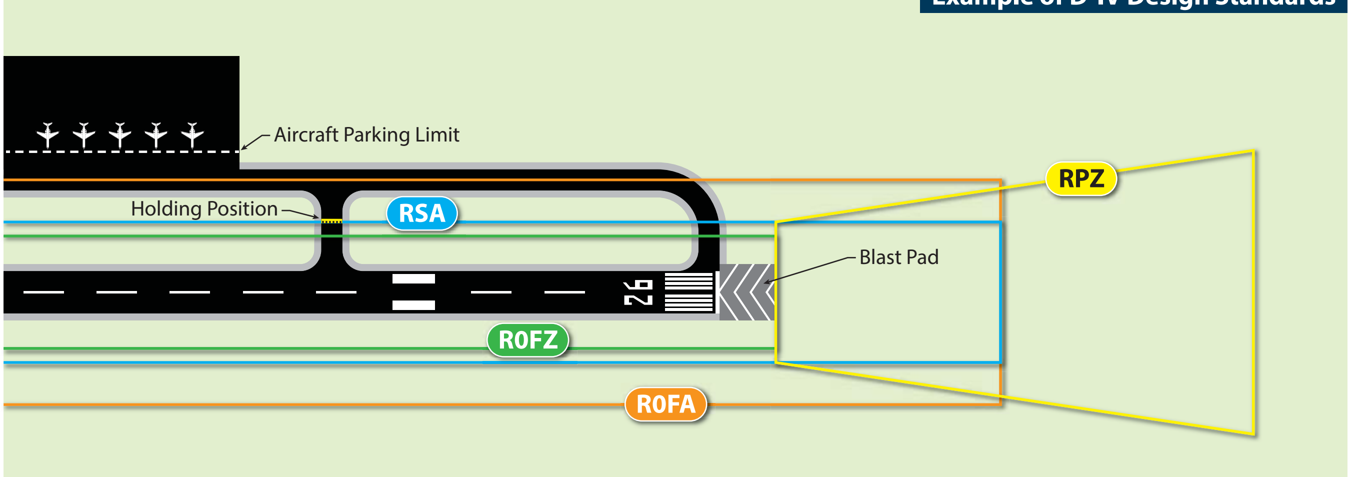


Exhibit 4E
FAA DESIGN STANDARDS

The FAA design standards impact the design of each of the airfield components to be analyzed. The following airfield components are analyzed in detail for compliance to FAA design standards:

- Runway Configuration
- Runway Design Standards
- Runways
- Taxiways
- Navigational and Weather Aids

RUNWAY CONFIGURATION

The Sunport's airfield system has three runways. Primary Runway 8-26 is oriented in an east to west manner. Crosswind Runway 3-21 is oriented in a southwest to northeast manner, and crosswind Runway 12-30 is oriented from the northwest to the southeast. All runways are capable of supporting commercial operations; however, Runway 12-30 primarily serves general aviation activity due to its length and strength. The two crosswind runways cross each other, and no runways cross the primary runway.

A crosswind runway configuration is very common and is in place at a number of commercial service airports across the country. A crosswind configuration is generally required to meet local wind conditions as detailed below. For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off.

FAA AC 150/5300-13A, *Airport Design,* recommends that a crosswind runway be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed on the basis of not exceeding a 10.5 knot (12 mph) component for runway design code (RDC) A-I and B-I, 13 knot (15 mph) component for RDC A-II and B-II, 16 knot (18 mph) component for RDC A-III, B-III, C-I through C-III, and D-I through D-III, and 20 knots for larger wingspans.

Weather data specific to the Sunport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the Sunport weather reporting station over a continuous period from November 2004 through October 2014. A total of 110,099 observations of wind direction and intensity as well as other weather observations were made. Of the total number of observations, 2,081 were made in Instrument Flight Rule (IFR) conditions. IFR conditions exist when visibility is below 3 miles or the cloud ceilings are below 1,000 feet.

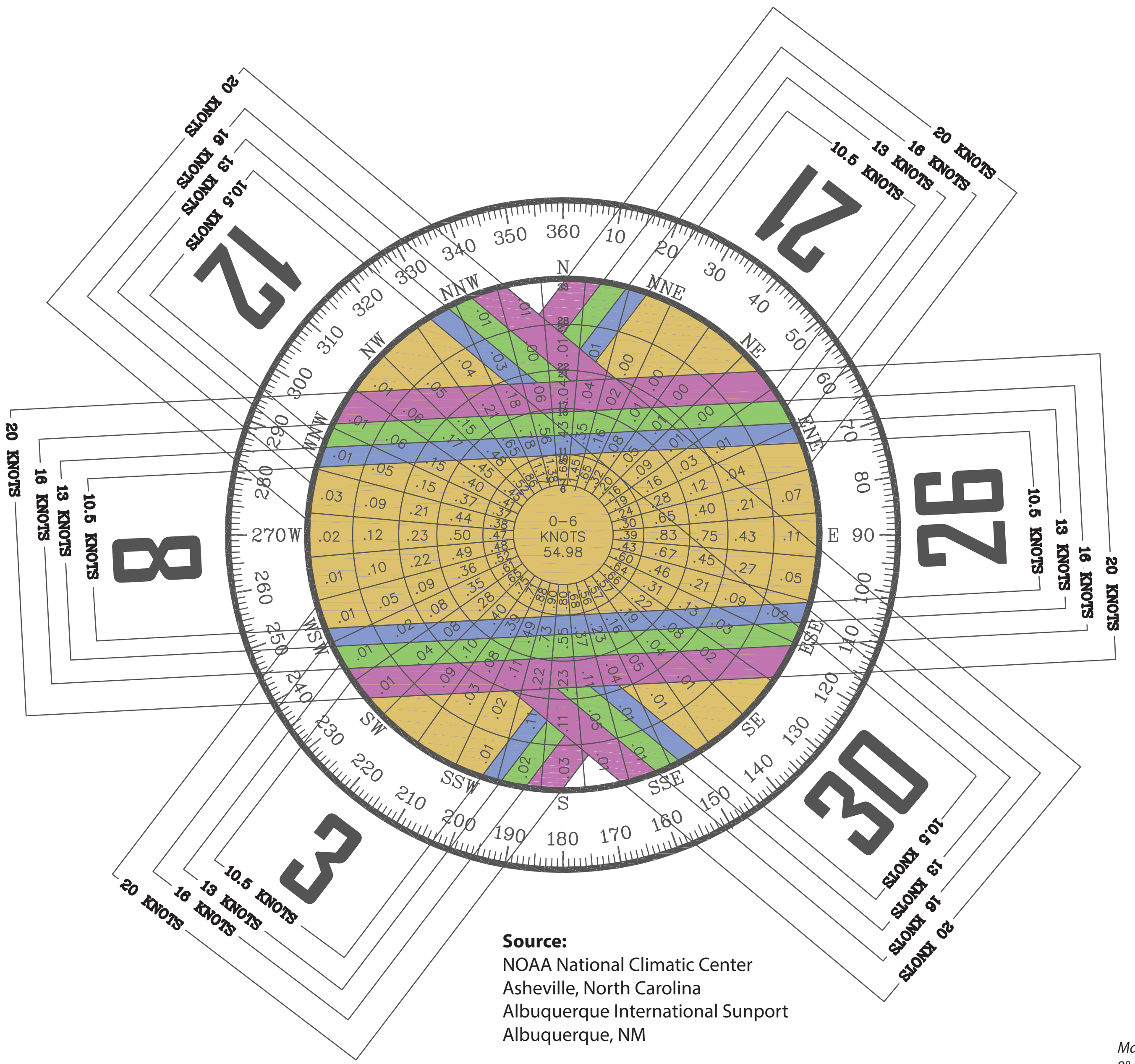
Exhibit 4F presents both an all-weather and IFR wind rose. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a particular location. The table at the top of the wind roses indicates the percent of wind coverage for each runway at specific wind intensity.

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 8-26	90.79%	94.30%	97.74%	99.18%
Runway 3-21	86.88%	91.73%	96.17%	98.71%
Runway 12-30	89.71%	94.06%	97.52%	99.16%
Combined 8-26/3-21	94.87%	97.52%	99.10%	99.79%
Combined 8-26/12-30	95.41%	97.65%	99.04%	99.69%
All Runways	98.48%	99.39%	99.78%	99.95%

IFR WIND COVERAGE

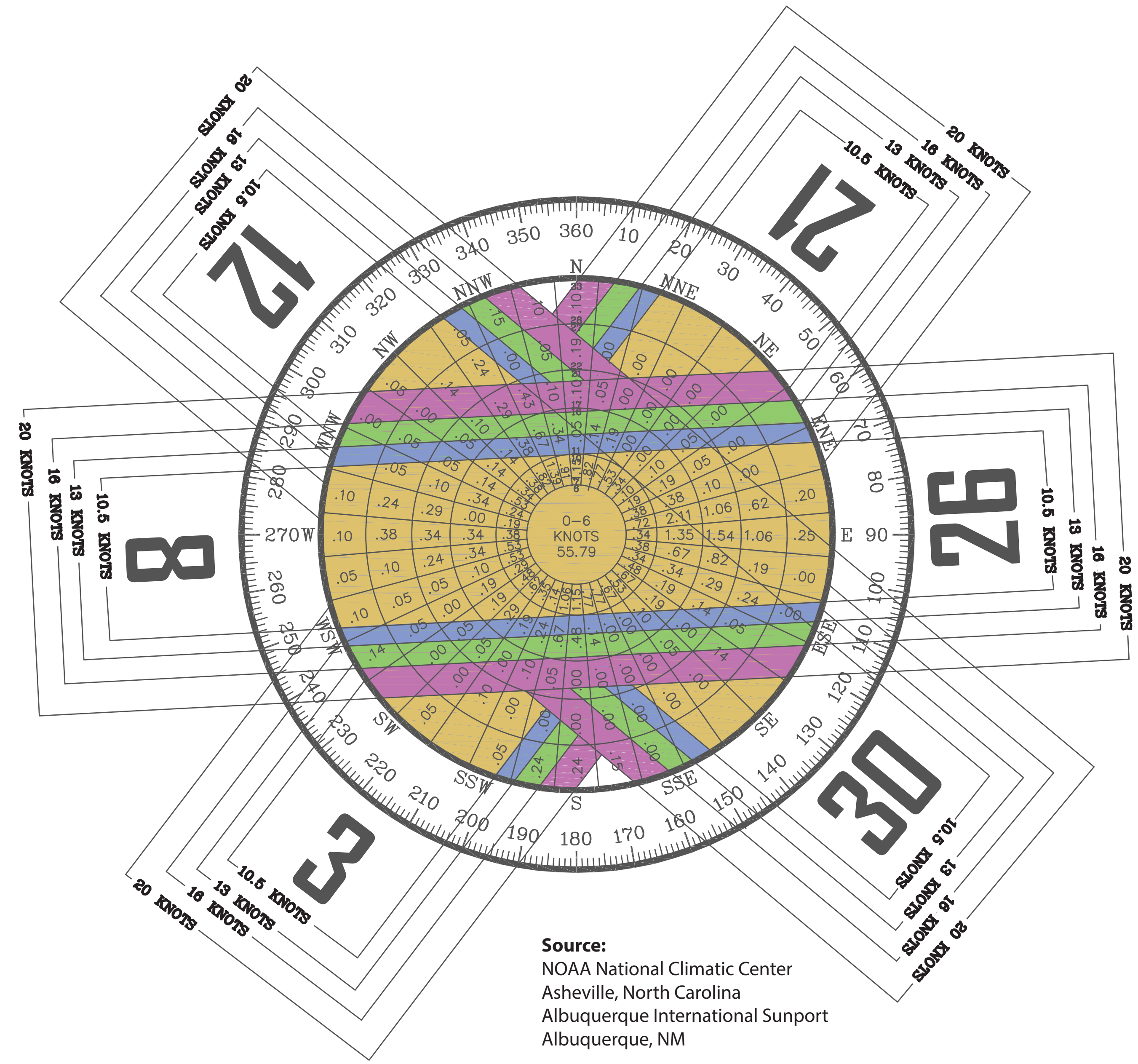
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 8-26	92.46%	94.55%	96.88%	98.19%
Runway 3-21	84.86%	89.04%	93.52%	97.09%
Runway 12-30	86.83%	91.89%	95.85%	97.95%
All Runways	97.95%	98.61%	98.90%	99.32%



Source:
NOAA National Climatic Center
Asheville, North Carolina
Albuquerque International Sunport
Albuquerque, NM

Observations:
110,099 All Weather Observations
November 2004-October 2014

Magnetic Declination
8° 50' East (Nov. 2014)
Annual Rate of Change
00° 7.0' West (Nov. 2014)



Source:
NOAA National Climatic Center
Asheville, North Carolina
Albuquerque International Sunport
Albuquerque, NM

Observations:
2,081 IFR Weather Observations
November 2004-October 2014

Exhibit 4F
WIND ROSES

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As can be seen, no single runway can provide sufficient wind coverage at 13 knots or below. Therefore, a crosswind runway is justified by FAA standards. The combination of the primary Runway 8-26 and Runway 3-21 provides 95 percent coverage for all wind categories except at 10.5 knots, while the combination of primary Runway 8-26 and Runway 12-30 provides 95 percent coverage for all wind categories. However, Runway 12-30 is not capable of accommodating all the larger aircraft that need at least 12-knot wind coverage. Unless the capabilities of Runway 12-30 can be significantly improved, all three runways are necessary for adequate wind coverage.

RUNWAY DESIGN STANDARDS

The FAA has established several design standards to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zone (RPZ).

The FAA has established several design standards to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation.

The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. The RPZ for each runway end should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in place which ensure the RPZ remains free of incompatible development. Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft expected to use the runways as well as the instrument approach capability. The various airport safety areas are shown on **Exhibit 4G** along with any deficiencies.

Runway Safety Area (RSA)

The RSA is defined in FAA Advisory Circular (AC) 150/5300-13A, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical design aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose such as runway edge lights or approach lights.

There are two locations where portions of the RSA extend beyond the Sunport property boundary. On the northeast end of Runway 26, approximately 1.6 acres of RSA land extends onto Kirtland Air Force Base (KAFB) property. On the southeast end of Runway 21, approximately 0.5 acres is on KAFB property, of which 0.4 acres is leased from KAFB. On the Runway 20 end, approximately 8.3 acres of the RSA extends onto KAFB property, the entirety of which is leased by the Sunport. Historically, it has been acceptable to the FAA for the RSA to extend onto KAFB property since the airfield is joint use and is still secure for airport operations.

Runway Object Free Area (ROFA)

The ROFA is "a two-dimensional ground area surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The ROFA does not have to be graded and level like the RSA; instead, the primary requirement for the ROFA is that no object in the ROFA penetrates the lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance to the critical design aircraft utilizing the runway.

There are two locations where the ROFA extends beyond the Sunport property boundary. On the northeast end of Runway 26, approximately 4.7 acres of ROFA land extends onto KAFB property. On the southeast end of Runway 21, approximately 2.5 acres is on KAFB property, of which 1.4 acres is leased from KAFB. On the Runway 20 end, approximately 26.6 acres of the ROFA extends onto KAFB property, the entirety of which is leased by the Sunport. Historically, it has been acceptable to the FAA for the ROFA to extend onto KAFB property since the airfield is joint use and is still secure for airport operations.

Runway Obstacle Free Zone (ROFZ)

The ROFZ is an imaginary volume of airspace which precludes object penetrations, including taxiing and parked aircraft. The only allowance for ROFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The ROFZ is established to ensure the safety of aircraft operations. If the ROFZ is obstructed, the airport's approaches could be removed or approach minimums could be increased.

There is one location where the ROFZ extends slightly beyond the Sunport property boundary. On the northeast end of Runway 26, approximately 0.06 acres of ROFZ land extends onto KAFB property. On the Runway 20 end, approximately 7.8 acres of the ROFZ extends onto KAFB property, the entirety which is leased by the Sunport. Historically, it has been acceptable to the FAA for the ROFZ to extend onto KAFB property since the airfield is joint use and is still secure for airport operations.

Precision Obstacle Free Zone (POFZ)

A precision obstacle free zone (POFZ) is defined for runway ends with a precision approach, such as the ILS approaches to Runways 8 and 3. The POFZ is 800 feet wide, centered on the runway, and extends from the runway threshold to a distance of 200 feet. The POFZ is in effect when the following conditions are met:

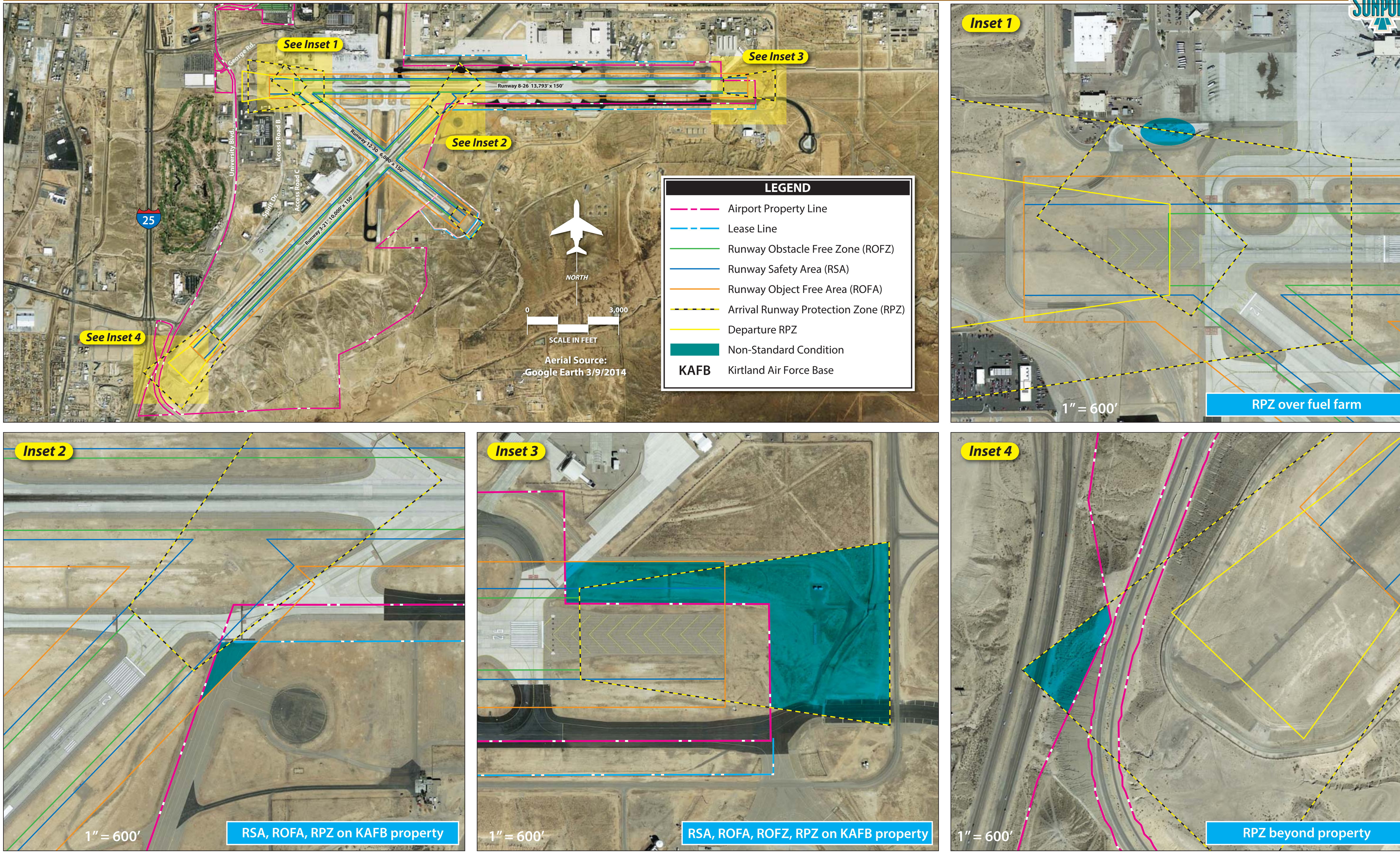

Exhibit 4G
AIRFIELD SAFETY AREAS

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a) The runway supports a vertically guided approach.
b) Reported ceiling is below 250 feet and/or visibility is less than ¾-mile.
c) An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. POFZ standards are met for Runways 8 and 3 at Albuquerque International Sunport. The POFZ for Runway 8 does extend over Taxiway A by approximately 15 feet. While the wings of taxiing aircraft may penetrate the POFZ in this location, neither the fuselage not the tail penetrates. The POFZ meets design standard.

Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the ROFA. The controlled activity area is any remaining portions of the RPZ. The dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13A, *Airport Design*, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements;
- Irrigation channels as long as they do not attract birds;
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator;
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable; and
- Unstaffed navigational aids (NAVAIDs) and facilities, such as required for airport facilities that are fixed by function in regard to the RPZ.

Any other land uses considered within RPZ land owned by the airport sponsor must be evaluated and approved by the FAA Office of Airports. The FAA has published *Interim Guidance on Land Uses within a Runway Protection Zone* (9.27.2012), which identifies several potential land uses that must be evaluated and approved prior to implementation. The specific land uses requiring FAA evaluation and approval include:

- Buildings and structures (examples include, but are not limited to: residences, schools, churches, hospitals or other medical care facilities, commercial/industrial buildings, etc.)

- Recreational land use (examples include, but are not limited to: golf courses, sports fields, amusement parks, other places of public assembly, etc.)
- Transportation facilities. Examples include, but are not limited to:
  - Rail facilities - light or heavy, passenger or freight
  - Public roads/highways
  - Vehicular parking facilities
- Fuel storage facilities (above and below ground)
- Hazardous material storage (above and below ground)
- Wastewater treatment facilities
- Above-ground utility infrastructure (i.e., electrical substations), including any type of solar panel installations.

The *Interim Guidance on Land within a Runway Protection Zone* states, "RPZ land use compatibility also is often complicated by ownership considerations. Airport owner control over the RPZ land is emphasized to achieve the desired protection of people and property on the ground. Although the FAA recognizes that in certain situations the airport sponsor may not fully control land within the RPZ, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses."

Currently, the RPZ review standards are applicable to any new or modified RPZ. The following actions or events could alter the size of an RPZ, potentially introducing an incompatibility:

- An airfield project (e.g., runway extension, runway shift),
- A change in the critical design aircraft that increases the RPZ dimensions,
- A new or revised instrument approach procedure that increases the size of the RPZ, and/or
- A local development proposal in the RPZ (either new or reconfigured).

Since the Interim guidance only addresses new or modified RPZ, existing incompatibilities are generally (but not always) grandfathered. While it is still necessary for the airport sponsor to take all reasonable actions to meet the RPZ design standard, FAA funding priority for certain actions, such as relocating existing roads in the RPZ, will be determined on a case-by-case basis.

The Approach and Departure RPZ (overlapping the same space) on the Runway 26 end extend onto KAFB property. That portion beyond Sunport property is approximately 17.6 acres. Approximately 3.0 acres of the Approach RPZ on the Runway 3 end extends beyond Sunport property on the west side of University Boulevard. University Boulevard also crosses the Approach RPZ for Runway 3. The Approach and Departure RPZ (overlapping the same space) on the Runway 20 end is on KAFB property; however, the Sunport has a lease on this property. The Approach RPZ on the Runway 8 end crosses the tanker truck refueling station. Approximately 0.3 acres of the Approach and Departure RPZ (overlapping the same space) on the Runway 21 end extends beyond Sunport property; however, the Sunport leases this property.

It is recommended that the Sunport obtain easement rights over KAFB property where the RPZ extends onto their property. The Sunport should also plan to purchase the three acres of RPZ land on the west side of University Boulevard and within the Runway 3 RPZ. The tanker truck refueling station was constructed prior the publication of the *Interim Guidance on Land within a Runway Protection Zone* and it is also outside the central portion of the RPZ; therefore, it is likely a grandfathered RPZ incompatibility.

Runway/Taxiway Separation

The design standards for the separation between runways and parallel taxiways are a function of the critical design aircraft and the instrument approach visibility minimum. The runway to taxiway separation standard for RDC D-IV runways is 400 feet (centerline to centerline). Parallel Taxiways A, E, and F meet this standard.

Runway 12-30 has an RDC of B-III with visual approaches only. The standard taxiway separation is 300 feet. Taxiways G and J are parallel to Runway 12-30 and are separated from the runway by greater than 300 feet, thus meeting standard.

Hold Line Separation

Hold lines are markings on taxiways leading to runways. When instructed, pilots are to stop short of the hold line. For Runways 8-26 and 3-21, the hold lines are 250 feet from the runway centerlines. The hold lines are at a separation distance of 200 feet for Runway 12-30.

According to FAA AC 150/5300-13A, *Airport Design*, Change 1, the hold line location must be increased based on an airport's elevation and the RDC of the runway. For RDC C/D/E-III, IV, V, the hold line position should be increased one foot for every 100 feet above sea level. With the Sunport elevation at 5,355 feet, the hold lines for Runways 8-26 and 3-21 should be increased above 250 feet by 54 feet or at 304 feet from the runway centerline. For RDC A/B-III, the hold line distance from the runway centerline should be increased one foot for every 100 feet above 5,100 feet. Thus, the hold lines serving Runway 12-30 should be located 204 feet from the runway centerline.

Due to terrain and geometry constraints, the FAA has permitted the Sunport to maintain their hold lines at the standard 250-foot and 200-foot distance and has not implemented the increase based on elevation. In 2004, a Modification to Standards (MOS) was approved by the FAA which permits the hold lines for Runways 8-26 and 3-21 to remain in their current location because changing them "could result in insufficient ramp separation, and capacity issues." The duration of an MOS is no more than five years and they must be reviewed periodically, especially during planning studies such as this master plan. The MOS for hold line separation will be reviewed in the alternatives chapter.

Aircraft Parking Area Separation

For Runways 8-26 and 3-31, aircraft parking areas should be at least 500 from the runway centerline. For Runway 12-30, aircraft parking areas should be at least 400 feet from the runway centerline. All aircraft parking areas meet this standard.

RUNWAYS

The adequacy of the existing runway system at Albuquerque International Sunport has been analyzed from a number of perspectives, including runway orientation and adherence to safety area standards. From this information, requirements for runway improvements were determined for the Sunport. Runway elements, such as length, width, and strength, are now presented.

Runway Length

The determination of runway length requirements for an airport is based on five primary factors:

- Mean maximum temperature of the hottest month
- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the runway
- Stage length of the longest nonstop destination (specific to larger aircraft)

Aircraft performance declines as elevation, temperature, and runway gradient factors increase. For the Sunport, the mean maximum daily temperature of the hottest month is 90.1 degrees Fahrenheit (F), which occurs in July. The airport elevation is 5,354.9 feet above mean sea level (MSL). The runway end elevation difference is 43 feet for Runway 8-26, 11 feet for Runway 3-21, and one foot for Runway 12-30. The gradient of the runways conforms to FAA design standards.

Runway length needs for commercial aircraft must factor the conditions described above and the load carried. The aircraft load is dependent upon the payload of passengers and/or cargo, plus the amount of fuel it has on board. For departures, the amount of fuel varies depending upon the length of non-stop flight or trip length. **Table 4E** shows the current and potential destinations of greater than 1,000 miles. The longest current non-stop flight is to New York (JFK), which is 1,820 miles. The longest potential domestic destination is Boston, which is one of the top 20 destinations from the Sunport (ranking 14th in 2014), at 1,968 miles.

TABLE 4E
Non-Stop Haul Lengths Over 1,000 Miles
Albuquerque International Sunport

Existing Daily Non-stops	Air Miles (Great Circle)
New York (JFK)	1,820
Baltimore (BWI)	1,665
Orlando (MCO)	1,549
Charlotte (CLT)	1,445
Atlanta (ATL)	1,266
Seattle (SEA)	1,178
Chicago (MDW)	1,118
Portland (PDX)	1,110
Potential Non-stops	
Boston (BOS)	1,968
Detroit (DET)	1,364
Potential International Non-stops	
Montreal (YUL)	1,872
Toronto (YYZ)	1,565
Mexico City (MEX)	1,169

Source: http://www.landings.com/_landings/pages/search/search_dist_apt.html

FAA AC 150/5325-4C, *Runway Length Recommendations for Airport Design,* indicates that individual aircraft planning manuals should be consulted when analyzing runway length for aircraft over 12,500 pounds. The aircraft planning manuals for the most common commercial aircraft currently or potentially using the Sunport were consulted to determine minimum runway length needs. The runway length needs were determined for travel distances of 1,000, 1,500, and 2,000 miles, which includes most current or potential domestic destinations as well as many potential international destinations. The analysis assumed a full passenger load and adequate fuel (including reserve) to reach the destination. In some cases, airlines will ferry fuel due to availability/pricing; however, fuel ferrying is not considered in the analysis. **Table 4F** presents the runway length requirements for the most common commercial aircraft currently or potentially using the Sunport.

TABLE 4F
Takeoff Length Requirements (Commercial)
Albuquerque International Sunport

Aircraft	1,000 mi.	1,500 mi.	2,000 mi.
Narrow Body Aircraft			
B737-8	7,900	8,300	9,500
B757-2	5,800	6,800	7,100
A320-2	7,100	8,000	8,700
MD-83	8,700	9,500	NA
MD-88	8,700	10,000	NA
Wide Body Aircraft			
A300	6,800	7,500	8,500
A310	5,800	6,300	7,000
B767-4	8,300	9,000	9,600
B747-4	6,700	7,200	7,700
B747-8	6,200	6,300	6,500
B787-8	8,600	8,800	9,200
B777-3	10,400	11,600	13,300
DC-10-30	8,300	9,000	9,800

NA: Fully loaded aircraft restricted at this elevation and distance.
Source: Aircraft operational manuals.

Runway 8-26 Length

Runway 8-26 is 13,793 feet long, which is sufficient to meet the needs of current and future commercial service aircraft operating domestically or to neighboring international destinations. In addition, the length allows the runways to serve nearly all U.S. military aircraft that may be associated with KAFB.

Runway 8-26 is 13,793 feet long, which is sufficient to meet the needs of current and future commercial service aircraft operating domestically or to neighboring international destinations.

The landing threshold for Runway 8 is displaced by 1,000 feet, which has the effect of limiting landing distance to 12,793 feet. Since landing length needs are typically less than takeoff length needs, the shorter landing distance available is acceptable to serve airport operations. Therefore, no consideration is given to relocating the landing threshold to the pavement end as it is unnecessary. In addition, relocating the landing threshold would require relocation of a portion of the MALSR approach lighting system which is currently imbedded in the first 1,000 feet of runway. Additionally, it would lower the aircraft approach slope, potentially impacting the population below the approach path.

Runway 3-21 Length

Providing a safe alternative for air carrier and business jet aircraft operations during times when the primary runway is not available is essential. It is not uncommon for the primary runway to be closed due to normal maintenance, runway rehabilitation, snow removal, and extreme wind conditions. Ideally, the crosswind runway serving commercial and business jet activity would be the same length as the primary runway. At a minimum, the commercial crosswind runway should be capable of accommodating the vast majority of operations; therefore, a length that is approximately 90 percent of the primary runway length should be considered.

The current Airport Layout Plan (ALP) for the Sunport shows the potential extension of Runway 3-21 to 11,000 feet in length.

Previous planning efforts and the current Airport Layout Plan (ALP) for the Sunport show the potential extension of Runway 3-21 to 11,000 feet in length. It is considered prudent to maintain this option in the long-term plans for the Sunport.

Runway 12-30 Length

Runway 12-30 primarily serves smaller general aviation aircraft (<12,500 lbs.). Following guidance from AC 150/5325-4C, *Runway Length Recommendations for Airport Design*, to accommodate 95 percent of small aircraft with less than 10 passenger seats, a runway length of 6,700 feet is recommended.

To accommodate 100 percent of these small aircraft including those with 10 or more passenger seats, a runway length of 6,800 feet is recommended.

Runway 12-30 is adequate to meet the needs of general aviation operators and should be maintained.

While it is desirable to have a general aviation crosswind runway meet the full-length recommendation, 80 percent of the full length is acceptable since there are two other longer runways. Therefore, a crosswind wind runway specifically serving smaller general aviation aircraft should be at least 5,500 feet long. Runway 12-30 is adequate to meet the needs of general aviation operators and should be maintained.

Runway Width

The width of the runway is a function of the airplane design group (ADG) for each runway. Runways 8-26 and 3-21 are both planned to remain in ADG IV, which has a design standard width of 150 feet. Both runways are 150 feet wide and should be maintained. Runway 12-30 is planned to remain in ADG III, which has a runway width design standard of 100 feet. In 1999, Runway 12-30 was reconstructed and extended with FAA funding participation. At the time, the existing runway width was maintained at 150 feet. Runway 12-30 is currently 150 feet wide, thus exceeding the design standard, which should be maintained.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. At the Sunport, pavement must be able to support multiple operations of large commercial and military aircraft on a daily basis.

The current strength rating for both Runway 8-26 and Runway 3-21 is 100,000 lbs. single wheel loading (S), 210,000 lbs. dual wheel loading (D), 360,000 lbs. for dual tandem wheel loading (DT), and 720,000 lbs. for double dual wheel loading (DDT). The current strength rating for Runway 12-30 is 65,000 lbs. S, 120,000 lbs. D, and 155,000 lbs. DT. The runway is not strength rated for DDT aircraft landing gear. The pavement strength for all runways is adequate and should be maintained.

Specific details on the condition and history of airfield pavements are available in **Appendix B**.

TAXIWAYS

The design standards associated with taxiways are determined by the taxiway design group (TDG) or the ADG of the critical design aircraft. As determined previously, the applicable ADG for Runways 8-26 and 3-21 is ADG IV now and into the future. For crosswind Runway 12-30, the applicable design standard is ADG III. **Table 4G** presents the various taxiway design standards related to ADGs III and IV.

TABLE 4G
Taxiway Dimensions and Standards
Albuquerque International Sunport

STANDARDS BASED ON WINGSPAN	***ADG III***	***ADG IV***	
Taxiway Protection			
Taxiway Safety Area (TSA) width	118	171	
Taxiway Object Free Area (TOFA) width	186	259	
Taxilane Object Free Area width	162	225	
Taxiway Separation			
Taxiway Centerline to:			
Fixed or Movable Object	93	129.5	
Parallel Taxiway/Taxilane	152	215	
Taxilane Centerline to:			
Fixed or Movable Object	81	112.5	
Parallel Taxilane	140	198	
Wingtip Clearance			
Taxiway Wingtip Clearance	34	44	
Taxilane Wingtip Clearance	23	27	
STANDARDS BASED ON TDG	***TDG 2***	***TDG 3/4***	***TDG 5***
Taxiway Width Standard	35	50	75
Taxiway Edge Safety Margin	7.5	10	15
Taxiway Shoulder Width	10	20	25

ADG: Airplane Design Group
TDG: Taxiway Design Group
Source: FAA AC 150/5300-13A, Airport Design

TABLE 4H
Aircraft by Associated TDG

Aircraft	TDG	RDC
Airbus A300/310	5	C-IV
Airbus A319/320	3	C-III
Boeing 717	3	C-III
Boeing 727	5	C-III
Boeing 737-700	3	C-III
Boeing 737-800/900	3	D-III
Boeing 747-4	6	D-V
Boeing 747-8	6	D-VI
Boeing 757 Series	5	D-IV
Boeing 767-800	5	C-IV
Boeing 777-300	6	D-V
Boeing 787-800	5	C-IV
Bombardier CRJ All Series	3	C-III
Embraer ERJ 175/195	3	C-III
MD-83/88	4	D-III

TDG: Taxiway Design Group
RDC: Runway Design Code
Source: FAA Data and Aircraft Certification Manuals

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be designed to the most appropriate TDG design standards based on usage. **Table 4H** presents the TDG for most commonly utilized commercial service aircraft at the Sunport.

The minimum taxiway design for Runway 8-26 and 3-21 should be TDG 5 to meet the needs of the critical design aircraft, the Boeing 757. As such, the taxiways associated with these two runways and/or those commonly utilized by TDG 5 aircraft should be 75 feet wide. For Runway 12-30, the applicable taxiway design is

TDG 3 to account for all general aviation aircraft. Thus, the taxiways associated with Runway 12-30 should be at least 50 feet wide.

The current taxiway widths at the Sunport are sufficient to meet existing and planned aircraft TDG design criteria.

The current taxiway system is composed of varying taxiway widths, with most being 75 feet wide. The current taxiway widths at the Sunport are sufficient to meet existing and planned aircraft TDG design criteria.

Taxiway Design Considerations

FAA AC 150/5300-13A, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft."

The taxiway system at the Sunport generally provides for the efficient movement of aircraft; however, recently published AC 150/5300-13A, *Airport Design*, provides updated recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation:

1. **Taxi Method**: Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate "judgmental oversteering," which is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.
2. **Steering Angle**: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.
3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.
4. **Intersection Angles**: Design turns to be 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.
5. **Runway Incursions**: Design taxiways to reduce the probability of runway incursions.
    - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiways systems simple using the "three-node" concept.
    - *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.

- *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
- *Avoid "High-Energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
- *Increase Visibility*: Right angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage, but should not be used as runway entrance or crossing points. A right angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
- *Avoid "Dual Purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
- *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
- *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

6. **Runway/Taxiway Intersections**:
   - *Right Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.
7. **Taxiway/Runway/Apron Incursion Prevention**: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.
8. **Wide Throat Taxiways**: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and makes lighting and marking more difficult.
9. **Direct Access from Apron to a Runway**: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.

10. **Apron to Parallel Taxiway End**: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

FAA AC 150/5300-13A, *Airport Design*, states that, "existing taxiway geometry should be improved whenever feasible, with emphasis on designated "hot spots." To the extent practicable, the removal of existing pavement may be necessary to correct confusing layouts. **Exhibit 4H** identifies all airfield areas of concern.

The FAA has identified the following four "hot spots" on the airfield described as follows:

- Hot Spot 1: The hold short marking on Taxiway E1 currently serves both Runways 8 and 12. When instructed to move beyond this point to the runway threshold, pilots must be sure to line up on the correct runway. Ideally, a single threshold taxiway would provide access to only one runway.

- Hot Spot 2: Taxiway G1 provides direct access from the general aviation apron to Runway 12-30. Ideally, pilots would have to make a turn from the apron onto parallel Taxiway G prior to turning to the Runway.

- Hot Spot 3: This area has the convergence of three taxiways (C, G, and F) and a runway (12-30). This layout may be confusing to pilots.

- Hot Spot 4: The hold short lines on Taxiways E and H in the vicinity of the Runway 21 may be confusing to pilots. Ideally, the hold short lines would allow an aircraft to be perpendicular to the Runway threshold. The hold short line on Taxiway H is particularly problematic as pilots would have virtually no peripheral view of the activity on Runway 3-21.

In the alternatives chapter, potential solutions to each of these Hot Spots will be presented.

Exhibit 4H also highlights the location of the "high-energy" portion of each runway (middle third). As noted above, FAA airfield geometry standards indicate that there should be no taxiways crossing a runway in the high-energy areas. There are three locations on the airfield where runway crossings are located within the "high-energy" portion of the runway. Two of them are high-speed exits for Runway 8-26 which are not typically utilized to cross the runway and are instead used to exit the runway. The third is the Taxiway C crossing of Runway 12-30. This taxiway is highly utilized to traverse the airfield, so pilots must be particularly aware of the runway crossing. In the alternatives chapter, potential solutions to mitigating the high-energy runways crossings will be examined.

There are several locations on the airfield where wide expanses of pavement exist, which can be confusing to pilots. Three prominent ones are identified on **Exhibit 4H**. In the alternatives chapter, options to mitigate these areas will be examined.

All entrance/exit taxiways should interface the runway to allow aircraft to hold at a 90 degree orientation with the runway centerline. This allows the pilot full operational view of the runway in both directions. Access to runways is preferred to be at a 90-degree angle, unless a high-speed exit is needed. Taxiways G1, C, and F enter Runway 12-30 at non-preferred angles. Options will be considered in the alternatives chapter to provide only 90-degree runway access points unless a high speed exit is applicable.

The FAA recommends that all direct access linking a ramp with a runway be modified by relocating the taxiway or developing "no taxi islands" on the ramp to prohibit direct access.

Another airfield geometry standard that does not conform to FAA standard is the direct aircraft ramp to runway access. FAA's Runway Safety Action Team (RSAT) study indicates that runway incursion risks increase when a pilot can traverse directly from a ramp or non-movement area to an active runway without having to make a turn. The FAA recommends that all direct access linking a ramp with a runway be modified by relocating the taxiway or developing "no taxi islands" on the ramp to prohibit direct access. There are several direct access points at the Sunport as follows:

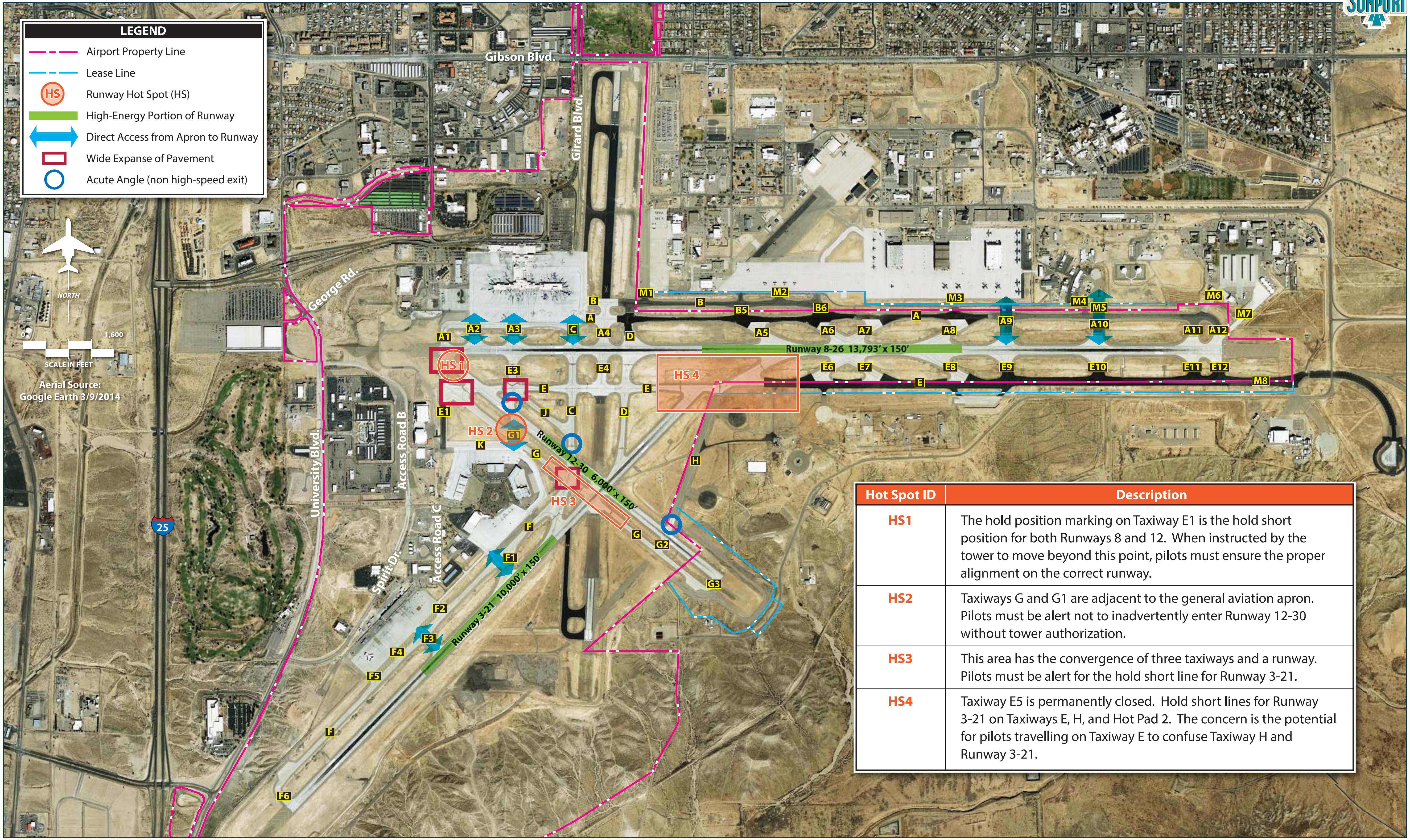
- Taxiways A2, A3, and C from the main terminal apron to Runway 8-26;
- Taxiways A9 and A10 from the military apron to Runway 8-26;
- Taxiway G1 from the general aviation apron to Runway 12-30;
- Taxiways F1 from the general aviation apron to Runway 3-21; and
- Taxiway F3 from the cargo apron to Runway 3-21.

Analysis in the following chapter will outline options for correcting the nonstandard direct access taxiway alignments.

Taxiway Exits

Each runway has associated taxiway exits. Those exits that also form a runway crossing are only counted as a single exit. Runway 8-26 has fourteen exits. These are comprised of four high-speed exits and ten exits providing 90-degree ingress/egress.

Runway 3-21 has six exits. Exits at Taxiways F1, C, and D, are angled and can be considered high-speed exits. Exits at F6 and F3 are 90-degree exits. Aircraft can also exit at the end of Runway 3 via Taxiway E. The space between Taxiways F3 and F6 is approximately 3,750 feet. This distance leads to a very long roll out and return taxi for aircraft landing on Runway 21. The current Airport Layout Plan includes an additional exit between Taxiways F3 and F6. Interviews with airport operators also indicate the need for an additional exit between the two. Future planning will maintain an additional taxiway exit.



Hot Spot ID	Description
HS1	The hold position marking on Taxiway E1 is the hold short position for both Runways 8 and 12. When instructed by the tower to move beyond this point, pilots must ensure the proper alignment on the correct runway.
HS2	Taxiways G and G1 are adjacent to the general aviation apron. Pilots must be alert not to inadvertently enter Runway 12-30 without tower authorization.
HS3	This area has the convergence of three taxiways and a runway. Pilots must be alert for the hold short line for Runway 3-21.
HS4	Taxiway E5 is permanently closed. Hold short lines for Runway 3-21 on Taxiways E, H, and Hot Pad 2. The concern is the potential for pilots travelling on Taxiway E to confuse Taxiway H and Runway 3-21.

Exhibit 4H
AIRFIELD HOT SPOT AND GEOMETRY ISSUES

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Runway 12-30 has six exits which are Taxiways G3, G2, G1, C, E3, and E1. Exits at E1 and G1 are considered Hot Spots by the FAA. This runway and the associated exits will be analyzed in the Alternatives Chapter. The recommendation from that analysis may include changes to the taxiway exit geometry.

The FAA has indicated that any excess pavement at airports, including potentially unnecessary taxiways, be identified. The alternatives chapter will present analysis of the optimal location for runway exits. If any exit taxiways are not necessary for capacity or efficiency, then a recommendation for removal of those taxiways will be presented.

If any exit taxiways are not necessary for capacity or efficiency, then a recommendation for removal of those taxiways will be presented.

INSTRUMENT NAVIGATIONAL AIDS

Instrument approaches to Runways 8 and 3 are served by sophisticated ILS precision instrument approaches offering Category I (CAT-I) minimums. These approaches allow properly equipped aircraft and pilots the ability to operate with weather minimums as low as 200-foot cloud heights and 2,400 feet runway visibility range (RVR). The HI-TACAN instrument approach to Runway 8 allows for slightly lower ⅜-mile visibility minimums.

Instrument approaches based on GPS have become very common across the country. Runways 8-26 and 3-21 are served by GPS approaches. A variant of GPS referred to as RNP (required navigation performance) allows an aircraft to fly a specific path between two 3D-defined points in space. RNP instrument approaches allow for more efficient curved flight paths through congested airspace, around noise sensitive areas, or through difficult terrain. The Sunport has RNP instrument approaches at both ends of Runway 8-26 and 3-21. Runway 12-30 does not have instrument approaches and is available for visual operations only.

The ILS and GPS approaches are excellent instrument approach procedures providing all-weather capability for the Sunport. As such, these procedures should be maintained in the future. As a busy commercial service airport, any potential improvements to the instrument approach minimums should be given consideration. GPS instrument approaches to Runway 12-30 will also be considered.

VISUAL NAVIGATION AIDS

The airport beacon is located on top of the control tower. The beacon provides for rapid identification of the airport with a rotating light that is green on one side and white on the opposite. The beacon should be maintained through the planning period.

All runway ends are equipped with visual glideslope indicator light systems, except Runway 12. The four-box precision approach path indicators (PAPIs) are available on Runways 26, 3, 21, and 30. Runway 8 provides the six-light staggered Visual Approach Slope Indicator (VASI) light system. Once this system reaches the end of its useful life, it should be replaced with the PAPI-4L system. If feasible, the PAPI system should be considered for the approach to Runway 12.

Runway end identification lights (REIL) are strobe lights set to either side of the runway. These lights provide rapid identification of the runway threshold. REILs should be installed at runway ends not currently providing an approach lighting system but supporting instrument operations. Currently, this would apply to runway ends 26 and 21, which are equipped with REILs and should be adequate unless replaced by a more sophisticated approach lighting system (ALS). An ALS would only be required on Runways 26 and 21 if the instrument approach procedure minimums were lower than ¾-mile, which is not currently planned. As such, the REILs should be maintained throughout the planning period.

The FAA recommends an approach lighting system for instrument approaches not lower than ¾-mile and requires one for lower visibility minimums. Runways 8 and 3 are equipped with a medium intensity approach lighting system with runway alignment indicator lights (MALSR). This system should be maintained in the future. Approach lighting systems are not anticipated for any other runway ends.

WEATHER AND COMMUNICATION AIDS

Albuquerque International Sunport has five lighted windcones located in proximity to the approach ends of Runways 8, 26, 3, 21, and 30. Windcones provide information to pilots regarding wind conditions, including direction and speed. These windcones should be maintained.

The airport traffic control tower (ATCT) provides an automated terminal information service (ATIS). ATIS broadcasts contain essential information, such as weather information, active runways, available approaches, and any other information required by the pilots, such as important NOTAMs. These broadcasts are updated hourly.

Albuquerque International Sunport is equipped with an Automated Surface Observing System (ASOS). This is an important system that automatically records weather conditions such as wind speed, wind gust, wind direction, temperature, dew point, altimeter setting, visibility, fog/haze condition, precipitation, and cloud height. This information can be accessed by pilots and individuals via an automated voice recording on a published telephone number. This system should be maintained through the planning period.

Many commercial service airports have runway visual range equipment providing visibility measuring and reporting equipment at specific locations adjacent to the runway. Runways 8-26 and 3-21 should be considered for RVR equipment.

A summary of the airside needs at Albuquerque International Sunport is presented on **Exhibit 4J**.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for handling aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacities of the various components of each area were examined in relation to projected demand to identify

CATEGORY	RUNWAY 8-26 EXISTING	RUNWAY 8-26 POTENTIAL REQUIREMENTS	RUNWAY 3-21 EXISTING	RUNWAY 3-21 POTENTIAL REQUIREMENTS	RUNWAY12-30 EXISTING	RUNWAY12-30 POTENTIAL REQUIREMENTS
RUNWAYS						
RDC	D-IV-1600	Same	D-IV-2400	Same	B-III-VIS	Same
Length x Width (in feet)	13,973 x 150	Same	10,000 x 150	11,000 x 150	6,000 x 150	Same[1]
Pavement Strength (in pounds)						
Single Wheel Loading (S)	100,000	Maintain	100,000	Maintain	65,000	Maintain
Dual Wheel Loadint (D)	210,000	Maintain	210,000	Maintain	120,000	Maintain
Dual Tandem Wheel Loading (DT)	360,000	Maintain	360,000	Maintain	155,000	Maintain
Double Dual Tandem Wheel Loadint (DDT)	720,000	Maintain	720,000	Maintain	NA	NA
Runway Design Standards[2]						
Runway Safety Area (RSA)	1.6 ac on KAFB	Lease or Buy RSA Land	0.2 ac on KAFB	Lease or Buy RSA Land	Meets Standard	Maintain
Runway Object Free Area (ROFA)	7.4 ac on KAFB	Lease or Buy ROFA Land	1.1 ac on KAFB	Lease or Buy ROFA Land	Meets Standard	Maintain
Runway Obstacle Free Zone (ROFZ)	0.6 ac on KAFB	Lease or Buy ROFZ Land	Meets Standard	Maintain	Meets Standard	Maintain
Precision Obstacle Free Zone (POFZ)	15' Penetration on Twy A	See Alternatives Analysis	Meets Standard	Maintain	NA	NA
Runway Protection Zones (RPZ)						
Owned/Airspace Control	Owned (8)/17.6 ac on KAFB (26)	Maintain (8)/ Lease or Buy RPZ land (26)	3.05 ac outside ABQ control (3)/ Owned (21)	Acquire 3.05 ac (3)	Own	Maintain
Incompatible Uses	None (8)/ Existing Fuel Farm (26)	Maintain	Existing Road (3)/None (21)	Maintain	None	Maintain
TAXIWAYS						
TDG	5	Same	5	Same	3	Same
Parallel Taxiway	Dual Full Length	Maintain	Partial	Maintain	Full Length	Maintain
Number of Exits	Fourteen	To Be Determined	Six	Add 1 exit between F3 and F6	Six	Maintain[1]
Taxiway Width (in feet)	Varys	Maintain	Varys	Maintain	Varys	Maintain
AIRFIELD GEOMETRY						
Hot Spots	Yes	Mitigate	No	Maintain	Yes	Mitigate
High Energy Crossing	Yes	Mitigate	No	Maintain	Yes	Mitigate
Direct Access to Runway from Apron	Yes	Mitigate	Yes	Mitigate	Yes	Mitigate
Wide Expanse of Pavement	Yes	Mitigate	No	Maintain	Yes	Mitigate
Acute Angled Exits (Other than high-speed exits)	Meets Standard	Maintain	Meets Standard	Maintain	Non-Standard	Mitigate
INSTRUMENT APPROACH PROCEDURES						
ILS	Yes - CAT I	Maintain	Yes - CAT I	Maintain	NA	NA
GPS (including RNP)	Yes	Maintain	Yes	Maintain	NA	Consider 1-mile Non-precision
Other	NA	NextGen Approaches	NA	NextGen Approaches	NA	NextGen Approaches
LIGHTING AND MARKING						
Runway Lighting	HIRL	Maintain	HIRL	Maintain	MIRL	Maintain
Centerline Lights	Yes	Maintain	Yes	Maintain	No	Maintain
Touchdown Zone Lighting	Yes (8)/No (26)	Maintain	Yes (3)/ No (21)	Maintain	No	Maintain
Runway Marking	Precision	Maintain	Precision	Maintain	Basic	Maintain
Taxiway Marking	Yes	Maintain	Yes	Maintain	Yes	Maintain
Approach Lighting System	MALSR (8)	Maintain	MALSR (3)	Maintain	NA	NA
Visual Approach Aids	VASI-6L (8)/PAPI-4L (26)	Replace VASI with PAPI-4L/Maintain	PAPI-4L	Maintain	None (12)/ PAPI-4L (30)	Maintain
NAVIGATION AND WEATHER AIDS						
	Existing: ATCT, ATIS, Five lighted windcones, Beacon			**Potential Requirements:** Maintain all/ Consider RVR Equipment for Rwy 8-26 and 3-21		

[1] Airfield geometry improvements may necessitate changes.
[2] Land leased by the Sunport is considered to be under Sunport control. These area measurements only apply to land not leased or owned by the Sunport.

KEY:

ac - Acres
RDC - Runway Design Code
TDG - Taxiway Design Code
ILS - Instrument Landing System
GPS - Global Positioning System
RNP - Required Navigation Performance
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
VASI - Visual Approach Slope Indicator
PAPI - Precision Approach Path Indicator
HIRL/MIRL - High/Medium Intensity Runway Lights

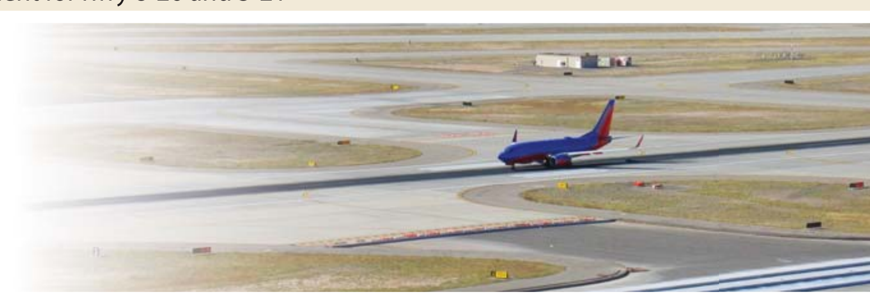

Exhibit 4J
AIRSIDE REQUIREMENTS

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future landside facility needs. This includes components for commercial service and general aviation needs such as:

- Passenger Terminal Complex Requirements
- Air Cargo Facilities Requirements
- General Aviation Requirements
- Airport Support Requirements

PASSENGER TERMINAL COMPLEX

The following resources were consulted to identify existing and future terminal building needs:

- Airport Cooperative Research Program (ACRP), Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*.
- ACRP, Project Number 07-04, *Spreadsheet Models for Terminal Planning and Design*.
- FAA Advisory Circular (AC) 150/5360-13, *Planning and Design Guidelines for Airport Terminal facilities*.
- International Air Transport Association (IATA), *Airport Development Reference Manual*.

Components of the passenger terminal complex include aircraft gate positions, departures processing, arrivals processing, concourse facilities, as well as public spaces. This section identifies the functional components of the terminal building and offers required space needed for projected passenger demand levels for each component.

Many aspects of passenger terminal design are based upon peaking periods of commercial activity as determined by the flight schedules for the Sunport. The flight schedule for Tuesday, June 10, 2014 was utilized as the basis for this analysis. This day represents an average peak day in the peak month for enplanement activity.

Exhibit 4K presents a summary of the terminal building space needs by functional area and by gross terminal area. The exhibit also includes a potential High Range enplanement forecast. This high range is approximately 15 percent greater than the long range forecast. The high range forecast is included so that Sunport management can adapt to any significant change in enplanements that were not originally forecast.

Aircraft Gates

Several methods were utilized to determine aircraft gate requirements for the Sunport. The first is the Gate Demand model from ACRP Report 25. This model utilizes two different approaches. The first approach uses the current ratio of annual passengers per gate, adjusted for forecast changes in fleet mix and annual load factors. This methodology assumes that the pattern of gate utilization will remain relatively stable over the 20-year forecast period. The changes in passengers per gate are due to changes in enplanements per departure (due to forecast increases in seating capacity and load factors), as opposed to increasing or decreasing the number of departures per gate. The second ACRP method considers increases in the number of departures per gate.

The two methods are then averaged to arrive at the aircraft gate forecast. In the short-term, 19 gates are estimated to be needed. In the intermediate-term, 20 gates are required, and in the long-term, 22 gates are required. The high range forecast results in a need for 24 aircraft gate positions, which is two more than is currently available.

FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities* was also consulted. The AC provides three methodologies: one based on the peak hour utilization rate, the second utilizes the daily departure for a daily utilization rate, and the third considers an annual utilization rate. Each of these was found to be consistent with the ACRP methodology.

Terminal Apron Requirements

There are four primary considerations that govern efficient aircraft apron design: the movement and physical characteristics of the aircraft to be served; the maneuvering, staging, and location of ground servicing equipment and underground utilities; the dimensional relationships of parked aircraft; and the safety, security, and operational practices related to apron control. The optimal apron design will depend upon available space, aircraft mix, and terminal configuration.

The main terminal apron is adequately sized through the long-term.

The main terminal area apron provides approximately 150,000 square yards of pavement with an additional 68,000 square yards available for aircraft not needing to park at the terminal gate. The main terminal apron is adequately sized through the long-term. If the high range enplanement forecast (3,830,000) were to be reached, then additional gates and terminal apron area may be required. The size of the additional apron will need to be able to accommodate the aircraft type intended to use it, and additional circulation apron will be necessary.

Terminal Building Requirements

The requirements for the passenger terminal building begin with a demand/capacity analysis of the existing facilities that identifies the current capacity of key processing areas for comparison to the passenger demand at the Sunport. The purpose of the analysis is to quantify and qualify the ability of the existing terminal facilities to satisfy the current demand of the traveling public at the Sunport.

A spreadsheet model based on industry standards and calibrated for the Sunport based upon observations of passenger activities and terminal operations and design was used in this analysis. The model utilizes the standard queuing theory which can be defined as: passengers arriving minus passengers

FUNCTIONAL AREA	Unit	Available	FORECAST Short 2,490,000	Intermediate 2,750,000	Long 3,330,000	High Range 3,830,000
DEPARTURES PROCESSING						
Ticket Counters						
Utilization Factor	80%		1,000	1,112	1,344	1,496
Counter Frontage	LF	410	229	254	307	342
Counter Area	SF	3,770	1,830	2,030	2,460	2,740
Airline Ticket Office	SF	16,100	11,429	12,709	15,360	17,097
Outbound Baggage/Screening	SF	21,714	13,029	14,488	17,510	19,491
Agent Positions	#	64	29	32	38	43
Kiosk Positions	#	14	6	6	7	8
Curbside Positions	#	12	4	4	5	6
Ticket Lobby						
Queuing Area	SF	14,500	9,700	10,790	13,040	14,510
Ticket Lobby Circulation	SF	16,316	7,086	7,879	9,523	10,600
Security Stations						
X-Ray Machines	#	16	8	9	11	12
Queing Area	SF	9,952	3,019	3,357	4,057	4,516
Station Area	SF	15,453	6,400	7,200	8,800	9,600
EDS Automated Machines	#	6	7	7	7	7
TSA Administration/Operations[1]	SF	2,100	10,000	11,000	13,300	15,300
ARRIVALS PROCESSING						
Baggage Claim						
Passengers Claiming Bags	75%		818	908	1,095	1,223
Claim Display Frontage	LF	840	491	545	657	734
Baggage Service Office	SF	3,100	981	1,089	1,314	1,467
Claim Lobby						
Claim Lobby Floor Area	SF	22,181	14,960	16,607	20,039	22,372
Claim Lobby Circulation Area	SF	29,656	11,690	12,977	15,659	17,482

[1] TSA leases an additional 10,400 sf in the Old Terminal Building

FUNCTIONAL AREA	Unit	Available	FORECAST Short 2,490,000	Intermediate 2,750,000	Long 3,330,000	High Range 3,830,000
CONCOURSE FACILITIES						
Passenger Holdrooms						
Gates	#	22	19	20	22	24
Holdroom Area	SF	62,138	51,300	54,000	59,400	64,800
Concourse Circulation						
Circulation Area	SF	33,796	28,250	31,414	37,968	42,262
PUBLIC SPACES						
Restrooms						
Area	SF	25,457	14,040	15,600	18,840	21,000
Concessions						
Food & Beverage	SF	36,170	37,350	41,250	49,950	57,450
Retail	SF	18,200	19,920	22,000	26,640	30,640
Public Area						
Circulation	SF	49,377	35,100	39,000	47,100	52,500
LOCAL AND FEDERAL OFFICES						
Airport Administration						
Administration/Operations/Police	SF	75,120	68,000	70,000	74,000	78,000
Admin Circulation	SF	12,559	11,369	11,703	12,372	13,040
Inspection Services						
Federal Inspection Services	SF	7,639	6,150	7,728	8,371	11,394
FUNCTIONAL AREA TOTAL						
Total Programmed Functional Area	SF	475,298	361,602	392,821	455,703	506,261
BUILDING SYSTEMS/SUPPORT						
Mechanical/HVAC	SF	87,567	87,567	87,587	87,587	87,587
Stairwells/Storage	SF	39,707	39,707	39,707	39,707	39,707
Unclassified/Vacant	SF	23,976	23,976	23,976	23,976	23,976
Airline Back Office (not ticket or baggage office)	SF	13,180	13,180	13,180	13,180	13,180
Unenclosed Storage	SF	24,928	24,928	24,928	24,928	24,928
Tug Drive	SF	31,422	31,422	31,422	31,422	31,422
TOTAL TERMINAL						
Gross Building Area	SF	696,078	582,382	613,621	676,503	727,061

Exhibit 4K
TERMINAL BUILDING CAPACITY AND REQUIREMENTS

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processed equals passengers in queue. The evaluation of individual processing elements is based on industry standards and formulas.

The model considers the level of service standards established by the International Air Transport Association (IATA). Level of service (LOS) defines the comfort and quality of the passenger experience. Some are related to crowding in queuing areas, while others define the amount of time a passenger must wait for processing. **Table 4J** outlines the basic level of service standards, while **Exhibit 4K** outlines space requirements for each functional element of the passenger terminal building.

In general, LOS C is a typical design goal for most airports. LOS B would be a preferred goal if the budget allows. LOS A is generally too expensive to achieve, and thus prohibitive to implement. For purposes of this analysis, an LOS C+ was used to represent a median between LOS B and C.

TABLE 4J
Level of Service Standards (IATA)
Albuquerque International Sunport

AREA PER OCCUPANT								
Level of Service Standards	**A** Ft^2	**B** Ft^2	**C+** Ft^2	**C** Ft^2	**C-** Ft^2	**D** Ft^2	**E** Ft^2	**F** Ft^2
Check-in Queue Area	19.4	17.2	16.1	15.1	14	12.9	10.8	-
Wait/Circulate	29.1	24.8	22.6	20.4	18.3	16.1	12.8	-
Holdroom	15.1	13.5	12.8	12	11.3	10.5	8	-
Bag Claim Area (excl. claim device)	21.5	19.4	18.3	17.2	16.1	15.1	12.9	-
Federal Inspection Services	15.1	12.9	11.8	10.8	9.7	8.6	6.5	-

A – Excellent levels of service; conditions of free flow; excellent level of comfort.
B – High level of service; condition of stable flow; very few delays; high level of comfort.
C – Good level of service; condition of stable flow; acceptable delay; good level of comfort.
D – Adequate level of comfort and service; condition of unstable flow; acceptable delays for short periods.
E – Inadequate level of service; condition of unstable flow; unacceptable delays; inadequate levels of comfort.
F – Unacceptable levels of comfort and service; conditions of cross flows, system breakdown and unacceptable delays; applies to areas below LOS E.

Departures Processing

The first destination for most enplaning passengers in the terminal building is the ticket counters. The ticketing area includes the counters, queuing area and lobby, the ticket offices, and bag screening and processing. Security screening is also included in the departures processing element.

Ticket Counters - The percentage of the departing passenger peak hour demand that checks in at the ticket lobby is estimated at 80 percent. The remainder are assumed to check in prior to arriving at the Sunport and do not have checked baggage. The capacity at the ticket counters was calculated based on the passenger processing rate derived from observation and IATA averages.

The ticket counter functions appear to be adequate through the long-term planning period. Only when considering a high range enplanement forecast does the airline ticket office element become somewhat constrained.

Ticket Lobby - The adequacy of the ticket lobby floor area is also evaluated to determine whether demand levels result in an acceptable level of service. The ticket lobby demand included a percentage of well-wishers in addition to the passengers. Industry standards assume that some passengers enter the queue with their friends or family for assistance. The evaluation was based on a service goal of a 2.5-minute maximum wait in queue and an LOS C+ of 16.1 square feet per person in queue with baggage.

Both the queuing and ticket lobby circulation elements are adequate through the long-term planning period. The queuing area would slightly exceed capacity under the high range forecast; however, the ticket lobby circulation element is well under capacity so some of this area could be converted to queuing area to compensate.

Bag Screening and Processing – The Transportation Security Administration (TSA) must inspect every checked bag that is to be put on an aircraft. Each airline contracts with TSA for this service. United, American, US Airways and Delta each have one in-line screening machine (CT-80DR+) located behind the airline ticket office. Southwest has two in-line machines (CT-80). Bags for Alaska and Jetblue flights are manually inspected. The space available behind the airline offices is adequate through the long-term planning period. Considerations should be given to a more fully automated in-line system rather than the current method.

Passenger Security Screening - The required queuing area for the checkpoint was determined using an area of 16.1 square feet per person at a level of service LOS C+. Across the country, TSA is making efforts to help streamline the screening process. Efforts are being made to provide staff during peak periods, install new equipment, and open pre-check lanes. The security screening at the Sunport consists of 16 X-ray machines for bags. Passengers then pass through either a metal detector, of which there are eight, or they pass through one of six EDS automated body scanning machines.

The passenger security queuing and station area is adequate through the long-term and high range forecast. There are two smaller TSA offices in the security screening area. The main TSA offices are located in the old terminal building. The total TSA office space is adequate through the intermediate-term. When considering the long-term and high range scenarios, TSA office space may be somewhat constrained.

Arrivals Processing

The passenger arrivals process consists primarily of those facilities and functions that provide means to reunite the arriving passenger with items that were checked at the origin of the flight.

Baggage Claim - It is estimated that 70 percent of arriving peak hour passengers claim checked baggage. The remaining 30 percent of the passengers bypass the baggage claim areas and go directly to the curb or to other ground transportation related facilities. An industry standard of 1.3 checked bags per passenger is utilized. The baggage claim capacity is based on the device frontage per person.

Claim Lobby - The lobby area adjacent to the baggage claim device includes space from the edge of the claim device to the railings surrounding the bag claim devices. Claim lobby area is based on meeting LOS C+ and is calculated as 18.3 square feet per person. The claim lobby floor area is adequate through the long-term; however, if the high range forecast is reached, then the claim lobby floor area may become constrained. The claim circulation area is adequate through the long-term and high range forecast planning periods.

Concourses

The concourses consist primarily of the public circulation spaces and secure passenger holdrooms. While holdrooms and circulation are calculated separately, it is common for actual usage to include both of these elements. For example, while passengers are waiting, they will typically disperse throughout the secure concourse. As it gets closer to boarding time, passengers tend to gather in the gate area. As a result, it is common to consider holdroom and concourse capacity in aggregate.

Holdrooms - The holdroom capacity is based upon available seats for the design aircraft for each gate and average load factor at the Sunport. Podium space and queuing/exit space is also considered. Holdroom spaces are adequate for current gate numbers through the long-term planning period. Additional hold room space may be necessary if the high range forecast is realized.

Circulation – The holdrooms are located on either side of the circulation element. The circulation requirement is based upon providing circulation at 22.6 square feet per occupant. The concourse circulation area is adequate through the intermediate planning period. The circulation element is shown to be constrained in the long-term planning horizon.

Public Spaces

Public spaces include restrooms, concessions, and other public areas.

Restrooms - Restrooms are strategically located throughout the terminal building on both the public and secure sides. Restroom capacity is calculated based on square footage per peak hour passenger, as provided in FAA Advisory Circular 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*. Current restroom capacity is adequate through the high range forecast.

Concessions and Retail - While planning standards and demand are an important consideration in the adequacy of concessions in a terminal, there are marketing considerations that determine the capacity and economic viability of airport food/beverage services and retail concessions. Concessions and retail are available on both the secure and non-secure sides of the terminal.

Concessions are based on providing 15 square feet per 1,000 annual enplaned passengers. Retail space is estimated as eight square feet per 1,000 annual enplaned passengers. Both are forecast to be at capacity by the end of the short-term planning period; however, local economies will heavily influence actual space needed for these functions.

Local and Federal Offices

Administrative Spaces - Often airport administrative offices are located within an airport terminal building. At the Sunport, the administration occupies space on each floor. By industry standards, the administrative offices are properly sized through the long-term planning period. The high-range forecast indicates that administrative space may exceed capacity at that time.

Inspection Services – ACRP Report 25 presents a model for estimating space requirements for processing international passengers through customs. Factors such as the number of flights, passenger loading factors, and acceptable LOS are considered. Currently, the Sunport does not have regularly scheduled international flights requiring customs processing; however, on occasion unscheduled international flights will operate along with some international general aviation flights. As a medium hub commercial service airport and a border state, the availability of customs service is important.

Since, the forecasts of aviation activity do not anticipate a significant increase in international activity, the current space allocated to inspection services is adequate. Additional space may be necessary if international service were to resume at the Sunport.

Building Systems and Support

The systems and support functions include mechanical rooms, heating and air conditioning (HVAC), unenclosed storage, the baggage tug drive, stairwells, and storage. These elements are necessary for the continued efficiency of the Sunport terminal building. These elements are not specifically forecast; however, if the building were to be expanded in the future, these elements should also be considered.

Total Terminal Building Requirements

At nearly 700,000 square feet, the current terminal building is adequately sized through the long-term planning period. If the high-range enplanement forecast is reached, then the estimated gross terminal building size should be approximately 727,000 square feet. Current storage and vacant space would easily provide enough space if converted to specific functional uses to cover the deficit.

__At nearly 700,000 square feet, the current terminal building is adequately sized through the long-term planning period.__

Certain functional elements may become constrained within the 20-year planning horizon of the Master Plan. For example, additional concession and retail space could be needed in the short-term. Over time, utilization of space may need to change to accommodate changing needs. For example, in the ticket lobby area, airlines are utilizing self-check-in procedures to a greater degree; therefore, there may not be a need for as many agent-staffed positions.

TERMINAL CURB

The terminal curb element is the direct interface between the terminal building and the ground transportation system. The length of curb available for loading and unloading passengers and baggage is determined by the type and volume of ground vehicles anticipated during the peak period on the design day. The airport has approximately 630 feet of enplaning/departure curb along the elevated roadway fronting the terminal. On the lower level, there is 660 feet of deplaning/arrival curb fronting the building for use by autos and taxis. In addition, there is a commercial island with 660 feet of additional space for use by commercial vehicles such as shuttles and full-size buses.

During the previous master planning effort, a curb survey was performed from January 10-13, 2000, to determine the vehicle mix and average dwell times at the curb fronts. At the time, the major improvements, such as the split terminal roadway system, the parking structure, and the consolidated rental car facility, had been completed. Since then, dwell times for vehicles utilizing the terminal curbs has decreased significantly due to security procedures instituted following 9/11.

The hourly vehicle count from the 2000 curb survey was adjusted down approximately 20 percent to account for the decrease in total enplanements and then the modal split (i.e., private autos, rental car shuttles, taxis, hotel shuttles and limousines) was applied. These raw figures were then input into the ARCP spreadsheet model. The output from the model is the curb length range required to maintain a LOS “C.”

Table 4K provides the curb length analysis for the departure/enplanement, arrival/deplanement, and commercial median curbs. All three terminal curbs are adequately sized through the long-term planning period. With the high-range enplanement forecast, the departure/enplanement curb begins to slightly exceed the available curb length. Planning for additional terminal curb length is not a high priority for this Master Plan.

TABLE 4K
Terminal Curb Requirements - Level of Service “C”
Albuquerque International Sunport

	Current	Short	Intermediate	Long	High-Range
Annual Enplanements	2,446,388	2,490,000	2,750,000	3,330,000	3,830,000
Terminal Curb Front (l.f.)					
Departure/Enplanement Curb	630	446-527	496-586	599-707	667-788
Arrival/Deplanement Curb	660	100-119	111-131	134-159	149-176
Commercial Median (l.f.)					
Arrivals/Deplanement Curb	660	192-227	213-252	257-304	288-341

Source: ACRP, Project Number 07-04, Spreadsheet Models for Terminal Planning and Design.

VEHICLE PARKING

Vehicle parking associated with the Sunport includes spaces utilized by passengers, visitors, employees, rental car companies, public transit, and taxis/shuttles. Existing parking availability was previously presented on Exhibit 1R. Parking needs are generally established by taking into consideration peak hour passengers, peak hour visitors, and the travel mode split. In accordance with airport parking industry standards, approximately 15 percent of total public parking is identified as short-term parking. The existing and long-term parking needs for the Sunport is shown in **Table 4L**.

TABLE 4L
Vehicle Parking Requirements
Albuquerque International Sunport

	Available	Current Need	Short	Intermediate	Long	High-Range
Public Parking Requirements						
On-Airport Short-Term Public	3,454	859	879	969	1,171	1,335
On-Airport Long-Term Public	807	4,865	4,983	5,493	6,634	7,564
Total On-Airport Parking	4,261	5,724	5,863	6,462	7,805	8,899
Off Airport Public Parking	6,100					
Total Public Parking	10,361					
Other Parking Requirements						
Employee	872	489	498	550	667	766
Rental Car Ready Return	1,200	600	633	698	844	1,001
Rental Car Service and Storage (acres)	34	13	14	16	19	22
Total All Parking	**12,433**	**6,813**	**6,994**	**7,710**	**9,316**	**10,666**

Note: Analysis assumes no additional off-airport public parking.

The Sunport does not have enough on-airport public parking to accommodate the current need for total parking. As a result, a portion of the public will rely on off-airport public parking options. The combination of on-airport and off-airport public parking provides enough spaces to accommodate forecast growth through the high-range planning horizon.

Employee parking is estimated as 200 spaces per one million enplaned passengers. The current supply of employee parking is adequate through the high range forecast. Rental car parking is consolidated at the rental car facility, which has approximately 1,200 ready/return spaces. Future rental car ready/return needs are calculated at 315 spaces per one million originating passengers. Rental car service and storage space is calculated as seven acres per one million originating passengers. Current rental car facilities are adequate through the high range forecast.

Overall, the combination of on- and off-airport parking is adequate to meet the high range forecast needs of the Sunport. Currently, the parking structure is considered short-term parking, which results in a large supply of short-term parking. Consideration should be given to the functional designation of various parking lots (i.e., short-term, long-term, and employee) in order to accommodate specific needs. For example, a portion of the parking structure could be changed from short-term to long-term parking, if that was necessary. In addition, parking habits are highly susceptible to factors such as location and price.

AIR CARGO REQUIREMENTS

The primary cargo-related facilities requiring analysis include the cargo apron, sort building space, and landside staging area (delivery truck and vehicle parking). The current air cargo facilities at the Sunport are located to the west of Runway 3-21 in the southwest quadrant of the Sunport. The facilities include a 52,000 square-foot sort/warehouse building constructed in 1992. An 89,700-square-yard cargo apron is available. Ground support equipment (GSE) storage space is located on both the north and south sides of the building and they encompass a total of 19,400 square yards. Truck parking and loading docks encompass approximately 25,000 square yards of space. Building facilities are leased by FedEx, UPS, 10 tanker Air, and Matheson Flight Extenders.

Air Cargo Facility

Estimates of the appropriate size of an air cargo sort facility are based upon national industry standards and range between 1.0 and 2.5 square feet per total tonnage shipped. Generally, 1.0 square foot per ton typically indicates that the facility is more efficiently utilized, and 2.0 square feet per ton typically indicates that the facility has some capacity for near-term growth. Based on current building size and cargo shipped in 2014, the Sunport cargo building maintains a 0.93 building utilization rate. Future space requirements were calculated by multiplying the projected tons shipped and received by a 1.25 utilization rate. Based upon this space calculation, the building will need to be enlarged by 26,804 square feet by the long-term to meet industry utilization standards.

Truck Dock/Staging/Parking Requirements

The existing air cargo building has a total of 30 truck dock positions. Truck dock requirements are based on a planning factor of 0.3 truck docks per 1,000 square feet of building space. No additional docks are necessary through the long-term planning period.

Truck parking and staging is currently estimated at 48 percent of the building size at the Sunport. This figure is slightly higher than the national average which is approximately one-third of the building size. Because the nature of air cargo is changing to include a larger percentage of truck deliveries, future estimates for staging and parking utilize the 48 percent factor.

Air Cargo Apron

The cargo apron area requirements are based on the current and projected aircraft type to be utilized in air cargo service at the Sunport. As presented in the Forecasts chapter, total tons shipped are forecast to grow modestly at 0.59 percent annually. The mix of aircraft used in cargo service is not anticipated to change significantly. The DC-10 and A-300 (or similar large jets) are anticipated to remain in the fleet and account for the largest cargo aircraft utilized. Future cargo apron requirements are primarily based on the type and amount of aircraft utilizing the ramp. The apron should also provide for circulation and access lanes for active GSE.

At the Sunport, there are nine air cargo positions available for large jets and five spaces available for smaller turboprop commuter cargo aircraft. The larger jets generally fall in ADG IV and the turboprops general fall in ADG II. Future cargo apron requirements are estimated at 9,000 square yards per ADG IV jet and 1,000 square yards per turboprop. These calculations include space for active ground service equipment and circulation, which includes the access taxilane and space for the turboprops to pull out without the need for a push-back.

There is a need for additional air cargo building and truck staging/parking area.

Air cargo activities require extensive ground service equipment including cargo lifters, moveable stairs, cargo containers, tug vehicles, and container movement vehicles. While some of this equipment is parked in the vicinity of the aircraft, most is stored to the sides of the cargo building. Following national trends, the space requirements for GSE storage space is estimated at 25 percent of the air cargo building size.

Table 4M presents the requirements needed to fully accommodate air cargo activity at the Sunport. As can be seen, there is a need for additional air cargo building and truck staging/parking area.

TABLE 4M
Air Cargo Requirements
Albuquerque International Sunport

Cargo Element	Available	Current Need	Short	Intermediate	Long
Total Cargo Forecast (in tons)	55,702	55,702	60,043	61,534	63,043
Cargo Building Requirements					
Air Cargo Building (s.f.)	52,000	69,628	75,054	76,918	78,804
Truck Dock Positions	30	21	23	23	24
Truck Staging/Parking (s.y.)	25,000	33,421	36,026	36,920	37,826
Cargo Apron Requirements					
Total Apron Space (s.y.)	89,700	55,000	55,000	64,000	73,000
Ground Support Equipment Space (s.y.)	19,400	13,926	15,011	15,384	15,761

Source: Coffman Associates analysis

GENERAL AVIATION FACILITIES

General aviation facilities are those necessary to accommodate airport activity by all aviation segments except commercial passenger service. This includes recreational flying, business aviation, charter, military, and some portions of air cargo and air ambulance activity. These airport users require a variety of services, such as fueling, terminal services, maintenance, and aircraft storage. The primary components considered for general aviation needs include:

- Aircraft Hangars
- Aircraft Parking Aprons
- General Aviation Terminal Building Services
- Auto Parking and Access

The future need for each of these components has been analyzed based on the aviation demand forecasts.

AIRCRAFT HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation, whether for owners of single or multi-engine aircraft, is toward more sophisticated aircraft (and, consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tie-downs. In a relatively moderate and dry climate such as Albuquerque, many will elect to tie-down their aircraft; however, owners of more expensive aircraft are more likely to utilize hangars.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at an airport in the future; however, hangar construction should be based upon actual demand trends and financial investment conditions. While a majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft owners may still tie-down outside (due to the lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. Currently, approximately 63 percent of based aircraft utilize outside tie-down parking positions. For planning purposes, the percentage of based aircraft owners desiring hangar storage increases progressively up to 77 percent in the long-term.

There are two general types of aircraft storage hangars: T-hangars and conventional hangars. T-hangars are similar in size and will typically house a single engine piston-powered aircraft. Some multi-engine aircraft owners may elect to utilize these facilities as well. There are typically many T-hangar units "nested" within a single structure. There are currently two nested T-hangar structures, one with six units and one with 10 units located on the Sunport.

Conventional hangars are the familiar large hangars with open floor plans that can store several aircraft. It is estimated that there are 80 aircraft parking positions within the conventional hangars at the Sunport.

Table 4N presents aircraft storage needs based on the demand forecasts. Currently, it is estimated that there are approximately 170 tie-down positions, 16 T-hangar positions, and 80 conventional hangar positions. Current and future hangar needs are a function of the existing and forecast based aircraft fleet mix. Future T-hangar positions are estimated at 1,500 sf per unit. Future conventional hangar space is a function of the average space requirement by aircraft type. Single engine piston space is estimated at 1,200 sf, multi-engine piston is estimated at 1,500 sf, turboprops are estimated at 2,400 sf, business jets are estimated at 3,000 sf, and helicopters are estimated at 1,200 sf per space.

TABLE 4N
Hangar Storage Needs
Albuquerque International Sunport

			FORECAST			
	Current Supply	**Current Need**	**Short-Term**	**Inter.-Term**	**Long-Term**	**Long-Term Need**
Based Aircraft	127	127	135	145	165	
Aircraft to Tie-Down	170	47	44	41	38	
Aircraft to be Hangared	80	80	91	104	127	
T-Hangar Spaces (est.)	16	9	10	13	16	0
Conventional Hangar Spaces (est.)	80	71	81	91	111	31
Total Hangar Spaces (est.)	**96**	**80**	**91**	**104**	**127**	**31**
T-Hangar Area (s.f.)	25,300	13,500	15,000	19,500	24,000	0
Conventional Hangar Area (s.f.)	188,800	145,500	165,600	189,000	233,100	44,300
Total Storage Area (s.f.)	**214,100**	**159,000**	**180,600**	**208,500**	**257,100**	**44,300**

Source: Coffman Associates analysis.

T-hangar space is adequate through the long-term planning period. Additional conventional hangar space is needed by the intermediate planning term. By the long-term, an additional 44,300 sf of conventional hangar space is needed.

Interviews with management of the FBOs indicate that there is an immediate need for hangars with higher hangar doors. The FBO hangars are currently unable to house aircraft with tails higher than 18 feet. One of the FBOs has indicated a desire to construct additional conventional hangars on the back apron area (Apron D on Exhibit 1W).

There is an immediate need for hangars with higher hangar doors.

Hangar requirements are general in nature and are based on standard hangar size estimates and typical user preferences. If a private developer desires to construct or lease a large hangar to house one plane, any extra space in that hangar may not be available for other aircraft. The actual hangar area needs will be dependent on the usage within each hangar.

GENERAL AVIATION AIRCRAFT APRON

A general aviation aircraft apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as the general aviation terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users, as well as a portion of locally based aircraft. Often, smaller aprons are available adjacent to FBO hangars, aviation businesses, and at other locations around an airport. An aircraft parking apron should provide space for the number of locally based aircraft that are not stored in hangars, transient aircraft, maintenance activity, and circulation. The general aviation apron layout at the Sunport follows this typical pattern.

The general aviation apron space consists of several distinct apron areas, all consolidated in the southwest portion of the Sunport. The total usable apron area for aircraft parking is approximately 104,300 square yards of pavement as previously shown on Exhibit 1W.

FAA AC 150/5300-13A, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. Busy day operations were determined by combining general aviation itinerant operations with other air taxi operations that would likely utilize the general aviation apron areas. At the Sunport, the number of itinerant spaces required is estimated at 25 percent of the busy-day itinerant general aviation/other air taxi operations.

A planning criterion of 900 square yards per aircraft was applied to determine current and future transient apron area requirements. This figure is estimated for an average aircraft space requirement and includes circulation apron. There is a current need for 42,600 square yards of transient apron and 47 transient positions. By the long-term, there is a need for 75,900 square yards of apron area and 84 aircraft positions.

Local aircraft tie-down needs are derived from the estimated number of based aircraft which will tie-down. For smaller piston powered aircraft, a planning criterion of 360 square yards was utilized and for larger turboprops, 500 square yards was used. Larger aircraft are assumed to be based in a hangar. There is a current need for approximately 18,200 square yards for total local tie-down apron. By the long-term planning period, there is a need for 16,000 square yards. The forecast decrease in local apron area need is the result of the assumption that more aircraft owners would store their aircraft in a hangar if space were available.

Thus, the existing general aviation apron at the Sunport is adequate through the long-term planning period.

The general aviation aprons are not specifically marked for local and transient parking. In total, it is estimated that there are 104,300 square yards of apron available for these purposes. The total long-term apron area need is estimated at 91,900 square yards. Thus, the existing general aviation apron at the Sunport is adequate through the long-term planning period. **Table 4P** presents the calculated aircraft apron needs for the Sunport.

TABLE 4P
Aircraft Apron Requirements
Albuquerque International Sunport

			FORECAST		
	Current Supply	**Existing Need**	**Short-Term**	**Intermediate-Term**	**Long-Term**
Transient Apron					
Positions	[redacted]	47	69	74	84
Apron Area (sf)	[redacted]	42,600	62,000	66,400	75,900
Local Apron					
Positions	[redacted]	47	54	51	49
Apron Area (sf)	[redacted]	18,200	17,200	16,400	16,000
Total Apron					
Positions	170	94	123	125	133
Apron Area (sf)	104,300	60,800	79,200	82,800	91,900

Source: Coffman Associates analysis

GENERAL AVIATION TERMINAL SERVICES

The general aviation facilities at the Sunport are often the first impression of the community that corporate officials and other visitors will encounter. General aviation terminal facilities at an airport provide space for passenger waiting, pilots' lounge, pilot flight planning, concessions, management, storage, and various other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by fixed base operators (FBOs) and other specialty operators for these functions and services. This is the case at the Sunport, as general aviation terminal space is currently provided by both airport FBOs. The commercial passenger terminal building also provides additional elements, such as restaurants and concessions, if the itinerant passengers so choose to shuttle over to the terminal for those services. It is estimated that there is approximately 46,000 square feet of general aviation terminal service space available at the Sunport.

For larger FBO operations, such as those at the Sunport, a ratio of one square foot for each five square feet of hangar space is used to determine general aviation terminal space requirements. Current general aviation terminal space requirements are met through the long-term planning horizon. Ultimately, each FBO operator will determine their own business need for additional office/general aviation terminal space.

GENERAL AVIATION VEHICLE PARKING

General aviation parking needs are attributable to transient airport users (visitors and employees), locally based users, and aviation businesses. Locally based users primarily include those attending to their based aircraft. Airport businesses need parking to accommodate employees and customers.

(Airport business parking needs should be based on the needs of the individual business and are not specifically included in this analysis.)

A planning standard ratio of one vehicle parking space per 1,000 square feet of hangar space us utilized to determine parking needs. **Table 4Q** summarizes this calculation and indicates that the existing parking lot central to the general aviation complex is adequate through the long-term planning period.

The existing parking lot central to the general aviation complex is adequate through the long-term planning period.

TABLE 4Q
General Aviation Terminal Building Space and Parking
Albuquerque International Sunport

GA Element	Available	Current Need	FORECAST Short-Term	Intermediate-Term	Long-Term
Conventional Hangar Area (sf)	188,800	145,500	165,600	189,000	233,100
GA Terminal/Office Area (sf)	46,000	29,100	33,120	37,800	46,620
GA Itinerant Parking Spaces	486	82	98	117	151
GA Local Parking Spaces	110	64	68	73	83
Total GA Parking Spaces	596	146	166	190	234
Total Parking Area (sf)	187,700	45,800	52,200	59,900	73,700

Source: Coffman Associates analysis

GENERAL AVIATION SUMMARY

Exhibit 4L presents a summary of the general aviation requirements. All current elements, except for conventional hangar space, are adequate through the long-term planning period. An additional 44,000 square feet of conventional hangar space is forecast to be needed in the long-term; however, both FBOs have indicated a need for hangars with higher doors to accommodate the higher tail heights of some business jets. As a result, there is an immediate need for this type of hangar. In the Alternatives chapter, locations for additional conventional hangars will be examined.

AIRPORT SUPPORT REQUIREMENTS

Various facilities that do not logically fall within classifications of airside or landside facilities have also been identified. These other areas provide certain support functions related to the overall operation of the airport.

	Available (est.)	Current Need	FORECAST Short Term	FORECAST Intermediate Term	FORECAST Long Term
AIRCRAFT STORAGE					
Aircraft to Tie Down	170	47	44	41	38
Aircraft to be Hangared	80	80	91	104	127
T-Hangar Positions	16	9	10	13	16
Conventional Hangar Positions	80	71	81	91	111
Total Hangar Positions	96	80	91	104	127
T-Hangar Area	25,300	13,500	15,000	19,500	24,000
Conventional Hangar Area	188,800	145,500	165,600	189,000	233,100
Total Hangar Area	214,100	159,000	180,600	208,500	257,100

AIRCRAFT APRON					
Transient Apron					
Positions	[redacted]	47	69	74	84
Apron Area (sf)	[redacted]	42,600	62,000	66,400	75,900
Local Apron					
Positions	[redacted]	47	54	51	49
Apron Area (sf)	[redacted]	18,200	17,200	16,400	16,000
Total Apron					
Positions	170	94	123	125	133
Apron Area (sf)	104,300	60,800	79,200	82,800	91,900

GENERAL AVIATION SERVICES					
GA Terminal/Office Space (sf)	46,000	29,100	33,100	37,800	46,600
GA Itinerant Parking Spaces	486	82	98	117	151
GA Local Parking Spaces	110	64	68	73	83
Total GA Parking Spaces	596	146	166	190	234
Total GA Parking Area (sf)	141,000	45,800	52,200	59,900	73,700

Exhibit 4L
GENERAL AVIATION REQUIREMENTS

AIRCRAFT RESCUE AND FIREFIGHTING (ARFF) FACILITIES

Part 139 commercial service airports are required to provide Aircraft Rescue and Firefighting (ARFF) services during air carrier operations. The Kirtland Air Force Base Fire Department (KAFB/FD) provides this service through a Memorandum of Agreement, dated August 24, 1984, and the deed transferring the runways to the City of Albuquerque, dated March 16, 1970.

Each certificated airport is required to maintain equipment and personnel based on an ARFF Index established according to the length of aircraft and scheduled daily flight frequency. There are five indices, A through E, with A applicable to the smallest aircraft and E the largest aircraft. The Sunport falls within ARFF Index C, based on an average of five or more scheduled departures per day by large air carrier aircraft with a length between 126 feet and 159 feet (i.e., Boeing 737/757). **Table 4R** presents the vehicle requirements and capacities for each index level.

TABLE 4R
ARFF Index Requirements

Index	Aircraft Length	Requirements
Index A	<90'	1. One ARFF vehicle with 500 lbs. of sodium-based dry chemical or
		2. One vehicle with 450 lbs. of potassium-based dry chemical and 100 lbs. of water and AFFF for simultaneous water and foam application
Index B	90'-126'	1. One vehicle with 500 lbs. of sodium-based dry chemical and 1,500 gallons of water and AFFF or
		2. Two vehicles, one with the requirements for Index A and the other with enough water and AFFF for a total quantity of 1,500 gallons
Index C	126'-159'	1. Three vehicles, one having Index A, and two with enough water and AFFF for all three vehicles to combine for at least 3,000 gallons of agent or
		2. Two vehicles, one with Index B and one with enough water and AFFF for both vehicles to total 3,000 gallons
Index D	159'-200'	1. One vehicle carrying agents required for Index A and
		2. Two vehicles carrying enough water and AFFF for a total quantity by the three vehicles of at least 4,000 gallons
Index E	>200'	1. One vehicle with Index A and
		2. Two vehicles with enough water and AFFF for a total quantity of the three vehicles of 6,000 gallons

AFFF: Aqueous Film-Forming Foam
ARFF: Aircraft Rescue and Firefighting
Source: 14 CFR Part 139

KAFB/FD meets ARFF standards required by military aircraft utilizing the facilities at the Sunport which meets ARFF Index E under FAR Part 139. The ARFF Index applicable to the Sunport is anticipated to remain within ARFF Index C; therefore, no changes are needed to maintain an adequate level of fire protection. When any rescue vehicle approaches the end of their useful life, they should be replaced in a timely manner.

SNOW REMOVAL EQUIPMENT

The Sunport is located in an area where snow and ice conditions occur on an infrequent basis with an annual average of approximately 11 inches. The FAA Advisory Circular (AC) 5200-30A, *Airport Winter Safety and Operations*, provides general guidance for snow clearance for commercial service airports. According to the AC, "commercial service airports should have sufficient equipment to clear one inch of snow weighing up to 25 pounds per cubic foot from the primary instrument runway, one or two principal taxiways to the ramp area, emergency or firefighter access roads, and sufficient ramp area to accommodate anticipated aircraft operations." The time that one inch of snow should be cleared is based on the number of annual operations for an airport. The Sunport is in the highest category of over 40,000 annual operations, so the clearance time requirement is one-half hour.

Snow removal equipment (SRE) includes four snowplows with 20-foot blades. Two of the plows also have brooms. These are assigned to the runway and taxiway system. There is also a fifth snowplow with an 11-foot blade assigned to the cargo ramp. The runway/taxiway system is also cleared with a combination blower/broom and a combination blower/loader. Two pickup trucks equipped with 7.5-foot blades and spreaders are used to clear the jetway areas. Another truck carries de-icer for the runway/taxiway system. Three other trucks with 10-foot blades are assigned to both the airfield and the airport roadways. The roadways and parking lots are also cleared with two trucks with 10-foot blades and two pickups with 7.5 foot blades and spreaders. The list of SRE was previously shown in Table 1H.

The current equipment inventory is adequate for the current airfield. Additional equipment could become necessary if airfield and apron pavements are increased significantly.

Snow removal materials storage is currently limited to bins within the airport maintenance building. Standalone storage buildings would increase capacity and loading efficiency.

Table 4S presents the snow clearing priority surfaces. The active air carrier runway and associated taxiways are the highest priorities. ARFF access roads are the next priority, followed by clearing access to Gate F16, which provides access to the airfield for additional equipment if needed.

TABLE 4S
Snow Removal Priority
Albuquerque International Sunport

Airside	Landside
1. Air carrier runway in use and associated taxiways	1. Sidewalks
2. ARFF access roads	2. Terminal roadway system
3. Gate F16 for mutual aid ARFF access	3. Parking structure ramps and roadways
4. Baggage tunnel ramps	4. Other areas as time allows
5. Terminal building apron	
6. South air freight apron	
7. Secondary air carrier runway and taxiways	

Source: Airport Certification Manual

AIRPORT MAINTENANCE FACILITIES

Maintenance facilities are co-located with the SRE facilities in a location between the general aviation area and the air cargo facilities. The maintenance area encompasses approximately three acres and includes three buildings. The maintenance building is a 14,000-square-foot facility with six maintenance bays, a wash bay, parts storage, electricians shop, paint equipment and paint storage, locker room, restrooms, break room, and offices. The widest overhead door on the building is only 20 feet and there is no lubrication pit. The wash bay is exposed on three sides and is not adequate to wash larger equipment.

The vehicle storage building is approximately 13,100 square feet. It provides heated, enclosed storage for vehicles and de-icing materials. It includes storage bins for sand and urea that are undersized. The building's two overhead doors are located at both ends and are both 20 feet wide. The building is also not conducive to efficient storage of equipment over 25 feet in length.

The third building is a smaller fleet maintenance building of approximately 2,500 square feet on the ground floor and 500 square feet of second floor space. It has three maintenance bays and two-story administrative space. The largest overhead door is just 16 feet wide.

Since the last Master Plan study, de-icing agents and trucks have been relocated to the west side of the terminal area apron.

Because of a lack of space at the consolidated facility, additional equipment is stored in various locations around the airport where space is available.

Previous study has identified a need for additional maintenance and equipment storage space. This included relocating the de-icing materials storage to its own heated enclosure designed for storage and loading. A system of three hoppers, each capable of storing three tons of materials, was recommended.

Additional vehicle storage capable of accommodating the larger vehicles was also recommended. It was determined that a new 24,000-square-foot building could adequately serve the large equipment storage needs. An additional unheated building of approximately 6,000 square feet was also recommended to be able to fully consolidate equipment storage at the site. Unless Part 139 requirements dictate major maintenance or snow removal changes, or airfield pavements change significantly, the additional space discussed above should be adequate for the planning period.

The 1999 Master Plan recommended relocating and consolidating maintenance functions and the snow removal equipment to the east side of Runway 3-21. A key advantage of such a location is that they do not need a public interface and do not need to be located adjacent to any of the major landside components.

FUEL STORAGE

As discussed in Chapter One – Inventory, fuel sales and delivery to aircraft is managed by the private operators on the airport including the FBOs and Aircraft Service International Group (ASIG). There is a total capacity of 1,391,400 gallons of storage capacity for Jet A fuel and 40,700 for AvGas. These totals include the capacity in fuel delivery trucks.

Additional fuel storage capacity should be planned when the Sunport is unable to maintain an adequate supply and reserve. While each fuel retailer determines their own desired reserve, a 14-day reserve is common for AvGas fuel and a seven-day supply is common for Jet A. When additional capacity is needed, it should be planned in 10,000- to 12,000-gallon increments, which can accommodate common fuel tanker trucks that typically have an 8,000-gallon capacity. Fuel storage requirements can vary based upon individual supplier and distributor policies. For this reason, fuel storage requirements will be dependent upon the individual distributors.

Future fuel storage capacity needs are outlined in **Table 4T**. Jet A fuel needs were determined by increasing the 2013 baseline consumption by the forecast average annual growth rate in operations for air carrier, air cargo, and a portion of air taxi operations (0.73 percent). AvGas needs were forecast by increasing the 2013 baseline consumption by the forecast average annual growth rate in operations for general aviation operations (1.11 percent). As can be seen, current fuel storage capacity is adequate through the long-term planning period.

TABLE 4T
Fuel Storage Requirements
Albuquerque International Sunport

			Planning Horizon		
	Current Capacity	Baseline Consumption (2013 est.)	Short-Term	Intermediate-Term	Long-Term
Jet A Requirements	1,391,400				
Annual Usage (gal.)		33,000,000	34,470,000	35,750,000	38,450,000
Daily Usage (gal.)		90,411	94,438	97,945	105,342
7-Day Storage (gal.)		634,615	662,885	687,500	739,423
Avgas Requirements	40,700				
Annual Usage (gal.)		430,000	460,000	490,000	540,000
Daily Usage (gal.)		1,178	1,260	1,342	1,479
14-Day Storage (gal.)		16,538	17,644	18,795	20,712

Projected growth based on operations growth forecast
Source: Airport fuel sales records; Coffman Associates analysis

PERIMETER FENCING

Perimeter fencing is used at airports primarily to secure the aircraft operational area. The physical barrier of perimeter fencing provides the following functions:

- Gives notice of the legal boundary of the outermost limits of a facility or security-sensitive area.
- Assists in controlling and screening authorized entries into a secured area by deterring entry elsewhere along the boundary.
- Supports surveillance, detection, assessment, and other security functions by providing a zone for installing intrusion-detection equipment and closed-circuit television (CCTV).
- Deters casual intruders from penetrating a secured area by presenting a barrier that requires an overt action to enter.
- Demonstrates the intent of an intruder by their overt action of gaining entry.
- Causes a delay to obtain access to a facility, thereby increasing the possibility of detection.
- Creates a psychological deterrent.
- Optimizes the use of security personnel while enhancing the capabilities for detection and apprehension of unauthorized individuals.
- Demonstrates a corporate concern for facility security.
- Limits inadvertent access to the aircraft operations area by wildlife.

The Sunport is served by perimeter fencing that meets standards for Part 139 airports. The fencing serves to provide both operational security as well as a deterrent to wildlife accessing the airfield movement areas. The fencing should be maintained through the planning period.

INFRASTRUCTURE CONSIDERATIONS

STORM SEWER

The *Albuquerque International Drainage Master Plan*, May 1995, analyzed the existing airport storm drainage systems for capacity and discharge flows and volumes. Since the Drainage Master Plan was published, many of the drainage improvements recommended have been accomplished. Most significantly, a drainage diversion was made for the flows generated north of the South General Aviation Area. The historic discharge for storm water flows originating in this area was to the west. In order that the flows at the crossing at University Boulevard and Clark Carr Boulevard could be brought within the crossing's capacity, a portion of the storm water was diverted south of the Sunport through a system constructed during the Runway 3-21 reconstruction project (2002). Other discharge and storm drainage improvements recommended in the Drainage Master Plan have been made as part of construction projects completed since 1995.

There are two remaining portions of the Sunport that have storm drainage improvements recommended in the Drainage Master Plan that have not been accomplished. One area is the portion of the airfield located adjacent to the northern end of former Runway 17-35. The existing storm drainage system capacity is not sufficient just upstream of the discharge point into the 36-inch Gibson Boulevard storm drain. Improvements to this portion of the storm drainage system can be incorporated into the Aviation Center of Excellence ACE development.

The second area with storm drainage problems identified in the Drainage Master Plan that has not yet been remedied begins at the northeast side of the terminal apron. A restrictor plate was installed during the terminal expansion project in the late 1980s because the storm drain downstream does not have the capacity for the flows generated upstream. The restrictor plate causes temporary storm water ponding on the terminal apron during larger storms. Resolution of the capacity problem downstream of the restrictor plate would involve replacing the downstream storm drain with larger pipe.

Downstream of the basin discussed above, the storm drainage discharges into the Kirtland Channel. This is a concrete-lined storm drainage channel located west of Yale Boulevard. During large storm events, the freeboard in the channel is not sufficient to contain the flows. Extension of the freeboard through a portion of the channel should eliminate this problem.

COMMERCIAL POWER

The existing terminal and parking structure are fed from the Randolph Substation located northwest of the Sunport on Randolph Road and west of Yale Avenue. The terminal and the parking structure are both supported by emergency generators that are switched automatically when the primary power feed fails. The primary power feeding the terminal facilities by Public Service Company of New Mexico (PNM) are based on a redundant loop system. Two feeds, both from the Randolph Substation, enter the Sunport campus at points east and west of the terminal and connect to the facilities through power centers located at different locations in the terminal and parking structure complex.

Emergency generators are also located at several of the power centers and supply enough power to maintain essential facility operations. In the terminal, this includes the public building life safety functions, including lighting, egress, fire pumps, HVAC and other essential power functions.

Most of the jetways at the terminal gates, however, are not powered by emergency generators. The exception is at gates A9-A12 where the jetways have been added to the emergency power circuits during previous expansion projects. No other major capacity issues have been reported on the terminal and parking structure electrical feeds.

The airfield is fed from redundant power sources from the PNM-owned and operated Sewer Plant and West Mesa substations that connect to each of the two City-owned airfield electrical control vaults. The City-owned airfield lighting system is also connected to emergency generators located at each of the two airfield electrical vaults to maintain an operational airfield during severe power outages or shutdowns. All of the runway lighting and guidance sign circuits are fed by the redundant system. An automatic control system will automatically turn on the selected runway and taxiway lights if there is a failure on either of the PNM primary feeds by selecting the second PNM primary circuit. If both PNM circuits fail, the emergency generators are started and connected to the airfield lighting and guidance sign circuits. Some of the FAA NAVAID installations, such as the Runway 8 and Runway 3 glide slope and ILS, are also included in the redundant power system. There is some excess capacity in the system if additional demand is installed in the airfield lighting system.

SOLAR POWER GENERATION

The Aviation Department has recently installed, through FAA Voluntary Airport Low Emissions (VALE) grants, solar photovoltaic arrays to lessen the electrical power system reliance on commercial generated power through PNM. Most of the 1.0 MW photovoltaic solar power generation infrastructure is located on parking canopies on the fourth level of the parking structure and at the recently reconstructed economy parking lot located north of the parking structure. The photovoltaic arrays power the lighting in the parking structure and feed Power Centers 2 and 3 in the terminal.

NATURAL GAS

The natural gas service to the Sunport is provided by the New Mexico Gas Company, a publicly regulated utility. The existing gas system appears to have adequate supply for the terminal and other facilities at the Sunport. The natural gas system feeds the terminal complex through a main and regulator station located west of the building near the east entrance to the bag tunnel. The Rent-A-Car (RAC) facility is fed from a line in University Boulevard. The general aviation area and the air freight facilities are fed from gas lines in Clark Carr and Spirit Drive.

SPECIFIC AREA REVENUE SUPPORT REQUIREMENTS

As introduced in Chapter One-Inventory, the Sunport owns several property parcels that have been developed or identified for future non-aviation revenue support functions. This section provides a more detailed analysis of these parcels and provides an assessment of their potential uses and benefits to the Sunport. Where appropriate, requirements necessary to bring these parcels into revenue production have been identified. The following parcels are discussed and are identified on **Exhibit 4M**:

- Aviation Center of Excellence
- Sunport Business and Technology Center
- Puerto Del Sol Golf Course
- Property north of Airport Loop Road and west of Girard
- Property located in the northeast corner of Sunport Boulevard and University Boulevard
- Property located in the southeast corner of Sunport Boulevard and University Boulevard

- Property located at the intersection of George Road and University Boulevard
- Yale Landfill – Development Potential

An update to the Albuquerque/Bernalillo County Comprehensive Plan is currently before the City Council. The Comprehensive Plan is anticipated for adoption in 2018.

The City is also working on a comprehensive overhaul of the Zoning Code. Referred to as the Integrated Development Ordinance (IDO), it is intended to simplify the development process. The IDO will be submitted for review by the Environmental Planning Commission (EPC) once the Comprehensive Plan has been adopted by the City Council. The IDO will first go to the EPC, then Land Use Planning and Zoning Committee (LUPZ), and finally, City Council. Adoption is anticipated in mid-year 2018.The intent of the update is to improve opportunities for economic development and streamline the City's development review and procedures while protecting the City's established neighborhoods and promote sustainable development.

With the exception of Sunport properties 3 and 4, the proposed IDO zoning for the non-aviation/commercial support parcels owned by the Sunport is NR-SU (non-residential, sensitive use). As stipulated in the latest draft of the IDO, "The purpose of the NR-SU district is to accommodate highly specialized public, civic, institutional, or natural resource-related uses that require additional review of location, site design, and impact mitigation to protect the safety and character of surrounding properties."

The Sunport will continue to be regulated by the Sustainable Master Plan, including permissive uses and applicable development standards. ACE and the Business and Technology Center will continue to be regulated by the existing Master Development Plans that currently govern both properties. Existing and future zoning are listed below for the non-aviation land uses listed.

1. AVIATION CENTER OF EXCELLENCE

Property Size: 75 acres.

Zoning: Previously - SU-1 for Airport and Related Uses. Per the IDO – NR-SU.

Potential Uses: The Aviation Center of Excellence (ACE) is planned to accommodate strategic aviation innovations and partnerships and a variety of users. Development is intended to create an employment center that offers a variety of jobs ranging from entry level to highly skilled. The northern portion of the property along Gibson Boulevard is intended to include commercial retail and service uses. The mid-section of the property is intended to include office and research and development uses. The southern portion of the property is intended to include aviation-related uses, which will not be visible from the public right-of-way. The approved Site Plan for Subdivision provides for a variety of uses and lot lines are shown.

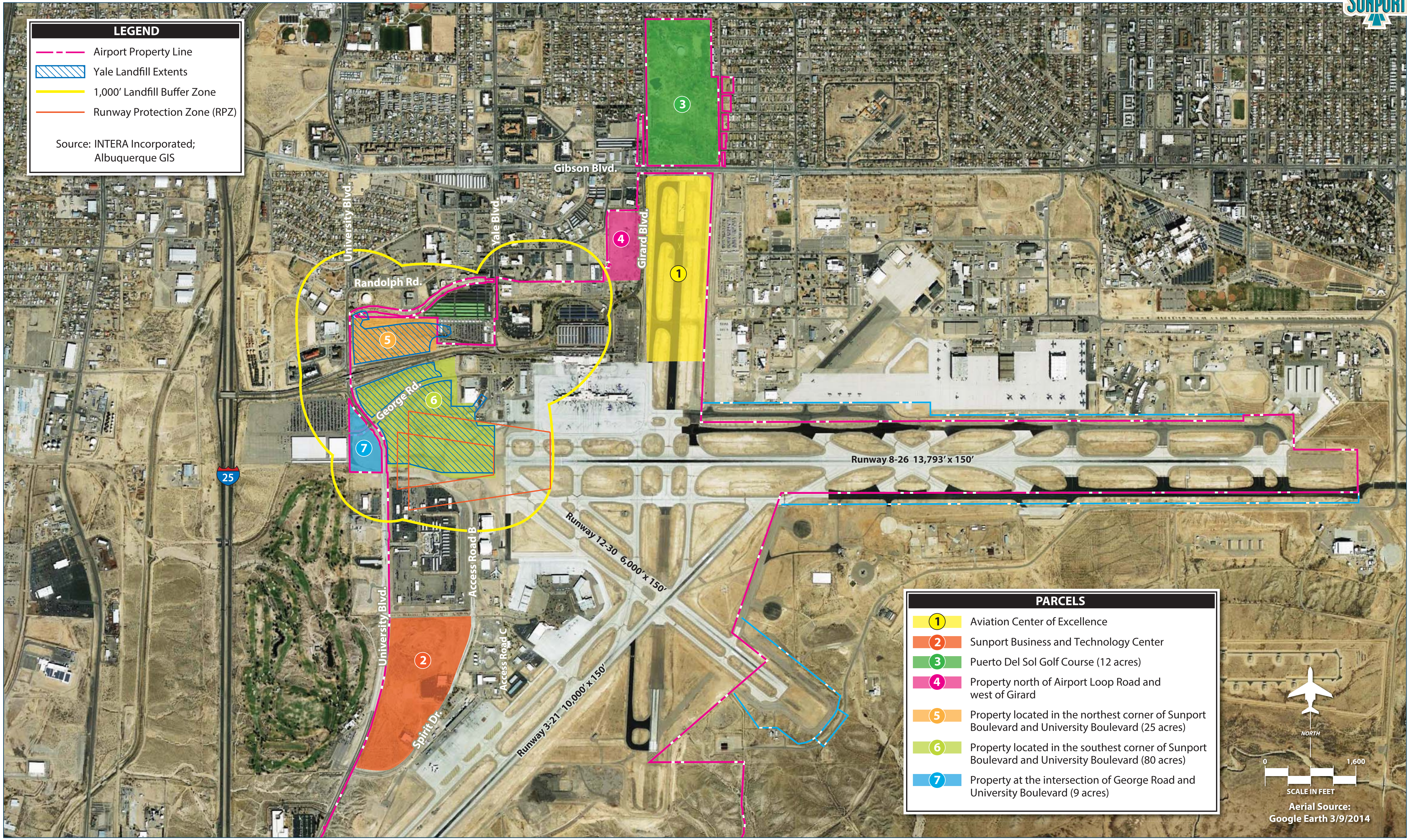

Exhibit 4M
SPECIFIC AREA PARCELS AND YALE LANDFILL

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Existing Infrastructure: Water service to the planned ACE development was included in the Site Plan for Subdivision approved by the City of Albuquerque Environmental Planning Commission in 2014. It includes a new 12-inch water main looped to the existing 14-inch main located in the Girard Boulevard corridor. Distribution lines within the ACE development should be designed as individual lots are developed with facilities. The 12-inch distribution main is conceptual in size and approved by the Albuquerque Bernalillo County Water Utility Authority (ABCWUA). A detailed design is recommended when the ACE development progresses.

Sanitary sewer service for the planned ACE development was included in the approved Site Plan for Subdivision and includes new 12-inch sewer mains located at the entry corridors into the ACE. One of the proposed mains will be connected to the existing 12-inch sanitary sewer main located in a corridor running to the west from KAFB and north of the terminal parking structure. The existing 12-inch sewer that extends to KAFB is in poor condition and should be replaced up to the KAFB property line by the new 12-inch main shown in the Site Plan for Subdivision as part of the ACE infrastructure development. A second 12-inch sanitary sewer main was identified in the ACE Site Plan for Subdivision to serve the northern portion of development area. This line will connect to an existing ABCWUA collection main located in Miles Road just west of Girard Boulevard.

Sanitary sewer collection lines within the ACE development should be designed as individual lots are developed with facilities. The 12-inch sewer mains are conceptual in size and approved by the ABCWUA. A detailed design is recommended when the ACE development progresses and when additional information is known about the facility types and uses in the ACE.

Storm drainage management with the ACE property has conceptually been planned to include on-site detention or retention of increase drainage flows resulting from development. The City of Albuquerque recently adopted revisions to the storm drainage ordinances that require treatment of initial flow from new development to protect downstream watershed and controlled waterways from pollutants. In the case of the ACE development area, retention and filtering of initial flows from the sites could be accomplished as part of the flow management scheme for maintaining historical flows from the site.

Site Development Requirements: The Site Plan for Subdivision for the property was approved in 2014 by the Environmental Planning Commission. Subsequent Site Development Plans for Building Permit for each development project is delegated to the City's Design Review Team (DRT), provided they are consistent with the Site Plan for Subdivision Design Standards. In addition to the City Planning Department's approval process, all buildings, structures, and site plans for projects at the ACE property shall be reviewed and approved by the ACE Architectural Control Committee (ACC).

2. SUNPORT BUSINESS AND TECHNOLOGY CENTER

Property Size: 65 acres.

Zoning: Previously - SU-1 for Airport and Related Uses. Per the IDO – NR-SU.

Potential Uses: The Sunport Business and Technology Center is a designated Foreign Trade Zone (FTZ). The FTZ designation allows companies to bring in raw materials or finished goods, which they can store, assemble, repackage, grade, manufacture, or re-export, without paying duty. Potential uses for the approximately 65-acre site include a wide range of commercial, office, warehouse, manufacturing, hotel/motel and incidental uses, institutional, educational, laboratory, and industrial uses.

Existing Infrastructure: The RAC facility constructed east of University Boulevard, south of Access Road B, is supplied through a water main in University Boulevard and a connected main in Access Road B. The water system is looped through the City mains that run north-south along the west boundary of the Sunport. The South General Aviation Area and Air Freight Cargo Facility and other smaller facilities located in the southern portion of the Sunport property are supplied water through the same mains that serve the new RAC facility. The water supply mains to these facilities were upgraded prior to 2003 and appear to be adequate for the existing development. Water service for development in the Foreign Trade Zone was conceptually planned in the Site Plan for Subdivision approved by the Environmental Planning Commission in 2008.

The RAC facility is served by the City's sanitary sewer system by an 8-inch main located in University Boulevard. The RAC site has a collection system within the development that discharges into the existing main in University Boulevard. The Foreign Trade Zone south of the RAC facility, as well as the south general aviation area, is served by sanitary sewers in Clark Carr Boulevard and Spirit Drive. These systems discharge into mains located in University Boulevard. These facilities are adequately served by the existing system. The collectors in Spirit Drive and University Avenue were designed to accommodate full commercial development along the Spirit Drive corridor.

Site Development Requirements: Future Site Plans for Building Permit will not require a public hearing and are delegated to the City Planning Director, provided they are consistent with the approved Site Plan for Subdivision and Design Standards. At the time of approval of the Site Plan for Subdivision in 2008, the City Aviation Department had concerns about the layout and phased development due to the terrain of the property; therefore, the lot lines, streets, and utility layouts are illustrative. The terrain does not lend itself to phase the project as it is shown and some of the lots may not be able to be developed cost-effectively, but until the time comes when a potential tenant proposes a project, the City's Aviation Department is agreeable to the layout shown on the approved Site Plan.

3. PUERTO DEL SOL GOLF COURSE

Property Size: 72 acres.

Zoning: Previously - SU-1 for Golf Course and Related Facilities. Per the IDO – NR-PO-A, City-Owned or Managed Parks.

Potential Uses: The current zoning for the property allows a golf course and related uses. The existing golf course was created in the 1970s as a buffer for the inbound and outbound flights that utilized Runway 17-35 (ACE project) to the south of the property that is no longer in use. The golf course property had previously been zoned for residential development. Due to this changed condition, the highest and best use of the property may not be a golf course. Other uses, such as housing and/or commercial development along Gibson Boulevard, may be appropriate for the site, but may also be met with opposition from the immediate neighbors and the golfing community.

Existing Infrastructure: In 2005, the Environmental Planning Commission (EPC) approved a Site Plan for Building Permit for a non-potable water storage facility and pump station on an approximately two-acre site within the northeast corner of the Puerto del Sol Golf Course. The tank was approved to further the City's Water Resources Management Strategy (AWRMS) to move the City away from dependence on groundwater. The tank is used to hold non-potable water that irrigates over 700 acres of parks, golf course turf, and green space. As part of the water storage facility pump station development, a pipeline was constructed to the east along Rio Bravo Boulevard and to the north on University Boulevard.

Site Development Requirements: The property is owned by the Aviation Department and operated through a lease/agreement with the City of Albuquerque Parks and Recreation Department. A zone change and associated Site Development Plan to accommodate a use other than a golf course will require going through the City approval process. This would require an application to and hearing before the EPC, which would likely be met with neighborhood opposition.

4. PROPERTY NORTH OF AIRPORT LOOP ROAD AND WEST OF GIRARD

Property Size: 12 acres.

Zoning: Previously - M-1. Per the IDO – NR-LM (non-residential-light manufacturing).

Potential Uses: This property is located just west of the ACE property. As an extension of the proposed uses on the ACE property, the subject land could accommodate similar or compatible manufacturing uses related to aviation.

Existing Infrastructure: Water and electric lines are located just south of the property and can be extended to accommodate future development. Existing utilities are also located within the ACE boundaries. These include water, sanitary sewer, gas, and electric. Future development on the subject site can tap into the existing and proposed infrastructure on the ACE property.

This property is just north of the existing terminal. The existing terminal and parking facilities appear to have sufficient water supply, both for potable use and for fire flow. Any additional facilities constructed in the future may require additional supply lines depending on the size and use of the facility, as well as the location of the new facilities and existing water mains.

The existing terminal and parking facilities are connected to the City sanitary sewer system to an eight-inch sewer on the east side of the facility and an 8-inch sewer on the west side of the facility. Both eight-inch lines connect to a 12-inch main located in Yale Boulevard. The existing sewer lines appear to be adequate for the flows generated from the existing facilities.

Site Development Requirements: The property is governed by the Airport Master Plan, and is subject to applicable Federal Aviation Administration Regulations. Development of this property will require a Site Development Plan to be approved by the EPC. Depending on whether there is an end user, a Site Plan for Building Permit could either be processed simultaneously with the Site Plan for Subdivision or be submitted as a follow-up action later by the end user. Once a Site Plan for Subdivision is approved, delegation of future Site Plans for Building Permit could be requested for delegation to the Development Review Board (DRB) for an expedited approval process.

5. PROPERTY LOCATED IN THE NORTHEAST CORNER OF SUNPORT BOULEVARD AND UNIVERSITY BOULEVARD

Property Size: 25 acres.

Existing Zoning: Previously - SU-1 for Airport and Related Uses. Per the IDO – NR-SU.

Potential Uses: This property was the former Yale Landfill (1948-1965) and is located within a designated landfill buffer zone.

Future uses on this site that require the least remediation include a solar farm and parking lot. Solar farm projects will require a Glint and Glare Study to assess the feasibility of this use. These uses will need to address the issue of a continuously settling foundation. Mitigation through dynamic compaction has been determined insufficient by the City of Albuquerque Environmental Health Department.

Existing Infrastructure: The U.S. Post Office, Old Terminal Building, and other facilities located west of the existing terminal building are supplied water from a main that runs north-south from Yale Boulevard to the southern portion of the Sunport. The main was relocated and upgraded during the Sunport Boulevard and Runway 8-26 Reconstruction projects in 1996-1997 and 2009. The old water main alignment crossed the old Yale Landfill and a portion was out of service due to the line breaking from the settling landfill. The new line was relocated out of the landfill and is adequate for the existing facilities that it supplies in this area including the new Snow Barn building being constructed south of the Old Terminal Building.

Developable property lies to the west of the existing facilities and the existing water mains. It is expected that the existing lines would have the capacity for development in this area depending on the type and use of the facilities. Looping the water lines to the water line in University Avenue may be necessary to accommodate development, depending on the type of construction and use of any new facilities. Care should be exercised in locating new lines in the area due to the location of landfill material in this area.

The U.S. Post Office, Old Terminal Building, and other facilities located west of the existing terminal building are connected to the City sanitary sewer system through collectors tied to the Yale Boulevard main. These facilities appear to have sufficient collection through the existing sanitary sewer system. Additional development may require additional capacity in the connector lines depending on the type, use, and location of the facilities.

Site Development Requirements: All development within the landfill buffer is subject to the City of Albuquerque's Interim Guidelines for development within City-designated landfill buffer zones. This requires:

1) Review of a proposed project by the City's Environmental Health Department Environmental Services Division,
2) Input from a professional engineer with expertise in landfills to determine if landfill gas exists on the property, and
3) If landfill gas is present at the subject property, plans for development must include risk abatement measures which are adequate to address any existing or future risk.

These abatement measures must be certified by a professional engineer and signed-off on by designated Albuquerque Environmental Health Services Division staff. (See "Yale Landfill – Development Potential" for additional information).

6. PROPERTY LOCATED IN THE SOUTHEAST CORNER OF SUNPORT BOULEVARD AND UNIVERSITY BOULEVARD

Property Size: 80 acres.

Zoning: Previously - SU-1 for Airport and Related Uses. Per the IDO – NR-SU.

Potential Uses: This property is part of the former Yale Landfill (1948-1965) and is located within a designated landfill buffer zone. Please refer to the heading, Property Located in the Northeast Corner of Sunport Boulevard and University Boulevard, for a brief history of this landfill.

Future uses on this site that require the little to no remediation efforts include a solar farm and parking lot. These uses will need to address the issue of a continuously settling foundation. Mitigation through dynamic compaction has been determined insufficient by the City of Albuquerque Environmental Health Department.

Existing Infrastructure: Please refer to "Existing Infrastructure" as described under the heading, Property Located in the Northeast Corner of Sunport Boulevard and University Boulevard.

Site Development Requirements: Please refer to "Site Development Requirements" as described under the heading, Property Located in the Northeast Corner of Sunport Boulevard and University Boulevard.

7. PROPERTY LOCATED AT THE NORTHEAST INTERSECTION OF GEORGE ROAD AND UNIVERSITY BOULEVARD

Property Size: Nine acres.

Zoning: Previously - SU-1 for Airport and Related Uses. Per the IDO – NR-SU.

Potential Uses: This property is located just west of the Yale Landfill (the two aforementioned properties). While this site was not a former landfill, it is located within a Landfill Buffer Zone. Options for future uses on this site are greater than those available for the properties located in the northeast corner of Sunport Boulevard and University Boulevard. However, this site is subject to special City review due to its location within a Landfill Buffer Zone. Through normal decomposition of buried refuse in former landfills, landfill gases may be produced as a byproduct. Landfill gases may migrate to offsite areas surrounding a landfill. Because of the adjacent landfill, this property will require special consideration of any impact by the former Yale Landfill.

Future uses on this site could accommodate a travel center. A detention pond on the north triangular portion of the property is needed for stormwater purposes.

Existing Infrastructure: Please refer to "Existing Infrastructure" as described under the heading, Property Located in the Northeast Corner of Sunport Boulevard and University Boulevard.

Site Development Requirements: Please refer to "Site Development Requirements," as described under the heading, Property Located in the Northeast Corner of Sunport Boulevard and University Boulevard.

YALE LANDFILL – DEVELOPMENT POTENTIAL

History: The Yale Landfill was operated by the City of Albuquerque from 1948 to 1965. It received residential and commercial waste and did not have a protective liner. The landfill currently has eight monitored wells. Wells are sampled annually. Some contaminants have been detected, but all are below regulatory levels. Methane gas levels on the site are monitored twice a year. Historically, at least three underground fires have occurred which burned for undetermined periods of time. It is believed these areas were flooded with water to extinguish them. These areas were located on the west-central portion of the landfill, near University Boulevard. It is unclear how much, if any, waste was removed for the construction of the original terminal entrance road, the old AMFAC parking lot to the south and east, and the western portion of the parking lot. It is believed that these areas all still have some, if not most, of the original waste under them. Exploration holes showed waste in this area to be around 10 feet deep. In 1988, approximately 400,000 cubic yards of waste were removed for construction of the new Post Office complex, which was located on the east portion of the landfill. From the end of 1995 until the beginning of 1997, approximately 285,000 tons of waste were removed from this landfill for completion of the new Sunport Boulevard terminal access off I-25. During this project, both George Road (formerly Viewpoint Road) and a portion of University Boulevard were relocated, and all waste removed from underneath them and hauled to Cerro Colorado Landfill.

The Yale Landfill site has been fairly well-graded so no major ponding of water occurs. A good amount of the waste has been removed for construction, so the site slopes drain fairly rapidly. Therefore, surface water infiltration is not a major problem at this site. In the past, methane gas readings above regulatory levels have been detected.

Development Considerations: In 2014, a Landfill Management Plan (LMP) for the former Yale Landfill was prepared by INTERA, Inc. on behalf of the City of Albuquerque Environmental Health Department (AEHD). The purpose of the LMP is to mitigate risks associated with the decomposition of waste in the unlined landfill. The LMP suggests that any development on the landfill has a significant potential to sustain structural damage from surface subsidence due to waste decomposition. Therefore, careful consideration must be given to historical and current data concerning the distribution of waste, the location of potential subsurface migration pathways, the locations of methane detections, and changes to the surface of the landfill when decisions are made concerning development and required mitigation. All projects requiring waste removal must meet the New Mexico Environmental Department's Solid Waste Division requirements.

Future development on the former landfill must comply with the City of Albuquerque's Interim Guidelines that are highlighted in the property descriptions for sites # 5, # 6, and # 7. Additional considerations outlined by the LMP are as follows:

1) Potential restriction of any building on buried landfill material (piers or landfill removal).
2) Provision for adequate drainage of surface water runoff away from landfill areas.
3) Prohibition of engineered storm water retention and detention basins over and/or adjacent to landfill materials.

4) Use of landscape practices that require little or no irrigation or providing means of prohibiting irrigation water from infiltrating and reaching buried landfill materials.
5) Removal of landfill material beneath subsurface utilities or adequate design to account for settlement.
6) Adequate design to control the migration of landfill gas away from the landfill and/or off the subject property.
7) Development of landfill gas mitigation measures that are protective of structures, utilities, and personnel.

Landfill Buffer Zone: The Yale Landfill Buffer Zone currently extends 500 feet from the edges of the landfill. The buffer zone width was based upon known facts concerning the landfill, typical patterns of methane gas migration, and potential future scenarios of development on the landfill itself. Currently, there is significant existing development within the buffer zone of the Yale Landfill. Buffer zone development includes hotels, offices, food service, airport parking, and water utilities.

Development Review Process: Site Plans for Building Permit on or within a landfill buffer zone are referred by the City's Planning Department to the City of Albuquerque Environmental Health Department for review. If the development is within a landfill buffer zone, the developer is notified by the Environmental Health Department of the need to comply with the Interim Guidelines, including submittal of a Landfill Gas Assessment Report. The Environmental Health Department then reviews the developer's assessment and may approve the assessment or may request additional effort/design. Once the assessment is complete, the Environmental Health Department will review the plans for mitigation of landfill gas and grant approval once the requirements are met. The Environmental Health Department will continue to communicate with the City's Planning Department to track the current development plans for the area on the Yale Landfill or within the buffer zone.

SUMMARY

This chapter has outlined the facilities required to meet potential aviation demands projected for the Sunport for the next 20 years. The next chapter, Chapter Five - Alternatives, examines potential improvements to the airfield system and the landside area. Most of the discussion focuses on those capital improvements that would be eligible for federal grant funds. Other projects of local concern are also presented on a limited basis. Several facility layouts that meet the forecast demands over the next 20 years are presented in Chapter Five, and an overall ALP that presents a long-term vision will ultimately be developed.