Phoenix Goodyear Airport
Master Plan

2018
Update

Table of Contents

Chapter 4: Facility Requirements

Chapter 5: Land Use and Zoning

Chapter 6: Alternatives Analysis

Chapter 7: Implementation and Financial Plan

Chapter 8: Airport Sustainability

Appendix A: References

Appendix B: Noise Disclosure Map

List of Tables

Chapter 2: Inventory Of Existing Conditions

Chapter 3: Aviation Activity Forecast

Chapter 4: Facility Requirements

Chapter 5: Land Use and Zoning

Chapter Alternatives Analysis

Chapter 7: Implmentation and Financial Plan

Chapter 8: Airport Sustainability

List of Figures

Chapter 2: Inventory Of Existing Conditions

Chapter 3: Aviation Activity Forecast

Chapter 4: Facility Requirements

Chapter 5: Land Use and Zoning

Chapter 6: Alternatives Analysis

Chapter 7: Implementation and Financial Plan

Appendix B: Noise Disclosure Map

Chapter 1

INTRODUCTION

The City of Phoenix (the City) has updated its Master Plan for the Phoenix Goodyear Airport (the Airport or GYR). This Airport Master Plan replaces the Airport Master Plan that was approved in June 2007. Since that time, there have been substantial changes in the aviation industry and the national economy that have affected the aviation industry, the Airport, and the City. Notwithstanding the effects of the 2008 economic downturn, the Airport has experienced notable growth throughout the last several years in corporate aviation, flight schools, pilot training operations, and aircraft maintenance. As such, an update to the master plan was necessary to account for recent and future growth.

1.1 Airport Master Plan Update

An airport master plan is a comprehensive study that describes the short-, intermediate-, and long-term development plans for an airport, and its ability to meet aviation demand into the future. This Master Plan will provide the City with a strategic plan for development through 2037. Planning focused on several core principles: aviation safety, meeting the needs of airport users and tenants, efficient use of Airport property, orderly development of facilities, and a reasonable and achievable Capital Improvement Plan. Input from airport users, tenants, local governments, businesses, and surrounding neighborhoods and communities was important to the plan's success.

To be eligible for Federal Aviation Administration (FAA) Airport Improvement Program (AIP) funding, the FAA recommends that airport operators update their master plans periodically (every 5 to 10 years) to document existing and future operational capabilities, demonstrate compliance with FAA airport design criteria, and incorporate changes to existing and proposed facilities. The prior master plan's Airport Layout Plan (ALP) was approved by the FAA in 2008. FAA approval of the updated ALP is necessary for the City to receive financial assistance under the terms of the Airport and Airway Improvement Act of 1982, as amended.

The master planning process involves collecting readily available data, forecasting future aviation demand, determining facility requirements, studying various alternatives, and developing future plans and schedules. The process takes into consideration the needs and concerns of the City, airport tenants and users, and the general public.

1.2 Planning Horizon

This Master Plan Update covers a planning period of 20 years. The planning period is divided into three periods: short-term (upcoming 5 years), intermediate-term (6 to 10 years), and long-term (11 to 20 years). The intermediate- and long-term planning periods are typically considered strategic in nature and help to ensure that short-term actions are consistent with longer term development needs.

1.3 Goals and Objectives

The primary objectives of an airport master plan are to produce an attainable, phased development plan that will satisfy the airport's needs in a safe, efficient, economical, and environmentally sound manner. The plan serves as a guide to decision makers, airport users, and the general public for implementing airport development actions while considering the City's goals and objectives. There are a number of objectives that the City would like to achieve as a result of this Master Plan Update.

Specific goals and objectives include, but are not limited to:

- Identify aviation trends that have impacted the airport since the last master plan
- Develop forecasts of aviation demand through the next 20 years
- Assess community land use goals and what adjacent land uses may hinder future growth
- Work with the public and other airport stakeholders to gain feedback on airport development
- Determine the Airport's facility requirements through the next 20 years
- Evaluate facilities for conformance with FAA airport design standards and applicable regulations
- Develop ALP drawings that graphically depict proposed capital improvements

- Update the Capital Improvement Program to reflect recommended projects, including the business case for improvements
- Recommend sustainability initiatives that may result in reduced energy consumption, resource use, and/or environmental impacts
- Develop Safety Critical Data with conformance to FAA regulations

1.4 Stakeholder Involvement

Stakeholder involvement during the preparation of an airport master plan is critical to the success of the plan. The purpose of the Stakeholder Involvement Program is to facilitate open and proactive communication with stakeholders and the public so that participating members will have a vested interest in the plan.

Stakeholder engagement was emphasized throughout the master planning process including advisory committees whose input influenced planning decisions. Community members were invited to participate and ask questions about the development of the Master Plan Update through a series of public meetings.

The Stakeholder Involvement Program included two advisory committees and public outreach strategies, including:

- **Technical Advisory Committee (TAC)** — A group of participants with strong technical skills related to airport environments, transportation expertise, and airport user groups. The committee provided a critical role in guiding and reviewing the project's technical analyses, alternatives, and recommendations.
- **Planning Advisory Committee (PAC)** — A group of participants from the surrounding communities, local governments, stakeholders, special interest groups, and large employers with a stake in the airport. The committee also played a critical role in guiding and reviewing project goals, technical analyses, alternatives, and recommendations.
- **Public Workshops** — Meetings at key milestones to inform the general public.
- **Public Events** — Local events that showcase master plan findings and processes to a wider audience.
- **Additional Outreach** — Information dissemination via social media and other media outlets.

Technical Advisory Committee Meetings:

- **Meeting 1:** Project Kick-Off
- **Meeting 2:** Inventory and Forecasts
- **Meeting 3:** Facility Requirements
- **Meeting 4:** Development Alternative Concepts
- **Meeting 5:** Recommended Development Plan

Planning Advisory Committee Meetings:

- **Meeting 1**: Project Kick-Off and Inventory
- **Meeting 2:** Forecasts and Facility Requirements
- **Meeting 3:** Development Alternative Concepts
- **Meeting 4:** Recommended Development Plan

Input from the committee meetings and public workshops was considered in the Recommended Development Plan.

Chapter 2

INVENTORY OF EXISTING CONDITIONS

The following provides a description of existing facilities at the Airport and includes other pertinent data essential to Master Plan Update analyses.

2.1 Background Information

The Airport is owned and operated by the City of Phoenix, but is situated in the City of Goodyear. Goodyear is located within Maricopa County, is in the west valley of the Phoenix metropolitan area. Maricopa County encompasses approximately 9,226 square miles in the south-central portion of Arizona, and includes 24 incorporated cities and towns. Approximately 61 percent of the Arizona population resides within Maricopa County.

The Airport is located within the northern portion of the corporate limits of the City of Goodyear. The City of Goodyear has a population of approximately 79,003 and is located west of Avondale and south of Glendale. The Airport encompasses approximately 789 acres at an elevation of 968 feet MSL. The Airport is bounded by Yuma Road to the north, Maricopa County Route (MC) 85 to the south, South Litchfield Road to the east, and South Bullard Avenue to the west. The Airport is located approximately two miles south of Interstate 10, which serves as the major east-west interstate traversing the metropolitan area. The location of the Airport is illustrated in **Figure 2-1.**

2.1.1 Airport History

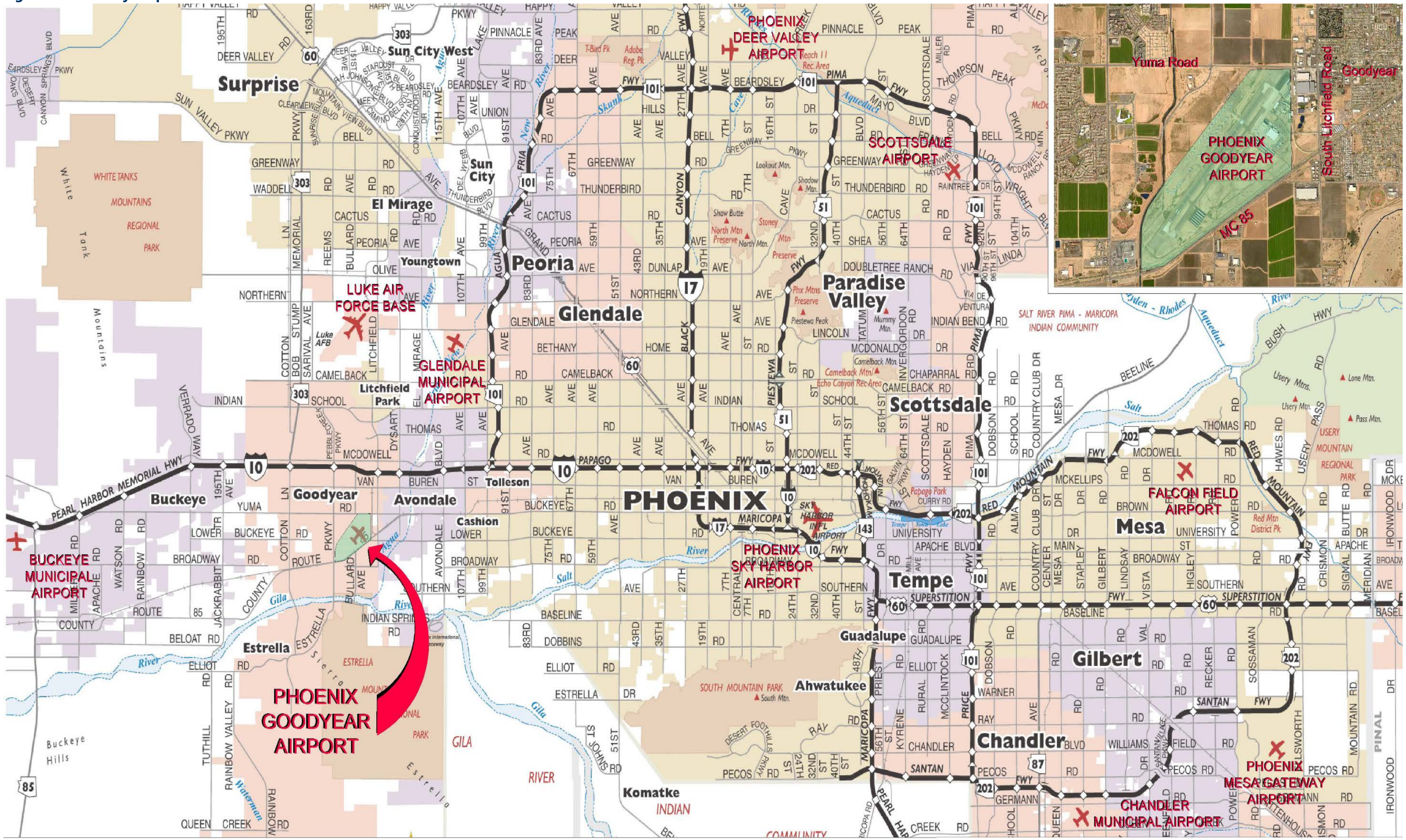
The Airport was established in 1941 as Naval Air Facility Litchfield Park (NAF Litchfield Park). The Goodyear Aerospace Corporation offered the U.S. Defense Plant Corporation land to construct and test fly aircraft during World War II. A landing field, hangar, and runway were constructed soon after it was established. After WWII, NAF Litchfield Park remained an operational facility; however, it served primarily as an aircraft storage and decommissioning facility from 1945 to 1965. The facility briefly returned to active military duty in the 1950’s for the Korean Conflict, but was decommissioned soon after, and the site was placed on the surplus list by the U.S. General Service Administration. The City of Phoenix purchased the property in 1968 for use as a reliever to Phoenix Sky Harbor International Airport.

Since this time, the City of Phoenix has invested many resources into the development of the Airport. Outcomes of previous master plans (1986 and 2007) include a new terminal building, T-hangars and tie downs, aircraft parking apron, and a maintenance facility. Several long-standing tenants of the Airport include an aircraft Maintenance, Repair, and Overhaul (MRO) company, flight schools, and a fixed-base operator (FBO).

2.1.2 Ownership and Management

The City of Phoenix owns and operates three airports including Phoenix Sky Harbor International, Phoenix Goodyear, and Phoenix Deer Valley airports. The Director of Aviation Services and three Assistant Aviation Directors manage the Aviation Department on behalf of the City; the Phoenix Goodyear Airport Manager oversees the daily operations at the Airport. The Phoenix Aviation Advisory Board (PAAB) is made up of nine members who are appointed by the Mayor and City Council. The PAAB reviews airport policies and makes recommendations to the City Council on major airport projects, concession contracts, and leases at all three City of Phoenix owned airports.

Figure 2-1: Vicinity Map



NOT TO SCALE

2.1.3 Airport Role

The Airport has a been a fixture in the West Valley and City of Goodyear for more than 70 years. The Airport is recognized by the City as an economic benefit to the local community. According to 2013 statistics, the Airport provided an economic impact of more than $138 million to the local economy and sustained 500 jobs in the region. The Airport is unique in that it serves general aviation, corporate, and industrial aviation users simultaneously. As such, the City recognizes the Airport offers a combination of assets that offer opportunities for business in the aviation and aerospace market, as well as a general aviation airport for aviation enthusiasts and professionals.

Since 1970, the FAA has classified a subset of the 5,400 public-use airports in the U.S. as being vital to serving the public needs for air transportation, and therefore may be eligible for federal funding to maintain or enhance their facilities. These airports are classified within the National Plan of Integrated Airport Systems (NPIAS), where the airport service level reflects the type of user the airport serves and the funding categories to assist in development. **Phoenix Goodyear Airport is classified as a reliever airport**. Reliever airports are those designated by the FAA as having the function of relieving congestion at a commercial service airport by providing general aviation access. These airports comprise a special category of airports and are located in proximity to a primary airport(s). In this case, the Airport is a reliever to Phoenix Sky Harbor International Airport, which is located 18 miles to the east (see **Figure 2-1**).

At the State level, the Arizona Department of Transportation (ADOT) Multimodal Planning Division – Aeronautics Group recognizes the importance of planning as a proactive approach to ensuring aviation continues its role in the statewide system. The division created a plan similar to the NPIAS in 1978 called the Arizona State Airports System Plan (AZSASP). The purpose of the AZSASP is to provide a framework for the integrated planning and development of Arizona's aviation assets. The most current version of the AZSASP was published in 2008[1]. The Airport also is classified as a reliever airport in the AZSASP.

At the regional level, the Airport is included in the Maricopa Association of Government's (MAG) Regional Aviation System Plan (RASP). There are a total of 16 airports in this system. According to the RASP, the Airport is classified as a general aviation reliever airport. The MAG included airports/aviation within the *2035 Regional Transportation Plan (RTP)* published in January of 2014[2]. According to the RTP, the focus of future planning efforts is upon ground access needs to airports in terms of both highway and transit facilities.

2.1.4 Recent Capital Improvements

The FAA Airport Improvement Program (AIP) has provided grant funds for the planning and development of the Airport. Funding has also been provided by the Arizona Department of Transportation (ADOT). **Table 2-1** provides a summary of projects that have been funded through AIP and ADOT grants since the 2007 master plan.

---

[1] 2008 AZSASP located on ADOT's website at: http://www.azdot.gov/planning/airportdevelopment/development-and-planning/state-airports-system-plan

[2] 2035 RTP located on the MAG website at: https://www.azmag.gov/Documents/RTP_2014-01-30_Final-2035-Regional-Transportation-Plan-(RTP).pdf

Table 2-1: Airport Grant History (CY 2008-2016)

FAA AIP Grants					
Grant #	**Fiscal Year**	**Federal Fiscal Year**	**Project #**	**Description**	**Amount**
3-04-0018-13-2008	CFY2008	FFY 2008	AV41000056	North Ramp Reconstruction (Phase I)	$444,963
3-04-0018-14-2008	CFY2009	FFY 2008	AV41000056	North Ramp Reconstruction (Phase II)	$794,533
3-04-0018-15-2009	CFY2009	FFY 2009	AV41000063	Taxiway B Environmental Assessment	$285,000
3-04-0018-16-2010	CFY2011	FFY 2010	AV41000062	T/W A Connectors (Phase I)	$1,150,000
3-04-0018-18-2011	CFY2012	FFY 2011	AV41000062	T/W A Connectors (Phase II and III)	$3,800,950
3-04-0018-19-2012	CFY2013	FFY 2012	AV41000067	T/W A Lighting and Signage	$1,182,300
3-04-0018-20-2015	CFY2015	FFY 2015	AV41000069	Runway Rehabilitation	$4,999,000
3-04-0018-21-2016	CFY2017	FFY 2016	AV41000072	Master Plan Update	$587,275
				Total	**$13,244,021**
ADOT Grants					
Grant #	**Fiscal Year**	**Federal Fiscal Year**	**Project #**	**Description**	**Amount**
E9F28	CFY 2009	SFY 2009	AV41000056	North Ramp Reconstruction (Phase I)	$11,710
E9F29	CFY 2009	SFY 2009	AV41000056	North Ramp Reconstruction (Phase II)	$20,910
E9F64	CFY 2010	SFY 2009	AV41000063	Taxiway B Environmental Assessment	$7,500
E1F32	CFY 2011	SFY 2011	AV41000062	T/W A Connectors (Phase I)	$26,316
E2F2G	CFY 2012	SFY 2012	AV41000062	T/W A Connectors (Phase II and III)	$100,025
E3F2W	CFY 2013	SFY 2013	AV41000067	T/W A Lighting and Signage	$58,000
E4S3U	CFY2014	SFY2014	AV41000070	Runway Shift – Phase I	$2,130,000
E5S2P	CFY2015	SFY2015	AV41000070	Runway Shift – Phase II	$2,090,000
E6S1Z	CFY2016	SFY 2015	AV41000070	Runway Shift – Phase III	$1,345,393
E6F2Y	CFY2016	SFY 2016	AV41000069	Runway Rehabilitation	$245,442
				Total	**$6,035,296**

Source: City of Phoenix Aviation Department, November 2016

Note: FAA AIP grant #17 was skipped.

2.2 Airside Facilities

Airside is the portion of an airport where aircraft, support vehicles, and equipment are located and in which aviation-specific activities take place. The inventory of airside facilities provides the basis airfield demand/capacity analyses and the determination of facility requirements. **Figure 2-2** depicts the airport, airside and landside facilities, and the multiple functional area described herein.

Figure 2-2: Functional Areas

LEGEND

- Aircraft Hangars
- Aircraft Tie-Down and Storage Area
- Fixed Base Operators
- Flight Schools
- Aircraft Maintenance Facility
- Airport Property Boundary

- Fueling Facility
- Airport Maintenance
- Wash Rack
- Waste Accumulation Site
- FAA Air Traffic Control Tower
- Terminal Building
- Terminal Auto Parking

Fixed Base Operators

LUX AIR JET CENTERS

Flight Schools

Lufthansa Flight Training

CTC AVIATION

FLY AT GOODYEAR

Aircraft Maintenance Facility

Other Tenants

LOCKHEED MARTIN

GALAXY

PHOENIX GOODYEAR AIRPORT

GYR

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS

ARMSTRONG

2.2.1 Airport Design Standards

Under the AIP, airport sponsors that accept federal grants for airport improvements must adhere to FAA standards established within various Advisory Circulars (ACs). For airfield facilities, design standards are contained within AC 150/5300-13A, *Airport Design*. The standards cover the wide range of size and performance characteristics of aircraft that are anticipated to use an airport. Various airport infrastructure and their functions are covered by these standards.

One of the most important aspects of AC 150/5300-13A is the consideration of an airport's critical design aircraft and its airport reference code (ARC). As defined by the FAA, the critical design aircraft is the most demanding category of aircraft, or family of aircraft, which conducts at least 500 operations per year at the airport. The ARC for a particular airport is a coding system developed by the FAA which is used to relate airport design criteria to the operational and physical characteristics of the aircraft types that will operate at an airport. The ARC is comprised of two components. The first component is the aircraft approach category (AAC), which is designated with a capital letter (A through E) and is based on operational characteristics. The second component is the airplane design group (ADG), which is designated by a Roman numeral, and is based on an aircraft's wingspan and tail height (physical characteristics). Examples of aircraft and their corresponding AAC and ADG are shown on **Figure 2-3.**

The 2007 master plan assigned ARC C-III to the Airport, with the Boeing 737-300 as the critical aircraft. It was recommended, however, that the Airport ultimately plan to accommodate ARC D-IV in the future using the DC-10 (40 series) as the critical design aircraft. Since 2007, several projects at the Airport were designed to D-IV standards, most notably the 2015 runway shift project and the 2016 runway rehabilitation project. Chapter 3 provides additional information pertaining to existing and future ARC and design aircraft, however, it should be noted that **the Airport is anticipated to continue to operate with a D-IV ARC designation throughout the 20-year planning horizon.** There are multiple locations at the Airport that have different ADG standards because of their function and services provided. A graphical illustration of the different ADG locations on the Airport are shown on **Figure 2-4.** A summary of the design standards based on the recommended critical design aircraft is shown in **Table 2-2.**

Figure 2-3: Example Aircraft and Corresponding AAC/ADG

*If aircraft MTOW is less than 12,500 lbs., it is considered "small."

Figure 2-4: Airplane Design Group (ADG) Areas

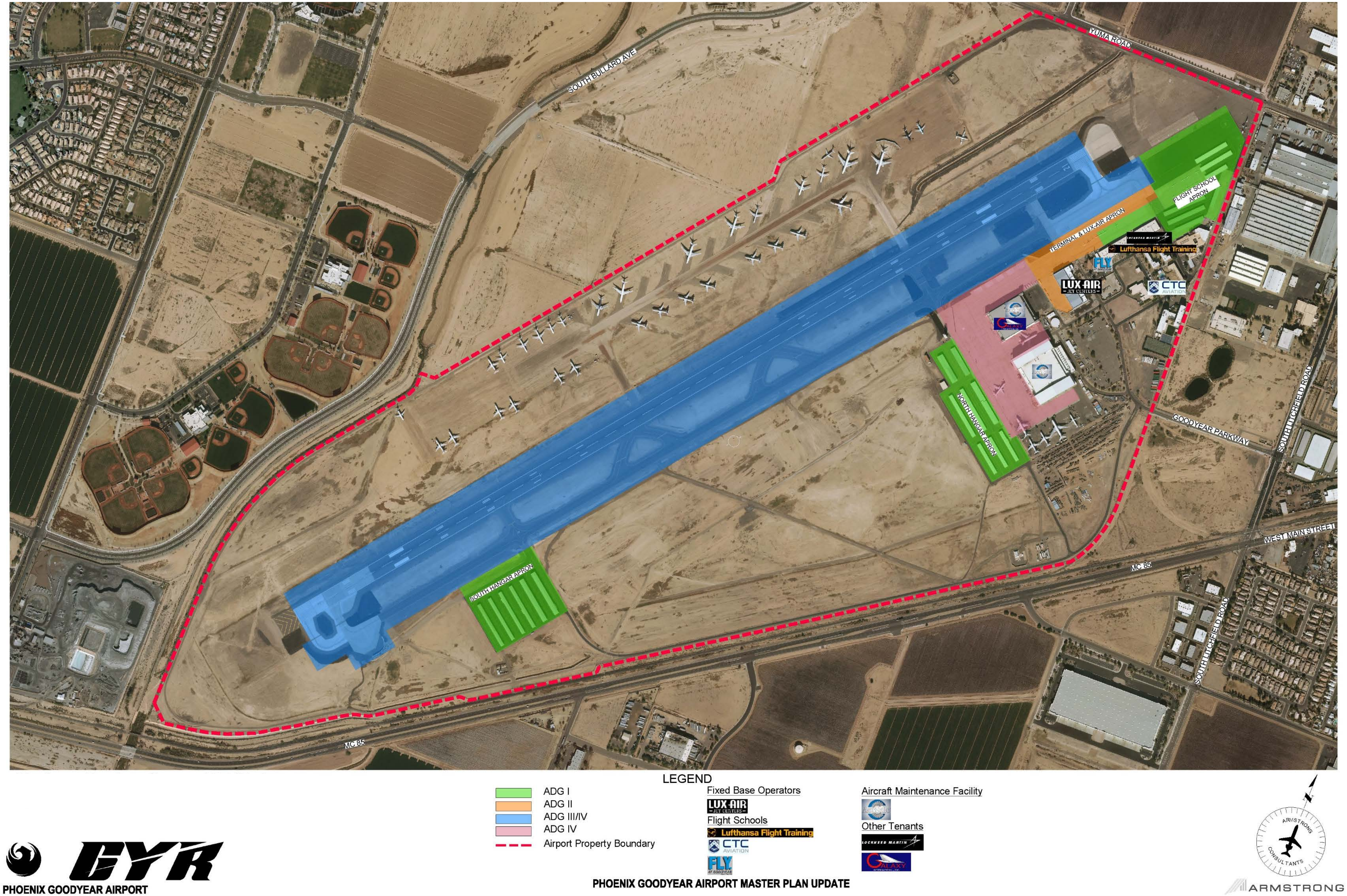


Table 2-2: Runway Design Standards

Runway Characteristic	Design Standard (ft)	Meets Standard
Runway Design Code (RDC)	R/W 3: D-IV/5000 R/W 21: D-IV/VIS	-
Visibility Minimums	R/W 3: Not < 1 mile R/W 21: Visual	-
Width	150	Yes
Shoulder Width	25	Yes
Blast Pad Width	200	Yes
Blast Pad Length	200	Yes
Runway Safety Area (RSA)		
Length Beyond Departure End	1,000	Yes
Length Prior to Threshold	600	Yes
Width	500	Yes
Runway Object Free Area (ROFA)		
Length Beyond Runway End	1,000	Yes
Length Prior to Threshold	600	Yes
Width	800	Yes
Runway Obstacle Free Zone (ROFZ)		
Length	200	Yes
Width	400	Yes
Approach Runway Protection Zone (RPZ)		
Length	1,700	No; control of a portion of the off-airport RPZ via easements or fee is needed on both ends
Inner Width	500	
Outer Width	1,010	
Departure Runway Protection Zone (RPZ)		
Length	1,700	No; control of a portion of the off-airport RPZ via easements or fee is needed on both ends
Inner Width	500	
Outer Width	1,010	
Runway Separation		
Parallel Runway Centerline	N/A	N/A
Holding Position	260	Yes
Parallel Twy/Twy Centerline	400	Yes
Aircraft Parking Area	500	No; Flight School Apron not properly marked
Helicopter Touchdown Pad	700	No; does not meet standards when aircraft more than 300,000 lbs. are on a simultaneous parallel approach (runway and helipad)

Sources: FAA Advisory Circular 150/5300-13A Change 1, *Airport Design*, 2014; FAA Advisory Circular 150/5390-2C, *Helipad Design*, 2012; Armstrong Consultants, Inc., 2016.

Runway Design Code (RDC) is another FAA design standard. To arrive at the RDC, the AAC, ADG, and approach visibility minimums are combined to form the RDC for a particular runway. The RDC provides information needed to determine certain design standards that apply. The AAC and ADG were discussed in the proceeding paragraphs; the final component of the RDC relates to the visibility minimums expressed by runway visual range (RVR) values in feet of 1,200; 1,600; 2,400; 4,000; and 5,000. If a runway is only used for visual approaches, the term "VIS" appears as the third component. The RDC components are described in **Table 2-3.** Based on the 2008 FAA approved ALP, **the RDC for Runway 3 is D/IV/5000; the RDC for Runway 21 is D/IV/VIS**.

Table 2-3: Runway Design Code

Aircraft Approach Category	Approach Speed	
Category A	less than 91 knots	
Category B	91 to 120 knots	
Category C	121 knots to 140 knots	
Category D	141 knots to 165 knots	
Category E	165 knots or more	
Airplane Design Group	**Wingspan**	**Tail Height**
Group I	< 49 feet	<20 feet
Group II	49 to 78 feet	20 to 29 feet
Group III	79 to 117 feet	30 to 44 feet
Group IV	118 to 170 feet	45 to 59 feet
Group V	171 to 213 feet	60 to 65 feet
Group VI	214 to 261 feet	66 to 79 feet
Runway Visual Range (feet)	**Flight Visibility Category (Statue mile)**	
VIS	Visual approach only	
5,000	Not lower than 1 mile	
4,000	Lower than 1 mile but not lower than 3/4 mile	
2,400	Lower than 3/4 mile but not lower than 1/2 mile (CAT-I PA)	
1,600	Lower than 1/2 mile but not lower than 1/4 mile (CAT-II PA)	
1,200	Lower than 1/4 mile (CAT-III PA)	

Source: FAA Advisory Circular 150/5300-13A Change 1, *Airport Design*, 2014.

It is common to have some areas on an airfield that do not meet design standards. A summary of non-standard conditions on the existing airfield are provided in following sections.

2.2.2 Runways

The Airport has a single runway designated Runway 3-21. Originally constructed in 1941, the runway has been resurfaced and modified numerous times. The runway's dimensions are 8,500 feet long by 150 feet wide. The runway has 25-foot wide paved shoulders along the entire length. The runway is constructed of grooved asphalt pavement with the exception of the first 800 feet of Runway 3 and the first 200 feet of Runway 21, which are constructed of concrete. Runway 3 also has a marked blast pad, which is a surface adjacent to the ends of runways provided to reduce the erosive effect of jet blast and propeller wash. Runway 21 has a paved area, but it is not marked as a blast pad and is used only for aircraft turn-arounds. Each runway end is marked with precision instrument markings that were recently added during the runway shift and rehabilitation projects. The runway has an effective gradient of 0.32 percent sloping downward towards the southwest end of the runway.

The following dimensional criteria are established in AC 150/5300-13A; required dimensions for the Airport are provided in **Table 2-2.**

- **Runway Safety Area (RSA).** The RSA is a surface surrounding a runway identified to reduce the risk of damage to an aircraft in the event of an undershot, overshot, or excursion from the runway. The RSA must be cleared and graded and have no hazardous surface variations, and free of objects, except for objects needed for air navigation or aircraft ground maneuvering.

- **Runway Object Free Area (ROFA).** The ROFA is an area centered and surrounding the runway that precludes parked airplanes and objects, except those needed for air navigation.
- **Obstacle Free Zone (OFZ).** An OFZ is a three-dimensional volume of airspace along the runway and extended runway centerline that provides clearance protection for arriving and departing aircraft. The OFZ is required to be free of all penetrations, except for frangible visual navigational aids (NAVAIDs) that need to be located in the OFZ because of their function. The OFZ extends 200 feet beyond the end of each runway and has a width of 400 feet. The third component is its height, which is the airspace above the surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline.
- **Runway Protection Zone (RPZ).** The RPZ's function is to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape, centered on the extended runway centerline, and begins 200 feet beyond the runway threshold. The RPZ dimension for a particular runway end is a function of the type of aircraft and approach visibility minimums associated with that runway end. The existing RPZs for Runway 3 and 21 extend beyond the airport property, and therefore portions of the RPZs are not under the control of the City.

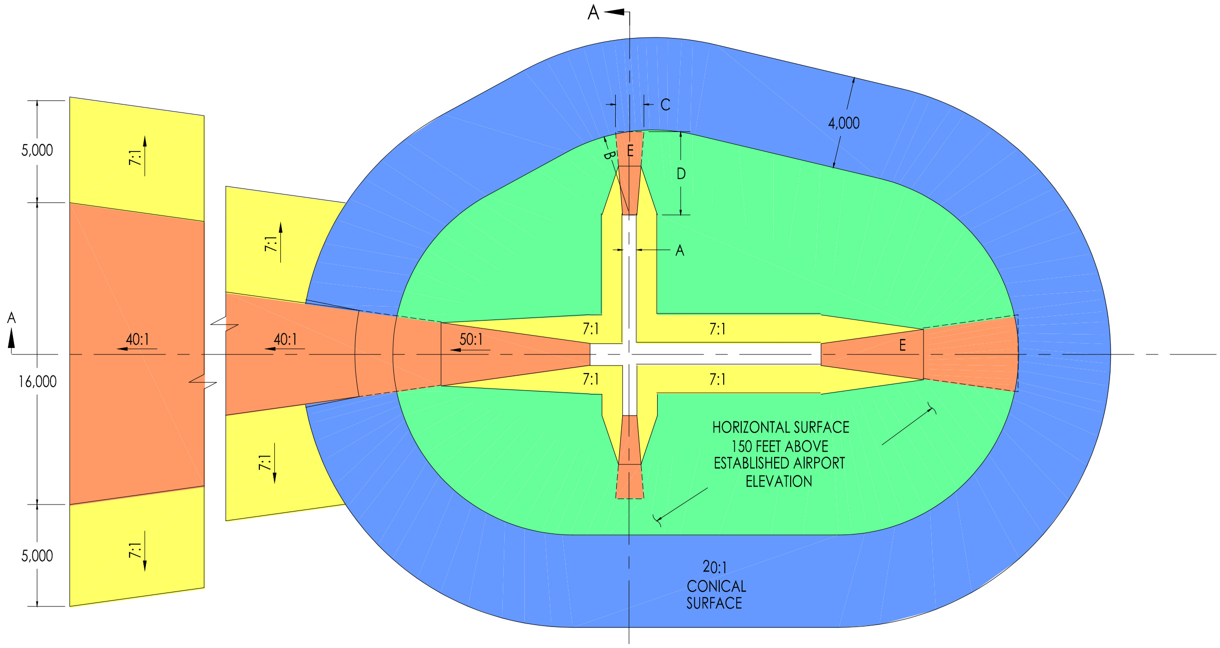
The Runway 3 RPZ extends beyond the Airport property to the south. There is one privately owned, off-airport parcel in the RPZ that is owned by JVH Property LLC and is used for aluminum processing. The Airport currently does not have an avigation easement for this parcel. Other off-airport land uses located within the RPZ include a railroad right-of-way and Maricopa County Highway 85. There are no structures or penetrations located in the off-airport Runway 3 RPZ.

The Runway 21 RPZ also extends beyond the Airport property to the northeast, across Yuma Road. There are six privately owned and one publicly owned off-airport parcels in the RPZ totaling 12.503 acres. Land uses within the off-airport RPZ include undeveloped agricultural land, railroad right-of-way (vacant), developed commercial property, and West Yuma Road right-of-way. The Airport currently does not have avigation easements for the six privately owned parcels. One parcel in the RPZ is zoned as Light Industrial (I-1), which permits incompatible development. The property was subdivided in 2013 to create several industrial lots. The 48.8-acre lot closest to Yuma Road is Lot 6 of the Beck Property Subdivision (APN 500-09-021) and is currently owned by EJM Arizona Commerceplex LLC.

2.2.2.1. Title 14, CFR Part 77 Imaginary Surfaces

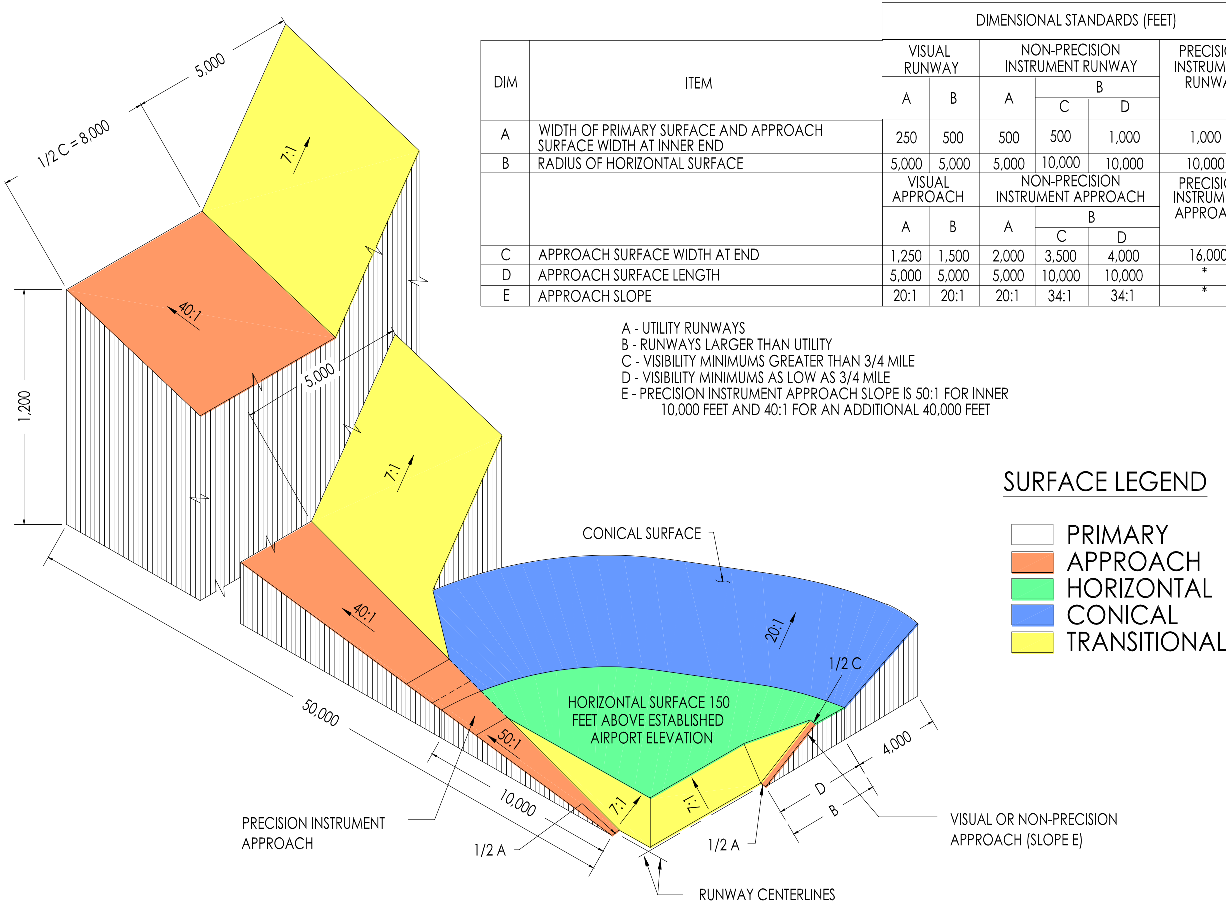
14 CFR Part 77 *Safe, Efficient Use, and Preservation of Navigable Airspace* establishes several imaginary surfaces that are used as a guide to provide a safe and unobstructed operating environment for aviation. These surfaces are shown in **Figure 2-5**. The primary, approach, transitional, horizontal, and conical surfaces identified in CFR Part 77 are applied to each runway on the basis of the type of approach procedure available or planned for that runway and the specific 14 CFR Part 77 runway category criteria. Runway 3 is classified as a larger-than-utility, non-precision instrument runway and has a RNAV (GPS) non-precision instrument approach. Runway 21 is classified as a larger-than-utility, visual runway.

Figure 2-5: 14 CFR Part 77 Imaginary Surfaces



DIM	ITEM	DIMENSIONAL STANDARDS (FEET) VISUAL RUNWAY A	VISUAL RUNWAY B	NON-PRECISION INSTRUMENT RUNWAY A	NON-PRECISION INSTRUMENT RUNWAY B C	NON-PRECISION INSTRUMENT RUNWAY B D	PRECISION INSTRUMENT RUNWAY
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH A	VISUAL APPROACH B	NON-PRECISION INSTRUMENT APPROACH A	NON-PRECISION INSTRUMENT APPROACH B C	NON-PRECISION INSTRUMENT APPROACH B D	PRECISION INSTRUMENT APPROACH
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A - UTILITY RUNWAYS
B - RUNWAYS LARGER THAN UTILITY
C - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
E - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A

Source: 14 CFR Part 77 Safe Efficient Use and Preservation of Navigable Airspace, 2015.

The 14 CFR Part 77 imaginary surfaces summarized in **Table 2-4** represent the existing dimensions for the Airport. These surfaces will be used to determine if any existing or potential obstacles exist depending on the planned development at the Airport. A more detailed penetration analysis was conducted and reflected on the ALP.

Table 2-4: 14 CFR Part 77 Imaginary Surfaces for Phoenix Goodyear Airport (in feet)

Item	Runway 3	Runway 21
Primary Surface Width	500	500
Primary Surface beyond RW End	200	200
Radius of Horizontal Surface	10,000	5,000
Approach Surface Dimensions	500 x 3,500 x 10,000	500 x 1,500 x 5,000
Approach Surface Slope	34:1	20:1
Transitional Surface Slope	7:1	7:1
Conical Surface Slope	20:1	20:1

Source: 14 CFR, Part 77 Safe, Efficient Use, and Preservation of Navigable Airspace, 2015.

2.2.2.2. Runway Use

The prevailing wind direction determines the desired alignment and configuration of a runway. Aircraft generally land and takeoff into the wind, and therefore can tolerate only limited crosswind components (the percentage of wind perpendicular to the runway centerline). Runway alignments should yield 95 percent wind coverage under stipulated crosswind components. If a runway does not meet this 95 percent coverage, then construction of an additional runway may be advisable. The allowable crosswind component for each AAC/ADG is shown in **Table 2-5.**

Table 2-5: Crosswind Component

Allowable Crosswind	Aircraft Approach Category/Airplane Design Group
10.5 knots	A-I & B-I
13 knots	A-II & B-II
16 knots	A-III, B-III & C-I through D-III
20 knots	A-IV through D-VI, E-I through E-VI

Source: FAA AC 150/5300-13A Change 1, *Airport Design*, 2014.

Historical wind data was obtained from FAA's National Climate Data Center, based on more than 37,000 observations made from the Airport weather station from 2006–2015. As shown in **Table 2-6**, the allowable crosswind components and corresponding wind coverage percentages exceed the recommended 95 percent coverage for all aircraft types. The historical wind data was then used to create a VFR, IFR, and all-weather wind rose with corresponding crosswind component data as presented in the ALP (see **Figure 2-6**).

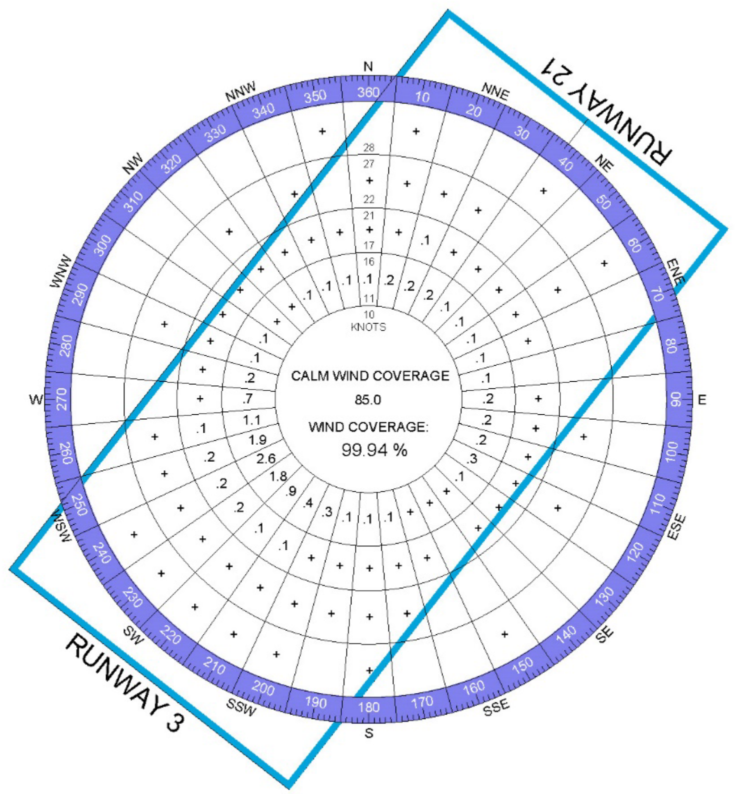
Table 2-6: Wind Coverage

Runway	Crosswind (Kts)	VFR Wind Coverage	IFR Wind Coverage	All Weather Coverage
3-21	10.5	97.20%	78.91%	97.13%
3-21	13.0	98.81%	83.23%	98.75%
3-21	16.0	99.73%	88.74%	99.69%
3-21	20.0	99.94%	95.81%	99.92%

Source: National Climate Data Center, Phoenix Goodyear Airport; time period: 2006-2015; total 37,730 observations.

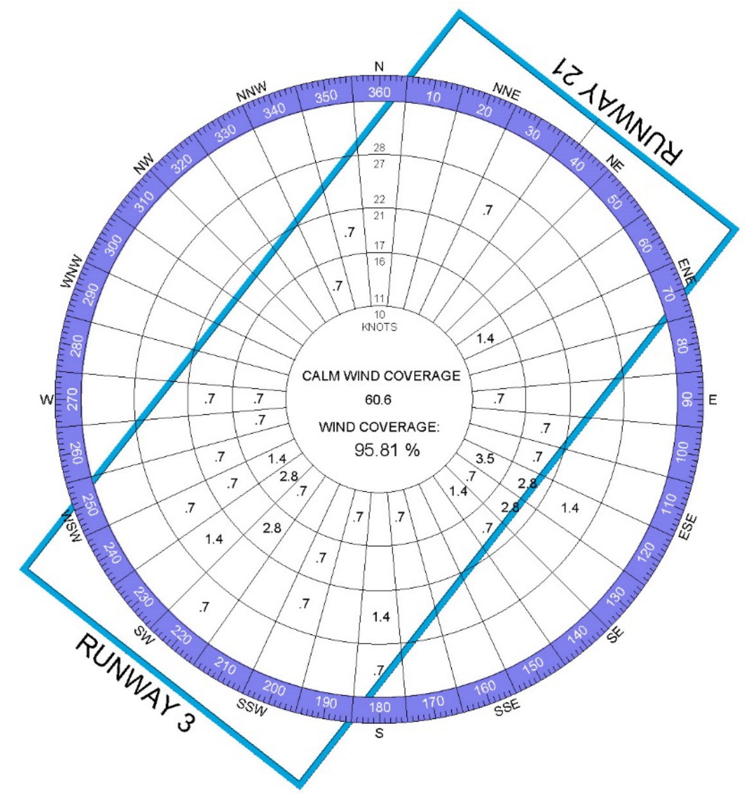
Figure 2-6: Wind Roses and Wind Coverage

VFR WIND ROSE



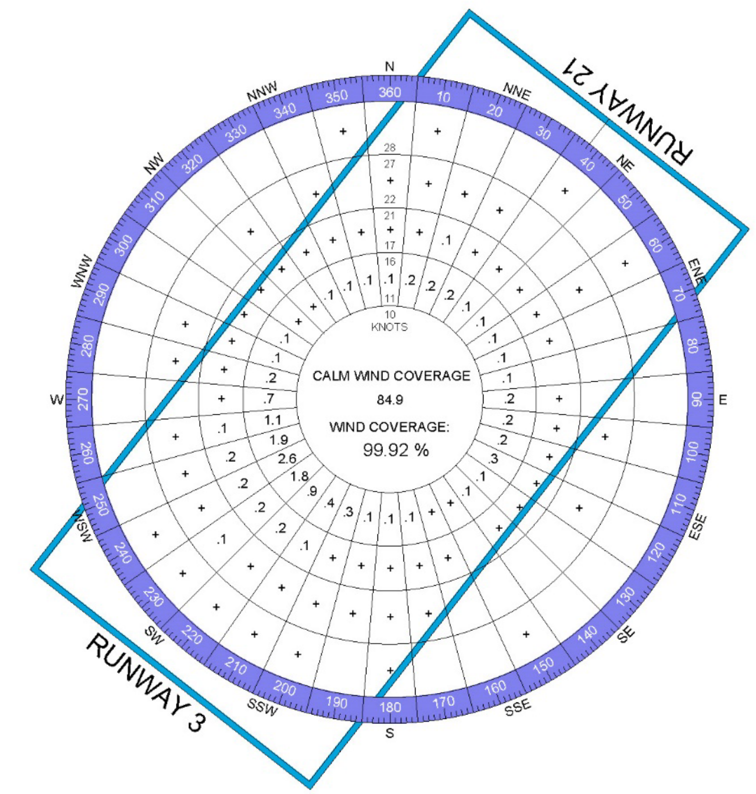
20 KNOT WIND ROSE - ARC: D-IV

IFR WIND ROSE



20 KNOT WIND ROSE - ARC: D-IV

ALL WEATHER WIND ROSE



20 KNOT WIND ROSE - ARC: D-IV

RUNWAY 3-21 WIND COVERAGE			
CROSSWIND COMPONENT	VFR COVERAGE	IFR COVERAGE	ALL WEATHER COVERAGE
10.5 KNOTS	97.20%	78.91%	97.13%
13 KNOTS	98.81%	83.23%	98.75%
16 KNOTS	99.73%	88.74%	99.69%
20 KNOTS	99.94%	95.81%	99.92%

SOURCE: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) NATIONAL CLIMATIC DATA CENTER (NCDC); STATION: PHOENIX GOODYEAR AIRPORT; 969' MSL; TIME PERIOD: 2006-2015; NUMBER OF OBSERVATIONS: 37,730

NOTE: IFR CONDITIONS OCCUR APPROXIMATELY 0.37% OF EACH YEAR

2.2.2.3. Runway Pavement Strength

According to FAA guidance, the aircraft types and the critical aircraft expected to use the airport during the planning period are used to determine the required pavement strength, or weight bearing capacity of airfield surfaces. The required pavement strength is an estimate based on average levels of activity and is expressed in terms of aircraft landing gear type and configurations. Pavement strength is not the maximum allowable weight; limited operations by heavier aircraft other than the critical aircraft may be permissible, although frequent operations by heavier aircraft can shorten the pavement's lifespan. The existing runway pavement composition and strength ratings for the Airport are illustrated in **Table 2-7**. If operations by heavier aircraft continue to increase, it is recommended that the runway pavement strength be re-evaluated and portions of the runway pavement strengthened, as needed.

Table 2-7: Runway Pavement Composition and Strength

Runway	Pavement Composition	Existing Pavement Strength (Landing Gear Configuration in Thousands of lbs.)
First 800 feet of Runway 3	Portland Cement Concrete Pavement	116.0-SW; 235.0-DW; 385.0-DTW; 870.0-DDTW
3-21 (inside of the runway)	Asphalt	116.0-SW;225.0-DW; 505.0-DTW; 989.0-DDTW
First 200 feet of Runway 21	Portland Cement Concrete Pavement	116.0-SW; 240.0-DW; 448.0-DTW; 953.0-DDTW

Notes: SW = single-wheel landing gear, DW = dual-wheel landing gear, DTW = dual-tandem wheel landing gear, DDTW = double dual-tandem wheel landing gear
Sources: Morrison-Maierle, Inc., Design Report – Runway Shift, Phoenix Goodyear Airport, February 2015; FAA Airport Master Record, November 2016.

2.2.3 Taxiways

A taxiway is provided for the movement (or taxiing) of aircraft from one part of an airport to another. A taxilane located outside the movement area, providing access from taxiways to aircraft parking positions, hangars, and terminal areas. At airports with an airport traffic control tower (ATCT), taxiways are under the control of the ATCT, whereas taxilanes are not.

The Airport is equipped with a single parallel taxiway (Taxiway A) with connector Taxiways A1, A2, and A3 leading to the terminal apron, flight school apron, fixed-base operator facilities, and aircraft maintenance facility. Taxiway connectors A4 through A10 are a combination of acute and conventional exit taxiways providing access from the runway to parallel Taxiway A. A summary of the taxiway system is provided in **Table 2-8.**

Table 2-8: Airport Taxiways

Taxiway Designation	Type	Taxiway Designation	Type
A	Parallel Taxiway	A6	Acute Exit
A1	Ramp Connector	A7	Acute Exit
A2	Ramp Connector	A8	Runway Entrance/Exit
A3	Ramp Connector	A9	Runway Entrance/Exit
A4	Acute Exit	A10	Runway Entrance/Exit
A5	Acute Exit		

ADG standards are based on wingspan and tail height, but not the dimensions of the aircraft undercarriage, whereas Taxiway Design Group (TDG) standards are based on the overall main gear width (MGW) and the cockpit-to-main gear (CMG) distance. Taxiway/taxilane width and fillet standards, and in some instances, runway to taxiway and taxiway/taxilane separation requirements, are determined by the TDG. Taxiways/taxilanes can be built to different TDG standards based on anticipated use. Taxiway design standards were revised by the FAA since the previous master plan was completed; therefore, a TDG was not previously established for the Airport. The DC-10-40 (existing design aircraft) falls within TDG 5 standards. The runway shift and runway rehabilitation projects included modifications to Taxiways A1, A3, and A10, to meet TDG 5 standards. Taxiway and taxilane design standards for each ADG by airfield location are depicted in **Table 2-9.**

Table 2-9: Taxiway/Taxilane Design Standards

	Design Standard (ft.)	Meet Standard
Airplane Design Group I		
Location	**Flight School Apron**	
Taxiway Protection		
Taxiway Safety Area (TSA)	49	Yes
Taxiway Object Free Area (TOFA)	89	Yes
Taxilane Object Free Area (OFA)	79	No (see **Table 2-10**)
Taxiway Separation		
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	70	N/A
Taxiway Centerline to Fixed or Movable Object	44.5	Yes
Taxilane Centerline to Parallel Taxilane Centerline	64	Yes
Taxilane Centerline to Fixed or Movable Object	39.5	No (see **Table 2-10**)
Wingtip Clearance		
Taxiway Wingtip Clearance	20	Yes
Taxilane Wingtip Clearance	15	No (see **Table 2-10**)
	Design Standard (ft.)	**Meet Standard**
Airplane Design Group (AGD) II		
Location	**Flight School Apron**	
Taxiway Protection		
Taxiway Safety Area (TSA)	79	Taxiway Safety Area (TSA)
Taxiway Object Free Area (TOFA)	131	Taxiway Object Free Area (TOFA)
Taxilane Object Free Area (OFA)	115	Taxilane Object Free Area (OFA)
Taxiway Separation		
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	105	N/A
Taxiway Centerline to Fixed or Movable Object	65.5	N/A
Taxilane Centerline to Parallel Taxilane Centerline	97	Yes
Taxilane Centerline to Fixed or Movable Object	57.5	No (see **Table 2-10**)
Wingtip Clearance		
Taxiway Wingtip Clearance	26	N/A
Taxilane Wingtip Clearance	18	No
	Design Standard (ft.)	**Meet Standard**
Airplane Design Group IV		
Location	**Remainder of Airfield**	
Taxiway Protection		
Taxiway Safety Area (TSA)	171	Yes
Taxiway Object Free Area (TOFA)	259	Yes
Taxilane Object Free Area (OFA)	225	N/A
Taxiway Separation		
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	215	Yes
Taxiway Centerline to Fixed or Movable Object	129.5	Yes
Taxilane Centerline to Parallel Taxilane Centerline	198	N/A
Taxilane Centerline to Fixed or Movable Object	112.5	Yes
Wingtip Clearance		
Taxiway Wingtip Clearance	44	Yes
Taxilane Wingtip Clearance	27	N/A

Existing Taxiway System	Design Standard (ft.)	Meet Standard
Taxiway Design Group V		
Taxiway A		
Taxiway Width	75	Yes
Taxiway Edge Safety Margin	15	Yes
Taxiway Shoulder Width	30	No (see **Table 2-10**)
Taxiway Connectors A1, A9, A10		
Taxiway Width	75	Yes
Taxiway Edge Safety Margin	15	Yes
Taxiway Shoulder Width	30	Yes
Taxiway Connectors A2 – A8		
Taxiway Width	75	Yes
Taxiway Edge Safety Margin	15	Yes
Taxiway Shoulder Width	30	No (see **Table 2-10**)

Note: N/A = The standard does not apply due to the Airport's geometry.
Source: FAA AC 150/5300-13A Change 1, *Airport Design*, 2014.

2.2.4 Helipad

The Airport has one general aviation helipad located on the aircraft apron between AerSale's Hangar 18 and the Lux Air Jet Centers facility, designated as Helipad H1. The helipad was constructed in 2010 to serve based and transient helicopters. The helipad's touchdown and lift-off area (TLOF) is a 40-foot square, and the final approach and take-off area (FATO) is a 64-foot square. The total area is constructed of concrete. The helipad has TLOF and FATO perimeter markings, as well as a standard helipad identification marking (H). Flush-mounted, medium intensity FATO perimeter lighting is available for nighttime operations, but the helipad is designated for VFR operations only. VFR approach and departure paths are generally from south to north according to air traffic control personnel.

The design helicopter is a single or composite helicopter that reflects the maximum weight, overall length, rotor diameter, and other specifications of all helicopters expected to operate at the helipad. Based on the TLOF and FATO dimensions of H1, various types of helicopters with a rotor diameter of 40 feet or less, and overall length of 42.5 feet or less may use the helipad.

2.2.5 Non-Standard Conditions

Non-standard conditions are noted in both the movement and non-movement areas on the Airport. Movement areas are all parts of the Airport that are controlled by air traffic control including the runway, taxiways, and the helipad. The non-movement area is any area where aircraft are not under the direct control of air traffic control and are responsible for their own separation. Non-movement areas include aircraft parking aprons and taxilanes. A summary of the areas that do not meet the current design standards is provided in **Table 2-10 and Table 2-11**. For comparison purposes, ADG C-III (existing) and D-IV (recommended) are both provided in **Table 2-10.** Non-standard conditions are addressed in the facility requirements.

Table 2-10: Summary of Non-Standard Conditions - Movement Areas

Runway 3-21		
Aircraft Approach Category (AAC)/Airplane Design Group (ADG)	**Design Standard Not Met**	**Comment**
D-IV	Runway centerline to aircraft parking area requires 500 feet separation	Terminal Apron aircraft parking area boundary to Runway 3-21 centerline distance is approximately 440 feet. The apron boundary should be marked to meet separation standards.
Helipad H1		
Helipad	**Design Standard Not Met**	**Comment**
General Aviation	FATO Center to Runway Centerline for VFR operations: Heavy Airplane over 300,000 lbs. requires 700 feet separation	H1 FATO center to Runway 3-21 centerline distance is approximately 580 feet. Helipad H1 does not meet FATO center to runway centerline separation standards when airplanes over 300,000 pounds are operating on Runway 3-21.
General Aviation	FATO Object Penetration	H1 FATO to adjacent taxilane centerline stripe distance is approximately 35 feet. ADG-II aircraft operating on the adjacent taxilane could penetrate the H1 FATO[1]. The taxilane centerline stripe should be moved to meet standards.
General Aviation	Safety Area Penetration	H1 Safety Area to adjacent taxilane centerline stripe distance is approximately 15 feet. ADG-II aircraft operating on taxilane adjacent to H1 would penetrate the H1 Safety Area[1]. The taxilane centerline stripe should be moved to meet standards.
Taxiway A and Connectors		
Airplane Design Group (AGD) Taxiway Design Group (TGD)	**Design Standard Not Met**	**Comment**
ADG-IV	Taxiway centerline to fixed or movable object requires 129.5 feet separation	The Terminal Apron aircraft parking area boundary is not marked to provide 129.5 feet of separation from Taxiway A. The Terminal Apron boundary should be marked to meet standards.
TDG 5	Taxiway shoulder widths are required to be 30 feet wide	Taxiway A shoulders are not present in multiple areas. Shoulders should be constructed to meet standards.
		Taxiway Connectors A2 and A3 shoulders are not present. Shoulders should be constructed to meet standards.
		Taxiway Connectors A4, A5, A6, A7, and A8 shoulder width is 25 feet. Shoulders should be widened to meet standards.
Non-Standard Airfield Geometry	Direct runway access from an apron	Taxiway Connectors A2, A3, and A8 provide direct access to Runway 3-21 from aircraft parking aprons without requiring a turn to taxiing aircraft. Access from aircraft parking aprons to Taxiway A should be relocated to provide indirect access requiring a turn to Runway 3-21.

Note: [1]To comply with helipad FATO and Safety Area standards, the taxilane adjacent Helipad H1 is closed when the helipad is in use.
Sources: FAA AC 150/5300-13A, Change 1, Airport Design; FAA AC 150/5390-2C, Helipad Design.

Table 2-11: Summary of Non-Standard Conditions - Non-Movement Areas

Airplane Design Group (ADG)	Design Standard Not Met	Comment
Flight School Apron		
ADG-I	Taxilane centerline to fixed or movable object is 39.5 feet	All of the shade structures, three utility poles, all aircraft tie-downs, chain link fence, and the Lufthansa USA building do not meet taxilane separation standards.
Terminal and Lux Air Apron		
Airplane Design Group (ADG)	**Design Standard Not Met**	**Comment**
ADG-II	Taxilane centerline to fixed or movable object is 57.5 feet	The westerly taxilane centerline strip (closet to the runway) is approximately 35 feet from the aircraft tie-down positions. The Taxilane ceterline stripe should be moved to meet standards.
Aersale Apron		
Airplane Design Group (ADG)	**Design Standard Not Met**	**Comment**
ADG-IV	Taxilane centerline to fixed or movable object is 112.5 feet	When aircraft are parked along the fence line the Taxilane centerline separation standard is not met[1].
North Hangar Apron		
Airplane Design Group (ADG)	**Design Standard Not Met**	**Comment**
ADG-I	Taxilane centerline to fixed or movable object is 39.5 feet	The taxilane leading to Taxiway A and A3 connector from the Aircraft Maintenance Facility apron does not meet standards. The Taxilane centerline stripe is approximately 27 feet from the ATCT vehicle parking and should be moved to meet standards.
		Taxilane centerline stripe is approximately 30 feet from the Wash Rack and does not meet standards. The centerline stripe should be removed to meet standards.

Note: [1]Taxilane standards are applicable when aircraft are operating under their own power.
Source: FAA AC 150/5300-13A, Change 1, *Airport Design*.

2.2.6 Airfield Pavements

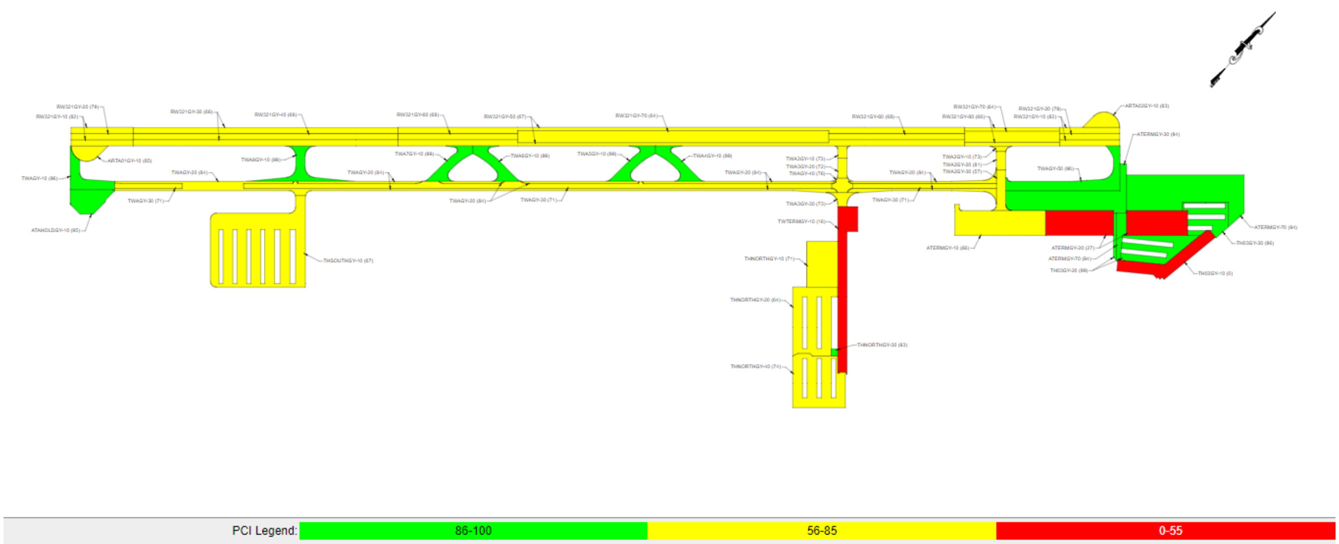
The Arizona Pavement Preservation Program (APPP) was established to assist in the preservation of Arizona's airport infrastructure. Every year ADOT, using the Airport Pavement Management System (APMS), identifies airport pavement maintenance projects eligible for funding for the upcoming five years (airports can also request FAA funding under the AIP). These projects are listed in the state's five-year Airport Capital Improvement Program. Once a project has been approved for funding by the State Transportation Board, the airport sponsor may elect to accept a state grant for the project and participate in the APPP, or sign an inter-government agreement (IGA) with the Aeronautics Group to participate in the APPP. ADOT conducts pavement surveys every three years.

The pavement condition index (PCI) is the standard used by the aviation industry to assess pavement condition. During a PCI survey, signs of deterioration within a selected sample area are identified, recorded, and analyzed. The results of a PCI evaluation provide an indication of the structural integrity and functional capabilities of a pavement. However, only the top layer of the pavement is examined and no measure is made of the structural capacity of the pavement. Nevertheless, the PCI does provide an objective basis for determining maintenance and repair needs as well as for establishing rehabilitation priorities.

Pavement defects are characterized in terms of type of distress, severity of distress, and amount of distress. This information is then used to develop a composite index (PCI number) that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent). In general, pavements above a PCI of 85 that are not exhibiting significant load-related distress will benefit from routine maintenance actions, such as periodic crack sealing or patching. Pavements with a PCI of 56 (65 for PCC pavements) to 85 may require pavement preservation, such as a surface treatment, thin overlay, or PCC joint resealing. Often, when the PCI is 55 or less, major rehabilitation, such as a thick overlay or reconstruction, are the only viable alternatives due to the substantial damage to the pavement structure.

Figure 2-7 depicts the most recent PCI inspection reported in the 2014 APMS update, which was conducted prior to the runway shift and rehabilitation projects. The APPP also includes determining the Pavement Classification Number (PCN) for the same airfield pavement. The Aircraft Classification Number-Pavement Classification Number (ACN-PCN) system of reporting pavement strength is structured so that a pavement with a given PCN can support an aircraft that has an ACN equal or less than the PCN. The PCN designation for the first 800 feet of the approach end of Runway 3 is 75/R/C/W/T[3]. The PCN designation for the first 200 feet of the approach end of Runway 21 is 86/R/C/W/T. The PCN designation for the remainder of Runway 3-21 is 66/F/B/W/T.

Figure 2-7: Airport PCI Map



Source: Phoenix Goodyear Airport Pavement Management Report, Applied Pavement Technology Inc., August 2014.

A review of the Airport's taxiway system reveals that the overall condition of the parallel taxiway varies. A large portion of parallel Taxiway A is in overall poor condition according to the PCN. It is likely that portions of the parallel taxiway will require strengthening in the near-term if operations by larger aircraft use the taxiway on a regular basis. It should be noted that the PCN does not include the new portion of Taxiway A and the two connector taxiways constructed with the 2015 runway shift project.

---

3 A PCN has a minimum value of 0 and has no upper limit. The numerical value equals the calculated operating weight. In addition to the numerical value, the PCN is reported with four codes.; R or F = pavement type; A, B, C, or D = subgrade strength category; W, X, Y, or Z = maximum allowable tire pressure; T or U = pavement evaluation method.

The taxiway connectors are in better overall condition and strength than parallel Taxiway A. Taxiway connector A4 is in the best condition. The remaining taxiway connectors appear to be in the relatively same condition, but may also require strengthening in the near-term if operations by larger aircraft use the taxiway connectors on a regular basis. Taxiways A9 and A10 are in excellent condition as they were part of the 2015 runway shift project and do not require strengthening within the planning period.

2.2.7 Airfield Lighting and Signage

Airfield lighting is essential for the safe operation of aircraft during night and/or periods of low visibility. Airfield signage is necessary for directing pilots and other airfield users to locations on both the movement and non-movement areas. The airfield's lighting and signage is summarized below.

Pavement edge lighting is placed along the edge of pavement to define the lateral limits of the pavement. Runway 3-21 is equipped with base-mounted Medium Intensity Runway Lights (MIRL). In addition, threshold lights are present to delineate the usable runway. The MIRLs and threshold lights are all light-emitting diode (LED) fixtures which were installed during the 2015 runway shift project. The runway distance remaining signs also were replaced with LED fixtures. During daylight hours, the MIRL and REIL (Runway End Identifier Lights) for both Runway 3 and 21 can be turned on by contacting the ATCT or airport operations. After sunset, the MIRL remains on until sunrise. The REIL for Runway 3 and 21 are turned off when the ATCT is closed.

Pavement edge lighting is not installed on the full length of Taxiway A, but rather only at connector taxiway intersections. All taxiway connector intersections (A1–A10) have approximately six based-mounted Medium Intensity Taxiway Lights (MITL) per side. The MITLs are also LED fixtures. In lieu of the MITL along the entirety of Taxiway A, medium intensity, semi-flush green taxiway centerline lights are provided on the full length of Taxiway A, as well as all taxiway connector centerlines. Based-mounted, LED runway guard lights (RGLs) are also installed at each runway hold line location. All airfield lighting is in excellent condition.

All major types of signs such as mandatory instruction, location, direction, information, and destination are present on the airfield. All signage associated with the runway and taxiway is lighted by LED fixtures and is in excellent condition.

A Taxiway A Lighting and Signage Modifications project was completed in September 2013, which called for relocation of existing hold bars and mandatory signs to 260 feet from the runway centerline; installation of RGLs at Taxiway A intersections with A1, A2, A3, A8, and A9; and installation of RGLs at A4, A5, A6, and A7. In addition, pavement striping and layout, electrical improvements, taxiway lighting adjustments and signs for Taxiway A were installed; this includes the new taxiway connector A10 which was added during this project. The project also included new taxiway centerline lights at Taxiways A2 and A3 and conversion of all taxiway lighting and signage to LED.

2.2.8 Navigational Aids

A navigational aid (NAVAID) is any ground based visual or electronic device used to provide course or altitude information to pilots. Both visual and electronic NAVAIDs can be found at the Airport and include rotating beacons, Precision Approach Path Indicators (PAPIs), a segmented circle with lighted wind cone, and supplemental wind cones.

Rotating beacons are provided for night operation as identification and location markers for airports and have a visibility range of 30 to 40 miles and a candlepower range from 190,000 to 400,000. Alternating white and green flashes indicate the airport's location. The primary rotating beacon is located on the ATCT near the midfield of the Airport. A second rotating beacon is located in the northeast quadrant of the airfield near the airport perimeter road closest to Gate No. 2. Both are in good condition, although the fixture and tower are considered outdated. The City of Phoenix owns and maintains both beacons.

REIL are considered visual NAVAIDs because they provide rapid and positive identification of the end of the runway. Runway 3-21 is equipped with REILs at both runway ends and both are LED fixtures. They are in good condition.

Visual glide slope indicators such as a PAPI are ground lighting devices that assist pilots with vertical guidance to the runway. A 4-light PAPI is located toward the end of each runway end. The PAPIs use LED fixtures and are in excellent condition. The City of Phoenix owns all PAPIs.

The Airport is equipped with four lighted wind cones; a primary (internally lit) wind cone with a segmented circle is located at the mid-field of the Airport, and three supplemental (externally lit) wind cones are located near both runway thresholds and the infield near Taxiway A3. The segmented circle indicates a left traffic pattern for Runway 3 and a right traffic pattern for Runway 21. All wind cones and the segmented circle are in good condition. Three of the wind cones are located within the ROFA and should be relocated. The location of the primary wind cone and segmented circle meets standards.

2.2.9 Flight Procedures

The majority of aircraft operations at the Airport are conducted under Visual Flight Rules (VFR). Unlike aircraft operating under Instrument Flight Rules (IFR), where air traffic control is responsible for separation from other aircraft and obstacles, aircraft operating under VFR are responsible for maintaining separation from other aircraft and obstacles themselves. Flight training and based aircraft provide a large quantity of VFR traffic at the Airport.

The RNAV (GPS) Runway 3 is currently the only existing published Instrument Approach Procedure (IAP) into the Airport. The RNAV (GPS) Runway 3 IAP is considered non-precision and has multiple visibility minima and decision height altitudes which are determined by the AAC and the specific type of approach being conducted. The RNAV (GPS) Runway 3 IAP include the following approaches: Localizer Performance (LP), Lateral Navigation (LNAV), and Circling approaches. The IAP minima are listed below in **Table 2-12.** The Airport also has 11 published instrument departure procedures which provide standardized instrument navigation instructions to departing aircraft.

Table 2-12: RNAV (GPS) Runway 3 Minimums

	Minimum Descent Altitude (Ft) – Minimum Visibility (Statute miles)			
Category	**A**	**B**	**C**	**D**
LP	1,340 - 1		1,340 - 1.125	
LNAV	1,580 - 1		1,580 - 1.75	
Circling	1,580 - 1.75		1,800 - 2.5	1,920 - 3

Source: FAA, Phoenix Goodyear Airport RNAV (GPS) RWY 3 Instrument Approach Procedure Plate, December 2016.

2.2.10 Weather Reporting Systems

The Airport uses an automated airport weather reporting station known as a Limited Aviation Weather Reporting Station (LAWRS). A LAWRS is a facility where observations are taken and transmitted by certified FAA or FAA-contract ATCT personnel. A limited number of automated sensors or equipment is available; however, when the facility is open, the LAWRS observer is responsible for the Meteorological Terminal Aviation Routine Weather Report (METAR), which is a routine weather report issued at hourly or half-hourly intervals broadcasting the automated weather observation.

2.3 Aircraft Parking Aprons and Storage Facilities

The Airport has several aircraft parking aprons for transient and based aircraft. A summary of apron and storage areas is provided on **Table 2-13,** and previously depicted on **Figure 2-2**. With the exception of the northwest aircraft storage area which is comprised of compressed soil, the majority of aprons are concrete pavement or asphalt. All aprons have centerline and pavement edge markings. The terminal and flight school aprons also include edge of usable taxilane and open aircraft parking position markings.

Table 2-13: Aircraft Parking Aprons and Storage Areas

Aircraft Apron Storage/Area	Location	Apron/Storage Area	Aircraft Parking (Type and Number of Spaces)
Flight School Apron[1]	Adjacent to Lufthansa and CTC facilities	75,000[1] SY	Shade structures/39 Open tie-downs/18
Terminal/Lux Air Apron	Adjacent to terminal and Lufthansa maintenance hangars to the north, and AerSale hangar to the south	27,700 SY	Open tie-downs/43
AerSale Apron	South of terminal and adjacent to AerSale hangars	95,300 SY	Open/varies
North Hangar Apron	South of the AerSale facility adjacent to the ATCT	55,000 SY	T-hangars/69 Shade structures/22
South Hangar Apron	Southeastern part of airfield near Runway 3 threshold	40,000 SY	T-hangars/78
Northwest Aircraft Storage Area[2]	Western portion of airfield	62 acres[2]	Open/varies

Notes: [1]Apron size includes pavement beneath shade structures; Lufthansa leases approximately 47,500 SY of apron in this area from the Airport. [2]Approximately 40 acres of this total is comprised of compacted treated soil.
Sources: City of Phoenix Aviation Department, 2016; Armstrong Consultants, Inc., 2016.

There are three types of hangar facilities – conventional hangars, T-hangars, and shade structures. Conventional hangars provide multiple aircraft storage and are often referred to as box hangars. T-hangars are rectangular storage hangars comprised of several interlocking "T" units; they are usually two-sided with either bi-fold or sliding doors. Shade structures provide only a roof for weather protection.

The Airport has a total of approximately 460,000 SF of conventional hangar space provided within five buildings (**see Table 2-14**). Four of the buildings are owned by the Airport, two are leased to AerSale and two to Lufthansa. The Airport has also executed a long-term ground lease for the new Lux Air facility.

Table 2-14: Conventional Hangars

Building[1]	Current Occupant(s)	Size (SF)	Condition
Hangar 105	Lufthansa Aviation Training USA	26,075[2]	Good
Hangar 106	Lufthansa Aviation Training USA (CTC & Lockheed Martin)	33,075[2]	Good
Lux Air	Lux Air Jet Centers	36,000	Excellent
Hangar 18	AerSale/Galaxy International	124,594[2]	Fair
Hangar 52	AerSale	240,000 (approx.)	Fair

Notes: [1]Building names as they were reported in the Draft Facility Condition Assessment, Faithful + Gould, 2015. [2]Gross square footage of building as reported in the Draft Facility Condition Assessment, Faithful + Gould, 2015.
Sources: Lux Air Jet Centers, 2016; Armstrong Consultants, Inc., 2016.

There are 12 T-hangar structures with a cumulative size of approximately 180,000 SF. All T-hangars are steel-framed, metal-sided buildings. The T-hangars are located at two areas on the airfield. Six T-hangar buildings are located on the north hangar apron adjacent to the AerSale apron and hangars, and six are located on the south hangar apron near the Runway 3 threshold. Five of the T-hangars on the north hangar apron can accommodate A/B-I type aircraft, and one is designated for A/B-II type aircraft. On the south hangar apron, four T-hangar buildings are used for A/B-I type aircraft, and two are used for A/B-II type aircraft. One hangar on the north hangar apron and one hangar on the south hangar apron have restrooms. All T-hangars are owned by the City of Phoenix and are in good condition. There are no designated vehicle parking spaces for general aviation aircraft owners on either the north or south hangar aprons. Per City of Phoenix requirements, aircraft owners park their vehicle in their hangar when not occupied by their aircraft.

The Airport also provides nine shade structures. Seven of the shade structures are leased to Lufthansa and can accommodate 39 aircraft. The cumulative size of these structures is 86,400 SF. They are located next to the Lufthansa training facilities on the flight school apron on the northeast portion of the airfield. The remaining two shade structures are maintained by the Airport and can accommodate 22 aircraft. These are located adjacent to the ATCT on the north hangar apron. The cumulative size of the shades structures is estimated to be 35,400 SF. All shade structures are steel-framed with a metal roof and appear to be in good condition.

Table 2-15: Summary of Hangars and Shade Structures

	Conventional Hangars	T-Hangars	Shade Structures	Total
Building/Structure	5	12	9	26
Total Number of Units	11	147	61	219
Total SF (approx.)	459,744	180,000	121,800	761,544

Sources: Draft Facility Condition Assessment, Faithful + Gould, 2015; City of Phoenix Aviation Department, 2016.

2.4 Landside Facilities

Landside facilities accommodate passengers, cargo/freight, and ground transportation vehicles. Landside facilities include terminal buildings, parking areas, entrance roadways, and other buildings that may not necessarily conduct aviation related activities.

2.4.1 Terminal Building

The terminal building is approximately 5,500 SF and is located on the northeast area of the Airport. The terminal building was constructed in 2001 and consists of a lobby, restrooms, conference rooms, and multiple offices for City of Phoenix personnel. The terminal building is in good condition.

A paved vehicle parking lot is available in front of the terminal building adjacent to Goodyear Parkway. It is asphalt with approximately 54 total parking spaces, including 20 covered spaces for City of Phoenix personnel. The pavement is in fair condition.

2.4.2 Fixed Based Operator

An FBO provides services to based and transient aircraft. The extent of services provided varies from airport to airport, but frequently includes aircraft fueling, maintenance and repair, aircraft rental and/or charter services, pilot lounge and flight planning facilities, and aircraft tie-down and/or hangar storage.

The Airport includes one FBO, Lux Air Jet Centers, that is located adjacent to the terminal building. The FBO occupies a new 66,000 SF facility which includes three large conventional hangar spaces. A paved vehicle parking lot is provided at the north end of the facility, which serves as the main public entrance; 37 spaces are provided. Lux Air employs approximately 11 full-time personnel.

2.4.3 Flight Schools

Three flight schools are currently based at the Airport; the two largest include Lufthansa Aviation Training USA, Inc. (Lufthansa, formerly Airline Training Center Arizona [ATCA]) and CTC Aviation (a subsidiary of L-3 Communications). Lufthansa trains pilots for commercial air carriers such as Lufthansa, KLM, ANA, and the German Air Force (Luftwaffe) and has been operating at the Airport since 1970. Lufthansa trained 220 students in 2016. CTC Aviation also train pilots for commercial airlines, and has been operating at the Airport since 2014. CTC trained 108 students in 2016.

The Lufthansa operation is extensive and the entire northeast portion of the Airport is designated for their campus. The campus includes flight operations/administration, a cafeteria, two aircraft maintenance hangars, seven covered aircraft shade structures and apron area (described in previous sections), three dormitories, German Air Force offices and dormitory, flight simulator building/classrooms, storage building, and two sports/recreation facilities. All Lufthansa buildings are in good condition. Designated paved vehicle parking areas are located in front of or adjacent to the majority of campus buildings (approximately 220 parking spaces). **Figure 2-8** graphically depicts the Lufthansa campus.

A third flight school, FLY Goodyear, serves the general public. The flight school trains using four Cessna 172-S aircraft, as well as provides the following services: aircraft checkouts, aircraft rentals, flight reviews, and instrument proficiency checks. FLY Goodyear has been located at the Airport since 2013 and operates from the FBO building.

Figure 2-8: Lufthansa Aviation Training USA Campus

Lufthansa Aviation Training USA

104	Flight Operation and Admin Building Cafeteria
105	Aircraft Maintenance Hangar
106	Aircraft Maintenance Hangar
A-1	Aircraft Ramadas Ramp
107	German Air Force Offices/Dormatories
108	Dormatories
53	Dormatories
54	Dormatories
55	Supplies/Storage
57	FNPT Building/CBT
S-1	Sports Facility Area 1
	2 Swimming pools
	Grill Area
S-2	Sports Facility Area 2
	Tennis Courts
	Basketball Court
	Volleyball Court
	Dedicated Evacuation Area

Lufthansa Aviation Training USA

PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS

2.4.4 Maintenance, Repair, and Overhaul

AerSale (formerly AeroTurbine) is a FAA Class IV repair facility that offers narrow and wide body aircraft maintenance, avionics installations, interior modifications, cargo conversions, aircraft painting, and aircraft dismantlement. In addition, the company offers over 34 acres of aircraft storage/parking for up to 150 commercial aircraft.

AerSale occupies two large buildings/hangars located south of the terminal and Lux Air buildings. Hangar 18 is located adjacent to the aircraft apron and is leased from the Airport. The building is approximately 124,000 SF, and was originally constructed in 1944 and renovated in 1990. The majority of the space is open hangar with some offices (offices are currently leased to Galaxy International). The overall condition of the building is fair to good. Hangar 52 is approximately 240,000 SF. The overall condition of the building also is fair to good. AerSale has a ground lease agreement with the Airport for this building; as such, the Airport is not responsible for its maintenance and upkeep.

Two vehicle parking lots are associated with the AerSale facility. The first is approximately 21,000 SY and paved in asphalt; it has approximately 315 vehicle parking spaces. This lot is in fair condition and can be accessed from Goodyear Parkway, Boeing Boulevard, or Corsair Circle. The second lot is located behind a fence with an access control gate, adjacent to the Hangar 18 facility. Access here is gained from either Corsair Circle or East Ave. The lot is paved, in good condition, and has approximately 68 parking spaces.

The remaining on-airport tenants include Lockheed Martin Flight Services, Galaxy International, and America's Best Crash Courses. Lockheed performs engineering flight testing for various aircraft platforms. Galaxy specializes in aircraft avionics and accessory repair and overhaul services. Lockheed leases approximately 16,000 SF of Hangar 106 from Lufthansa for its operations, and Galaxy also leases a small portion of Hangar 18 from AerSale for their operations. These tenants use the designated AerSale or Lufthansa vehicle parking lot/spaces. America's Best Crash Courses is located in the terminal building and offers civilian and military preparation courses for FAA Airframe and Powerplant (A&P) licenses.

2.4.5 Airport Traffic Control Tower

The ATCT is owned by the FAA and operated by Serco, who provides air traffic control services on behalf of the FAA under a contract. The ATCT is staffed daily from 6:00 am to 9:00 pm. The ATCT consists of two floors (400 SF each floor). The mechanical systems are located on the first floor and management offices are located on the second floor. The cab is approximately 400 SF. The tower is approximately 140 feet tall and controllers have an unobstructed line-of-sight to both runway ends, all taxiways, and aircraft parking aprons. Entry to the tower is through access controlled gates. There are 12 vehicle parking spaces. The facility is in fair condition.

2.4.6 Additional Airport Buildings/Structures

Additional buildings and structures include a maintenance building, airfield electrical building, general aviation wash racks, waste accumulation sites, a deluge water tank and pump house, and the various Goodyear Tire Company extraction/injection/monitoring Superfund site wells. The majority of the facilities are Airport owned and maintained, with the exception of the wash rack located on the flight school apron and the Superfund site wells. **Table 2-16** provides a summary of these facilities.

Table 2-16: Summary of Additional Airport Buildings/Structures

Building	Location	Function	Size (SF)	Condition
Maintenance Building	Northeast; adjacent to terminal building parking lot	Workshop, storage, maintenance yard	2,563[1]	Good
Airfield Electrical Building	Northeast; adjacent to the north T-hangars and ATCT	Airfield lighting controls and back-up generator	1,345[1]	Good
GA Wash Racks	On the southern perimeter of the north T-hangar apron near the electrical building; On the eastern perimeter of the flight school apron	GA aircraft exterior wash facility and air compressor	3,432[1] 800	Good Good
Waste Accumulation	Six sites: south hangar apron, north hangar apron (2), adjacent to Hangar 52, airport maintenance building, and south of flight school apron	Designated collection site for aircraft oil, tires, and other miscellaneous waste materials	Varies	Good
Superfund Site Wells, Piping, and Treatment Plants[2]	Various landside and airside locations	Goodyear Tire and Rubber Co. wells used for the extraction, injection, treatment, and monitoring of the Superfund site ground water plume	-	Good
Deluge Water Tank/Pump House	Northeast; Adjacent to the AerSale and Lux Air facilities at the intersection of Galaxy Way and Corsair Circle	Fire suppression system including a 50,000-gallon tank and corresponding pumps; ties into the AerSale and Lux Air hangars	Pump House: 2,250	Fair

Notes: [1]Gross square footage as reported in the Facility Condition Assessment, 2015; [2]The Superfund wells and equipment are not owned or maintained by the City of Phoenix.
Sources: Draft Facility Condition Assessment, Faithful + Gould, 2015; Armstrong Consultants, Inc., 2016.

2.5 Support Facilities

Aviation support facilities include aircraft fueling, aircraft rescue and firefighting, airport maintenance, utilities, and security.

2.5.1 Fueling Facilities

The City of Phoenix and Lufthansa maintain two separate fuel facilities that are summarized in **Table 2-17**. The facilities are located directly adjacent to one another along the airport perimeter road, southeast of the north hangar apron. The fueling facility owned and maintained by Lufthansa is comprised of four 20,000-gallon capacity tanks containing 100LL Avgas. The City of Phoenix facility is comprised of three 20,000-gallon capacity above-ground tanks. Two of the tanks are designated to hold Jet A fuel, with the remaining tank designated for 100LL Avgas. Both fuel facilities consist of above ground steel tanks within a containment area. Lux Air Jet Centers manages the fuel dispensing operation. Fuel is dispensed to aircraft through mobile fueling trucks. There is a total of 16 fuel trucks owned by the City of Phoenix and the Lufthansa; eight fuel trucks are for 100LL Avgas with a total capacity of 7,850 gallons; the remaining eight fuel trucks are for Jet A with a total capacity of 33,800 gallons.

Table 2-17: Fuel Storage

Owner	Fuel Type	Capacity (gallons)	Total
City of Phoenix	Jet A	20,000	Jet A 40,000 gal
		20,000	
	100 LL	20,000	100 LL 100,000 gal
Lufthansa	100 LL	20,000	
		20,000	
		20,000	
		20,000	

Source: City of Phoenix Aviation Department, 2016.

2.5.2 Aircraft Rescue and Firefighting

There are no airport rescue and firefighting (ARFF) facilities located on-Airport. The Airport is not a Part 139 certificated airport, therefore ARFF equipment is not required. A local fire station is contacted in the event of an emergency that requires firefighting services.

2.5.3 Airport Maintenance

An airport maintenance facility is located adjacent to the terminal building and is approximately 2,560 SF. The building contains a workshop, storage area, and a break room. The facility also has a maintenance yard to store equipment and vehicles. All equipment is owned and operated by the City of Phoenix Aviation Department.

2.5.4 Utilities

Major utilities serving the airport include water, sewer, telephone, natural gas, electricity, and internet services. The City of Goodyear provides water and sewage services. CenturyLink provides telephone and internet services. Natural gas service is provided by Southwest Gas Corporation. Electric service is provided by Arizona Public Service Corporation.

2.5.5 Fencing and Security

The Airport has five-foot-high chain-link fence with a mix of three and five strands of barbed wire around the entire perimeter of the airfield. Four automatic gates are installed throughout the perimeter fencing to allow vehicle access to the airfield for authorized persons. The automatic gates are equipped with an electric chain drive operator and gate access controls. In addition, eight manually operated access gates are located throughout the Airport as well as several gates with access control systems.

2.6 Vehicle Access and Circulation

Primary access roadways and on-Airport roadways are described below.

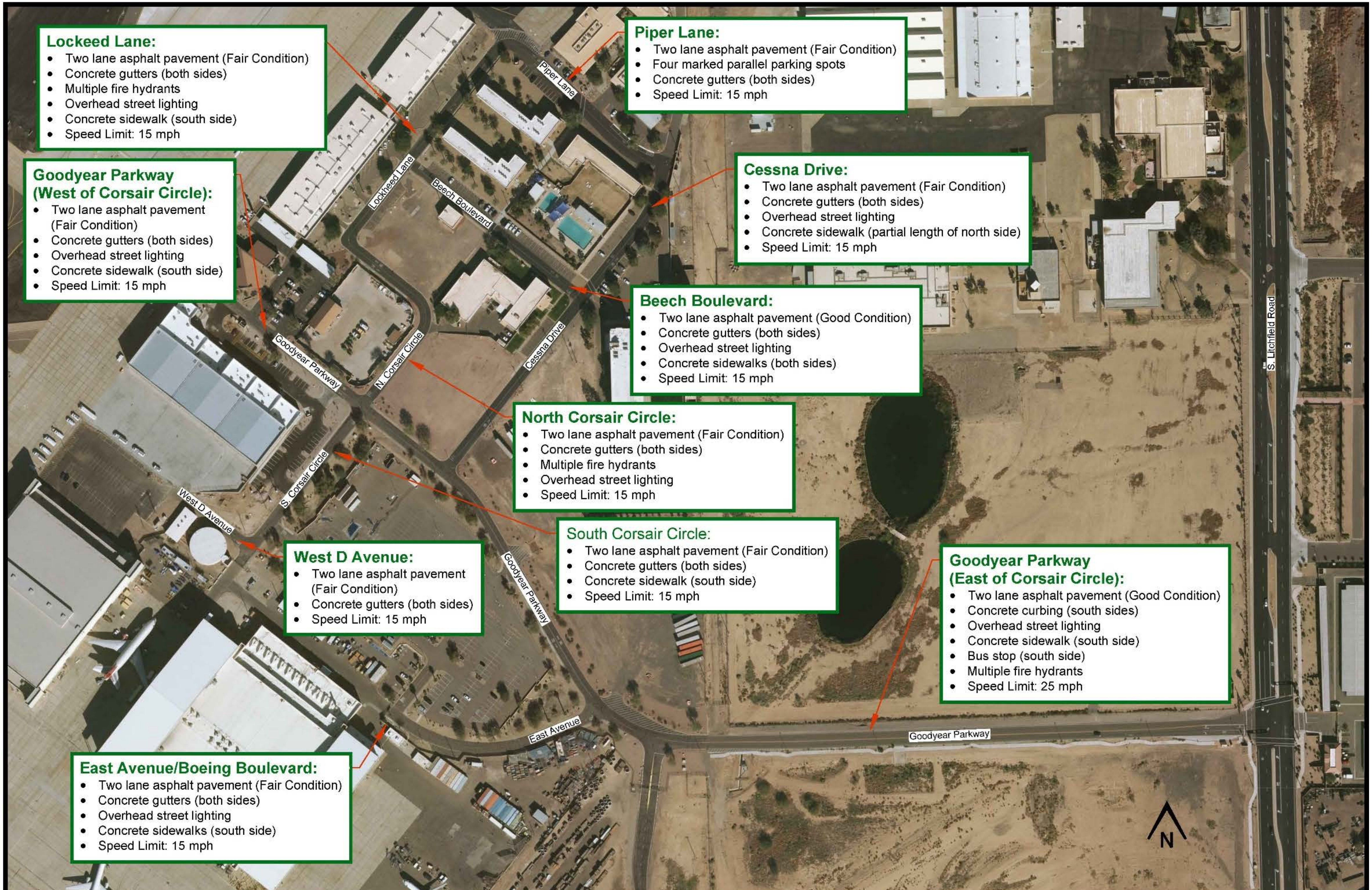
2.6.1 Regional Access

The Airport is accessed from I-10 via Litchfield Road. The Airport may also be accessed from Maricopa County Route 85 or Lower Buckeye Road from the south. The Airport's only entrance is located at the intersection of Litchfield Road and Goodyear Parkway. A public bus stop is located at the southwest corner of Goodyear Parkway and Litchfield Road with a designated bus stop lane, shade structure, and bench. However, this route is not currently active. The closest public bus stop is located at Litchfield and Yuma Roads, approximately half a mile north of the Airport entrance.

2.6.2 Public Access Roadways

Goodyear Parkway is the only public entrance into the Airport. From the intersection at Litchfield Road, the roadway veers west and terminates near the terminal building and vehicle parking lot. To the north of Goodyear Parkway are several ancillary roadways used to access the Lufthansa campus; to the south, other roadways are used to access the AerSale facility. These roadways are not meant for use by the general public. See **Figure 2-9** for a summary of the access roadways located at the Airport.

Figure 2-9: Public Access Roadways and Conditions



Source: Armstrong Consultants, Inc., 2017

2.6.1 Airfield Circulation

Access to the secured airfield areas is provided through Gate 1, located at the end of Goodyear Parkway in between the terminal and Lux Air buildings, Gate 2, located a quarter-of-a-mile west from the main Airport entrance prior to the intersection of Goodyear Parkway and Boeing Way near the AerSale facility, and Gate 3, which is located on the northwest portion of the airfield off Yuma Rd. Entrance via Gate 1 provides access to the terminal apron area, and is primarily for Airport and FBO staff, contractors, or transient customers. Gate 2 provides access to all other areas and is used by tenants who have based aircraft stored in the north or south T-hangars, ATCT personnel, and AerSale staff and affiliates. Gate 3 is utilized as an emergency access point and is not open to the public or Airport tenants. The remainder of the airfield is accessed via the Airport's perimeter road. The airport perimeter road is in overall good condition.

2.7 Environmental Inventory

Environmental considerations are inventoried as part of this Master Plan Update. These considerations will be used to evaluate potential development alternatives to best avoid or reduce impacts on environmental resources.

2.7.1 Air Quality

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) based on health risks for six pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and two sizes of particulate matter (PM) measuring 10 micrometers or less in diameter and PM measuring 2.5 micrometers in diameters. An area with ambient air concentrations exceeding the NAAQS for a criteria pollutant is said to be a nonattainment area. The EPA requires nonattainment areas to demonstrate how they will attain the NAAQS by an established deadline. To accomplish this, states prepare State Implementation Plans (SIPs) which are typically a comprehensive set of reduction strategies and emissions budgets designed to bring the area into attainment.

The Airport is located in a nonattainment area for Particulate Matter (PM_{10}) and Ozone (O_3) 8-hour. The Airport is designated as a maintenance area for Carbon Monoxide (CO) and O_3 1-hour. Likewise, according to the Arizona Department of Environmental Quality (ADEQ) Maricopa Association of Governments (MAG) 2013 Carbon Monoxide Maintenance Plan, based on the 2008 Maricopa County CO Emissions Inventory, the Airport is located in a CO Maintenance area.

2.7.2 Biological Resources

The Endangered Species Act requires Federal agencies to ensure that any action carried out "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat" of critical species.

The Airport is located in the Sonoran Desert which is home to numerous threatened and endangered plant and animal species. However, per the U.S. Fish and Wildlife Service (USFWS), there are no critical habitats within the Airport boundary. Federally listed threatened and endangered species within Maricopa County are depicted in **Table 2-18**.

Table 2-18: Threatened and Endangered Species in Maricopa County

Common Name	Scientific Name	Status
Birds		
California least tern	Sterna antillarum browni	Endangered
Mexican spotted owl	Strix occidentalis lucida	Threatened
Southwestern willow flycatcher	Empidonax traillii extimus	Endangered
Yellow-billed cuckoo	Coccyzus americanus	Threatened
Yuma clapper rail	Rallus longirostris yumanensis	Endangered
Fish		
Colorado pikeminnow	Ptychocheilus lucius	Experimental Population
Desert pupfish	Cyprinodon macularius	Endangered
Gila topminnow	Poeciliopsis occidentalis	Endangered
Razorback sucker	Xyrauchen texanus	Endangered
Roundtail chub	Gila robusta	Proposed Threatened
Spikedace	Meda fulgida	Endangered
Woundfin	Plagopterus argentissimus	Experimental Population
Flowering Plants		
Acuna cactus	Echinomastus erectocentrus var. acunensis	Endangered
Arizona cliffrose	Purshia (=cowania) subintegra	Endangered
Arizona hedgehog cactus	Echinocereus triglochidiatus var.arizonicus	Endangered
Nichol's turk's head cactus	Echinocactus horizonthalonius var. nicholii	Endangered
Mammals		
Lesser long-nosed bat	Leptonycteris curasoae yerbabuenae	Endangered
Ocelot	Leopardus (=felis) pardalis	Endangered
Sonoran pronghorn	Antilocapra americana sonoriensis	Endangered

Source: U.S. Fish and Wildlife Service, November 2016

The USFWS provides a list of migratory birds within their Information Planning and Conservation System tool. A number of migratory birds of concern are located in the vicinity of the Airport. According to the City of Phoenix, the burrowing owl has been found on the airfield in the past. Also, according to the IPaC tool, there are no refuges or fish hatcheries in the vicinity of the Airport. **Table 2-19** depicts the birds on the migratory birds of concern list in the vicinity of the Airport.

Table 2-19: Migratory Birds of Concern in Airport Vicinity

Species Name	Bird of Conservation Concern (BCC)	Seasonal Occurrence in Vicinity of GYR
Bald Eagle Haliaeetus leucocephalus	Yes	Wintering
Bell's Vireo Vireo bellii	Yes	Breeding
Bendire's Thrasher Toxostoma bendirei	Yes	Year-round
Black-chinned Sparrow Spizella atrogularis	Yes	Wintering Breeding
Brewer's Sparrow Spizella breweri	Yes	Wintering
Burrowing Owl Athene cunicularia	Yes	Year-round
Common Black-hawk Buteogallus anthracinus	Yes	Breeding
Costa's Hummingbird Calypte costae	Yes	Breeding
Elf Owl Micrathene whitneyi	Yes	Breeding
Gila Woodpecker Melanerpes uropygialis	Yes	Year-round
Gilded Flicker Colaptes chrysoides	Yes	Year-round
Golden Eagle Aquila chrysaetos	Yes	Year-round
Gray Vireo Vireo vicinior	Yes	Breeding
Lawrence's Goldfinch Carduelis lawrencei	Yes	Year-round
Le Conte's Thrasher toxostoma lecontei	Yes	Year-round
Least Bittern Ixobrychus exilis	Yes	Year-round
Loggerhead Shrike Lanius ludovicianus	Yes	Year-round
Long-billed Curlew Numenius americanus	Yes	Wintering
Lucy's Warbler Vermivora luciae	Yes	Breeding
Mountain Plover Charadrius montanus	Yes	Wintering
Peregrine Falcon Falco peregrinus	Yes	Year-round
Pinyon Jay Gymnorhinus cyanocephalus	Yes	Year-round
Prairie Falcon Falco mexicanus	Yes	Year-round
Rufous-crowned Sparrow Aimophila ruficeps	Yes	Year-round
Short-eared Owl Asio flammeus	Yes	Wintering
Snowy Plover Charadrius alexandrinus	Yes	Breeding
Sonoran Yellow Warbler Dendroica petechia ssp. sonorana	Yes	Breeding
Swainson's Hawk Buteo swainsoni	Yes	Breeding
Western Grebe aechmophorus occidentalis	Yes	Breeding
Willow Flycatcher Empidonax traillii	Yes	Breeding

Source: U.S. Fish and Wildlife Service IPaC tool, November 2016

In addition to the USFWS, the Arizona Game and Fish Department also was referenced. The Airport is located in both the U.S. Geological Survey Perryville and Tolleson quadrants, and according to the Department's HabiMap tool, data from November 2016 reveals federally registered threatened and endangered species do not occur on the Airport. In addition, based on an Arizona Breeding Bird Atlas query in November 2016, the Yellow-billed Cuckoo (*Coccyzus americanus*) is listed as breeding code "Probable" in the Tolleson quadrant. A sensitive species list generated from the Heritage Data Management System based on known occurrences was queried in November 2016 and revealed the Yellow-billed Cuckoo, Southwestern Willow flycatcher, and the Yuma Clapper rail are also located in the Tolleson quadrant.

A Wildlife Hazard Assessment (WHA) was recently prepared for the Airport in 2016. The report contains specific measures and recommendations to reduce wildlife hazards at the Airport, and was based on the results of a 12-month monitoring effort.

2.7.3 Department of Transportation Act, Section 4(f)

Section 4(f) refers to the original section within the U.S. Department of Transportation (DOT) Act of 1966, which established the requirement for consideration of park and recreational lands, wildlife and waterfowl refuges, or any publicly or privately owned historic site listed or eligible for listing on the National Register of Historic Places. Section 4(f) applies to projects that receive funding from or require approval by an agency of the U.S. DOT. There are three Section 4(f) resources in the vicinity of the Airport.

- The Goodyear Ballpark and Recreational Complex is located just west of the Airport adjacent to Bullard Avenue. The complex includes Goodyear Ballpark, the Indians Development Complex, and the Reds Development Complex. Each baseball team has two practice fields for year-round use, while the other eight fields are for use by the City of Goodyear and its residents outside of spring training for recreational leagues and special citywide events. The City of Goodyear approved a bond election in 2004 for $10 million to help build the complex.
- Estrella Mountain Regional Park is located approximately two miles south of the Airport. A County trail leads from the Park north connecting to the Goodyear Ballpark and Recreational Complex and continues west along Western Ave.
- Tres Rios Wetlands is located three miles southeast of the Airport. The wetlands are owned and operated by the City of Phoenix and include hiking trails and a wildlife and waterfowl refuge.

2.7.4 Farmlands

The Farmland Protection Policy Act (Public Law 97-98) directs federal agencies to use criteria developed by the U.S. Department of Agriculture to identify and analyze impacts related to the conversion of farmland to nonagricultural uses. The areas available for development on airport property have been identified by the Maricopa Association of Governments as a transportation land use (existing and future) dedicated for urban development. Therefore, this Act does not apply to Airport development.

2.7.5 Hazardous Materials

According to ADEQ, the Phoenix Goodyear Airport Superfund site is located approximately 17 miles west of Phoenix. The site is divided into a northern portion, referred to as PGA-North (PGAN), and a southern portion, called PGA-South (PGAS). Contamination is not contiguous between the two areas. The designated Potential Responsible Party for PGAS is the Goodyear Tire and Rubber Company.

The cleanup of PGAS has been ongoing for 30 years. According to ADEQ, more than 5,900 pounds of trichloroethylene (TCE) have been removed through two groundwater pump and treat systems; more than 16 pounds of chromium have been removed through a groundwater pump and treat system; and more than 2,500 pounds of TCE have been removed from the subsurface by a Soil Vapor Extraction system. While there are no remaining source areas at PGAS and the contaminant plume has been contained through treatment, ground water monitoring, remediation, and treated water injection continues at the site.

The presence of PGAS will not prohibit future development at the Airport, but potential impacts to the PGAS will need to be considered because progress in groundwater treatment is mandated by Goodyear Tire and

Rubber Company's Consent Decree with the EPA. The EPA formed a Community Advisory Group (CAG) in 2001 that meets on a regular basis (the CAG was disbanded between 2014 and 2016).

There are numerous extraction, injection, and monitoring wells on Airport property, as well as remediation piping and two groundwater treatment plants. Impact to these facilities should be avoided.

Hangar 18 has gone through a significant mitigation project to remove the majority of asbestos and lead, however some known and unknown remnants are still present. The exterior of the building is comprised of asbestos panels, and lead paint remains on the interior steel structure. Likewise, Hangar 52 may also have known and unknown asbestos and lead still present. If the hangars are ever demolished or modified, then procedures that are in compliance with EPA regulations will need to be followed. Potentially, the planned development alternatives for the Airport may impact Hangar 18 and 52. As such, the timeframe to address the known hazardous materials in the hangars will need to be considered in the overall schedule of development.

2.7.6 Historic, Architectural, Archeological, and Cultural Resources

The National Historic Preservation Act of 1966, as amended, requires that a review be made to determine if any properties that are in, or eligible for inclusion in, the National Register of Historic Places are within the area of a proposed airport development action.

Two cultural resource surveys were completed on Airport property in recent years. The first survey was completed in March 2010 on 797 acres for planned infrastructure improvement that included a Class III cultural resource survey. The survey identified two sites: a historic irrigation ditch with four associated culverts, and the NAF Litchfield Park (known today as the Phoenix Goodyear Airport). The earthen ditch carries excess irrigation water through the Airport, and is associated with the historic Roosevelt Canal. Nineteen archeological features and 33 buildings were documented during the Class III pedestrian survey and the historic building inventory, respectively. The archaeological features were representative of the historic military and civilian use of the Airport since 1943 and included primarily historic and modern debris concentrations. Of the standing buildings and structures on Airport property, 11 were constructed prior to 1960. Ten of these are considered contributing to the eligibility of the Airport for listing on the National Register of Historic Places as a historic district. The survey also recorded 19 archaeological features, including the remains of military-related structures, pavement, a transmission line, a pet burial site, and trash deposits of facility related garbage, including small parts of dismantled aircraft.

The second survey, completed in December 2013, consisted of an impact assessment for the proposed Lux Air Jet Center facility located in the proposed Phoenix Goodyear Airport Historic District and included similar findings as the March 2010 survey.

2.7.7 Wetlands

Wetlands are defined in Executive Order 11990, Protection of Wetlands, as "those areas that are inundated by surface or ground water with a frequency sufficient to support…a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas…" The USFWS National Wetlands Inventory (NWI) provides information on the characteristics and locations of wetlands. According to the NWI, two ravines classified as wetlands exist on Airport property. The ravines are irrigation distribution canals belonging to the Roosevelt Irrigation District canal system.

However, the two on-Airport features identified in the NWI were previously determined "not to be waters of the U.S." A jurisdictional delineation for the Airport was completed in 1999 by the U.S. Army Corps of Engineers (ACOE) who determined the irrigation distribution canals are not waters of the U.S. The ACOE recently confirmed their determinations remain valid and that any improvements to the irrigation distribution canals would not require a Section 404/401 permit (email, March 27, 2017). Consideration of impacts to the irrigation distribution canals should be considered as development alternatives are evaluated.

There are two freshwater wetlands located adjacent to parcels off-Airport property. One is 3.38 acres and located approximately 1,200 feet west of the aircraft storage area adjacent to South Bullard Ave. The other is 2.05 acres and located within the Lockheed Martin complex north of Goodyear Parkway and west of S. Litchfield Road. The ACOE regulates the discharge of dredge and/or fill material into waters of the U.S., including wetlands under Section 404 of the Clean Water Act (CWA). Coordination with the ACOE would be needed if any potential airport developments would impact the off-airport wetlands to determine if they are considered waters of the U.S. and subject to Sections 401/404 of the Clean Water Act.

2.7.8 Floodplains

Floodplains are defined as "the lowland and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." According to the Federal Emergency Management Agency (FEMA) National Flood Insurance Rate Map, Bullard Wash, located northeast of the Airport, is considered to be a 100-year flood-plain. The City of Goodyear has undertaken improvements to the Bullard Wash. The recent Bullard Wash Channel improvements included construction of a flood control channel between I-10 and Lower Buckeye Road, along with other maintenance projects associated with the wash. This containment channel controls and diverts the wash before it reaches Airport property.

Much of the area surrounding the Airport is designated as Zone X, which is a 500-year flood-plain, but is protected from a 100-year flood by the Bullard Wash. Two small areas, one just east of the south end of Runway 3-21 and another, east of the Airport are classified as a Zone A floodplain. A Zone A floodplain is a 100-year flood area with depths of 1-3 feet where no base flood elevations have been determined.

The City of Goodyear has obtained ownership of the Bullard Wash and also has obtained approval of a Letter of Map Revision (LOMR) from FEMA for the Bullard Wash excavation that occurred with the Ball Park project. The purpose of the LOMR is to identify the limits of the Special Flood Hazard Areas. According to the City of Goodyear, much of the property adjacent to the Bullard Wash will be removed from the FEMA flood zone designation.

There are no surface waters located on Airport property, and there are no wild and scenic rivers on or near the Airport.

2.7.9 Stormwater Pollution Prevention Plan

The CWA seeks to protect and improve the quality of the nation's waters, and prohibits the discharge of any pollutants to waters of the U.S. unless that discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Initial efforts under the NPDES program focused on reducing pollutants in discharges of industrial process wastewater and municipal sewage. As pollution control measures were implemented, it became evident that there were other sources contributing to the degradation of water quality.

In 1990, the U.S. Environmental Protection Agency (EPA) published regulations governing storm water discharges under the NPDES program. These regulations established requirements for permitting storm water discharges from industrial facilities, construction sites, and municipal storm sewer systems (not affiliated with the Airport system).

In December 2002, EPA delegated the NPDES storm water program to the Arizona Department of Environmental Quality (ADEQ). The Arizona Pollutant Discharge Elimination System (AZPDES) program now has regulatory authority over discharges of pollutants to Arizona surface water.

The Airport is regulated under the Arizona Pollutant Discharge Elimination System Multi-Sector General Permit for Industrial Activities AZMSGP2010-002 (MSGP-2010) released by the ADEQ for its stormwater runoff. A Stormwater Pollution Prevention Plan (SWPPP) was prepared for the Airport in January 2016, which also includes spill prevention and response procedures.

According to the SWPPP, permit coverage for stormwater discharges from Phoenix Airports was originally obtained under the United States Environmental Protection Agency's MSGP-2000, effective October 30, 2000. The MSGP-2000 expired in 2005 and was administratively continued in Arizona until February 1, 2011 when the AZPDES MSGP-2010 became effective.

Stormwater discharges from Phoenix Airports are currently covered under the MSGP-2010. The Airport is covered under the MSGP-2010 Sector S. The stormwater pollution prevention program includes Airport tenants covered by MSGP-2010 Sector S that conduct industrial activities at the Airport as co-permittees. Tenants and operators at the Airport that conduct activities with potential to cause stormwater pollution but are not covered under the MSGP-2010 are required to comply with the SWPPP. For the purposes of compliance with this SWPPP, "co-permittee" refers to all tenants, aviation divisions and operators who conduct activities that may influence stormwater quality. The City of Phoenix Aviation Department submitted Notices of Intent (NOIs) to seek coverage under MSGP-2010 (for Aviation facilities and the co-permittees) by the permit deadline of May 31, 2011.

According to the Airport's SWPPP, there are five storm water system inlets located on the northeast side of the Airport along Yuma Road and the abandoned rail spur between Lockheed Martin and the Airport. There are three storm water system outfalls located on the southwest side of the Airport along MC85. The stormwater on the Airport generally flows in a southwesterly direction. Development alternatives will need to consider impacts to the established stormwater patterns on and adjacent to the Airport.

2.7.10 Wildlife Hazard Assessment

In 2014, ADOT received a grant from the FAA to conduct Wildlife Hazard Assessments (WHA) at various airports in the state, including Phoenix Goodyear Airport. The WHA included 12 months of ongoing monitoring to identify the presence of wildlife species, especially migratory birds, and seasonal fluctuations in the behaviors and abundance of species that occur in the vicinity. According to the WHA, potential wildlife attractants at the Airport include grasslands, weedy vegetation, and bare ground which provide wildlife opportunities for feeding, loafing, and roosting. Various open water drainage ditches are located on the airfield that contain small amounts of water that can attract birds and provide travel corridors for mammals.

Much of the surrounding area is vacant land that attracts doves and pigeons. An off-site water treatment pond is east of the Airport and has the potential to attract birds including mourning doves, shorebirds, and waterfowl. The Agua Fria River is just east of the Airport and the Gila River to the south.

The WHA indicated that there was enough wildlife activity in the area to recommend development of a Wildlife Hazard Management Plan (WHMP). The WHMP recommended the implementation of wildlife hazard management policies and procedures that can be incorporated into daily operations, and site-specific modifications and physical changes that would make the Airport environment less attractive to potentially hazardous wildlife.

2.8 Sustainability

The FAA provides airports with funding to develop comprehensive sustainability planning documents. These documents, called sustainability master plans or airport sustainability plans, include initiatives for reducing environmental impacts, achieving economic benefits, and increasing integration with local communities. To date, the FAA has funded 45 such studies at airports across the U.S.

An evaluation of possible sustainability initiatives will be included in later chapters of this master plan. Sustainability initiatives will focus on initiates that may reduce energy consumption and/or environmental impacts from airport development and operation. The Aviation Department is committed to incorporating sustainability principles and practices into their operations, management, and administrative processes. This is evidenced by the Department's preparation of a Sustainability Management Plan (January 2015), and use of U.S. Green Building Council's Leadership in Energy Environmental Design (LEED®) standards.

2.8.1 Design and Construction

In 2010, the Aviation Department developed the DCS Green Guide addressing horizontal construction projects (e.g., non-building design and construction where LEED® standards do not apply) to reduce impacts and resource use. The DCS Green Guide outlines performance standards for heavy civil design and construction and was intended to be consistent with the sustainability initiatives developed by the City of Phoenix for vertical construction through implementation of Leadership in Energy and Environmental Design (LEED®) standards. The DCS Green Guide includes Life Cycle Analysis and Life Cycle Cost Analysis tools for use during project development.

Specific construction related goals also are applied to each project, such as recycling pavement materials. Where feasible, excavated soils, asphalts, and concrete removed during rehabilitation projects are reused in new pavement designs, reducing waste and debris transportation emissions.

2.8.2 Waste Management and Recycling

The FAA Reform and Modernization Act of 2012, Section 133 of H.R. 658 requires airport master plans to address (1) the feasibility of solid waste recycling; (2) reduction of waste; (3) waste management contracts; and (4) the potential for cost savings or revenue generation. The FAA published guidance for airport recycling programs in 2014.

The Airport has a total of five City of Phoenix owned waste dumpsters located onsite that are serviced and collected by the City's Public Works Department. The waste dumpsters vary in size between 4-yard and 6-yard volumes. Two of the 4-yard dumpsters are located at the South Hangar Apron area, with the remaining two located at the North Hangar Apron area and in the maintenance yard. The 6-yard dumpster is located adjacent to Gate 1. All of the waste dumpsters are scheduled for pick-up on a weekly basis. A 30-yard waste dumpster is also located at the Airport and is designated for green waste only. This waste dumpster is collected on demand approximately once a month. The City of Phoenix also rents a 40-yard waste dumpster approximately once a year for the cleaning of hangars at the Airport.

Currently, opportunities to recycle paper, plastics, oils, and metals are limited at the Airport even though tenants have expressed an interest in increasing their recycling. Recyclables are collected in the terminal building, and other recyclable containers are located in various locations around the Airport. The Aviation Department has a dedicated Recycling Coordinator who manages and plans to expand the existing recycling program and provide additional recycling to tenants.

A portion of the AerSale business includes recycling metal scraps and other various aircraft parts. This is done privately as part of AerSale's operation, but is still considered a key Airport recycling effort.

2.8.3 Air Quality

Currently, the Aviation Department's one car, three pick-up trucks, and one van are not powered with alternate fuels. There is one electric golf cart located at the Airport for staff use around the terminal area. Due to a lack of alternative fuel infrastructure, alternative fuel vehicles are currently not practical or cost effective enough to establish an alternative fuel fleet. The Aviation Department is committed to exploring opportunities to establish a more sustainable fleet at the Airport.

The Aviation Department uses a number of methods to reduce airborne dust. Leftover millings from aviation projects are used to create roadway surfaces and gravel is applied to disturbed soil areas. Because temporary air pollution may occur as a result of construction projects, the design and construction of proposed improvements will incorporate Best Management Practices (BMP) and/or Management Mitigation Measures to reduce air quality impacts including minimizing land disturbance, using water trucks for dust suppression, covering trucks when hauling soil, and the use of wind breaks. These practices are selected based on the site's characteristics. Short-term and temporary impacts during construction are required to conform to FAA AC 150/5370-10G, *Standards for Specifying Construction of Airports*.

In addition, there is an industry/government collaborative effort underway known as the Piston Aviation Fuels Initiative (PAFI). The mission of PAFI is to evaluate candidate unleaded replacement fuels and identify those fuels best able to technically satisfy the needs of the existing aircraft fleet, while also considering the production, distribution, cost, availability, environmental and health impacts of those fuels. Owners and operators of more than 167,000 piston-engine aircraft operating in the U.S. rely on aviation gasoline (avgas) for fuel. Avgas is the only remaining lead-containing transportation fuel. Avgas emissions have become the largest contributor to the low levels of lead emissions produced. The City of Phoenix Aviation Department may be interested in exploring the findings of the alternative Avgas solution. As such, the development alternatives should consider how a new type of fuel for the general aviation community may impact the Airport and its fueling infrastructure.

2.8.4 Water Management and Water Quality

The Aviation Department has implemented water conservation measures to support City's goals and sustainability planning. As part of the Aviation Department's Sustainability Management Plan, the City of

Phoenix conducted an inventory of all metered water use at the Airport in order to establish a water usage baseline. The inventory included water meters for active accounts listed by the Aviation Department and City of Goodyear Water Department. Based on the findings of the Water Meter Inventory Report, the Airport's water usage has decreased 45 percent since 2010. **Table 2-20** summarizes water usage at the Airport.

Table 2-20: Annual Water Usage

Year	Annual Use (Gallons)
2010	1,049,444
2011	584,188
2012	694,892
2013	521,356
2014	477,224

Source: Water Meter Inventory Report Compilation, March 2015.

As part of the data gathering for this Master Plan, some water conservation and sustainability measures were observed. A bottle filling station is available in the terminal building. Low flow fixtures are provided in the restrooms of the terminal building and common break area. Low water use landscaping and irrigation systems are provided in all of the common areas that are owned and maintained by the Airport.

2.8.5 Energy Management

The Airport purchases electricity from Arizona Public Service Company. In recent years, the Airport has implemented several energy initiatives including installation of new airfield lighting with LED type fixtures. A summary of the Airport's energy usage by service area from 2012–2016 is provided in **Table 2-21.**

Table 2-21: Energy Usage by Service Area (2012-2016)

Service Area	2012	2013	2014	2015	2016[3]
Beacon					
kWh	0[1]	42	26[2]	55	25
Costs	$257	$282	$278	$292	$261
Building 18					
kWh	32,700	37,200	36,000	18,900[3]	-
Costs	$11,337	$10,048	$11,735	$8,547[3]	-
Building 48					
kWh	183,760	197,720	193,920	200,800	170,320
Costs	$22,638	$25,836	$25,504	$26,935	$23,377
Building 56					
kWh	4,436	5,569	5,656	1,053	191
Costs	$969	$1209	$1228	$464	$287
Gate					
kWh	1,435	1,618	1,308	1,439	1,334
Costs	$473	$529	$507	$517	$474
Litchfield Road					
kWh	20,412	20,412	20,412	20,412	18,171
Costs	$7,744	$7,850	$7,841	$7,982	$7,676
S-Fuel					
kWh	5,325	7,528	9,542	8,771	8,683
Costs	$1,056	$1,466	$1,806	$1,721	$1,694
Signs					
kWh	1,014	1,088	980	1,138	1,023
Costs	$408	$446	$430	$468	$423
ST Hangar					
kWh	33,320	34,960	34,080	30,400	23,600
Costs	$5,561	$6,075	$5,981	$6,024	$5,330
Terminal					
kWh	452,940	1,110,720	1,213,120	1,307,460	964,100
Costs	$68,763	$140,530	$150,919	$162,692	$133,657
Total					
kWh	735,342	1,416,857	1,515,044	1,590,428	1,189,688
Costs	$119,206	$194,271	$206,229	$215,642	$173,179

Notes: [1]Data not available. [2]Data missing for certain months. [3]Partial year of data.
Sources: LeighFisher Sustainability Baseline Report – Phoenix Airport System based on City of Phoenix, PWD data, 2013 and Arizona Public Service Electric Company.

Chapter 3

AVIATION ACTIVITY FORECASTS

The forecasts presented in this chapter represent a 20-year outlook of aviation-related activity at Phoenix Goodyear Airport (GYR, Goodyear, or the Airport) for the intended use of facility planning purposes.

3.1 Summary of Results

As described in subsequent sections, forecasts were prepared for two primary activity indicators at the Airport – based aircraft and aircraft operations. Several methodologies were evaluated and a preferred forecast was selected for each indicator. The preferred forecasts were compared to the Federal Aviation Administration's (FAA's) Terminal Area Forecast (TAF) as required in a master plan.

Forecasts were prepared based on historical levels of activity, discussions with Airport tenants including the flight schools and MRO businesses, and an examination of local socioeconomic trends and regional and national aviation industry trends. It is anticipated that the Airport will experience steady, linear growth in based aircraft and aircraft operations through the 10-year timeframe; then, while based aircraft continue a general linear trend, more elevated levels of operational activity are expected to occur in the 11- to 20-year horizon. These higher activity levels are anticipated based on reported plans for continued tenant development and expansion, both by the flight school operators and the MROs. Based aircraft are anticipated to increase from 222 in 2016 to 315 in 2036, and aircraft operations are projected to grow from 123,394 in 2016 to 200,360 in 2036.

The preferred master plan update forecasts were compared to the FAA's TAF released in January 2017. For all classes of airports, forecasts for based aircraft and total operations are considered consistent with the TAF if they meet the following criterion: Forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period. If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used in FAA decision making. All of the preferred forecasts for 5- and 10-year activity levels are considered consistent with the TAF.

A summary of preferred forecasts for aircraft operations by type and based aircraft is shown in **Table 3-1**. As shown, total operations at the Airport are anticipated to increase from 123,394 in base year 2016 to 200,360 in 2036, which represents a compounded annual growth rate (CAGR) of 2.45 percent. Based aircraft are projected to increase from 222 in 2016 to 315 in 2036, which reflects a CAGR of 1.76 percent.

Another important evaluation in the forecast process is identification of the future critical or design aircraft or aircraft family. The Airport's current approved Airport Layout Plan (ALP) from 2008 shows the critical aircraft family has an airport reference code (ARC) of D-IV. Based on existing and projected levels of large aircraft operations at the Airport fueled by continuing growth in corporate and MRO tenant activity, it is recommended that the Airport's ultimate design aircraft remain D-IV.

The remainder of the chapter summarizes the process to develop the forecasts of future aviation demand.

Table 3-1: Forecast Summary: Preferred Methodologies

	Operations						
Year	Air Carrier	Itinerant GA	Local GA	Itinerant Military	Local Military	Total	Based Aircraft
2016	108	45,941	73,090	3,072	1,183	123,394	222
2021	336	48,049	79,767	3,091	1,103	132,346	241
2026	350	50,363	85,122	3,091	1,103	140,030	265
2031	364	52,356	113,548	3,091	1,103	170,462	290
2036	379	53,759	142,028	3,091	1,103	200,360	315
CAGR 2016–2036	6.47%	0.79%	3.38%	0.03%	-0.35%	2.45%	1.76%

Sources: FAA TAF issued January 2017; Woods and Poole, Inc.; Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.2 Introduction

This chapter discusses the background, assumptions, and methodologies used to project future aviation demand at the Airport. It is important to recognize that there can be short-term fluctuations in an airport's activity due to a variety of factors that can be difficult to anticipate. The forecasts developed in this document are intended to consider the routine ebb and flow in aviation activity levels while projecting what the long-term trend of activity will most likely be. The resulting projections provide a meaningful framework to guide the analyses for future Airport development needs and alternatives.

The projections of aviation demand developed for the Airport are documented in the following sections:

- Historical and current aviation activity
- National aviation trends
- Socioeconomic trends
- Other relevant trends and activities
- Previous forecasts
- Forecast assumptions and approach
- Based aircraft forecasts
- Aircraft operations forecasts
- Forecast summary
- FAA forecast review and approval

This forecast analysis includes methodologies that consider historical aviation trends at the Airport, in the Phoenix metropolitan region, and throughout the nation. Local historical data were collected from FAA sources including TAF records, Air Traffic Activity System (ATADS), Traffic Flow Management System Counts (TFMSC), 5010-1 Airport Master Record, and airport traffic control tower (ATCT) records, as well as the 2008 Arizona State Aviation System Plan (SASP). In addition, socioeconomic data for the City of Goodyear, Phoenix Metropolitan Statistical Area (MSA), and State of Arizona were examined to track local trends and conditions that can impact general aviation demand. Projections of aviation activity for the Airport were prepared for near-term (2021), mid-term (2026), and long-term (2036) timeframes.

3.3 Historical and Current Aviation Activity

The FAA categorizes a wide range of general aviation uses including personal and recreational flying, business transportation, instructional flying, commercial sight-seeing operations, and on-demand operations including air taxi (i.e., charter), air tours, and medical transport services. Because the Airport supports each of these general aviation (GA) activities, as well as military activity and air carrier operations generated by aircraft MRO tenants, the Airport is impacted by many factors encompassing economic, social, and industry-wide trends within multiple geopolitical arenas. Perhaps most uniquely, the Airport serves as a major provider of flight instruction for international students conducted by Lufthansa Aviation Training USA and CTC Aviation, which brings an additional layer of complexity to projected aviation activity. Aviation forecasts must be developed within this larger context to most effectively understand the Airport's role in the broader aviation system while planning for its future.

At general aviation airports such as Goodyear, there are two primary indicators of activity: based aircraft and aircraft operations. A based aircraft is generally defined as an aircraft that is considered airworthy and is stored at an airport for the majority of the year. It should be noted that commercial aircraft that are stored by MROs at the Airport are not considered based aircraft and are not included in the forecasts presented in this master plan update. These aircraft are considered to be either based at other airports and temporarily stored at the Airport, or are in various stages of being parted out. An aircraft operation represents either a take-off or landing conducted by an aircraft; as a result, a take-off and a landing—such as those that occur with flight training "touch-and-go" practice flights—counts as two operations.

Historical based aircraft and operations data for the Airport provides a baseline for the consideration of projections of future activity at the Airport. While historical trends are not always reflective of future periods, historical data provides insight into how local, regional, and national demographic and past events have contributed to aviation-related trends nationally and at a specific airport.

The following sections summarize overall historical aviation-related activity at the Airport in terms of aircraft operations and the number of based aircraft. In general, within the aircraft sectors served by the Airport, the Airport has experienced similar historical trends in activity as has been seen nationwide. The Airport has primarily been impacted by the economic recession of 2008–2010 and the relocation of a former flight school in 2014. These and other conditions were considered in the process of developing forecasts for the Airport's future activity.

3.3.1 Based Aircraft

Several sources of information related to existing and historical based aircraft information were consulted, from both the FAA and from the Airport. The FAA TAF is the official FAA forecast of aviation activity for U.S. airports and contains historic data and projections for active airports in the National Plan of Integrated Airport Systems (NPIAS).

Table 3-2 presents a summary of historical based aircraft at the Airport based on the FAA TAF and records provided by the Airport. As shown, there is a significant difference between the number of aircraft reported by the FAA TAF and the Airport historically and in base year 2016. The TAF estimated a slight overall increase in based aircraft between 2007 and 2016 with a CAGR of 0.33 percent, while Airport records show a slight decrease during that same timeframe (-0.25 percent CAGR). It should be noted that CAGR calculates a constant rate of change over a given time period. It dampens the effect of volatility during periods that experience significant change, and is essentially a "smoothed" annual growth rate. Because data provided by the Airport represents actual counts, the Airport's recorded data is the preferred source to develop forecasts of based aircraft in this master plan.

Table 3-2: Historical Based Aircraft

Year	FAA TAF	Airport Records	Percent Difference
2007	198	227	14.6%
2008	254	233	-8.3%
2009	254	254	0.0%
2010	218	248	13.8%
2011	218	244	11.9%
2012	223	240	7.6%
2013	184	191	3.8%
2014	191	195	2.1%
2015	200	210	5.0%
2016	204	222	8.8%
CAGR 2007–2016	0.33%	-0.25%	N/A
CAGR 2012–2016	-2.20%	-1.93%	N/A

Sources: FAA TAF issued January 2017; Airport records, 2016.

3.3.2 Aircraft Operations

Annual aircraft operations represent the number of take-offs and landings occurring at the Airport during a calendar year. Historical operations data include operations conducted by based aircraft, as well as operations conducted by itinerant aircraft.

Table 3-3 presents an overview of historical aircraft operations at the Airport over the last 10 years as reported by the FAA TAF and the ATCT. Both the TAF and the ATCT report significant declines in total operations between 2007 and 2016. Similar to based aircraft, there is a significant difference between operations reported in the FAA TAF and ATCT records. In base year 2016, the ATCT recorded approximately 123,000 operations, while the TAF estimated nearly 114,000. This is a significant difference, especially as airport forecasts submitted to the FAA for review are evaluated based on their divergence from the TAF. It should be noted that TAF reports data based on the FAA fiscal year, while the ATCT reports operational data in calendar years. While this does not account for the majority of the discrepancy, it does have a slight impact on the difference in the final reported numbers.

Table 3-3: Historical Annual Aircraft Operations

Year	FAA TAF	ATCT	Percent Difference
2007	187,114	188,136	0.5%
2008	180,703	177,994	-1.5%
2009	179,992	178,019	-1.1%
2010	152,629	145,953	-4.6%
2011	141,820	138,626	-2.3%
2012	143,074	144,174	0.8%
2013	134,333	120,741	-11.3%
2014	80,991	86,499	6.4%
2015	107,848	111,461	3.2%
2016	114,360	123,394	7.3%
CAGR 2007–2016	-5.32%	-4.58%	N/A
CAGR 2012–2016	-5.45%	-3.82%	N/A

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016.

Airport forecasts conducted as part of a planning study such as this master plan update are reviewed in terms of their divergence from the 5- and 10-year periods. If an airport's 5-year forecasts are greater than 10 percent of the TAF and/or 10-year forecasts are greater than 15 percent, the forecasts must be reviewed and approved by FAA headquarters rather than by the local FAA Airports District Office (ADO). The FAA review and approval process is described in greater detail in subsequent sections of this chapter. For the purposes of this master plan update, historical operations recorded by the ATCT are used as the preferred source to develop forecasts.

3.3.3 Comparison of Activity Within the Region

An important aspect for consideration in the forecasting process is an airport's role within the area that it serves and how its activity compares with the local and regional markets. The Phoenix metropolitan area has a relatively high number of airports that serve both commercial and general aviation activity. **Table 3-4** identifies historical activity at the Airport compared with other airports in the Phoenix area that are equipped with an ATCT. These airports include Chandler Municipal (CHD), Phoenix Deer Valley (DVT), Falcon Field (FFZ), Glendale Municipal (GEU), Phoenix-Mesa Gateway (IWA), Phoenix Sky Harbor International (PHX), and Scottsdale (SDL).

Historically, the Airport has historically accounted for between 5 to 8.5 percent of based aircraft in the region and 6 to 11 percent of annual operations (scheduled commercial operations have been removed from the data because the Airport does not provide scheduled commercial service).

Table 3-4: Comparison of Regional Activity at Airports with ATCTs

Fiscal Year	CHD		DVT		FFZ		GEU	
	Total Ops	Based Aircraft	Total Ops	Based Aircraft	Total Ops	Based Aircraft	Total Ops	Based Aircraft
2007	260,636	449	396,527	1,149	286,311	988	150,729	402
2008	254,276	378	366,391	943	328,455	628	140,151	220
2009	205,771	378	409,042	943	277,856	850	115,557	220
2010	179,609	375	369,075	981	225,540	605	81,670	196
2011	158,877	330	331,377	981	212,678	605	93,165	196
2012	189,980	333	358,623	995	185,281	611	71,357	285
2013	204,141	333	356,282	975	243,141	611	71,383	289
2014	224,207	312	337,017	965	255,288	680	64,943	289
2015	218,031	299	364,122	951	243,382	662	76,835	268
2016[1]	215,373	308	365,903	972	270,044	675	72,051	271
CAGR 2007–2016	-2.10%	-4.10%	-0.89%	-1.84%	-0.65%	-4.14%	-7.87%	-4.29%

Fiscal Year	GYR		IWA		PHX		SDL	
	Total Ops	Based Aircraft	Total Ops	Based Aircraft	Total Ops	Based Aircraft	Total Ops	Based Aircraft
2007	188,136	227	298,085	111	131,274	117	188,496	471
2008	177,994	233	251,923	96	119,722	109	198,051	392
2009	178,019	254	183,548	89	92,037	90	166,267	392
2010	145,953	248	171,415	89	87,398	67	143,313	341
2011	138,626	244	170,457	131	86,505	60	140,990	341
2012	144,174	240	156,117	128	95,520	60	145,729	306
2013	120,741	191	160,248	105	91,704	68	139,590	306
2014	86,499	195	215,211	105	79,781	64	149,910	306
2015	111,461	210	203,446	118	78,162	61	148,526	330
2016[1]	123,394	222	224,843	120	82,230	61	155,483	337
CAGR 2007–2016	-4.58%	-0.25%	-3.08%	0.87%	-5.06%	-6.98%	-2.12%	-3.65%

Note: [1] FAA estimate for the TAF reported data (all airports except GYR)
Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016; Airport Records, 2016.

Table 3-5 presents an overview of the historical activity in the region including the airports listed in **Table 3-4.** Data for the other Phoenix area airports was obtained from FAA TAF, while data for the Airport reflects information from the ATCT and Airport records. The entire region has experienced a decrease in operations and based aircraft. As shown, historical operations at the Airport have decreased at a higher rate between 2007 and 2016 than the region as a whole, but the number of based aircraft has decreased only slightly during that same timeframe.

Table 3-5: Historical Activity – Regional Comparison

Year	Operations			Based Aircraft		
	PHX Airports	GYR	% GYR	PHX Airports	GYR	% GYR
2007	1,899,067	188,136	9.9%	3,885	227	5.8%
2008	1,839,558	177,994	9.7%	3,020	233	7.7%
2009	1,629,974	178,019	10.9%	3,216	254	7.9%
2010	1,410,573	145,953	10.3%	2,872	248	8.6%
2011	1,335,737	138,626	10.4%	2,862	244	8.5%
2012	1,345,524	144,174	10.7%	2,941	240	8.2%
2013	1,400,663	120,741	8.6%	2,871	191	6.7%
2014	1,407,139	86,499	6.1%	2,912	195	6.7%
2015	1,440,171	111,461	7.7%	2,889	210	7.3%
2016	1,500,122	123,394	8.2%	2,948	222	7.5%
CAGR 2007–2016	-2.59%	-4.58%	-	-3.02%	-0.25%	-

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT and Airport Records, 2016.

3.4 National Aviation Trends

The preparation of forecasts of aviation-related demand requires a general understanding of recent and anticipated national trends in the aviation industry. National trends provide insight for the development of aviation activity projections for the Airport. Some trends in the aviation industry will undoubtedly have a greater impact on the Airport than others.

According to the FAA's *2017-2021 NPIAS Report*, there are 5,136 public use airport facilities located throughout the U.S. Sixty-five percent (3,332) of those airports are included in FAA's NPIAS, which indicates they are considered significant to the national transportation system and thus eligible for federal funding. General aviation airports comprise 85 percent of the airports listed in the NPIAS. Because of its role in regional economy, level of activity, location in a metropolitan area, and other factors, the NPIAS defines the Airport as a regional general aviation airport, as well as a reliever. Regional general aviation airports have high levels of activity with some jets and multi-engine propeller aircraft and an average of 90 total based aircraft, including three jets.

Despite its role within the NPIAS, activity at the Airport is unique in that the Airport experiences a significant amount of flight training operations, including training of the German Air Force, and air carrier operations associated with the MRO tenants. These characteristics are essential to the Airport's long-term financial viability, and facility planning should accommodate tenants and their operational capabilities to the extent possible. It is also important to note that these activities are growing due to national factors such as the shortage of airline pilots, as well as the need to maintain the commercial airline fleet to serve the industry. The commercial airline industry needs are the primary drivers of the Airport's aviation activity. The following sections examine the key trends most applicable to the Airport in its role as a regional general aviation airport with significant flight training and MRO-associated operations. These trends are considered in the development of the forecasts of future activity at the Airport.

3.4.1 FAA-Projected General Aviation Forecast Trends

The FAA publishes annual forecasts which summarize the primary trends affecting aviation activity including U.S. and international economic conditions, projected fuel costs, and emerging technologies. FAA forecasts provide detailed analyses of historical and forecasted aviation trends and provide a general framework for anticipated future regional and national aviation activity.

The FAA forecast specifically addresses the historical and future trends affecting general aviation activity. General aviation activity has historically experienced cyclical periods of growth and retraction based on factors such as economic conditions, pilot demographics, regulatory conditions, technologies, and industry reliance on general aviation activity. While national general aviation activity experienced rebounded growth during the mid- and late-1990s, the terrorist attacks of 2001 and the economic downturn of 2008 dampened this nationwide activity, although some pockets of the U.S. have continued to realize growth in general aviation.

Measures of general aviation activity in the U.S., annually monitored and forecasted in the FAA aerospace forecasts, include active pilots, active hours flown, and active aircraft fleet. Each of these measures will continue to evolve through the 21-year FAA forecast horizon as each category (and sub-category therein) aligns and realigns with current and projected future conditions. Future growth is anticipated to be focused in the corporate and business aviation sectors that are most often tied to turboprop and jet general aviation aircraft, while the greatest decreases are expected by the piston aircraft as the fleet, and their pilots, continue to age.

The following sections summarize the key findings of each measure, based on the most recent available information contained in *FAA Aerospace Forecasts, Fiscal Years 2017–2037*.

3.4.2 Active Pilots

An active pilot is defined by the FAA as those persons with a pilot certificate and a valid medical certificate. **Table 3-6** presents historical and projected U.S. active pilots data by certificate type. It should be noted that instrument-rated pilots should not be added to other categories in deriving the total, as these are a subset of the total number of pilots. Instrument-rated pilots are those that are capable of flying larger, more sophisticated aircraft.

Between 2010 and 2016, the total number of active pilots continued its downward trajectory with a decrease of approximately 1.2 percent, dropping from a total of 627,588 active pilots to 584,362 active pilots—one of its lowest numbers in decades. Much of this decrease is due to the aging pilot population and rising cost to own and operate aircraft. Over the next 21-year forecast period, the total number of active pilots is projected to increase by a CAGR of 0.05 percent, with the total number of active pilots projected to reach 590,715 by 2037.

The projected increase can be partially attributed to recent legislation that relieves some of the limitations associated with pilot medical certificates, as well as the need to train commercial airline pilots for the probable growth in worldwide commercial aviation activity. These future commercial pilots are required to first train in general aviation aircraft.

Table 3-6: FAA Projected General Aviation Forecast Trends – Active Pilots

Year	Students	Recreational	Sport Pilot	Private	Commercial	Airline Transport	Rotorcraft Only	Glider Only	Total
Historical									
2010	119,119	212	3,682	202,020	123,705	142,198	15,377	21,275	627,588
2011	118,657	227	4,066	194,441	120,865	142,511	15,220	21,141	617,128
2012	119,946	218	4,493	188,001	116,400	145,590	15,126	20,802	610,576
2013	120,285	238	4,824	180,214	108,206	149,824	15,114	20,381	599,086
2014	120,546	220	5,157	174,883	104,322	152,933	15,511	19,927	593,499
2015	122,729	190	5,482	170,718	101,164	154,730	15,566	19,460	590,039
2016	128,501	175	5,889	162,313	96,081	157,894	15,518	17,991	584,362
CAGR 2010–2016	1.27%	-3.15%	8.14%	-3.58%	-4.12%	1.76%	0.15%	-2.76%	-1.18%
Forecast									
2017	130,950	175	6,350	160,000	92,500	159,600	15,480	17,700	582,755
2018	132,150	175	6,700	158,050	89,950	159,900	15,500	17,500	579,925
2020	133,400	175	7,450	154,450	86,900	161,100	15,700	17,300	576,475
2025	135,900	170	9,000	149,450	84,350	164,800	16,850	16,850	577,370
2030	138,350	165	10,850	144,950	83,850	168,900	18,500	16,650	582,215
2037	141,200	165	13,600	139,000	83,800	175,100	21,300	16,550	590,715
CAGR 2016–2037	0.45%	-0.28%	4.07%	-0.74%	-0.65%	0.49%	1.52%	-0.40%	0.05%

Note: [1]An active pilot is a person with a pilot certificate and a valid medical certificate.
Source: FAA Aerospace Forecasts, Fiscal Years 2017–2037.

3.4.3 Active Hours Flown

Aircraft hours flown by active aircraft reflects aircraft utilization, frequency, and duration of use. Since 2010, single-engine piston hours flown have decreased from 12,161 to 11,191, with the lowest hours reported in 2014 at 10,395. This downward trajectory is projected to continue over the forecast horizon at a CAGR of approximately 0.9 percent, primarily due to the retiring fleet of single-engine aircraft coupled with aging owners who are no longer flying. Within these same timeframes, multi-engine piston aircraft have historically decreased at 2.1 percent and are anticipated to continue to decline at a moderate CAGR of 0.11 percent by 2037. A summary of historical and projected active general aviation hours flown is provided in **Table 3-7.**

As total piston hours wane, turboprop and jet hours are anticipated to steadily increase. Together, turbine aircraft hours increased 2.8 percent between 2010 and 2016, a trend that is anticipated to continue at a CAGR of 2.5 percent over the forecast horizon. Turbo jets are anticipated to grow most significantly, reaching 7,736 hours by 2037—compared to just 4,173 hours in 2016. Much of this growth is associated with an overall upsurge in corporate and business activity as more business enterprises realize the productivity benefits of corporate air travel.

3.4.4 Active General Aviation Aircraft Fleet

In its *Aerospace Forecast 2017–2037*, the FAA reports projected growth rates of the active general aviation and air taxi fleet for all airports in the U.S. An active aircraft is defined as one that has a current registration and was flown at least one hour during the calendar year. As depicted in **Table 3-8,** driven by turboprop, jet, and rotorcraft activity, the overall forecast for the number of general aviation aircraft in the fleet remains stable to positive, with active aircraft in the U.S. fleet projected to increase at a CAGR of 0.08 percent. While modest, this reverses the historical downward trajectory reported from 2010 to 2016.

Over the 21-year planning horizon, the fleet is anticipated to reflect similar trends, with growth in the turbine (1.9 percent), experimental (1.96 percent), and sport aircraft (4.1 percent) fleet counterbalancing the 0.8 percent annual decrease in the single- and multi-engine piston aircraft fleet. These trends also are reflected in the U.S. active hours flown and can be attributed to similar causes within the industry.

Table 3-7: FAA Projected General Aviation Forecast Trends – General Aviation Hours Flown

Year	Piston			Turbine			Rotorcraft			Experimental[1]	Sport Aircraft[1]	Other	Total GA Hours
	Single-Engine	Multi-Engine	Total	Turbo prop	Turbo Jet	Total	Piston	Turbine	Total				
Historical													
2010	12,161	1,818	13,979	2,325	3,375	5,700	794	2,611	3,405	1,226	311	181	24,802
2011	11,844	1,782	13,626	2,463	3,407	5,871	757	2,654	3,411	1,203	278	181	24,570
2012	11,441	1,766	13,206	2,733	3,418	6,151	731	2,723	3,454	1,243	169	180	24,403
2013	10,706	1,646	12,352	2,587	3,488	6,076	636	2,312	2,949	1,191	173	135	22,876
2014	10,395	1,573	11,967	2,613	3,881	6,494	818	2,424	3,242	1,244	165	158	23,271
2015	11,217	1,608	12,825	2,538	3,837	6,375	798	2,496	3,294	1,295	191	162	24,142
2016	11,191	1,603	12,794	2,539	4,173	6,712	784	2,565	3,350	1,335	204	162	24,558
CAGR 2010–2016	-1.38%	-2.08%	-1.47%	1.48%	3.60%	2.76%	-0.21%	-0.21%	-0.27%	1.43%	-6.79%	-1.83%	-0.16%
Forecast													
2017	11,007	1,596	12,604	2,538	4,445	6,983	777	2,636	3,413	1,372	218	163	24,753
2018	10,760	1,590	12,350	2,539	4,655	7,194	793	2,705	3,497	1,411	232	163	24,847
2020	10,416	1,577	11,992	2,545	5,064	7,609	828	2,843	3,671	1,479	260	163	25,174
2025	9,901	1,550	11,451	2,662	5,894	8,556	919	3,174	4,092	1,640	335	164	26,239
2030	9,501	1,543	11,044	2,947	6,662	9,609	999	3,488	4,488	1,799	414	165	27,519
2037	9,187	1,566	10,754	3,561	7,736	11,296	1,118	4,005	5,124	2,007	529	167	29,876
CAGR 2016–2037	-0.94%	-0.11%	-0.82%	1.62%	2.98%	2.51%	1.70%	2.14%	2.04%	1.96%	4.64%	0.14%	0.94%

Note: [1]Experimental light-sport category previously shown under sport aircraft was moved under the experimental aircraft category in 2012. All figures for aircraft hours flown are reported in thousands.
Source: FAA Aerospace Forecasts, Fiscal Years 2017–2037.

Table 3-8: FAA Projected General Aviation Forecast Trends – General Aviation Fleet

Year	Piston			Turbine			Rotorcraft			Experimental[1]	Sport Aircraft[1]	Other	Total GA Fleet
	Single-Engine	Multi-Engine	Total	Turbo prop	Turbo Jet	Total	Piston	Turbine	Total				
Historical													
2010	139,519	15,900	155,419	9,369	11,484	20,853	3,588	6,514	10,102	24,784	6,528	5,684	223,370
2011	136,895	15,702	152,597	9,523	11,650	21,173	3,411	6,671	10,082	24,275	6,645	5,681	220,453
2012	128,847	14,313	143,160	10,304	11,793	22,097	3,292	6,763	10,055	26,715	2,001	5,006	209,034
2013	124,398	13,257	137,655	9,619	11,637	21,256	3,137	6,628	9,765	24,918	2,056	4,277	199,927
2014	126,036	13,146	139,182	9,777	12,362	22,139	3,154	6,812	9,966	26,191	2,231	4,699	204,408
2015	127,887	13,254	141,141	9,712	13,440	23,152	3,286	7,220	10,506	27,922	2,369	4,941	210,031
2016	126,820	13,200	140,020	9,460	13,770	23,230	3,335	7,365	10,700	28,475	2,530	4,950	209,905
CAGR 2010–2016	-1.58%	-3.05%	-1.72%	0.16%	3.07%	1.82%	-1.21%	-1.21%	0.96%	2.34%	-14.61%	-2.28%	-1.03%
Forecast													
2017	125,760	13,155	138,915	9,285	14,100	23,385	3,380	7,510	10,890	28,970	2,685	4,955	209,800
2018	124,730	13,115	137,845	9,180	14,415	23,595	3,425	7,650	11,075	29,490	2,835	4,960	209,800
2020	122,685	13,045	135,730	9,080	15,115	24,195	3,515	7,920	11,435	30,240	3,160	4,950	209,710
2025	117,410	12,820	130,230	9,420	16,965	26,385	3,740	8,625	12,365	31,835	3,965	4,955	209,735
2030	112,010	12,505	124,515	10,420	18,975	29,395	3,985	9,390	13,375	33,340	4,770	4,985	210,380
2037	105,550	11,970	117,520	12,585	22,040	34,625	4,385	10,680	15,065	35,310	5,885	5,015	213,420
CAGR 2016–2037	-0.87%	-0.46%	-0.83%	1.37%	2.27%	1.92%	1.31%	1.79%	1.64%	1.03%	4.10%	0.06%	0.08%

Note: [1]Experimental light-sport category previously shown under sport aircraft was moved under the experimental aircraft category in 2012.
Source: FAA Aerospace Forecasts, Fiscal Years 2017–2037.

3.4.5 General Aviation Activity Trends

In recent years, the general aviation community, including aircraft manufacturers, suppliers, and service providers, has experienced significant changes that have resulted in major shifts within the industry. In addition to broad shifts in the economic and political climates, the aviation industry has specifically faced new regulations; game-changing technologies such as the evolution toward more autonomous vehicles, unmanned aerial systems (UAS), and NextGen; and demographic and social transformations affecting both pilots and the passengers they serve. Given that many of these changes are just now being realized and will continue to evolve, it is difficult to project their long-term impacts with any certainty.

The General Aviation Manufacturers Association (GAMA) publishes one of the most comprehensive sources of information about the general aviation industry in the U.S. and abroad known as the *General Aviation Statistical Databook and Industry Outlook*. The 2017 publication identifies trends and historical aviation-related activity data through 2015 and forecasts of aviation activity through 2025. Like the FAA forecast, GAMA reports that market categories within the general aviation industry have witnessed mixed levels of expansion and contraction, with the fixed-wing and rotorcraft turbine fleet as key growth segments and piston aircraft witnessing the greatest levels of decline. On a broad scale, more than $24 billion in new general aviation aircraft were delivered in 2016 led by North American sales, although this shows a decline from the $29 billion in general aviation deliveries in 2015.

GAMA reports on a number of industry indicators in the U.S., including active general aviation aircraft, hours flown, AvGas consumption, and total fuel consumption (i.e., AvGas, Jet A). A summary of these trends is provided in **Table 3-9.** Nationwide, general aviation activity declined following the events of September 11, 2001, and rising fuel costs and economic volatility further accelerated this decline from 2008 to 2014. The industry began to rebound by 2015 in all categories except AvGas consumption, indicating that fuel consumption was primarily attributable to jet aircraft in accordance with associated trends in the U.S. fleet mix.

Forecast data indicates that the total number of active U.S. general aviation aircraft is projected to slightly decrease through the forecast year of 2025, with the total number of hours flown reflecting a conversely increasing rate. This indicates that a fewer number of aircraft will fly more hours in the coming years. Recent historical activity appears to have normalized and has returned to slow, steady growth.

Table 3-9: U.S. General Aviation Activity Data

Classification	Historical					Forecast					CAGR 2015-2025
	2000	2010	2013	2014	2015	2016	2017	2018	2020	2025	
Active U.S. GA aircraft	217,534	223,370	199,927	204,408	210,030	203,425	203,300	203,200	203,195	203,745	-0.3%
U.S. GA hours flown (thousands)	29,960	24,802	22,876	23,271	24,142	23,300	23,490	23,714	24,201	25,513	0.6%
U.S. AvGAS consumption (million gallons)	322.8	220.7	197.3	209.5	208.2	208	203	200	197	193	-0.76
Total U.S. aviation fuel consumption (million gallons)	1,304.8	1,655.6	1,456.9	1,676.0	1,679.7	1,679	1,744	1,794	1,894	2,062	2.07%

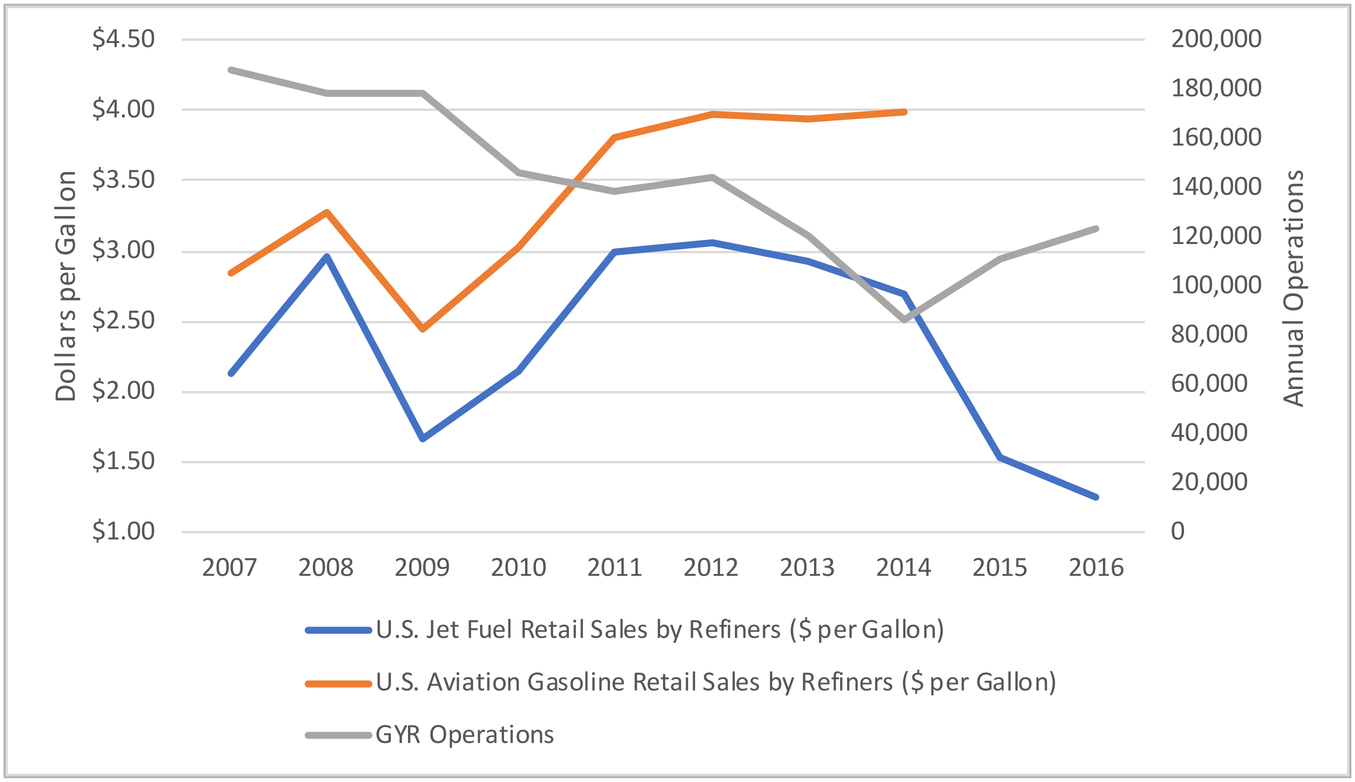
Sources: FAA survey and forecast via GAMA Outlook.

3.4.6 Fuel Costs

The recent trend of dropping oil prices is greatly benefiting the airline industry. Jet fuel prices are well-known as the largest expense to airlines, comprising nearly three-quarters of their expenses. The cost of the AvGas used by the internal-combustion engines of piston-powered aircraft is linked with many types of general aviation activity. According to *FAA Aerospace Forecasts 2017–2037*, "oil prices fell by 31% in 2016 to around $39 per barrel bringing the cumulative decline between 2013 and 2016 to 61%. However, 2016 marked the bottom of the latest cycle and HIS Global Insight is projecting oil prices in 2017 to increase by about 20% to $47 per barrel."

As depicted in **Figure 3-1**, annual operations at the Airport declined from 2007 to 2014 with a generally inverse relationship with fuel cost. Operations reached their apex in 2014 as fuel prices remained relatively stable; however, this decline is attributable to the departure of Oxford Aviation. Between 2012 and 2014, the price of AvGas and Jet A fuel has remained fairly stable as operations at the Airport quickly began to rebound. The stabilization of fuel prices, in addition to an international commercial pilot shortage that has led to increased training operations at the Airport, should promote a steady increase in activity at the Airport for the foreseeable future.

Figure 3-1: AvGas and Jet Fuel Prices versus Aircraft Operations



Sources: U.S. Energy Information Administration 2007–2016 data; FAA TAF issued January 2017.

3.4.7 National and International Pilots Shortage

For years, analysts have been anticipating an airline pilot shortage based on the changing federal requirements and fewer numbers of trained pilots coming out of the military. Part of the shortage in experienced pilots can be credited to the recent increase in FAA pilot qualification requirements. In 2013, the FAA published a rule requiring first officers—also known as co-pilots—to hold an Airline Transport Pilot (ATP) certificate, requiring 1,500 hours of total time as a pilot. Previously, first officers were required to have only a commercial pilot certificate, which requires 250 hours of flight time. This new requirement has discouraged many students from entering flight training programs due to the increased cost associated with the new training requirements or led U.S. pilots to look for jobs with foreign airlines where flight-hour requirements are not as stringent.

The pilot population is also still responding to a 2010 FAA regulatory change that increased the duration of validity of pilot certificates under the age of 40 from 36 months to 60 months. Since this change, the number of student pilot licenses has increased from 119,119 in 2010 to an estimated 128,501 in 2016. According to the *FAA Terminal Aerospace Forecasts, 2017–2037*, The number of student pilot certificates is anticipated to reach 141,200 by 2037. Pilots 40 years of age or older also must pass a comprehensive medical exam every 2 years, which can deter pilots from obtaining and renewing their licenses.

Additionally, the industry is confronting waning interests in students interested in a career as a pilot due to high educational costs, low salary expectations post-graduation, demanding travel schedules, and general industry upheaval since September 11. This issue is compounded by the declining availability of military-trained pilots to meet the aviation industry's growing needs. A 2014 Government Accountability Office (GAO) Report notes that 70 percent of airline pilots hired had come from the military prior to 2001; fewer than 30 percent are hired from the military today.

Flight schools at the Airport specialize in commercial, GA, and military training (German Air Force) and based on interviews with the schools, it has been identified that there is more demand for training at the schools than there is capacity. A significant proportion of students who train at the Airport go on to become commercial pilots for non-U.S. airlines. Based on commercial pilot licensing projections identified in the *FAA Terminal Aerospace Forecasts 2017–2037*, the demand for such training in the U.S. is anticipated to continue through 2035. As such, it is anticipated that demand for pilot training at the Airport will be strong both in the immediate future and long-term.

3.4.8 Business Use of Aviation

Business use of aviation is important at the Airport and throughout the nation. In this document, business and corporate aircraft are used interchangeably, as they both refer to aircraft that support a business enterprise. However, the FAA employs their own distinct definitions. The FAA defines business use as, "Any use of an aircraft (not for compensation or hire) by an individual for transportation required by the business in which the individual is engaged." The agency defines corporate transportation as, "Any use of an aircraft by a corporation, company, or other organization (not for compensation or hire) for the purposes of transporting its employees and/or property, and employing professional pilots for the operation of the aircraft."

While business-related aviation is often considered to specifically pertain to corporate jets or turbo props, multi- and single-engine piston aircraft are often used for regional business travel. This is particularly true in areas with high populations and limited or congested transportation connectivity outlets. At the Airport, business use of aviation primarily consists of single- and multi-engine piston aircraft; however, the Airport has experienced an increase in itinerant turboprop and jet activity in recent years.

The FAA's *2015–2019 Report to Congress* estimates that business aircraft usage annually comprises 8.7 percent of all aviation activity, and an additional 9.7 percent of the nation's general aviation activity is considered corporate. These figures represent a small decline in the use of business/corporate aviation as compared to 2008 and 2012, when they totaled 9.6 percent and 11.9 percent, respectively.

Business aviation offers companies multiple benefits associated with time savings, employee satisfaction, and schedule control among many other advantages. Increased personnel productivity is one of the most important benefits of using business aircraft, and companies flying general aviation aircraft have significantly higher scheduling capabilities. Itineraries can be changed as needed, and aircraft can fly to destinations not served by scheduled airlines. Additionally, business aircraft saves employee time, provides en-route productivity, minimizes time away from home, and enhances industrial security and personal safety.

In addition to the significant qualitative and quantitative benefits that corporations receive from business aviation, this activity leads to additional indirect impacts that can significantly bolster local, regional, and state economies. In fact, the National Business Aircraft Association's (NBAA's) Business Aviation Fact Book 2014 shows that nationwide business aviation contributes $150 billion to the U.S. economic output.

3.4.9 NextGen

NextGen is an initiative from the FAA to develop technology geared toward making air travel safer and more efficient to replace older/existing technology. There are many initiatives being developed specifically for airports to help accommodate the demand for additional capacity in a safe, efficient, and environmentally responsible manner, such as the FAA's En Route Automation Modernization (ERAM), which processes data from 64 radars and tracks 1,900 aircraft at a time. While NextGen is an FAA-driven initiative, it requires aircraft operators of both private and airline carriers to equip aircraft and pursue NextGen practices. Specifically, the FAA will require that aircraft be equipped with Automatic Dependent Surveillance-Broadcast Out (ADS-B) equipment by January 1, 2020, to fly in most controlled airspace. This equipment continuously transmits aircraft data, such as airspeed, altitude, and location, to ADS-B ground stations. While certain exemptions may apply, and there are rebates for the installation of this equipment, the requirement of ADS-B equipment in all aircraft may be a minor deterrent to small and recreational aircraft activity in the future. In the *FAA Terminal Aerospace Forecasts 2017–2037*, the FAA projects a decline in single- and multi-engine operations through 2035. While the requirement for aircraft to be equipped with ADS-B technology is not the sole reason for these negative projections, it likely has some impact.

3.4.10 Unmanned Aircraft Systems

Unmanned Aircraft Systems (UAS), commonly referred to as drones, have revolutionized the National Airspace System (NAS) in recent years. Developments in UAS technology and growth in their demand and use in several industries have increased concern due to the current NAS not being tailored to accommodate manned and unmanned aircraft operating in the same environment. For UAS and manned aircraft to operate safely and efficiently in an integrated system within the NAS, continued study is needed that may affect policies at all levels.

To compound the issue, requirements and regulations regarding the operation of a UAS are ever-evolving, and, in many instances, are not followed. The FAA has promoted numerous outreach efforts, such as B4UFLY to support the safe integration of UAS into the NAS, but the effects are difficult to determine due to the difficulty involved with collecting accurate data on their use. The presence of UAS in the NAS, and the expansion of their abilities based on improved battery life, improved range, and reduced cost, will ultimately have an ever-increasing impact on the NAS. It is unknown at this juncture how UAS will impact future activity at the Airport or at other airports throughout the U.S. This growing segment of the aviation industry needs to continue to be monitored.

3.5 Socioeconomic Trends

Depending on the role of an airport and the population base that it serves, the socioeconomic profile of the local community can often influence existing and future aviation-related activity. The geographical areas that are examined include the City of Goodyear, the Phoenix Metropolitan Statistical Area (MSA), which includes cities in Maricopa and Pinal Counties, and the State of Arizona. This analysis examines historical trends and future projections of population, employment, per capita personal income (PCPI), and gross regional product (GRP). Several sources of data were used for this section including Woods and Poole Economics, Inc., U.S. Census data, and the Maricopa Association of Governments (MAG).

The role and activity of the Airport combined with socioeconomic factors play a vital part of the master planning process. Socioeconomic factors provide a general understanding of the existing conditions in the area along with developing future projections of the aviation activity for the Airport. The following data provides a summary of the socioeconomic data for the City of Goodyear, Phoenix MSA, and the State of Arizona considered in the development of the Airport forecasts.

3.5.1 Population

Arizona's population has undergone dramatic shifts in the last several decades. Beginning in the 1970s, the state's population grew rapidly with annual decade-over-decade growth of nearly 43 percent. This trend continued into the turn of the 21st century until the 2008–2010 economic downturn. The state was particularly hard hit by the downturn and faced significant impacts to the housing industry, state revenues, and employment base. Since the recession, the population has begun to recover, but at a slower rate than historic levels.

Table 3-10 shows the historical population growth comparatively in Goodyear, Phoenix MSA, and the State of Arizona. Between 2007 and 2016, Goodyear experienced a CAGR of 4.99 percent, while the Phoenix MSA experienced a CAGR of 3.87 percent. Goodyear and the Phoenix MSA grew at a higher rate than the rest of the state, which experienced a CAGR of 1.58 percent during that same timeframe.

Table 3-10: Resident Population

Year	Goodyear	Phoenix MSA	Arizona
2007	51,366	3,928,589	6,036,577
2008	56,002	4,022,176	6,161,718
2009	60,639	4,115,763	6,286,859
2010	65,275	4,209,350	6,412,000
2011	67,419	4,279,290	6,491,870
2012	69,563	4,349,230	6,561,810
2013	71,707	4,419,170	6,631,750
2014	73,851	4,489,110	6,731,480
2015	75,995	4,567,200	6,836,670
2016	79,624	4,653,084	6,952,428
CAGR 2007–2016	4.99%	1.90%	1.58%

Sources: MAG Socioeconomic Projections 2015-2040; U.S. Census 2000–2014.

3.5.2 Regional Economy

In addition to population, other demographic factors impact demand for general aviation in a particular region. The regional economy also can significantly impact aviation demand. Regional economic trends are summarized in this analysis through an examination of employment and earnings data.

Employment is often used to understand economic activity due to the regular availability of data from various agencies, as well as the simplicity of data to gain a snapshot of the overall health of specific catchment area. **Table 3-11** summarizes the historical employment rates for the City of Goodyear, Phoenix MSA, and state from 2007 to 2016 (2010–2016 data for City of Goodyear). This data shows similar trends among these three areas, with employment growth maintaining a steady, albeit moderate, rate of increase. Employment growth in the Phoenix MSA slightly outpaced statewide increases.

According to many economists, a healthy economy is defined by a 2 percent annual growth rate. As shown in **Table 3-12**, the GRP of both Phoenix MSA and the state have rebounded from the economic downturn with CAGRs of 2.41 and 2.18 percent, respectively (2007–2016). GRP is not available for the City of Goodyear. These figures have been adjusted to 2016 dollars to adjust for inflation.

Table 3-11: Employment Totals

Year	Goodyear	Phoenix MSA	Arizona
2007	Unavailable	2,138,884	3,088,402
2008		2,168,196	3,128,378
2009		2,197,508	3,168,354
2010	18,744	2,226,820	3,208,330
2011	19,947	2,282,268	3,271,643
2012	21,259	2,337,715	3,334,955
2013	22,678	2,393,163	3,398,268
2014	24,229	2,448,610	3,461,580
2015	31,462	2,504,220	3,536,250
2016	33,238	2,559,572	3,610,148
CAGR 2007–2016	Unavailable	2.02%	1.75%

Sources: MAG Socioeconomic Projections 2015–2040; U.S. Census 2000–2014; City of Goodyear Development Services Dept.

Table 3-12: Gross Regional Product

Year	Phoenix MSA ($2016 in millions)	State of Arizona ($2016 in millions)
2007	$189,139	$259,667
2008	$192,480	$264,647
2009	$195,821	$269,627
2010	$199,162	$274,606
2011	$204,192	$279,979
2012	$209,223	$285,352
2013	$214,253	$290,725
2014	$219,283	$296,098
2015	$226,706	$305,541
2016	$234,327	$315,257
CAGR 2007–2016	2.41%	2.18%

Source: Woods and Poole, Inc.

3.5.3 Per Capita Personal Income

PCPI is another way to measure the economic growth of an area and provides a broad measure of individual economic well-being. PCPI is a composite measure of market potential and indicates the general ability of persons to purchase products and services.

Table 3-13 summarizes the historical PCPI for the Phoenix MSA and Arizona. PCPI has slowly improved in the years following the 2008–2010 economic recession. It should be noted that PCPI data obtained from Woods and Poole is reported in constant dollars (year 2016) to adjust for inflation over time. Historical and forecasted PCPI data for the City of Goodyear are not reported by Woods and Poole.

Table 3-13: Per Capita Personal Income

Year	Phoenix MSA ($2016 in millions)	State of Arizona ($2016 in millions)
2007	$39,357	$37,267
2008	$39,332	$37,456
2009	$39,308	$37,646
2010	$39,283	$37,836
2011	$39,734	$38,147
2012	$40,186	$38,457
2013	$40,637	$38,768
2014	$41,088	$39,078
2015	$41,828	$39,800
2016	$42,558	$40,500
CAGR 2007–2016	0.87%	0.93%

Source: Woods and Poole, Inc.

3.5.4 Socioeconomic Trends – Summary

Over the past two decades, the West Valley area of the Phoenix metropolitan region has experienced a significant population increase that has changed the demographics, employment base, and economic condition of Goodyear and the surrounding areas. This shift has also brought a sweeping economic change, as the City continues a shift from an area of high agricultural production to a robust and diversified economic base. The City is bolstered by numerous major healthcare providers, the military activity of nearby Luke Air Force Base, and the aviation and aerospace expertise centered on the Airport's 75-year history in the community.

The City's location within the Phoenix MSA with close access to major transportation corridors, low cost of living, and abundant available land will all contribute to the continued development of the region. As a result, the forecast assumptions about future Airport activities are rooted in anticipated population growth and strong economic growth through the forecast horizon.

3.6 Other Relevant Trends and Activities

The previous sections have identified local socioeconomic and national aviation industry trends. However, there are other trends and activities specific to the Airport that also should be considered in the development of the Airport forecasts to ensure a comprehensive understanding of potential issues that may impact future demand.

3.6.1 Developable Land

The Airport owns approximately 400 acres of property that is currently undeveloped or available for redevelopment. This space has the potential to be used for existing tenant expansion, additional tenant development, aircraft storage, facility improvements, and other aviation or non-aviation uses. As a result, the Airport has the potential to accommodate facilities and expansion of aviation-related businesses and tenants, as well as support projected levels of aviation demand.

Additionally, the Airport was designated as a Military Reuse Zone (MRZ) by the Arizona Legislature following the closure of the U.S. Naval Air Facility in Goodyear. This program was designed to minimize the impact of military base closures on local economies and provides tax incentives to aviation or aerospace (A&A)

companies, insurers, and airport authorities within designated MRZs. The program provides significant tax incentives to companies that establish eligible A&A-related business enterprises within an MRZ. More details about the MRZ can be found in Chapter 5, *Land Use and Zoning*.

3.6.2 NASCAR

The Airport is located approximately 5 miles northwest of Phoenix International Raceway (PIR), which hosts two annual NASCAR auto races and numerous other racing events throughout the year. Based on conversations with Airport staff and tenants, it was identified that corporate and itinerant activity typically experiences a noteworthy spike during NASCAR event weekends. The major races that occur at PIR are in March and November, which are months when the Airport experiences higher levels of activity compared with other months of the year. It is anticipated that peak levels of activity will continue to occur during NASCAR event weekends, which will sustain elevated operations in March and November; however, because there are only two major races throughout the year, facility requirements should be based on more regularly occurring periods of heightened activity.

3.6.3 Spring Training

Spring is a peak season for visitors in the Phoenix region. One of the many reasons for the high number of visitors every March is Major League Baseball (MLB) spring training. There are 15 MLB teams that play in the Cactus League, which is based in and around the Phoenix metropolitan area. Teams practice and play at 10 area facilities, including Goodyear Ballpark located adjacent to the Airport, which hosts the Cleveland Indians and Cincinnati Reds.

Based on conversations with Airport staff and tenants, it was noted that spring training in and of itself does not appear to significantly impact Airport activity or capacity. However, it should be noted that March experienced the highest number of monthly itinerant operations at the Airport in 3 of the past 10 years, and the month is typically one of the busiest for itinerant activity due to the overall increase in visitors who travel to the region. This is a similar trend at other Phoenix-area airports. While it is estimated that March will continue to be one of the busier months for itinerant activity over the 20-year planning period, it is not anticipated that spring training will have significant impacts on annual activity at the Airport in the future.

3.6.4 Aircraft Maintenance, Repair, and Overhaul

The Airport has multiple MRO tenants that specialize in maintenance, repair, demolition, painting, and storage of commercial service aircraft. This activity is critical to the financial success of the Airport, supports the national aviation industry, and is expected to continue growing according to the MRO tenants. Through data provided by the MRO tenants and review of FAA ATCT data, the number of annual aircraft operations conducted by an aircraft with more than 60 seats (i.e., air carrier) that can be attributed to the MRO tenants has averaged approximately 100–200 per year. This number is anticipated to continue increasing as all of the MRO firms indicated they had plans to expand existing facilities as the industry continues to grow.

Because airfield geometry should be planned for and developed based on the most demanding aircraft or group of aircraft on a regular basis, typically defined by the FAA as 500 annual operations, the air carrier operations associated with the MRO tenants have driven the design of certain airfield projects. It is not anticipated that air carrier operations associated with MRO tenants will reach the 500-operations threshold in the 20-year planning horizon, however, when combined with larger corporate aircraft activity, the ultimate design aircraft is recommended to remain D-IV. While D-IV aircraft do not currently conduct 500 annual operations at the Airport, there are multiple airports in Arizona (including Pinal Airpark and Kingman Airport) and nationwide that operate with a design aircraft designation that exceeds existing levels of activity. This is due to the type of activity that is supported on a routine basis and in support of the national aviation industry. Additional information regarding the design aircraft, aircraft operations, and activity generated by the MRO tenants is included in subsequent sections of this chapter.

3.6.5 Flight Training

The four flight schools at the airport (CTC Aviation, Lufthansa Aviation Training USA, the German Air Force, and FLY Goodyear) provide military, commercial, and general aviation training. Flight training accounts for more than 40 percent of all operations at the Airport.

According to estimates provided by the ATCT, flight training operations have historically accounted for approximately 90 percent of local general aviation activity. Between 2007 and 2009, the Airport experienced roughly 80,000–90,000 training operations annually. Activity began to decline slightly in 2010, then significantly in 2013 and 2014, which can be attributed to the departure of a flight school in 2013. Since 2014, training activity has steadily increased and accounted for nearly 66,000 operations in 2016. This loss of the flight school also resulted in a decline in based aircraft, but not nearly to the same extent as the local general aviation activity, as many operations are typically conducted by a single based aircraft that is used repetitively for the operational training.

Three of the four schools (CTC, Lufthansa, and the German Air Force) have onsite dormitories where students live full-time. Due to an international pilot shortage and other factors, these providers anticipate that training activity at the Airport would likely double if additional dormitory space were available. As a result, flight training at the Airport is forecasted to increase over the 20-year planning horizon, as discussed in greater detail in subsequent sections of this chapter. It should be noted that, overall, flight schools anticipated that the increase in demand for flight training at the Airport would likely result in a much more significant increase in operations over time compared to the number of aircraft needed to accommodate this demand.

3.7 Previous Forecasts

Prior to the development of forecasts for this master plan update, previous forecasts for the Airport were examined to gauge their continued validity. Forecasts of general aviation operations and based aircraft identified in the 2007 Airport Master Plan, 2008 Arizona SASP, and the FAA TAF issued January 2017 are shown in **Table 3-14**. It should be noted that only general aviation operations were forecasted in the 2008 SASP. As such, **Table 3-14** presents forecasted activity of general aviation operations rather than total aircraft operations.

According to Airport and ATCT records, there were 222 based aircraft at the Airport and 113,404 general aviation operations that occurred in base year 2016. As shown in **Table 3-14**, both the 2007 Airport Master Plan and the 2008 SASP produced forecasts that are well above current levels of activity for both of these elements. The FAA TAF forecasts were prepared more recently; however, the TAF estimates for based aircraft and general aviation operations in base year 2016 are much lower than actual figures reported by the Airport due to the use of FAA fiscal year 2015 data. The FAA uses a time series approach to project general aviation aircraft activity that does not necessarily account for changes such as the loss and return of flight school operations. The TAF projects relatively modest growth through 2036, particularly for general aviation operations; this growth is anticipated to be exceeded based on historical trends at the Airport.

Based on an analysis of previous forecasts, it has been determined that updated forecasts of aviation activity are required as a specific component of this master plan update. Some previous forecasting efforts yielded projections that were too aggressive given current levels of activity, and the FAA TAF projects significantly lower-than-anticipated levels of future activity due to its simplistic approach to general aviation forecasting. The following sections identify the assumptions, approach, and methodologies used to develop updated forecasts of based aircraft and aircraft operations at the Airport.

Table 3-14: Comparison of Previous Forecasts

Year	Based Aircraft			General Aviation Operations		
	FAA TAF	2007 MP	2008 SASP	FAA TAF	2007 MP	2008 SASP
2007	198	263	276	174,225	141,548	178,896
2008	254	281	282	169,672	156,032	182,537
2009	254	299	288	173,516	170,516	186,178
2010	218	317	293	145,991	185,000	189,818
2011	218	334	299	135,719	193,571	193,459
2012	223	352	305	136,849	202,143	197,100
2013	184	369	311	129,561	210,714	201,120
2014	191	387	318	74,183	219,286	205,140
2015	200	404	324	96,383	227,857	209,160
2016	204	426	331	104,373	236,429	213,180
2017	206	447	337	108,997	245,000	217,200
2018	210	469	345	109,355	260,625	221,992
2019	213	490	353	109,714	276,250	226,785
2020	216	512	360	110,075	291,875	231,577
2021	219	533	368	110,437	307,500	236,369
2022	223	555	376	110,799	323,125	241,162
2023	226	576	384	111,163	338,750	245,954
2024	230	598	391	111,529	354,375	250,746
2025	234	619	399	111,896	370,000	255,538
2026	238	Unavailable	407	112,264	Unavailable	260,331
2027	242		415	112,634		265,123
2028	246		422	113,006		269,915
2029	250		430	113,379		274,708
2030	254		438	113,752		279,500
2031	258		Unavailable	114,127		Unavailable
2032	262			114,504		
2033	266			114,882		
2034	270			115,262		
2035	274			115,643		
2036	278			116,025		

Note: [1]Italicized cells indicate forecasted activity.
Sources: FAA TAF issued January 2017. 2007 Phoenix Goodyear Airport Master Plan. 2008 AZ SASP.

3.8 Forecast Assumptions and Approach

Forecast assumptions have been developed based on input provided by Airport staff, tenants, and an examination of the trends identified in previous sections of this chapter. These assumptions provide general guidelines that aid in the development of forecasts of aviation demand and include the following:

- The Airport will continue to operate as a general aviation airport through the planning period
- Airports in the Phoenix metropolitan area will remain open for the foreseeable future
- The Airport will continue to seek general aviation, corporate, business aviation, flight training, and MRO based tenants and transient operations
- The aviation industry on the national level will grow as forecasted by the FAA in its annual aerospace forecasts
- The socioeconomic characteristics of Goodyear, Phoenix MSA, and the State of Arizona will continue to grow as forecasted
- Both Federal and State aviation programs will be in place through the planning period to assist in funding future capital development needs

The overall approach to develop forecasts for this Airport master plan update was based on detailed analyses of individual types of aviation-related activities that occur at the Airport, and a determination of how those activities will be influenced by local, regional, and national aviation and non-aviation factors over the 20-year timeframe. This analysis entailed data collection from various resources including Airport records, the ATCT, FAA databases, Woods and Poole Inc., U.S. Census, 2007 Phoenix Goodyear Airport Master Plan, 2008 Arizona SASP, and MAG. In addition, data and information were obtained through in-person interviews with Airport tenants including flight schools, MRO tenants, and the fixed-base operator (FBO). This information provided a thorough understanding of tenant goals, facility needs, and potential impacts to future aviation activity at the Airport.

3.9 Based Aircraft Forecasts

Based aircraft are those considered airworthy and stored at an airport for the majority of the year. The Aviation Department has maintained detailed records of the number and type of based aircraft at the Airport. The FAA maintains historical records of based aircraft in the TAF for all NPIAS airports, including Goodyear. As noted in **Section 3.2**, there has historically been a significant discrepancy between the number of based aircraft reported in the TAF and by the Aviation Department. Because the data provided by the Airport represent actual aircraft counts and records are updated regularly, these data are preferable for use in the development of based aircraft forecasts. It should be noted that commercial aircraft stored by MRO tenants are not considered based aircraft and are not included in the forecasts presented in this master plan update. Their presence is significant however, as there have been instances where the number of aircraft being stored has surpassed 100.

3.9.1 Based Aircraft Forecast Methodologies

The number of based aircraft at the Airport has fluctuated significantly between 2007 and 2016 although, overall, there has only been a decrease of five aircraft in that timeframe. This fluctuation is largely attributed to the increasing costs of aircraft ownership/operation, fallout from the 2008–2010 economic decline and the departure of a flight school from the Airport in 2013. It also is possible that some fluctuations are due to timing of when the counts are conducted as the number represents a snapshot in time, as aircraft may come and go over the course of a year. Since 2013, the number of based aircraft at the Airport has increased steadily, a trend that is anticipated to continue in the future.

Several methodologies were utilized to develop forecasts of based aircraft including socioeconomic comparisons, FAA forecast comparisons, and market share. Descriptions and results of these methodologies and the preferred forecast methodology are presented in the following sections.

3.9.1.1 Socioeconomic: Population Variable Methodology

Socioeconomic characteristics of a community do not always dictate aviation-related activity at a local airport; however, the strong growth in population and the economy in the West Valley region of greater Phoenix had significant impacts at the Airport. Historical and projected population data were obtained from MAG and Woods and Poole, an independent firm that specializes in long-term economic and demographic projections.

The socioeconomic population variable methodology assumes that the number of based aircraft at the Airport beginning in base year 2016 will mimic population projections for the compared geographic areas through 2036. **Table 3-15** identifies forecasted based aircraft comparing existing and projected populations of the City of Goodyear, Phoenix MSA, and the State of Arizona. As shown, the socioeconomic-population variable methodology produces a range of based aircraft from 304 to 501 by the end of the 20-year planning period, with CAGRs ranging from 1.59 percent to 4.16 percent.

Table 3-15: Based Aircraft Forecast: Socioeconomic Population Variable Methodology

Year	Goodyear		Phoenix MSA		Arizona	
	Population	Based Aircraft	Population	Based Aircraft	Population	Based Aircraft
2016	79,624	222	4,653,084	222	6,952,428	222
2021	99,584	278	5,089,882	241	7,540,072	241
2026	126,799	354	5,562,940	265	8,171,482	261
2031	153,778	429	6,068,613	290	8,841,245	282
2036	179,823	501	6,596,778	315	9,530,820	304
CAGR 2016–2036	4.16%		1.76%		1.59%	

Source: Woods and Poole, Inc.

3.9.1.2 Socioeconomic: Employment Variable Methodology

Similar to the socioeconomic population variable methodology, the socioeconomic employment variable methodology assumes that between 2016 and 2036, the number of based aircraft at the Airport will increase at the same rate as the growth in employment for the compared geographic areas.

Table 3-16 identifies forecasted based aircraft by comparing existing and projected employed persons in the City of Goodyear, the Phoenix MSA, and the State of Arizona. As shown, this methodology produces forecasts that range from 317 to 450 based aircraft by 2036, with CAGRs ranging from 1.80 percent to 3.59 percent, similar to the population variable results.

Table 3-16: Based Aircraft Forecast: Socioeconomic Employment Variable Methodology

Year	Goodyear		Phoenix MSA		Arizona	
	Employment	Based Aircraft	Employment	Based Aircraft	Employment	Based Aircraft
2016	33,238	222	2,559,572	222	3,610,148	222
2021	41,776	279	2,838,414	246	3,981,814	245
2026	48,876	326	3,127,402	271	4,363,962	268
2031	56,690	379	3,425,843	297	4,755,143	292
2036	67,315	450	3,733,008	324	5,154,008	317
CAGR 2016–2036	3.59%		1.90%		1.80%	

Sources: MAG; Woods and Poole, Inc.; Kimley-Horn.

3.9.1.3 Socioeconomic: Per Capita Personal Income Variable Methodology

PCPI can be an indicator of a local population's propensity to travel or own an aircraft. Commercial service is not provided at the Airport; however, the Airport has experienced an increase in business travel and jet operations in recent years. The PCPI variable was examined to project based aircraft at the Airport. As shown in **Table 3-17**, both forecasts of based aircraft using this methodology project 297 based aircraft by 2036, both resulting in the same CAGR of 1.47 percent. It should be noted that forecasts of PCPI were not available for the City of Goodyear. Projections of PCPI have been adjusted to constant 2016 dollars ($2016) to adjust for inflation over time.

Table 3-17: Based Aircraft Forecast: Socioeconomic PCPI Variable Methodology

Year	Phoenix MSA		Arizona	
	PCPI ($2016)	Based Aircraft	PCPI ($2016)	Based Aircraft
2016	$42,558	222	$40,500	222
2021	$46,242	241	$44,035	241
2026	$50,043	261	$47,685	261
2031	$53,665	280	$51,129	280
2036	$57,009	297	$54,261	297
CAGR 2016–2036	1.47%			

Source: Woods and Poole, Inc.

3.9.1.4 Socioeconomic: Gross Regional Product Variable Methodology

The fourth socioeconomic variable examined to project based aircraft at the Airport is GRP. GRP is a measurement of a market's economy that is defined as the market value of all final goods and services produced in a given timeframe. As with the other socioeconomic methodologies presented in this section, the socioeconomic GRP variable methodology assumes based aircraft at the Airport will mimic growth rates of GRP for the compared geographic areas.

Results of this methodology are presented in **Table 3-18.** As shown, this methodology projects 385 based aircraft by 2036 when comparing GRP for Arizona and 396 based aircraft by 2036 when comparing GRP for the Phoenix MSA. The CAGRs are similar at 2.79 percent using the State of Arizona, compared to 2.94 percent using the Phoenix MSA. Projections of GRP have been adjusted to $2016 to adjust for inflation over time.

Table 3-18: Based Aircraft Forecast: Socioeconomic GRP Variable Methodology

Year	Phoenix MSA		Arizona	
	GRP ($2016 in millions)	Based Aircraft	GRP ($2016 in millions)	Based Aircraft
2016	$234,327	222	$315,257	222
2021	$273,243	259	$364,803	257
2026	$316,296	300	$419,260	295
2031	$364,336	345	$479,602	338
2036	$418,192	396	$546,763	385
CAGR 2016–2036	2.94%		2.79%	

Source: Woods and Poole, Inc.

3.9.1.5 Regional Market Share Methodology

The second type of methodology used to project based aircraft at the Airport involves the application of a market share projection. Market share compares an individual component's share (based aircraft at Goodyear) with a larger market. The market selected for comparison to the Airport includes all Phoenix area airports that are equipped with an ATCT. These airports include Chandler Municipal, Phoenix Deer Valley, Falcon Field, Glendale Municipal, Phoenix-Mesa Gateway, Phoenix Sky Harbor International, and Scottsdale.

In 2016, based aircraft at the Airport accounted for 7.5 percent of all based aircraft at airports in this specific segment of the Phoenix market. This figure is applied to forecasts of based aircraft for these regional airports published in the FAA TAF and held constant throughout the projection period. As shown in **Table 3-19**, this methodology projects an increase in based aircraft from 222 in 2016 to 316 in 2036, representing a CAGR of 1.77 percent.

Table 3-19: Based Aircraft Forecast: Regional Market Share Methodology

Year	Regional Airports Based Aircraft	GYR Based Aircraft	GYR Market Share
2016	2,948	222	7.5%
2021	3,228	241	7.5%
2026	3,540	264	7.5%
2031	3,871	289	7.5%
2036	4,230	316	7.5%
CAGR 2016–2036	1.82%	1.77%	N/A

Source: Woods and Poole, Inc.

3.9.1.6 FAA Fleet Projection Methodology

The final forecast methodology used to project based aircraft applies FAA growth rates of individual aircraft types to the existing based aircraft fleet at the Airport. Between 2016 and 2037, the *FAA Aerospace Forecast 2017–2037* anticipates that single-engine piston aircraft in the U.S. fleet will decline 0.9 percent annually; multi-engine piston aircraft are projected to decline 0.5 percent annually during the same timeframe. Jet aircraft are expected to increase 2.3 percent annually from 2016 to 2036 and rotorcraft (helicopters) are anticipated to increase 1.6 percent annually. These figures have been applied to the fleet at the Airport in base year 2016 and held constant throughout the projection period, as presented in **Table 3-20.** This methodology results in a decrease in based aircraft at the Airport from 222 in 2016 to 188 in 2036, representing a CAGR of -0.82 percent. This decline is attributed to the fact that the fleet mix at the Airport primarily comprises single-engine and multi-engine piston aircraft, many of which are used for training.

Table 3-20: Based Aircraft Forecast: FAA Fleet Projection Methodology

Year	Single Piston	Multi - Piston	Jet	Helicopter	Total
2016	204	15	1	2	222
2021	195	15	1	2	213
2026	186	14	1	2	204
2031	178	14	1	3	196
2036	170	14	2	3	188
CAGR 2016–2036	-0.90%	-0.50%	2.30%	1.60%	-0.82%

Source: Woods and Poole, Inc.

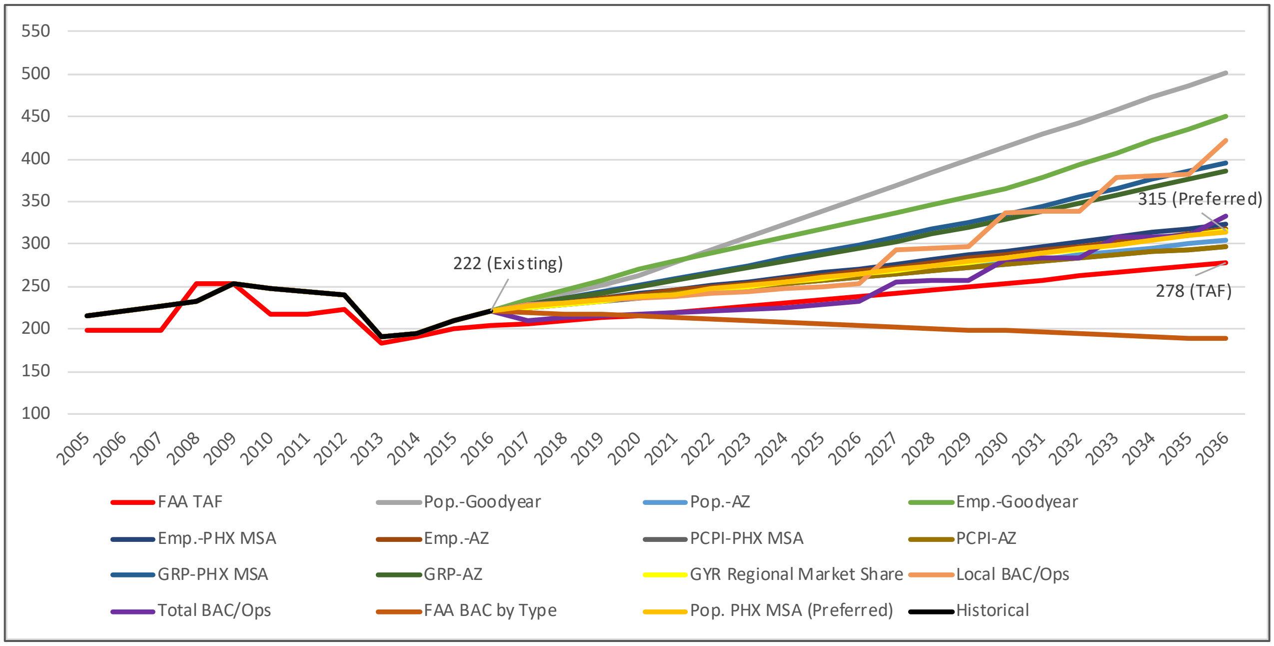
3.9.1.7 Based Aircraft Forecast Preferred Methodology

While the number of based aircraft at the Airport has fluctuated significantly between 2007 and 2016, there has been only a slight overall decline at the Airport during that time. The most significant decrease in recent years was a result of the relocation of a flight school in 2013; however, the number of based aircraft has increased consistently since then. If the relocation of this flight school had not occurred, based aircraft at the Airport would have likely increased overall since 2007.

This result at the Airport goes against national trends of decreasing based aircraft at many general aviation airports and in the U.S. fleet as a whole. It is further anticipated that the number of based aircraft at the Airport will continue to grow at a steady pace throughout the projection period, fueled largely by flight school activity and an increasing population in Goodyear and the West Valley region of Phoenix. While the number of based aircraft at the Airport has closely followed activity at other regional airports, FAA TAF forecasts for the region project nearly flat growth throughout the 20-year planning horizon.

The City of Goodyear is anticipated to grow at an annual rate of more than 4 percent through 2036; however, growth in based aircraft is not expected to increase at such an aggressive rate as the aircraft in the Phoenix area have multiple options to choose from in basing their aircraft. The Phoenix MSA is anticipated to slightly outpace Arizona in population growth over the next 20 years. Due to the Airport's location within a growing metropolitan area, anticipated growth in flight school activity, and availability of land to develop facilities needed to accommodate future demand, the socioeconomic Phoenix MSA population variable methodology is the preferred forecast for based aircraft at the Airport. A summary of based aircraft forecast methodologies and compared with the FAA TAF is provided in **Figure 3-2.** This methodology results in based aircraft growing from 222 in 2016 to 315 in 2036, a CAGR of 1.76 percent.

Figure 3-2: Based Aircraft Forecast Methodologies



Sources: FAA TAF; Phoenix Goodyear ATCT, 2016; Woods and Poole, Inc.

3.9.2 Based Aircraft Fleet Mix

As with most general aviation airports, the majority of the based aircraft fleet at the Airport is composed of single-engine piston aircraft. As noted in the previous section, the FAA projects declines in both single- and multi-engine piston aircraft and increases in jet and rotorcraft aircraft through 2036. However, the Airport has experienced increases in both single- and multi-engine piston aircraft in recent years, a trend that is anticipated to continue with the anticipated future demand for flight training.

While no declines in any category of aircraft are expected over the 20-year planning horizon, it is anticipated that—similar to national forecasts—jets and helicopters will comprise a more significant proportion of the overall fleet at the Airport over time. Existing and projected fleet mix is shown in **Table 3-21.** As shown, the percentage of single-engine piston aircraft is projected to decline from approximately 92 percent in 2016 to 87 percent in 2036. Multi-engine piston aircraft are projected to increase from approximately 7 percent to 8 percent of the fleet, jet aircraft from 0.5 percent to 2 percent, and helicopter from approximately 1 percent to 3 percent.

Table 3-21: Based Aircraft Fleet Mix

Year	Single Engine Piston		Multi-Engine Piston		Jet		Helicopter		Total	
	#	%	#	%	#	%	#	%	#	%
2016	204	91.9%	15	6.8%	1	0.5%	2	0.9%	222	
2021	219	90.7%	17	7.1%	2	0.8%	3	1.4%	241	
2026	237	89.4%	20	7.4%	3	1.2%	5	2.0%	265	
2031	256	88.2%	22	7.7%	5	1.6%	7	2.5%	290	
2036	275	87.0%	25	8.0%	6	2.0%	9	3.0%	315	
CAGR 2016–2036	1.48%	N/A	2.62%	N/A	9.63%	N/A	8.07%	N/A	1.76%	N/A

Source: Kimley-Horn.

3.10 Aircraft Operations Forecasts

The number of annual aircraft operations projections are used to determine funding and design criteria at airports. At airports with ATCTs, aircraft operations are tracked and recorded by the air traffic controllers. Several factors impact the number of aircraft operations that occur at a particular airport, including the number of based aircraft, local demographics, national economic and aviation-related trends, proximity to other airports, capability and existing condition of facilities, business needs, and several others. Forecasts of aircraft operations at the Airport have been developed for the following categories:

- Air carrier operations
- Military operations
- Military operational fleet mix
- Local general aviation operations
- Itinerant general aviation operations
- Aircraft operations summary
- Local/itinerant operations
- Daytime/evening operations
- Touch-and-go operations
- Annual instrument approaches
- Operational fleet mix
- Critical design aircraft

3.10.1 Air Carrier Operations Forecast

The FAA defines the air carrier category as aircraft with a seating capacity of more than 60 seats or a maximum payload capacity of more than 18,000 pounds carrying passengers or cargo for hire or compensation. While the Airport does not have scheduled commercial service, a significant number of air carrier operations are generated by MRO tenants. As previously noted, the MRO tenants provide storage, maintenance, repair, and dismantling of air carrier-type aircraft. Historically, annual operations generated by MRO tenants have ranged from approximately 100 to 400, and demand is generally driven by secured contracts with airlines. Because activity at the Airport is influenced by both the health of the airline industry and the MRO tenants' ability to establish agreements with air carrier operators, gauging annual air carrier operations with any precision is challenging.

To develop forecasts of air carrier operations, the *FAA Aerospace Forecasts 2017–2037* was examined in conjunction with information provided by MRO tenants. Methodologies for air carrier operations forecasts are presented in the following sections.

3.10.1.1 MRO Tenants Estimate Methodology

Discussions with MRO tenants revealed that future demand of air carrier operations is largely contingent on the health of the U.S. economy and the airline industry, as well as the tenants' ability to generate contracts with airlines. The ownership of the largest MRO tenant has turned over several times in the past, and the tenant has often operated as a smaller component of a much larger company. New ownership has identified that the success of this MRO tenant is a primary objective, and management anticipates that this could translate into a more aggressive pursuance of contracts with airlines and more air carrier operations at the

Airport in the future. The other MRO tenants also have plans to expand their existing facilities due to increasing demand for services, which would further bolster air carrier activity.

The air carrier operations forecast MRO tenants estimate methodology assumes that the tenants could generate 500 annual air carrier operations by 2021. This figure was estimated by the largest MRO tenant in an interview conducted in February 2017. From 2021 to 2036, an annual growth rate of 0.8 percent is applied, which reflects projected growth in the U.S. commercial fleet per *FAA Aerospace Forecast 2017–2037*. As shown in **Table 3-22,** this methodology produces an increase from 108 air carrier operations in 2016 to 563 in 2036, which represents a CAGR of 8.61 percent.

Table 3-22: Air Carrier Operations Forecast: MRO Tenants Estimate Methodology

Year	Air Carrier Operations
2016	108
2021	500
2026	521
2031	542
2036	563
CAGR 2016–2036	8.61%

Sources: FAA Aerospace Forecast 2017–2037; Goodyear ATCT, 2016.

3.10.1.2 U.S. Mainline Carrier Methodology

The second methodology used to project air carrier operations uses FAA forecasts of the U.S. mainline carrier fleet through 2036, which projects that the U.S. mainline carriers will grow at 0.8 percent annually through the forecast period. Mainline carriers are considered primary operating units rather than regional subsidiaries. As noted, air carrier operations generated by MRO tenants are largely dependent on the strength of the U.S. economy and the airline industry. The 108 air carrier operations that occurred at the Airport in 2016 represented a relatively low level of activity compared to previous years. As noted, there was a change in ownership which likely impacted the level of activity in 2016. The U.S. mainline carrier methodology assumes that air carrier operations in 2017 will return to their historical annual average from 2007–2016 (i.e., 165 annual operations) and continue to grow by 0.8 percent annually through 2036 as established by *FAA Aerospace Forecasts 2017–2037*. As shown in **Table 3-23,** this methodology projects an increase from 108 air carrier operations in 2016 to 192 in 2036, which represents a CAGR of 2.93 percent.

Table 3-23: Air Carrier Operations Forecast: U.S. Mainline Carrier Methodology

Year	Air Carrier Operations
2016	108
2021	171
2026	178
2031	185
2036	192
CAGR 2016–2036	2.93%

Sources: FAA Aerospace Forecast 2017–2037; Phoenix Goodyear ATCT, 2016.

3.10.1.3 Hybrid Methodology

The final methodology examined for the forecast of air carrier operations is a hybrid that combines the U.S. mainline carrier and the MRO tenants estimate methodologies. This hybrid methodology combines averages of the two previous methodologies and results in a forecast that is not as aggressive as the MRO tenants estimate, but does take into account a portion of MRO growth that may occur over time based on its anticipated changes in activity.

The justification for use of this hybrid approach is that while demand may exist currently and in the future, the implementation process for facility expansion to accommodate demand is often a long-term process, and demand may grow at slower levels over time. The results of this methodology are shown in **Table 3-24.** As shown, this methodology results in an increase in air carrier operations from 108 in 2016 to 379 in 2036, a CAGR of 6.47 percent.

Table 3-24: Air Carrier Operations Forecast: Hybrid Methodology

Year	Air Carrier Operations
2016	108
2021	336
2026	350
2031	364
2036	379
CAGR 2016–2036	6.47%

Sources: FAA Aerospace Forecast 2017–2037; Phoenix Goodyear ATCT, 2016.

3.10.1.4 Air Carrier Operations Forecast Preferred Methodology

The number of future air carrier operations that may occur at the Airport is contingent on several factors, many of which are beyond the control of the Airport and MRO tenants. Historically, the Airport experienced an average of 165 air carrier operations annually. Based on discussions with the Aviation Department and MRO tenants, it has been well established that there is significant demand for MRO services at the Airport, and expansion of existing facilities will likely occur. However, the exact size and timing of the implementation of these actions are not yet known. It is anticipated that gradual growth in air carrier operations will continue until expansion of MRO facilities occurs, at which point demand will increase at a greater rate. As such, the hybrid methodology is the preferred forecast for air carrier operations for this master plan update. This methodology projects air carrier operations will increase from 108 in 2016 to 379 in 2036, a CAGR of 6.47 percent.

3.10.2 Military Aircraft Operations Forecast

Military activity accounted for approximately 3.5 percent of operational traffic at the Airport in 2016. Based on data provided from the ATCT, historical military operations at the Airport fluctuated significantly between 2007 and 2016, and they can be difficult to predict because military activity at public use airports is typically not tied to the same drivers that impact general aviation or commercial operations. Many of the military operations are performed by the German Air Force as part of their training. As a result of the uncertainty, the FAA's TAF forecast is the preferred methodology for military operations at the Airport. The TAF depicts 3,091 itinerant, 1,103 local, and 4,194 total military operations annually throughout the projection period, as presented in **Table 3-25.**

Table 3-25: Military Operations Forecast

Year	Local Military Operations	Itinerant Military Operations	Total Military Operations
2016	1,183	3,072	4,255
2021	1,103	3,091	4,194
2026	1,103	3,091	4,194
2031	1,103	3,091	4,194
2036	1,103	3,091	4,194
CAGR 2016–2036	-0.35%	0.03%	-0.07%

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016.

3.10.3 Local General Aviation Operations Forecast

Local general aviation operations at the Airport are primarily driven by activity associated with the flight school tenants. Approximately 90 percent of local general aviation operations were generated by flight schools in 2016, and demand for flight training at the Airport is anticipated to increase throughout the 20-year planning horizon. Because different factors influence local and itinerant general activity, separate forecasts have been developed for each segment. Furthermore, comparisons to socioeconomic factors are not examined because local general aviation activity is so closely tied to the flight schools.

3.10.3.1 FAA Aerospace Forecast Methodology: ATP Licenses

The first methodology for local general aviation operations utilizes the FAA's projected growth rate of air transport licenses (ATP) from 2016 to 2036. This comparison was selected because a significant portion of flight training at the Airport is associated with commercial airline training. ATP licenses differ from commercial pilot certificates (CPLs) in that they are not only valid in the U.S., but also in several other countries. Many student pilots who complete flight training courses become commercial pilots in countries other than the U.S., requiring the ATP licenses.

FAA Aerospace Forecasts 2017–2037 identified that ATP licenses would increase by 0.5 percent annually through 2036. This figure is applied to local general aviation activity at the Airport in base year 2016 and held constant throughout the projection period. As shown in **Table 3-26**, this methodology projects an increase in local general aviation operations from 73,090 in 2016 to 80,757 in 2036, which represents a CAGR of 0.50 percent.

Table 3-26: Local GA Operations Forecast: FAA Aerospace Forecast Methodology – ATP Licenses

Year	Local GA Operations
2016	73,090
2021	74,936
2026	76,828
2031	78,769
2036	80,757
CAGR 2016–2036	0.50%

Sources: FAA Aerospace Forecast 2017–2037; Phoenix Goodyear ATCT, 2016.

3.10.3.2 Unconstrained Flight School Growth Methodology

The second methodology used to forecast local general aviation operations applies separate assumptions to flight school and non-flight school activity. Based on interviews with flight school tenants, it was identified that if additional dormitory space were available, flight school operations could double within a 5-year timeframe. The unconstrained flight school growth methodology assumes that flight school operations will double from 51,500 in 2016 to 103,000 in 2021. For flight school operations during the latter phase of the forecast period between 2021 and 2036, a 0.4 percent annual growth rate is applied, which represents *FAA Aerospace Forecasts 2017–2037* projections of local general aviation operations at airports with an ATCT. Together, flight school local operations are anticipated to grow at an annual rate of 3.84 percent through the forecast period.

For non-flight school operations, this methodology assumes that 0.4 percent annual growth will occur from 2016 to 2036. As noted, this figure represents the average annual growth rate of local general aviation operations at airports equipped with an ATCT, as identified in the *FAA Aerospace Forecasts 2017–2037*. As shown in **Table 3-27**, this methodology projects an increase in local general aviation operations from 73,090 in 2016 to 132,741 in 2036, which represents a CAGR of 3.03 percent.

Table 3-27: Local GA Operations Forecast: Unconstrained Flight School Growth Methodology

Year	Flight School Local Operations	Other Local GA Operations	Total Local GA Operations
2016	51,500	21,590	73,090
2021	103,000	22,025	125,025
2026	105,077	22,469	127,546
2031	107,195	22,922	130,117
2036	109,356	23,384	132,741
CAGR 2016–2036	3.84%	0.40%	3.03%

Sources: FAA Aerospace Forecasts 2017–2037; Phoenix Goodyear ATCT, 2016.

3.10.3.3 Regional Market Share Methodology

Similar to the methodology used for based aircraft, the market share methodology compares local general aviation operations at the Airport to all Phoenix area airports that are equipped with an ATCT. As previously mentioned, these airports include Chandler Municipal, Phoenix Deer Valley, Falcon Field, Glendale Municipal, Phoenix-Mesa Gateway, Phoenix Sky Harbor International, and Scottsdale. Projected local general aviation operations for compared airports were obtained from the FAA TAF issued January 2017.

In 2016, local general aviation operations at the Airport accounted for 8.7 percent of all local general aviation operations at airports in the Phoenix market. Historically, the Airport's market share of local general aviation operations has been approximately 10 percent. The regional market share methodology assumes that the Airport's market share will gradually increase to 10 percent by 2036. As shown in **Table 3-28**, this methodology projects an increase in local general aviation operations from 73,090 in 2016 to 90,528 in 2036, which represents a CAGR of 1.08 percent.

Table 3-28: Local GA Operations Forecast: Regional Market Share Methodology

Year	PHX Airports Local GA Operations	GYR Market Share	GYR Local GA Operations
2016	838,655	8.7%	73,090
2021	874,162	9.1%	79,767
2026	884,389	9.6%	85,122
2031	894,761	9.8%	87,798
2036	905,281	10.0%	90,528
CAGR 2016–2036	0.38%	N/A	1.08%

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016.

3.10.3.4 Local GA Forecast: Hybrid Methodology

The final methodology developed to forecast local GA operations combines elements of both the regional market share methodology and the unconstrained flight school growth methodology. The resulting hybrid methodology assumes that, between 2016 and 2036, local GA operations will follow the regional market share methodology. Additionally, facilities accommodating flight school growth will be developed in phases starting in 2027. By 2036, the demand identified by the flight schools (i.e., an additional 51,500 local general operations) would be fully realized.

A summary of the hybrid methodology is presented in **Table 3-29**. As shown, this methodology projects an increase from 73,030 local general aviation operations in 2016 to 142,028 operations in 2036, which represents a CAGR of 3.38 percent.

Table 3-29: Local GA Operations Forecast: Hybrid Methodology

Year	Market Share Local GA Operations	Additional Flight School Local GA Operations	Total Local GA Operations
2016	73,090	N/A	73,090
2021	79,767		79,767
2026	85,122		85,122
2031	87,798	25,750	113,548
2036	90,528	51,500	142,028
CAGR 2016–2036	1.08%	N/A	3.38%

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016.

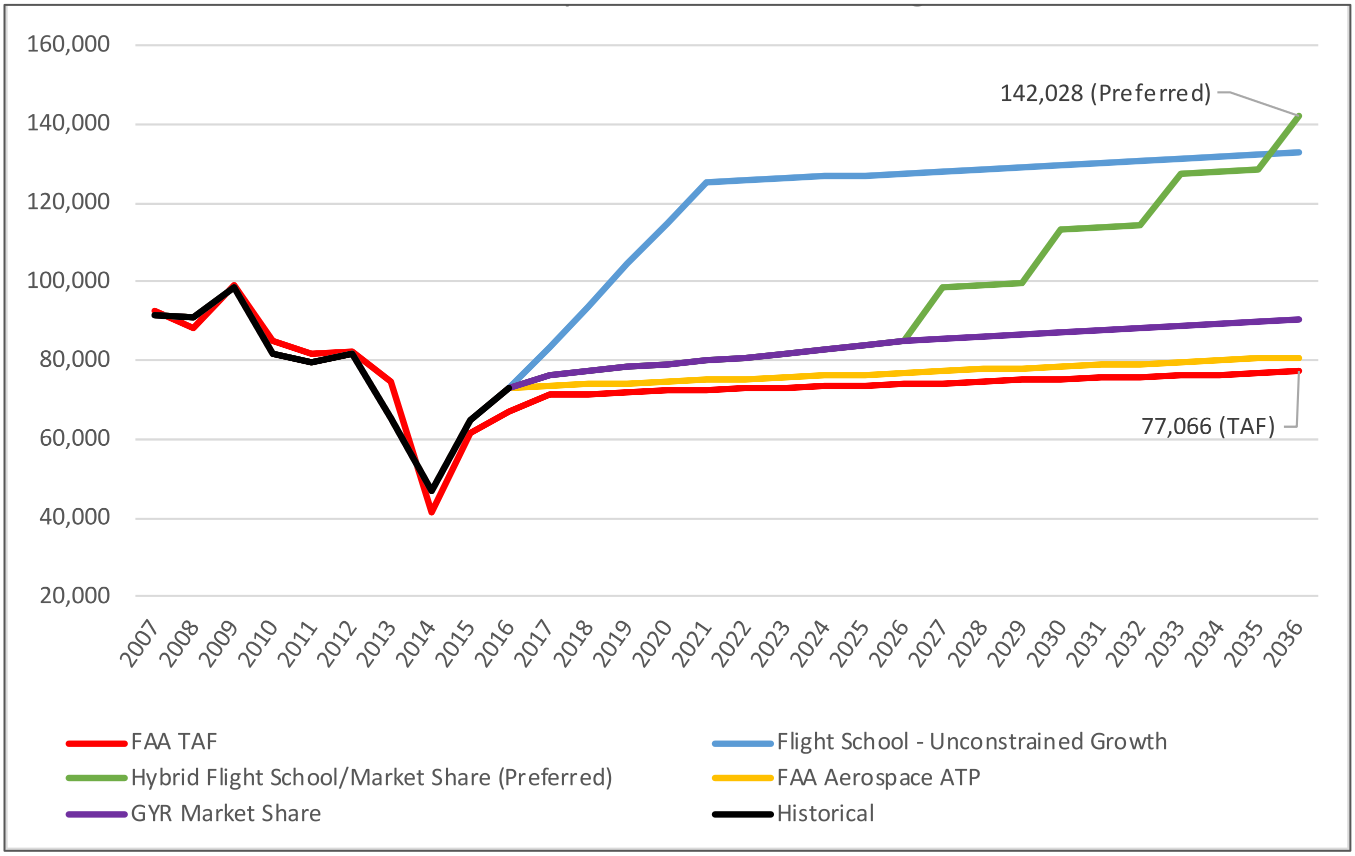
3.10.3.5 Local GA Operations Forecast Preferred Methodology

As noted previously, local general aviation operations at the Airport are largely driven by pilot training. Based on interviews with the flight schools, the demand for training has increased in recent years due to an international commercial pilot shortage, and that shortage is anticipated to continue in the long term. All of the flight schools interviewed during this study estimated that 2016 activity would easily double if additional dormitory space was available to house students.

While it is the intent of the Airport to accommodate existing and potential future tenants to the extent possible, the point at which additional facilities may be developed to accommodate flight training demand is unknown. The FAA identifies that the number of active ATP licenses is anticipated to increase through 2036, so it can be assumed that the demand for pilot training should increase accordingly at the Airport during the 20-year projection period. As such, the hybrid methodology is the preferred forecast for local general aviation operations because it incorporates anticipated local demand unrelated to the flight schools at the

Airport, while including a caveat that the additional facilities will be constructed to accommodate flight training tenants before 2036. A summary of local general aviation operations forecast methodologies compared with the FAA TAF is shown in **Figure 3-3.** This methodology projects local general aviation operations will increase from 73,090 in 2016 to 142,028 in 2036, a CAGR of 3.38 percent.

Figure 3-3: Local GA Operations Forecast Methodologies



Sources: FAA TAF issued January 2014; Phoenix Goodyear ATCT, 2016.

3.10.4 Itinerant General Aviation Operations Forecast

Itinerant operations are performed by an aircraft that lands at an airport, arriving from outside the airport area, or departs an airport and leaves the airport area (20 miles from an airport). The following sections present forecasts developed for itinerant general aviation operations.

3.10.4.1 Socioeconomic: Population Variable Methodology

Historical and projected population data were obtained from MAG and Woods and Poole, as presented in an earlier section. The socioeconomic population variable methodology assumes that the number of itinerant general aviation operations at the Airport beginning in base year 2016 will mimic population projections for the compared geographic areas through 2036. **Table 3-30** identifies forecasted local general aviation operations by comparing existing and projected populations of the City of Goodyear, the Phoenix MSA, and the State of Arizona. As shown, the socioeconomic population variable methodology produces a range of itinerant general aviation operations from 62,979 to 103,753 by the end of the 20-year planning period, which represent CAGRs of 1.59 percent to 4.16 percent.

Table 3-30: Itinerant GA Operations Forecast: Socioeconomic Population Variable Methodology

Year	Goodyear		Phoenix MSA		State of Arizona	
	Population	Itinerant GA Operations	Population	Itinerant GA Operations	Population	Itinerant GA Operations
2016	79,624	45,941	4,653,084	45,941	6,952,428	45,941
2021	99,584	57,457	5,089,882	50,254	7,540,072	49,824
2026	126,799	73,160	5,562,940	54,924	8,171,482	53,996
2031	153,778	88,726	6,068,613	59,917	8,841,245	58,422
2036	179,823	103,753	6,596,778	65,132	9,530,820	62,979
CAGR 2016–2036	4.16%		1.76%		1.59%	

Sources: Phoenix Goodyear ATCT, 2016; Woods and Poole, Inc.

3.10.4.2 Socioeconomic: Employment Variable Methodology

The socioeconomic employment variable methodology assumes that the number of itinerant general aviation operations at the Airport will increase at the same rate as the growth in employment for the compared geographic areas between 2016 and 2036. **Table 3-31** identifies forecasted local general aviation operations comparing existing and projected employed persons in the City of Goodyear, the Phoenix MSA, and the State of Arizona. As shown, this methodology produces a range between 65,587 and 93,042 itinerant general aviation operations by 2036, representing CAGRs of 1.80 percent to 3.59 percent.

Table 3-31: Itinerant GA Operations Forecast: Socioeconomic Employment Variable Methodology

Year	Goodyear		Phoenix MSA		State of Arizona	
	Population	Itinerant GA Operations	Population	Itinerant GA Operations	Population	Itinerant GA Operations
2016	33,238	45,941	2,559,572	45,941	3,610,148	45,941
2021	41,776	57,728	2,838,414	50,946	3,981,814	50,671
2026	48,876	67,556	3,127,402	56,133	4,363,962	55,534
2031	56,690	78,356	3,425,843	61,489	4,755,143	60,512
2036	67,315	93,042	3,733,008	67,003	5,154,008	65,587
CAGR 2016–2036	3.59%		1.90%		1.80%	

Sources: Phoenix Goodyear ATCT, 2016; Woods and Poole, Inc.

3.10.4.3 Socioeconomic: Per Capita Personal Income Variable Methodology

As shown in **Table 3-32**, PCPI is examined to project itinerant general aviation operations at the Airport. It should be noted that forecasts of PCPI were not available for the City of Goodyear. Projections of income have been adjusted to constant 2016 dollars to adjust for inflation over time. As shown, the Phoenix MSA PCPI variable results in 61,542 itinerant operations by 2036, and the Arizona PCPI variable results in 61,551 operations by 2036. Although the CAGR for both variables are shown as identical, Arizona's is a fraction of a percent higher which results in a slight difference between operations forecasts.

Table 3-32: Itinerant GA Operations Forecast: Socioeconomic PCPI Variable Methodology

Year	Phoenix MSA		Arizona	
	PCPI ($2016)	Itinerant GA Operations	PCPI ($2016)	Itinerant GA Operations
2016	$42,558	45,941	$40,500	45,941
2021	$46,242	49,918	$44,035	49,951
2026	$50,043	54,022	$47,685	54,091
2031	$53,665	57,931	$51,129	57,999
2036	$57,009	61,542	$54,261	61,551
CAGR 2016–2036	1.47%			

Sources: Phoenix Goodyear ATCT, 2016; Woods and Poole, Inc.

3.10.4.4 Socioeconomic: Gross Regional Product Variable Methodology

The final socioeconomic variable examined to project itinerant general aviation operations at the Airport is GRP. As with the other socioeconomic methodologies presented in this section, the socioeconomic GRP variable methodology assumes that itinerant general aviation operations at the Airport will mimic growth rates of general aviation for the compared geographic areas. As shown in **Table 3-33**, this methodology projects 81,989 itinerant general aviation operations by 2036 comparing GRP for the Phoenix MSA, and 79,677 local general aviation operations by 2036 comparing GRP for Arizona. Projections of GRP have been adjusted to 2016 dollars to adjust for inflation over time.

Table 3-33: Itinerant GA Operations Forecast: Socioeconomic – GRP Variable Methodology

Year	Phoenix MSA		Arizona	
	GRP ($2016 in millions)	Itinerant GA Operations	GRP ($2016 in millions)	Itinerant GA Operations
2016	$234,327	45,941	$315,257	45,941
2021	$273,243	53,571	$364,803	53,161
2026	$316,296	62,011	$419,260	61,097
2031	$364,336	71,430	$479,602	69,890
2036	$418,192	81,989	$546,763	79,677
CAGR 2016-2036	2.94%		2.79%	

Sources: Woods and Poole, Inc.; Phoenix Goodyear ATCT, 2016.

3.10.4.5 Regional Market Share Methodology

The regional market share methodology compares itinerant general aviation operations at the Airport to all Phoenix area airports that are equipped with an ATCT (Chandler Municipal, Phoenix Deer Valley, Falcon Field, Glendale Municipal, Phoenix-Mesa Gateway, Phoenix Sky Harbor International, and Scottsdale). Projected itinerant general aviation operations for compared airports was obtained from the FAA TAF issued January 2017.

In 2016, itinerant general aviation operations at the Airport accounted for 7.1 percent of all itinerant general aviation operations at airports in the Phoenix market. Historically, the Airport's market share of itinerant general aviation operations has been approximately 8.5 percent. The regional market share methodology assumes that the Airport's market share will gradually increase through 2036.

As shown in **Table 3-34,** this methodology projects an increase in itinerant general aviation operations from 45,941 in 2016 to 53,759 in 2036, which represents a CAGR of 0.79 percent.

Table 3-34: Itinerant GA Operations Forecast: Regional Market Share Methodology

Year	PHX Airports Itinerant GA Operations	GYR Market Share	GYR Itinerant GA Operations
2016	645,228	7.1%	45,941
2021	632,223	7.6%	48,049
2026	637,509	7.9%	50,363
2031	646,365	8.1%	52,356
2036	655,595	8.2%	53,759
CAGR 2016-2036	0.08%	N/A	0.79%

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016.

3.10.4.6 FAA Aerospace Forecast Methodology – GA Hours Flown

Another methodology used to project itinerant general aviation operations at the Airport applies the growth rate for total hours flown nationally, as described in *FAA Aerospace Forecast 2017–2037*. The FAA projects that total general aviation hours flown will increase 0.9 percent annually through 2036. This figure is applied to base year 2016 itinerant general aviation operations and held constant through the projection period. Results of this methodology are described in **Table 3-35.** As shown, this methodology projects an increase in itinerant general aviation operations from 45,941 in 2016 to 54,957 in 2036, resulting in a CAGR of 0.90 percent.

Table 3-35: Itinerant GA Operations Forecast: GA Hours Flown

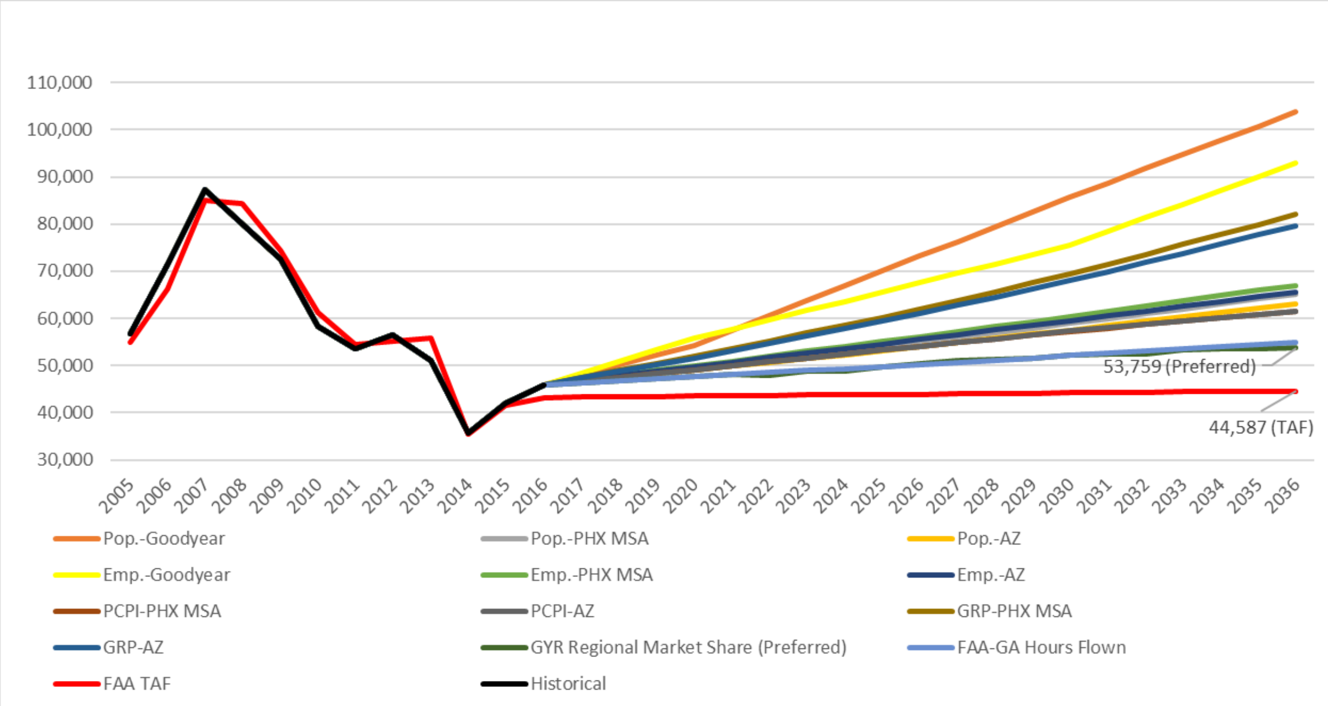
Year	Itinerant GA Operations
2016	45,941
2021	48,046
2026	50,247
2031	52,549
2036	54,957
CAGR 2016–2036	0.90%

Sources: FAA Aerospace Forecast 2017–2037; Phoenix Goodyear ATCT, 2016.

3.10.4.7 Itinerant GA Operations Forecast Preferred Methodology

Based on an analysis of historical itinerant general aviation operations at the Airport, it is evident that this activity is closely tied to trends that are occurring at other airports within the Phoenix region. A statistical analysis of itinerant general aviation operations at the Airport between 2007 and 2016 compared to itinerant operations at other airports in the Phoenix MSA equipped with an ATCT during the same timeframe resulted in a correlation coefficient of 0.91, which is significantly higher than any of the other variables that were measured. The results of this analysis indicate that itinerant general aviation operations at the Airport will likely continue to mimic activity that will occur within the Phoenix region. As such, the preferred methodology for itinerant general aviation operations is the regional market share methodology. A summary of itinerant general aviation operations forecast methodologies compared with the FAA TAF is shown in **Figure 3-4.** This methodology projects itinerant general aviation operations will increase from 45,941 in 2016 to 53,759 in 2036, a CAGR of 0.79 percent.

Figure 3-4: Itinerant GA Operations Forecast Methodologies



Sources: FAA TAF issued January 2014; Phoenix Goodyear ATCT, 2016.

3.10.5 Aircraft Operations Forecast Summary

A summary of all preferred methodologies for the various segments of aircraft operations is presented in **Table 3-36.** As shown, total annual operations are anticipated to increase from 123,394 in 2016 to 200,360 in 2036, which represents a CAGR of 2.45 percent.

Table 3-36: Operations Forecast: Summary

Year	Air Carrier	Itinerant GA	Local GA	Itinerant Military	Local Military	Total Operations
2016	108	45,941	73,090	3,072	1,183	123,394
2021	336	48,049	79,767	3,091	1,103	132,346
2026	350	50,363	85,122	3,091	1,103	140,030
2031	364	52,356	113,548	3,091	1,103	170,462
2036	379	53,759	142,028	3,091	1,103	200,360
CAGR 2016–2036	6.47%	0.79%	3.38%	0.03%	-0.35%	2.45%

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.10.5.1 Local/Itinerant Operations

Based on the preferred methodologies presented in previous sections of this chapter, **Table 3-37** presents a summary forecast of local and itinerant aircraft operations. As shown, itinerant operations are anticipated to increase from 49,121 in 2016 to 57,228 in 2036, which represents a CAGR of 0.77 percent. Local operations are projected to increase from 74,273 in 2016 to 143,131 in 2036, a CAGR of 3.33 percent. As shown, growth in local operations significantly outpaces that of itinerant operations, primarily driven by the anticipated demand for flight training.

Table 3-37: Aircraft Operations Forecast: Local and Itinerant Operations

Year	Itinerant Operations	Local Operations	Total Operations
2016	49,121	74,273	123,394
2021	51,476	80,870	132,346
2026	53,804	86,225	140,030
2031	55,811	114,651	170,462
2036	57,228	143,131	200,360
CAGR 2016–2036	0.77%	3.33%	2.45%

Sources: FAA TAF issued January 2017; Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.10.5.2 Daytime/Evening Operations

Another component of the forecast is the development of forecasts of daytime/evening operations. This is an important element to include in the planning process because noise impacts created by aircraft arriving or departing at night are greater than during the day. The ATCT at the Airport is open from 6:00AM to 9:00PM daily. The FAA defines nighttime operations as those that are conducted between 10:00PM and 7:00AM. According to the FAA's TFMSC Distributed OPSNET database, which creates a summary of traffic by day and hour based on the DZ (departure) and AZ (arrival) message times received by the FAA Air Traffic Airspace (ATA) lab, 95.7 percent of operations at the Airport in 2016 were conducted during daytime hours. The remaining 4.3 percent were conducted during nighttime hours. TFMSC processes the individual flight records provided by the ATA Lab and assembles them from TFMS. These estimates do not represent actual operations that occurred, but they are indicative of the percent of IFR traffic that occurred at specific times of day in 2016. Based on interviews with flight schools and tenants, it was estimated that between 3 percent and 5 percent of total operations were conducted at night. As such, the 95.7 percent daytime and 4.3 percent nighttime operations estimate in 2016 is reasonable for total operations at the Airport. As shown in **Table 3-38**, this split is anticipated to remain constant throughout the projection period.

Table 3-38: Aircraft Operations Forecast: Daytime/Nighttime Operations

Year	Daytime Operations	% Daytime	Nighttime Operations	% Nighttime	Total Operations
2016	118,088	95.70%	5,306	4.30%	123,394
2021	126,655	95.70%	5,691	4.30%	132,346
2026	134,008	95.70%	6,021	4.30%	140,030
2031	163,132	95.70%	7,330	4.30%	170,462
2036	191,744	95.70%	8,615	4.30%	200,360

Sources: FAA TFMSC Database; Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.10.5.3 Touch-and-Go Operations

A touch-and-go operation is defined as an operation conducted by an aircraft that lands and departs on a runway without stopping or exiting the runway. This type of operation is typically associated with flight training. Based on conversations with the ATCT manager, approximately 90 percent of local operations (including those categorized as military) are considered training operations. Of these, approximately two-thirds are estimated to be touch-and-go operations. Based on these estimates, touch-and-go operations are anticipated to increase from 44,519 in 2016 to 85,793 in 2036, which represents a CAGR of 3.33 percent, as presented in **Table 3-39.**

Table 3-39: Aircraft Operations Forecast: Touch-and-Go Operations

Year	Total Operations	Local Operations	Training Operations	Touch-And-Go Operations
2016	123,394	74,273	66,846	44,519
2021	132,346	80,870	72,783	48,474
2026	140,030	86,225	77,603	51,684
2031	170,462	114,651	103,186	68,722
2036	200,360	143,131	128,818	85,793
CAGR 2016–2036	2.45%	3.33%	3.33%	3.33%

Sources: Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.10.5.4 Annual Instrument Approaches

As defined by the FAA, an Instrument Approach Procedure (IAP) is a series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be visually made. All operations that are not categorized as instrument operations are considered visual operations. According to records provided by the ATCT, approximately 2 percent of total operations at the Airport utilized IAPs. This figure is held constant throughout the planning period, as depicted in **Table 3-40**.

Table 3-40: Aircraft Operations Forecast: Annual Instrument Approaches

Year	Total Operations	Instrument Operations	% Instrument	Non-Instrument / Visual Operations	% Non-Instrument
2016	123,394	2,493	2.02%	120,901	97.98%
2021	132,346	2,674	2.02%	129,672	97.98%
2026	140,030	2,829	2.02%	137,201	97.98%
2031	170,462	3,444	2.02%	167,018	97.98%
2036	200,360	4,048	2.02%	196,312	97.98%

Sources: FAA TFMSC Database; Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.10.5.5 Operational Fleet Mix

Operational fleet mix projections identify the type of aircraft that currently operate and are anticipated to operate at the Airport, including operations conducted by both based and itinerant aircraft. Forecasts have been developed using data obtained from the FAA's TFMSC database and are presented in **Table 3-41.**

Table 3-41: Aircraft Operations Fleet Mix

Year	Single-engine Piston		Multi-Engine Piston		Turboprop		Jet		Helicopter		Total
	Number	%	Number	%	Number	%	Number	%	Number	%	
2016	113,204	92%	8,337	7%	185	.2%	556	0%	1,112	1%	123,394
2021	119,797	91%	9,354	7%	199	.2%	1,109	1%	1,887	1%	132,346
2026	125,041	89%	10,332	7%	210	.2%	1,716	1%	2,731	2%	140,030
2031	150,131	88%	13,107	8%	256	.2%	2,749	2%	4,219	2%	170,462
2036	174,012	87%	16,029	8%	301	.2%	4,007	2%	6,011	3%	200,360
CAGR 2016–2036	2.17%	N/A	3.32%	N/A	2.45%	N/A	10.37%	N/A	8.79%	N/A	2.45%

Source: Kimley-Horn.

3.10.5.6 Military Operational Fleet Mix

A unique component of this master plan update is the identification of the military operational fleet mix. Data for 2016 operations were obtained from the FAA's TFMSC database and through discussions with the Phoenix Goodyear ATCT manager. The ATCT manager noted that, while a significant number of operations that occur at the Airport are classified as military, nearly all of them are conducted by pilots training with the German Air Force. Very few military operations occur at the Airport that are not related to military training use of general aviation aircraft. The German Air Force's fleet currently consists of Grob G-120 aircraft. While the German Air Force's fleet may change in the future, it is anticipated that any new aircraft types will remain relatively similar to the Grob G-120 in size and capability. The existing and projected military operational fleet mix is identified in **Table 3-42.**

Table 3-42: Military Operational Fleet Mix

Year	Total Military Operations	C17	C130	TE2	GROB 120
2016	4,255	2	2	2	4,249
2021	4,194	2	2	2	4,188
2026	4,194	2	2	2	4,188
2031	4,194	2	2	2	4,188
2036	4,194	2	2	2	4,188

Note: C130=Lockheed 130 Hercules, C17=Boeing Globemaster, TE-2=Hawkeye. All models of aircraft are U.S. military except the Grob G-120, which is used by the German Air Force.
Sources: FAA TFMSC Database; Phoenix Goodyear ATCT, 2016; Kimley-Horn.

3.10.6 Critical Design Aircraft

Facility planning for general aviation airports is impacted by existing and anticipated levels of aviation-related demand, both based aircraft and annual aircraft operations, as well as the size and type of aircraft that currently operate and are projected to operate at an airport.

As previously discussed in **Chapter 2**, the FAA classifies airports by ARC, which identifies the overall planning and design criteria for the airport. Per FAA AC 150-5300-13A, the ARC is assigned based on the size of the largest aircraft that generally records at least 500 operations annually at an airport; this aircraft is known as the airport's "design aircraft." However, this document further adds that, "The first consideration of the airport planner should be the safe operation of aircraft likely to use the airport. Any operation of an aircraft that exceeds design criteria of the airport may result in either an unsafe operation or a lesser safety margin unless air traffic control (ATC) Standard Operating Procedures (SOPs) are in place for those operations."

The critical design aircraft can consist of multiple aircraft that are considered collectively as a "family" of aircraft. The ARC is used to determine the appropriate design standards for pavement surfaces, safety area dimensions, runway lengths, separation standards, and taxiway criteria in an attempt to ensure that the airfield layout and geometry provide a safe and efficient operating environment for the aircraft that typically use the airport.

It is important to note that the Airport is the only general aviation airport in the Phoenix area equipped with an ATCT that has a runway width of 150 feet (design standard for D-IV). There are no other general aviation airports in the metropolitan area that are equipped with a runway capable of accommodating D-IV and larger aircraft. While Phoenix Sky Harbor International Airport and Phoenix-Mesa Gateway Airport are able to accommodate D-IV aircraft, these facilities are commercial service airports.

Additionally, as indicated in **Chapter 2,** the approved ALP signed in 2008 established the existing and ultimate ARC and critical design aircraft as a DC 10-40 which is an ARC D-IV. A footnote appears on the ALP's runway data table indicating that "actual ARC is C-III, which is based on a Boeing 737-300 as the critical aircraft." However, since the 2007–2008 time period when the ALP was last approved, several projects at the Airport have been designed to meet the D-IV design standards, most notably the Runway Shift project in 2015 and the Runway Rehabilitation project in 2016.

An analysis of the FAA's TFMSC database was conducted to identify the recommended critical design aircraft for this Airport master plan update. The most demanding group of aircraft that conducted at least 500 operations in 2016 had an ARC of B-II; however, there were also 148 operations at the Airport conducted by aircraft with an Aircraft Approach Category (AAC) of D or an Airplane Design Group (ADG) of IV or V. These operations consisted of both commercial aircraft such as the Boeing 757 and Boeing 767 generated by MRO tenants, and corporate aircraft models such as the Gulfstream G500 and Learjet 35/36.

Based on recent increases in corporate activity coupled with projected air carrier operations, it is reasonable to assume that the 148 operations of AAC D and ADG IV+ that occurred in 2016 will grow at the same rate as air carrier operations projections (see **Table 3-43**). As shown, the application of the growth rate for the preferred air carrier operations methodology results in 526 operations by aircraft with an ARC of D-IV+ by 2036.

The MRO tenants generate a significant amount of operations by aircraft that are being phased out of airlines' fleets, which include older models with ARCs of C-IV and D-IV such as the DC-10 and the Boeing 747. As fleets are modernized, it is anticipated that these older models will comprise a higher proportion of the air carrier fleet at the Airport as they arrive to be parted out or stored.

MRO tenants identified that their number of annual operations could reach 500 by 2021. While the preferred methodology for air carrier operations produced a less aggressive growth rate, all indications are that activity associated with MRO tenants should increase as all of these tenants have plans to expand existing facilities. MRO activity as it pertains to aircraft operations at the Airport is largely contingent on the overall health of the economy and airline industry, and the tenant's ability to secure contracts with airlines for aircraft repair, maintenance, painting, and storage. The MROs are vital tenants at the Airport, and the ability of the Airport to accommodate activity generated by MROs is paramount to the financial success. The MROs provide a significant economic benefit to the Airport, the surrounding community, and on a national level in the support of the commercial airline industry. It is recommended that future planning considerations account for aircraft operations conducted by aircraft with ARCs of D-IV and above.

Table 3-43: ARC D-IV+ Operations

Year	Air Carrier Operations	AAC D Operations	ADG IV+ Operations	ARC D-IV+ Operations
2016	108	82	68	150
2021	336	112	93	205
2026	350	153	127	281
2031	364	210	174	384
2036	379	287	238	526
CAGR 2016–2036	6.47%			

Sources: TFMSC Database, 2016; Kimley-Horn.

Based on an analysis of historical corporate and MRO-related activity, estimates of future activity provided by MRO tenants, the value of the tenant to the Airport and the surrounding community, and the fact that several projects have been designed at the Airport to accommodate D-IV standards, **it is the recommendation of this master plan update that the ARC remain as D-IV over the planning period, and the critical design aircraft should be the Boeing 767-300.**

3.11 Forecast Summary

Based on historical trends, socioeconomic factors, and expectant growth in flight school and MRO tenant activity, it is anticipated that the Airport will experience relatively steady growth in both operations and based aircraft throughout the 20-year planning horizon. While the aviation industry was significantly impacted by the economic downturn from 2008 to 2010 and is continuing its return to activity levels experienced in years leading up to that event, the Airport has remained relatively unaffected. The Airport's activity levels were previously impacted by a flight school's decision to relocate, without which growth would have continued. While the FAA projects that aviation activity at other airports in the Phoenix MSA will see slow, modest growth through 2036, it is anticipated that the Airport will outpace other airports in the region due to the MRO and flight school tenant growth. Summaries of activity that have been submitted to the FAA for review and approval are depicted in the tables presented in **Section 3.12.**

3.12 FAA Forecast Review and Approval

FAA ADOs or Regional Airports Divisions are responsible for forecast approvals. When reviewing a sponsor's forecast, the FAA must ensure the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate methodologies. Additional discussion on assumptions and methodologies can be found in the APO report, *Forecasting Aviation Activity by Airport*. After a thorough review of the forecast, FAA then determines if the forecast is consistent with the TAF.

For all classes of airports, forecasts for based aircraft and total operations are considered consistent with the TAF if they meet the following criterion: Forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period. If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used in FAA decision making. This may involve revisions to the airport sponsor's submitted forecasts, adjustments to the TAF, or both.

A comparison of forecasts of aviation with TAF forecasts are presented in the FAA template tables below. As shown, the forecasts presented in this master plan satisfy the criteria for approval at the ADO level.

Figure 3-5: FAA Template for Comparing Airport Planning and TAF Forecasts

Template for Comparing Airport Planning and TAF Forecasts (1)

Based Aircraft	Year	GYR Forecast	TAF	GYR/TAF % Difference
Base yr.	2016	222	204	8.8%
Base yr. + 5yrs.	2021	241	219	10.0%
Base yr. + 10yrs.	2026	265	238	11.5%
Base yr. + 15yrs.	2031	290	258	12.2%
Itinerant Operations				
Base yr.	2016	49,121	46,328	6.0%
Base yr. + 5yrs.	2021	51,476	46,834	9.9%
Base yr. + 10yrs.	2026	53,804	47,168	14.1%
Base yr. + 15yrs.	2031	55,811	47,503	17.5%
Local Operations				
Base yr.	2016	74,273	68,032	9.2%
Base yr. + 5yrs.	2021	80,870	73,590	9.9%
Base yr. + 10yrs.	2026	86,225	75,083	14.8%
Base yr. + 15yrs.	2031	114,651	76,611	49.7%
Total Operations				
Base yr.	2016	123,394	114,360	7.9%
Base yr. + 5yrs.	2021	132,346	120,424	9.9%
Base yr. + 10yrs.	2026	140,030	122,251	14.5%
Base yr. + 15yrs.	2031	170,462	124,114	37.3%

Note: TAF data is on a U.S. government fiscal year basis (October through September).

(1) Table is developed from Appendix C in the FAA Report, "Forecasting Aviation Activity By Airport."

Sources: FAA Office of Aviation Policy and Plans (APO-110), "Forecasting Aviation Activity by Airport." Kimley-Horn.

Figure 3-6: FAA Template for Summarizing and Documenting Airport Planning Forecasts

Template for Summarizing and Documenting Airport Planning Forecasts (1)

A. Forecast Levels and Growth Rates (Sample Data Shown)

Airport Name: Phoenix Goodyear Airport (GYR)

Specify base year: 2016

	2016	2021	2026	2031	Average Annual Compound Growth Rates		
	Base Yr. Level	Base Yr.+5yrs.	Base Yr.+10yrs.	Base Yr.+15yrs.	Base Yr. to +5	Base Yr. to +10	Base Yr. to +15
Operations							
Itinerant							
Air Carrier	108	336	350	364	25.5%	12.5%	8.4%
Total Commercial Operations	108	336	350	364	25.5%	12.5%	8.4%
General aviation	45,941	48,049	50,363	52,356	0.9%	0.9%	0.9%
Military	3,072	3,091	3,091	3,091	0.1%	0.1%	0.0%
Local							
General aviation	73,090	79,767	85,122	113,548	1.8%	1.5%	3.0%
Military	1,183	1,103	1,103	1,103	-1.4%	-0.7%	-0.5%
TOTAL OPERATIONS	123,394	132,346	140,030	170,462	1.4%	1.3%	2.2%
Instrument Operations	2,493	2,674	2,829	3,444	1.4%	1.3%	2.2%
Peak Hour Operations	146	157	166	202	1.4%	1.3%	2.2%
Based Aircraft							
Single Engine (Nonjet)	204	218	237	255	1.4%	1.5%	1.5%
Multi Engine (Nonjet)	15	17	20	22	2.6%	2.7%	2.7%
Jet Engine	1	2	3	5	15.1%	12.5%	10.8%
Helicopter	2	3	5	7	11.4%	10.0%	8.9%
Other	0	0	0	0	N/A	N/A	N/A
TOTAL	222	241	265	290	1.7%	1.8%	1.8%

B. Operational Factors

	Base Yr. Level	Base Yr.+5yrs.	Base Yr.+10yrs.	Base Yr.+15yrs.
GA operations per based aircraft	536	530	510	573

(1) Table is developed from Appendix B in the FAA Report, "Forecasting Aviation Activity By Airport."

Sources: FAA Office of Aviation Policy and Plans (APO-110), "Forecasting Aviation Activity by Airport." Kimley-Horn.

Chapter 4

FACILITY REQUIREMENTS

This chapter identifies the infrastructure and facilities needed at the Airport to meet forecast aviation demand presented in Chapter 3. To properly plan for the future needs of the Airport, it is necessary to identify the specific types and quantity of infrastructure and facilities that are needed to serve the anticipated unconstrained demand levels.

Facility requirements were developed for the airside, landside, general aviation, and support facilities after conducting a capacity and demand analysis. Additionally, recommendations and feedback from airport personnel, tenants, businesses, and other stakeholders obtained during TAC and PAC meetings, interviews, public events, workshops, and online surveys were considered.

4.1 Planning Horizon

Beginning with a base year of 2016, facility requirements were identified for the near-term (2021), mid-term (2026), and long-term (2036) timeframes. Short-term timeframes focus on addressing immediate deficiencies and needs.

A good plan is one that is based on actual demand as it occurs at an airport, rather than time-based predictions. Actual activity will vary over time and may be higher or lower than what is forecasted. Using the three planning milestones (short-, medium-, and long-term) the Airport can make informed decisions regarding the timing of development when demand is realized. This approach will result in financially responsible and demand-based development of the Airport. The planning horizon will be used in subsequent sections to present the facility requirements. A summary of the forecast of based aircraft and total operations is provided in **Table 4-1**.

Table 4-1: Summary of Forecast Based Aircraft and Operations

Year	Based Aircraft	Total Operations	Peak Month Operations
2016 (base year)	222[1]	123,394[2]	12,675[3]
2021	241	132,346	13,595
2026	265	140,030	14,384
2031	290	170,462	17,510
2036	315	200,360	20,581

Notes: 1Airport Management data. 2FAA Traffic Flow Management System Counts (TFMSC) database. 3Peak month was determined to be November.
Sources: Airport Management, FAA TFMSC database, Kimley-Horn.

4.2 Peaking Characteristic

The capacity of an airport relates to the activity levels during a peak, or design, period. The aviation demand forecasts are used to determine the operational peaking characteristics and will be used to determine facility requirements.

To ensure that a facility isn't overbuilt, several factors are used to analyze airport facilities. The average day of the peak month, or the design day, is an accepted industry methodology used in evaluating peaking characteristics. Metrics such as average annual day doesn't adequately take into consideration increased activity at certain times of the year. Considering only the busy or peak day of the peak month, however, may result in facilities that are overbuilt.

The periods used in the capacity analysis and facility requirements are as follows:

- **Peak Month** — the calendar month when peak passenger volumes of aircraft operations occur
- **Design Day** — the average day in the peak month; 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

For the purpose of estimating peak design hourly operations, FAA Traffic Flow Management System Counts (TFMSC) for the Airport were evaluated and revealed that night-time operations (10:00 pm to 7:00 am) occurred 4.3 percent of the time in 2016. This means that 95.7 percent of operations occurred during the daytime (15 hours). Considering that the maximum peak hourly occurrence can be nearly twice the average of the hourly operations calculated for this time period means that the design hour operations are approximately 13 percent of the design day operations. The average peak monthly, daily, and hourly operations projected for the Airport are summarized on **Table 4-2.**

Table 4-2: Summary of Peak Demand Forecast Operations

Year	Total	Peak Month	Design Day	Design Hour
2016 (base year)	123,394[1]	12,675[2]	423	54
2021	132,346	13,595	453	58
2026	140,030	14,384	479	61
2031	170,462	17,510	584	74
2036	200,360	20,581	686	88

Notes: [1]FAA TFMSC database. [2]Peak month was determined to be November.

Source: Armstrong Consultants, Inc., 2017.

4.3 Airfield Capacity

Airfield capacity, also referred to as throughput capacity, is a measure of the maximum number of aircraft operations which can be accommodated at an airport in a one-hour period. FAA defines capacity in terms of specific time intervals. The two most commonly used time intervals are hourly and annual. As operations, or demand, approach the capacity of the airfield, individual aircraft delay will increase. Successive hourly demands exceeding the hourly capacity result in unacceptable delays. The Annual Service Volume (ASV) is defined by FAA as "a reasonable estimate of an airport's annual capacity" and is the most important value that must be computed in order to understand the runway capacity at an airport. In other words, ASV is the theoretical limit of operations that the airport can safely accommodate with delay occurring on a regular basis. The ASV takes into account different runway use, aircraft mix, weather conditions, and other related factors.

- **Airfield Geometry** — The airfield configuration, or the physical orientation and proximity of the various runway and taxiways, is a primary factor in determining airport capacity due to its direct influence on how aircraft maneuver the airfield.
- **Runway Configuration** — The Airport has a single-runway configuration. Therefore, the capacity of the runway will be representative of the overall capacity of the Airport.
- **Exit Taxiways** — The number and location of exit taxiways directly influence runway occupancy time and the overall capacity of the system.

The Airport has a single, full-length parallel taxiway with a series of exit taxiways. The taxiway exits are generally located in positions that allow aircraft to efficiently clear the runway, which in turn, minimizes runway occupancy time. Runway exit taxiways should be located approximately 2,000 to 4,000 feet past the arrival threshold for general aviation and corporate jet aircraft, and located approximately 4,000 to 8,000 feet for aircraft weighing more than 300,000 pounds. Using these criteria, the number of eligible exit taxiways for each runway end are shown in **Table 4-3.**

Table 4-3: Eligible Exits Taxiway

Runway end	2,000 to 4,000-Foot Range	4,000 to 8,000-Foot Range
Runway 3 (east flow)	2 - (T/Ws A6, A8)	4 - (T/Ws A1, A2, A3, A4)
Runway 21(west flow)	2 - (T/Ws A3, A5)	4 - (T/Ws A7, A8, A9, A10)

Source: Armstrong Consultants, Inc., 2017.

4.3.1 Capacity Methodology

Estimates of airfield capacity were developed in accordance with the methods presented in FAA Advisory Circular (AC) 150/5060-5, Change 2, *Airport Capacity and Delay*. Methodologies were used to calculate the hourly capacity of the runway system and ASV of the airfield. To calculate ASV, the ratio of annual demand to average daily demand during the peak month is calculated. Next, the ratio of average daily demand to average peak (design) hour demand during the peak month is determined. The values are then multiplied with the corresponding weighted hourly capacity used compute ASV. These calculations are based on the following criteria.

4.3.1.1 Aircraft Mix Index

The FAA has designated four categories of aircraft for capacity determinations which are based on the maximum certified takeoff weight, the number of engines, and the wake turbulence classifications. The mix index is calculated by adding the percent of Class C aircraft plus three times the percent of Class D aircraft. The percent of Class A and B aircraft (both under 12,500 pounds) is not considered to significantly affect airfield capacity because the wake turbulence generated by these smaller aircraft is not an issue. Class C aircraft include multi-engine aircraft greater than 12,500 pounds, but less than 300,000 pounds with a large wake turbulence classification. The Boeing 757-200 and Airbus A319 are examples of aircraft that fall within Class C. The final category of aircraft is Class D, which include multi-engine aircraft greater than 300,000 pounds with a heavy wake turbulence classification, such as the Boeing 767-300 and DC-10. The aircraft mix indexes are shown in **Table 4-4.**

Table 4-4: Aircraft Operational Mix

Aircraft Class				Mix Index (C+3D)
Year	A & B	C	D	
2016	99.71%	0.27%	0.002%	0
2021	99.71%	0.27%	0.002%	0
2026	99.71%	0.27%	0.002%	0
2031	99.71%	0.27%	0.002%	0
2036	99.71%	0.27%	0.002%	0

Source: Armstrong Consultants, Inc., 2017.

4.3.1.2 Percent of Aircraft Arrivals and Touch-and-Go Operations

The percent of arrivals at general aviation airports is assumed to equal departures, even during the peak hour. Therefore, a 50 percent arrival factor was applied to the capacity calculations.

A touch-and-go operation refers to a training procedure in which the pilot performs a normal landing followed by an immediate takeoff, without stopping or taxiing clear of the runway. While each touch-and-go operation actually accounts for two runway operations (one landing and one takeoff), this procedure typically takes less time than separate arrivals or departures. Therefore, airports with a high percent of touch-and-go operations will have a greater airfield capacity than an airport with less training activity.

Touch-and-go operations are significant at the Airport due to the flight schools. It is anticipated that the same level of touch-and-go operations, approximately 30 to 40 percent, will continue throughout the planning period. For planning purposes, it is assumed that all touch-and-go operations occur during Visual Flight Rules (VFR) conditions. Therefore, based on Figure 3-3 of AC 150/5060-5, the VFR conditions touch-and-go factor is 1.31. It is assumed there are no touch-and-go operations during Instrument Flight Rules (IFR) conditions, and therefore, the IFR touch-and-go factor is 1.00.

4.3.1.3 Meteorological Conditions

Meteorological conditions influence the utilization of an airfield's runway(s). Variations in the weather resulting in reduced visibility minimums typically reduces airfield capacity. Using the meteorological data collected for this master plan update, the area averages VFR conditions more than 99 percent of the time, with IFR conditions less than 1 percent of the time.

Changes in wind direction and velocity dictate runway usage. The wind coverage analysis presented in Chapter 2 indicates that wind coverage exceeds the required 95 percent for each of the all-weather crosswind components—10.5 through 20 knots. Using radar data obtained from the City of Phoenix Aviation Department, individual runway end utilization is shown in **Table 4-5**. Runway use was assumed to be consistent for all categories of aircraft and users.

Table 4-5: Runway End Utilization

	Annual Average (%)		
Runway	Arrivals	Departures	Touch-and-Go Operations
Runway 3	18	26	26
Runway 21	82	74	74

Sources: 2012 radar data provided by the City of Phoenix Aviation Department.

4.3.2 Capacity Analysis

During VFR conditions the Airport's hourly runway capacity base is approximately 102 aircraft operations[1]. Applying the 1.31 touch-and-go factor and the 0.94 runway exit factor, the adjusted hourly VFR capacity is 125 aircraft operations. The Airport's IFR hourly runway capacity base is 70 aircraft operations[2]. Applying the 1.00 touch-and-go factor and the 0.39 runway exit factor, the adjusted hourly capacity during IFR conditions is 27 aircraft operations. It is important to note that these runway capacities represent "theoretical" capacities that can be realized under optimal conditions. In practice, the actual runway capacity will be less than the theoretical values. Often, actual runway capacities equaling approximately 80 percent of the theoretical capacity are realized.

[1] Source: Figure 3-3 of FAA AC 150/5060-5
[2] Source: Figure 3-43 of FAA AC 150/5060-5

The weighted runway capacity is a function of the different annual runway use configurations, the percent of time each runway use configuration is used, the hourly capacity for each runway use configuration, and the ASV weighted factor. Where:

$$c_w = \left(\frac{(p_1 \cdot c_1 \cdot w_1)+(p_2 \cdot c_2 \cdot w_2)+\cdots+(p_n \cdot c_n \cdot w_n)}{(p_1 \cdot w_1)+(p_2 \cdot w_2)+\cdots+(p_n \cdot w_n)}\right)$$

Where:

- Cw = weighted hourly capacity
- Pn = percent of time configuration "n" is used
- Cn = hourly capacity of configuration "n"
- Wn = ASV weighting factor (based on the percent of maximum capacity)

The resultant of the weighted hourly capacity is approximately 121 aircraft operations. The ASV is thereby determined using the following equation:

Annual Service Volume = (Cw x D x H) where:

- C_w = 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

There were 123,394 total operations at the Airport in 2016. The average daily demand during the peak month in 2016 is approximately 423 operations per day. The ratio of annual demand to average daily demand during the peak month is 292 (123,394 ÷ 423). The ratio of average daily demand during the peak month to the average peak hour demand during the peak month is 7.8 (423 ÷ 54).

The resultant ASV for the Airport equals approximately 275,590 aircraft operations (121 x 292 x 7.8).

4.3.3 Capacity Summary

The preceding information was used to calculate the capacity of the Airport in accordance with accepted industry methodologies. These calculations were based on the specific airfield configuration, operational, and meteorological characteristics of the Airport on a typical day.

A demand that exceeds the annual service volume will likely result in significant delays on the airfield. However, regardless of how substantial an airport's capacity may appear, delays can occur even before an airport reaches its stated capacity. According to FAA Order 5090.3C, Field Formulation of the National Plan of Integrated Airport Systems (NPIAS), for most every type of capacity enhancing project, the FAA recommends beginning to plan for such improvements when the activity levels reach 60 to 75 percent of the annual capacity. A summary of the airfield capacity is shown in **Table 4-6.**

Based on the existing airfield configurations and the results of the capacity analysis, the Airport is not likely to reach the point in the planning horizon where the FAA would recommend additional capacity. For planning purposes, it is recommended that the necessary airfield improvements to increase capacity in the future be considered as development alternatives are created. One example of an enhancement to increase the capacity of the current airfield includes constructing an additional runway to accommodate the forecasted demand. Depending on the location of a new runway, land and additional taxiways may be needed to further enhance capacity. Also, instrument approaches and/or operational procedures also can enhance the capacity of an airfield and should be considered as development alternatives are created.

Table 4-6: Summary of Airfield Capacity

		Capacity		
Year	Annual Demand	ASV	% of Capacity	Weighted Hourly Capacity
2016	123,394	275,590	45	121
2021	132,346	275,590	48	121
2026	140,030	275,590	51	121
2031	170,462	275,590	62	121
2036	200,360	275,590	73	121

Source: Armstrong Consultants, Inc., 2017.

4.4 Airside Facilities

Airside facilities consist of those facilities that are related to aircraft arrival, departure, and ground movement, along with all associated navigational aids, airfield lighting, pavement markings, and signage. This section presents the required airside facilities in a quantitative and qualitative manner. The aviation demand forecasts provide quantitative findings via analytical means, whereas interviews, discussions, and a survey with airport personnel, TAC and PAC members, tenants, and users provide more qualitative requirements.

4.4.1 Runway Requirements

The following summarizes applicable runway design standards, runway length and width requirements, pavement strength requirements, an assessment of non-standard geometry, and a discussion regarding a potential parallel runway.

4.4.1.1 Runway Design Standards

The design aircraft(s) and Airport Reference Code (ARC) are key components of the FAA's design standards. The design aircraft (or family of design aircraft), along with the ARC, provide the information needed to determine which FAA design standards apply to the airfield, and in turn can be used to determine some of the necessary facility requirements. As summarized in **Chapters 2 and 3,** the existing ARC for the Airport is D-IV, and the existing design aircraft is the DC-10-40. In the future, the ARC should remain at D-IV throughout the planning period. The future critical design aircraft is the Boeing 767-300.

4.4.1.2 Runway Length

The 2007 Airport Master Plan recommended improvements to the Runway Safety Areas (RSA) by shifting the runway while also removing the Runway 21 displacement and maintaining a runway length of 8,500 feet. Following the plan, a *Technical Memorandum* confirmed the recommendation that Runway 3-21 be shifted. It confirmed the Runway 3 end should be extended by 300 feet and the Runway 21 threshold displacement of 1,800 should be removed. The RSA compliance project resulted in a runway length (arrival and departure) of 8,500 feet with no runway threshold displacements or declared distances.

There are many factors that determine runway length, including airfield elevation, mean maximum temperature of the hottest month, and the effective gradient of the runway. Also, the performance characteristics and operating weight of aircraft impacts the amount of runway length needed. The following information for the Airport was used for the analysis:

- Field elevation: 969 feet mean sea level (MSL)
- Mean maximum temperature of hottest month (July): 106.9° F
- Maximum difference in runway centerline elevation (Runway 3-21): 26.2 feet
- Performance characteristics and operating weight of aircraft

The process to determine recommended runway lengths for a selected list of critical design aircraft begins with determining the weights of the critical aircraft that are expected to use the airport on a regular basis. For aircraft weighing 60,000 pounds or less, the runway length is determined by family groupings of aircraft having similar performance characteristics. The first family grouping is identified as small aircraft, which is defined by the FAA as aircraft weighing 12,500 pounds or less at maximum takeoff weight (MTOW). The second family grouping is identified as large aircraft, which is defined by the FAA as aircraft exceeding 12,500 pounds but weighing less than 60,000 pounds. For aircraft weighing more than 60,000 pounds, the required runway length is determined by aircraft-specific length requirements. **Table 4-7** depicts the aircraft weight categorization as recommended by the FAA.

Table 4-7: Airplane Weight Categorization for Runway Length Requirements

Aircraft Weight Category (MTOW)			Aircraft Grouping
≤ 12,500 Pounds	Approach Speed < 30 knots		Family groupings of small airplanes
	Approach Speed ≥ 30 knots, but < 50 knots		Family groupings of small airplanes
	Approach Speed ≥ 50 knots	With < 10 Passengers	Family groupings of small airplanes
		With ≥ 10 Passengers	Family grouping of small airplanes
Over 12,500 pounds, but < 60,000 pounds			Family groupings of large airplanes
≥ 60,000 pounds or more, or regional jets[1]			Individual large airplane

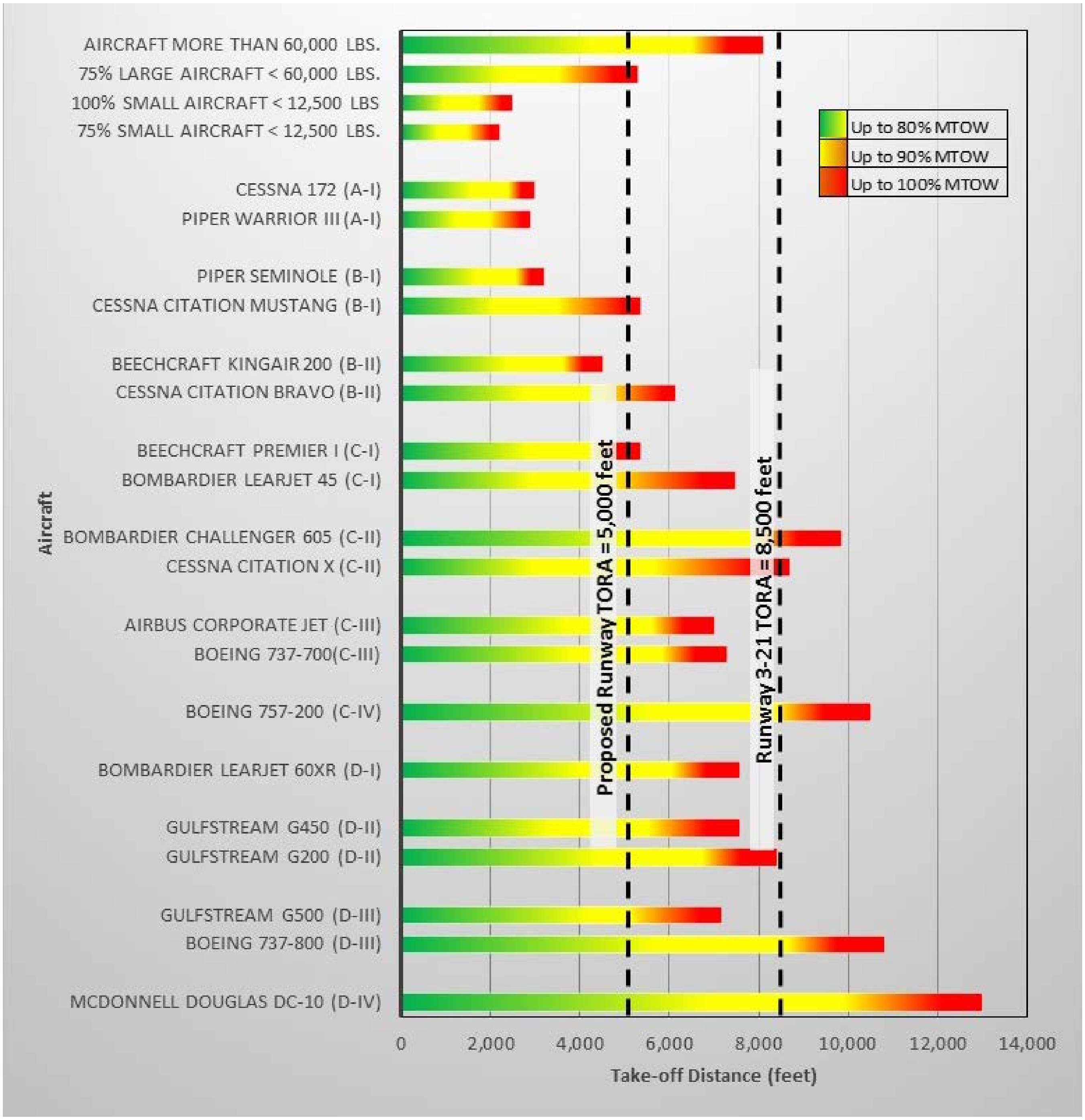
Note: [1]All regional jets, regardless of their MTOW, are assigned to the 60,000 pounds or more weight category.
Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design, 2005.

Recommended runway lengths are determined using charts in AC 150/5325-4B based on seating capacity and the mean daily maximum temperature of the hottest month of the year.

With an existing runway length of 8,500 feet, Runway 3-21 can accommodate 100 percent of the small airplanes in the fleet mix. Runway lengths to serve large aircraft weighing greater than 12,500 pounds, but less than 60,000 pounds, are determined using a percentage of useful load, which is the difference between the maximum allowable gross weight and the operating empty weight. According to the AC, 75 percent of the fleet at 60 percent useful load requires a runway length of 5,410 feet, and 100 percent of the fleet at 60 percent useful load requires a length of 7,190 feet. For aircraft weighing more than 60,000 pounds, which do periodically utilize the Airport, the required runway length is approximately 8,100 feet.

Therefore, based on the runway length analysis, findings of the *Technical Memorandum*, and completion of the recent runway improvement projects, the existing runway length is sufficient to accommodate the departure and arrival length requirements of the projected aircraft fleet mix through the planning horizon. Results of the runway length analysis are summarized in **Table 4-8**. In addition to the runway length analysis, **Figure 4-1** graphically depicts the take-off length requirements for a variety of aircraft currently using or anticipated to use the Airport over the course of the planning period.

Figure 4-1: Runway Departure Length Requirements (Hot Day)



Notes: Required runway lengths are shown for aircraft at MTOW (Maximum Takeoff Weight). Mean maximum temperature of hottest month = 106.9° F air temperature

Sources: FAA AC 150/5325-4A, *Runway Length Requirements for Airport Design*; Armstrong Consultants, Inc., 2017.

Table 4-8: Runway 3-21 Length Analysis

Aircraft Grouping	Recommended Runway Length (ft)
Small Aircraft (<12,500 lbs., < 10 passenger seats)	
75 percent of these small airplanes	3,030
95 percent of these small airplanes	3,590
100 percent of these small airplanes	4,240
Large Aircraft (<60,000 lbs.)	
75 percent of these planes at 60 percent useful load	5,410
75 percent of these planes at 90 percent useful load	8,480
100 percent of these planes at 60 percent useful load	7,190
100 percent of these planes at 90 percent useful load	11,260

Sources: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, 2005; Armstrong Consultants, Inc., 2017.

4.4.1.3 Runway Width

The required runway width is a function of airplane approach category, airplane design group, and the approach minimums for the design aircraft expected to use the runway on a regular basis. The existing runway pavement width of 150 feet for Runway 3-21 meets FAA design standards and should be maintained throughout the planning period. Similarly, the required runway width for a potential additional runway in the future is driven by the same criteria. Based on the design standards for aircraft within the B-II category, a width of 75 feet is recommended for a potential additional runway.

4.4.1.4 Runway Orientation

The FAA AC 150/5300-13A, *Airport Design*, recommends that a runway's orientation provide at least 95 percent crosswind coverage. Based on the wind data presented in **Table 2-7** in **Chapter 2**, the wind coverage exceeds the recommended 95 percent wind coverage for each crosswind component (10.5 through 20 knots) for Runway 3-21. Therefore, the true azimuth of Runway 3-21 (38^0 05' 16.08") should remain for the planning horizon.

4.4.1.5 Pavement Strength

After the Runway 3-21 Shift and Runway Rehabilitation projects, the pavement strength for the first 800 feet of the approach end of Runway 3 is 116,000 pounds SW, 235,000 pounds DW, 385,000 DTW and 870,000 DDTW. The pavement strength for the first 200 feet of Runway 21 is 116,000 SW, 240,000 pounds DW, 440,000 DTW and 945,000 DDTW. The pavement strength for the remainder of Runway 3-21 is as 116,000 pounds SW, 225,000 pounds DW, 505,000 pounds DTW and 985,000 pounds DDTW.

A sample of the current and forecasted fleet mix with the corresponding maximum take-off weight and landing-gear configuration is depicted in **Table 4-9.** Runway 3-21 pavement bearing strength appears to be adequate for the select aircraft identified in **Table 4-9.** Use by aircraft with a maximum take-off weight that exceeds the runway bearing strength periodically should not significantly impact the lifespan of the pavement. However, the Airport should monitor the pavement condition to determine if the use by heavier aircraft is accelerating the need to rehabilitate the runway.

Table 4-9: Select Aircraft Pavement Bearing Strength Requirements

Aircraft	Maximum Take-off Weight (lbs)	Landing Gear Configuration (Nose Gear/Main Gear/Belly Gear)
Cessna 172R Skyhawk (A-I)	2,450	SW/SW
Cessna Mustang (B-I)	10,600	SW/SW
Beechcraft King Air 200 (B-II)	12,500	SW/DW
Bombardier Learjet 45 (C-I)	19,500	SW/DW
Bombardier Challenger 605 (C-II)	47,600	DW/DW
Boeing 737-700 (C-III)	171,000	DW/DW
Airbus A319 (C-III)	141,000	DW/DW
Boeing 757-200 (C-IV)	255,000	DW/DTW
Boeing 767-300 (D-IV)	350,000	DW/DTW
Bombardier Learjet 60XR (D-I)	23,500	SW/DW
Gulfstream G450 (D-II)	73,900	DW/DW
Gulfstream G500 (D-III)	85,100	DW/DW
Boeing 737-800 (D-III)	174,200	DW/DW
McDonnell Douglas DC-10-40 (D-IV)	555,000	DW/DTW/DW
Boeing 747-400 (D-V)	870,000	DW/DTW/DTW
Boeing 777-300 (D-V)	660,000	DW/TDTW

Abbreviations: SW = Single Wheel, DW = Dual Wheel, DTW = Dual Tandem Wheel, TDTW = Triple Dual Tandem Wheel
Source: Armstrong Consultants, Inc., 2017.

4.4.1.6 FAA Hot Spots and Non-Standard Geometry

An airport "hot spot" is a location on an airport movement area with a history of potential risk of collision or runway incursion and where heightened attention by pilots and drivers is necessary. These areas have an increased risk or potential for runway incursions or surface accidents due to a variety of factors, such as airfield geometry, traffic-flow, pavement markings, signage and lighting, situational awareness, and training. To date, the FAA has not identified any official hot spots at the Airport.

Non-standard conditions observed in both the movement and non-movement areas of the airfield were identified in **Chapter 2**, and summarized in **Tables 2-10 and 2-11**. Of the non-standard conditions, those located in the movement area that are related to pavement geometry and/or marking are discussed below. A location on an airfield that is considered by the FAA to be non-standard geometry does not necessarily mean it is a "hot spot."

- **Non-standard Geometry 1**. According to runway separation standards for aircraft within the D-IV category, the runway centerline to aircraft parking area requires 500 feet of separation. The existing Terminal/Lux Air Apron area boundary to Runway 3-21 centerline is approximately 440 feet. It is recommended that the apron boundary be marked at the correct separation distance to delineate the beginning/ending of the parking apron.
- **Non-standard Geometry 2**. Taxiway separation standards for ADG IV aircraft require the taxiway centerline to a fixed or movable object distance to be 129.5 feet. The existing Terminal/Lux Air Apron area boundary is not marked to provide 129.5 feet from the Taxiway A centerline. It is recommended

that the Terminal/Lux Air Apron boundary be marked at the correct separation distance to delineate the limits of where aircraft may park on the apron.

- **Non-standard Geometry 3**. Design standards based on the existing TDG 5 for the Airport require taxiway shoulder widths of 30 feet. Taxiway A and several taxiway connectors do not meet the width requirement. For example, shoulders are nonexistent in various locations along the length of Taxiway A and along taxiway connectors A2 and A3. Shoulders should be constructed where missing to the correct width requirements. Furthermore, the existing width of the shoulder along taxiway connectors A4 through A8 is only 25 feet. The shoulders in these areas should be widen to the required 30-foot standard.
- **Non-standard Geometry 4.** Given FAA's position on the importance of preventing runway incursions, no aircraft apron should provide direct access to an active runway. Currently, taxiway connectors A2, A3, and A8 provide direct access to Runway 3-21. It is recommended that the taxiway connectors be reconfigured and/or shifted which would require taxiing aircraft to turn first in order to provide indirect access to Runway 3-21.
- **Non-standard Geometry 5.** According to general aviation helipad design standards, Helipad H1 does not meet the following:
- FATO center to runway centerline for VFR operations with operations by heavy aircraft more than 300,000 pounds requires a separation of 700 feet during concurrent operations. The existing H1 FATO center to Runway 3-21 centerline distance is approximately 580 feet. At the existing H1 location, separation standards are not met, and therefore concurrent operations by heavy aircraft weighing more than 300,000 pounds on Runway 3-21 and helicopters making a VFR approach or departure to/from the helipad is not permitted. If this is something that may occur in the future due to an increase in either aircraft's operations, it is recommended that the helipad H1 be relocated to a different location. It should be noted that the non-standard geometry of helipad H1 is mitigated by operating procedures, coordinated via ATCT.
- The H1 FATO center to the adjacent taxilane centerline stripe distance is approximately 35 feet. ADG-II aircraft operating on the adjacent taxilane could penetrate the H1 FATO. Thus, it is recommended that in the short-term, the taxilane centerline stripe be moved or the taxilane be restricted when Helipad H1 is in use to meet separation standards. Possible relocation of H1 should be considered thereafter.
- The H1 safety area to adjacent taxilane centerline stripe distance is approximately 15 feet. Presently, ADG-II aircraft operating on the adjacent taxilane penetrate the H1 safety area. Thus, it is recommended that in the short-term, the taxilane stripe be moved or the taxilane be restricted when Helipad H1 is in use to meet separation standards. and possible relocation of H1 be considered thereafter.

4.4.1.7 Potential Parallel Runway

The results of the airfield capacity indicate the Airport may reach approximately 72 percent of its ASV by the year 2036. Additional airfield capacity can be provided by construction of a second runway. The 2007 Airport Master Plan recommended that a parallel runway be constructed south of the existing runway to satisfy forecast demand. Based on feedback from airport users, tenants, and flight schools, a parallel runway is still desired for use by the flight schools and occasional corporate jet operators.

As such, a larger-than-utility runway should be considered in this master plan to ensure sufficient property is preserved for a potential runway in the future. A larger-than-utility runway accommodates aircraft with a maximum gross weight of 12,500 pounds or greater would serve the needs of the flight schools and the majority of the corporate and business jet operators. In addition, one end of the runway should include a non-precision instrument approach, such as an RNAV (GPS), with visibility minimums one-statute mile or greater. The runway should have a minimum length of 5,000 feet and meet FAA design standards for a RDC B-II and TDG 2. TDG 2 taxiways are required to be 35 wide, and RDC B-II runways are required to be 75 feet wide. The location for a parallel runway meeting the above criteria will be assessed in the alternatives analysis.

4.4.2 Taxiway Requirements

Taxiway geometry should be improved whenever feasible with emphasis on "hot spots," and to the extent practical, the removal or marking of pavements to correct confusing layouts.

The existing design aircraft falls within TDG 5. Based on the recent runway improvement projects in 2015 and 2016, portions of Taxiway A were enhanced to TDG 5 standards. As such, it is recommended that the TDG for Taxiway A and its connectors remain the same over the course of the planning period.

In addition, a PCN report dated October 2014 indicated Taxiway A and several connector taxiways do not meet the pavement bearing strength needed to accommodate several of the aircraft currently using and forecasted to use the Airport. Hence, consideration should be given to strengthening the taxiways during the planning horizon.

Finally, there are two aircraft run-up areas located on the ends of Taxiway A. With multiple flight schools located at the Airport, there are times when multiple aircraft taxi to the departure ends of Runway 3-21 simultaneously. Aircraft run-up areas increase operational efficiency by allowing aircraft ready for departure to bypass those on the taxiway that are performing run-ups. The existing aircraft run-up areas are in good condition and provide adequate space. To enhance safety, it is recommended that the designated aircraft run-up area hold bars be marked to correspond with the connecting taxiway's centerline to fixed or movable object separation distance.

4.4.3 Airfield Lighting, Marking, Signage, and NAVAIDs Requirements

Several improvements to the airfield lighting, signage, markings, and NAVAIDs are recommended.

- **Airfield Lighting.** Pavement edge lighting does not exist for the full length of Taxiway A. It is recommended that pavement edge medium intensity taxiway lights (MITLs) be installed on the remaining length of Taxiway A and all taxiway connectors. Should additional airfield lighting be necessary in the future, it is recommended that efficient LED fixtures be installed.
- **Airfield Signage.** Airfield signage was upgraded in 2013 to internally lit LED fixtures. The airfield signs should be maintained throughout the planning period. Should additional airfield signage be necessary in the future, it is recommended that efficient LED fixtures be installed.
- **Pavement Markings**. It is recommended that the pavement markings be maintained as needed to prevent fading. The apron pavement markings are in good condition; however, multiple areas do not meet marking standards and should be corrected.
- **NAVAIDs.** The existing visual NAVAIDs are adequate for non-precision instrument approaches. The Airport plans to install enhanced centerline markings and surface painted hold position markings. It is recommended that the runway end identifier lights (REILs) and precision approach path indicators

(PAPIs) for Runway 3-21 be maintained throughout the planning period. The Airport has four lighted wind cones on the airfield. The primary wind cone and segmented circle should be maintained. The supplemental wind cones are located within the Runway 3-21 ROFA. It is recommended that the supplemental wind cones be relocated outside of the Runway 3-21 ROFA, if possible. Should a secondary runway be constructed in the future, it is recommended that REILs, PAPIs, and supplemental wind cones be installed with the runway.

- **Beacon**. The Airport has two rotating beacons. The primary rotating beacon located on top of the ATCT should be maintained throughout the planning period. The secondary rotating beacon is outdated and utilizes an inefficient light fixture. It is recommended that the beacon be upgraded with an LED fixture if the Airport plans to utilize the secondary rotating beacon.
- **Weather Reporting Systems.** The Airport uses a LAWRS with a limited number of automated sensors and a dedicated observer responsible for routine weather report, also known as a METAR. An automatic weather reporting system such as an Automated Weather Observing System (AWOS) should be considered in the future. Compared to LAWRS, an AWOS provides more efficient and accurate weather data.

4.4.4 Helipad Requirements

The size of the existing helipad and navigational aids currently meet user needs; however, during periods of elevated activity or special events near the Airport such as NASCAR races, multiple helicopters also operate on areas of the apron south of the existing helipad. Based on feedback from Airport Management and the TAC, designation of additional helicopter landing areas is recommended.

4.5 Aircraft Parking Apron Requirements

The layout and size of an apron depends on aircraft and ground vehicle circulation needs and FAA airfield design standards. FAA AC 150/5300-13A, *Airport Design*, provides design criteria for apron layout and capacity. For the purpose of calculating the required aircraft apron size, the following planning criteria were used:

- 500 SY of apron per aircraft for helicopters
- 800 SY of apron per aircraft for single-engine and multi-engine aircraft
- 1,200 SY of apron per aircraft for turbo-props and business jets
- 30 percent of single-engine based aircraft will require apron parking
- 10 percent of multi-engine, turbojet, and helicopters based aircraft will require apron parking
- Itinerant aircraft apron requirements are based on design hour operations

4.5.1 Flight School Apron

As of 2016, the number of based single- and multi-engine aircraft at the Airport totaled 219. Approximately 25 percent are operated by Lufthansa and CTC flight schools. The total amount of apron available on the Flight School Apron is 75,000 SY, of which approximately 47,500 SY is leased to Lufthansa and CTC for the parking and maneuvering of their aircraft (57 total parking spaces made up of shaded and open tie-downs). This equates to approximately 800 SY of parking apron per aircraft. To determine the amount of additional apron required for the flight schools, it was assumed that flight school aircraft would make up 25 percent of the forecasted total single- and multi-engine based aircraft in the future. **Table 4-10** summarizes the demand for future Flight School Apron area.

4.5.2 Terminal/Lux Air Apron

The requirement for itinerant aircraft parking on the Terminal/Lux Air apron was also estimated. It was assumed that an average of 33 percent of total operations are itinerant general aviation operations. Using the estimated future design hour operations (see **Table 4-2**) and the average percentage of itinerant general aviation operations, the amount of itinerant aircraft parking demand was estimated between 19-29 aircraft per day over the planning horizon. Furthermore, it was assumed that of these itinerant aircraft, 75 percent would be single- and multi-engine aircraft and 25 percent would be jet aircraft. Hence, approximately 82,800 SY of additional apron would be required for itinerant aircraft parking over the course of the planning period. The increased apron area would equate to about 70 additional parking spaces.

4.5.3 AerSale Apron

Due to the unique nature of AerSale's business model, traditional methodologies for calculating the apron requirement do not apply. Activity on the AerSale apron is unique because the range of aircraft types is not consistent (various mix of medium-to-large air carrier aircraft) and the parking configurations are not standard. The existing AerSale apron does not meet the needs of the tenant. For example, maneuvering tugged aircraft into the hangars and around the apron is a challenge. For planning purposes, it is recommended that the apron be increased by 50 percent in the short-term, and doubled in either the mid- or long-term depending on demand.

Based on conversations with AerSale, the construction of a new demolition pad, as well as expansion of one of their hangars is desired in the near future due to anticipated increase their aircraft dismantling operations. The best locations for such additions will be examined in the alternatives analysis.

4.5.4 Aircraft Storage Area

Although technically not designated as apron, the aircraft storage area on the western portion of the airfield has adequate space available. This area is approximately 62 acres, of which approximately 40 acres are compacted treated soil. Additional space is available to the north (approximately 15 acres) and to the south (approximately 2 acres) to expand the storage area if needed during the planning horizon.

4.5.5 Aircraft Parking Apron Summary

Additional aircraft parking apron area is needed in the planning period. The Airport should monitor the utilization of the apron and based on the above criterion, and make adjustments in apron size as needed. **Table 4-10** depicts the aircraft parking apron requirements.

Based on the 2014 PCN report, several of the Airport's aprons are not structurally adequate to handle the normal aircraft using these apron areas. These aprons include portions of the Flight School Apron and the taxilane adjacent to the AerSale Apron and the north T-Hangar apron. Further review and verification of the pavement strength should be undertaken in the near future. In order for the airport to accommodate heavier aircraft on a regular basis, the pavement strength of the aforementioned aprons may also need to be increased.

Table 4-10: Aircraft Parking Apron Requirements (in SY)

Apron	Year				
	Existing	2021	2026	2031	2036
Flight School (tie-down apron)[1]	75,000	76,600	80,600	84,600	89,400
Terminal/Lux Air (terminal/itinerant apron)[2]	27,700	58,390	62,210	69,900	78,500
AerSale Apron (other services apron)[3]	95,300	142,950	142,950	190,600	196,600
Total Aircraft Parking Apron Area	**198,000**	**277,940**	**285,760**	**345,100**	**364,500**

Notes: [1]Includes percentage of total based aircraft which are operated by Lufthansa and CTC flight schools and calculations are based on 800 SY per forecasted SE/ME aircraft; calculations have been rounded and are approximate. [2]Includes remainder of forecasted based aircraft plus forecasted itinerant aircraft calculations; calculations have been rounded and are approximate. [3]Conventional apron requirement calculation methodologies do not necessarily apply for the aircraft apron parking requirements of MRO operators.
Source: Armstrong Consultants, Inc., 2017.

4.6 Aircraft Storage Hangar Requirements

The Airport has conventional hangars, T-hangars, and shade structures. Storage space for based aircraft was determined using guidelines suggested in manufacturer's literature of the evolution of business aircraft sizes. The following was assumed for conventional hangars: 1,200 SF for single-engine aircraft; 1,400 SF for multi-engine aircraft; and 1,800 SF for turboprop or turbojet aircraft. For T-hangar, 1,450 SF for single- and multi-engine aircraft is assumed.

Assumptions regarding storage needed for each type of aircraft are illustrated in **Table 4-11.**

Table 4-11: Aircraft Storage Assumptions

Percent of Aircraft Type	Storage Type
10% air carrier (MRO Aircraft)	Conventional Hangar
90% air carrier (MRO Aircraft)	Open Storage
100% of turbojet	Conventional Hangar
55% of multi-engine	Conventional Hangar
35% of multi-engine	T-hangar or Shade Structure
10% of multi-engine	Parking Apron
10% of single-engine	Conventional Hangar
60% of single-engine	T-hangar or Shade Structure
30% of single-engine	Parking Apron

Source: Armstrong Consultants, Inc., 2017.

Using the above criterion and the based aircraft forecasts, combined with consideration of the potential fleet mix, **Table 4-12** depicts the demand requirements for aircraft storage types at the Airport. The current aircraft hangar and shade structure storage appears to be adequate for existing demand. It should be noted that requirements are not rigid, meaning that shifting of the space requirements between conventional and T-hangars is something that will need to be considered as operations fluctuate and user's specific requirements are identified.

Table 4-12: Aircraft Storage Hangar Requirements

Hangar Type	Year				
	Existing	2021	2026	2031	2036
Aircraft Requiring Conventional Hangars	-	33	38	43	47
Aircraft Requiring T-Hangars or Shade Structures	-	138	149	161	173
Total Number of Aircraft Needing Storage	**-**	**171**	**187**	**204**	**220**
Hangar Size Requirements (SF)					
Conventional Hangars[1]	36,000	42,600	49,600	57,000	62,800
T-Hangars or Shade Structures	301,800	200,100	216,000	233,450	250,850
Total Hangar Size	**337,800**	**242,700**	**265,600**	**290,450**	**313,650**

Note: [1]Conventional hangar square footage is for Lux Air Jet Center only.
Source: Armstrong Consultants, Inc., 2017.

4.7 Landside and Support Facility Requirements

The following summarizes requirements for the general aviation terminal, fueling facilities, ARFF, airport maintenance facilities, fencing and security, utilities, and miscellaneous buildings.

4.7.1 General Aviation Terminal and FBO

The terminal building at general aviation airports typically offers various amenities to passengers, local and transient pilots, and airport management. Terminal buildings most often house public restrooms, public telephones, a pilot lounge area, and information regarding airport services. A general aviation terminal building should accommodate forecasted peak-hour general aviation pilot and passenger demand.

The methodology used to determine the terminal building requirements is based on the number of airport users anticipated to use the facility during the design hour. The design hour is defined as the peak hour of an average day of the peak month. The design hour measures the number of passengers departing or arriving on an aircraft in an elapsed hour of a typical busy (design) day. Given that the design hour takes into account the activities of the airport as a whole, this methodology may not reflect the most accurate way to calculate the size requirements of the facility. This is because the flight schools and MRO operators do not routinely use the terminal building. Therefore, a modified design hour derived from the total itinerant operations during the peak month was calculated over the course of the planning period.

For planning purposes, a factor of 2.5 people (pilots and passengers) per peak-hour (design hour) and an area of 100 to 150 SF of space per person is considered adequate to accommodate the peak hour traffic. To determine the terminal facility size requirement, the modified itinerant operations design hour and 100 SF of space was used. Additionally, the total square-footage of the City's terminal building and the shared public space of the new FBO was combined for the calculation. These were combined because with the addition of the new FBO, some general aviation itinerant users will use the FBO over the City terminal and vice versa. The addition of the FBO public shared space in fact adds to the overall "terminal" space, even though the space is located in physically different locations. Thus, using the criteria described, the general aviation terminal requirements were calculated and are summarized in **Table 4-13.**

Table 4-13: General Aviation Terminal Requirements

Year	Design Hour Operations[1]	Terminal Function Size (SF)
2016	20	8,000[2]
2021	22	5,500
2026	23	5,750
2031	28	7,000
2036	33	8,250

Notes: [1]Modified design hour based on total itinerant operations in the peak month. [2]Total square-footage of the terminal building and FBO common area (5,500 SF + 2,500 SF).
Sources: ACRP Report 113, *Guidebook on General Aviation Facility Planning*; Armstrong Consultants, Inc., 2017.

According to the calculations above, the existing 8,000-square-foot combined terminal building and FBO common area should meet the space requirements for the majority of the planning period. Beginning in 2036, as the peak hour pilot and passenger demand increases, the existing size of the combined terminal building and FBO common area may become somewhat constrained. Therefore, it is recommended that the City continue to monitor the utilization of both spaces throughout the planning horizon and consider expansion as needed.

The terminal building and FBO are centrally located at the Airport and provides good access to the aircraft parking apron. It is recommended that the City continue using the terminal building for airport administration personnel and look for potential tenants to use the remainder of the building. The building will likely need some level of modernization and upgrading such as roof replacement, mechanical, plumbing, and HVAC systems replacement as the building approaches the end of the planning horizon. Vehicle parking for visitors can be constrained at times.

The Lux Air facility was opened in January 2017 and should have no need for upgrades or refurbishment except for routine maintenance for the planning period.

4.7.2 Fueling Facilities

It is typically recommended that general aviation airports have sufficient fuel storage capacity for up to a week of fueling demands. The existing aircraft fueling facilities are adequate for existing demand. However, it is likely that fueling storage capacity will need to be increased in the future. Future demand could require increasing Jet A fuel storage from 40,000 gallons to 60,000 gallons. In addition, 100 LL storage may be increased from 100,000 gallons to 150,000 gallons in seven or eight storage tanks. An additional 10 to 20,000-gallon tank for alternative fuels should also be planned. Ultimate build out of the fuel farm could mean expanding from seven 20,000-gallon tanks to 12 tanks over the year planning horizon.

Designated fuel truck parking is lacking at the Airport. Currently, fuel trucks park along the edge of the north T-hangar apron and in various locations in front of the Lux Air facility. This can potentially restrict aircraft movement into and out of the T-hangars and on the taxilane. Thus, it is recommended that designated fuel truck parking that is adequate for safely handling fueling equipment be constructed at a location on the airport where the trucks can be parked and not cause potential aircraft maneuvering issues.

4.7.3 Aircraft Rescue and Firefighting

The forecast shows an increase of approximately 62 percent annual operations during the 20-year planning horizon with an increase in heavy jet traffic. While not required by current regulations, increasing the Airport's ARFF capabilities could be considered in one of the following ways:

- Request standby ARFF services from local fire departments, whereby an appropriate firefighting vehicle would physically be sent to the airport for critical operations of heavy aircraft or other aircraft with special requirements.
- Establishing an ARFF station on the Airport that meets FAR Part 139 requirements.
- Either directly, or by mutual agreement with local fire departments, ensure that all firefighting equipment identified for airport response be capable of delivering water, chemical, and aqueous film forming foam operations. Additionally, local firefighters should be trained in the use of specialized agents, and tactics necessary to the airport environment.

4.7.4 Airport Maintenance

Airport maintenance facilities need to be large enough to store and repair maintenance equipment. Typically, maintenance facilities also will occupy space around the building to locate fuel, spare equipment, and park commercial size trucks, tractors, and apparatuses. Most maintenance yards will be either located in a secure part of an airport or have security fencing/wall to protect the equipment. The existing maintenance building and storage yard occupy approximately 3,900 SY, or 0.8 acres. It is recommended that the existing maintenance building be expanded as the need arises to maintain additional infrastructure. Adequate space exists in the storage yard for an expanded maintenance building.

4.7.5 Utilities

The current capacity for all utilities is adequate for present day demands. However, some infrastructure is aging and should be evaluated for ability to supply additional capacity as necessary in future years.

The deluge water tank and pump house are older facilities and should be evaluated to determine if they are adequate for their assigned function, and if their use can be expanded to serve new hangar development. New hangar development may bring the need for additional water capacity to meet current fire codes, and large developments for larger aircraft may require deluge systems or other fire control systems. These can likely be accommodated from existing water utilities depending on the time/need for resupply, and capacity of a new deluge systems. This also assumes possible installation of foam or other firefighting agent systems in hangars to supplement the available water supply. As new developments occur, available water capacity should be evaluated relative to the needs of each facility.

The airport electrical vault is up to date and meets current demand. It also has the capacity to be expanded. Commercial electrical feeds are assumed adequate for current and future use, but large developments could require independent substations or dedicated transformers to power their operations. All new developments should be coordinated with outside utility providers to assure sufficient capacity exists to support final development and operations.

4.7.6 Fencing and Security

The primary purpose of airport fencing is to restrict inadvertent entry to the airport by unauthorized people and wildlife. While the Airport has no FAR Part 139 security requirement, it has already implemented appropriate fencing and other access control systems necessary to control improper entry into its facilities and has provided a level of security for its operators. Additionally, the Airport has implemented a Security Identification Display Area (SIDA) and identification badge program that further controls who can access the operational areas of the airport. The existing perimeter fencing and security infrastructure serve the needs of the Airport; however, improvements are recommended.

There are several areas where the perimeter fence has large gaps beneath where wildlife, particularly coyotes and javelina, are able to gain access to the airfield. According the airport personnel and the findings from the 2016 Wildlife Hazard Assessment (WHA), the southwestern corner of airport property near a culvert and ditch sees the most activity by wildlife. Airport operations staff have indicated that the western portion of the airport property near the MRO storage parking area has been breached on several occasions and the aircraft have been vandalized. Thus, based on the WHA findings, it is recommended that the existing perimeter fence be removed and replaced with a new fenceline approximately 27,000 feet in length to better deter breaches from wildlife and unauthorized personnel. Additionally, CCTV cameras at access Gates 1, 2, and 3 will create additional situational awareness that can be tied into the Airport's Access Control and Alarm Monitoring System System.

Until the existing fencing can be replaced, it is recommended that airport personnel continue to monitor the fencing as outlined within the WHA for wildlife, and continue to monitor and work with local authorities to increase the security of the airfield from unauthorized individuals as needed. There are several programs and publications designed to increase general aviation airport security.

4.7.7 Additional Airport Buildings/Structures

Most existing airport buildings are in reasonably good shape or new, and many older buildings have been refurbished, or upgraded to meet the requirements of their current use.

- **Blast Fence**. The blast fence, located behind the run-up area on the Runway 3 end, is in good condition. The fence functions as a safety device to redirect high energy exhaust and prevent erosion during aircraft run-up and engine testing. The blast fence currently meets the needs of the Airport and should be maintained throughout the planning period.
- **Wash Rack**. The general aviation wash rack located on the North Hangar Apron is in good condition; however, it is recommended that the wash rack be relocated to provide adequate separation from adjacent taxilane centerlines. The existing position of the wash rack located on the Flight School Apron (which is used exclusively by the flight school operators) does not provide adequate separation from the adjacent taxilane centerline. The wash rack also is positioned directly adjacent to a wall which restricts the maneuvering ability of aircraft into and out of position. It is recommended that wash rack be relocated to an area on the Flight School Apron where it meets separation standards.
- **Flight School Dormitories.** It was suggested during discussions with both Lufthansa and CTC flight schools that the need for additional dormitory space may be required in the near future. Both schools plan to increase their operations and anticipate more students over the next 5 to 10 years. Approximately 285 dormitory rooms are currently available for students within the three buildings

found on campus—123 are allocated to Lufthansa, 102 to CTC, and 60 to the German Air Force. Both Lufthansa and CTC indicated that during 2016, the dormitories were nearly at capacity. Thus, it is recommended that additional areas on the flight school campus be reviewed for potential locations for new dormitory facilities.

4.8 Airport Access and Vehicle Parking Requirements

The following summarizes airport access and vehicle parking requirements.

4.8.1 Airport Access

The Airport currently has only one entrance to access the landside and airside portions of the airfield. Goodyear Parkway (which intersects at Litchfield Road) adequately serves this function today; however, it is possible that as development on and around the airport increases, the need for an additional airport access point will become likely. A second airport access point was suggested in the 2007 Airport Master Plan, siting future development and the creation of business corridors within the City of Goodyear. A second access point to the Airport from the north also was suggested, possibly stemming from Bullard Avenue. This is still a likely possibility given the anticipated location of future development. Likewise, anticipated development around the Airport identified in the City of Goodyear *General Plan*, has not changed, but has increased with the addition of the Goodyear Ballpark recreational area. As such, it is recommended that the Airport plan for an additional airport entrance road.

4.8.2 Vehicle Parking

There are several vehicle parking lots located throughout the Airport property. The primary vehicle parking location for the general public is located adjacent to the terminal building where Goodyear Parkway terminates. Likewise, with the addition of the new Lux Air Jet Center facility which opened in early 2017, additional parking for the public is now available. The Lux Air facility and its vehicle parking lot is located directly across from the terminal building where Goodyear Parkway terminates. There are currently 45 public parking spaces in the terminal building lot (a total of 64 spaces are available; however, 19 of these spaces are designated for City of Phoenix personnel), and 37 parking spaces in the Lux Air lot, for a total of 82 general public parking spaces. The other parking lots on the property are private lots designated for employees of AerSale, Lufthansa, CTC, and the other various tenants, and are not intended for use by the general public. When determining the vehicle parking requirements over the course of the planning period, only the need for public parking was calculated. Vehicle parking requirements for tenants were determined based upon in-person interviews.

Normally, an airport's vehicle parking area should be able to satisfy the forecasted peak hour (design hour) general aviation pilot and passenger demand. Again, because of the unique nature of the operations at the Airport, the same rationale that was used to determine the terminal building size requirements has also been used to determine the vehicle parking requirements. The modified design hour based on the total itinerant operations during the peak month over the course of the planning period and the standard 2.5 passengers per design hour were used for the calculations. The vehicle parking space requirements for the 20-year planning period are depicted in **Table 4-14.**

Table 4-14: Public Parking Requirements

Year	Parking Spaces
2016[1]	82
2021	55
2026	56
2031	70
2036	83

Note: [1]Existing vehicle parking spots available for the general public at the terminal and Lux Air Jet Center only.
Source: Armstrong Consultants, Inc, 2017.

Based on the existing general public parking spaces currently available and the calculations above, no additional parking spaces are needed until the end of the planning period. Based on discussions with AerSale and Lufthansa/CTC flight schools, no additional vehicle parking is required. Both tenants indicated that additional vehicle parking would be needed in the near future.

Neither the north or south T-hangar aprons have vehicle parking spaces for based aircraft tenants. Tenants park their vehicle in the T-hangar when not occupied by an aircraft. It is recommended that the City consider adding designated vehicle parking locations on the north and south T-hangar aprons.

4.9 Summary of Facility Requirements

Facility requirements are summarized in **Table 4-15**. Recommendations are identified for the short- and long-term time frames. It should be noted that the summary table includes only those facility requirements that were determined using the aviation demand forecasts and the capacity analysis.

Table 4-15: Facility Requirements Summary

Runways	Base Year (2016)	Short-Term (0 – 5 yrs.)	Medium-Term (6 – 10 yrs.)	Long-Term (11 – 20 yrs.)
Runway 3-21				
Runway Design Code (RDC)	RW 3: D-IV/5000 RW 21: D-IV/VIS	Maintain Existing Maintain Existing		
Length (ft)	8,500	Maintain Existing		
Width (ft)	150	Maintain Existing		
Taxiways				
Taxiway A				
Taxiway Design Group (TDG)	5	Maintain Existing		
Width (ft)	75	Maintain Existing		
Shoulder width (ft)	30[1]	Construct in areas where it is missing[1]	Maintain	
Taxiway Connectors A1-A10				
Taxiway Design Group (TDG)	5	Maintain Existing		
Width (ft)	75	Maintain Existing		
Shoulder width (ft)	30[2]	Construct in areas where it is missing[2]	Maintain	
Terminal[3]				
General Aviation (SF)	8,000[4]	5,500	5,750	7,000 – 8,250
Hangars[5]				
Conventional (total SF)	36,000[6]	42,600	49,600	57,000 – 62,800
T-hangars/shade (total SF)	301,800	200,100	216,000	233,450 – 250,850
Aprons[7]				
Aircraft Parking (SY)	198,000	277,940	285,760	345,100 – 364,500
Vehicle Parking				
Public Spaces	82	55	56	70 – 83

Notes: [1]Paved shoulder is missing in various locations along the length of the taxiway. [2]Paved shoulder is not present on connectors A2 and A3, and connectors A4-A8 have shoulders which are only 25-feet in width. [3]Calculated using a modified design hour based on the total itinerant operations in the peak month. [4]Combined total square footage of the terminal building and the FBO shared common areas. [5]Hangar development will depend on actual demand. [6]Total square-footage of conventional hangar space available to the general public; other conventional hangars are leased to AerSale and Lufthansa/CTC flight schools for their exclusive use. [7]Apron development will be dependent on actual demand.
Source: Armstrong Consultants, Inc., 2017.

Chapter 5

LAND USE AND ZONING

Designating land use and zoning on, adjacent to, and in the close proximity of an airport is an important task for airport sponsors. Typical land use compatibility considerations include safety, height hazards, and noise exposure, all of which sponsors should address when designating land use and zoning ordinances on and around airports within their jurisdiction. In order to gain a better understanding of the land uses in the vicinity of the Airport, Maricopa County, and the cities of Goodyear and Avondale land use maps and zoning were reviewed. It is essential both the cities and county's land use planning efforts are working in conjunction to prevent incompatible land use in the vicinity of the Airport.

The following are addressed in the chapter:

- **Airport Design Standards.** FAA's airport design standards can impact existing land uses around an airport. A summary of the design standards that extend off airport property will be described.
- **Airspace Considerations.** Title 14, Code of Federal Regulations (14 CFR) Part 77 Imaginary Surfaces can have an impact on existing land uses and zoning around an airport. A summary of applicable imaginary surfaces that could impact existing land uses and zoning controls will be described.
- **Land Use.** For the purpose of analyzing the existing land use around the Airport, the Maricopa County Land Use data will be used.
- **General Plans.** The City of Goodyear's vision for growth and development is contained within the *Goodyear 2025 General Plan*. A discussion of areas that may affect the Airport are identified.
- **Zoning.** The existing zoning near the Airport will be presented. The City of Goodyear zoning districts will be described and any incompatible uses discussed.
- **Land Use and Zoning Summary.** A summary of incompatible land uses and zoning will be presented along with recommended actions.

5.1 Airport Design Standards

As summarized in **Chapter 2**, there are several airport design standards that apply to an airport. The standards are meant to enhance safety and efficiency and improve the economics of the airport system. **Table 2-2** depicts the existing airport design standards for the Airport. All of the design standards discussed in **Chapter 2** are located on Airport property with the exception of a portion of one, the Runway Protection Zones (RPZ) on both ends of Runway 3-21. The purpose of the RPZ is to enhance the protection of people and property on the ground, which is why the FAA encourages airport operators to own or control as much land as possible within RPZs. When land located within an RPZ is not owned in fee or controlled via avigation easements, the land becomes susceptible to development which may or may not be compatible with RPZ design standards, even if the land use or zoning itself is deemed compatible.

A discussion of the Airport's existing RPZs was described in **Chapter 2**. It was noted there are parcels of land located both in the RPZ for Runway 3 and 21, in which the City of Phoenix nor the City of Goodyear control. **Table 5-1** summarizes the land located in the existing Runway 3-21 RPZs that contains parcels that are not presently controlled by the Airport.

Table 5-1: Properties Within Runway Protection Zones

Owner	Area Within the RPZ (Acres)
Runway 21 RPZ1	
EJM Property/Beck Property (vacant)	8.75
Union Pacific Railroad (vacant, tracks removed)	0.36
Qwest Corporation (Century Link)	0.63
Jehovah's Witnesses	0.002
Cavco Litchfield	0.001
Cavco Litchfield	0.10
West Yuma Road Right-of-Way	2.66
Runway 3 RPZ[1]	
JVH Property LLC	6.0 (Approximate)
Union Pacific Railroad and MC85 Right-of Way	1.0 (Approximate)

Note: [1]Acreage not determined from actual boundary survey.

Sources: Runway 21 RPZ – Supporting Factors in the Need to Obtain Positive Control of the Runway 21 Runway Protection Zone at Phoenix Goodyear Airport, prepared by HNTB, June 2016; Runway 3 RPZ – Maricopa County Assessor's Office, April 2017.

In order to comply with FAA design standards, the City of Phoenix Aviation Department needs to gain positive control of the land within the Airport's RPZ, either by fee simple acquisition or easement(s).

The *Development Alternatives* chapter considers the impacts of the existing RPZ land uses and makes recommendations to improve control of the RPZ in the future. Runway capacity alternatives will consider all of the airport design standards and the potential impacts on land uses around the Airport. **Figure 5-1** illustrates the parcels of land described in **Table 5-1.**

5.2 Airspace Considerations

Chapter 2 provides an overview of FAA's imaginary surfaces that surround an airport. These surfaces are used as a guide to provide a safe and unobstructed operating environment for aviation. Title 14, Code of Federal Regulations (14 CFR) Part 77 Imaginary Surfaces consists of five surfaces: primary, approach, horizontal, conical, and transitional.

For the purpose of land use compatibility, typically the primary, approach, and transitional surfaces are the most common surfaces to encounter potential land use impacts. While analyzed, the conical and horizontal surfaces begin at 150 feet above the ground and typically don't impact land use immediately adjacent to an airport unless the surrounding terrain is mountainous.

The terrain immediately adjacent to the Airport is generally flat and does not conflict with the Airport's airspace. The Estrella Mountains are located approximately four miles to the Southeast and have been analyzed for obstacle penetrations.

Figure 5-1: Land Ownership in Runway Protection Zones

RUNWAY 3 PROTECTION ZONE

LAND OWNERSHIP				
NUMBER	PARCEL	OWNER NAME	PROPERTY ADDRESS	MAILING ADDRESS
1	500-07-016F	JVH PROPERTY LLC	3829 S ESTRELLA PKWY GOODYEAR 85338	3700 PARK EASDT DRIVE UNIT 300 BEACHWOOD OH 44122
2	500-07-006P	CITY OF GOODYEAR	SECT. 20, T1N, R1W	190 N LITCHFIELD RD PO BOX 5100 GOODYEAR AZ 85338
3	500-07-006R	CITY OF PHOENIX	1658 S LITCHFIELD RD GOODYEAR 85338	251 W WASHINGTON ST 3RD FLOOR PHOENIX AZ 85003
4		MARICOPA COUNTY	MC 85	
5	500-07-022R	SUN MP INVESTMENT PROPERTIES LLC	SECT. 20, T1N, R1W	5665 N SCOTTSDALE RD STE 135 SCOTTSDALE AZ 85253
6	500-07-022S	CITY OF GOODYEAR	SECT. 20, T1N, R1W	190 N LITCHFIELD RD PO BOX 5100 GOODYEAR AZ 85338
7	500-07-022M	SUN MP INVESTMENT PROPERTIES LLC	SECT. 20, T1N, R1W	5665 N SCOTTSDALE RD STE 135 SCOTTSDALE AZ 85253
8	500-07-022P	SUN MP INVESTMENT PROPERTIES LLC	SECT. 20, T1N, R1W	5665 N SCOTTSDALE RD STE 135 SCOTTSDALE AZ 85253
9	500-09-021	EJM-ARIZONA COMMERCEPLEX LLC/AZEJM LAND H LLC	SECT. 9, T1N, R1W	9061 SANTA MONICA BLVD LOS ANGELES CA 90069
10	500-04-015V	LARSON PROPERTY INVESTMENTS LLC	1040 S CAMINO ORO GOODYEAR 85338	1040 CAMINO ORO GOODYEAR AZ 85338
11	500-04-021A	MOUNTAIN STATES TELEPHONE & TELEGRAPH CO	14064 W YUMA RD GOODYEAR 85338	1801 CALIFORNIA ST DENVER CO 80202
12	500-04-994	ESTRELLA MOUNTAIN CONGREGATION OF JEHOVA ETAL	14038 W YUMA RD GOODYEAR 85338	629 N SARIVAL AVE GOODYEAR AZ 85338
13	500-04-019V	CITY OF GOODYEAR	14000 W YUMA RD GOODYEAR 85338	17665 W ELLIOT RD GOODYEAR AZ 85338
14	500-07-003J	JRC GOODYEAR LLC	1300 S LITCHFIELD RD GOODYEAR 85338	2122 E HIGHLAND AVE STE 400 PHOENIX AZ 85016
15	500-07-975	JRC GOODYEAR LLC	SECT. 16, T1N, R1W	2122 E HIGHLAND AVE STE 400 PHOENIX AZ 85016

RUNWAY 21 PROTECTION ZONE

PARCEL OWNERSHIP SOURCE: MARICOPA COUNTY ASSESSORS OFFICE 2016
PLACE DATA SOURCE: GOOGLE EARTH 2017

PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG

5.3 Land Use

Arizona Revised Statute (ARS) 28-8486, Public Airport Disclosure, requires that public airport owners publish a map depicting the boundaries of the "territory in the vicinity of the public airport." The territory is defined as property that is within the traffic pattern airspace defined by the FAA which includes property that experiences a Day-Night Average Sound level (DNL) of 60 decibels or higher in counties with more than 500,000 residents (in counties with 500,000 residents or less, the threshold is 65 decibels). ARS 28-8486 requires the State Real Estate Office prepare a disclosure map in conjunction with the airport owner that is recorded with the county and available to the public. In order to evaluate the impact the Airport may have on land uses in the vicinity of the Airport, a review of the current and future land uses in the cities of Goodyear and Avondale is necessary. The result of the review will be a public airport disclosure map for the Airport. The outermost limits of the boundary also extend into other cities, such as Phoenix, Tolleson, Litchfield Park, and Buckeye. Because of the limited acreage within these municipalities, the Maricopa Association of Governments (MAG) data was used to evaluate the land uses. The Phoenix Goodyear Airport public airport disclosure map and the existing land use of the surrounding area is depicted on **Figure 5-2.**

5.4 General Plans

The City of Goodyear and the City of Avondale have General Plans outlining their vision for the growth and development. A discussion of areas that may affect the Airport is described herein.

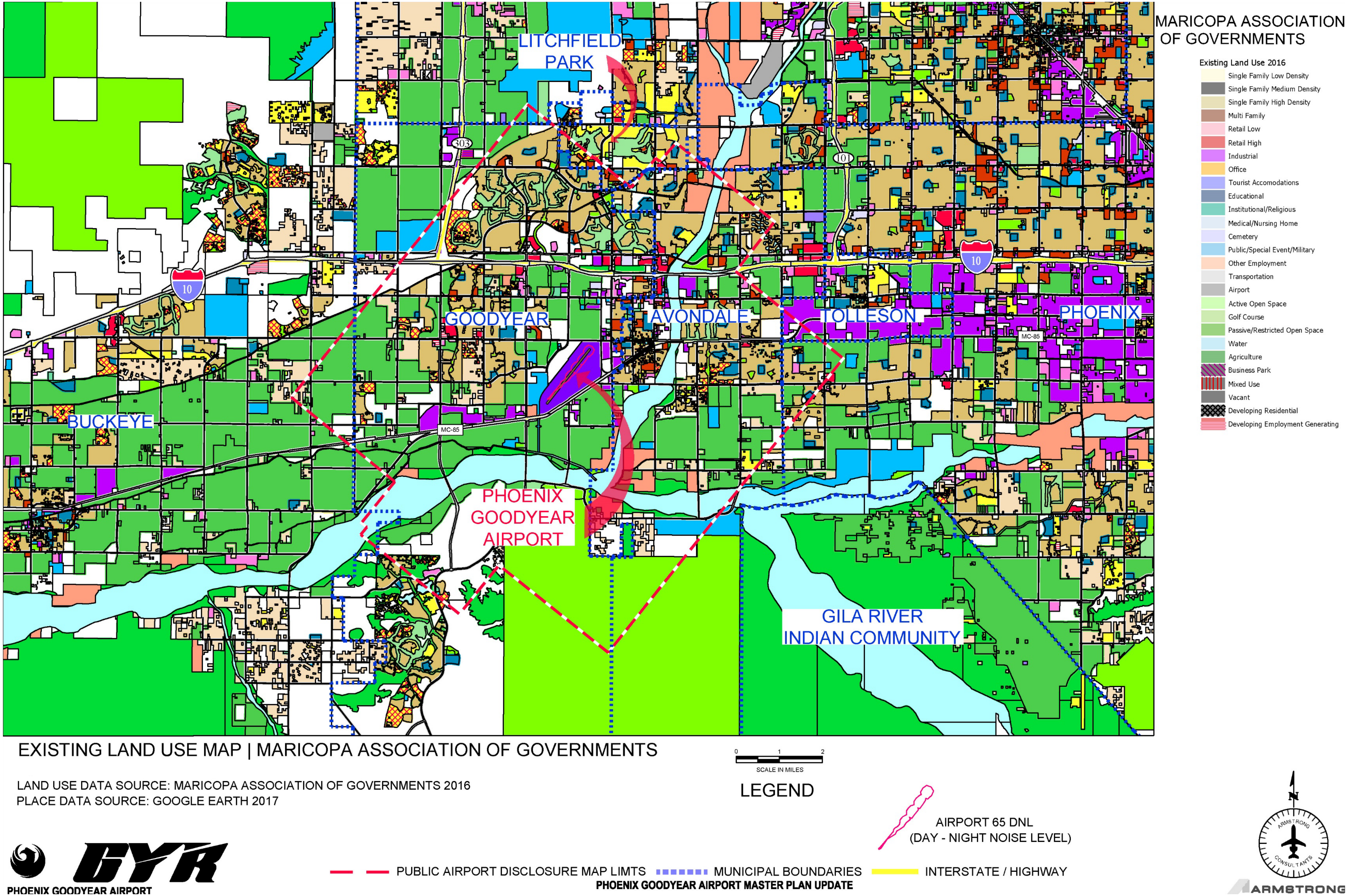
5.4.1 City of Goodyear

As is common in most large metropolitan areas, the City of Goodyear is bordered by and near several other municipalities and communities in all directions; the municipal boundary is adjacent to Litchfield Park and Glendale to the north; Avondale, Tolleson, and Phoenix to the east; the Gila River Indian Community, Pinal County, and various wilderness areas to the south and southeast; and Buckeye to the west. The municipal boundary of the City of Goodyear itself is longer than it is wide, i.e., most of its land is contained in a north-south direction versus an east-west direction. In total, the City of Goodyear encompasses approximately 191 square-miles. The Airport is located in the northern portion of the municipal boundary, near the official city center. Because of the proximity of the nearby municipalities, it is important to review the land uses of not only the City of Goodyear, but of the surrounding communities as well.

The community's vision for the growth and development of Goodyear is contained within the *Goodyear 2025 General Plan*[1], which was created by the community and approved by voters on November 4, 2014. According to the City of Goodyear, "The purpose of the General Plan is to guide decision making in the community in order to ensure that we are growing according to our shared vision." A significant component of the *General Plan* is the Land Use and Transportation Plan. The Land Use and Transportation Plan "represents the preferred land use, physical form, and mobility pattern for Goodyear," according to the City of Goodyear.

[1] http://www.goodyearaz.gov/home/showdocument?id=10645

Figure 5-2: Existing Land Use Map



There are several categories of land use, along with special overlay districts, contained within the land use plan, as well as general and specific design guidelines for each category. The Land Use and Transportation Map graphically depicts the various land use categories found within the General Plan. As per the map, the Airport property resides within the Industrial land use category.

As defined in the *General Plan,* the Industrial category "provides areas for more intensive business and employment uses which have a greater impact on surrounding land uses. Uses that are appropriate include office, industrial, and business parks. Supportive uses such as community and neighborhood commercial and public facilities are also allowed in the Industrial category, to the extent that they are needed to serve the primary uses within the category."

The majority of adjacent land to the north, south, and west of the Airport (that is not within the Industrial category) is designated within the Business and Commerce category, which is similar to Maricopa County's designations. Land to the east of the Airport and its Industrial boundary does not fall within City of Goodyear limits, which is where the County land use map is helpful. Again, a small amount of residential land use is present, but is not uncommon given the age of the Avondale neighborhood.

A review of the *Goodyear 2025 General Plan*, reveals that one of the potential barriers to implementation of the plan is: "Luke Air Force Base and the Phoenix Goodyear Airport are important community assets; however, certain types of land uses are restricted within their proximity." Another policy is to promote development within the City's designated growth areas first, with the Airport identified as being located within a targeted job center. A policy in the plan is to "protect the Phoenix Goodyear Airport Traffic Pattern and their respective critical noise contours surrounding the Airport from incompatible land uses in support of their continued and/or expanded future operations." Another economy policy is to "foster the creation of jobs within key industry clusters; aviation and aerospace."

There are also several special land use overlays contained in the *Goodyear 2025 General Plan* such as the Village Center Overlay, Transit-Oriented Development Overlay, Luke Compatible Land Use Overlay, Wildlife Linkage Overlay, and the Aggregate Mining Overlay.

5.4.2 City of Avondale

In total, the City of Avondale encompasses approximately 30 square-miles. The Airport is located west of the municipal boundary. Because of the close proximity, it is important to review the land uses of not only the City of Goodyear, but of the surrounding communities as well.

The City of Avondale adopted a general plan in 1990, which was later updated in 2002. The current 2030 General Plan is the most recent update, occurring in 2012 and planning for community growth through the year 2030. Both the 1990 Plan and the 2002 Plan were based on the citizen's vision for the future. The 1990 Plan contained land use circulation and transportation, recreation and natural resources, public facilities and services, urbanization, and economic development elements. The 1990 Plan called for redevelopment plans for the downtown area. Since the 1990 Plan, other plans were completed to address topics not anticipated in the 1990s. These plans include:

- Freeway Corridor Plan (1991)
- Tres Rios Greenway Specific Plan (1992)
- North Avondale Plan (1996)

- Redevelopment Implementation Plan (1999)
- Avondale Business Core Redevelopment Implementation Plan (1999)

The 2002 Plan included land use, economic development, growth area, cost of development, housing, conservation, redevelopment and rehabilitation, open space, environmental planning and conservation, circulation, bicycling, water resources, public safety and facilities, public buildings, and safety elements that are required by ARS §9-461.05 for jurisdictions over 50,000.

The 2002 Plan encouraged the development of safe and affordable housing types that were called for in the 1990 Plan. The 2002 Plan recognized the desire for a range of housing options by identifying areas for low density residential development south of Broadway Road for executive housing.

The majority of the existing land use in the City of Avondale remains agriculture, or vacant with more than 8,600 acres. Open space is the second largest land use with more than 2,700 acres. Medium density residential is the third largest land use with more than 2,400 acres. The smallest land use is multi-family residential with only 369 acres.

A review of the individual goals and policies of the 2030 Plan revealed that a policy goal contained in Economic Element includes "identifying opportunities to leverage the proximity to the Phoenix Goodyear Airport and other regional assets." No other mention of the Airport was made in the 2030 Plan.

The land uses within the City of Avondale limits closest to the Airport consist of a mixture of medium and high density housing, local commercial, education, and the Historic Avondale District. Consideration of potential impacts to these land uses will be evaluated in the Development Alternative chapter.

5.4.3 Maricopa Association of Governments

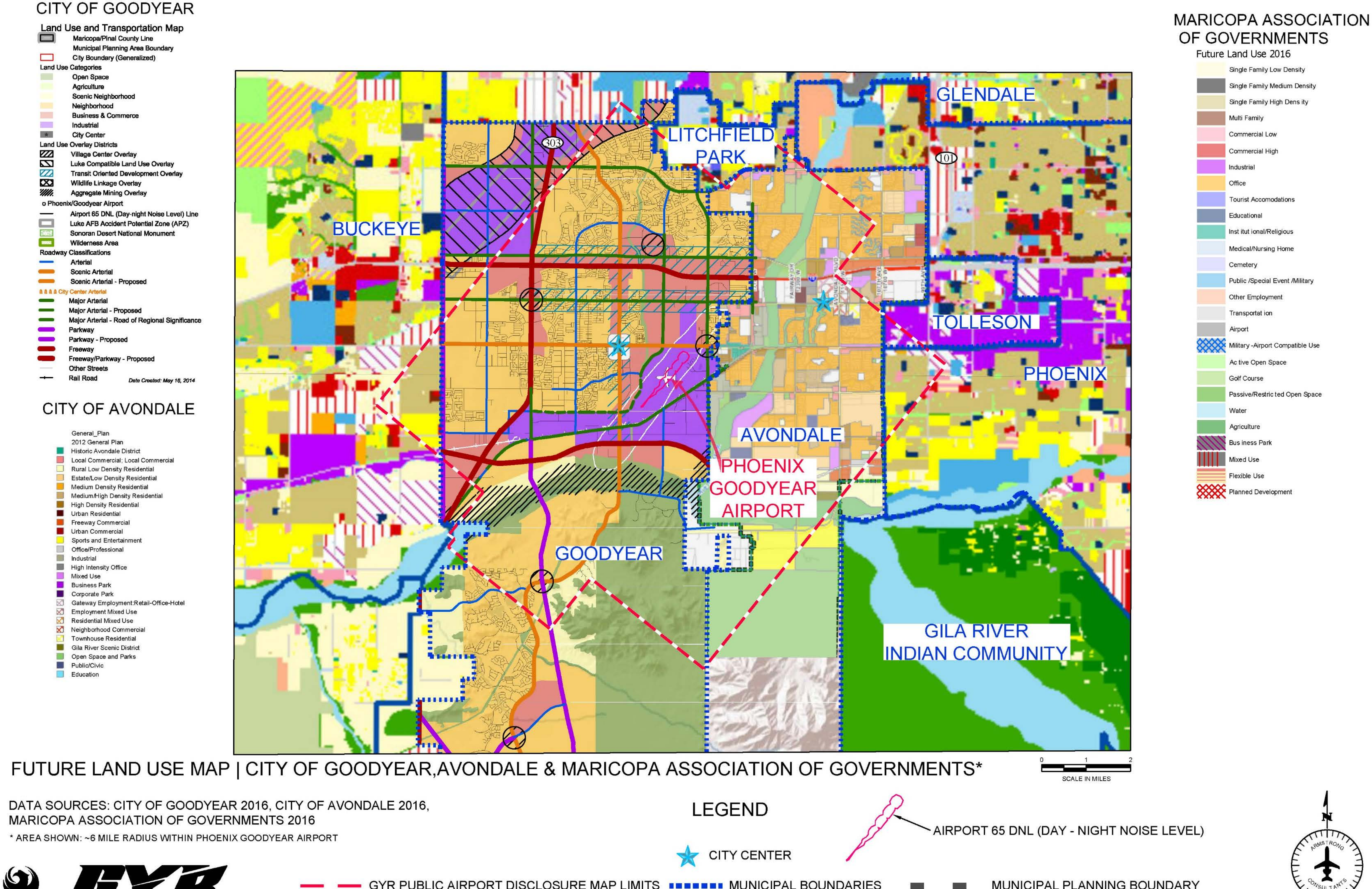
The cities of Goodyear and Avondale, along with other nearby cities (with the exception of the Gila River Indian Community and Pinal County), are contained within Maricopa County. On a regional scale, data-driven long-range planning and policy development for the metropolitan Phoenix in areas such as transportation, air and water quality, and solid waste management is performed by the Maricopa Association of Governments (MAG). MAG was formed in 1967 when elected officials realized that many of the issues mentioned above affected residents beyond the borders of their individual jurisdictions. One tool MAG offers is a County-wide interactive land use map.

According to the MAG Existing Land Use Maps, land adjacent to the Airport's property is classified as agricultural, industrial, commercial, vacant, and public/special event. These classifications pair well with airports, and are compatible. There is some residential (mostly single-family high density and multi-family) land use within a 2–3-mile radius of the Airport, most of which is found to the north, east, and west of the Airport. Although residential land use is not ideal in such near proximity of an airport, it is not uncommon. Most neighborhoods in this area have been a part of the landscape for many years.

According to the MAG Future Land Use Maps, land adjacent to the Airport's property will be converted to different classifications such as business park, mixed use, and industrial with no agriculture in the vicinity of the Airport. These classifications also pair well with airports, and are also compatible.

The future land use designations for Maricopa County, the City of Goodyear, the City of Avondale, and land in surrounding communities is illustrated as **Figure 5-3**.

Figure 5-3: Future Lane Use Map



PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG

5.5 Zoning

Applicable zoning regulations in the cities of Goodyear and Avondale are summarized herein.

5.5.1 City of Goodyear

The Zoning Ordinance of the City of Goodyear, Arizona[2] revised on December 18, 2013, contains the regulations, standards, and zoning districts for the City. **Figure 5-4** depicts the City of Goodyear Zoning Districts within the Public Airport Disclosure Limits of the Phoenix Goodyear Airport. Likewise, the accompanying Zoning Districts Map[3] graphically depicts the different zoning districts found within City limits. According to the map, the Airport property in its entirety is zoned as an agricultural district. As per the *Zoning Ordinance,* "the purpose of the Agricultural (AG) District is to allow agricultural, ranching, and related uses with the City. The other purpose of the AG category is to act as a holding zone for land until a suitable rezoning and development occurs." As such, it is assumed the Airport falls within the latter definition, as it is not used for agricultural purposes. Furthermore, within the AG category, one of the permitted uses of land is for "public facilities" upon approval. The Airport therefore would qualify as a public facility.

Adjacent land north, northwest, and west of the Airport is zoned Light Industrial Park (I-1) or as a Planned Development Area (PAD). The land adjacent to the Airport that is zoned PAD could become problematic for potential noise complaints if residential units are constructed. There also is vacant land zoned PAD approximately 4,000 feet off the end of Runway 21 in line with the runway centerline that could also become problematic for potential noise complaints if residential units are constructed.

Land to the east, southeast, and southwest is a mixture of Light Industrial Park (I-1), General Industrial Park (I-2), General Commercial (C-2), and Planned Development Area (PAD). Recognizing that there is some disparity between the existing *Zoning Ordinance* and the land use categories as described within the *Goodyear 2025 General Plan*. The *General Plan* addresses this and lists the various zoning districts under the correlating land use category. Per the *General Plan*, the listed zoning districts "may be considered within the correlating land use categories, so long as the proposed zoning adheres to the Development Standards." The zoning districts permitted within the land use Industrial category as found within the *Goodyear 2025 General Plan* are agricultural (AG), general commercial (C-2), light industrial (I-1), general industrial (I-2), public facilities district (PFD), and planned area development (PAD).

There are no special zoning overlay districts that would impact the Airport within the zoning ordinance.

5.5.2 City of Avondale

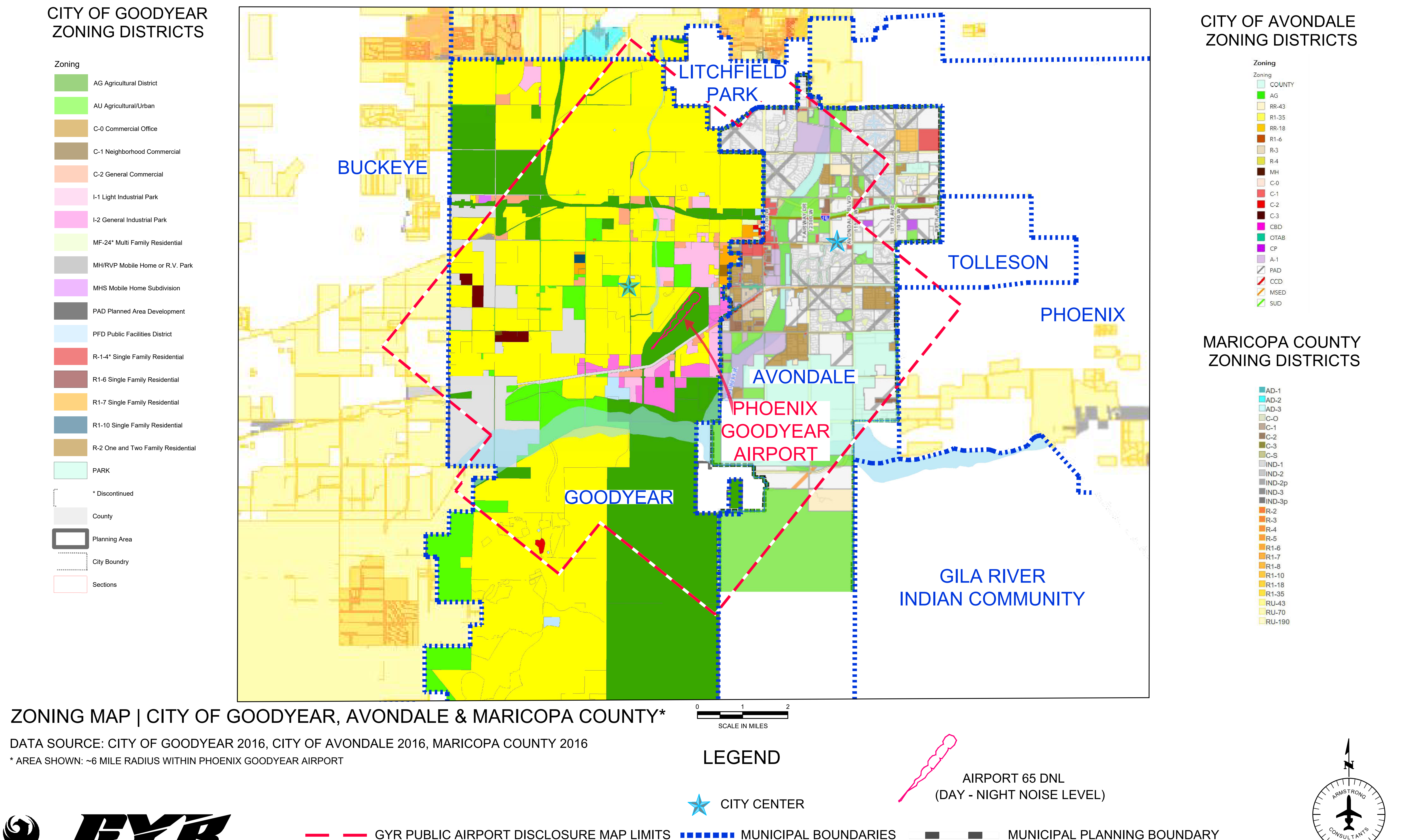
The City of Avondale is located to the east of the City of Goodyear and lies within the Public Airport Disclosure Limits of the Phoenix Goodyear Airport. The City of Avondale Zoning Ordinance, amended and restated February 16, 2016, comprises the existing regulations, standards, and zoning districts for the City in conjunction with the City of Avondale General Plan. **Figure 5-4** depicts the City of Avondale's Zoning Districts within the Public Airport Disclosure Limits of the Phoenix Goodyear Airport.

---

[2] http://www.goodyearaz.gov/government/departments-divisions-a-z/development-services/planning-zoning/zoning-ordinance

[3] http://www.goodyearaz.gov/home/showdocument?id=13480

Figure 5-4: Zoning Map



City of Avondale land within the Public Airport Disclosure Limits consists of a mixture of Commercial Districts (C-2), Residential Districts (R-4, R-3, R1-6, MH), Agricultural Districts (AG), Employment Districts (A-1, CP), Special Districts (CCD, MSED, SUD), and Planned Area Development Districts (PAD). Land that is located within the Public Airport Disclosure Limit and in close proximity to the Airport that is zoned Residential Districts could be problematic for potential noise complaints.

Land to the east and northeast of the Airport has been designated as Planned Area Development Districts. Multiple of the zoned Planned Area Development Districts located to the east and northeast have been designated for a mix of residential use and could be problematic in the future for potential noise complaints.

5.6 Aircraft Noise

Airport noise is often the most significant environmental issue the FAA considers when evaluating proposed airport actions. Airport development actions that change runway configurations, aircraft operations and/or movements, aircraft types using the airport, or aircraft flight characteristics may affect existing and future noise levels. The primary consideration when analyzing noise is how an action would change the cumulative noise exposure of individuals to aircraft noise in areas surrounding the airport. Land use compatibility with aircraft noise is typically determined based on the annual average Day-Night Average Sound Level (DNL). DNL is measured in decibels (dBs) and is normally illustrated by lines, or contours, joining equal noise values and drawn over a base map of an airport and surrounding area. FAA has established land use compatibility guidelines relative to certain DNL noise levels in 14 CFR Part 150.

The DNL 65+ dB noise contour is the Federal noise level at which residential and noise-sensitive land uses are considered non-compatible. In addition to Federal noise levels, Arizona also has requirements designed to support airport zoning and regulation, provide an additional level of safety for people and property on the ground, and educate nearby residents and visitors about potential noise and overflight issues associated with airports. Arizona Revised Statute 28-8486 requires the filing of an airport disclosure map with the Arizona Department of Real Estate and mandates that, for counties with a population of more than 500,000 persons such as Maricopa, that 60 DNL be included on the airport disclosure map. The disclosure map must clearly depict the exterior boundaries that are likely subject to aircraft noise and overflights and to notify existing or potential property owners in this area, including the 60 DNL noise contours and the traffic pattern airspace as defined by FAA.

Figures 5-5 and 5-6 depict existing and future airport noise exposure contours developed as part of this Master Plan Update. The future contours reflect 2036 and the FAA approved aviation demand forecast for the Airport. As shown, the existing 60 DNL noise contour does not extend beyond the Airport's boundaries. By 2036, even with the growth in activity that is projected, the 60 DNL noise contour extends only slightly beyond the airport boundary on the south side of the facility.

The Aviation Department has been tracking noise concerns for many years. Airport records date back to the 1990s. Since 2013, there have been a total of 80 aircraft noise complaints from 26 separate households. The number of noise complaints and the number of households providing complaints have fluctuated over time. In late 2015, the Department made changes that allowed the public to replay flight tracks and make complaints online. A mobile app to provide noise complaints was also released in February 2016.

Appendix B includes an update to the Airport's Noise Disclosure Map.

Figure 5-5: Existing Airport Noise Exposure Contours

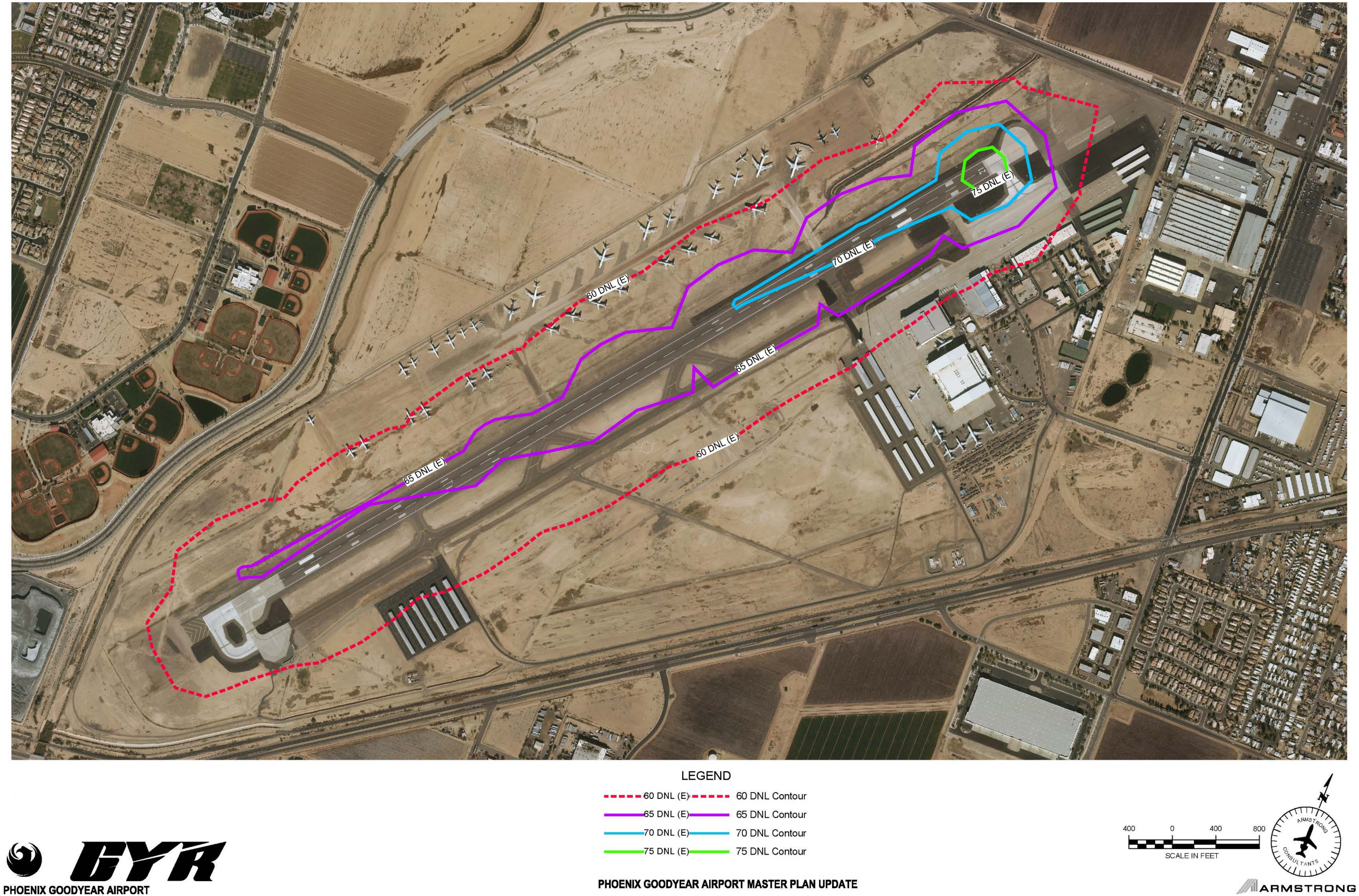
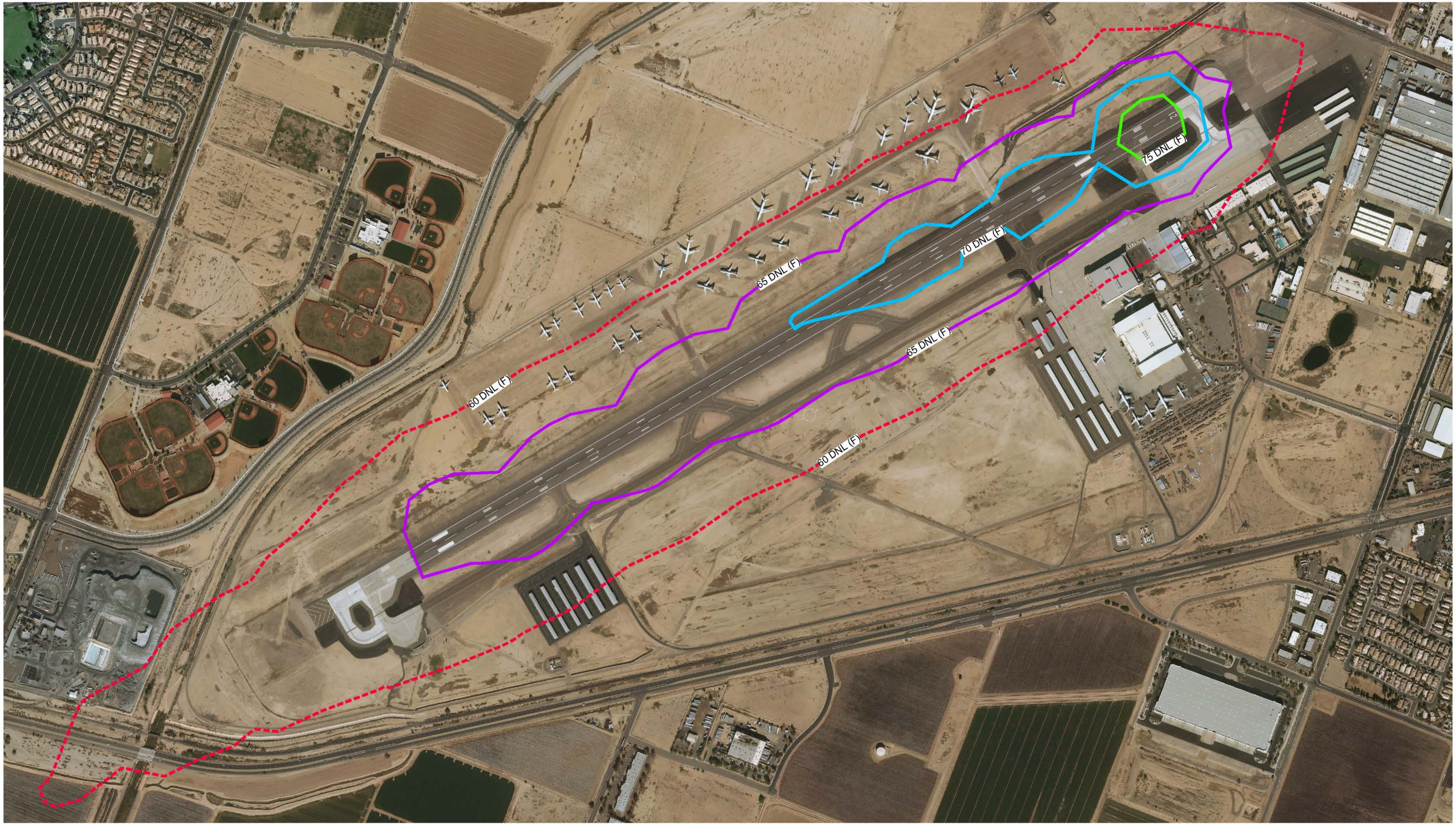


Figure 5-6: Future Airport Noise Exposure Contours



GYR
PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG

5.7 Land Use and Zoning Summary

The findings of the land use and zoning evaluation is an important element of the development alternatives. Land use and zoning compatibility with the Airport is essential for future development. The summary of land use and zoning for the cities of Goodyear and Avondale is depicted in **Table 5-2.**

Table 5-2: Land Use and Zoning Summary

City of Goodyear			
	Compatible with Airport	**Non-Compatible with Airport**	**Overlays in Place or Planned**
Existing Land Use	Yes	No areas identified	No
Future Land Use	Yes	No areas identified	No
Zoning	Yes	Some PAD land may become non-compatible	No
City of Avondale			
Existing Land Use	Yes	No areas identified	No
Future Land Use	Yes	No areas identified	No
Zoning	Yes	Some Residential and PAD land may be non-compatible	No

Chapter 6

ALTERNATIVES ANALYSIS

Alternatives presented in this Chapter were intended to accommodate aviation demand forecasts and facility requirements developed in previous tasks of this Airport Master Plan Update. Feedback from the Master Plan's Technical Advisory Committee (TAC), Planning Advisory Committee (PAC), and the general public were also incorporated. The following sections present alternatives considered. The preferred alternatives are summarized in Chapter 7 and on the Airport Layout Plan (ALP).

6.1 Facility Needs

This section summarizes the recommended facility requirements described in Chapter 4 to accommodate forecast demand and the evaluation criteria used to identify preferred development alternatives. Based on the facility requirements and stakeholder input, the following facilities were examined:

- Airfield facilities
  - Parallel runway
  - Non-standard taxiways
  - Helipads
- Landside facilities
  - Aircraft storage hangars
  - Aircraft parking apron
- On-Airport land use
- Additional facilities
  - Designated fuel truck parking
  - Airport access
  - General aviation wash rack

Evaluation criteria were established to compare the development alternatives. Alternatives were evaluated based on their ability to:

- Satisfy forecast demand
- Minimize environmental impacts
- Facilitate safety
- Enhance revenue/future development
- Minimize impacts to the surrounding environs
- Minimize impacts to existing facilities

Preferred alternatives for airside facilities, landside facilities, and on-airport land uses were identified based on the above criteria and feedback received from the TAC, PAC, and the public.

6.2 Non-Development Alternatives

Non-development alternatives were identified to establish a baseline of effects that could occur as a result of inaction to construct needed facilities at the Airport. The evaluation considers whether facility improvements should occur at the Airport, or if another scenario would better serve existing and potential future Airport tenants and users. The non-development alternatives that were examined include:

- No-Build
- Relocation/Transfer of Aviation Activities
- Construction of a New Airport

The no-build alternative considers no additional airside, landside, or support facilities being constructed at the Airport. No additional physical enhancements would be implemented except for routine maintenance for the operational functionality of the Airport. This alternative does not satisfy projected levels of aviation demand identified in **Chapter 3** and the subsequent facility requirements presented in **Chapter 4**. As such, the no-build alternative is not recommended as a viable development strategy.

The second non-development alternative examined is the relocation or transfer of specific or all aviation activities at the Airport to another airport. Previous chapters of this Airport Master Plan Update have detailed the unique mix of tenants and users at the Airport including high-activity flight schools; specialized maintenance, repair, and overhaul (MRO) tenants; and a fixed-base operator (FBO) that recently constructed a new large hangar. Interviews with these tenants indicated that the Airport provides an accommodating environment and that relocation of their operations was not seen as a desirable option.

In addition to the direct economic benefits provided by on-airport tenants, the Airport acts as an economic driver within the community and provides a valuable service as a general aviation (GA) facility. There is not another GA airport in the Phoenix metropolitan area that has a runway capable of accommodating large commercial aircraft that are serviced and/or stored by the MRO tenants. Even a partial transfer of aviation activities to another airport would likely result in decreased revenues at the Airport, and could ultimately result in its closure. As such, the relocation/transfer of aviation activities is not recommended as a viable option.

In rare situations, new airports may be constructed to alleviate congestion or enhance operational safety, or might be considered if the cost of redeveloping an existing airport exceeds the cost of building new facilities. Based on projected levels of activity and availability of developable land, construction of a new airport is not recommended as a viable development alternative for the Airport.

6.3 Airfield Alternatives

Alternatives were developed for the following airfield facilities:

- Parallel runway
- Non-standard taxiways
- Helipads

6.3.1 Parallel Runway Alternatives

As noted in the demand/capacity analysis presented in **Chapter 4**, the annual service volume (ASV) or "capacity" of the Airport is 275,590 operations. By 2035, it is projected that there will be 200,360 annual operations at the Airport and the ratio of annual aircraft operations to ASV is projected to be 72.7 percent. The FAA recommends planning for additional capacity enhancements when the ratio of aircraft operations to ASV reaches 60 percent, and implementing capacity enhancements when this ratio reaches 80 percent.

While a parallel runway is not required during the 20-year planning horizon of this Master Plan Update, it is recommended that space for a parallel runway be preserved to ultimately enhance airfield capacity if it is needed in the future. A parallel runway 5,000 feet in length and 75 feet in width designed to meet runway design code (RDC) B-II standards is recommended to accommodate the forecast general aviation fleet mix. This runway length would accommodate all current training activities and some of the MRO operations. The parallel runways should be separated by 700 feet between runway centerlines to allow for simultaneous

Visual Flight Rule (VFR) operations[1]. The runway should be equipped with a visual approach and a 20:1 approach surface[2].

The previous Master Plan recommended a 4,300-foot-long by 75-foot-long parallel runway located 700 feet east of Runway 3-21, which also was depicted on the approved ALP. A parallel runway 5,000 feet in length in this location would require (1) relocation of existing T-hangars and the airport traffic control tower (ATCT); (2) land acquisition or easements for portions of the runway protection zone (RPZ) that extend off-Airport property; and (3) relocation of MC 85 and adjacent Union Pacific Railroad line. Furthermore, a parallel runway on the east side of the airfield would also inhibit potential development near existing facilities and tenants. Based on the potential impacts that would be incurred by development of a parallel runway east of existing Runway 3-21, this option was deemed not viable and was not considered for additional analysis in this Master Plan Update.

Existing Runway 3 is equipped with an RNAV (GPS) approach with 1-mile visibility minima and an approach slope of 34:1. The previous ALP recommended increasing the Runway 3 approach to a precision approach with 50:1 visibility minima and maintaining Runway 21 with a visual approach and 20:1 approach slope.

A precision approach on the Runway 3 end would significantly increase the size of the RPZ. However, the use of off-airport property is not recommended in this Master Plan Update.

It is recommended that Runway 21 ultimately include a non-precision instrument approach such as an RNAV (GPS) with 1-mile visibility minima and a 34:1 approach slope. Recent improvements in technology have made it easier and less expensive to obtain these types of approaches compared to Instrument Landing Systems (ILSs). The primary benefit of having instrument approaches (regardless if they are precision or non-precision) on both runway ends is that it provides additional flexibility for operators. As such, it is recommended that Runway 21 ultimately be equipped with a non-precision instrument approach. This action would require mitigation of any obstructions penetrating the 34:1 approach surface. Obstructions to this surface will be identified on the ALP.

The following sections present two parallel runway alternatives.

6.3.1.1 Parallel Runway Alternative 1 - North

Parallel Runway Alternative 1 includes a parallel runway located 700 feet west of Runway 3-21 and as far north as possible while keeping FAA-required safety and protection areas, the largest of which is the RPZ, on existing Airport property (see **Figure 6-1**). The primary benefit of Alternative 1 is that the proposed north runway end would be within proximity to existing tenants including flight schools, who are anticipated to be the primary users of a parallel runway.

There are several impacts associated with Alternative 1, the most significant being that it would limit potential future development on the northwest portion of the airfield. This area west of the Runway 21 end

---

[1] FAA AC 150/5300-13A recommends that parallel runway separation for simultaneous Instrument Flight Rule (IFR) operations be at least 5,000 feet, which would place the proposed parallel runway off Airport property.

[2] The parallel runway could be equipped with a non-precision instrument approach such as an area navigation (RNAV) global positioning system (GPS) as it would not alter the runway's safety areas, but such an approach would only be useable when existing Runway 3-21 is inoperable.

has existing vehicle access from Yuma Road which is considered a prime area for development due to the easy access. Additionally, there is a drainage canal located on the northern portion of the airfield that could also be impacted. Lastly, the southwestern portion of the airfield (west of the existing Runway 3 end) that would be available is not ideal for landside development as this area does not have vehicle access, and potential development could have impacts associated with Bullard Wash.

6.3.1.2 Parallel Runway Alternative 2 - South

Parallel Runway Alternative 2 includes a parallel runway located west of existing Runway 3-21 situated as far south as possible while keeping all runway safety areas including the RPZ within the existing Airport property boundary (see **Figure 6-2**). The location of the runway would not incur environmental impacts associated with the drainage canal. Alternative 2 also would preserve an area on the northwest portion of the airfield that has high development potential and readily available vehicle access.

Alternative 2 would situate the parallel runway such that the northern RPZ would be located over the drainage canal, but there would be no construction or environmental impacts associated with the canal. The southern RPZ would be located on an area of the airfield that has limited landside development potential based on proximity to Bullard Wash and lack of vehicle access.

Figure 6-1: Parallel Runway Alternative 1 - North

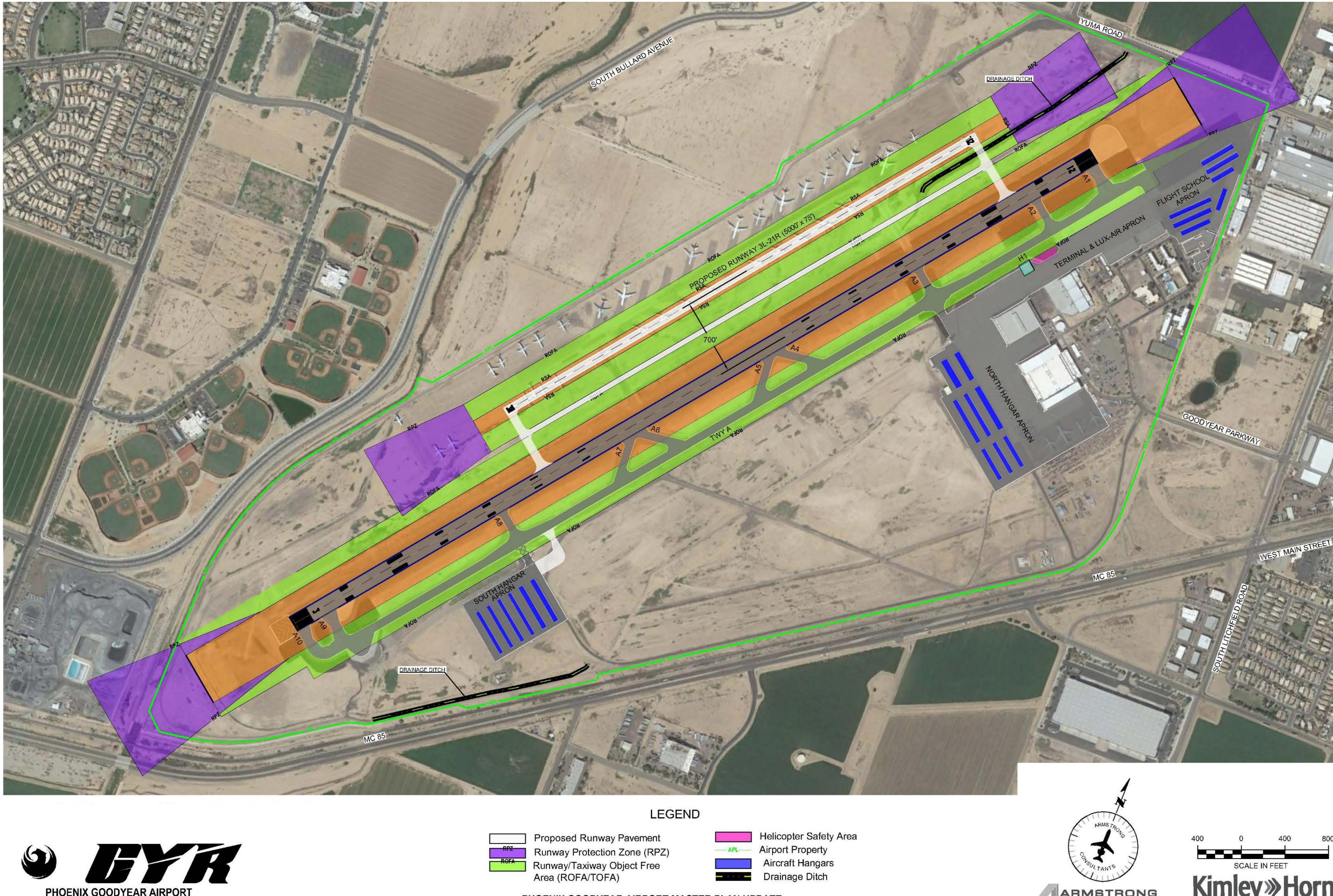
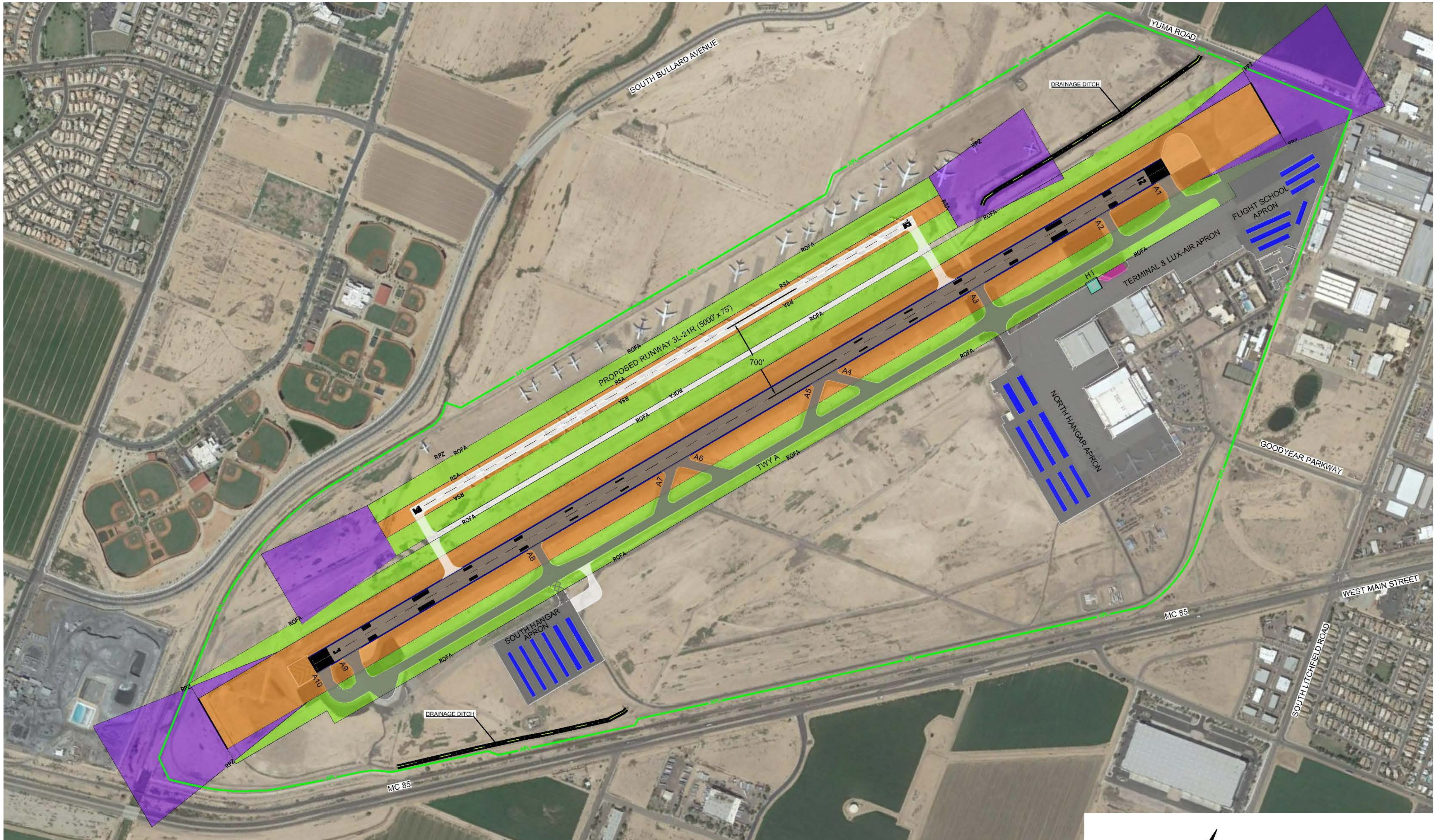


Figure 6-2: Parallel Runway Alternative 2 – South



GYR PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG

Kimley»Horn

6.3.1.3 Parallel Runway - Preferred Alternative

A comparison of Parallel Runway Alternatives 1 and 2 with regard to the evaluation criteria is summarized in **Table 6-1**. Each alternative was scored for the potential impact related to development for each of the six criteria. As shown, Parallel Runway Alternative 2 scores higher in terms of minimizing environmental impacts, enhancing revenue through future development opportunities, and minimizing impacts to the surrounding community.

Table 6-1: Parallel Runway Alternatives Evaluation Summary

Criteria	Alternative 1	Alternative 2
Satisfies Forecast Demand	3	3
Minimizes Environmental Impacts	1	2
Facilitates Safety	2	2
Enhances Revenue/ Future Development	2	3
Minimizes Impacts to Surrounding Community	1	2
Minimizes Impacts to Existing Facilities	2	2
Evaluation Total	**11**	**14**

Legend: 3=Positive Impact, 2=No Impact, 1=Negative Impact.
Source: Kimley-Horn.

There are common impacts associated with Parallel Runway Alternatives 1 and 2 including environmental impacts during construction and ultimate relocation of a portion or all the commercial aircraft parking area that is currently on the west side of the airfield. While Alternative 1 would situate the northern portion of the runway closer to flight schools and other tenants anticipated to be primary users, the main difference between the two alternatives is how they would impact potential future development on the west side of the proposed runway.

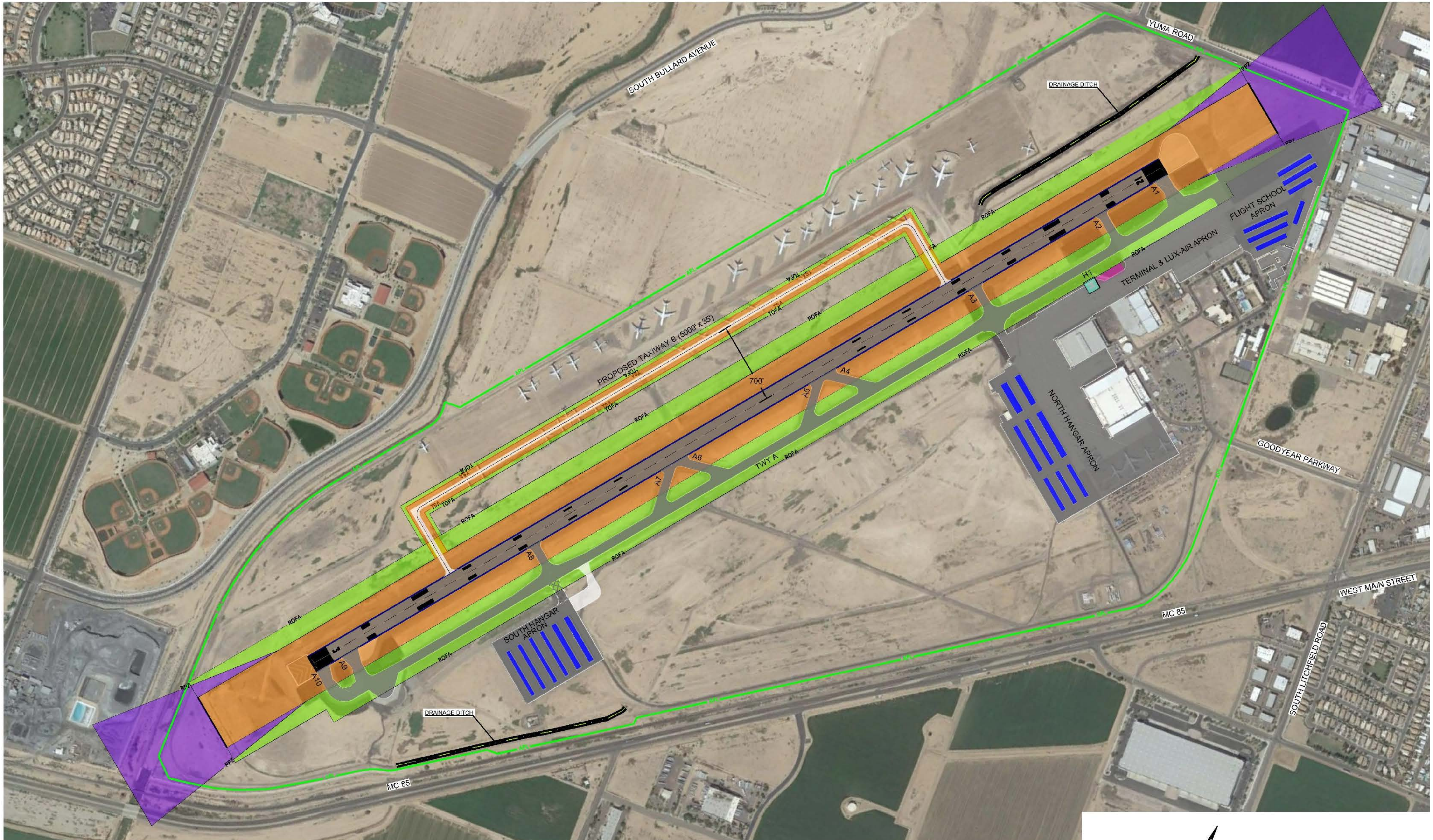
Parallel Runway Alternative 1 would provide an area on the southwest portion of the airfield that does not currently have a vehicle access point, and potential development could have impacts associated with the Bullard Wash. Parallel Runway Alternative 2 would preserve an area on the northwest portion of the airfield that currently has vehicle access on Yuma Road and has high development potential.

It should be noted that both Parallel Runway Alternatives 1 and 2 would limit the area on the western portion of the airfield currently used for commercial aircraft storage. It is estimated that the amount of area currently used for commercial aircraft storage is approximately 95 acres, although much of this area is underutilized. It is recommended that commercial aircraft storage ultimately be relocated if/when a parallel runway is implemented or at a time other development is planned for the west side.

Both alternatives were presented to the PAC and TAC, and both committees concurred that Parallel Runway Alternative 2 should be the long-term recommended development option.

Since it is uncertain when a parallel runway will ultimately be needed, a phased development approach is recommended starting with construction of a taxiway that could eventually be converted to a parallel runway (see **Figure 6-3**). This phased approach would be initiated to spur aviation-related development on the west side which currently does not have paved airfield access. Permanent structures or any development that would be within FAA safety and protection areas for a runway would not be allowed during this taxiway phase, but other facilities such as aircraft parking aprons or taxilanes could be constructed to support

Figure 6-3: Parallel Runway - Taxiway Phase



PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG

Kimley»Horn

development. The primary goal of this interim phasing option is to support additional aviation development and prepare for long-term operational capacity enhancements.

If the taxiway phase of the parallel runway were to be constructed, the taxiway should be designed to accommodate up to Airplane Design Group II and Taxiway Design Group 2 aircraft, which includes the majority of the current and projected fleet mix, except for MRO related commercial aircraft. Taxiway construction standards for these categories of aircraft are similar to runway construction standards for the ultimate parallel runway; hence, all pavements would be utilized for future runway use. Cost estimates developed for construction of the parallel taxiway presented in **Chapter 7** include a 4-inch base course and 8-inch concrete overlay. If the overlay were constructed of asphalt, some reconstruction could be needed before a conversion to a runway could occur. However, an 8-inch concrete surface with 4 inches of base course meets TDG 2 requirements for a taxiway and ADG II requirements for a runway, and no reconstruction other than relocation of lighting will be needed.

6.3.2 Non-Standard Taxiways

As noted in **Chapter 4**, connector Taxiways A2, A3, and A8 are considered non-standard taxiways as they provide direct access to Runway 3-21 without a turn. While improvements to Taxiway A8 are currently underway, mitigation for Taxiways A2 and A3 is still required.

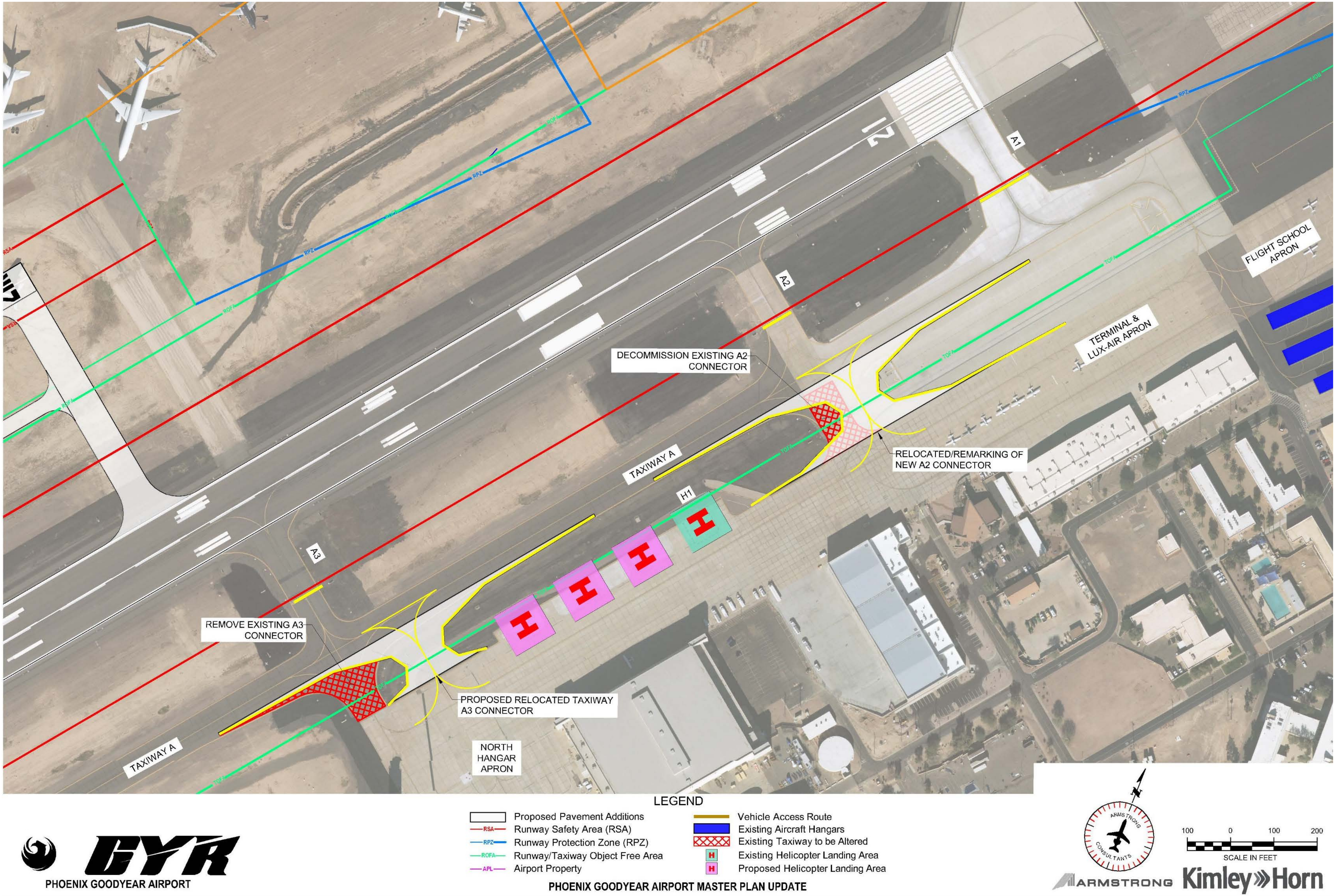
Potential options to mitigate Taxiway A2 would be relocation to the south or north. Relocation to the south would require complete reconstruction. This option also would move the connector taxiway closer to the helipad, which could have impacts on operational safety. Relocation to the north would move the connector away from the helipad and could be achieved by replacement of the pavement markings, edge lighting, and signage to create a new connector on existing pavement. Based on cost and safety implications, it is recommended that Taxiway A2 be relocated to the north by replacing pavement markings, lighting, and signage.

Taxiway A3 could be relocated to the north or the south. Relocation to the south would move taxiing activity away from the apron area and could impact future development. Relocation to the north would move the taxiway toward the helicopter parking area but could be achieved without impacts to operations. Areas to the south of the existing apron are anticipated to be developed in the future and a connector taxiway may have to be reconfigured if/when that development occurs. Hence, it is recommended that Taxiway A3 be relocated to the north, as close as practical to the existing connector to limit encroachment near the helicopter parking areas. A graphical representation of improvements to non-standard Taxiways A2 and A3 is shown in **Figure 6-4**.

6.3.3 Helipads

The Airport currently has one helipad east of Taxiway A, situated between connector Taxiways A2 and A3. During high activity periods or special events such as NASCAR races, helicopters also operate from the apron south of the designated helipad. Based on discussions with Airport management, three additional helicopter landing areas should be located on the apron where operations currently occur between Taxiways A2 and A3 since this area is close to the FBO (see **Figure 6-4)**.

Figure 6-4: Non-Standard Taxiway Recommendations



6.4 Landside Development Alternatives

As noted in **Chapter 4**, the Airport requires an additional 166,500 SY (~35 acres) of aircraft parking apron (approximately 21 acres for MRO tenants, 10.5 acres for FBO tenants, and 3 acres for flight schools) and 26,800 SF of conventional aircraft storage hangars by 2036.

Four landside development alternatives were identified to accommodate required aircraft parking apron and storage hangars. The objective of the alternatives was to locate facilities in a logical manner that fosters potential future development. Landside Development Alternatives 1, 2, and 3 were created and presented to the TAC and PAC for input. Alternative 4 was developed based on feedback provided. In each alternative, the required amount of conventional aircraft storage hangars is located on future FBO apron.

6.4.1 Landside Development Alternative 1

Landside Development Alternative 1 proposes relocation of the north T-hangars to the southern portion of the airfield, allowing for additional MRO and FBO development near existing facilities. Additional flight school apron would be located in vacant areas near the existing flight school campus (see **Figure 6-5**).

The objective of Landside Development Alternative 1 is to retain all long-term tenant development on the east side of Runway 3-21 and preserve the west side of the airfield for airfield development. The benefits of this are (1) future MRO development can occur adjacent to existing apron and hangar areas; (2) the location of the proposed FBO apron and hangars provide parallel taxiway access; and (3) relocation of the T-hangars fosters separation between based aircraft and itinerant/MRO activity. Impacts associated with Alternative 1 include relocation of the wash rack facility, and lack of connectivity between existing and proposed FBO facilities.

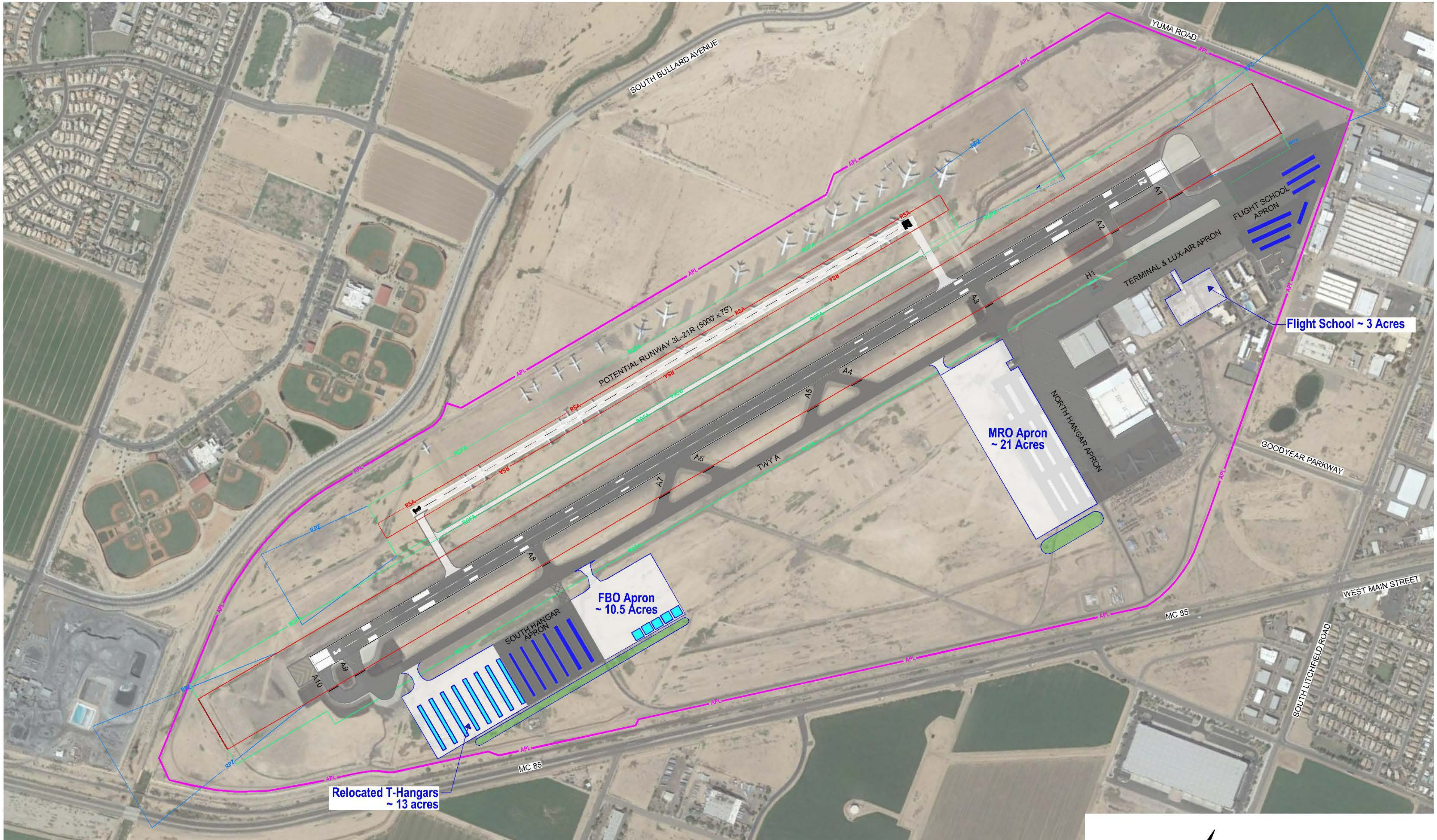
Based on input provided by the TAC, locating future facilities on the east side of Runway 3-21 was viewed as favorable, but the committee raised concerns regarding the lack of connectivity between the existing and proposed locations of FBO and T-hangar facilities.

6.4.2 Landside Development Alternative 2

In Landside Development Alternative 2 FBO facilities would be situated on the south side of the airfield with parallel taxiway access, and the north T-hangars and wash rack facility would not be relocated. Landside Development Alternative 2 identifies potential locations for these facilities in the event that MRO and FBO demand requires relocation of the T-hangars and wash rack. Additional MRO apron would be located to the east of existing MRO areas toward the Airport property boundary, and flight school apron expansion would occur in the same location as Alternative 1 (see **Figure 6-6**).

The primary objective of Landside Development Alternative 2 is to preserve the option of keeping the north T-hangars and wash rack in their existing locations while locating proposed MRO facilities to the east. While this option satisfies projected demand and preserves a larger area of developable land between existing MRO tenants and potential future development on the south side of the airfield, MRO development would be limited by access roads and the fuel farm. Furthermore, the area designated for MRO expansion is currently used for aircraft storage, which would require relocation. Based on feedback from the TAC, the proposed location of FBO facilities on the southern portion of the airfield was not identified as an optimal location based on issues with jet blast from the run up area.

Figure 6-5: Landside Development Alternative 1



LEGEND

Proposed Pavement Additions	Airport Property
Runway Safety Area (RSA)	Existing Aircraft Hangars
Runway Protection Zone (RPZ)	Proposed Aircraft Hangars
Runway/Taxiway Object Free Area	Vehicle Parking

400 0 400 800
SCALE IN FEET

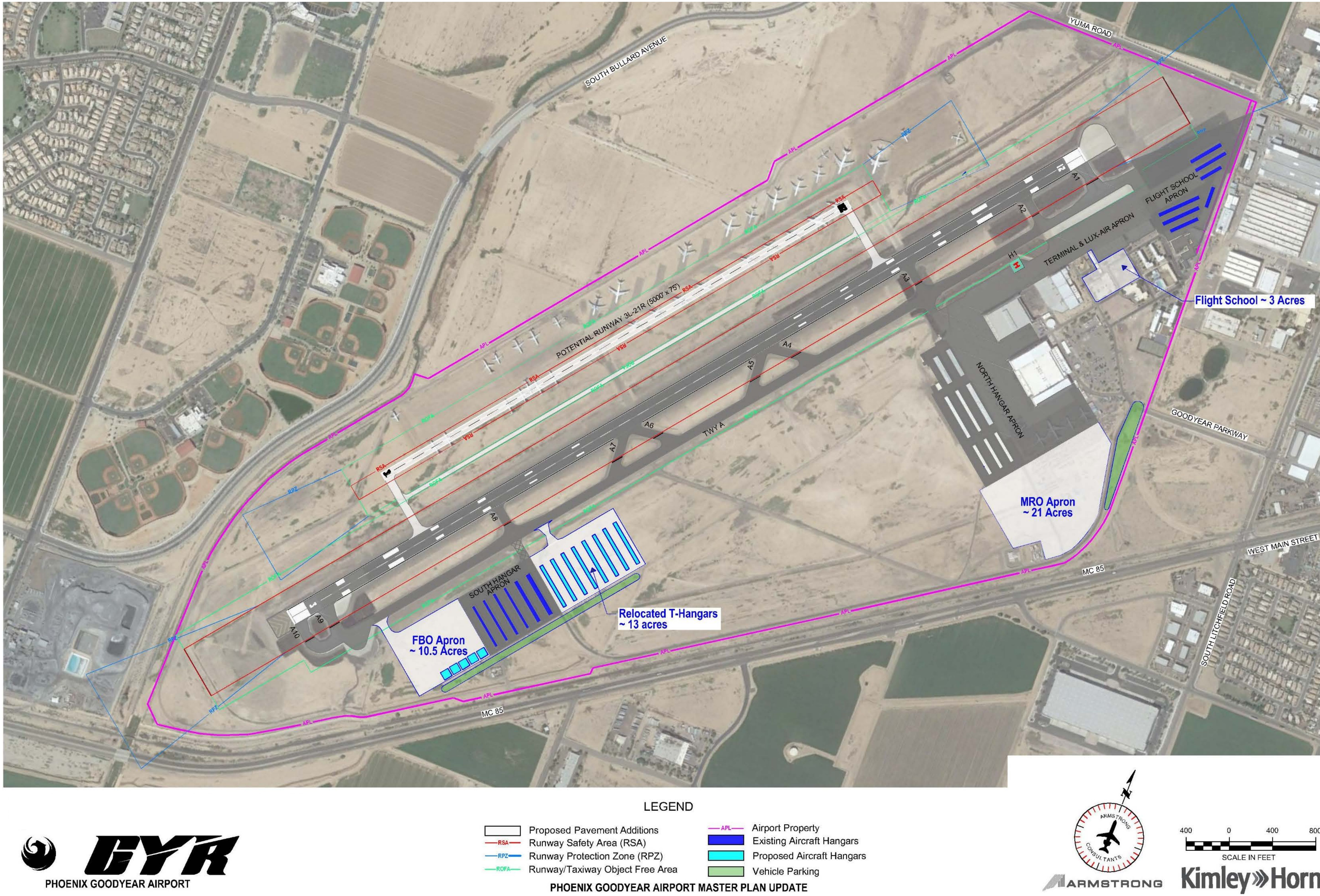
GYR PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS

Kimley»Horn

Figure 6-6: Landside Development Alternative 2



6.4.3 Landside Development Alternative 3

Landside Development Alternative 3 proposes a large apron with combined MRO and FBO use south of the existing MRO/FBO apron areas with relocated T-hangars on the northwest portion of the airfield. The flight school apron expansion would be located on primarily undeveloped areas, similar to other landside development alternatives (see **Figure 6-7**).

The primary objective of Landside Development Alternative 3 is to consolidate facilities based on aircraft size (small based aircraft and larger itinerant and commercial aircraft) and cluster development toward the northern portion of the Airport to reduce the overall development footprint. A combined FBO/MRO apron that accommodates larger aircraft would reduce construction and maintenance costs compared with multiple aprons, and the relocated T-hangars and potential future development near them could utilize vehicle access from Yuma Road if the current access point was converted for public use. The wash rack facility would also require relocation.

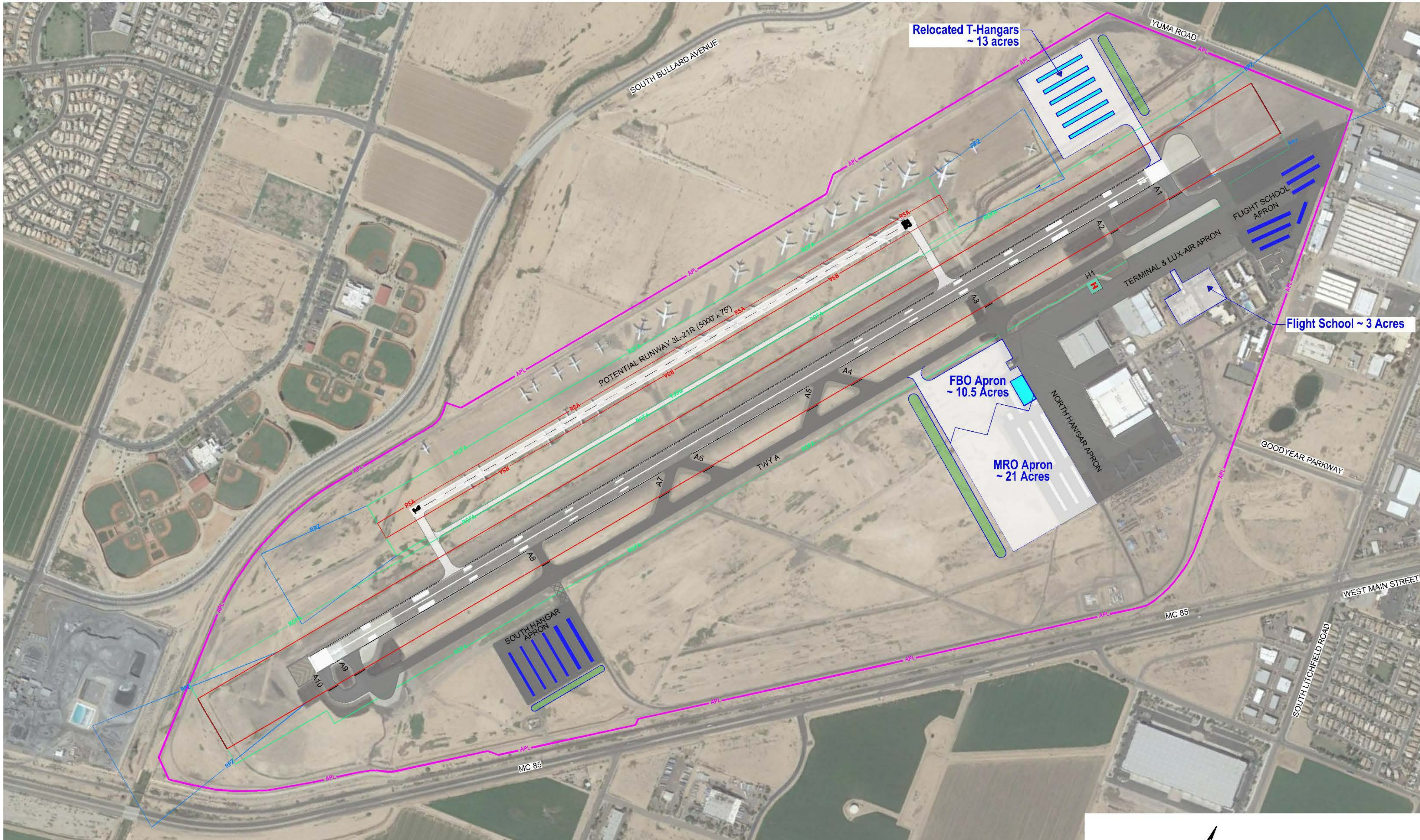
The TAC favored consolidation of facilities based on the size of aircraft that would utilize them. The primary objection to Alternative 3 was that the northwest portion of the airfield was identified as an area with high development and revenue-generating potential, and relocated T-hangars were not viewed as the highest and best use of this site.

6.4.4 Landside Development Alternative 4

As noted previously, Landside Development Alternatives 1, 2, and 3 were initially presented to the TAC and PAC for input. Overall, the committee favored grouping facilities based on aircraft size (flight schools/based aircraft, MRO/FBO). The committee also suggested that clustering future facilities near existing facilities would allow for more congruent land use planning of developable land. It also was agreed that relocation of the north T-hangars and wash rack facility was necessary for logical phasing of development for FBO and MRO tenants.

Landside Development Alternative 4 incorporates this feedback and proposes a combined FBO/MRO apron located to the south of the existing tenants, and relocated T-hangars and wash rack facility would be on the south portion of the airfield, north of the existing T-hangars. Similar to the three previous alternatives, the flight school apron would expand into primarily undeveloped areas near the existing campus. Alternative 4 provides space for FBO/MRO tenant development to occur as needed while relocating T-hangars near similar areas that are more suitable for development (see **Figure 6-8**).

Figure 6-7: Landside Development Alternative 3



LEGEND

- Proposed Pavement Additions
- Runway Safety Area (RSA)
- Runway Protection Zone (RPZ)
- Runway/Taxiway Object Free Area
- Airport Property
- Existing Aircraft Hangars
- Proposed Aircraft Hangars
- Vehicle Parking

400 0 400 800
SCALE IN FEET

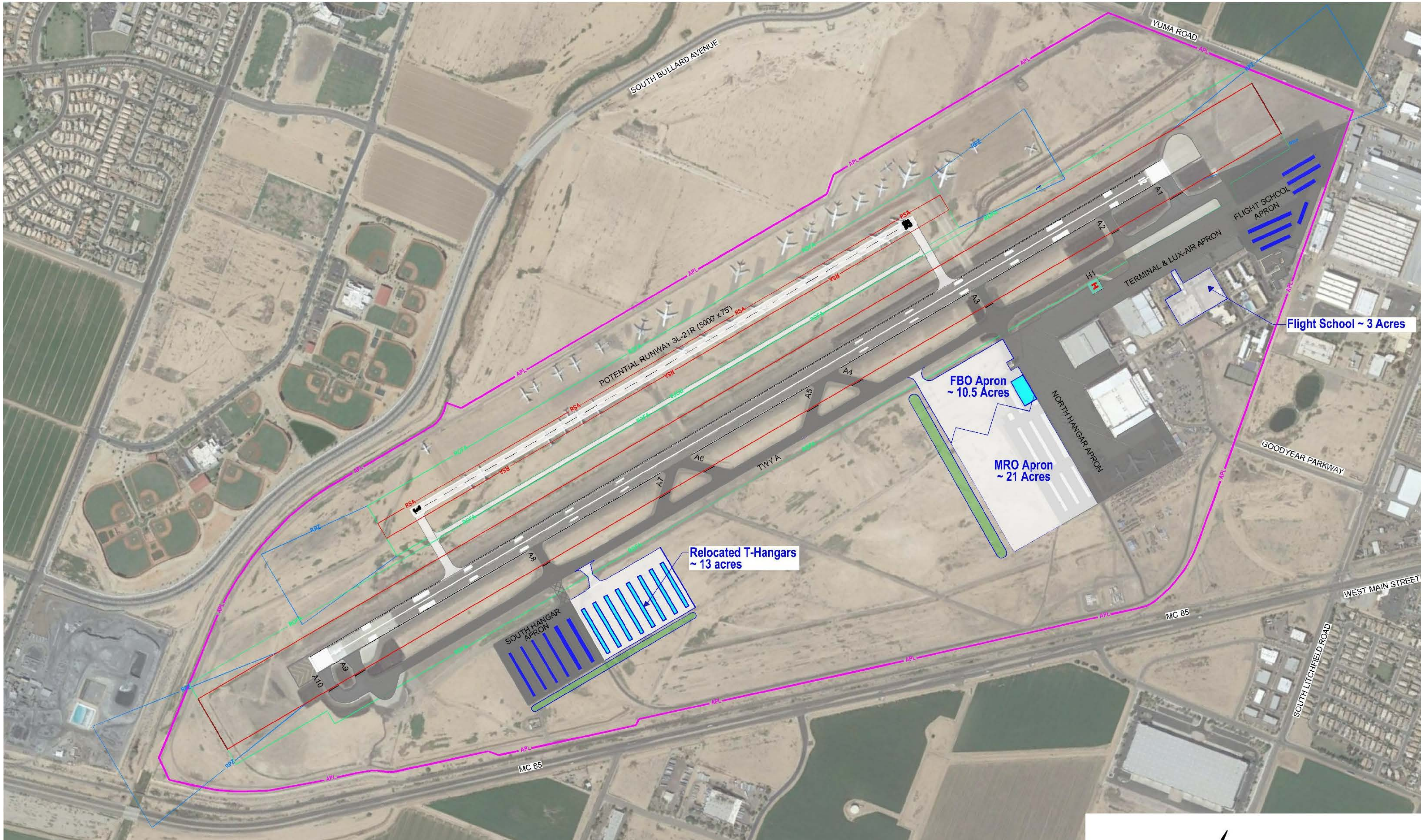
PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS

Kimley»Horn

Figure 6-8: Landside Development Alternative 4



LEGEND

Proposed Pavement Additions
Runway Safety Area (RSA)
Runway Protection Zone (RPZ)
Runway/Taxiway Object Free Area
Airport Property
Existing Aircraft Hangars
Proposed Aircraft Hangars
Vehicle Parking

400 0 400 800
SCALE IN FEET

GYR PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG Kimley»Horn

6.4.5 Landside Development Alternatives – Preferred Alternative

Landside development alternatives were evaluated by the PAC, TAC, Airport Management, and the public. Based on the evaluation criteria presented in **Section 6.1**, Landside Development Alternative 4 is recommended as the preferred alternative. A comparison of Landside Development Alternatives 1, 2, 3 and 4 and how they meet the evaluation criteria is summarized in **Table 6-2**. As shown, Landside Development Alternative 4 scores the highest of the four alternatives, with the biggest differences in how it can facilitate safety and enhance revenue potential through future development opportunities.

Table 6-2: Landside Development Alternatives Evaluation Summary

	Alternative			
CRITERIA	1	2	3	4
Satisfies Forecasted Demand	3	3	3	3
Minimizes Environmental Impacts	1	1	1	1
Facilitates Safety	2	2	2	3
Enhances Revenue/Future Development	2	2	1	3
Minimizes Impacts to Community	2	2	2	2
Minimizes Impacts to Existing Facilities	1	1	1	1
Evaluation Total	**11**	**11**	**10**	**13**

Legend: 3=Positive Impact, 2=No Impact, 1=Negative Impact.
Source: Kimley-Horn, November 2017.

6.5 On-Airport Land Use

To promote logical future on-airport development, it is important to identify a land use plan that provides a framework for development that is compatible with existing and proposed facilities. The initial step in the identification of future land uses is to establish land use planning goals. Recommended land uses should:

- Enhance revenue/future development
- Maximize compatibility with existing facilities
- Minimize impacts to the surrounding community
- Satisfy long-term development needs
- Provide optimal use of land and existing/future access points

The next step in the land use planning process is identification of recommended land uses. In total, seven land uses were identified that include permitted activities and general requirements for potential development within each category as shown in **Table 6-3**.

Table 6-3: Land Use Categories

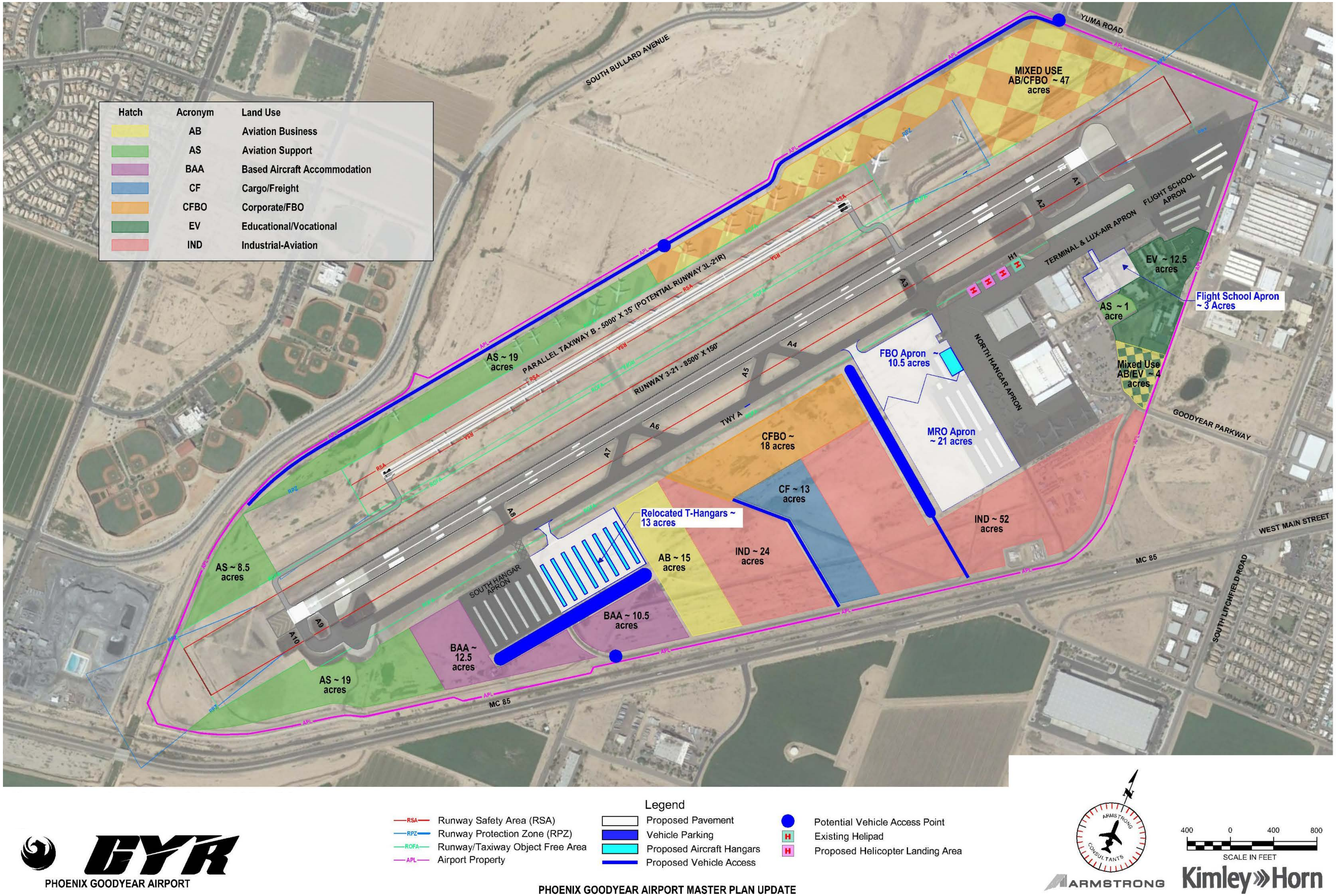
Land Use	Permitted Activities	General Requirements
Educational/ Vocational	Flight schools, flight training, airframe and powerplant mechanic training, satellite campus	Apron access, hangars and storage, office/ administrative space, student housing
Industrial/ Aviation	MRO, specialized aviation services, parts storage, commercial aircraft storage	Apron access (heavy apron), large aircraft hangars, office/administrative space
Corporate/FBO	FBO, itinerant aircraft parking apron, auto parking, conventional aircraft hangars, fuel truck parking	Parallel taxiway access, apron access, corporate hangar space, auto parking, building/administrative space
Based Aircraft Accommodation	Aircraft apron, taxilanes, T-shades, conventional hangars, T-hangars, auto parking	Aircraft taxiing and maneuvering areas, aircraft parking apron (light apron), small hangars, auto parking
Aviation Support	General equipment storage, maintenance facilities, terminal building	Apron access, taxiway access, vehicle service road access
Aviation Business	Aviation-related businesses not associated with FBO or aircraft repair/maintenance, retail, office, auto parking	Aircraft hangars, office/administrative space, auto parking
Cargo/Freight	Cargo buildings, auto and large commercial truck parking	Taxilane access, road access, truck maneuvering space, auto parking

Source: Kimley-Horn, November 2017.

It should be noted that land uses reflect only aviation-related categories. Given the amount of available land outside the Airport's boundaries within the City of Goodyear and the Airport's objective to support aviation development, all future Airport land uses are aviation-related. As such, land uses that support non-aviation activities, such as commercial or retail were not considered. It is also important to note that up-front investment costs for development can vary significantly within each land use. For example, design and construction of a 10-unit T-hangar within the "Based Aircraft Accommodation" land use would require a relatively low initial investment compared to development of a new FBO within the Corporate/FBO land use.

The Recommended Airport Land Use Map presented in **Figure 6-9** was developed based on input from the TAC and PAC, Airport Management, and the public. The land uses consider the ultimate conditions of the airfield, which assumes a future parallel Runway 3R-21L. As shown, the western portion of the airfield is preserved for Aviation Support and a mix of Aviation Business and Corporate/FBO use. Areas near the flight schools are preserved for Educational/Vocational, Aviation Support, and Aviation Business use. Areas near the south T-hangars and proposed relocated T-hangars are preserved for Based Aircraft Accommodation and Aviation Support, while areas near the FBO and MRO are preserved for Corporate/FBO and Industrial use. In between the north and south portions of the airfield, there are areas preserved for Aviation Business and Cargo/Freight. It should be noted that the Airport experiences some seasonal ground cargo activity. The preservation of space for this type of use would be for ground cargo and potential air cargo activity if future demand dictates such a need.

Figure 6-9: Recommended Airport Land Use Map



6.6 Additional Facilities

The recommended airfield and landside development alternatives and land uses influence where additional facilities are located. Locations for additional facilities including fuel truck parking, Airport access, and a relocated GA aircraft wash rack were identified and are described below.

6.6.1 Fuel Truck Parking Area

As noted in **Chapter 4,** designated fuel truck parking is lacking at the Airport. Currently, fuel trucks park along the edge of the north T-hangar apron and in various locations in front of the Lux Air facility, which can potentially restrict aircraft movement into and out of the T-hangars and taxilane. Thus, designated fuel truck parking should be provided at a location where the trucks cannot cause potential aircraft maneuvering conflicts. Since the FBO is responsible for all truck-fueling activity, parking locations should be on or near the FBO's facilities, and have adequate accessibility to the apron and maneuvering areas.

It is recommended that fuel truck parking be located on the proposed FBO apron that is currently occupied by the north T-hangars (to be relocated). This location would provide adequate access to existing and potential tenant areas, and would not interfere with aircraft parking or maneuvering. The FBO apron where fuel truck parking should be located is shown in **Figure 6-10.**

6.6.2 General Aviation Wash Rack

As noted, the GA wash rack currently located near the north T-hangars requires relocation to allow for FBO/MRO apron expansion. The wash rack facility primarily services based aircraft and its location should be adjacent to the existing south T-hangar location and relocated T-hangars to minimize the amount of taxiing required to access the facility. It has already been noted that the southernmost portion of the airfield east of the Runway 3 end is exposed to jet blast near the run up area despite the presence of a jet blast fence. As such, the wash rack facility should be located at the southeast corner of the proposed relocated T-hangars. This location would be accessible via Taxiway A and would be convenient for existing and future based aircraft located on the south apron. The preferred location of the wash rack facility is shown in **Figure 6-10.**

6.6.3 Airport Access

Anticipated growth in the number of flight school students, tenant employees, and based aircraft owners will require additional vehicle access to the Airport. Currently, the Airport has a single public access point via Goodyear Parkway that connects to South Litchfield Road. There is a second vehicle access point along Yuma Road that connects to the vehicle service road; however, this is designated for Airport use only. Ultimately, this road should be considered as an additional public access point. This access road is shown on the Recommended Airport Land Use Map (**Figure 6-9**) and in **Figure 6-10**. A secondary access road to the west side of the airfield also is depicted that connects via S. Bullard Ave. This access road would be necessary if significant development were to occur on the west portion of the airfield. Associated costs for this access road would be paid by developers rather than the Airport. These two roads would only provide access to the west side of the airfield as the RPZs on Runway 3-21 would not allow an access road to reach the east side of the airfield.

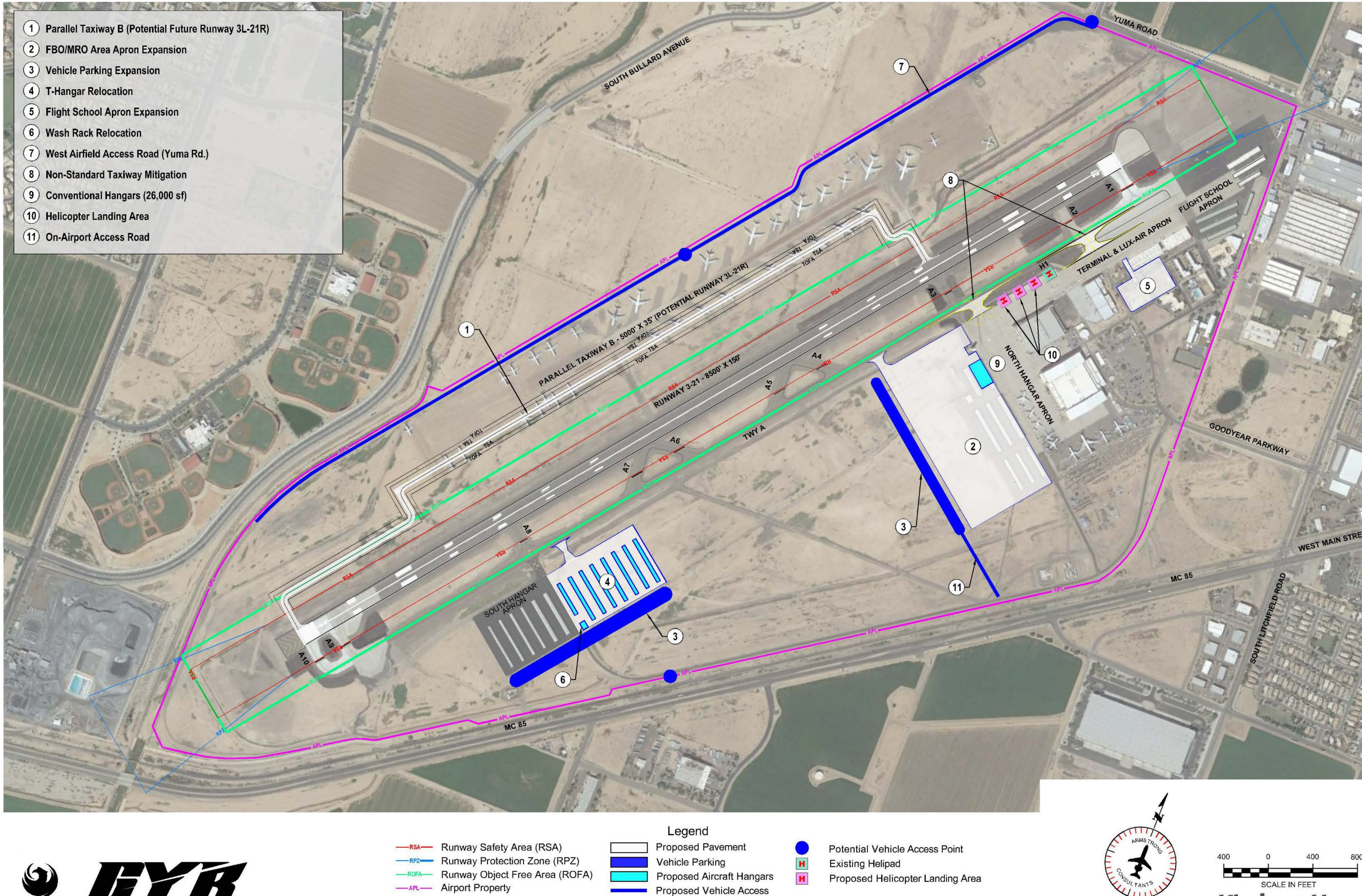
The ideal location for an additional vehicle access point to the east side of the airfield would be toward the south end of the Airport off MC 85. The primary complication with this location is the presence of a railroad line that runs parallel to MC 85 through Airport property. At-grade crossings on railways pose significant safety issues and a ramp entrance would be cost prohibitive. As such, it is recommended that the Airport continue to monitor development to identify if an additional east-airfield access road is needed.

6.7 Alternatives Development Summary

Recommended development described in this Chapter is presented in **Figure 6-10**. The recommended phasing of these improvements along with cost estimates and funding sources are presented in **Chapter 7.** It should be noted that the improvements shown in **Figure 6-10** depict conditions at the end of the 20-year planning horizon. As noted previously, it is not anticipated that a parallel runway will be needed within the planning horizon; therefore, only a parallel taxiway and associated safety areas are depicted on the recommended plan.

None of the projects identified in the 20-year Recommended Development Plan are expected to impact airport noise beyond the temporary period of construction. The new taxiway and other hangar development would not be expected to significantly affect noise exposure levels in the airport environs.

Figure 6-10: Alternatives Development Summary



GYR PHOENIX GOODYEAR AIRPORT

PHOENIX GOODYEAR AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS

Kimley»Horn

Chapter 7

IMPLEMENTATION AND FINANCIAL PLAN

Analyses documented in previous chapters of this Master Plan Update evaluated the Airport's facility needs based on existing infrastructure and forecasts of aviation demand. These facility needs were presented as various development alternatives, which culminated with a Preferred Alternative that was selected based on feedback provided at various advisory committee meetings and a public workshop. The Preferred Alternative identified all improvements recommended to be implemented within the 20-year planning horizon. In addition to these improvements, the City of Phoenix Aviation Department previously identified other recommended projects in its Airport Capital Improvement Program (ACIP), which are incorporated into the overall program.

These projects include previously identified safety and maintenance improvements as well as associated environmental documentation needs and planning studies. The combination of projects identified in the Master Plan Update and those included in the AICP represent the Recommended Development Plan (RDP).

This chapter summarizes the RDP, phasing plan, environmental documentation requirements, funding sources, and an updated 20-year ACIP.

7.1 Recommended Development Plan

Figure 6-10 depicts the recommended facility improvements developed for the Preferred Alternative, which includes airfield and landside components and considers on-airport land uses, Airport access, and other general aviation and support facilities. As noted, the RDP includes recommended facilities from the Preferred Alternative and City of Phoenix Aviation Department planned and programmed projects.

The RDP considers the phasing and timing for the implementation of individual projects and the dependence of projects on one another.

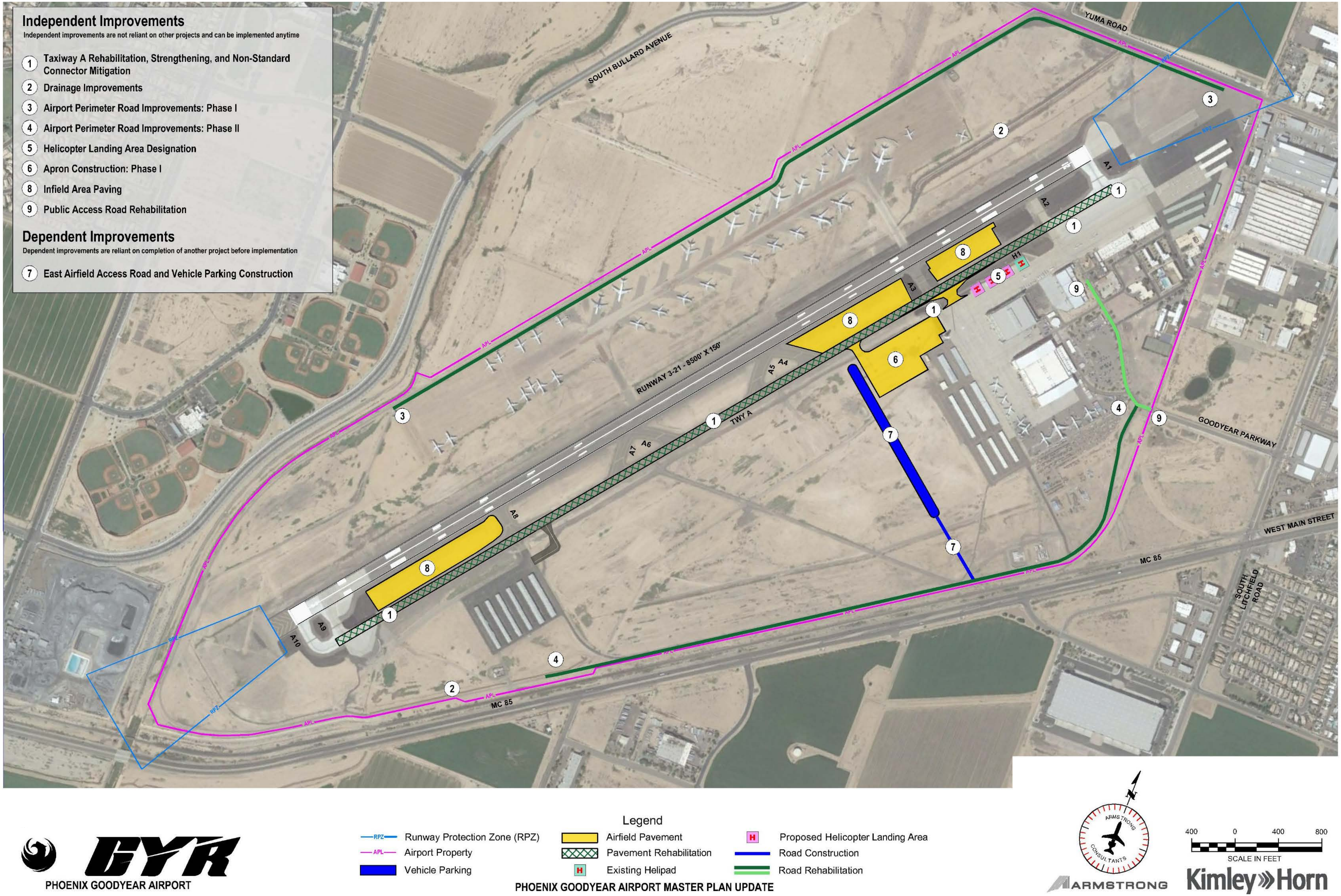
Implementation of the RDP is planned to occur in three phases, as described below.

7.1.1 Phase I

Phase I is depicted on **Figure 7-1** and includes near-term projects to be implemented in the 0- to 5-year timeframe (FY 2019–2023). Non-infrastructure projects such as planning studies and construction design are not shown, but are included in the cost estimates. The following projects are included in Phase I.

- **Taxiway A rehabilitation and strengthening (underway) and mitigation of non-standard taxiway connectors.** Mill and overlay Taxiway A with new paved shoulders and raised fixtures; includes geotech, drainage, and pavement design; relocate A3 connector; restripe A2 connector; and addition of TDG 5 fillets on Taxiway A3.
- **FBO/MRO apron construction (Phase I) and vehicle access and parking.** Construct 34,000 square-yards of new FBO/MRO area aircraft parking apron; construct 21,000 square-yards of vehicle parking; construct connector road (700 feet by 23 feet) from existing east Airport access road to new FBO/MRO area apron and vehicle parking.
- **Drainage improvements (including infield pavements).** Design and construct an underground ditch and improvements to storm drain structures (approx. 5,000 linear feet); design and construct 91,017 square-yards of infield paving in vicinity of connector Taxiways A2, A3, and A9.

Figure 7-1: Recommended Development Plan: Phase I (0-5 Years)



- **Airport perimeter road improvements and public access road rehabilitation.** Phase I Airport perimeter road improvements (8,800 feet by 23 feet) on west side of airfield; Phase II Airport perimeter road improvements (6,500' x 23') on east side of airfield; and rehabilitate the public access road (1,400 feet by 24 feet) from Litchfield Road to terminal building complex.
- **Helicopter landing area designations.** Mark apron pavements for three additional helicopter landing areas immediately adjacent to the existing helipad/landing area.
- **Utilities inventory.** Conduct comprehensive inventory of existing utilities.
- **Business Development Plan**. Conduct study to identify business development potential and recommendations.

7.1.2 Phase II

Phase II is depicted on **Figure 7-2** and includes mid-term projects to be implemented in the 6- to 10-year timeframe (FY 2024–2028). The following projects are included in Phase II.

- **FBO/MRO apron construction (Phase II).** Construct 62,000 square-yards new FBO/MRO area aircraft parking apron.
- **Existing apron rehabilitation**. Phase I rehabilitate apron near flight schools (18,150 square-yards); Phase II rehabilitate apron near terminal (36,000 square-yards).
- **Terminal parking improvements.** Rehabilitate 1,200 square-yards of existing terminal vehicle parking and construct 2,900 square-yards of new parking.
- **South aircraft parking apron construction and wash rack relocation.** Construct 48,000 square-yards new pavement and relocate wash rack facility.
- **North T-hangar relocation and vehicle parking construction**. Relocate eight 10-unit T-hangars to south apron and construct 17,000 square-yards of vehicle parking.
- **Connector taxiway rehabilitation (Phase I).** Rehabilitate connector taxiways and shoulders A4, A5, A6, and A7 (9,100 square-yards).
- **Taxiway B design/NEPA and construction.** Phase I: conduct environmental review under the National Environmental Policy Act (NEPA) and design for proposed parallel Taxiway B; Phase II: construct Taxiway B and connector taxiways (5,000 feet by 35 feet).
- **RPZ land use control.** Obtain fee simple or avigation easements for portions of the north and south RPZ that extend off Airport property.
- **Airport master plan update.** Conduct update to the 2017 Airport Master Plan.

7.1.3 Phase III

Phase III is depicted on **Figure 7-3** and includes long-term projects to be implemented in the 11- to 20-year timeframe (FY 2029–2038). The following projects are included in Phase III.

- **Existing apron rehabilitation (public and private).** Phase I: rehabilitate apron (76,000 square-yards MRO); Phase II: rehabilitate apron (26,800 square-yards FBO); Phase III: rehabilitate apron (46,900 square-yards flight schools); Phase IV: rehabilitate apron (2,517 square-yards MRO).

Figure 7-2: Recommended Development Plan: Phase II (6-10 Years)

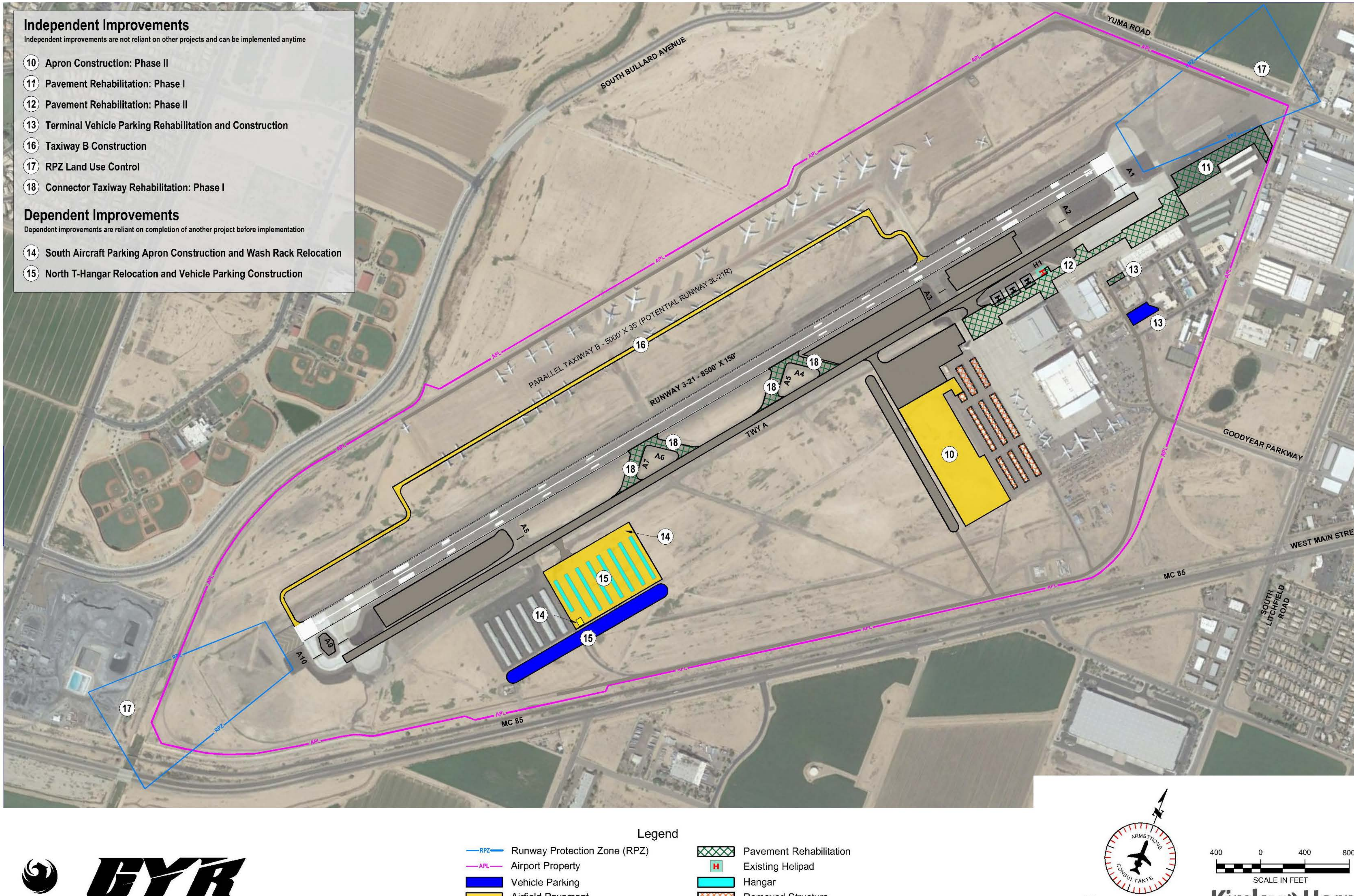
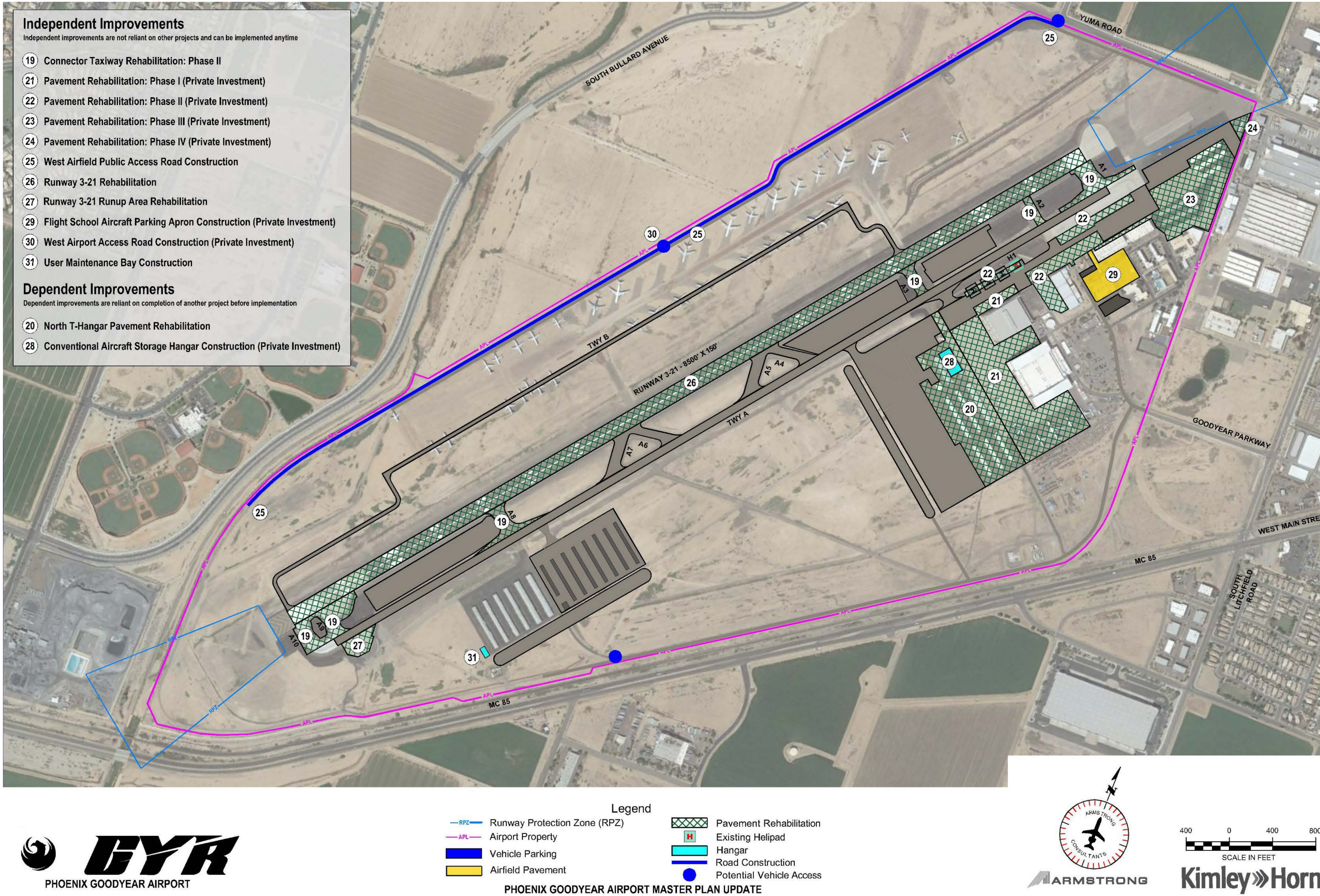


Figure 7-3: Recommended Development Plan: Phase III (11-20 Years)



- **Connector taxiway rehabilitation (Phase II).** Rehabilitate connector taxiways and shoulders A1, A2, A3, A8, A9, and A10 from Runway 3-21 edge to Taxiway A edge (38,200 square-yards).
- **Flight school aircraft parking apron construction.** Construct 15,000 square-yards of new aircraft parking apron for flight schools (includes minor building demolition).
- **North T-hangar apron rehabilitation and strengthening.** Rehabilitate and strengthen 69,100 square-yards of existing aircraft parking apron and taxilane.
- **Conventional hangar construction.** Construct 26,800 SF of conventional hangars.
- **Runway rehabilitation**. Mill and overlay of Runway 3-21 (140,200 SY); mill and overlay of runup area on Runway 3-21 (5,600 square-yards).
- **User maintenance bay construction.** Construct maintenance area with two covered bays (located near future wash rack).
- **West airfield access road construction, access road construction, and east airfield access study**. Construct Airport access road (approx. 860 feet by 16 feet) from Yuma Road; construct new Airport access road from Bullard Avenue (1,700 feet by 24 feet); conduct study to determine demand, cost, and feasibility for constructing east airfield access from MC 85.
- **NEPA/design for taxiway-runway conversion.** Conduct environmental review under NEPA and design for potential taxiway-runway conversion.

A compilation of all projects in phases I through III is presented in **Figure 7-4**.

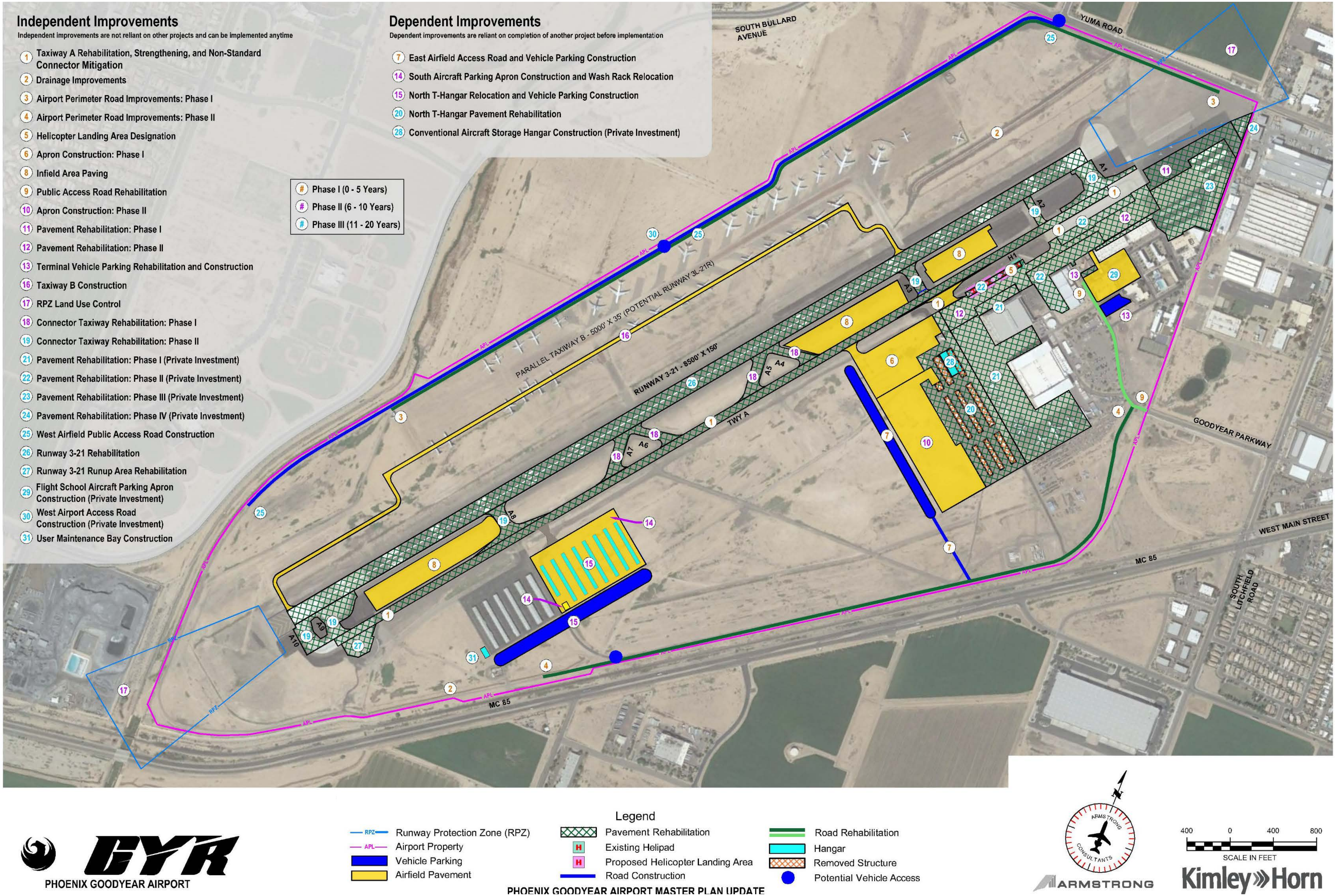
7.2 Environmental Strategy

It is important to have a strategy for obtaining required environmental approvals under NEPA for the RDP. It is anticipated that for certain projects, FAA approval of the ALP will be conditional upon environmental review. Other NEPA-related environmental considerations may include drainage and impacts to sensitive habitat or hazardous waste sites on Airport property.

There are three types of environmental review:

- **Environmental Assessment (EA).** A public document that an airport sponsor prepares to provide sufficient evidence to determine whether a proposed action would require preparation of an Environmental Impact Statement (EIS) or a finding of no significant impact (FONSI). The average completion timeframe is 6 months to 2 years.
- **Environmental Impact Statement (EIS).** A public document required for airport development actions that may "significantly affect the quality of the human environment." The EIS describes the impacts on the environment as a result of a proposed action, the impacts of alternatives, and plans to mitigate impacts. The average completion timeframe is 2 to 3 years.

Figure 7-4: Recommended Development Plan (0-20 Years)



- **Categorical Exclusion (CatEx).** There is a category of actions which do not individually or cumulatively have a significant effect on the human environment, and therefore, neither an EA or an EIS is required. The typical timeframe to document a CatEx and receive FAA approval is 2 to 6 months.

The projects included in the RDP that are anticipated to require environmental review are presented in **Table 7-1.**

Table 7-1: Potential Environmental Review Requirements

Project	Anticipated Environmental Action[2]	Project	Anticipated Environmental Action
Phase I		**Phase III**	
Taxiway A rehabilitation, strengthening, and non-standard connector mitigation	CatEx[1]	Connector taxiway rehabilitation: Phase II	CatEx
Apron construction: Phase I	CatEx	Flight school aircraft parking apron construction (Private Investment)	CatEx
Airport Perimeter road improvements and public access road rehabilitation	CatEx	North T-hangar pavement rehabilitation	CatEx
Phase II		Conventional aircraft storage hangar construction	CatEx
Apron construction: Phase II	CatEx	Runway 3-21 and runup area rehabilitation	CatEx
Terminal vehicle parking improvements	CatEx	User maintenance bay construction	CatEx
South aircraft parking apron construction and wash rack relocation	CatEx		
North T-hangar relocation and vehicle parking construction	CatEx		
Connector taxiway rehabilitation: Phase I	CatEx		
Taxiway B construction	CatEx		
RPZ land use control	CatEx[1]		

Notes: 1Denotes completed documentation. 2Final determination of the likely environmental action will require coordination with FAA.
Source: Kimley-Horn.

7.3 Funding Plan

The funding plan identifies likely funding sources for projects included in the RDP. In support of the development of the funding plan, a Capital Improvement Program (CIP) was developed coincident with the RDP; the CIP presents funding sources expected to be available through the planning period for projects in the RDP.

7.3.1 Assumptions

The funding plan was developed according to information and assumptions that provide a reasonable basis for analysis at a level appropriate for an airport master plan. Some of the assumptions used to project funding sources may not be realized, and unanticipated events and circumstances may occur. Therefore, the actual results will vary, and such variations could be material.

The funding plan is preliminary in nature and is not intended to be used to support the sale of bonds or to obtain any other forms of financing. More detailed cost estimates and financial analyses are required to implement individual projects. It is also important to note that some projects in the RDP could be postponed if forecast aviation activity is not realized, construction costs rise significantly, or if projected funding is not available.

Cost estimates for projects in the RDP were prepared based on criteria specific to the region. Cost estimates included hard construction costs as well as soft costs, which assume the following:

- 72.5 percent for "hard costs" including materials and mobilization
- 17.5 percent for soft costs including design, permitting, construction management and quality assurance, environmental monitoring, program management, engineering and architectural services, and testing and inspection
- 2.5 percent for construction contingency
- 2.5 percent for project contingency
- An escalator factor of 5 percent per year relative to the anticipated year of project implementation.

Conservative assumptions were used to avoid overestimating the financial capacity of the Aviation Department during the planning period. Key among these assumptions was that net revenues generated from Department operations to fund capital projects would be negligible. Other key planning assumptions are as follows:

- FAA Airport Improvement Program (AIP) entitlement grants were projected assuming the annual maximum amount would be received.
- AIP discretionary grants, Arizona Department of Transportation Multimodal Planning Division Aeronautics Group (ADOT) grants, and other State capital outlay funds were assumed to be available for specific eligible projects at or below the average annual historical levels for projects with similar eligibility.

7.3.2 Funding Sources

Assumed funding sources are described in detail in the following sections. Each of the funding sources available to the Aviation Department has unique availability, eligibility, and time constraints. For all funding sources considered, the availability of funds does not necessarily mean that all funds projected to be available would be allocated to projects in the RDP.

7.3.2.1 Airport Improvement Program Grants

The AIP is the FAA's grant program for funding capital development at eligible airports including general aviation airports that are designated reliever facilities such as Phoenix Goodyear Airport. The AIP provides annual non-primary entitlement grants to airports, which is based on 20 percent of the 5-year cost of need, for an annual maximum of $150,000. When additional funding is required, the FAA may issue discretionary AIP grants to supplement entitlement funds. AIP funds can be used for most non-revenue generating airport development. It can also be used for revenue generating projects assuming there are no other needs at an airport and FAA agrees.

Grant-specific assumptions made for this analysis are as follows:

- **Entitlement grants.** As the operator of a non-primary airport, the City is eligible for an AIP entitlement apportionment in each federal fiscal year in which the AIP is funded at a level of $3.2 billion or more. The entitlement is calculated as 20 percent of the 5-year cost of the need listed for the Airport in the most recent NPIAS, with an overall cap of $150,000 annually. It was assumed that the FAA's current methodology for allocating entitlements will not change. Accordingly, a total of approximately $3.0 million in AIP entitlement grants would be available during the planning period.

- **Discretionary grants.** Discretionary grants are administered by FAA for projects based on a prioritized basis. Projects associated with safety, reconstruction/rehabilitation, and capacity receive highest priority. As the operator of a non-primary airport in Arizona, the City is eligible for 91.06 percent of eligible project costs to be financed by discretionary funds, though this percentage may differ based on the amount of available discretionary funds that are administered. It was assumed that the City will receive $79.9 million during the planning period.

7.3.2.2 State Funds

ADOT provides grants to assist with federal grant matching for projects that are eligible for FAA grants (referred to as Federal/State/Local grants), aid with airport pavement preservation, and other projects that benefit the State airport system (referred to as State/Local grants).

To enhance the utilization of available state funds, ADOT established the Arizona Development Loan Program. The program was designed to be a flexible funding mechanism to assist eligible airport sponsors in improving the economic status of their respective airports. Operators of airports identified in the ADOT State Airports System Plan are eligible for projects related to construction of runways, taxiways, aprons, aircraft storage facilities (hangars), fueling facilities, general aviation terminal buildings, utility services (power, water, sewer, etc.), approach aids, ramp lighting, airport fencing, airport drainage, land acquisition, planning studies, and the preparation of plans and specifications for airport construction projects when the Loan Program is active. ADOT has noted that the Loan Program is currently suspended and that it may terminate the Program depending on funding that is available in future years to support the Program.

ADOT provides half of the local matching share for FAA-funded capital development, subject to funding availability in the State Aviation Fund. These Federal/State/Local grants have continued through 2018, even with ADOT's recent financial constraints on the State Aviation Fund. ADOT's State/Local grant program supports airport development for up to 90 percent of a project's eligible cost. State/Local projects are prioritized utilizing ADOT's priority ranking system and must be approved by the State Transportation Board. It should be noted that ADOT State/Local grants have been suspended through fiscal year 2020.

The CIP identifies that approximately $8.8 million in State grants would be received through the planning period. The maximum annual State contribution for both Federal/State/Local and State/Local grant funds is approximately $2.1 million per airport assuming full programs from both the FAA and ADOT. Specific projects presented in the RDP and ACIP may require multi-year phasing contingent on funding availability and project eligibility.

Another State-sponsored funding mechanism includes grants administered based on the results of ADOT's Airport Pavement Management System (APMS) Program. Every year the State, utilizing the APMS, identifies airport pavement maintenance projects eligible for funding for the upcoming five years. The Airport has participated in the APMS program in the past, and while several projects in the ACIP presented at the end of this chapter could be eligible for funding via this mechanism, it is not identified as a quantifiable funding source since it requires both the project to be selected among the long list of projects in the state and for the Airport sponsor to opt in. The project selection criteria do not guarantee that a pavement maintenance project will be funded. It should be noted that ADOT has suspended the administration of APMS grants through fiscal year 2019.

7.3.2.3 City of Phoenix/Local Funding

The City could issue two types of debt to help fund airport improvement projects: general obligation bonds and general airport revenue bonds. The City has issued general obligation bonds, which may be levied on all taxable property, to fund major capital projects in the past. The City has not issued general airport revenue bonds in the past, which are secured by revenues generated by airport users (e.g., fuel sales, rental revenues).

It was assumed that the City would not issue general obligation bonds or general airport revenue bonds in the future, as consistent with prior policy. Therefore, no funds were assumed to be available from City-issued bonds.

7.3.2.4 Tenant or Third-party Funding

Projects identified in the RDP that provide direct benefit to a tenant or that are anticipated to occur on private leaseholds may not be eligible for AIP or State grants. As such, the City has indicated that it will seek third-party financing where appropriate as a funding source for a number of projects in the RDP.

7.4 Capital Improvement Program

Table 7-2 summarizes the Airport's CIP for near-term (FY 2019–2023), mid-term (FY 2024–2028), and long-term (FY 2029–2038) projects. Estimated capital expenditures total approximately $142 million (in escalated dollars) for all projects in the RDP. **Table 7-2** shows that projected funding sources are sufficient to meet projected needs for near-term projects assuming full funding of the various programs and availability of funding from all sources.

Table 7-2: 20-Year Airport CIP

	Funding Sources					
	Project Cost[1]	Federal AIP Grants		State Grants	Private Funding	Local Funds
		Entitlement	Discretionary			
Near-term (FY 2019-2023)						
Taxiway A rehabilitation and strengthening	$6,938,000	--	$6,317,743	$310,129	--	$310,129
Drainage improvements (ADOT)	$3,402,000	--	--	$3,061,800	--	$340,200
Airport perimeter road improvements: Phase I	$80,000	--	--	--	--	$80,000
Airport perimeter road improvements: Phase II	$160,000	--	--	--	--	$160,000
Helicopter landing area designations	$31,000	--	--	--	--	$31,000
Apron construction: Phase I	$8,581,000	$750,000	$7,063,859	$383,571	--	$383,571
East airfield access road construction and vehicle parking construction	$2,426,000	--	$2,209,116	$108,442	--	$108,442
Infield area paving	$484,855	--	--	$436,370	--	$48,486
Public access road rehabilitation	$492,000	--	--	$442,800	--	$49,200
Utilities inventory	$496,000	--	--	--	--	$496,000
Business Development Plan	$75,000	--	--	--	--	$75,000
Subtotal	**$23,165,855**	**$750,000**	**$15,590,717**	**$4,743,111**	**$0**	**$2,082,027**
Mid-term (FY 2024-2028)						
Apron construction: Phase II	$15,252,000	$750,000	$13,138,471	$681,764	--	$681,764
Pavement rehabilitation: Phase I	$1,537,000	--	$1,399,592	$68,704	--	$68,704
Pavement rehabilitation: Phase II	$9,795,000	--	$8,919,327	$437,837	--	$437,837
Terminal vehicle parking rehabilitation and construction	$707,000	--		$636,300	--	$70,700
South aircraft parking apron construction and wash rack relocation	$8,125,000	--	$7,398,625	$363,188	--	$363,188
North T-hangar relocation and vehicle parking construction	$3,512,000	--	--	--	--	$3,512,000
Taxiway B construction: Phase I- NEPA documentation and design	$392,000	--	$356,955	$17,522	--	$17,522
Taxiway B construction: Phase II	$7,726,000	--	$7,035,296	$345,352	--	$345,352
Airport master plan update	$822,000	--	$748,513	$36,743	--	$36,743
RPZ land use control	$ TBD	--	--	$ TBD	--	$ TBD
Connector taxiway rehabilitation: Phase I	$852,000	--	$775,831	$38,084	--	$38,084
Subtotal	**$48,720,000**	**$750,000**	**$39,772,611**	**$2,625,495**	**$0**	**$5,571,895**
Long-term (FY 2029-2038)						
Connector taxiway rehabilitation: Phase II	$1,848,000	$750,000	$932,789	$82,606	--	$82,606
North T-hangar pavement rehabilitation	$16,659,000	--	$15,169,685	$744,657	--	$744,657
Pavement rehabilitation Phase I (Private Investment)	$24,361,000	--	--	--	$24,361,000	--
Pavement rehabilitation Phase II (Private Investment)	$5,302,000	--	--	--	$5,302,000	--
Pavement rehabilitation Phase III (Private Investment)	$3,692,000	--	--	--	$3,692,000	--
Pavement rehabilitation Phase IV (Private Investment)	$317,000	--	--	--	$317,000	--
West Airport public access road construction	$662,000	--	--	--	--	$662,000
Runway 3-21 rehabilitation	$9,473,000	$750,000	$7,876,114	$423,443	--	$423,443
Runway 3-21 runup area rehabilitation	$268,000	--	$244,041	$11,980	--	$11,980
Conventional aircraft storage hangar construction	$2,018,000	--	--	--	$2,018,000	--
Flight school aircraft parking apron construction	$2,576,000	--	--	--	$2,576,000	--
West Airport access road construction	$1,379,000	--	--	--	$1,379,000	--
East airfield access study	$128,000	--	--	$115,200	--	$12,800
User maintenance bay construction	$1,158,000	--	--	--	--	$1,158,000
NEPA/design for taxiway-runway conversion	$317,000	--	$288,660	$14,170	--	$14,170
Subtotal	**$70,158,000**	**$1,500,000**	**$24,511,289**	**$1,392,056**	**$39,645,000**	**$3,109,656**
Grand Total	**$142,043,855**	**$3,000,000**	**$79,874,617**	**$8,760,661**	**$39,645,000**	**$10,763,577**

Note: [1]Project costs escalated to year of construction assuming an annual rate of 5.0%.
Sources: City of Phoenix, Kimley-Horn.

Table 7-3 summarizes costs for projects in the CIP grouped by funding source. Approximately two percent of total project costs could be funded by FAA entitlement grants, 56 percent by FAA discretionary grants, six percent by State grants, 28 percent by private sources, and eight percent by local funds.

Table 7-3: Cost Estimates Summary by Funding Source

		Funding Sources				
	Project Cost[1]	Federal AIP Grants		State Grants	Private Funding	Local Funds
		Entitlement	Discretionary			
RDP Phase						
Phase I	$23,165,855	$750,000	$15,590,717	$4,743,111	$0	$2,082,027
Phase II	$48,720,000	$750,000	$39,772,611	$2,625,495	$0	$5,571,895
Phase III	$70,158,000	$1,500,000	$24,511,289	$1,392,056	$39,645,000	$3,109,656
Grand Total	**$142,043,855**	**$3,000,000**	**$79,874,617**	**$8,760,661**	**$39,645,000**	**$10,763,577**

Note: [1]Project costs have been escalated to year of construction assuming an annual rate of 5.0%.
Source: Kimley-Horn.

7.5 Five-Year Airport Capital Improvement Program

The Airport's 5-year CIP details funding sources and the anticipated starting year for each project in Phase I of the RDP and is presented in **Table 7-4.** While a 20-year CIP identifies anticipated needs throughout the planning horizon, projects identified within a 5-year timeframe typically reflect more immediate airport needs or facilities where potential funding has already been secured.

Table 7-4: 5-Year Airport CIP

Funding Sources							
	Start Year	Project Cost[1]	Federal AIP Grants		State Grants	Private Funding	Local Funds
			Entitlement	Discretionary			
5-Year CIP Project							
Taxiway A rehabilitation and strengthening	2019	$6,938,000	--	$6,317,743	$310,129	--	$310,129
Drainage improvements (ADOT)	2019	$3,402,000	--	--	$3,061,800	--	$340,200
Helicopter landing area designations	2019	$31,000	--	--	--	--	$31,000
Airport perimeter road improvements: Phase I	2020	$80,000	--	--	--	--	$80,000
Airport perimeter road improvements: Phase II	2021	$160,000	--	--	--	--	$160,000
Apron construction: Phase I	2021	$8,581,000	$750,000	$7,063,859	$383,571	--	$383,571
East airfield access road construction and vehicle parking construction	2022	$2,426,000	--	$2,209,116	$108,442	--	$108,442
Infield area paving	2022	$484,855	--	--	$436,370	--	$48,486
Public access road rehabilitation	2023	$492,000	--	--	$442,800	--	$49,200
Utilities inventory	2023	$496,000	--	--	--	--	$496,000
Business Development Plan	2023	$75,000					$75,000
Total by Fiscal Year							
2019		$10,371,000	--	$6,317,743	$3,371,929	--	$681,329
2020		$80,000	--	--	--	--	$80,000
2021		$8,741,000	$750,000	$7,063,859	$383,571	--	$543,571
2022		$2,910,855	--	$2,209,116	$544,812	--	$156,928
2023		$988,000	--	--	$442,800	--	$545,200
Subtotal		**$23,165,855**	**$750,000**	**$15,590,717**	**$4,743,111**	**$0**	**$2,082,027**

Note: [1]Project costs have been escalated to year of construction assuming an annual rate of 5.0%.
Source: Kimley-Horn.

Chapter 8

AIRPORT SUSTAINABILITY

The Aviation Department maintains a Sustainability Management Plan (SMP) that (1) articulates its vision for an airport system that effectively serves the needs of all airport users; (2) maximizes the economic benefits provided back to the community; and (3) demonstrates the City's commitment to a healthy and sustainable future. The Aviation Department is currently in the process of updating the SMP over the next 12 months[1].

The Aviation Department developed the Design and Construction Green Guide (DCS Green Guide) in 2010 to specifically mitigate or eliminate the environmental impacts of horizontal (i.e., non-building) construction projects at Phoenix Sky Harbor International, Phoenix Deer Valley, and Phoenix Goodyear airports. The DCS Green Guide is intended to identify opportunities to incorporate sustainable practices into project design and construction early in the process to minimize any additional costs that may be associated with such measures. These key purposes are reflected in the DCS Green Guide vision statement:

DCS will perform design and construction activities in harmony with the community and the environment we live and work in, balanced by scope, schedule, and budget.

The DCS Green Guide is organized in accordance with the natural progression of a project. Specific measures are outlined for engineers during design and contractors during construction. These measures are respectively known as the Sustainable Horizontal Design (HD) and Sustainable Horizontal Construction (HC) performance standards. The DCS Green Guide also provides additional information about the required actions, strategies for achievement, and necessary documentation required for each performance standard. Many HD performance standards also require the completion of a cost/benefit summary for City review and approval.

This chapter summarizes the sustainability recommendations from the SMP that the Aviation Department would consider for implementation at the Airport. Additionally, the HD and HC performance standards of the DCS Green Guide have been evaluated in terms of their applicability to the Recommended Development Plan (RDP). An overview of the potential applicability of Leadership in Energy and Environmental Design (LEED) standards at the Airport also are provided. This chapter meets the requirements of the FAA Modernization and Reform Act of 2012 (FMRA), which outlines specific components to be addressed when preparing airport recycling, reuse, and waste reduction plans as part of airport master plans and other types of planning efforts (see **Section 8.1.4**).

8.1 Sustainability Recommendations

The following section outlines the measures available in the SMP recommended for further review in terms of their relevancy to the Phoenix Goodyear Airport.

8.1.1 Demolition and Construction

Airport construction projects can result in significant environmental impacts including, but not limited to, energy and water consumption, waste generation, and air quality impacts. Demolition and construction best practices would be conducted before and during construction and through the commissioning stage to reduce the environmental impacts associated with an airport improvement projects.

Table 8-1 outlines practices related to demolition and construction that would be implemented at the Airport.

---

1 The SMP was first developed through 2014 and subsequently published in 2015. The 2015 plan was used for this Master Plan Update.

Table 8-1: Sustainability Practices for Demolition and Construction

.	Key Measures
Goal: Implement the DCS Green Guide for applicable civil projects	
Policies and contracts 1: Develop a policy for the Green Guide and implement it for civil projects as applicable	Publicize DCS Green Guide to design and construction teams via website
Policies and contracts 2: Require waste diversion plan preparation and tracking for all non-LEED construction projects	Include DCS Green Guide in contract specification language and include the Aviation Department's Demolition and Construction Waste Plan template
	Write diversion plan specification language as part of DCS contracts
	Use Unifer to track demolition and construction waste recycling for all construction projects
	Report diversion rate and total tonnage of demolition and construction water for each DCS project in Unifer
	Summarize demolition and construction waste diversion rate for all completed projects

Source: City of Phoenix, March 2015.

The Aviation Department also is reviewing the use of the Institute for Sustainable Infrastructure (ISI) Envision rating standard as an infrastructure sustainability guide for new construction.

8.1.2 Financial Sustainability

Improvement projects, including those identified in the RDP, should be initiated at the Airport as they are required by demand. This reduces the financial burden of undertaking projects before they are required and maintaining facilities that could be underutilized during a portion of their lifecycles.

Most significantly, the Airport may require a new parallel runway as aviation demand grows in the future. While the timing of the parallel runway is uncertain, it is not anticipated to be needed within the next 20 years. As a result, the RDP includes the initial construction of a taxiway that could be transitioned to a runway. Construction of the taxiway is intended to facilitate development on the west side of the Airport. The ALP includes an Ultimate Airport Development Plan depicting the parallel runway and all associated FAA-required design criteria (such as the runway protection zones) to protect land areas for ultimate airfield development.

8.1.3 Operations and Maintenance

Operations and maintenance (O&M) encompasses activities that allow the Airport to effectively function and serve the community, tenants, and users. Most of the activities that occur at the Airport are conducted by tenants including flight schools, MRO facilities, charter operators, private general aviation aircraft owners, and others. As a result, the Aviation Department does not directly control many of the activities that occur on Airport property. However, the Aviation Department is discussing incorporating sustainability requirements into lease agreements and/or Airport Rules and Regulations that require on-Airport businesses, aircraft owners, and other users to comply with best practices. A number of sustainability practices relating to tenant outreach are included in **Table 8-2.**

The O&M activities which the Aviation Department is directly responsible for include landscaping, upkeep of City-owned and operated airside and landside facilities, and procurement and operations of airport equipment and Aviation Department vehicles.

Table 8-2 outlines the O&M-related sustainability practices for further consideration at the Airport. As part of these ongoing activities, the Aviation Department conducts outreach to the local community surrounding the Airport; this outreach is robust and well received.

Table 8-2: O&M Sustainability Practices

Initiative	Key Steps
Goal: Development management plan for "potential to emit" (PTE) for generator sets and other stationary source emissions[1]	
Permits and fleets 1: Develop Aviation Department Guidance for airport generator purchasing, replacement, and retirement[1]	Inventory airport generator and stationary source emissions
	Identify scenarios for generator needs: a base forecast assuming current capacity and a 2014–2024 "wish list" of additional potential needs
	Conduct economic lifecycle cost analysis for each existing generator set to identify optimal retirement dates
Goal: Meet or exceed City of Phoenix Sustainable Fleet Strategy requirements for Strategy period	
Permits and fleets 3: Develop targets for meeting Sustainable Fleet Strategy requirements	Identify and perform cost-benefit analysis for feasible/practical alternative actions to enable attainment (of Sustainable Fleet Strategy goals)
	Modify fleet purchase plan to ensure attainment or meet with City Public Works Department to discuss fleet and cost needs
Goal: Increase the use of environmentally preferred products (EPP) and services at the Aviation Department and establish an EPP utilization baseline	
Policies and contracts 3: Update Tenant Improvement Handbook to include common landlord practices on energy and water conservation	Suggest language that "strongly encourages" conservation measures during new construction in the Tenant Improvement Handbook
Policies and contracts 4: Report the use of environmentally preferred purchasing for products and services and integrate EPP language into related contracts	Track and update EPP alternatives and require more sustainable products use by tenants
Goal: Support business partners' sustainability goals at the Phoenix airports	
Outreach 5: Develop a business partner sustainable strategy and communications plan	Create Tenant Communications Plan, outlining the creation of a Tenant Sustainability Issues Working Group and standards for engaging the group
	Make a SMP overview presentation at tenant meetings and ask tenants to get involved. Request contact information for interested parties to sit on a Tenant Sustainability Issues Working Group

Note: [1]Phoenix Goodyear Airport has one back-up generator housed in the Airfield Electrical Building.
Source: City of Phoenix, March 2015.

In addition to the measures outlined above, the SMP identifies a series of measures to specifically address greenhouse gas (GHG) emissions. The City established a citywide goal of reducing GHG emissions by 15 percent from 2005 levels by 2025 and reducing carbon dioxide intensity by 30 percent by 2030. To address the City's longer-term goals, the Aviation Department prioritized reducing GHG intensity as measured by GHG emitted per passenger served and is committed to reducing GHG emission intensity by 30 percent for airport-controlled sources. At this time, Phoenix Sky Harbor International Airport is the only airport in the Phoenix system that does Airport Carbon Accreditation. Plans to expand registration to include reliever airports are currently being considered. **Table 8-3** outlines the GHG emissions-related sustainability practices for further consideration at the Airport.

Table 8-3: Sustainability Practices for GHG Emissions

Initiative	Key Steps
Goal: Reduce GHG Emission Intensity 30% by 2030 (carbon intensity) from aviation facilities and fleet operations	
Report Greenhouse Gas Emissions annually and develop a carbon intensity reduction strategy for aviation facilities and fleet operations	Define Aviation Department GHG reporting parameters (scope and boundaries)
	Collect and report current GHG inventory
	Identify opportunities to reduce the carbon intensity (CO2-e/sf and/or C02-e/lf) of aviation facilities, airport-specific systems, or fleet operations
	Establish a 5-year emission intensity reduction goal with annual target areas
	Establish an annual review process to update reporting standards and modify carbon intensity reduction strategies
	Develop and submit funding request(s) for GHG reduction initiatives if necessary

Source: City of Phoenix, March 2015.

In addition to the O&M and GHG emissions recommendations provided by the SMP, potential sustainability measures under City consideration addressing the general aviation wash rack identified in the RDP and aviation fuel are described in the section below.

8.1.3.1 General Aviation Wash Rack

Due to its location east of the Runway 3 end, relocation of the City-owned general aviation wash rack is identified on the RDP. Wash racks allow for aircraft cleaning and disposal of wastewater with soaps, detergents, oils, and other non-hazardous materials that result from the cleaning process. As part of the relocation effort, the Aviation Department could consider the installation of a closed-loop wastewater recycling system that minimizes water uses while properly disposing of the wastewater. A second wash rack owned by Lufthansa Aviation Training USA is located on the eastern edge of the flight school apron. A closed-loop system also should be considered when this wash rack reaches the ends of its useful life.

8.1.3.2 Aviation Fuel

AvGas, the aviation fuel used by piston-powered general aviation aircraft, contains high amounts of lead, which is a highly toxic substance and known carcinogen. Lead is the only known additive that prevents damaging engine knock, or detonation, that can result in sudden engine failure. The FAA, U.S. Environmental Protection Agency, and aviation industry partners are currently working to develop an unleaded AvGas alternative. If the FAA identifies and approves a viable unleaded alternative for general aviation aircraft, the Aviation Department should inquire if the alternative fuel(s) is “drop-in” (approved for use without modification to aircraft engines or airport fueling infrastructure) or requires modifications to the three City-owned fuel storage tanks at the Airport. Sustainable alternative jet fuel used in turbine engines have already been approved by the FAA. These drop-in fuels mimic the chemistry of petroleum jet fuel and do not require modifications to Airport infrastructure.

8.1.4 Solid Waste and Recycling

The FMRA amended Title 49, United States Code to provide a number of changes to the Airport Improvement Program (AIP), including two changes regarding recycling, reuse, and waste reduction at airports. Most significantly, FMRA requires that airports that receive AIP funding have or plan to prepare a master plan that addresses issues related to solid waste recycling within the master plan. FMRA outlines five specific elements that should be included in an airport recycling, reuse, and waste reduction plan:

- Feasibility of solid waste recycling at the airport

- Minimizing the generation of solid waste at the airport
- Operations and Maintenance requirements
- Review of waste management contracts
- Potential for cost savings or the generation of revenue

The FAA released a memorandum on September 30, 2014 to assist airports prepare an FMRA-compliant airport recycling, reuse, and waste reduction plans as an element of a master plan or master plan update.[2] Based on the guidance provided by this memorandum, this section reviews the current waste and recycling practices at the Airport and provides guidance to improve future practices. Recommendations and initiatives in the SMP are also incorporated.

8.1.4.1 Facility Description and Background

Phoenix Goodyear Airport is a general aviation facility west of metropolitan Phoenix in Maricopa County, Arizona. While the Airport is physically located within the northern portion of the City of Goodyear, the facility is owned and operated by the City of Phoenix. The Airport encompasses 789 acres at an elevation of 968 feet mean sea level (MSL). The Airport was founded in 1941 as Naval Air Facility Litchfield Park to support military activity during World War II. The City of Phoenix purchased the property in 1968 to serve as a reliever to Phoenix Sky Harbor International Airport. Today, the Airport maintains its classification as a reliever airport in the National Plan of Integrated Airport Systems (NPIAS). The Airport's single runway (Runway 3-21) is 8,500 feet long and 150 feet wide. Chapter 2: Inventory of Existing Conditions provides additional information about the airside and landside facilities at Phoenix Goodyear Airport.

As described in Chapter 3: Aviation Activity Forecasts, the Airport accommodated 123,394 total operations and hosted 222 based aircraft in 2016. Both of these indicators of aviation activity are anticipated to steadily grow through the planning horizon. By 2036, the Airport is projected to support 200,360 total operations (2.45 percent compound annual growth rate) and 315 based aircraft (1.76 percent CAGR). Higher levels of activity are possible, given tenant development and expansion.

8.1.4.1.1 Existing Recycling Efforts

As evidenced by the SMP, the Aviation Department recognizes the importance of recycling and employs a Recycling Coordinator tasked with increasing recycling and waste diversion at all three City-owned airports. Recycling at the Phoenix Goodyear Airport is currently limited to a small number of receptacles in the terminal building and other selected locations around landside facilities. Airport staff are responsible for emptying these receptacles and hauling the contents to recycling processing centers. Furthermore, several tenants, such as AerSale, recycle various aircraft components as part of their business models.

Large tenants, including the MROs, FBO, and flight schools, are responsible for much of the activity that occurs at the Phoenix Goodyear Airport. These tenants are responsible for custodial services associated with the interior and exterior of the Airport premise within their lease-holding. This extends to the disposal of

[2] This memorandum, as well as other resources associated with enhancing airport recycling, reuse, and waste reduction projects, is available online at www.faa.gov/airports/environmental/airport_recycling.

municipal solid waste; deplaned waste from aviation activities and charter flights; universal waste such as batteries, electronic devices, and aerosol cans; and hazardous wastes associated with their leaseholds.

According to the FAA's September 30, 2014 guidance memorandum, an Airport sponsor's responsibility for waste and recycling management on-airport property can generally be described as areas of direct control, influence, and no direct control or influence. **Table 8-4** summarizes the levels of control that the Aviation Department holds over various areas of the Airport. This information is important when considering how to prioritize and select potential waste reduction measures for evaluation and implementation. Note that there are no areas at the Airport over which the Aviation Department commands neither direct control nor influence.

Table 8-4: Areas of Influence

Area[1]	Type of Waste Generated[2]						Type of Control
	C&D[3]	MSW[3]	Deplaned waste	hazardous waste	universal waste	Spill clean-up/ Remediation	
Airfield	✓						Direct
Heliport	✓						
Terminal Building	✓	✓	✓		✓		
Airport Maintenance Facility		✓			✓	✓	
FBO		✓	✓		✓	✓	Influence
Flight schools		✓			✓	✓	
MROs		✓		✓	✓	✓	
Air traffic control tower (ATCT, managed by Serco)		✓			✓		

Notes: [1]Some types of tenants are sub-leaseholders and not directly reflected in this list; however, the Airport holds influence in all cases. [2]List represents the most common types of waste found at a general aviation airport. [3]C&D = Construction and demolition. MSW = Municipal solid waste.
Source: Kimley-Horn.

8.1.4.1.2 Current Waste Management Program

The Airport has a total of five City of Phoenix-owned waste dumpsters located onsite that are serviced and collected by Curbside Recycling and Disposal (Curbside). Two 4-yard dumpsters are located at the south hangar apron area, two are located at the north hangar apron area, and a 6-yard dumpster is located in the maintenance yard. All of the waste dumpsters are emptied on a weekly basis. A 30-yard waste dumpster is also located at the Airport and is designated for green waste only. This waste dumpster is collected on demand (approximately once a month).

8.1.4.1.3 Recycling and Waste Reduction Targets and Policies

The City aims to recycle 40 percent of City facilities' waste by 2040 in an effort known as Reimagine Phoenix. This is an interim step in a larger initiative to create zero waste by 2050. Appropriately, the 2015 General Plan notes that, *"In order to be THE Sustainable Desert City, changes must occur in the way we think about our waste—not as a by-product to be disposed, but as a resource that can generate energy, create jobs, and spur economic development."* The City has identified three key actions to move towards zero waste to advance this effort:

- Expand the current recycling program to remove commonly recycled products from the waste stream (and reducing the number of non-recyclable products from the recycle bins) through public education and awareness campaigns and new programs that increase access to recycling services for residents and businesses.

- Increase the number of products recyclable by incubating local businesses to capture new products from the waste stream.
- Support the transition to a circular economy and encourage the retail industry to provide products that are either 100 percent recyclable or able to be repurposed at end of life.

By increasing access to recycling services for Airport users, any future recycling programs at the Airport would primarily support the City's first key action. In addition to these City-defined initiatives, Chapter 27, Article IV of the City of Phoenix Ordinances addresses solid waste recycling. These ordinances regulate a number of issues associated with recycling and waste diversion, such as pick-up and handling of recyclable materials. The City does not mandate recycling within City limits, nor are City-owned entities required to recycle. Because the Airport is physically located in the City of Goodyear, the Goodyear *Code of Ordinances* is applicable to Airport activity. Chapter 10: Health and Sanitation of the Code of Ordinances for Goodyear addresses waste management. Recycling is neither specifically addressed nor mandated by the City of Goodyear.

At a broader level, Arizona has few state-specific requirements. Recycling is addressed in the Arizona Revised Statutes (A.R.S.) Title 49, Article 8 – Arizona Recycling Program. A.R.S. 49-882 grants the Arizona Department of Environmental Quality (ADEQ) the authority to administer and enforce environmental laws. Among other duties, ADEQ is mandated to enforce cities' and counties' compliance with A.R.S. sections 9-500.07 and 11-269, which require that municipalities and counties (respectively) provide residents with the opportunity to engage in recycling and waste reduction. The A.R.S. does not include a similar provision for business access to recycling and waste reduction services. While ADEQ offers several programs to support recycling and waste reduction, the agency has not enacted any rules concerning specific recycling or waste reduction practices beyond the aforementioned residential access (i.e., opportunity) requirement.

While no specific laws nor rules mandating recycling, reuse, and waste reduction apply to Airport, the Aviation's Department's DCS Green Guide includes a number of provisions related to recycling, reuse, and waste diversion. These provisions are applicable during horizontal airport improvement projects conducted at the three City-owned airports. All provisions are not obligatory for all projects; instead, project teams develop a project-specific plan in conjunction with the City. Credits are awarded for HD and HC performance standards, with overall goals established on a project-specific basis. The DCS Green Guide measures applicable to recycling, reuse, and waste reduction are summarized in **Table 8-5.**

Table 8-5: DCS Green Guide Performance Standards Addressing Recycling, Reuse, and Waste Reduction

Project Type		Performance Standard	Intent	Available Credits
HD Performance Standards				
Administrative	HD-AD-2	Environmentally preferred purchasing	Encourage the use of products that reduce, minimize or eliminate environmental and health impacts associated with the manufacture, use and/or disposal of such products. Review and specify EPP in design specifications where appropriate.	1
Pavements	HD-PV-4	Maximize recycling and reuse of existing pavements and materials	Reuse or recycle existing resources to minimize the amount of material imported to the site, while achieving the same pavement quality. Use less energy-intensive methods for comparable results. Reused or recycled materials may result in a cost effective and environmentally sustainable project.	Multiple
		Recycle 20% to 50% of materials		1
		Recycle 51% to 75% of materials		1
Lighting, mechanical, and utility systems design	HD-LM-3	Flexibility and reusability reviews	Review opportunities to design projects with reusable, replaceable, recyclable, and de-constructible components. Create adaptable systems and infrastructure that will enhance future uses, upgrades and expansions.	2
HC Performance Standards				
Materials and resources	HC-MR-1	Construction waste and management plan	Promote waste diversion and good housekeeping practices at the work site. Create a plan that identifies demolition and construction waste streams from the project. It will outline the goals and methods to divert this waste from landfills and to return appropriate materials into the manufacturing life cycle.	Required
	HC-MR-2	On-site reuse or recycling of construction materials and infrastructure	Avoid use of landfills for construction debris. Maximize the reuse or recycling of material on-site and reduce the amount of construction waste taken from the jobsite.	Multiple
		15% to 25% reused or salvaged		1
		26% to 40% reused or salvaged		1
	HC-MR-3	Off-site recycling for reuse of construction materials and infrastructure	Avoid use of landfills for construction debris and recycle or reuse material off-site if on-site recycling is not an option.	Multiple
		15% recycled		1
		25% recycled		1
	HC-MR-4	Use of recycling content materials	Use products that incorporate recycled content materials for the project, thereby reducing impacts resulting from extraction and processing of virgin materials.	1

Source: City of Phoenix DCS Green Guide, December 2010.

8.1.4.2 Waste Audit

To enhance recycling efforts, it is important for the Aviation Department to understand the types and volume of waste generated by Airport users, as well as the locations at which the waste generation occurs, via a waste stream audit. A waste stream audit was not included in the scope for the Master Plan Update, but can be conducted by the Aviation Department in the future.

According to the FAA's "Recycling, Reuse, and Waste Reduction at Airports: A Synthesis Document" (2013), the primary components of a waste stream audit include:

- Examine waste records, including waste hauling records and supply, equipment, and other waste management costs
- Conduct facility walk-through
  - Observe staff, users, and waste handling procedures
  - Identify waste pick-up locations and hauling practices
- Collect and analyze waste produced at the Airport via a material sort

This baseline information will provide the Aviation Department specific data about the existing conditions at the Airport and help identify the areas that may provide the greatest opportunity for improvement. The audit also can help define performance targets for recycling, reuse, and waste reduction, as well as metrics for future monitoring. While an audit does require an investment in terms of time and money, the findings are vital to selecting future policies with the ability to meaningfully enhance Airport sustainability.

8.1.4.3 Review of Recycling Feasibility

The feasibility of implementing a recycling program at an airport can vary considerably based on a variety of factors such as type and volume of aviation activity, geographic location, regulatory conditions, and local market conditions. Specifically, Section 133 of the FMRA indicates numerous factors that affect the scope and nature of an airport recycling program as follows:

- Local markets for recyclable commodities
- Cost for transport and processing recyclables
- Local recycling infrastructure
- Willingness of an airport and its tenants to implement recycling programs
- The nature of an airport's waste stream
- Competition between recycling and landfilling firms
- Airport layout and logistics

Each of these factors impact the feasibility of recycling at the Airport to varying degrees and plays an important role in its associated cost. Like many airports, budget constraints have been the most significant obstacle to establishing a more robust recycling program at the Airport. Existing lease language, which does not mandate specific recycling or waste reduction practices, also may impede efforts until contracts can be updated accordingly. In consideration of the level and type of aviation activity within the City's direct control and based on current market conditions, it is unlikely that a budget-neutral solution to waste diversion could be identified for the Airport.

Rooted in the City's larger sustainability goals, the Aviation Department has expressed a willingness to implement recycling programs at the Airport. Any investments that are made to increase recycling will positively impact the City's 40 percent waste reduction goal by 2040. Further, preliminary discussions with some tenants revealed that they are agreeable to implementing recycling or waste reduction practices should access be provided. Because lease-holders are responsible for their own waste management and tenants are responsible for the majority of on-airport activity, their inclusion and participation in any future recycling and waste reduction efforts will be vital to the program's overall success. At this time, no logistical constraints that could hinder recycling efforts, such as space for recycling receptacles in certain areas, facility layouts, or access to secure areas, have been identified at the Airport.

8.1.4.4 O&M Requirements

As described in **Section 8.1.4.1 Facility Description and Background**, Airport staff is responsible for hauling the contents of the recycling receptacles in the Airport Terminal to a local recycling processing center. As previously noted, major Airport tenants including the MROs, FBO, and flight schools are responsible for much of the activity that occurs at the Airport. These tenants are responsible for custodial services associated with the interior and exterior of the Airport premise within their lease-holdings. The only exception is FLY Goodyear, which utilizes a City-owned building for meetings and other business activities. Municipal solid waste generated by these tenants is comingled with all other waste generated in the City buildings and disposed of via the City's contract with Curbside.

Used oil generated by general aviation tenants that lease hangar space from the Aviation Department have access to waste accumulation sites at several locations on Airport property. These sites are operated by the Aviation Department as a convenience and method to reduce the potential of releases. Under a Citywide contract, Mesa Oil collects and disposes petroleum-based used fluids from the waste accumulate sites, including waste oil, oil rags, and used filters. Used oil collected by Mesa Oil undergoes a series of processes to convert it to fuel oil for resale or energy recovery. While this strategy does not provide a revenue stream to the Aviation Department, the City has not paid for the disposal of used oil or filters since this contract was implemented.

In addition to used fluids, Environmental Response, Inc. transports and brokers the proper disposal or treatment of aircraft tires, recovered free-product, and solvents placed by general aviation tenants at the waste accumulation sites. Construction and demolition debris is the responsibility of the contractor for each specific Airport project. Waste generated from horizontal projects is subject to the provisions of the DCS Green Guide as summarized in **Section 8.1.4.1**. Waste generated at vertical (i.e., building) construction projects is subject to LEED standards. While there are limited markets in which to sell construction debris, there may be an opportunity to reuse waste during future projects. At a minimum, the Aviation Department may consider tracking and evaluating concrete, asphalt, land and clearing debris, and building components for potential reuse.

8.1.4.5 Review of Waste Management Contracts

The waste management contract for the disposal of municipal solid waste is currently held by Curbside (Contract No. P-10472-20). This contract was officially awarded on June 15, 2017, with service effective on or about June 20, 2017 for a period of 3 years. Under this contract, Curbside is responsible for providing trash disposal service at the Airport on an "as needed" basis as determined by the Aviation Division. The cost is based on a set price depending on the type and number of containers, charged on a per-month basis. As described above, Mesa Oil is responsible for used oil collection and Environmental Response, Inc. provides for the proper disposal or treatment of aircraft tires, recovered free-product, and solvents placed by general aviation tenants in the waste accumulation sites.

All other Airport tenants are individually responsible for the proper disposal, treatment, or recycling of waste generated by their on-airport activities. Tenant leases do not currently include any provisions mandating particular practices addressing recycling, reuse, or waste reduction. Similarly, leases do not address the use or purchase of environmentally preferred products, such as products with high recycled content and minimal packaging and environmentally friendly cleaning products. **Table 8-6** summarizes tenant leases with their corresponding effective dates and terms. This information may be useful in identifying the Aviation Department's next opportunity to add recycling, reuse, and waste reduction objectives into existing leases.

Table 8-6: Airport Tenants and Corresponding Lease Terms

Tenant[1]	Effective Date	First Contract End	Lease Term	Status
AerSale (Hangar 52)	07/01/96	06/27/26	06/27/26	Fixed-term (without renewal)
Lux Air Jet Center	07/07/14	07/6/39	07/6/39	
Sycamore Aviation Recycling	04/20/17	04/19/18	04/19/18	
AerSale (Hangar 18)	05/17/13	5/16/18	05/16/18	Initial term
Galaxy International[2]	07/01/12	6/30/17	06/30/18	
Aero Panache	05/01/11	Unlimited		
L-3 CTC Aviation Training	01/01/16			
Lufthansa Aviation Training USA[3]	01/01/15			
Reymundo Rodriguez, Jr.	9/01/09			
Time for Sale	05/1/17			
West Coast Wash Station	11/16/09			

Notes: [1]FLY Goodyear conducts meetings in City-owned buildings and is thus not responsible for procuring an individual waste management contract. Cavu Aerospace is a sub-tenant and is accordingly not in a contractual agreement with the City. These tenants have thus been excluded from this table. [2]Galaxy leases additional hangar space from AerSale for its operations. [3]Lockheed Martin leases hangar space from Lufthansa for its operations.
Source: City of Phoenix, January 2018.

Waste handling and existing recycling efforts under the jurisdiction of the Aviation Department are funded by the Airport's operations and maintenance budget. According to lease agreements, tenants pay all expenses related to the premises, including (but not limited to) custodial expenses, at a cost additional to their net rents.

8.1.4.6 Potential for Cost Savings or Revenue Generation

Depending on specific market conditions, the volume and type of waste generated, and other variables, recycling, reuse, and waste reduction plans or programs have the capacity to generate cost savings or revenue generation for an organization. The Airport is not located in an area with a robust market for recyclable materials and the volume of recycles within its municipal waste stream is not anticipated to be excessive. As a result, the greatest potential for cost savings is likely based in a program designed to minimize waste generation. Because the cost of trash collection through Curbside is largely dependent on the amount of waste generated, reducing waste volumes may allow the Airport to lower service levels and associated costs. To complement this effort, Curbside may be able to evaluate the Airport's existing service levels to identify cost-control opportunities. According to the company's website, "the cost to process recycling is typically lower than the cost of disposal, and the pricing to [the client] can therefore be more favorable." [3]

Additionally, the Aviation Department may consider evaluating the feasibility of contracting with another recycling or waste recovery vendor for specific types of materials such as scrap metal, glass, cardboard, or aluminum cans. A waste audit would provide important information regarding the type and volume of waste being generated at the Airport that could be used during an assessment of potential markets. If it is determined that a market does exist for such materials, this effort could minimize the waste in landfills and associated hauling costs while providing an additional revenue stream to the Airport.

8.1.4.7 Plan to Minimize Solid Waste Generation

Waste reduction was a key measure evaluated by the City's 2015 SMP. As part of that effort, the Aviation Department's Waste and Recycling Work Group discussed numerous strategies that could be implemented at its three airports including composting food waste, collecting demolition waste, and supporting tenants' recycling efforts (City of Phoenix 2015, p. 52). The SMP's recommended practices for further consideration at the Airport are summarized in **Table 8-7.**

Table 8-7: Sustainability Practices for Recycling and Waste Reduction

Initiative	Key Practices
Goal: Achieve 40% waste diversion by 2020 at all three City-owned airports	
Waste 1: Develop a Solid Waste Management Plan (SWMP)	Document current waste management processes, data collection policies, equipment and tenant waste streams
	Establish a Waste Management Task Force and coordinate efforts with stakeholders thorough the Business and Properties Tenant Outreach Program
	Establish a Waste Management GA Task Force subcommittee for both GYR and DVT
	Conduct a waste steam audit of PHX, DVT, GYR
	Develop draft/final SWMPs for PHX, DVT, GYR

Source: City of Phoenix, March 2015.

In conjunction with the key practices outlined in the SMP, the Aviation Department could consider further evaluating the feasibility of adding recycling service for municipal solid waste to its existing contract with Curbside. The following materials are accepted by Curbside in commercial disposal bins:

- Paper products including office paper, envelopes, junk mail, newspapers, magazines, catalogs, receipts, shredded paper, and paper bags
- Cardboard and all boxes (flattened)
- Aluminum, tin, and steel cans
- Plastic containers numbers one through seven
- Glass bottles and jars

[3] Additional information about Curbside's ability to reduce costs associated with waste disposal, hauling, and recycling is available at http://www.curbsideaz.com/index.php?page=about

If recycling services are further evaluated for the Airport, the Aviation Department must determine if a centralized or decentralized collection system most appropriately meets its needs. A centralized collection system requires individual tenants or airport users to haul recycling material to a centrally located receptacle. Under a decentralized structure, numerous recycling bins are placed across the property, often adjacent to trash dumpsters. The centralized system offers cost efficiencies; however, the inconvenience of transporting recyclables to a specific site presents an added hurdle to waste diversion. Decentralized systems are costlier, but offer more convenience and are more likely to result in a higher rate of diversion. The cost of service is determined based on waste volume, pick-up frequency, and type of collection system.

Because tenant participation is one of the greatest opportunities to enhance recycling, reuse, and waste diversion at the Airport, the Aviation Department could consider revising lease documents and/or the Airport Rules and Regulations to require tenants to implement such practices.

To take advantage of economies of scale, the Aviation Department could consider incorporating tenant waste in any Airport-wide recycling initiatives. This may include recycling hauling through curbside or a third-party vendor and/or the sale of materials like scrap metal and aluminum cans. The Aviation Department also could work with the City Finance Department to assist tenants negotiate a contract with Mesa Oil to recycle used oil and filters at the same rates offered to the City. By reducing the cost of properly disposing of used oil for tenants, this practice could neutralize the additional cost of other recycling efforts implemented as part of tenant custodial practices.

From a management perspective, there are a number of strategies the Airport could implement now that may enhance existing recycling efforts and support future practices including:

- Develop standard operating procedures for staff that promote waste reduction across the Airport
- Develop an education and outreach campaign that showcases opportunities to reduce waste and recycling for Airport tenants, passengers, pilots, and other users
- Establish standards in tenant leases and/or Airport Rules and Regulations for the use of low-waste or limited packaging material in environmentally preferable product requirements

Regardless of the recycling, reuse, or waste reduction strategies ultimately adopted at the Airport, the Aviation Department should consider the needs, characteristics, and preferences of stakeholder groups when a plan is developed. Because of the need for user participation, it is preferable to first adopt a plan that presents the fewest obstacles to compliance. Once tenants and other users become accustomed to the new waste management practices, additional policies could be implemented to increase the volume or type of waste that is recycled or otherwise diverted from the landfill. In this way, recycling—like sustainability more broadly—is a process of continual improvement instead of an end goal that can be achieved through the implementation of a singular policy

8.1.5 Water Management and Water Quality

Potable water at the Airport is supplied by the City of Goodyear. The Aviation Department established a goal in the SMP to reduce water consumption intensity by 10 percent by 2020. To understand existing conditions and identify the most feasible opportunities to achieve this goal, the City conducted a detailed assessment of water usage at the Airport. The Water Meter Inventory Compilation Report assessed water usage at individual meters and provided a number of general recommendations to promote water conservation. The report shows that water usage at the Airport decreased 45 percent between 2010 and 2014[4]. New restroom remodels use the latest water conservation standard which has contributed to the decline in water usage. To build upon this trend, the report offered several additional recommendations for consideration as resources become available:

- Evaluate meter usage on a monthly basis
- Evaluate meter services for current usage and future demands
- Update the database tool to provide meter read data updates on a monthly basis
- Conduct landscape watering schedules in accordance with the Facility Manager's Guide to Water Management published by the Arizona Municipal Water Users Association

It is recommended that the Aviation Department continue to pursue these recommendations to further reduce water consumption at the Airport.

8.1.6 Energy Management

Because energy is necessary for virtually all aspects of airport operations, it represents a significant cost both in terms of environmental impact and expense. Energy consumption at the Airport increased from 735,342 kilowatt hours (kWh) in 2012 to nearly 1,200,000 kWh in 2016. As a result of this upward trend, energy management should be a priority both in terms of economic and environmental sustainability. As one important step is this process, the City installed new LED airfield light fixtures in 2015. The Aviation Department's policy is to look at new construction and renovation as an opportunity to reduce energy use.

The Aviation Department may consider conducting an energy audit to better understand existing conditions at the Airport. While airport tenants are sub-metered and responsible for their own energy usage, a more granular-level assessment of consumption by area, equipment, and time-of-use can provide important insight into problematic areas and opportunities for improvement. This information can be extremely useful when working with tenants to identify and implement energy conservation measures (ECMs) under their control. Additionally, the City could consider investing in a building automation system (BAS) to provide centralized control of building systems such lighting; heating, ventilation, and air conditioning (HVAC); fire; security; and other systems depending on facility-specific needs.

Practices identified by the SMP that could be further evaluated for the Airport are summarized in **Table 8-8.** Of note, the Aviation Department has developed a Strategic Energy Management Plan (SEMP) at Phoenix Sky Harbor International. The Aviation Department could consider conducting a follow-on study to assess energy consumption at Phoenix Goodyear Airport and identify potential strategies to reduce use.

[4] Section 2.7.4 of Chapter 2: Inventory of Existing Conditions provides a summary of Airport water usage between 2010 and 2014.

Table 8-8: Sustainability Practices for Energy Management

Initiative	Key Steps
Goal: Improve the energy efficiency of existing airport facilities by 20% by 2020 and minimize greenhouse gas emissions from operations	
Energy 1: Develop a SEMP	Facilities and services staff to collaborate with ASHRAE II audit consultant to identify and prioritize ECMs for Aviation facilities (Completed for PHX)
	Establish an Energy Efficiency Task Force to meet at least quarterly and coordinate efforts with stakeholders through the B&P Tenant Outreach Program
Energy 2: Fully implement the Honeywell Energy Manager Program for energy data tracking, analysis, and reporting [1]	Fully implement the Honeywell Energy Manager Program (Completed for PHX)
Goal: Determine and obtain available grant funding for cost-effective energy projects	
Energy 3: Complete preparation for FAA energy grant as needed	Conduct baseline energy assessments of facilities and prioritize energy conservation measures; Coordinate facilities and services staff and information for ASHRAE audit consultant

Note: [1]This initiative includes eight separate steps required for the implementation of the Honeywell Energy Manager Program; however, only one is included here for the purpose of brevity.
Source: City of Phoenix, March 2015.

8.2 Assessment of Recommended Development Plan

As presented in Chapter Seven, the Master Plan developed a RDP that includes projects to guide future Airport growth. Recommended projects were identified to accommodate future forecasts of aviation demand and meet the needs of existing and future users. In this section, each of the recommended projects are assessed in terms of their relationship to the sustainability frameworks provided by the DCS Green Guide and LEED standards or the Envision rating system. The recommended projects include the following:

- Airfield facilities
  - Construct a 5,000-foot-long by 35-foot-wide parallel Taxiway B (potential future 5,000-foot-long by 75-foot-wide runway)
  - Relocate non-standard taxiways (Taxiways A2 and A3) [5]
- Landside facilities
  - Construct 26,800 SF of aircraft storage hangars
  - Expand aircraft parking aprons by 35 acres
  - Relocate T-hangars
  - Provide additional vehicle parking areas
- Additional facilities
  - Construct a designated fuel truck parking area
  - Conduct a study addressing potential additional access road (east airfield access via MC 85)
  - Relocate the general aviation wash rack

[5] The Airport is currently in the design phase of an improvement project to mitigate non-standard geometry on Taxiway A8.

8.2.1 DCS Green Guide

Table 8-9 presents an assessment of the potential to incorporate DCS Green Guide sustainability metrics or the Envision rating system into the planning, design, and construction of the following (i.e., horizontal) recommended projects:

- Construct 5,000-foot taxiway (ultimate runway)
- Relocate non-standard taxiways
- Expand aircraft parking aprons by 35 acres
- Expand vehicle parking for T-hangars
- Construct designated fuel truck parking
- Construct additional airport access roads

Demolition is only required for the expansion of the aircraft parking apron and relocation of T-hangars and the general aviation wash rack. The table does not include any O&M practices because the DCS Green Guide was developed specifically to address sustainability during airport improvement projects. Recommended O&M practices for the Airport are presented in **Section 8.1.3**.

Table 8-9: Application of DCS Green Guide to Applicable Recommended Development Plan

Code	Performance Standard	Intent	Recommended Horizontal Projects						Project Phase
			Taxiway (Ultimate Runway)	Relocate Taxiways	Aircraft Parking Aprons	T-Hangar Parking	Designated Fuel Truck Parking	Airport Entrance Roads	
HD Performance Standards									
HD-AD-1	LEED AP with pavement design experience	Support and encourage the integration of sustainable concepts and practices into the design process with the inclusion of LEED AP on the design team. The LEED AP will assist the team in researching, developing and integrating sustainable innovations into project design.	✓	✓	✓	✓	✓	✓	D
HD-AD-2	Environmentally preferred purchasing	Encourage the use of products that reduce, minimize or eliminate environmental and health impacts associated with the manufacture, use and/or disposal of such products. Review and EPP in design specifications if appropriate.	✓	✓	✓	✓	✓	✓	All
HD-AD-3	Low impact development	Minimize the impact of development on the project site and avoid development of areas that contain rare or valuable attributes that would be irretrievably lost in the development process. Protect the existing infrastructure including utilities and groundwater monitoring wells.			✓	✓	✓	✓	D
HD-PV-1	Subgrade materials enhancement, supplements, engineering, testing	Improve the condition of native or existing sub-grade materials to reduce the use of imported materials.	✓	✓	✓	✓	✓	✓	D
HD-PV-2	Long-life pavement	Look at engineering technologies and design to extend the life of pavements. “Long-life pavement” design reduces airport traffic disruption, monetary costs, and environmental costs associated with reconstruction.	✓	✓	✓	✓	✓	✓	D
HD-PV-3	Alternative and innovative pavements	Leverage historic and emerging technologies to provide designs suitable for the intended application, while balancing environmental and financial costs.	✓	✓	✓	✓	✓	✓	D
HD-PV-4	Maximize recycling and reuse of existing pavements and materials	Reuse or recycle existing resources to minimize the amount of material imported to the site, while achieving the same pavement quality. Use less energy-intensive methods for comparable results. Reused or recycled materials may result in a cost effective and environmentally sustainable project.			✓	✓	✓	✓	D/C
HD-PV-4	Recycle 20% to 50% of materials				✓	✓	✓	✓	D/C
HD-PV-4	Recycle 51% to 75% of materials					✓	✓	✓	D/C
HD-LM-1	Lighting technologies review and energy conservation return on investment	Review opportunities to achieve increased lighting quality and increased energy efficiency, thereby reducing environmental impacts associated with lighting products. In reviewing newer lighting technologies, energy cost savings will be calculated to determine the return on investment for lighting upgrades.	✓	✓	✓	✓	✓	✓	D
HD-LM-2	Mechanical technologies review and energy conservation return on investments	Review opportunities to achieve increased energy efficiency and reduce environmental impacts associated with mechanical equipment. In reviewing mechanical technologies, energy and maintenance cost savings will be calculated to determine the return on investment for mechanical technologies upgrades.							D
HD-LM-3	Flexibility and reusability reviews	Review opportunities to design projects with reusable, replaceable, recyclable, and de-constructible components. Create adaptable systems and infrastructure that will enhance future uses, upgrades, and expansions.	✓	✓	✓	✓	✓	✓	P/D/C
HD-LD-1	Urban design principals: Pedestrian comfort, urban heat island, and increasing connectivity	Review and implement urban design principals to increase pedestrian comfort, reduce the urban heat island effect, increase connectivity and safety for pedestrians, and encourage the use of public transportation.						✓	P/D
HD-LD-1	Develop report review 2 urban design principles for projects							✓	P/D
HD-LD-1	Develop report review 4 urban design principles for projects							✓	P/D
HD-LD-1	Successful implementation of at least 2 approved pedestrian comfort designs							✓	P/D/C
HD-LD-2	Landscape to reduce irrigation needs and urban heat island effect	Minimize the use of potable water for landscape irrigation on the project site. Coordinate landscaping design with City of Phoenix standards.							P/D
HD-LD-2	Reduce potable water for landscaping irrigation								P/D
HD-LD-2	Eliminate potable water use for landscaping irrigation								P/D
HD-PS-1	Surface parking lots	Implement design features in surface parking lots that reduce energy use and Urban Heat Island effect. These features will enhance lighting and increase safety and comfort. In addition, define sustainable parking initiatives to encourage HOV usage. Multiple points may be possible from other applicable Performance Standards.				✓	✓		-
HD-PS-1	Analyze listed required actions					✓	✓		D
HD-PS-1	Design all City project manager approved initiatives					✓	✓		D
HD-PS-2	Parking structures	Implement design features for parking structure projects to reduce energy use. Sustainable parking facilities might improve customer safety, reduce single-occupancy vehicle usage and reduce the Urban Heat Island effect.							-
HD-PS-2	Analyze listed required actions								-
HD-PS-2	Design all City project manager approved initiatives								-
HD-ID-1	Innovation in design	Provide innovative design ideas, with the opportunity to be awarded design points for exceptional performance in a particular Sustainable Design Performance Standard. Additional design points may be awarded for use of innovative materials, technologies, or practices not specifically addressed by this rating system.	✓	✓	✓	✓	✓	✓	P/D

Code	Performance Standard	Intent	Recommended Horizontal Projects: Taxiway (Ultimate Runway)	Relocate Taxiways	Aircraft Parking Aprons	T-Hangar Parking	Designated Fuel Truck Parking	Airport Entrance Roads	Project Phase
HC Performance Standards									
HC-IM-1	Construction and health safety planning	Prepare a project-specific health and safety plan and provide the construction team with health and safety management. Include hazard awareness, hazard prevention techniques, and worker personal protective equipment, as required by the Occupational Safety and Health Administration (OSHA).	✓	✓	✓	✓	✓	✓	P/D/C
HC-IM-2	LEED AP/Construction sustainability liaison	Support and encourage the integration of sustainable concepts and practices into construction processes with the inclusion of LEED AP on the construction team. The LEED AP will plan and assist implementation of the performance standards. The LEED AP will track and document goals and coordinate communication with the City. The LEED AP also can train the team and inspect project sustainability measures (see HC-IM-3, Contractor & Subcontractor Sustainability Training and HC-IM-4, Sustainability Inspection Program & Reporting).	✓	✓	✓	✓	✓	✓	C/DM
HC-IM-3	Contractor and subcontractor sustainability training	Prior to the start of construction, make on-site construction team members aware of sustainability practices and initiatives chosen for the project in order to gain an understanding of implementation roles and responsibilities. Facilitate sustainable and proactive ideas, decisions and best practice methods to minimize environmental, social and economic impacts.	✓	✓	✓	✓	✓	✓	C/DM
HC-IM-4	Sustainability inspection program and reporting	Ensure compliance with chosen sustainable construction performance standards and promote sustainability as an active and ongoing construction goal. Capture quantifiable information regarding sustainability activities on the construction project.	✓	✓	✓	✓	✓	✓	C/DM
HC-IM-5	Construction scheduling and sequencing	Increase project efficiency and reduce environmental impacts by coordinating delivery of materials more exactly with installation times. This reduces the impacts on materials, including moisture exposure and physical damage, due to unnecessary on-site storage of materials. Have deliveries made during off-peak hours and by using designated haul routes. Prevent impacts to surrounding environment due to storage and transportation activities.	✓	✓	✓	✓	✓	✓	D/C/DM
HC-IM-6	Promote use of regional materials and local suppliers (within 500 miles of the project)	Maximize the use of regional materials and local suppliers to benefit the local community. Increase the demand for materials and products that are extracted and manufactured in the region. Reduces environmental, economic, and social impacts associated with long-distance transport of construction materials.	✓	✓	✓	✓	✓	✓	D/C
HC-IM-6	Local supplier-preferred procurement policy and 20% - 40% utilization of local suppliers		✓	✓	✓	✓	✓	✓	D/C
HC-IM-6	Regional materials procurement policy and 20% to 40% use of regional materials		✓	✓	✓	✓	✓	✓	D/C
HC-IM-6	40% or more regional materials used		✓	✓	✓	✓	✓	✓	D/C
HC-AC-1	Low-emission diesel construction vehicles, equipment, and generators	The Aviation Department is dedicated to decreasing the impact of its construction activities by reducing air emissions generated from construction vehicles and equipment and encouraging the use of newer, cleaner units.	✓	✓	✓	✓	✓	✓	C/DM
HC-AC-1	Using alternative fuels		✓	✓	✓	✓	✓	✓	C/DM
HC-AC-1	25% increase of low-emission vehicles		✓	✓	✓	✓	✓	✓	C/DM
HC-AC-1	50% increase of low-emission vehicles		✓	✓	✓	✓	✓	✓	C/DM
HC-AC-1	75% increase of low-emission vehicles		✓	✓	✓	✓	✓	✓	C/DM
HC-AC-1	100% increase of low-emission vehicles		✓	✓	✓	✓	✓	✓	C/DM
HC-AC-2	Construction vehicles, equipment, and material delivery – Idling restrictions	Reduce emissions and noise generated by restricting idling from construction vehicles, equipment and on- and off-road materials delivery vehicles.	✓	✓	✓	✓	✓	✓	C/DM
HC-AC-3	Alternative transportation plan during construction	Reduce vehicle emissions by providing alternative transportation to the job site for contractor staff. Reduces airport road congestion and fuel consumption from use of construction personnel private vehicles and company vehicles.	✓	✓	✓	✓	✓	✓	C/DM
HC-AC-4	Track project criteria air pollutant emissions	The project information collected in this performance standard will be used by the Airport to calculate the amount of project emissions reduced by the contractor's mitigation measures, as selected.	✓	✓	✓	✓	✓	✓	C/DM
HC-AC-5	Construction materials conveying plan	Reduce emissions from construction vehicles related to transporting materials around the site.	✓	✓	✓	✓	✓	✓	C/DM
HC-SM-1	Low-impact development and minimizing site disturbance	Minimize unnecessary disturbance of soil, vegetation, and other features during construction.	✓	✓	✓	✓	✓	✓	C/DM
HC-SM-1	Develop construction site plan		✓	✓	✓	✓	✓	✓	C/DM
HC-SM-1	Successfully follow construction site plan		✓	✓	✓	✓	✓	✓	C/DM
HC-SM-2	Use of City-approved dust palliatives	Use only City-approved dust palliatives to prevent air and water pollution from wind erosion at construction sites.	✓	✓	✓	✓	✓	✓	C/DM
HC-EM-1	Project energy requirements and management plan/stationary power	Determine construction project energy needs for the initial and long-term phases of the construction project. Reduce the use of non-stationary power units where feasible.	✓	✓	✓	✓	✓	✓	C/DM
HC-EM-1	Develop and implement project energy requirements plan		✓	✓	✓	✓	✓	✓	C/DM
HC-EM-1	Stationary power can be used for at least one process		✓	✓	✓	✓	✓	✓	C/DM
HC-EM-2	Energy efficient lighting and equipment and energy requirement plan	Determine construction project energy needs for the initial and long-term phases of the projects and reduce energy use by using energy efficient lighting, equipment, and generator sets during construction.	✓	✓	✓	✓	✓	✓	C/DM
HC-EM-2	Develop and implement project energy requirements plan		✓	✓	✓	✓	✓	✓	C/DM
HC-EM-2	Utilize energy efficient or less-emitting equipment or renewable energy sources		✓	✓	✓	✓	✓	✓	C/DM

Code	Performance Standard	Intent	Recommended Horizontal Projects						Project Phase
			Taxiway (Ultimate Runway)	Relocate Taxiways	Aircraft Parking Aprons	T-Hangar Parking	Designated Fuel Truck Parking	Airport Entrance Roads	
HC-EM-3	Energy systems commissioning and installed systems testing	Work with the commissioning agent to verify that mechanical and electrical systems and controls have been installed and calibrated correctly and perform according to the design. Provide contractor input into development of procedures for operation, maintenance, and recalibration for installed system(s). Alternatively, use thermal infrared imaging procedures for identifying mechanical and electrical installation issues.							D/C
HC-MR-1	Construction waste and management plan	Promote waste diversion and good housekeeping practices at the work site. Create a plan that identifies demolition and construction waste streams from the project. It will outline the goals and methods to divert this waste from landfills and to return appropriate materials into the manufacturing life cycle.	✓	✓	✓	✓	✓	✓	C/DM
HC-MR-2	On-site recycling of construction materials and infrastructure	Avoid use of landfills for construction debris. Maximize the reuse or recycling of material on-site and reduce the amount of construction waste taken from the jobsite.	✓	✓	✓	✓	✓	✓	C/DM
HC-MR-2	15% to 25% reused or salvaged		✓	✓	✓	✓	✓	✓	C/DM
HC-MR-2	26% to 40% reused or salvaged		✓	✓	✓	✓	✓	✓	C/DM
HC-MR-3	Off-site recycling of construction materials and infrastructure	Avoid use of landfills for construction debris and recycle or reuse material off-site; if on-site, recycling is not an option.	✓	✓	✓	✓	✓	✓	C/DM
HC-MR-3	15% recycled		✓	✓	✓	✓	✓	✓	C/DM
HC-MR-3	25% recycled		✓	✓	✓	✓	✓	✓	C/DM
HC-MR-4	Use of recycling content materials	Use products that incorporate recycled content materials for the project, thereby reducing impacts resulting from extraction and processing of virgin materials.	✓	✓	✓	✓	✓	✓	D/C
HC-EQ-1	Noise and vibration mitigation plan	Prior to the commencement of construction, establish acceptable noise and vibration levels for stationary, portable, and power-actuated construction equipment. For each construction phase, develop control measures as indicated to reduce noise and vibration levels from construction activities adjacent to commercial and residential communities and for passenger and employee comfort.	✓	✓	✓	✓	✓	✓	C
HC-EQ-2	Light pollution reduction	Minimize light trespass and glare from construction activities. Reduce development impact on nocturnal environments by improving nighttime visibility through glare reduction. This allows distinction of signage and runway/taxiway lighting and reduces light pollution at adjacent buildings.	✓	✓	✓	✓	✓	✓	D/C
HC-IC-1	Innovation in HC	Provide the opportunity for projects to earn additional construction points for exceptional performance in a particular sustainable performance standard. Alternatively, additional construction points may be awarded for use of innovative materials, technologies or practices not specifically addressed by this rating system.	✓	✓	✓	✓	✓	✓	All

Note: C = Construction, D = Design, DM = Demolition, P = Planning

Sources: City of Phoenix DCS Green Guide, December 2010. Kimley-Horn.

8.2.2 LEED Certification

LEED Silver certification is required for all new construction and major renovations of City-owned buildings and strongly recommended for buildings constructed by third-party owners. Because LEED standards exclusively apply to vertical construction, they are only applicable to the construction of an aircraft storage hangar. Accordingly, City policy recommends using LEED for the hangar.

The master plan also provides a recommended land use plan to provide a framework for future development that is compatible with existing and proposed facilities[6]. The recommended land use plan provides for seven permitted activities and general requirements for potential development within each category. Recommended land uses include:

- Educational/vocational
- Corporate/FBO
- Based aircraft accommodation
- Aviation support
- Aviation business
- Cargo/freight

While the facilities necessary to support these types of activities are not specifically defined in the recommended land use plan, the Aviation Department may need to construct new or renovate existing City facilities should these land uses be pursued in the future. For example, aviation support could include general equipment storage, maintenance facilities, and a terminal building. Cargo/freight may require air cargo handling facilities. LEED standards would apply to these types of vertical construction projects if owned by the City. Future tenant developments also may be required to use LEED standards if such a policy is approved by the Aviation Department in the next few years.

Furthermore, Airport tenants have identified other projects for future on-airport construction, such as classroom and dormitory space for flight schools and privately owned office and administrative space; air cargo handling facilities; and aircraft storage hangars for MROs, FBOs, corporate jet/charter operators, etc. Because these projects would be privately funded and dependent on lease negotiations with the City, they are excluded from the list of preferred development projects and not subject to the City's LEED requirements. However, the Aviation Department may encourage the incorporation of LEED principles during all on-airport construction projects to support the City's sustainability goals in the future. It is important to remember that the lifecycle costs of LEED-certified buildings are often lower than traditional construction, which can improve a facility's long-term return on investment for building owners and developers.

Table 8-10 assesses the potential for incorporating LEED sustainability measures into any vertical construction at the Airport, whether conducted by the City or third-party owners. These criteria must be evaluated on a project-specific basis and are included here only to highlight the breadth of sustainable principles potentially applicable to the Airport. It should be noted that this assessment presents LEED v4 standards for BD+C: New Construction and Major Renovation. If the LEED policy is approved for tenant

[6] See Section 6.5 On-Airport Land Uses in Chapter 6 for additional details about the recommended land use plan.

construction, design engineers could consider the LEED standards most applicable to the specific facility under design. For example, the LEED BD+C: Multifamily Midrise methodology may be most appropriate for new dormitory space constructed as part of a flight school expansion.

Specific to City of Phoenix goals and priorities, LEED points associated with reduction of energy and water use, demolition and construction waste recycling, and ongoing (operational) recycling planning must be achieved. As such, both horizontal and vertical construction should be designed using Life Cycle Cost tools to minimize the ongoing impacts of the new installations.

8.3 Summary

As a growing Airport supporting diverse aviation activities and on-airport businesses, the Aviation Department has the opportunity to incorporate a wide range of sustainability practices in all of the focus areas identified by the SMP. Additionally, the DCS Green Guide and LEED standards provide the framework for charting a more socially and environmentally responsible future at the airport and for all residents, business, and visitors that rely on the services it provides.

Table 8-10: Application of LEED Standards to Recommended Land Uses

Category	LEED Standard	Potential to Incorporate	Project Phase
Location and transport	LEED for Neighborhood Development location		-
	Sensitive land protection		-
	High priority site		-
	Surrounding density and diverse uses		
	Access to quality transit	✓	P
	Bicycle facilities	✓	P
	Reduced parking footprint	✓	P
	Green vehicles	✓	P
Sustainable sites	Construction activity pollution prevention	✓	D/C
	Site assessment	✓	D
	Site development - protect or restore habitat	✓	P/D
	Open space	✓	P
	Rainwater management	✓	P/D/O&M
	Heat island reduction	✓	P
	Light pollution reduction	✓	P/D
Water	Outdoor water use reduction – 30% reduction from baseline	✓	D/O&M
	Indoor water use reduction – 20% reduction from baseline	✓	D/O&M
	Building-level water metering	✓	D
	Outdoor water use reduction – 50% reduction from baseline	✓	D/O&M
	Indoor water use reduction	✓	D/O&M
	Cooling tower water use	✓	D
	Water metering	✓	D
Energy and atmosphere	Fundamental commissioning and verification	✓	C
	Minimum energy performance	✓	D
	Building-level energy metering	✓	D

Category	LEED Standard	Potential to Incorporate	Project Phase
Energy and atmosphere	Fundamental refrigerant management	✓	D/O&M
	Enhanced commissioning	✓	C
	Optimize energy performance	✓	D/O&M
	Advanced energy metering	✓	D
	Demand response	✓	O&M
	Renewable energy production	✓	D
	Enhanced refrigerant management		O&M
	Green power and carbon offsets	✓	D/O&M
Materials and resources	Storage and collection of recyclables	✓	D/O&M
	Construction and demolition waste management planning	✓	D/C
	Building life-cycle impact reduction	✓	P/D
	Building product disclosure and optimization – environmental product declarations	✓	All
	Building product disclosure and optimization – sourcing of raw materials	✓	D/C/O&M
	Building product disclosure and optimization – material ingredients	✓	D/C/O&M
	Construction and demolition waste management	✓	C/DM
IAQ	Minimum IAQ performance	✓	D/O&M
	Environmental tobacco smoke control	✓	D/O&M
	Enhanced IAQ strategies	✓	D/O&M
	Low-emitting materials	✓	D/O&M
	Construction IAQ management plan	✓	D/C
	IAQ assessment	✓	O&M
	Thermal comfort	✓	D/O&M
	Interior lighting	✓	D/O&M
	Daylight	✓	D/O&M
	Quality reviews	✓	All
	Acoustic performance	✓	D/O&M
Innovation	Innovation	✓	All
	LEED AP	✓	All
Regional priority	Regional priority	✓	D/O&M

Note: C = Construction, D = Design, O&M = Operations & Maintenance, P = Planning

Sources: USGBC, July 2017. Kimley-Horn.

Appendix A

REFERENCES

A.1 References

AeroTurbine. (2015). *Aircraft Maintenance Services*. Retrieved November 30, 2016, from AeroTurbine: http://www.aeroturbine.com/products-and-services/airframe-maintenance-services/

Airline Training Center Arizona. (n.d.). *Campus*. Retrieved November 30, 2016, from Airline Training Center Arizona: http://www.atca.net/campus/#facilities

Airline Training Center Arizona. (n.d.). *Our History*. Retrieved November 30, 2016, from Airline Training Center Arizona: http://www.atca.net/company/#our-history

AirNav. (2016, December 8). *Phoenix Goodyear Airport (GYR), RNAV (GPS) RWY 3 Instrument Approach Procedure Plate.* Retrieved from AirNav.com: http://155.178.201.160/d-tpp/1613/06648R3.PDF

Applied Pavement Technology Inc. (August 2014). *Phoenix Goodyear Airport Pavement Management Report.* Illinois: Applied Pavement Technology Inc. Retrieved November 30, 2016

Applied Pavement Technology Inc. (October 2014). *Phoenix Goodyear Airport Pavement Classification Number Report.* Illinois: Applied Pavement Technology Inc. Retrieved November 30, 2016

Archaeological Consulting Services Ltd. (Revised March 8, 2010). *Cultural Resouce Survey of 797 Acres for the Goodyear Airport Improvement Project.* Archaeological Consulting Services Ltd. Retrieved November 30, 2016

Archaeological Consulting Services, Ltd. (2013). A Cultural Resource Impact Assessment for the Proposed Lux Air Phoenix Goodyear AIrport FBO Facility, Goodyear, Maricopa County, Arizona. Phoenix: Archaeological Consulting Services, Ltd. . Retrieved January 18, 2017

Arizona Department of Environmental Quality (2016). *Map of Nonattainment & Attainment Areas*. Retrieved November 18, 2016, from Arizona Department of Environmental Quality: http://legacy.azdeq.gov/environ/air/plan/notmeet.html

Arizona Department of Environmental Quality (2016). *Phoenix-Goodyear Airport South*. Retrieved November 18, 2016, from EPA National Priority List (NPL) Site: http://legacy.azdeq.gov/environ/waste/sps/Phoenix_Goodyear_Airport_South.html

Arizona Department of Real Estate (2017). *Airport Boundry Maps - Public Airports*. Retrieved March 16, 2017, from Arizona Department of Real Estate: http://www.re.state.az.us/AirportMaps/PublicAirports.aspx

Arizona Game and Fish Department (2016, November 29). *HabiMap*. Retrieved November 29, 2016, from Arizona Game and Fish Department: http://www.habimap.org/habimap/

Armstrong Consultants, Inc. (2016). *Data Collection Survey for Phoenix Goodyear Airport (GYR).* Mesa: Armstrong Consultants, Inc.

CDM Smith & EEC. (January 2016). *Stormwater Pollution Prevention Plan.* CDM Smith & EEC. Retrieved November 30, 2016

City of Goodyear (2013, December 18). *Zoning Ordinance.* Retrieved March 15, 2017, from Goodyear, Arizona: http://www.goodyearaz.gov/government/departments-divisions-a-z/development-services/planning-zoning/zoning-ordinance

City of Goodyear (2014, May 16). *Land Use and Transportation Map*. Retrieved March 15, 2017, from Goodyear, Arizona: http://www.goodyearaz.gov/home/showdocument?id=13628

City of Goodyear (2015, June). *City of Goodyear Capital Imrovement Plan*. Retrieved March 21, 2017, from Goodyear, Arizona: http://www.goodyearaz.gov/home/showdocument?id=11370

City of Goodyear (2016, March 3). *City of Goodyear Zoning Districts Map.* Retrieved March 15, 2017, from Goodyear, Arizona: http://www.goodyearaz.gov/home/showdocument?id=13480

City of Goodyear (2016, April). *Goodyear 2025 General Plan*. Retrieved March 15, 2017, from Goodyear, Arizona: http://www.goodyearaz.gov/government/departments-divisions-a-z/development-services/general-plan-annual-report

City of Goodyear (n.d.). *Aviation and Aerospace*. Retrieved March 15, 2017, from Goodyear, Arizona Economic Development: http://develop.goodyearaz.com/key-industries/aviation-and-aerospace

City of Goodyear (n.d.). *Benefits within a Foreign Trade Zone*. Retrieved February 16, 2017, from City of Goodyear Economic Development Department: http://develop.goodyearaz.com/business-assistance/incentives/benefits-within-a-ftz

City of Goodyear (n.d.). *Goodyear is Geared for Growth*. Retrieved March 15, 2017, from Goodyear, Arizona Economic Development: http://develop.goodyearaz.com/why-goodyear

City of Goodyear (n.d.). *GYR Aviation & Aerospace Employment Corridor*. Retrieved March 15, 2017, from Goodyear, Arizona Economic Development: http://www.goodyearaz.gov/home/showdocument?id=11774

City of Goodyear (n.d.). *Land Use Plan*. Retrieved March 15, 2017, from Goodyear, Arizona: http://www.goodyearaz.gov/government/departments-divisions-a-z/development-services/general-plan-annual-report/land-use-plan

City of Goodyear (n.d.). *Military Reuse Zone*. Retrieved February 16, 2017, from City of Goodyear Economic Development Department: http://develop.goodyearaz.com/business-assistance/military-reuse-zone

City of Phoenix Aviation Department (2016, October). *Goodyear Airport Pilot Guide*. Retrieved January 17, 2017, from Phoenix Goodyear Airport: https://goodyearairport.com/docs/librariesprovider2/pdfs/for-pilots/2447-sky-harbor-gyr-pilot-guide-aug-2016---web.pdf?sfvrsn=4

City of Phoenix Aviation Department (January 2015). *Sustainability Management Plan.* Phoenix: City of Phoenix Aviation Department. Retrieved November 30, 2016

CTC Aviation (2016). *Crew Training Centres*. Retrieved November 30, 2016, from CTC Aviation: http://www.ctcaviation.com/about/centres/

CTC Aviation (2016). *Overview*. Retrieved November 30, 2016, from CTC Aviation: http://www.ctcaviation.com/about/

Economic Development - Aviation and Aerospace (n.d.). Retrieved November 17, 2016, from Goodyear, Arizona: http://develop.goodyearaz.com/key-industries/aviation-and-aerospace

Faithful+Gould (June 30, 2015). Draft Report of Facility Condition Assessment (Phase 4) for Goodyear Airport. Phoenix: Faithful+Gould.

Federal Aviation Administration (n.d.). Retrieved March 15, 2017, from Runway Safety - Hot Spot List: https://www.faa.gov/airports/runway_safety/hotspots/hotspots_list/

Federal Aviation Administration (2001, May 11). *Orders & Notices - Order 7900.5B Surface Weather Observing*. Retrieved November 22, 2016, from Federal Aviation Administration: https://www.faa.gov/air_traffic/publications/at_orders/media/SWO.pdf

Federal Aviation Administration (2012). *Instrument Flying Handbook FAA-H-8083-15B.* Retrieved February 22, 2017, from Federal Aviation Administration: https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/FAA-H-8083-15B.pdf

Federal Aviation Administration (2014, February 2). *AC 150/5300-13A Change 1 - Airport Design*. Retrieved from Federal Aviation Administration: https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5300-13A-chg1-interactive.pdf

Federal Aviation Administration (2015, April 3). *Planning and Capacity - Norhtwest Mountain Region*. Retrieved February 15, 2017, from Federal Aviation Administration: https://www.faa.gov/airports/northwest_mountain/planning_capacity/

Federal Aviation Administration (2016, December 5). All Weather Wind Rose Form "722788 PHOENIX GOODYEAR AIRPORT ANNUALPERIOD RECORD 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 ". Retrieved from Federal Aviation Administration Web Site: https://airports-gis.faa.gov/airportsgis/publicToolbox/windroseForm.jsp?windroseId=null&requestToken=1480972229652

Federal Aviation Administration (2016, May 16). *Chart Supplements - Arizona, Phoenix Goodyear*. Retrieved November 17, 2016, from Federal Aviation Administration: http://aeronav.faa.gov/afd/10nov2016/sw_44_10NOV2016.pdf

Federal Aviation Administration (2016, November 10). *FAA Form 5010-1 Phoenix Goodyear Airport Master Record*. Retrieved from Airport IQ 5010 Airport Master Records and Reports: http://www.gcr1.com/5010web/airport.cfm?Site=GYR&CFID=1663676&CFTOKEN=36575098

Federal Aviation Administration (2016, December 5). *IFR Wind Rose Form "722788 PHOENIX GOODYEAR AIRPORT ANNUALPERIOD RECORD 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015* ". Retrieved from Federal Aviation Administration Web Site: https://airports-gis.faa.gov/airportsgis/publicToolbox/windroseForm.jsp?windroseId=null&onLoadCommand=none&requestToken=1480969951382

Federal Aviation Administration (2016, December 8). *Phoenix Goodyear Airport (GYR), RNAV (GPS) RWY 3 Instrument Approach Procedure Plate*. Retrieved from AirNav.com: http://155.178.201.160/d-tpp/1613/06648R3.PDF

Federal Aviation Administration (2016, December 5). *VFR Wind Rose Form "722788 PHOENIX GOODYEAR AIRPORT ANNUAL PERIOD RECORD 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015*". Retrieved from Federal Aviation Administration Web Site: http://96.127.35.176:8080/windRose/GenerateHandler?mode=VF&airportID=KGYR&stateID=AZ&airportName=PHOENIX%20GOODYEAR%20AIRPORT&usaf=722788&wban=03186&beginYear=2006&endYear=2015

Federal Aviation Administration (n.d.). *Program & Initiatives - Aviation Gasoline*. Retrieved March 21, 2017, from Federal Aviation Administration: https://www.faa.gov/about/initiatives/avgas/

Federal Aviation Admnistration (2012, April 24). *AC 150/5390-2C, Helipad Design.* Retrieved from Federal Aviation Administration: https://www.faa.gov/documentLibrary/media/Advisory_Circular/150_5390_2c.pdf

Federal Aviation Regulations (2016, December 15). *Part 71 Designation of Class A, B, C, D, and E Airspace Areas; Air Traffic Service Routes; And Reporting Points.* Retrieved from Electronic Code of Federal Regulations: http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=14:2.0.1.2.6#sp14.2.71.a

Federal Emergency Management Administration (2013, October 16). *Federal Emergency Management Administration*. Retrieved November 18, 2016, from FEMA FLood Map Service Center: https://msc.fema.gov/portal/search?AddressQuery=goodyear%20az#searchresultsanchor

Galaxy International, Inc. (2013). *Home*. Retrieved November 30, 2016 , from Galaxy International, Inc.: http://www.galaxyinternational.com/index.html

Haws, J. (2016, December 8). Phoenix Goodyear Airport Waste Operations. (M. Tommasson, Interviewer)

Landrum & Brown (2013). Technical Memorandum, Runway Shift Justification Study Phoenix Goodyear Airport. Landrum & Brown. Retrieved March 15, 2017

Lauritano, C. S. (2013, August/September). Phoenix-Goodyear Airport: A monument to the City's past, but more importantly, a key to its future. *Infocus*(August/Septemeber 2013), p. 3. Retrieved November 17, 2016, from http://www.goodyearaz.gov/home/showdocument?id=110

LeighFisher (November 2013). *Sustainability Baseline Assessment.* LeighFisher. Retrieved December 7, 2016

Lockheed Martin (2016). *Flight Operations Services - Goodyear, Arizona*. Retrieved November 30, 2016, from Lockheed Martin: http://www.lockheedmartin.com/us/products/airborne-ground-surveillance-radar-systems/flight-operations-services.html

LuxAir Jet Centers (2016). *Home*. Retrieved November 30, 2016, from Lux Air Jet Centers: http://www.luxairjetcenters.com/

Maricopa Association of Governments (2014, January). *2035 Regional Transportation Plan (RTP).* Retrieved November 17, 2016, from Maricopa Association of Governments: https://www.azmag.gov/Documents/RTP_2014-01-30_Final-2035-Regional-Transportation-Plan-(RTP).pdf

Maricopa County Regional Development Services (2015). *Maricopa County GIS Portal*. Retrieved December 16, 2016, from http://gis.maricopa.gov/home/default.aspx

Mead & Hunt, Inc. (June 2016). *Wildlife Harzard Assessment - Phoenix Goodyear Airport.* Scottsdale: Mead & Hunt Inc. Retrieved November 30, 2016

Morrison-Maierle, Inc. (2016). Final Engineering Report - Runway Rehabilitation Phoenix Goodyear Airport. City of Phoenix Aviation Department.

Morrison-Maierle, Inc. (2016). *Final Engineering Report - Runway Rehabilitation, Phoenix Goodyear Airport.* Phoenix: Morrison-Maierle, Inc. Retrieved January 2017

Morrison-Maierle, Inc. (February 2015). *Design Report - Runway Shift, Phoenix Goodyear Airport.* Phoenix: Morrison-Maierle, Inc.

National Business Aviation Association (2011, March 14). *Airports - How Changes in Magnetic North Are Impacting Airports*. Retrieved February 15, 2017, from National Business Aviation Association: https://www.nbaa.org/ops/airports/20110314-magnetic-north.php

Phoenix Goodyear Airport (2016, Novemeber 10). Retrieved Novemeber 2016, from AirNav.com: http://www.airnav.com/airport/KGYR

U.S. Department of Agriculture Natural Resources Conservation Service (2016). *Custom Soil Resource Report for Maricopa County, AZ, Central.* Retrieved November 18, 2016, from U.S. Department of Agriculture Natural Resources Conservation Service: http://websoilsurvey.nrcs.usda.gov/app/

U.S. Department of the Interior (2011, August 19). *Arizona Segements, A-G*. Retrieved November 18, 2016, from National Park Service Nationwide Rivers Inventory: https://www.nps.gov/ncrc/programs/rtca/nri/states/az.html

U.S. Department of Transportation (2016, September 30). *2017-2021 NPIAS Report.* Retrieved November 17, 2016, from Federal Aviation Administration: https://www.faa.gov/airports/planning_capacity/npias/reports/

U.S. Department of Transportation Federal Highway Administration (2012, July 20). *Section 4(f)*. Retrieved November 18, 2016, from U.S. Department of Transportation Federal Highway Administration: https://www.environment.fhwa.dot.gov/4f/4fpolicy.asp

U.S. Fish & Wildlife Serivce (2016, November 29). *IPaC Regulatory Documents*. Retrieved November 29, 2016, from www.ecosfws.gov: https://ecos.fws.gov/ipac/project/KXO5GOWVO5DYFOMX425T4UML4U/regulatoryDocuments

U.S. Fish & Wildlife Service National Wetlands Inventory (2016). *U.S. Fish & Wildlife Service National Wetlands Inventory*. Retrieved November 18, 2016, from National Wetlands Inventory - V2: https://www.fws.gov/wetlands/Data/Mapper.html

U.S. Government Publishing Office (2017, February 23). Code of Federal Regulations Title 14, Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace. United States.

United States Environmental Protection Agency (2016, August). *Air Quality Analysis.* Retrieved November 18, 2016, from United States Environmental Protection Agency: https://www3.epa.gov/region09/air/maps/r9_o38hr.html

Western Regional Climate Center (n.d.). *Litchfield Park, Arizona (024977) Period of Record: 08/01/1917 to 06/06/2016.* Retrieved from Western Regional Climate Center, Monthly Temperature: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?az4977

Weston Solutions, Inc. (March 2015). *Water Meter Inventory Report Compilation - Phoenix Goodyear Airport.* Tempe: Weston Solutions, Inc. Retrieved December 6, 2016

Appendix B

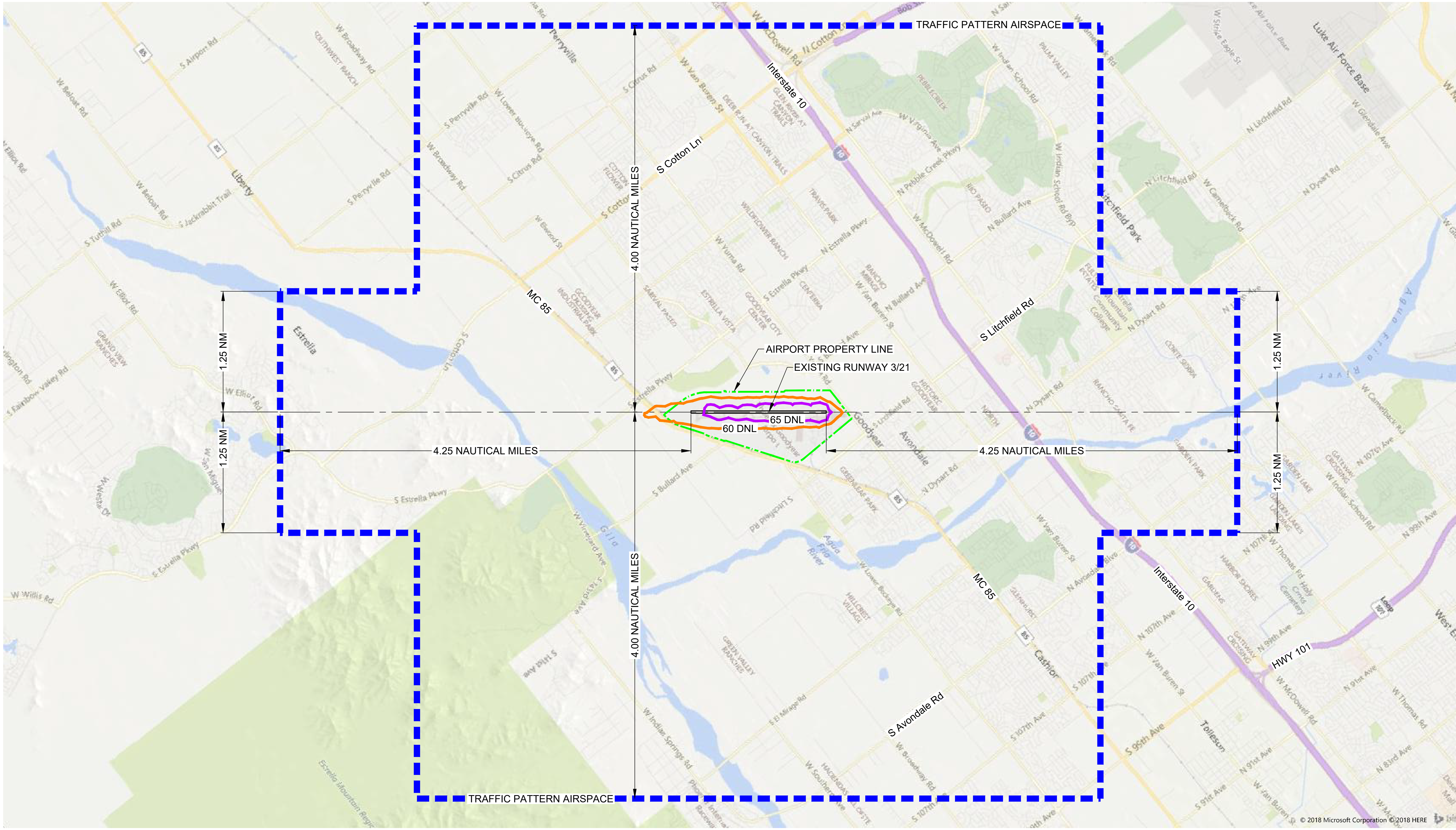
NOISE DISCLOSURE MAP

B.1 Noise Disclosure Map

As noted in previous chapters, based on definitions described in A.R.S. 28-8486, the state real estate department shall have and make available to the public a Noise Disclosure Map for applicable airports, which includes Phoenix Goodyear Airport.

The figure on the following page provides the updated Noise Disclosure Map and associated Airport Influence Area. As presented, the 65 DNL noise contour remains on Airport property but the 60 DNL noise contour extends off Airport property to the south, though there are no residences in this area.

Figure B-1: Noise Disclosure Map



Noise Disclosure Map

NOTES:

1. This map has been prepared in accordance with A.R.S., Section 28-8486, relating to public airport disclosure.
2. The Traffic Pattern Boundaries have been established in accordance with the guidelines provided in FAA Order 7400.2D.
3. The Airport Noise Contours were developed with the FAA AEDT 2c software and are based on Total Annual Operations (Take-off and Landings) of 200,360.

LEGEND

- 60 DNL Contour
- 65 DNL Contour
- Traffic Pattern Airspace
- Airport Property Line
- Runway 3/21
- Extended Runway Centerline

1500 0 1500 3000
SCALE IN FEET

ARMSTRONG CONSULTANTS

PHOENIX GOODYEAR AIRPORT

ARMSTRONG

PREPARED FOR

City of Phoenix

PREPARED BY

Kimley»Horn

ARMSTRONG