FLAGSTAFF AIRPORT
AIRPORT MASTER PLAN





CITY OF FLAGSTAFF · ARIZONA · ESTABLISHED 1882 ·



AIRPORT MASTER PLAN

For

Flagstaff Airport

Prepared for

The City of Flagstaff

Prepared by

Coffman Associates, Inc.

December 2018

FLAGSTAFF AIRPORT

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FLAGSTAFF AIRPORT

Introduction







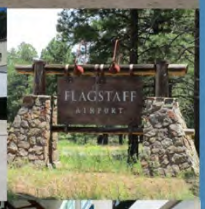
FLAGSTAFF AIRPORT

INTRODUCTION













An Airport Master Plan provides an evaluation of the airport's aviation demand and an overview of the systematic airport development that will best meet those demands. The Master Plan establishes development objectives and provides for a 20-year planning period that details the rationale for various study elements including airfield configuration, facility development, on-airport land use recommendations, and support facilities. It also serves as a strategic tool for establishing airport improvement priorities and justifying the need for federal and state funding assistance.

The Federal Aviation Administration (FAA) recommends that airports update their Master Plan every seven to 10 years, or as necessary to address local changes at the airport. The last Master Plan for Flagstaff Airport was completed in 2007. As such, the preparation of this Airport Master Plan is necessary as a timely reassessment of the development direction of Flagstaff Airport in order to meet the needs of the local economy and an ever-changing air transportation industry.

The Flagstaff Airport Master Plan has been undertaken to evaluate the airport's capabilities and role, to forecast future aviation demand, and to plan for the development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the Master Plan is to provide guidelines for the airport's overall maintenance, development, and operation in an environmentally and fiscally responsible manner while adhering to appropriate FAA safety design standards.

An important outcome of the Airport Master Plan process is a recommended development plan which reserves sufficient areas for future facility needs. Such planning will protect development areas and ensure they will be readily available when required to meet future needs. The intended outcome of this study is a detailed on-airport land use concept which outlines specific uses for all areas of airport property, including strategies for revenue enhancement.

The City of Flagstaff recognizes the importance of air transportation to the surrounding region, as well as the unique challenges that operating an airport presents. The investment in an airport yields many benefits to both the community and the region which it serves. With a sound and realistic plan in place, Flagstaff Airport will continue to remain an important link to the regional and national air transportation systems and will maintain the public and private investments in its facilities.

STUDY OVERVIEW

The City of Flagstaff is responsible for funding capital improvements at the airport, as well as obtaining FAA and Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group) development grants. In addition, the city oversees facility enhancements and infrastructure development conducted by private entities at the airport. The Master Plan is intended to provide guidance for future development and justification for projects which the airport may receive funding through an updated capital improvement program (CIP) to demonstrate the future investment required by the City of Flagstaff, as well as the FAA and ADOT-MPD – Aeronautics Group.

The Airport Master Plan will follow a systematic approach outlined by the FAA to identify existing and future airport needs in advance of the actual need for improvements. This is done to ensure that the City of Flagstaff and airport administration can coordinate environmental reviews, project approvals, design, financing, and construction to minimize the negative effects of maintaining and operating inadequate or insufficient facilities. The intended result is a recommended development concept which outlines the proposed uses for all areas of airport property.

The City of Flagstaff has contracted with the airport planning firm of Coffman Associates, Inc. to undertake the Airport Master Plan. The study is prepared in accordance with FAA requirements, including Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, and AC 150/5300-13A, *Airport Design*.

MASTER PLAN GOALS AND OBJECTIVES

The primary objective of the Flagstaff Airport Master Plan is to develop and maintain a financially feasible, long term development program, which will satisfy aviation demand of the region while also being compatible with area development, other transportation modes, and the environment. Accomplishing this objective requires an evaluation of the existing airport so as to make a determination of what actions should be taken to maintain a safe, adequate, and reliable airport facility.



This Airport Master Plan is intended to provide guidance through an updated capital improvement and financial program to demonstrate the future investments required by the city. The new planning study also provides justification for new priorities. The plan will be closely coordinated with other planning studies in the area and with aviation plans developed by the FAA and ADOT-MPD – Aeronautics Group. The plan will also be coordinated with the recently completed *Flagstaff Airport Sustainability Master Plan*. As a result of incorporating sustainability elements into this planning process, the airport can become a more environmentally friendly economic center and neighbor.

While an Airport Master Plan must be developed according to FAA requirements, it can also be prepared in a manner which makes it useful in strategic planning for the airport. The FAA requires specific elements within a Master Plan. The elements, to be detailed in the following section, are guidelines which allow for a systematic and technical approach to reach the final recommended plan.

Specific goals and objectives to be considered in the Airport Master Plan include:

- Maintain and ensure the safety and security of the airport.
- Justify the proposed development through the technical, economic, and environmental investigation of concepts and alternatives.
- Determine the projected facility needs of airport users over the next 20 years.
- Provide an effective graphic presentation of the development of the airport and anticipated land uses in the vicinity of the airport.
- Establish a realistic schedule for the implementation of the development proposed in the plan, particularly the short-term capital improvement program.
- Propose an achievable financial plan to support the implementation schedule.
- Present a plan that adequately addresses the issues and satisfies local, state, and federal regulations.
- Consider environmental stewardship in the study process.
- Research and evaluate socioeconomic factors likely to affect the air transportation demand in the region.
- Recommend improvements that will enhance the airport's safety, efficiency, and capability to serve the area's aviation needs.
- Incorporate the results of the recently completed *Flagstaff Airport Sustainability Master Plan*.
- Conduct an aeronautical survey in compliance with applicable FAA guidelines and incorporate Airport Geographic Information System (AGIS) databases.
- Produce current and accurate airport base maps and an updated Airport Layout Plan (ALP).
- Conduct an airport economic benefit analysis which will measure and analyze the economic benefits created by the airport for the City of Flagstaff and surrounding region.
- Develop a robust and productive public involvement program throughout the planning process.

BASELINE ASSUMPTIONS

A study such as this typically requires some baseline assumptions that will be used throughout the analysis. The baseline assumptions for this study include:

- The airport will continue to operate as a publicly owned commercial service airport through the planning period.
- The airport will continue to serve general aviation and corporate business aviation tenants as well as other itinerant operators.
- A federal and state airport improvement program will be in place through the planning period to assist in funding capital development needs.

MASTER PLAN ELEMENTS AND PROCESS

The Airport Master Plan is being prepared in a fashion pursuant to the scope of services that has been coordinated with the City of Flagstaff, FAA, and ADOT-MPD – Aeronautics Group. The study has 10 specific elements that are intended to assist in the identification of future facility needs and which provide the supporting rationale for their implementation. **Exhibit A** provides a graphical depiction of the elements and process involved with the study.

Element 1 – Initiation includes the development of the scope of services, budget, and schedule. A Planning Advisory Committee (PAC) is also formed and study material will be assembled in a workbook format. General background information will be established that will include outlining the goals and objectives to be accomplished during the Master Plan.

Element 2 – Inventory summarizes facilities and operational data, area airspace, weather conditions, population and economic data, vicinity land uses, and environmental conditions of the airport and surrounding area. New aerial photography and planimetric mapping of the airport is also obtained to aid in the study process. An AGIS survey is also implemented into this element and includes the collection of airport and aeronautical data to meet the demands of the Next Generation National Airspace System.

Element 3 – Forecasts examines the potential aviation demand for commercial service, general aviation, air taxi, and military activity at the airport over a 20-year period. Specific indicators for based aircraft, aircraft operations, commercial service passenger enplanements, and peaking characteristics will be analyzed. The results of this effort are used to determine the types and sizes of facilities which would be required to meet the projected aviation demand at the airport through the long term planning period.

Element 4 – Facility Requirements converts aviation demand needs into types and volumes of actual physical facilities required to meet existing and forecast demands in aviation activity. The critical design aircraft and physical planning criteria based upon AC 150/5300-13A, *Airport Design*, is also established in preparation of a needs assessment for airside and landside facilities.

Element 5 – Airport Alternatives considers a variety of solutions to accommodate projected airside and landside facility needs through the long term planning period. An analysis is completed to identify the strengths and weaknesses of each proposed development alternative, with the intention of determining a single direction for development.



STUDY INITIATION

- Scope of Service
- Establish PAC
- Goals and Objectives

Planning Advisory Committee

INVENTORY

- Airport Facilities
- Airspace and Air Traffic Activity
- Airport Access and Parking, Utilities, and Aerial Photography
- Area Socioeconomic Data
- Local Planning and Land Use
- AGIS Survey

Working Papers

FORECASTS

- Based Aircraft and Fleet Mix
- Annual Operations
- Commercial Passenger Enplanements

Working Papers

FACILITY REQUIREMENTS

- Design Categories
- Runway Length and Strength
- Support Facilities
- Taxiways
- Airfield Capacity
- Hangar Facilities
- Terminal Building
- Aprons
- Navigational Aids

Working Papers

Planning Advisory Committee

Public Information Workshop

AIRPORT ALTERNATIVES

- Evaluate Development Scenarios
  - Airside
  - Landside
  - Support

Working Papers

Planning Advisory Committee

Public Information Workshop

RECOMMENDED MASTER PLAN CONCEPT/ CAPITAL PLAN

- Detailed Master Plan Facility and Land Use Plans
- Economic Benefit Analysis
- Airport Development Schedule
- Cost Estimates
- Funding Sources

ENVIRONMENTAL EVALUATION

- Review/Evaluation of NEPA Environmental Categories
- Sustainable Management Plan

Working Papers

Planning Advisory Committee

Public Information Workshop

AIRPORT LAYOUT PLANS

- Airport Layout Plan
- Landside Drawing
- Airspace/Approach Drawings
- On-Airport Land Use Plan
- Property Map





Element 6 – Recommended Master Plan Concept/Capital Program provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the airport following input from the PAC, FAA, ADOT-MPD – Aeronautics Group, City of Flagstaff officials, and the general public. A detailed CIP is included which defines the schedule and costs for the recommended development projects. In addition, an economic benefit analysis is conducted to measure and analyze the economic impacts of Flagstaff Airport.

Element 7 – Airport Layout Plan (ALP) Drawing Set is developed to depict existing and proposed facilities and provides the official ALP drawings that are produced as a result of the recommended development plan. These drawings are used by the FAA and ADOT-MPD – Aeronautics Group in determining grant eligibility and funding.

Element 8 – Environmental Evaluation provides the City of Flagstaff with proper guidance regarding, and to facilitate compliance with, the *National Environmental Policy Act* (NEPA). Throughout the study process, environmental factors are evaluated that assess existing and future conditions on and adjacent to the airport. This preliminary environmental evaluation follows FAA guidelines in implementing NEPA. A sustainability management plan will also be prepared that incorporates the recommended goals, objectives, and policies of the *Flagstaff Airport Sustainability Master Plan*.

Element 9 – Public Coordination and Communication provides opportunities to inform the public on the Master Plan process. Working papers are prepared at various milestones in the planning process. A series of PAC meetings and Public Information Workshops are also planned during the process to discuss study findings.

Element 10 – Final Reports and Approvals provide documents which depict the findings of the study effort and present the study and its recommendations to appropriate local organizations. The final document incorporates the revisions to previous working papers prepared under earlier elements into a usable Master Plan document.

STUDY PARTICIPATION

The Flagstaff Airport Master Plan is of interest to many within the local community and region. This includes local citizens, local businesses, community organizations, city officials, airport users, airport tenants, and aviation organizations. As a component of the regional, state, and national aviation systems, the Master Plan is of importance to both state and federal agencies responsible for overseeing the air transportation system.

To assist in the development of the Airport Master Plan, the City of Flagstaff has identified a group of stakeholders including government representatives, airport users and tenants, and local community leaders to act in an advisory role in the development of the Master Plan. Members of this PAC will meet four times at designated points during the study to review study materials and provide comments to



help ensure that a realistic, viable plan was developed. **Table A** provides a list of those entities that are represented on the PAC.

TABLE A
Planning Advisory Committee - Representing Entities
Flagstaff Airport Master Plan

City of Flagstaff - Flagstaff Airport
City of Flagstaff – Finance and Budget Department
City of Flagstaff – Economic Vitality Department
City of Flagstaff – Community Development Department
City of Flagstaff – Sustainability and Environmental Management Section
Flagstaff Airport Commission
Federal Aviation Administration
Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group
Flagstaff Airport Traffic Control Tower
Arizona Military Airspace Working Group
National Business Aviation Association
Experimental Aircraft Association
Arizona Pilots Association
Airport Tenant – Wiseman Aviation
Airport Rental Car Companies
Coconino County – Planning Department
Northern Arizona University
American Airlines
Greater Flagstaff Chamber of Commerce
Arizona State Land Department
Gore Industries
Local Citizen Representative

A series of open house Public Information Workshops are also conducted as part of the study coordination effort. These workshops are designed to allow any and all interested persons to become informed and provide input concerning the Master Plan process. Notices of meeting times and locations are advertised through local media outlets. Draft working papers and other information related to the Master Plan are available to the public via a website dedicated to the study at: **http://flagstaff.airportstudy.com**.

FLAGSTAFF AIRPORT

CHAPTER ONE
Inventory






FLAGSTAFF AIRPORT

Chapter One
INVENTORY







Preparation of the Flagstaff Airport Master Plan begins with a collection and summary of baseline information pertaining directly to or influencing the airport and the area it serves. This information is used in subsequent analyses and has been gathered during an on-site inspection of the airport, interviews with airport staff, commercial operators, and other airport tenants. Documents, including the *Flagstaff Regional Plan 2030 – Place Matters* (As Amended 2015), *Flagstaff Airport Sustainability Plan* (2015), *Flagstaff Pulliam Airport Master Plan* (2007), *Flagstaff Pulliam Airport Noise Compatibility Plan* (2005), and *Flagstaff Pulliam Airport Noise Exposure Maps* (2004), were also used in the preparation of this study. Information was also obtained from outside resources, including documents prepared by the Federal Aviation Administration (FAA), City of Flagstaff, Coconino County, and other pertinent regional planning and economic development agencies. The information presented in this chapter includes:

- Background information related to the City of Flagstaff and surrounding region, including descriptions of the local geography, regional climate, and surface transportation systems.

- Physical inventories and descriptions of current facilities and services offered at the airport. The analysis includes airfield and landside infrastructure and services.

- Descriptions of the local and regional airspace, regional airport facilities, air traffic control, and aircraft operating procedures.

- Flagstaff Airport's role in regional, state, and national aviation systems. Development at the airport since the completion of the previous Master Plan will also be discussed.

- A review of existing local and regional plans and studies which will be utilized later in the process to determine their potential influence on the development and implementation of this Airport Master Plan.

- A summary of socioeconomic characteristics for the region, state, and nation.

- Review of existing environmental conditions and sensitivities, on or near the airport, to be factored into the recommended development plan determined later in the study process.

REGIONAL SETTING

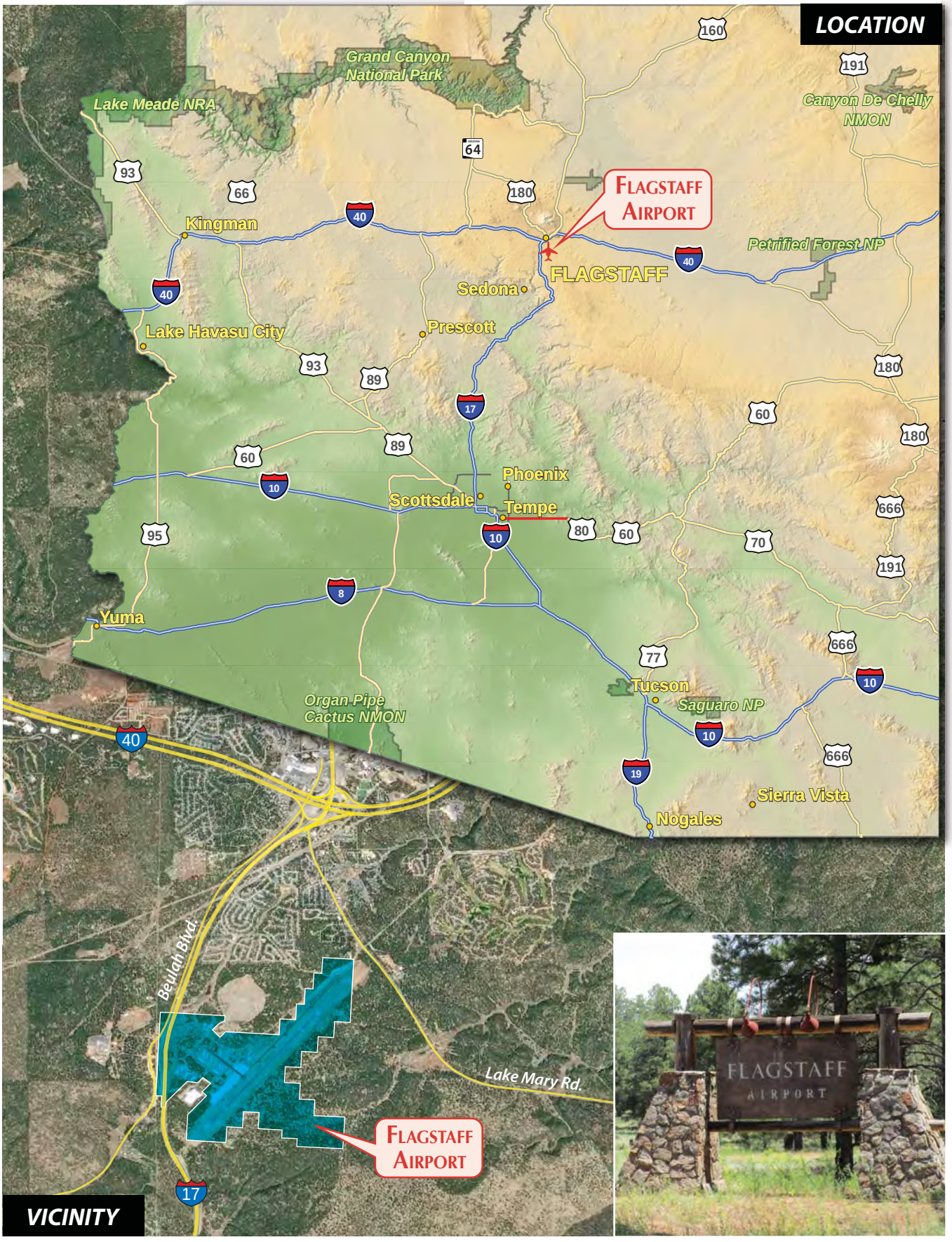
The City of Flagstaff, with an estimated population of more than 70,000, is located at the base of the San Francisco Peaks in Coconino County, Arizona. Flagstaff is the county seat and is also the largest city in Coconino County with approximately 50 percent of the county population residing in the city. Located at approximately 7,000 feet above mean sea level (MSL), Flagstaff is a year-round tourist destination with more than five million visitors annually. Attractions in the area include numerous National Monuments and other public lands, snow sports, hiking and cycling, and many other cultural and recreational opportunities.

AIRPORT LOCATION



Airport Entrance
Source: Coffman Associates

The airport is located southwest of the City of Flagstaff. At an elevation of 7,014 feet MSL, the airport's location is higher than any other in the State of Arizona. The airport is located adjacent to lands within Coconino National Forest, a 1.856-million-acre area managed by the United States Forest Service. The airport itself is comprised of 795 acres of land owned by the City of Flagstaff and includes additional land located on two avigation easements from the United States Forest Service, an agency of the United States Department of Agriculture. These easements total an additional 313.45 acres. The location of the airport is shown on **Exhibit 1A**.


LOCATION
Grand Canyon National Park
Lake Meade NRA
Canyon De Chelly NMON
Kingman
FLAGSTAFF AIRPORT
FLAGSTAFF
Petrified Forest NP
Sedona
Lake Havasu City
Prescott
Phoenix
Scottsdale
Tempe
Yuma
Tucson
Saguaro NP
Organ Pipe Cactus NMON
Sierra Vista
Nogales
Beulah Blvd.
Lake Mary Rd.
FLAGSTAFF AIRPORT
VICINITY

FLAGSTAFF
AIRPORT

TRANSPORTATION NETWORK

The City of Flagstaff is accessed from Interstate Highways 17 and 40. Interstate Highway 17, much of which is known as the Arizona Veterans Highway, extends south from Flagstaff and connects to Phoenix, and is located immediately west of the airport. Interstate Highway 40, a major east-west route through the south-central portion of the United States, extending west to Barstow, California and east to Wilmington, North Carolina, and is located approximately two miles north of the airport.

U.S. Highways also provide access to Flagstaff. U.S. Highway 89 provides a north-south link through Flagstaff, running north to Page, Arizona, then to Utah. To the south, it extends to Wickenburg, Arizona. State Highway 89A runs south from Flagstaff, past the airport, and through Sedona before reuniting with U.S. 89 at Prescott. U.S. Highway 180 runs northwest from Flagstaff to Grand Canyon National Park. These highways serve as key arterial roadways within the city as well. Another arterial route, Lake Mary Road, runs on the north side of the airport, but does not provide direct access to the airport.

Primary access to the airport is from John Wesley Powell Boulevard which extends from an interchange with Interstate 17. South Pulliam Drive connects to the terminal area and West Shamrell Boulevard provides access to office buildings and hangar facilities. Both of these routes connect to John Wesley Powell Boulevard. **Table 1A** summarizes average daily traffic volumes based on City of Flagstaff data for the routes near the airport.

TABLE 1A
Traffic Counts (Flagstaff Airport Area)

			Average Daily Volume		
Route	**Between**	**Direction**	**1999**	**2006**	**2013**
I-17	Lake Mary Rd & Airport Exit	NB	15,243	13,867	9,704
I-17	Lake Mary Rd & Airport Exit	SB	14,871	14,207	10,046
JW Powell Blvd	I-17 Airport Exit Ramp & Shamrell Blvd	EB	1,750	2,004	1,994
JW Powell Blvd	I-17 Airport Exit Ramp & Shamrell Blvd	WB	1,642	1,680	1,722
Pulliam Dr	John Wesley Powell & Amethyst	NB	677	724	753
Pulliam Dr	John Wesley Powell & Amethyst	SB	882	666	701
Beulah Blvd	Mountain Dell & John Wesley Powell	NB	1,798	1,161	1,618
Beulah Blvd	Mountain Dell & John Wesley Powell	SB	2,494	1,545	2,158

Source: *City of Flagstaff Traffic Volumes 2003-2012*

Public transportation within the City of Flagstaff is operated by Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA). NAIPTA operates the Mountain Line bus system which includes eight routes, none of which connect to the airport. Taxi and ride-hailing services that provide transportation to and from the airport are also available in Flagstaff.

The Flagstaff Urban Trails system includes routes which connect to the airport from the City of Flagstaff via the Ponderosa Trail and a bike lane along South Pulliam Drive.

REGIONAL CLIMATE

Climatic conditions must be considered in the planning and development of an airport. Average temperature is a significant factor in determining runway length needs, while local wind patterns can affect the operation and capabilities of the runway system. The need for navigational aids and lighting can be determined by evaluating the prevailing visibility and cloud ceiling conditions. **Table 1B** summarizes historic climate data based on readings from the Flagstaff Airport automated surface observing system (ASOS). As indicated in the table, the average high temperature is greatest during July and the lowest temperatures are experienced in January. Average monthly precipitation ranges between a high of 2.73 inches in July and a low of 0.44 inches in June. Snowfall most commonly occurs between October and May, with the greatest amounts occurring November through April.

TABLE 1B
Historic Climate Data
Flagstaff, Arizona

Period	Average Total Precipitation (in.)[1]	Average Total Snowfall (in.)[1]	Average Daily Max Temp (F)[1]	Average Daily Low Temp (F)[1]	Average Wind Speed (mph)[1]
January	2.07	19.9	42.2	15.3	6.2
February	2.01	16.3	44.8	18.0	7.1
March	2.03	18.1	50.2	22.4	7.1
April	1.25	7.3	58.5	28.0	8.9
May	0.62	1.7	68.0	34.3	8.0
June	0.44	0.0	78.0	41.8	7.8
July	2.47	0.0	81.6	50.9	5.6
August	2.73	0.0	79.1	49.8	4.4
September	1.91	0.1	73.5	41.9	5.4
October	1.49	1.6	63.4	31.5	5.8
November	1.60	8.6	51.6	22.5	6.2
December	2.03	15.6	43.4	16.6	6.2

[1]Source: Western Region Climate Center as sourced from the on-airport automated surface observation system (ASOS)

KEY:
in. - Inches
MPH - Miles per hour
F - Degrees Fahrenheit

AIRPORT HISTORY

Flagstaff Airport was constructed in 1949 on United States Forest Service land deeded to the City though the *Federal Airport Act*. The airport replaced Koch Field, the site of which is approximately 10 miles northwest of the current airport and had served Flagstaff since 1929. The Koch Field site was subject to adverse wind conditions during the winter months; therefore, the decision was made to construct a new airport. The replacement airport was named in honor of Charles "Maggie" Pulliam, Flagstaff's city manager for 44 years. Originally constructed to a length of 5,300 feet, the runway was lengthened to 6,300 feet in 1955. Two additional runway extensions occurred; the first, in 1969, increased the length to 6,999 feet and the second, in 2007, brought the runway to its current length of 8,800 feet.

The airport traffic control tower (ATCT) was constructed in 1975. It remained operational until the FAA air traffic controllers' strike in September 1981. Nationwide, controllers were subsequently fired, resulting in many towers being closed while new controllers were hired and trained. The Flagstaff ATCT reopened in 1984 and has operated continuously since that time.

Much of the hangar development at the airport occurred during the late 1970s and 1980s, with the construction of two hangars, Peabody Coal Company and Arizona Department of Public Safety in 1979. This was followed by construction of many of the airport-owned T-hangars and shade hangars west of the terminal area in the 1980s. The current passenger terminal facility was constructed in 1993 to replace the original terminal building which was built in 1950.

During the 2000s, the airport received grant funding to design and implement a runway extension project which was completed in 2007. The purpose of the project was to meet the needs of both existing and anticipated future users of the airport. Since that time, additional projects have been undertaken, including reconstruction of the commercial ramp area and the southern portion of parallel Taxiway A. Other projects at the airport include electrical system upgrades and reconstruction of the taxiway which connects to the general aviation complex west of the runway system.

CAPITAL IMPROVEMENT HISTORY

Many of the projects described above were funded through grants from FAA and/or the State of Arizona combined with local matching funds provided by the City of Flagstaff. To assist in funding capital improvements at airports, FAA established the Airport Improvement Program (AIP). The AIP is the mechanism for administering federal grants through the Aviation Trust Fund, which was established in 1970 to provide funding for aviation capital investment programs, including aviation development, facilities and equipment, and research and development. The Aviation Trust Fund is also used to finance a portion of the operation of the FAA. The Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group) also provides funding assistance to the airport by providing matches to FAA grants and, in some instances, funding a project through a state grant only.

A summary of the grants received for airport improvements is included in **Table 1C**. As indicated in the table, since 2002 more than $40.8 million has been invested in improvements at the airport. Of that, the FAA has contributed 80.6 percent, ADOT-MPD – Aeronautics Group has contributed 14.6 percent, and the local share is 4.8 percent.

TABLE 1C
Grant Summary (2002-Present)
Flagstaff Airport

FY	FAA/EDA/DOT	ADOT	Project Description	Federal	State	Local
2002	AIP 22	E2F31	Master Plan Update	$1,000,000	$49,088	$49,088
2003	AIP 23	E4F21	ARFF & ARFF Vehicle	$3,050,600	$149,749	$149,749
2003	AIP 24	E5F59	Air Rescue Firefighting Facility, Phase II	$413,261	$10,876	$10,875

TABLE 1C (Continued)
Grant Summary (2002-Present)
Flagstaff Airport

FY	FAA/EDA/DOT	ADOT	Project Description	Federal	State	Local
2005	AIP 25	E5F60	Environmental Assessment	$120,000	$3,158	$3,158
2006	AIP 26	E6F49	Completion of EA For Runway 3-21, Phase III	$247,000	$6,500	$6,500
2006	AIP 27	E6F75	John Wesley Powell & Pulliam Drive Widening	$1,016,825	$26,760	$26,757
2007	AIP 28	E7F42	Conduct Enviro Assessment for Runway 3, Phase IV	$218,500	$5,750	$5,750
2007	AIP 29	E7F43	Widen Airport Access John Wesley Powell, Phase II	$500,000	$13,157	$13,158
2007	AIP 30	3-04-0015-030-2005	Extension of Runway 3/21 to the NE	$10,483,414	N/A	$551,759
2007	Part of AIP 30	E7S01	Extension of Runway 3/21 to the NE	N/A	$1,420,350	$157,817
2007	AIP 30 Match	E7S29	Extension of Runway 3/21 to the NE	N/A	$1,079,650	$119,961
2008	Part of AIP 30	E8S14	Extension of Runway 3/21 to the NE	N/A	$2,000,000	$222,222
2008	AIP31	N/A	Extension of Runway 3/21 Phase II	$1,000,000	N/A	$52,632
2008	AIP32	E9F17	Acquire Snow Removal Equipment, Extend Runway 3/21, Terminal Improvements	$1,818,622	$47,858	$47,858
2009	AIP 33	E9F38	Security Enhancements, Extend Runway 3/21	$1,563,050	$41,133	$41,133
2010	AIP 34	E1F26	Acquire Snow Removal Equipment, Improve Airport Pavement Markings, Reconstruct South Parallel Taxiway A & Perform Airfield Electrical Upgrades	$1,223,613	$32,201	$32,201
2011	AIP 35	E2F2C	Taxiway A Rehab & Electrical Upgrades	$3,512,782	$92,441	$92,441
2011	DOT	N/A	Small Community Air Service Development Revenue Guarantee	$800,000	N/A	N/A
2012	N/A	E2S1X	Apron Reconstruction-Commercial ramp joint repairs, including replacement of backer rod spacers and sealing joints	N/A	$201,339	$22,371
2013	N/A	E3S3E	Design drainage improvements Phases I & II (West Plex Taxilane Reconstruction)	N/A	$498,886	$55,432
2013	AIP 36	E4F3P	Westplex Taxilane Reconstruction	$4,905,017	$240,780	$240,780
2013	AIP 37	E4F30	Sustainability Master Plan	$270,000	$13,254	$13,254
2015	AIP 38	E5F3R	Rehabilitate Runway 3/21 - Design Only	$293,500	$14,408	$14,408
2015	AIP 39	E6F2U	Update Airport Master Plan with AGIS and ALP	$500,000	$24,544	$24,545
2016	AIP 40	N/A	Wildlife Hazard Assessment/Wildlife Assessment Management Plan	$150,000	$7,363	$7,364
			TOTAL	$33,086,184	$5,979,245	$1,961,213
			FUNDING PERCENTAGES	80.6%	14.6%	4.8%

Source: Flagstaff Airport records
N/A – Not Applicable

AIRPORT OPERATIONS

Aircraft operations, defined as a takeoff or landing, are classified as either local or itinerant. Local operations consist mostly of aircraft training operations conducted within the airport traffic pattern, and touch-and-go and stop-and-go operations. Itinerant operations are arriving or departing aircraft which have an origin or destination away from the airport.

Aircraft operations are further sub-classified into four general categories: air carrier, air taxi, general aviation, and military. Air carrier operations are defined as those conducted commercially by aircraft having a seating capacity of 60 or more and/or a maximum payload capacity of 18,000 pounds. Air taxi operations can include small commercial service aircraft operations, as well as general aviation type aircraft for the "on-demand" commercial transport of persons and property in accordance with Title 14 Code of Federal Regulations (CFR) Part 135 and Subchapter K of Title 14 CFR Part 91.

Commercial service operations at Flagstaff Airport are classified as air taxi. Air carrier operations typically include mainline passenger and cargo airlines. Commercial service operations counted as air taxi are represented by regional airlines utilizing small regional jets or turboprop aircraft while hauling under the banner of the mainline carriers. General aviation operations include a wide array of aircraft use, ranging from personal to business and corporate uses. Military aircraft also operate at the airport. **Exhibit 1B** summarizes annual historical airport operations.

Exhibit 1B also presents the annual aircraft operations as counted by the ATCT at Flagstaff Airport since 1997. The exhibit includes two categories of itinerant operations: instrument flight rules (IFR) and visual flight rules (VFR) operations. IFR operations are those conducted during instrument weather conditions or during VFR but under a completed instrument flight plan.

BASED AIRCRAFT

A based aircraft generally refers to a general aviation aircraft stored at a specific airport which is used as a home base. Identifying the current number of based aircraft at an airport is important to Master Plan analysis, yet it can be challenging due to transient nature of aircraft storage. An aircraft owner may choose to store an aircraft at multiple airports during the course of a year. Additionally, there are no FAA requirements for aircraft owners to specify a home base airport for their registered aircraft. Based on airport records, there are currently 139 civilian-based aircraft at the airport, including single and multi-engine piston aircraft, turboprop aircraft, helicopters, and gliders. Based aircraft fleet mix information is also presented on **Exhibit 1B**.

COMMERCIAL AIR SERVICE

Commercial service airports provide local and regional access to the national and international aviation systems. It is well documented that these airports are vital to interstate commerce and a key component



FLAGSTAFF AIRPORT

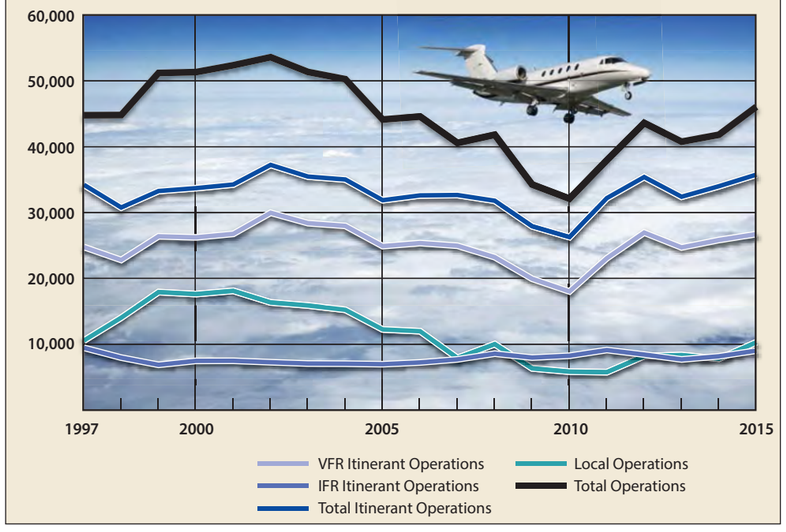
Year	IFR Itinerant Operations					VFR Itinerant Operations					Total Itinerant Operations					Total Local Operations			Total Operations	Annual Enplanements
	AC	AT	GA	MIL	SUB	AC	AT	GA	MIL	SUB	AC	AT	GA	MIL	SUB	GA	MIL	SUB		
1997	0	7,188	2,259	14	9,461	14	4,635	19,936	180	24,765	14	11,823	22,195	194	34,226	10,450	107	10,557	44,783	46,704
1998	1	5,329	2,605	39	7,974	204	3,429	18,936	230	22,799	205	8,758	21,541	269	30,773	13,916	119	14,035	44,808	39,573
1999	0	4,262	2,570	47	6,879	2	2,994	23,173	225	26,394	2	7,256	25,743	272	33,273	17,811	112	17,923	51,196	36,656
2000	0	4,551	2,909	17	7,477	10	2,909	23,173	138	26,230	10	7,460	26,082	155	33,707	17,450	172	17,622	51,329	34,483
2001	0	4,332	3,087	74	7,493	0	3,791	22,644	331	26,766	0	8,123	25,731	405	34,259	17,829	283	18,112	52,371	31,370
2002	10	4,264	2,898	100	7,272	4	5,011	24,549	403	29,967	14	9,275	27,447	503	37,239	16,033	321	16,354	53,593	37,257
2003	3	4,286	2,709	76	7,074	51	5,154	22,832	354	28,391	54	9,440	25,541	430	35,465	15,363	525	15,888	51,353	36,400
2004	4	4,586	2,397	63	7,050	2	4,342	23,268	362	27,974	6	8,928	25,665	425	35,024	14,756	474	15,230	50,254	40,064
2005	4	4,390	2,472	107	6,973	0	3,716	20,852	336	24,904	4	8,106	23,324	443	31,877	11,800	450	12,250	44,127	41,180
2006	2	4,470	2,677	90	7,239	19	4,301	20,606	442	25,368	21	8,771	23,283	532	32,607	11,544	438	11,982	44,589	41,996
2007	4	4,899	2,714	87	7,704	0	4,568	19,820	574	24,962	4	9,467	22,534	661	32,666	7,403	511	7,914	40,580	45,770
2008	600	5,009	2,807	157	8,573	18	3,936	18,500	770	23,224	618	8,945	21,307	927	31,797	9,270	751	10,021	41,818	54,553
2009	1,023	4,456	2,372	128	7,979	5	2,901	16,511	527	19,944	1,028	7,357	18,883	655	27,923	5,836	506	6,342	34,265	68,056
2010	500	5,295	2,273	189	8,257	2	2,510	14,934	574	18,020	502	7,805	17,207	763	26,277	5,551	290	5,841	32,118	68,296
2011	27	6,715	2,201	183	9,126	10	4,402	18,098	556	23,066	37	11,117	20,299	739	32,192	5,359	404	5,763	37,955	63,136
2012	20	6,440	1,806	172	8,438	1	5,622	20,743	591	26,957	21	12,062	22,549	763	35,395	7,721	490	8,211	43,606	63,971
2013	44	5,670	1,802	180	7,696	68	6,145	18,129	365	24,707	112	11,815	19,931	545	32,403	7,999	359	8,358	40,761	56,875
2014	20	5,909	1,914	327	8,170	0	6,836	18,345	652	25,833	20	12,745	20,259	979	34,003	7,405	410	7,815	41,818	68,754
2015	15	6,188	2,459	369	9,031	2	7,748	18,153	824	26,727	17	13,936	20,612	1,193	35,758	9,669	629	10,298	46,056	67,421

Source: FAA Operational Network (OPSNET)
database access on 11.11.16 at - https://aspm.faa.gov/

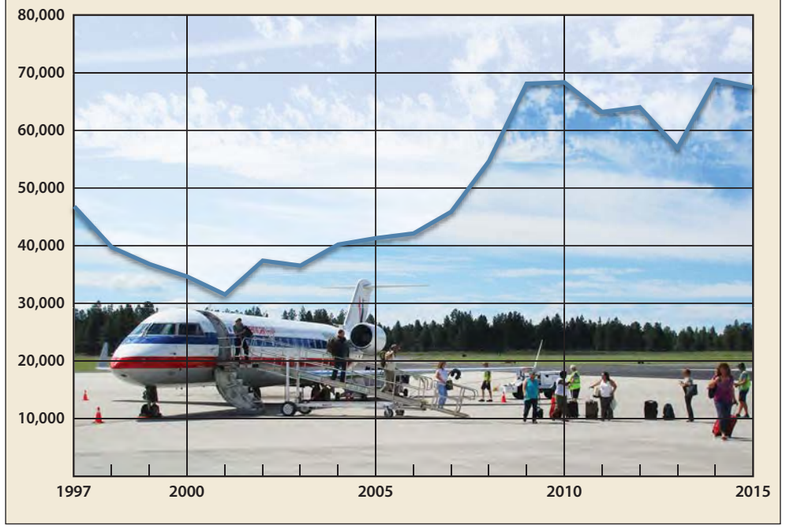
Key:

AC - Air Carrier (commercially operated aircraft having seating capacity more than 60 seats or a maximum payload capacity of 18,000 pounds)
AT - Air Taxi (commercially operated aircraft having 60 or fewer passenger seats or less than 18,000 pounds maximum payload capacity)
IFR - Instrument Flight Rules
VFR - Visual Flight Rules
GA - General Aviation
MIL - Military
SUB - Subtotals

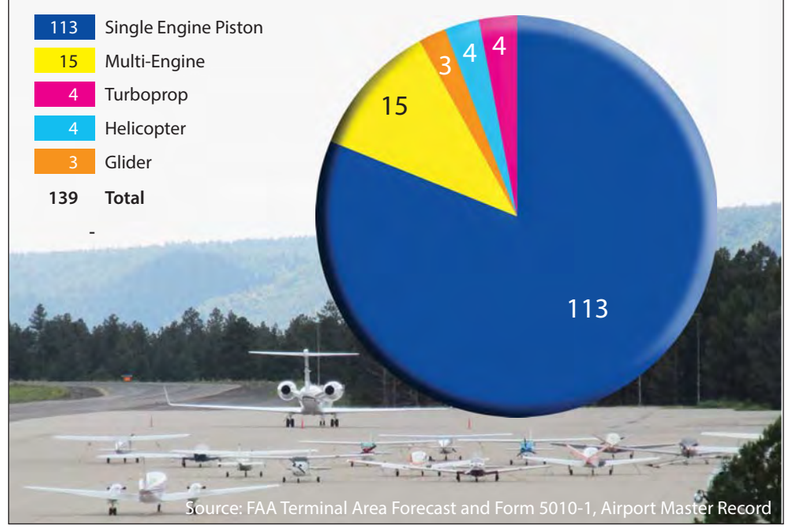
ANNUAL OPERATIONS



ANNUAL ENPLANEMENTS



BASED AIRCRAFT FLEET MIX - EXISTING



Source: FAA Terminal Area Forecast and Form 5010-1, Airport Master Record

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to local and regional economic infrastructure. These facilities support growth in all socioeconomic categories.

The annual total of revenue from passengers boarding an aircraft at the airport, referred to as enplanements, is the metric utilized by the FAA to determine the annual level of entitlement funding dedicated to the airport under the AIP. Currently, an airport must reach 10,000 annual enplanements to be eligible for a minimum one million dollars in annual entitlement funds from FAA. Airline passenger enplanements are typically influenced by many factors, including number of airlines serving the airport, frequency of daily departures, types of aircraft used, and diversity of number of non-stop destinations. Historical enplanement data for the airport is provided on **Exhibit 1B**. As indicated on the exhibit, the airport consistently exceeds FAA's enplanement threshold for entitlement funding eligibility.

Commercial service at the airport dates to 1950 when Frontier Airlines initiated service in June of that year. Frontier served the airport continuously for nearly three decades until leaving in 1979 with the advent of airline deregulation. Flagstaff Airport is currently served by American Airlines through an agreement with SkyWest Airlines which offers daily service to Phoenix Sky Harbor International Airport. As of November 2016, there are three daily flights departing every day of the week. This is anticipated to change to four daily flights in early 2017. These operations are conducted with Bombardier CRJ-700 regional jets which seat 70 passengers.

AIRPORT ADMINISTRATION

Flagstaff Airport is owned and operated by the City of Flagstaff and is included within the Department of Economic Vitality. A full-time Airport Director, who reports to the City's Economic Vitality Director, has responsibility for the overall management, maintenance, and operations of the airport. Additionally, airport staff includes one administrative specialist, an operations and airport rescue and firefighting (ARFF) manager, and six operations and ARFF specialists.

The City of Flagstaff is governed by a mayor, vice mayor, and five city councilmembers. Additionally, the City of Flagstaff employs a City Manager. The City of Flagstaff has also established an Airport Commission which reports to the City Council on development within the Airpark and matters affecting the operation and efficiency of the airport. The Airport Commission holds monthly meetings at the airport and consists of seven members appointed by the City Council.

The City of Flagstaff enacted Rules and Regulations, codified under Chapter 8-06 of the city ordinances, to ensure the safe, orderly, and efficient operation of the airport. The City has also adopted Minimum Standards for the airport in 2004. The Minimum Standards identify threshold entry requirements for those wishing to provide aeronautical services to the public. Additionally, the Minimum Standards insure that those who provide commodities and services at the airport are not exposed to unfair or irresponsible competition.

PASSENGER FACILITY CHARGES

Flagstaff Airport collects a passenger facility charge (PFC). PFCs are authorized by 14 CFR Part 158 and are administered by the FAA. PFCs collected from qualified enplaned passengers are used to fund eligible projects. An airport operator can impose a PFC of up to $4.50 per eligible, enplaned passenger. Once a PFC is imposed, it is added to the ticket price paid by passengers enplaning at the airport, collected by the airlines, and remitted to the airport operator, less an allowance for airline processing expenses. Projects that are eligible for funding with PFC include those that preserve or enhance the capacity, safety, or security of the air transportation system; reduce noise or mitigate noise effects; or furnish opportunities for enhanced competition between or among air carriers. PFCs cannot be used for revenue-generating facilities at airports, such as restaurants and other concession space, rental car facilities, revenue producing public parking facilities, or construction of exclusively leased space or facilities.

The airport's most recent PFC application was submitted in 2015 and includes funding for the following future projects:

- Pavement Mill & Overlay for Runway 3/21
- Environmental Assessment for heliport and land acquisition and perimeter road improvements

FLAGSTAFF AIRPORT SUSTAINABILITY PLAN

The *Flagstaff Airport Sustainability Plan*, completed in 2015, outlines a holistic approach to airport operations. The plan defines sustainability at Flagstaff Airport as an integrated approach to, "managing an airport as to ensure the integrity of the Economic viability, Operational efficiency, Natural Resource Conservation, Social responsibility, and Resiliency of the Airport." The airport aligned the goals of this plan with the City of Flagstaff's *Municipal Sustainability Plan* (2013 – 2014) to extend the benefits beyond just this facility, but also to the community and broader region. The *Flagstaff Airport Sustainability Plan* commits the airport to retire some existing practices to make room for more efficient policies and new technologies to achieve the goals it sets. Using input from stakeholders in the community, the plan focuses on the following ten categories:

- Air Quality
- Community Well-Being
- Energy
- Dark Skies
- Natural Resource Management
- Land Use
- Planned Development
- Resiliency and Preparedness
- Waste Management
- Water

For each category, there are accompanying goals and metrics for the airport to strive toward. Additionally, the *Flagstaff Airport Sustainability Plan* outlines the implementation and monitoring requirements to ensure it is put to use and remains relevant. The plan calls for monthly activities, including a review of initiatives and data tracking, to make monitoring a part of the airport's culture. It is also recommended that airport staff meet with the City of Flagstaff sustainability staff three times per year for checkups,

along with the preparation of an annual sustainability report. Lastly, every two years airport staff will review all aspects of the plan and adjust as necessary to ensure it remains suited to the ever-changing conditions.

The recommendations of the recently completed *Flagstaff Airport Sustainability Plan* will be further considered during this Master Plan. Its recommended goals, objectives, and policies will become the basis for an Airport Sustainability Management Plan to be incorporated later in the study process (see **Appendix B**).

AIRPORT SYSTEM PLANNING ROLES

Airport planning exists on many levels: national, state, and local. Each level has a different emphasis and purpose. On the national level, Flagstaff Airport is included in the *National Plan of Integrated Airport Systems, 2017-2021* (NPIAS). At the state level, the airport is included in the *Arizona Airports System Plan*, last updated in 2008. The local planning document is the Airport Master Plan, which was last updated and approved by the City in 2007.

FEDERAL AIRPORT PLANNING

The nationwide system of airports which exists today is due, in large part, to the existence of federal policy that promotes the development of civil aviation. Many of the nation's existing airports were either initially constructed by the federal government or their development and maintenance was partially funded through various federal grant-in-aid programs to local communities. As part of a continuing effort to develop a national airport system to meet the needs of civil aviation and promote air commerce, the United States Congress has continually maintained a national plan for the development and maintenance of airports.

On the national level, Flagstaff Airport is designated in the NPIAS as a nonhub, primary commercial service airport. This grouping includes 249 airports nationwide that individually provide regularly scheduled passenger commercial service and record less than 0.05 percent of total U.S. passenger enplanements but have more than 10,000 annual enplanements. Overall, the NPIAS identifies 3,332 existing airports which are considered significant to the national air transportation system. The NPIAS is published and used by the FAA in administering the AIP, which is the source of federal funds for airport improvement projects across the country. The AIP program is funded exclusively by user fees and user taxes, such as those on fuel and airline tickets. The 2017-2021 NPIAS estimates that $32.5 billion worth of needed airport improvements are eligible for AIP funding across the country over the next five years. An airport must be included in the NPIAS to be eligible for federal funding assistance through the AIP.

The NPIAS supports the FAA's strategic goals for safety, system efficiency, and environmental compatibility by identifying specific airport improvements. The current NPIAS identifies approximately $12.5 million in development needs at the Flagstaff Airport for the five-year planning horizon. This figure is not a

guarantee of federal funding; instead, it represents development needs as presented to the FAA by the airport administration in the annual airport capital improvement program. Of the $32.5 billion in airport development needs identified by the NPIAS nationally, approximately 16.2 percent, or $5.3 billion, is proposed for the 249 nonhub commercial service airports, which includes Flagstaff Airport.

Airports that apply for and accept AIP grants must adhere to various grant assurances. These assurances include maintaining the airport facility safely and efficiently in accordance with specific conditions. The duration of the assurances depends on the type of airport, the useful life of the facility being developed, and other factors. Typically, the useful life for an airport development project is a minimum of 20 years. Thus, when an airport accepts AIP grants, they are obligated to maintain that facility in accordance with FAA standards for at least that long.

STATE AIRPORT PLANNING

Within the *Arizona State Airport System Plan* (2008), Flagstaff Airport is classified as a commercial service airport. The plan outlines four goals for the 83 public use airports within the State of Arizona. These include:

- Development: Arizona should provide an airport system that is adequately maintained to meet current and projected demand and is easily accessible from both the ground and the air.

- Economic Support: Arizona should advance a system of airports that is supportive of Arizona's economy, ensuring that the airport system is matched to Arizona's socioeconomic and demographic characteristics.

- Safety and Standards: Arizona should provide for a safe airport system, as measured by compliance with applicable safety standards, which supports health, welfare, and safety-related services and activities.

- Environmental Sensitivity and Stewardship: Arizona should promote a system of airports that is sensitive to and considerate of the environment. The system should support aviation outreach opportunities.

A performance-based analysis is presented within the System Plan to evaluate airports against 45 measures. As outlined in the System Plan, Flagstaff Airport was in compliance with a majority of the performance measures. Potential improvements for the airport outlined in the plan include runway end identifier lights (REILs), segmented circle and perimeter fencing.

LOCAL AIRPORT PLANNING

An Airport Master Plan is the primary local planning document for airport. The Master Plan is intended to provide a 20-year vision for airport development based on aviation demand forecasts. The most recent update to the airport planning document is the 2007 Airport Master Plan.

Over time, the forecast element of a Master Plan typically becomes less reliable due to changes in aviation activity and/or the economy. As a result, the FAA recommends an update of airport master plans every five to 10 years, or as necessary to address any significant changes. Therefore, this is an appropriate time to update the Airport Master Plan and revisit the development assumptions from the previous planning study.

One component of the Airport Master Plan is a set of Airport Layout Plan (ALP) drawings that are used to depict existing and future development on the airfield. The airport's ALP drawings are being updated during this Master Plan process.

TITLE 14 CFR 139 CERTIFICATION

An airport must have an Airport Operating Certificate (AOC) if it is serving air carrier aircraft with more than nine seats or serving unscheduled air carrier aircraft with more than 30 passenger seats. Title 14 CFR Part 139 (Part 139) describes the requirements for obtaining and maintaining an AOC. This includes meeting various regulations codified under the CFR.

Under Part 139, airports are classified in the following categories based on the type of air carrier operations served:

Class I Airport – an airport certificated to serve scheduled operations of large air carrier aircraft (more than 30 seats) that can also serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft (more than 9 seats but less than 31 seats).

Class II Airport – an airport certificated to serve scheduled operations of small air carrier aircraft and the unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.

Class III Airport – an airport certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft.

Class IV Airport – an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled air carrier aircraft regulated under 14 CFR Part 121.

Flagstaff Airport is classified as a Class I CFR Part 139 commercial service airport. This designation supports the regularly (or irregularly) scheduled operations of large and/or small air carrier aircraft conducting commercial passenger services at the airport. Part 139 regulations (which implemented provisions of the *Airport and Airway Development Act of 1970*, as amended on November 27, 1971) set standards for: the marking and lighting of areas used for operations; firefighting and rescue equipment and services; the handling and storing of hazardous materials; the identification of obstructions; and safety inspection and reporting procedures. It also requires airport operators to have an FAA-approved Airport Certification Manual (ACM).

The ACM defines the procedures to be followed in the routine operation of the airport and for response to emergency situations. The ACM is a working document that is reviewed annually by an FAA Certification Inspector and updated as necessary. It reflects the current condition and operation of the airport and establishes the responsibility, authority, and procedures as required. There are required sections for the ACM covering administrative detail and procedural detail. The current, FAA-approved ACM for Flagstaff Airport was last updated in 2014 and includes the following sections:

- General Information (multiple sections)
- Airport Information (multiple sections)
- Snow & Ice Control Plan
- Aircraft Rescue & Firefighting
- Hazardous Materials
- Traffic & Wind Direction Indicators
- Airport Emergency Plan
- Self-Inspection Program
- Pedestrian and Ground Vehicles
- Obstructions
- Protection of NAVAIDS
- Public Protection
- Wildlife Hazard Management
- Maintenance and Inspection Program (multiple sections)

AIRPORT INVENTORY

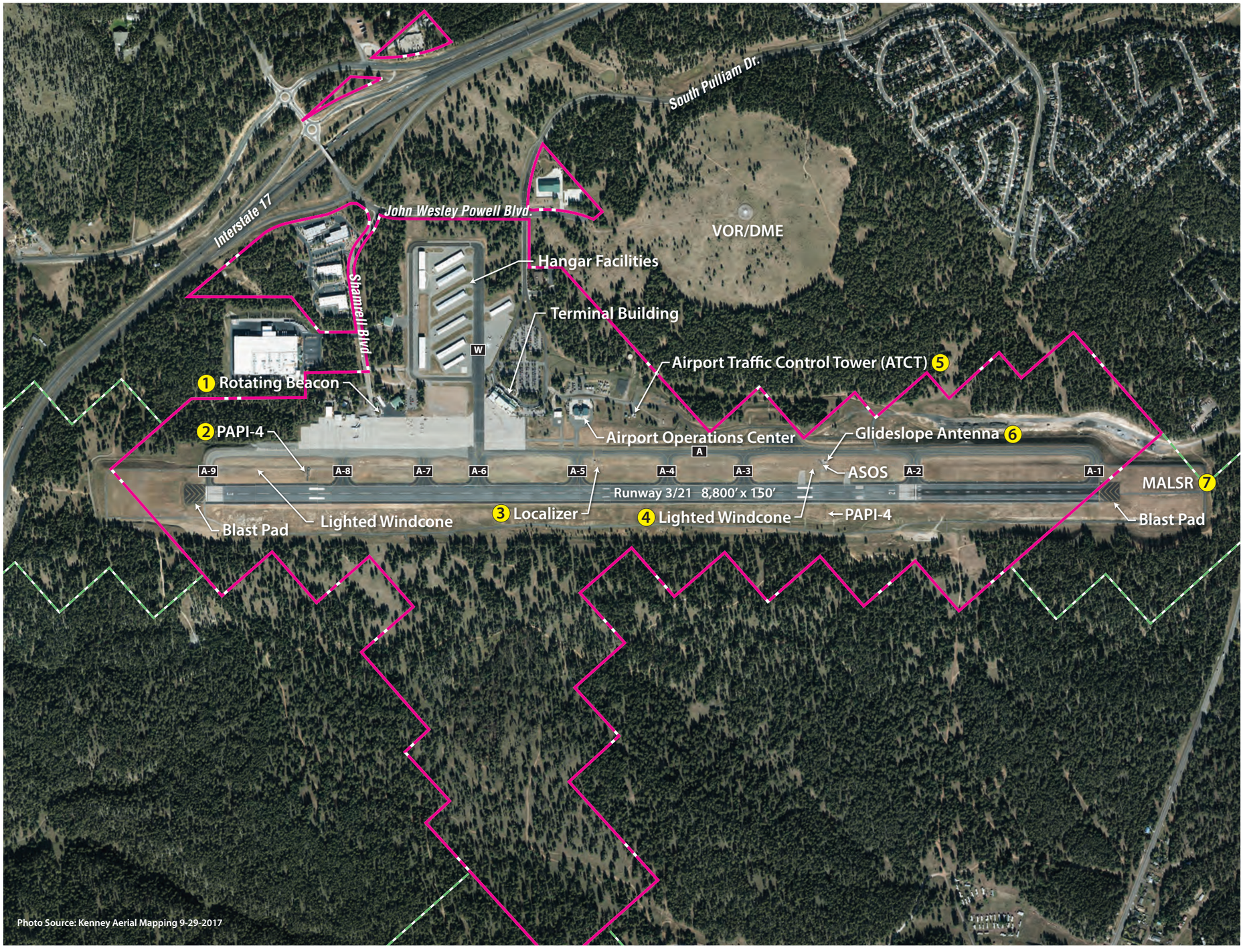
Airport facilities can be divided into two distinct categories: airside and landside. Airside facilities include those directly associated with aircraft operations, such as runways, taxiways, lighting and signage, and instrument approach aids. Landside facilities include those necessary to provide a safe transition from surface to air transportation and support aircraft servicing, maintenance, and operational safety on the ground.

AIRSIDE FACILITIES

Airside facilities are depicted on an aerial photograph for visual reference on **Exhibit 1C**. A summary of the facility data is provided on **Exhibit 1D** and discussed in detail in the following sections.



FLAGSTAFF AIRPORT



1 Rotating Beacon



4 Lighted Windcone



2 PAPI-4



5 ATCT



3 Localizer



6 Glideslope Antenna



LEGEND

- Existing Airport Property Line
- USDA Avigation Easement

N

0 1,000

SCALE IN FEET

7 MALSR

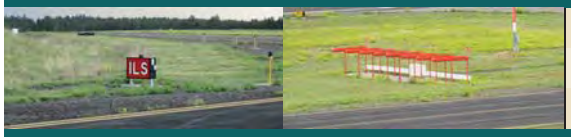


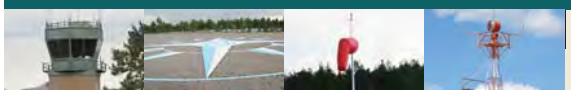
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	Runway 3	Runway 21
RUNWAYS		
Runway Length	8,800′	
Runway Width	150′	
Runway Pavement Surface Material	Asphalt	
Runway Pavement Surface Treatment	Porous Friction Courses (PFC)	
Runway Pavement Condition (Reported)	Good	
Runway Pavement Markings	Non-precision	Precision
Displaced Threshold		1,800′
Runway Lighting	HIRL	
Usable for Air Carrier Operations	Yes	
Traffic Pattern	Left	
Runway Pavement Strength (lbs)		
Single Wheel	30,000	
Dual Wheel	95,000	
Dual Single Wheel	120,000	
Dual Tandem Wheel	140,000	
TAXIWAYS		
Taxiway Lighting	MITL on Parallel and Entrance/Exit Taxiways	
Markings	Taxiway Centerline on all Taxiways	
VISUAL APPROACH/LIGHTING AIDS		
	PAPI-4L	PAPI-4L
STRAIGHT-IN INSTRUMENT APPROACHES		
		ILS or LOC/DME
	RNAV GPS	RNAV GPS
		VOR/DME
WEATHER AND NAVIGATIONAL AIDS		
	ASOS, ATCT, Lighted Windcones, Compass Rose, Rotating Beacon, Localizer, Glideslope Antenna, CTAF, UNICOM	







KEY

MITL - Medium Intensity Taxiway Lighting
HIRL - High Intensity Ruway Lighting
ILS - Instrument Landing System
LOC - Localizer
PAPI - Precision Approach Path Indicator
RNAV - Area Navigation
GPS - Global Positioning System
VOR - Very High Frequency Omnidirectional Range
DME - Distance Measuring Equipment
ASOS - Automated Surface Observation System
ATCT - Airport Traffic Control Tower
CTAF - Common Traffic Advisory Frequency
UNICOM - Universal Communication



Runway

Flagstaff Airport has a single runway which is oriented northeast-southwest and is designated Runway 3-21, and which generally corresponds to the compass readings when aligned with the extended runway centerline. The 8,800-foot long by 150-foot wide asphalt runway has a porous friction course (PFC) treatment and is reported in FAA publications to be in good condition. PFC is designed to promote drainage to reduce hydroplaning potential.

Runway 21 has a displaced threshold of 1,800 feet for aircraft landings from the northeast. A displaced threshold is one that is located at a point on the runway other than the designated beginning of the runway. The displaced threshold is necessary to maintain obstruction clearances for the existing instrument landing system (ILS) approach to Runway 21. As a result of the displacement, the landing length available on Runway 21 is 7,000 feet.

Additionally, declared distances are used at the airport to specify lengths of pavement available for aircraft operations. Air carrier operators incorporate the declared distances into their Operations Specifications which are a component of the operations certificates issued by FAA under 14 CFR Part 119. Four declared distances are established as follows:

- Takeoff Runway Available (TORA): The runway length declared available and suitable for the ground run of an airplane taking off. This distance is 8,800 feet for Runway 3 and Runway 21.

- Takeoff Distance Available (TODA): The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA. This distance is 8,800 feet for Runway 3 and Runway 21.

- Accelerate-Stop Distance Available (ASDA): The runway plus stopway length declared available for the acceleration and deceleration of an aircraft aborting a takeoff. This distance is 8,800 feet for Runway 3 and Runway 21.

- Landing Distance Available (LDA): The runway length declared available and suitable for landing. This distance is 8,800 feet for Runway 3 and 7,000 feet for Runway 21.

Strength

FAA provides two types of information regarding the strength of a runway. In general, the pavement strength is an indication of the runway material's ability to withstand repeated use by larger, heavier aircraft on a regular basis. While the pavement strength rating is not the maximum weight limit, aircraft weighing more than the certified strength can only operate on the runway on an infrequent basis. Heavy aircraft operations can shorten the life span of airport pavements if they are not designed to handle these aircraft. The FAA has adopted a standardized methodology for reporting pavement strengths which applies only to pavements with bearing strengths of 12,500 pounds or greater. Runway 3-21 has

a pavement strength of 30,000 pounds single wheel loading (SWL), which refers to the design of certain aircraft landing gear that has a single wheel on each main landing gear strut. The runway pavement has also been strength-rated at 95,000 pounds dual wheel loading (DWL), 120,000 pounds for dual single wheel loading (2SWL), and 140,000 pounds for dual tandem wheel loading (DTWL).

FAA also provides guidance on using the Aircraft Classification Number-Pavement Classification Number (ACN-PCN) method to report runway pavement strength. PCN values are reported in a coded format using five elements: numerical pavement condition value, pavement type, subgrade strength category, allowable tire pressure, and PCN evaluation method.

The PCN numerical value is a relative indication of the load carrying capacity of a pavement with a reference load of 181 pounds per square inch (psi). This is typically derived using information about the most demanding airplane operating at the airport. The pavement type is listed as either rigid or flexible. Rigid pavement is a single layer to support and distribute the load, while flexible pavement is multiple flexible layers used to distribute the load. Subgrade values refer to strength classifications with A being the greatest strength and D the lowest. Additionally, the allowable tire pressure is ordered from greatest to least beginning with W and ending with Z. The final element is an indication of the method used to derive the PCN. Two options are available: aircraft or technical. The aircraft approach uses information from the aircraft which operate at the airport, and the technical approach uses a technical study of the pavement structure and operational information for the airport. The PCN for Runway 3-21 at Flagstaff Airport is: 37/F/D/W/T. To decode, the PCN of Runway 3-21 is 37, the pavement is classified as flexible with an ultra-low, Class D subgrade. The pavement may be used without limitations on tire pressure. This evaluation was prepared using technical data as reported on the FAA's National Flight Data Center.

Pavement Markings

Pavement markings aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. The Airport provides and maintains parking systems in accordance with Part 139.311(a) and Advisory Circular 150/5340-1, *Standards for Airport Marking*.

Runway 3 is equipped with non-precision markings, which include the runway centerline, designation, threshold markings, edge markings, and aiming points. Runway 21 is equipped with precision runway markings, which identifies the runway centerline, designation, threshold markings, aiming points, edge markings, and touchdown zones.

Taxiway and taxilane centerline markings are provided to assist pilots in maintaining proper clearance from pavement edges and objects near the taxiway/taxilane edges. Taxiway markings at the airport include:

- Centerline;
- Leadoff lines on normally used exits;

- Dashed type edge markings along the portion of Taxiway A which is contiguous to aircraft parking aprons and the terminal ramp.

Taxiway markings also include aircraft hold line positions located on the entrance/exit and connecting taxiways. Enhanced taxiway centerline markings have been installed at all hold line positions. All hold line position markings are glass beaded, highlighted in black, and double sized in accordance to FAA regulations. The hold line positions function to keep aircraft from entering the runway environment without clearance. The location of hold lines is established by the design aircraft for a runway. The hold lines on entrance/exit taxiways are 250 feet from the runway centerline. FAA standards suggest that all runway hold line positions be aligned fully parallel with the runway centerline so that the pilot has full range of view in both runway directions. Aircraft movement areas on various parking aprons are identified with centerline markings. Aircraft tiedown positions are identified on various apron surfaces as well.

Blast pads, located adjacent to the end of a runway, are provided to reduce the erosive effect of jet blast or propeller wash. These are marked with yellow chevrons at both ends of the runway and are each approximately 200 feet long and 200 feet wide.

Taxiways

The Flagstaff Airport taxiway system, depicted on **Exhibit 1C**, consists of a full parallel taxiway for Runway 3-21, nine entrance/exit taxiways between the runway and parallel taxiway, and a connector taxiway. The entrance/exit taxiways are sequentially named A-1 through A-9 moving north to south along the runway system. The distance between the runway centerline and the parallel Taxiway A centerline is 400 feet. Taxiway widths at the airport range between 50 and 107 feet wide. Taxiway W connects parallel Taxiway A to the general aviation hangar area located west of the airport terminal. A series of taxilanes provide access within the general aviation hangar area.

Airfield Lighting and Signage

Airfield lighting systems extend an airport's usefulness into periods of darkness and/or poor visibility. A variety of lighting systems are installed at the airport for this purpose. These lighting systems, categorized by function, are summarized as follows.



Rotating Beacon
Source: Coffman Associates

Identification Lighting*:* The location of the airport at night is universally identified by a rotating beacon. The rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The rotating beacon at Flagstaff Airport is located on the northwest side of the general aviation aircraft apron adjacent to the fixed base operator (FBO).

Runway and Taxiway Lighting/Signage: Runway and taxiway edge lighting utilize light fixtures placed near the edge of the pavement to define the lateral limits of the pavement. This lighting is essential for safe operations during night and/or times of low visibility in order to maintain safe and efficient access to and from the runways and aircraft parking areas. Runway 3-21 is equipped with high intensity runway lights (HIRL) along the edge of the pavement. Parallel Taxiway A and the nine entrance/exit taxiways are outfitted with medium intensity taxiway lighting (MITL).

The airport also has a runway/taxiway signage system. The presence of runway/taxiway signage is an essential component of a surface movement guidance control system necessary for the safe and efficient operation of the airport. The signage system installed at the airport includes signs for runway and taxiway designations, holding positions, instrument landing system (ILS) critical areas, routing/directional, runway end and exits, and runway distance remaining.

Visual Glide Slope Approach Aids: Visual glide slope approach aids provide a visual cue to pilots using a series of lights to alert them to whether they are on the correct glide path to landing. Both ends of the runway are equipped with four-box precision approach path indicator (PAPI-4) systems with a 3.00-degree glide path.



Precision Approach Path Indicator
Source: Coffman Associates

Approach Light Systems (ALS): Runway 21 is equipped with a medium intensity approach lighting system (MALS) which offers a lighted, visual grid for pilots to identify the runway end while on final approach. The MALS is supplemented with runway alignment indicator lights (RAIL). The combined MALS and RAIL is referred to as a MALSR. The RAIL portion of the MALSR is a linear progression of strobe lights which provides pilots with a rapid, visual cue of the runway centerline.

Electronic Navigational Aids

Navigational aids are electronic devices that transmit radio frequencies, which pilots of properly equipped aircraft can translate into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying to or from Flagstaff Airport include a very high frequency omni-directional range (VOR) facility and the global positioning system (GPS).

The VOR, in general, provides azimuth readings to pilots of properly equipped aircraft transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility (VOR-DME) to provide distance as well as direction information to the pilot. As previously mentioned, the VOR-DME facility is located north of the airport terminal.

GPS is an additional navigational aid for pilots. GPS was initially developed by the United States Department of Defense for military navigation around the world. GPS differs from a VOR in that pilots are not required to navigate using a specific facility. GPS uses satellites placed in orbit around the earth to transmit electronic radio signals, which pilots of properly equipped aircraft use to determine altitude, speed, and other navigational information. With GPS, pilots can directly navigate to any airport in the country and are not required to navigate to a specific ground-based navigation facility.

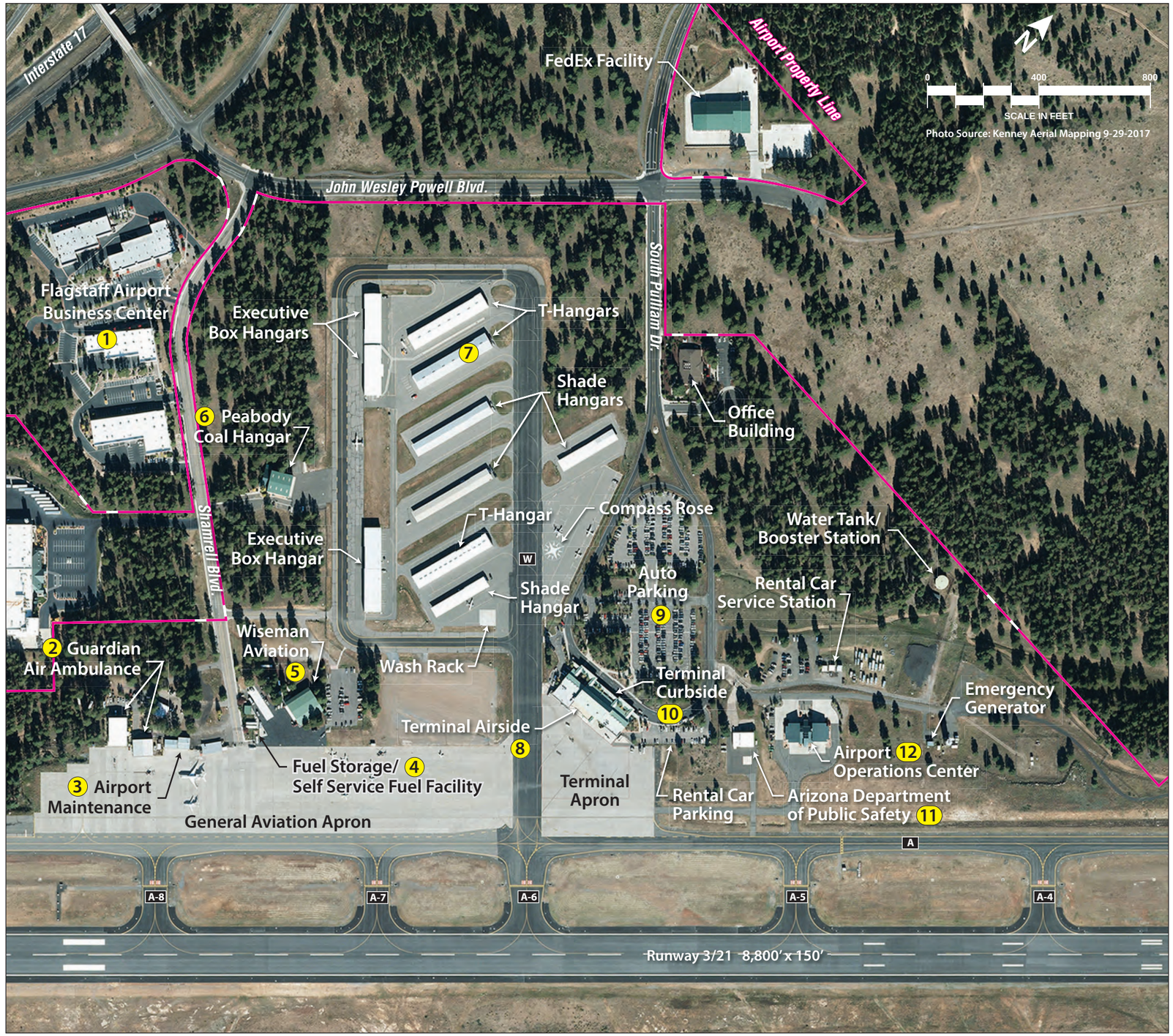
Many commercial service airports are equipped with an Instrument Landing System (ILS). The ILS systems at the airport are comprised of dual transmitter localizer equipment and dual transmitter glideslope equipment. The localizers provide an instrument approach course for horizontal alignment with runway centerline. The glideslopes provide vertical guidance for landing aircraft. Additionally, the MALSR serving Runway 21 provides for visual alignment with the extended course centerline.

LANDSIDE FACILITIES

Landside facilities at Flagstaff Airport include a terminal building, fixed base operators (FBOs), specialized aviation service operators (SASOs), aircraft storage hangars, aircraft parking aprons, and various support facilities, such as fuel storage, automobile parking, aircraft rescue and firefighting (ARFF) and fencing/gates. The landside facilities at the airport are identified on **Exhibit 1E**.



FLAGSTAFF AIRPORT



1 Flagstaff Airport Business Center



5 Wiseman Aviation



9 Auto Parking



2 Guardian Air Ambulance



6 Peabody Coal Hangar



10 Terminal Curbside



3 Airport Maintenance



7 Hangar Facilities



11 Arizona Department of Public Safety



4 Fuel Storage



8 Terminal Airside



12 Airport Operations Center



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Passenger Terminal Facility

The Flagstaff Airport terminal was opened in 1993. Originally built with 21,700 square feet, the structure was later expanded to include additional area for passenger holding prior to departure. The terminal is currently 24,137 square feet following expansion and renovations in 2008 and 2009, and includes space for passenger ticketing and holding, common areas, and baggage claim. There are currently six rental car companies offering services in the terminal. Additionally, terminal tenants include the Terminal Air Café, an on-demand ground transportation service, and a gift shop. The terminal has two levels. The first level includes all of the passenger service and airline areas, while the upper floor mezzanine level includes a conference room and airport management offices.



View of Passenger Terminal from Commercial Apron
Source: Coffman Associates

As previously mentioned, the passenger terminal building is directly accessible from South Pulliam Drive, which is a two-lane paved roadway that provides access to the terminal area and associated vehicle parking lots. The terminal is accessed by a circular drive which surrounds the parking lot area and facilitates curbside passenger drop off and pickup.

Hangars

Three types of hangars are available at Flagstaff Airport: executive box hangars, T-hangars, and shade hangars. Executive box hangars are typically smaller than 10,000 square feet. These hangars are normally utilized by individual owners to store several aircraft or by smaller airport businesses. This type of hangar is becoming more popular at general aviation airports and often is included in a larger contiguous facility that contains several separate hangar facilities. At Flagstaff Airport, there are 19 executive box hangars located in three buildings on the southwest side of the hangar facility area. These hangars are owned by the City of Flagstaff. Additionally, there are four privately owned hangars at the airport. These include the Peabody Coal Company hangar, Arizona Department of Public Safety hangar, and two Guardian Air Ambulance hangars.

T-hangars provide aircraft storage facilities within a larger hangar complex. These hangars typically provide space for only one aircraft and are used for private storage only. There are three, 14-unit T-hangar complexes at Flagstaff Airport.

Shade hangars are structures which provide roof cover for aircraft, but are not fully enclosed. These are typically used for smaller aircraft. At Flagstaff Airport, there are two 14-unit and two 10-unit shade hangar complexes. The location of the hangar facilities is noted on **Exhibit 1E**.



Shade Hangar
Source: Coffman Associates

Aircraft Parking Aprons

Aircraft parking aprons at the airport are depicted on **Exhibit 1E**. The largest apron at the airport is the general aviation apron located southwest of the terminal building. The general aviation apron provides 48 fixed wing parking positions and two marked helicopter parking positions, and is constructed of concrete measuring approximately 46,700 square yards. Immediately northeast of this apron is the passenger terminal parking apron. The terminal apron is 17,000 square yards and constructed of concrete pavement. Separated from the transient apron by Taxiway W, this area includes space for airline support equipment and areas for ground equipment circulation. There are three positions for commercial service aircraft on the terminal apron.

A third apron area, identified as the local apron, is located west of the terminal area. This area includes 18 local marked positions and is for long term aircraft storage. This apron area is approximately 8,500 square yards and constructed of asphalt.

Fixed Base Operator

Fixed base operators (FBOs) provide aviation services, such as fueling, flight training, and aircraft repair and maintenance. The airport has one FBO, Wiseman Aviation, which has been located on the airport for more than fifteen years and provides a full range of aviation services. The Wiseman Aviation hangar is located next to the transient apron near the terminus of Shamrell Boulevard. As previously mentioned, Wiseman Aviation provides fueling services at the airport. Additional services provided by Wiseman Aviation include flight catering, rental cars, pilot lounge and flight planning facilities, and hangar rentals.

Parking

Public parking is available in a surface lot immediately north of the terminal building. This parking lot contains 396 spaces for short term and long term parking. There are currently no parking fees and employees also utilize the public lot. A rental car ready/return parking lot is located northeast of the terminal building. There are 56 spaces for ready/return use by the rental car companies. Additional parking is located at Wiseman Aviation for employees and customers.

Fuel Storage

There are two primary types of fuel used for aviation purposes, both of which are available at the airport: Jet A and 100LL. Jet A is used in jet and turboprop aircraft, while 100LL is used in piston-driven aircraft. Commercial retail fueling is provided through Wiseman Aviation, a fixed base operator at the airport. Fuel is stored in two aboveground tanks, each with a capacity of 12,000 gallons. Jet A fuel is stored in one tank and 100LL is stored in the other.

In addition to the tanks, Wiseman Aviation also operates three fuel trucks. These include a 3,000-gallon Jet A, 2,200-gallon Jet A, and 1,000-gallon 100 LL storage tanks. The fuel farm is located at the terminus of Shamrell Boulevard adjacent to the transient apron and near the Wiseman Aviation hangar. Self-service fueling is also available for Jet A and 100LL from a fuel island that is connected to the main storage tanks at the Wiseman Aviation facilities.





Fuel Tanks and Self-Service Fuel Station
Source: Coffman Associates

Additionally, there are three private fuel storage facilities maintained for the express use of their owners. The following airport businesses maintain fuel storage: Peabody Western Coal (12,000 gallons of Jet A), Arizona Department of Public Safety (1,000 gallons of Jet A), and Guardian Air Ambulance (12,000 gallons of Jet A).

Fencing

A nine-foot tall chain link fence topped with three strands of barbed wire extends around the airport perimeter. The fence is intended to prevent unauthorized public access to the airfield and is also designed to exclude domestic animals and wildlife. The fencing at the airport meets Transportation Security Administration (TSA) requirements and a combination of automatic and manual gates is situated around the airfield in order to prevent inadvertent entry.

Airport Operations Center

The airport operations center, constructed in 2005, houses the airport rescue and firefighting (ARFF) equipment, snow removal equipment (SRE), and is also used for airport maintenance. The airport operations center is located northeast of the terminal providing midfield access for these essential support activities.



Landside View of Airport Operations Center
Source: Coffman Associates

Aircraft Rescue and Firefighting

Title 14 CFR Part 139 specifies five ARFF indices which relate to the level of capabilities required during air carrier operations. There are five indices (A through E), which are assigned according to the length of aircraft and scheduled for daily flight frequency. Flagstaff Airport is currently designated as an Index A airport. Index A, the minimum designation, requires one vehicle carrying at least 450 pounds of potassium-based dry chemical and water with a commensurate quantity of aqueous firefighting foam (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF foam application. This index assignment was based on air carrier service with an aircraft of less than 90 feet in length and five or more daily departures. As previously noted, beginning in November 2016, air carrier operations are conducted with Bombardier CRJ-700 regional jets, which are over 100 feet in length. Therefore, the ARFF index may need to be reevaluated.

According to FAA requirements, at least one ARFF vehicle must be capable of responding from the fire station to the mid-point of the farthest runway within three minutes of the alarm and initiate discharge of an extinguishing agent. Under FAA regulations, ARFF services must be provided 15 minutes prior through 15 minutes following all commercial airline flights. The FAA Chart Supplement (formerly the Airport Facility/Directory) entry for Flagstaff Airport notes that Index B service is available upon request.

The ARFF is staffed by airport employees who are trained and certified in ARFF procedures. The location is shown on **Exhibit 1E.** The airport's Index A capability is maintained between 0530 to 2230 MST daily, or as necessary to cover all air carrier flights. This time may be extended as a result of flight delays.

Two ARFF vehicles, listed below, are stored at the airport:

- 2005 Oshkosh Striker T-1500, 4X4, equipped with 1,500 gallons of water, 220 gallons of AFFF, and 450 pounds of dry chemical. This vehicle is designated "RESCUE1."

- 1989 E-One R-500 ARFF 4X4, equipped with 500 gallons of water, a 60-gallon AFFF tank, and 500 lbs. of dry chemical (purple K). This vehicle is designated “RESCUE 2."

Additional firefighting equipment may be summoned as needed from the City of Flagstaff Fire Department. This equipment responds to the airport within seven minutes.

Snow and Ice Control

As noted previously, the Flagstaff area experiences between 15 and 20 inches of snow per month during the winter and totals more than 100 inches annually. As a result, snow and ice removal is a necessary function during these periods to ensure that the airfield system can accommodate aircraft movements. To maintain snow and ice control, the airport uses the equipment summarized in **Table 1D**. The primary function of each piece of equipment, as outlined in the ACM, is also identified in the table.

The ACM also identifies the following priorities for snow removal at Flagstaff Airport.

1. Plow runway to minimum of 120’ wide. Plow Alpha Taxiway full length. Push terminal building airside ramp. Plow from Peabody hangar to Alpha taxiway (if Peabody is flying).

2. Plow Shamrell Blvd. and Pulliam Drive, Tower Road and vehicle parking lot entries (landside of terminal building). Push northern portion of GA ramp (no aircraft present) and push ramp in front of Guardian hangar. Blow taxiway windrows.

3. Plow north run-up area. Continue opening connectors from north (RWY 3 active) or south (RWY 21 active).

4. Begin plowing Westplex with emphasis on cargo aircraft tiedown area, then shades and T-hangars. Push/plow GA tiedown area using caution around parked aircraft. Blow/push west taxiway windrow.

5. Clean rental car “ready line” lot (cars removed) and vehicle parking lots landside. Re-plow Pulliam Drive. Clean terminal “admin” parking lot (south side) if cars are removed.

6. Once cleared, haul snow from tiedown areas, parking lots, and FBO ramp as required. Dump or blow as appropriate. Plow rental car wash rack lot and ATC tower parking lot.

7. General clean up and “slushing” of previously cleared areas. Double-check runway and taxiway edges along with commercial ramp.

TABLE 1D
Snow and Ice Removal Equipment
Flagstaff Airport

Equipment Description	Primary Function
2003 Oshkosh P-Series snow plow with 22' bi-directional "Hot Wing" plow & dump bed	Plow runway, taxiways, ramps, and tiedown areas
1994 Oshkosh PA2546 snow plow with 11' front plow, 11' wing blade & dump bed	Plow runway, taxiways, ramps and tiedown areas
2013 Wausau snow blower rated at 66 tons/min (4K tons/hour)	Blow windrows from runways and taxiways
1993 CAT 936F rubber tire loader with 4-yard bucket and 24' pusher attachment	Clean ramps, connector throats, and West-plex areas. Load snow.
2008 CAT 966H rubber tire loader with 5.5-yard bucket and 24' pusher attachment	Push displaced threshold, ramps, connector taxiways, and Westplex areas. Load snow.
1996 International 12-yard dump truck with 12' variable angle plow	Plow roadways, West taxiway, parking lots, and haul snow
2006 John Deere Tractor 5525 snow plow attachment, bucket, and gannon	Plow roadways, parking lots, hangar areas, and edging
2001 Ford F-250 4x4 pickup with 7½' snow plow attachment	Plow roadways, parking lots, hangar areas, & edging

Source: Flagstaff Airport Certification Manual

Utilities

The availability and capacity of the utilities serving the airport are factors in determining the development potential of the airport, as well as the land immediately adjacent to the facility. Utility availability is a critical factor when considering future expansion capabilities for both airside and landside components. The following utility providers serve the airport.

- Electricity – Arizona Public Service (APS) Company
- Natural Gas – Citizen Utilities
- Water – City of Flagstaff
- Wastewater – City of Flagstaff

Airpark

Flagstaff Airport is also the location of the Flagstaff Airport Business Center. Development of the Flagstaff Airport Business Center was made possible in part with funding through an Economic Development Authority grant of $2 million and significant local investments in 1995. There are currently four buildings within the Flagstaff Airport Business Center that serve an array of business activities.



Flagstaff Airport Business Center Entrance
Source: Coffman Associates

VICINITY AIRSPACE

Airspace within the United States is broadly classified as either controlled or uncontrolled. The difference between controlled and uncontrolled airspace relates primarily to requirements for pilot qualifications, ground-to-air communications, navigation and air traffic services, and weather conditions. Six classes of airspace have been designated in the United States, as shown on **Exhibit 1F**. Airspace designated as Class A, B, C, D, or E is considered controlled airspace and Class G airspace is commonly uncontrolled airspace. Aircraft operating within controlled airspace are subject to varying requirements for positive air traffic control. Airspace in the vicinity of the airport is also depicted on **Exhibit 1F**.

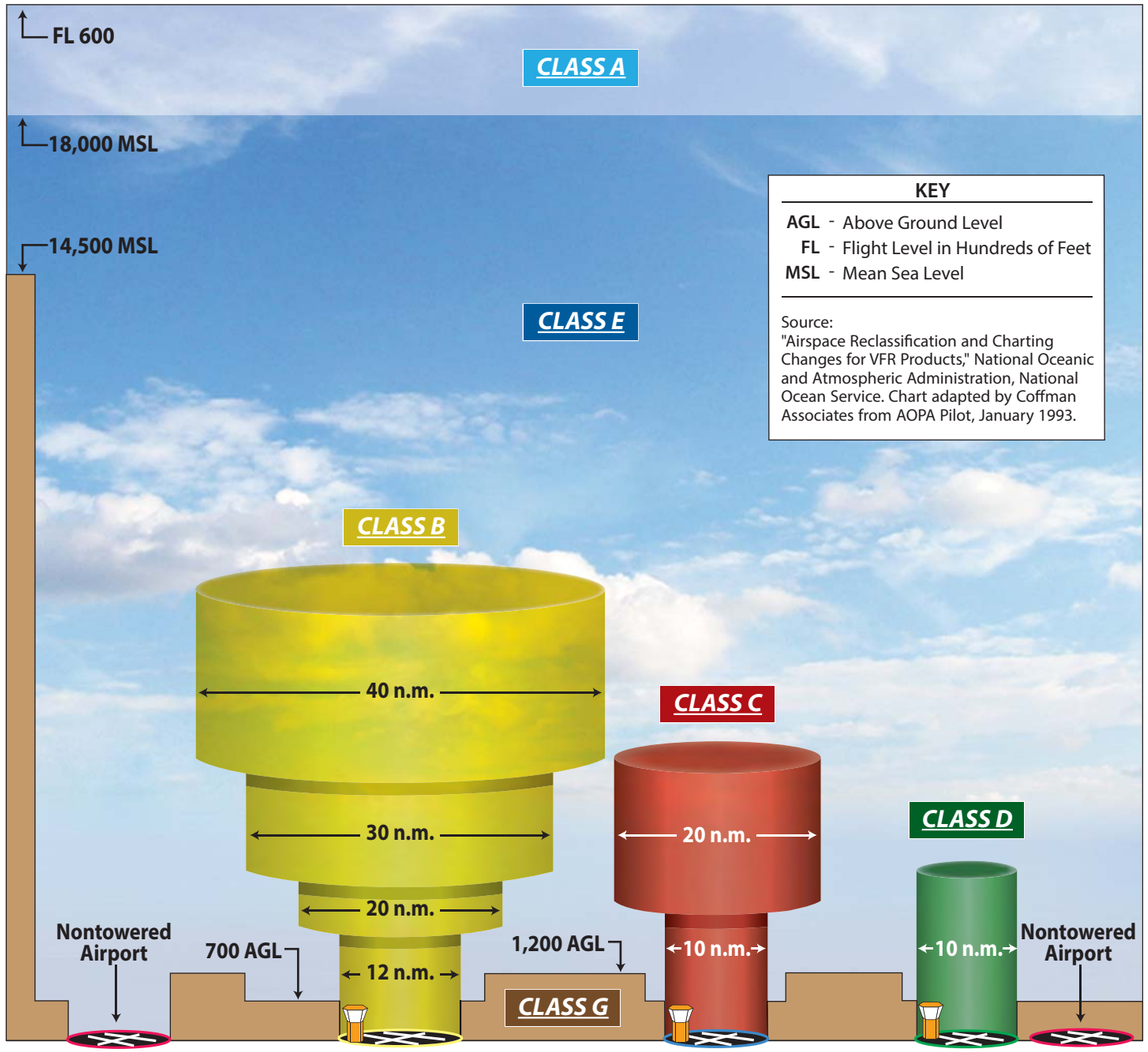
Class A Airspace: Class A airspace includes all airspace from 18,000 feet MSL to flight level (FL) 600 (60,000 feet MSL). This airspace is designated in 14 CFR Part 71.193 for positive control of aircraft. The Positive Control Area (PCA) allows flights governed only under IFR operations. The aircraft must have special radio and navigation equipment, and the pilot must obtain clearance from an ATC facility to enter Class A airspace. In addition, the pilot must possess an instrument rating.

Class B Airspace: Class B airspace has been designated around some of the country's busiest commercial service airports, such as Phoenix Sky Harbor International Airport. Class B airspace is designed to regulate the flow of uncontrolled traffic, above, around, and below the arrival and departure airspace required for high-performance, passenger-carrying aircraft at busy commercial service airports. This airspace is the most restrictive controlled airspace encountered by pilots operating under VFR. The northernmost portion of the Phoenix Class B airspace is 85 miles south of Flagstaff Airport.

In order to fly within Class B airspace, an aircraft must be equipped with special radio and navigation equipment and must obtain clearance from air traffic control. Moreover, a pilot must have at least a private pilot's certificate or be a student pilot who has met the requirements of 14 CFR Part 61.95, which requires special ground and flight training for Class B airspace. Helicopters do not need special navigation equipment or a transponder if they operate at or below 1,000 feet and have made prior arrangements in the form of a Letter of Agreement with the FAA controlling agency. Aircraft are also required to have and utilize a Mode C transponder within a 30-nautical-mile range of the center of Class B airspace. A Mode C transponder allows the ATCT to track the altitude of the aircraft.

Class C Airspace: The FAA has established Class C airspace at 120 airports around the country as a means of regulating air traffic in these areas. Class C airspace is designed to regulate the flow of uncontrolled traffic above, around, and below the arrival and departure airspace required for high-performance, passenger-carrying aircraft at some commercial service airports. In order to fly inside Class C airspace, the aircraft must have a two-way radio, an encoding transponder, and have established communication with ATC. Aircraft may fly below the floor of Class C airspace or above the Class C airspace ceiling without establishing communication with ATC. Tucson International Airport constitutes the closest Class C airspace to Flagstaff Airport.

Class D Airspace: Class D airspace is controlled airspace surrounding airports with an ATCT. The Class D airspace typically constitutes a cylinder with a horizontal radius of five nautical miles from the airport,



KEY

AGL	Above Ground Level
FL	Flight Level in Hundreds of Feet
MSL	Mean Sea Level

Source:
"Airspace Reclassification and Charting Changes for VFR Products," National Oceanic and Atmospheric Administration, National Ocean Service. Chart adapted by Coffman Associates from AOPA Pilot, January 1993.

DEFINITION OF AIRSPACE CLASSIFICATIONS

CLASS A Generally airspace above 18,000 feet MSL up to and including FL 600.

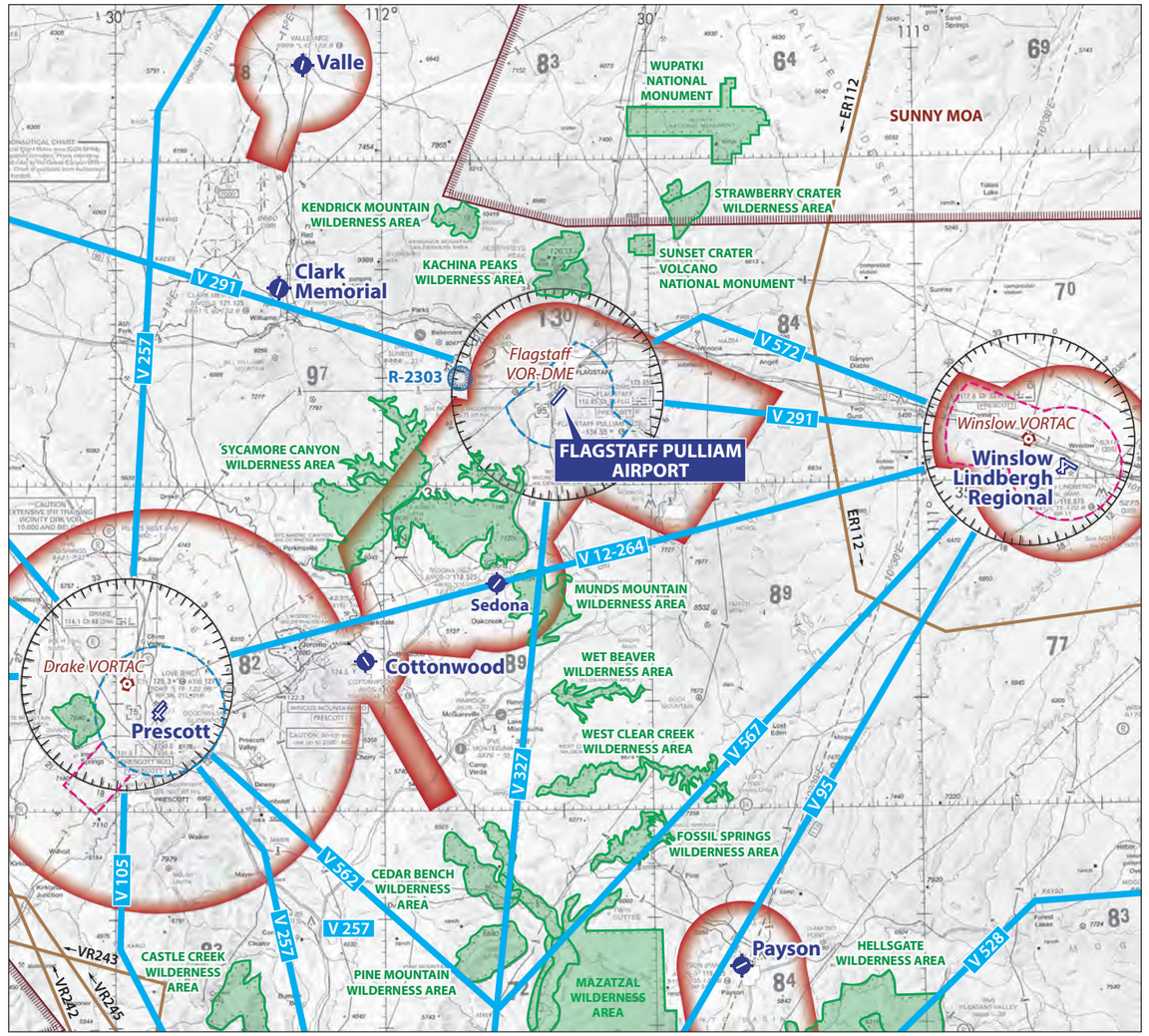
CLASS B Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.

CLASS C Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.

CLASS D Generally airspace from the surface to 2,500 feet AGL surrounding towered airports.

CLASS E Generally controlled airspace that is not Class A, Class B, Class C, or Class D.

CLASS G Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E.



LEGEND

- Airport with hard-surfaced runways 1,500' to 8,069' in length
- Airports with hard-surfaced runways greater than 8,069' or some multiple runways less than 8,069'
- VORTAC
- Compass Rose
- Class D Airspace
- Class E Airspace
- Class E Airspace with floor 700 ft. above surface
- Victor Airways
- MOA - Military Operations Area
- Prohibited, Restricted, Warning and Alert Areas
- Military Training Routes
- Wilderness Areas

Source: Phoenix Sectional Chart, US Department of Commerce, National Oceanic and Atmospheric Administration, April 28, 2016

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extending from the surface up to a designated vertical limit, typically set at approximately 2,500 feet above the airport elevation. **Exhibit 1F** shows the Class D airspace surrounding Flagstaff Airport. The Class D airspace consists of controlled airspace extending upward from the surface to and including 8,800 feet MSL.

Flagstaff Airport falls within Class D airspace during times when the ATCT is operational. At all other times, Class G airspace surrounds the airport.

Class E Airspace: Class E airspace consists of controlled airspace designed to contain IFR operations near an airport and while aircraft are transitioning between the airport and enroute environments. Unless otherwise specified, Class E airspace terminates at the base of the overlying airspace. Only aircraft operating under IFR are required to be in contact with air traffic control when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio communications with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist. Class E airspace helps to buffer the Class D airspace at the airport in order to protect approaches to the various runways, generally having a floor of 700 feet above ground level (AGL).

Class G Airspace: Airspace not designated as Class A, B, C, D, or E is considered uncontrolled, or Class G, airspace. ATC does not have the authority or responsibility to exercise control over air traffic within this airspace. Class G airspace lies between the surface and the overlaying Class E airspace (700 to 1,200 feet AGL). As previously mentioned, the airspace surrounding Flagstaff Airport reverts to Class G when the tower is closed.

SPECIAL USE AIRSPACE

Special use airspace is defined as airspace where activities must be confined because of their nature or where limitations are imposed on aircraft not taking part in those activities. The designation of special use airspace identifies for other users the areas where military activity occurs, provides for segregation of that activity from other fliers, and allows charting to keep airspace users informed. These areas are depicted on **Exhibit 1F**.

Victor Airways: Victor Airways are designated navigational routes extending between VOR facilities. Victor Airways have a floor of 1,200 feet AGL and extend upward to an altitude of 18,000 feet MSL. Victor Airways are eight nautical miles wide.

The Flagstaff VOR-DME is located immediately north of the Flagstaff Airport terminal building. The following Victor Airways lead to and from the VOR-DME facility in close proximity to the airport:

- V291 connects through Flagstaff airspace with a path to the northwest and a path to the east toward Winslow, Arizona.
- V572 is located northeast of the airport and turns southeast toward Winslow, Arizona.
- V327 extends south of the airport toward Phoenix, Arizona.

Restricted Airspace: Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute Title 14 CFR Part 73, *Special Use Airspace*. As indicated on **Exhibit 1F**, restricted area R-2303 is located approximately five miles west of the airport. This restricted area is active between 0800 and 2400 Monday through Saturday.

Military Operating Areas (MOAs): This special use airspace is established outside positive control areas to separate/segregate certain nonhazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. MOAs are established to contain certain military activities such as air combat maneuvers, air intercepts, acrobatics, etc. The Sunny MOA is approximately 20 miles north of the airport. This MOA is in effect by Notice to Airmen with 24-hours' notice and encompasses airspace above 12,000 feet MSL.

Special Conservation Areas: Aircraft are requested to maintain a minimum altitude of 2,000 feet above the surface of designated special conservation areas, which can include wilderness areas, National Park Service lands and wildlife refuge breeding grounds. FAA Advisory Circular (AC) 91-36D defines the "surface" as the highest terrain within 2,000 feet laterally of the route of flight or the uppermost rim of a canyon or valley.

Eleven wilderness areas are located within 50 miles of Flagstaff Airport:

- Cedar Bench (South)
- Fossil Springs (South)
- Kachina Peaks (North)
- Kendrick Mountain (Northwest)
- Munds Mountain (South)
- Red Rock-Secret Mountain (Southwest)
- Strawberry Crater (Northeast)
- Sycamore Canyon (Southwest)
- West Clear (South)
- Wet Beaver (South)
- Woodchute Wilderness (Southwest)

Additionally, there are five Bald Eagle Breeding Areas within 50 miles of the Flagstaff Airport:

- Verde River Bald Eagle Breeding Area (Southwest)
- Lake Mary Bald Eagle Breeding Area (South)
- Ashurst Lake Bald Eagle Breeding Area (East)

- Dogtown Reservoir Bald Eagle Breeding Area (West)
- Whitehorse Lake Breeding Area (West)

Finally, the following National Monuments, managed by the National Park Service, are also located within 50 miles of the Flagstaff Airport:

- Tuzigoot National Monument (Southwest)
- Montezuma Castle National Monument (South)
- Walnut Canyon National Monument (East)
- Sunset Crater Volcano National Monument (Northeast)
- Wupatki National Monument (Northeast)

AIRSPACE CONTROL

The FAA has established 22 Air Route Traffic Control Centers (ARTCCs) throughout the continental United States to control aircraft operating under IFR within controlled airspace and while enroute to a destination. The primary responsibility of the ARTCC is the assignment of specific routes and altitudes along Federal Airways to maintain proper separation and orderly traffic flow. Albuquerque Center controls enroute airspace in most of Arizona, New Mexico and parts of California, Colorado, Oklahoma, and Texas.

The Phoenix TRACON (Terminal Radar Approach Control) is an air traffic control facility that provides safety alerts, aircraft separation, and sequencing of aircraft arriving, departing, and transitioning the airspace and airports in the Arizona region. Phoenix TRACON is the step between local control (on-airport control tower) and Albuquerque Center ARTCC. Flight plans can be opened or closed utilizing the Prescott Service Station (FSS).

Flagstaff Airport has an ATCT, which is privately staffed under FAA-contract by Serco, Inc., a private aviation services company that specializes in air traffic control operations. The ATCT is located approximately 1,100 feet northeast of the terminal building and is staffed from 6:00 a.m. to 9:00 p.m. April 1 through September 30 and from 7:00 a.m. to 7:00 p.m. October 1 through March 31.

Current ATCT services include ground control (121.9 MHz), ATC (134.55 MHz), and automated terminal information service (ATIS) information (125.8 MHz). Outside of its operational hours, there are no formal ATC services available at the airport. When the ATCT is closed, air traffic advisories are made using the common traffic advisory frequency (CTAF), which is the same frequency as the tower (134.55 MHz).

The ATCT located on the airfield controls air traffic within Class D airspace that surrounds the airport. Approach and departure control services for arriving and departing aircraft on an instrument flight plan are provided by Phoenix TRACON on radio frequency 126.375 MHz.

INSTRUMENT APPROACH PROCEDURES

Instrument approach procedures are a series of predetermined maneuvers established by the FAA, using electronic navigational aids that assist pilots in locating and landing at an airport, especially during instrument flight conditions. There are currently four published instrument approach procedures at the Flagstaff Airport, including an ILS precision instrument approach to Runway 21. Precision instrument approaches provide vertical descent information and course guidance information to the pilot. Non-precision approaches only provide course guidance to the pilot.

The capability of an instrument approach is defined by the visibility and cloud ceiling minimums associated with the approach. Visibility minimums define the horizontal distance the pilot must be able to see in order to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for the pilot to complete the approach. If the observed visibility or cloud ceilings are below the minimums prescribed for the approach, the pilot cannot complete the instrument approach. **Exhibit 1G** summarizes FAA-approved and published instrument approach procedures, including associated weather minimums for the airport.

The most sophisticated instrument approach at the airport is the ILS approach to Runway 21. The ILS Runway 21 approach provides visibility minimums as low as ½-mile and cloud ceilings of 255 feet. Generally, this type of approach is considered the minimum for a commercial service airport. Larger medium and large hub airports will typically have even more sophisticated instrument approaches offering lower visibility minimums. Instrument approaches based on GPS have become very common across the country. GPS is comparatively inexpensive, as it does not require a significant investment in ground based equipment by the airport or FAA, but relies on a satellite system maintained by the United States government for many types of navigation.

Flagstaff Airport has a total of two GPS approaches, with one established for each runway end. The GPS approaches provide for visibility minimums down to ½-mile with varying cloud ceiling heights. The VOR Runway 21 approach utilizes the Flagstaff VOR-DME facility located less than one nautical mile north of the terminal. This ground based facility emits frequencies that properly equipped aircraft can utilize to track to the airport. It should be noted that recent changes have occurred to the instrument approach procedures at the airport. Those mentioned above are the instrument approaches that are currently in effect.

LOCAL OPERATING PROCEDURES

The airport traffic pattern is the directional traffic flow that is prescribed for aircraft arriving or departing. Essentially, the traffic pattern defines which side of the runway aircraft will operate. The traffic pattern at the airport is maintained to provide the safest and most efficient use of the airspace surrounding the airport. While aircraft can be expected to operate over most areas in the region, the density of aircraft operations is higher near the airport. This is the result of aircraft following the established traffic patterns for the airport. The traffic patterns for Flagstaff are published as standard left-hand for both Runways 3

	WEATHER MINIMUMS BY AIRCRAFT TYPE							
	Category A		Category B		Category C		Category D	
	Cloud Height (ft. AGL)	Visibility (miles)	Cloud Height (ft. AGL)	Visibility (miles)	Cloud Height (ft. AGL)	Visibility (miles)	Cloud Height (ft. AGL)	Visibility (miles)
ILS or LOC 21								
Straight ILS	255	0.50	255	0.50	255	0.50	255	0.50
Straight LOC	337	0.50	337	0.50	337	0.50	337	0.50
Circling	506	1	546	1	1,086	3	1,546	3
RNAV (GPS) 3								
LPV DA	250	0.75	250	0.75	250	0.75	250	0.75
LNAV/VNAV DA	268	0.875	268	0.875	268	0.875	268	0.875
LNAV MDA	346	1	346	1	346	1	346	1
Circling	506	1	546	1	1,086	3	1,546	3
RNAV (GPS) 21								
LPV DA	255	0.50	255	0.50	255	0.50	255	0.50
LNAV/VNAV DA	316	0.625	316	0.625	316	0.625	316	0.625
LNAV MDA	357	0.50	357	0.50	357	0.625	357	0.625
Circling	506	1	546	1	1,086	3	1,546	3
VOR 21								
Straight	517	1	517	1	517	1	517	1
Circling	506	1	546	1	1,086	3	1,546	3

Aircraft categories are established based on 1.3 times the stall speed in landing configuration as follows:

Category A: 0-90 knots (ex. Cessna 172)
Category B: 91-120 knots (ex. Beechcraft King Air)
Category C: 121-140 knots (ex. CRJ-700 and Challenger 604))
Category D: 141-166 knots (ex. Gulfstream IV)



Abbreviations:

AGL - Above Ground Level
DA - Decision Altitude
GPS - Global Positioning System
ILS - Instrument Landing System
LOC - Localizer
LNAV - Lateral Navigation
LPV - Localizer Performance with Vertical Guidance
MDA - Minimum Descent Altitude (Used for non-precision approaches)
RNAV - Area Navigation
VNAV - Vertical Navigation
VOR - Very High Frequency Omnidirectional Range

and 21. The traffic pattern altitude for smaller general aviation aircraft is 989 feet above ground level (AGL). For larger general aviation jets, commercial service, and military aircraft, the pattern altitude is 1,489 feet AGL. The traffic pattern altitude for helicopters is 489 feet AGL.

As outlined in the airport's Part 150 Study documentation, runway use is estimated to be 30 percent for Runway 3 and 70 percent for Runway 21. This results in most of the aircraft arrivals occurring from the northeast and most departures to the southwest.

The FAA's Chart Supplement (formerly the Airport/Facility Directory) lists two noise abatement procedures. The first directs pilots to avoid overflight of the village area located three miles south of the airport, and the second states that Runway 21 should be used in calm wind conditions.

DEPARTURE PROCEDURES

Departure procedures are preplanned instrument procedures which provide obstruction clearance from the runway to the appropriate enroute structure. These procedures can either provide obstacle clearance protection information to pilots through obstacle departure procedures (ODPs) or increase airspace efficiency and reduce communications and departure delays through standard instrument departures (SIDs). There is one obstacle departure procedure published for Flagstaff Airport. The procedure directs pilots away from terrain north and northwest of the airport with a left turn for aircraft departing on Runway 21 and a right turn for aircraft departing Runway 3.

REGIONAL AIRPORTS

A review of public-use airports within the vicinity of Flagstaff Airport was conducted to identify and distinguish the type of air service provided in the area surrounding the airport. Information pertaining to each airport was obtained from FAA Form 5010-1, *Airport Master Record*. **Exhibit 1H** provides information on public-use airports within 50 nautical miles of Flagstaff Airport.

There are six public-use airports within a 50-nautical mile radius, as presented on the exhibit. Of these, only one, Prescott-Ernest Love Field, is classified as a commercial service airport. Prescott-Ernest Love Field is 47 nautical miles east of Flagstaff Airport and provides a similar level of services.

The remaining airports: H.A. Clark Memorial Field, Sedona Airport, Winslow-Lindbergh Regional Airport, Cottonwood Airport, and Valle Airport are all considered general aviation airports.

SEDONA AIRPORT (SEZ)



Airport NPIAS Classification ..... General Aviation
FAA Asset Study Classification ..... Local
Location from FLG ..... 18.5 nm S
Elevation ..... 4,830′
Weather Reporting..... AWOS-3PT
ATCT ..... None
Annual Operations..... 35,040
Based Aircraft..... 60

RUNWAY	3-21
Length	5,132′
Width	100′
Pavement Strength (lbs.)	
SWL	15,000
DWL	30,000
DTWL	NA
Lighting	MIRL
Marking	Basic
Approach Aids	PAPI (both)
Instrument Approaches	RNAV (GPS)
Services Available	
Fuel	100LL, Jet A
FBO	Yes

H.A. CLARK MEMORIAL FIELD (CMR)



Airport NPIAS Classification ..... General Aviation
FAA Asset Study Classification ..... Basic
Location from FLG ..... 27.6 nm W
Elevation ..... 6,691′
Weather Reporting..... AWOS-3
ATCT ..... None
Annual Operations..... 6,500
Based Aircraft..... 3

RUNWAY	18-36
Length	6,000′
Width	100′
Pavement Strength (lbs.)	
SWL	NA
DWL	NA
DTWL	NA
Lighting	MIRL
Marking	Non-Precision
Approach Aids	PAPI (both)
Instrument Approaches	None
Services Available	
Fuel	100LL
FBO	Yes

COTTONWOOD AIRPORT (P52)



Airport NPIAS Classification ..... General Aviation
FAA Asset Study Classification ..... Local
Location from FLG ..... 30.5 nm SW
Elevation ..... 3,560′
Weather Reporting..... AWOS-AV
ATCT ..... None
Annual Operations..... 18,980
Based Aircraft..... 14

RUNWAY	14-32
Length	4,252′
Width	75
Pavement Strength (lbs.)	
SWL	4,000
DWL	NA
DTWL	NA
Lighting	MIRL
Marking	Non-Precision
Approach Aids	PAPI (both)
Instrument Approaches	RNAV (GPS)
Services Available	
Fuel	100LL
FBO	Yes

VALLE AIRPORT (40G)



Airport NPIAS Classification ..... Non-NPIAS
FAA Asset Study Classification ..... N/A
Location from FLG ..... 38.5 nm NW
Elevation ..... 5,999′
Weather Reporting..... ASOS
ATCT ..... None
Annual Operations..... 6,800
Based Aircraft..... 8

RUNWAY	1-19
Length	4,199′
Width	45
Pavement Strength (lbs.)	
SWL	NA
DWL	NA
DTWL	NA
Lighting	MIRL
Marking	Non-Precision
Approach Aids	PSIL (both)
Instrument Approaches	GPS (both), VOR/DME (19)
Services Available	
Fuel	100LL, Jet A
FBO	No

WINSLOW-LINDBERGH REGIONAL AIRPORT (INW)



Airport NPIAS Classification ..... General Aviation
FAA Asset Study Classification ..... Basic
Location from FLG ..... 47.0 nm E
Elevation ..... 4,941′
Weather Reporting..... ASOS
ATCT ..... None
Annual Operations..... 21,170
Based Aircraft..... 12

RUNWAY	4-22	11-29
Length	6,236′	7,100′
Width	75′	150′
Pavement Strength (lbs.)		
SWL	50,000	60,000
DWL	80,000	70,000
DTWL	125,000	110,000
Lighting	MIRL	MIRL
Marking	Basic	Non-Precision
Approach Aid	None	VASI (both)
Instrument Approaches		VOR or GPS
Services Available		
Fuel	100LL, Jet A	
FBO	No	

PRESCOTT - ERNEST A. LOVE FIELD (PRC)



Airport NPIAS Classification ..... Commercial Service
FAA Asset Study Classification ..... Regional
Location from FLG ..... 47.0 nm SW
Elevation ..... 5,045′
Weather Reporting..... ASOS
ATCT ..... None
Annual Operations..... 2,725,385
Based Aircraft..... 205

RUNWAY	3L-21R	3R-21L	12-30
Length	4,846′	7,619′	4,408′
Width	60′	150′	75′
Pavement Strength (lbs.)			
SWL	12,500	63,000	12,500
DWL	NA	80,000	NA
DTWL	NA	100,000	NA
Lighting	MIRL	MIRL	MIRL
Marking	None	Non-Precision (3L), Precision (21R)	Non-Precision (12), Basic (30)
Approach Aid	PAPI (both)	PAPI (both)	
Instrument Approaches		ILS or LOC/DME (21L), RNAV-RNP (3R), RNAV-GPS (3R. 21L)	VOR (12), RNAV-GPS 12
Services Available			
Fuel	100LL, Jet A		
FBO	No		

ABBREVIATIONS

ASOS - Automated Surface Observation System
ATCT - Airport Traffic Control Tower
AWOS - Automated Weather Observation System
DME - Distance Measuring Equipment
DWL - Dual Wheel Loading
DWL - Dual Wheel Loading
DTWL - Dual Tandem Wheel Loading
GPS - Global Positioning System
ILS - Instrument Landing System
LOC - Localizer
MIRL - Medium Intensity Runway Lighting
NPIAS - National Plan of Integrated Airport Systems
PAPI - Precision Approach Path Indicator
RNAV - Area Navigation (GPS variant)
RNP - Required Navigation Performance
SWL - Single Wheel Loading
VASI - Visual Approach Slope Indicator
VOR - VHF Omnidirectional Range

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AREA LAND USE AND ZONING

Land use plans for the area surrounding an airport can have a significant impact on airport operations and growth. The following section identifies baseline information related to land use and zoning in the vicinity of the airport. By understanding the land use issues surrounding the airport, more appropriate recommendations can be made for the future of the airport.

FEDERAL LEGISLATION AND REGULATIONS

There are numerous federal laws and regulations related to airport land use compatibility. Airports that accept federal development grants are required to make every reasonable effort to comply with these laws and regulations. Following is a summary of the federal laws, regulations, and guidance related to land use compatibility and zoning surrounding airports.

Airport and Airway Improvement Act of 1982 - United States Code (USC), Title 49

Upon acceptance of federal funds, this Act obligates the airport owners to operate and maintain the airport and comply with specific assurances, including maintenance of compatible land uses around airports. Implementation of this Act is through stipulations outlined in the grant documents signed by airport owners upon receipt of federal funds for a project.

Pursuant to the provisions of Title 49, U.S.C., subtitle VII, as amended, sponsor assurances are required to be submitted as part of a project application by sponsors requesting funds. Upon acceptance of the grant offer by the sponsor, these assurances are incorporated in, and become part of, the grant agreement. There are 39 separate grant assurances, several of which address airport planning.

The primary land use compatibility grant assurances include:

- Grant Assurance 21 requires, in part, that the sponsor:

  "…take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft."
- Grant Assurance 20 relates to an airport sponsor's obligation for hazard removal and mitigation to address potential obstructions to the airspace around the airport. Grant Assurance 20 states that the airport sponsor will:

  "…take appropriate action to assure that such terminal airspace as is required to protect instrument and visual operations to the airport (including established minimum flight altitudes) will be adequately cleared and protected by removing, lowering, relocating, marking, or lighting or otherwise

mitigating existing airport hazards and by preventing the establishment or creation of future airport hazards."

Objects Affecting Navigable Airspace – Title 14 CFR Part 77 and A Model Zoning Ordinance to Limit Height of Objects Around Airports – FAA Advisory Circular (AC) 150/5190-4A

This federal regulation establishes standards for determining obstructions in navigable airspace. It sets forth notification and review requirements for construction and alteration of structures (i.e., buildings, towers, etc.). It also provides for studies of obstructions to determine their effect on the safe and efficient use of airspace, as well as providing for public hearings regarding these obstructions, along with provisions for the creation of antenna farm areas. It also establishes methods of identifying surfaces that must be free from penetration by obstructions, including buildings, cranes, cell towers, etc., in the vicinity of an airport. This regulation is predominately concerned with airspace-related issues. Implementation and enforcement of the elements contained in this regulation are a cooperative effort between the FAA and the individual state aviation agencies or the airports themselves.

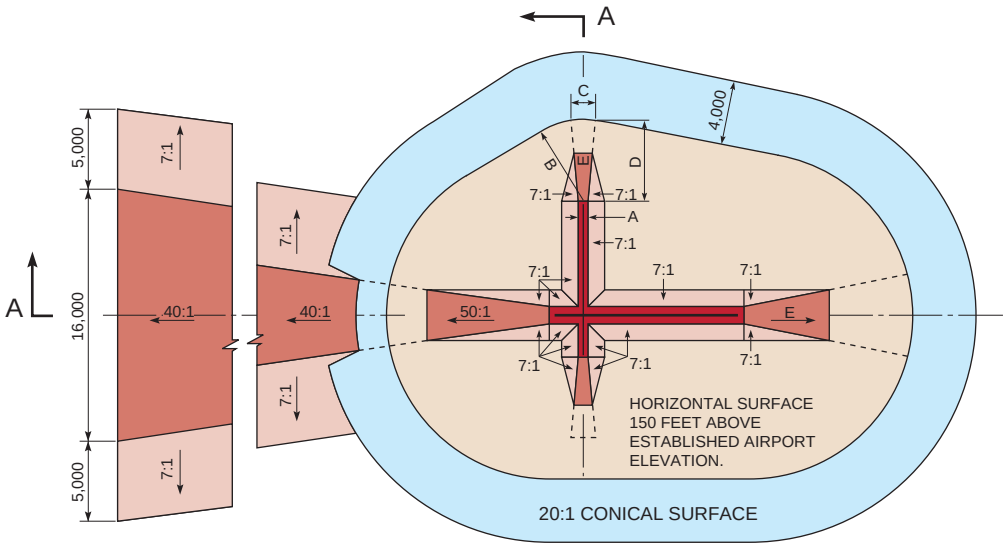
The imaginary surfaces defined in Title 14 CFR Part 77 include the primary surface, transitional surface, approach surface, horizontal surface, and the conical surface. **Exhibit 1J** depicts a model example of the application of the Part 77 surfaces.

FAA AC 150/5190-4A provides information regarding development of a zoning ordinance to control the height of objects. It is based upon the surfaces described in Subpart C of Title 14 CFR Part 77, *Objects Affecting Navigable Airspace*. This document provides sample language and model ordinances for use by local airports.

Title 10 of the City of Flagstaff Zoning Code includes provisions for the Airport Overlay (AO) zone and outlines administrative procedures to help protect height and hazard zoning within the vicinity of the airport based on the approach, transitional, horizontal, and conical surfaces outlined in Title 14 CFR Part 77. The zoning code states that, "no structure shall be constructed or maintained, or tree permitted to grow, within any airport zone or surface in excess of the height limitation established," by the Part 77 surfaces. It should be noted that the text of the AO zone references a drawing from the 1984 ALP which may not reflect current conditions or FAA guidance.

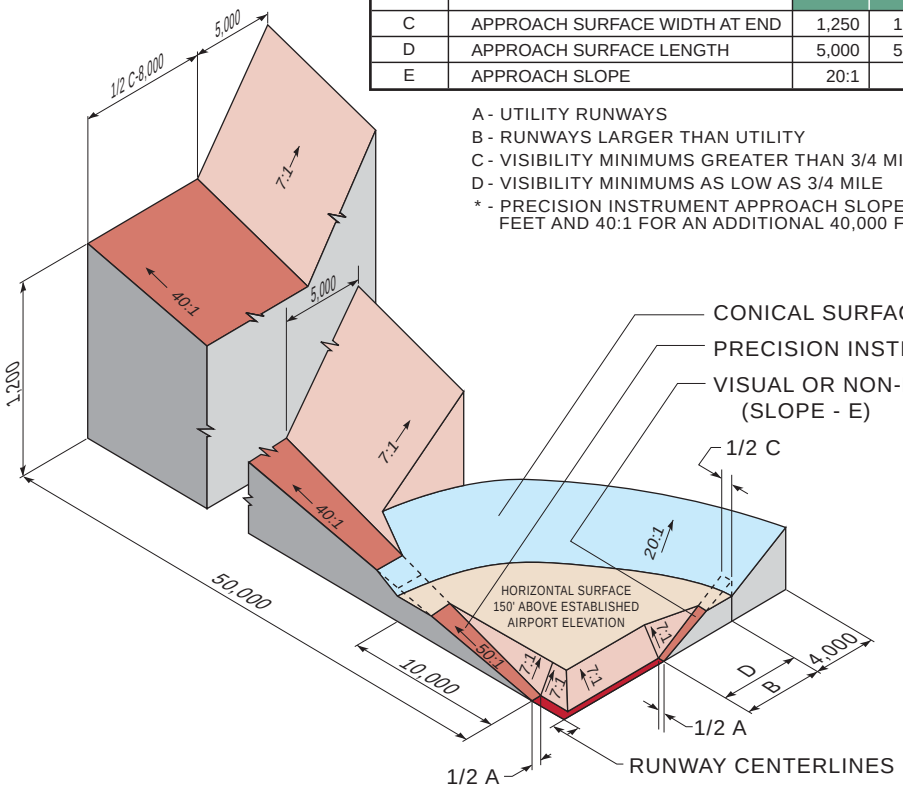
Airport Noise Compatibility Planning – Title 14 CFR Part 150 and Noise Control and Compatibility Planning for Airports – FAA Advisory Circular (AC) 150/5020-1

This federal regulation provides guidance for controlling planning for aviation noise compatibility on and around airports. These procedures and standards are used by the airport to prepare noise exposure maps and noise compatibility programs. The Title 14 CFR Part 150 process enables communities to plan for compatible land use around airports to minimize the impact from incompatible land uses on the



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
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		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
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
* - 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, Section 77.25, Civil Airport Imaginary Surfaces.

airport. The noise compatibility planning process is the only "regulatory" avenue available to local airport operators for addressing airport noise issues.

Flagstaff Airport completed a voluntary noise compatibility study in 2005. Commonly referred to as a Part 150 study, this plans involves preparations of two documents: the Noise Exposure Maps (NEM) and the Noise Compatibility Plan (NCP). The NEM document is the baseline analysis for the noise conditions at the airport and includes existing and forecast noise exposure contours. The NCP is the second phase and provides an analysis of alternatives to reduce or eliminate airport noise impacts identified in the NEM and concludes with a plan to effectively mitigate noise impacts.

The FAA's AC 150/5020-1 document guides the development of a Part 150 land use compatibility plan to ensure the environs surrounding an airport are not developed in a manner that could pose a risk to the airport's operations.

Airport Master Plans – FAA Advisory Circular (AC) 150/5070-6B

This document guides the development of Airport Master Plans. The guiding principle of the airport planning process is to develop a safe and efficient airport through the use of acceptable standards. While there are many steps in the planning process, none of these steps should be treated in a piecemeal manner. The airside and landside issues must be equally evaluated to create a plan that provides for compatible airport and community development where possible.

Airport Design - Advisory Circular (AC) 150/5300-13A

This document provides the basic standards and recommendations for airport design. Topics include various runway and taxiway safety areas, the runway protection zones, threshold siting surfaces, runway length, and facility separation standards.

LOCAL PLANNING

It is important to note the distinction between the primary land use concepts (existing land use, existing zoning, and general plan land use) used in evaluating development within the airport environs. Existing land use refers to property improvements as they exist today. This information is typically gathered from the county assessor's records or local land use maps. Existing zoning identifies the type of land use permitted on a given piece of property in accordance with the responsible jurisdiction's ordinances and maps. The future land use plan identifies the projected or future land use according to the locally adopted planning documents, sometimes referred to as comprehensive plans or general plans. These plans guide future development within the community planning area and provides the basis for zoning designations. In some cases, the land use allowed in the zoning ordinance or depicted in the future land use plan may differ from the existing land use.

Existing land use on the land surrounding Flagstaff Airport is composed of suburban residential development north of the airport, Fort Tuthill County Park, I-17 and industrial development to the west; and undeveloped U.S. Forest Service land to the south and east. To the northeast is the Pine Canyon development which includes homes and a private golf course. Existing land uses are shown on **Exhibit 1K**.

Also shown on **Exhibit 1K** is the future land use map as presented in the *Flagstaff Regional Plan 2030*. As indicated on the exhibit, much of the undeveloped areas surrounding the airport are within the Urban Growth Boundary. As noted in the *Flagstaff Regional Plan*, the Urban Growth Boundary is "used to mark the separation of urbanizable land from rural land and within which urban growth should be encouraged and contained and outside of which urban development should not occur." The policies within the plan clearly promote development within the Urban Growth Boundary; however, there are no specific land use plans for the areas adjacent to the airport which are controlled by the U.S. Forest Service.

The City of Flagstaff zoning map is shown on **Exhibit 1L**. As indicated on the map, much of the land to the south is classified as Public Lands Forest (PLF). There are also areas to the north and south of the airport which are zoned for rural residential (RR) development, which is described as development that would, "provide both housing and limited agricultural uses in those non-urban areas of the City which cannot be economically and efficiently provided with all those City services which are necessary for urban living." Additionally, there are lands north of the airport which are given two types of industrial classifications, Research and Development (RD) and Light Industrial Open (LI-O). These designations outline development which is similar to what exists today in these areas. Near I-17, there is also land designated as Highway Commercial (HC). This zone is established to "protect established commercial neighborhoods and to provide for a full range of services for the motoring public and for the community in general."

In addition to the height overlay discussed previously, the City of Flagstaff has established three Airport Noise Impact Areas based on noise exposure contours for the airport as part of the Airport Overlay Zone (AO). These include AP-1 (60-65 DNL); AP-2 (65-70 DNL); and AP-3 (70-75 DNL).

Similar to 14 CFR 150, the Airport Noise Impact Areas specify that noise levels should be classified into noise zones, using the DNL classifications for all noise sources.[1] There are three Airport Noise Impact Areas:

1. AP-1 for areas of Ldn 60-65;
2. AP-2 for areas of Ldn 65-70; and
3. AP-3 for areas of Ldn 70-75.[2]

In Section 10-40.50.040, Part C of the Zoning Code, regulations for where and what type of development can occur in the above Noise Impact Areas are explained. Residential development in AP-2 is discouraged, and it is strongly discouraged in AP-3. Only in the event that there is an absence of alternative

[1] Flagstaff Zoning Code Section 10-40.50.040 (Adopted February 16, 2016)
[2] Ldn is the mathematical symbol used by the AO Zone to represent DNL.

development options should development in these areas occur. Further, where the city determines that residential uses must be allowed, measures should be taken to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB (AP-2) and 30 dB (AP-3). These standards should be incorporated into building plans and considered in individual approvals. These NLR criteria will not eliminate outdoor noise problems, though, making building location, site planning, and design important aspects to mitigate outdoor noise exposure. Measures that reduce noise at a site should be used wherever practical.

SOCIOECONOMIC CHARACTERISTICS

Socioeconomic characteristics are collected and examined to derive an understanding of the dynamics of growth within the airport. This information is essential in determining aviation demand level requirements, as most general aviation demand can be directly related to the socioeconomic condition of the area. Statistical analysis of population, employment, and income trends can define the economic strength of the region and the ability of the region to sustain a strong economic base over an extended period of time.

POPULATION

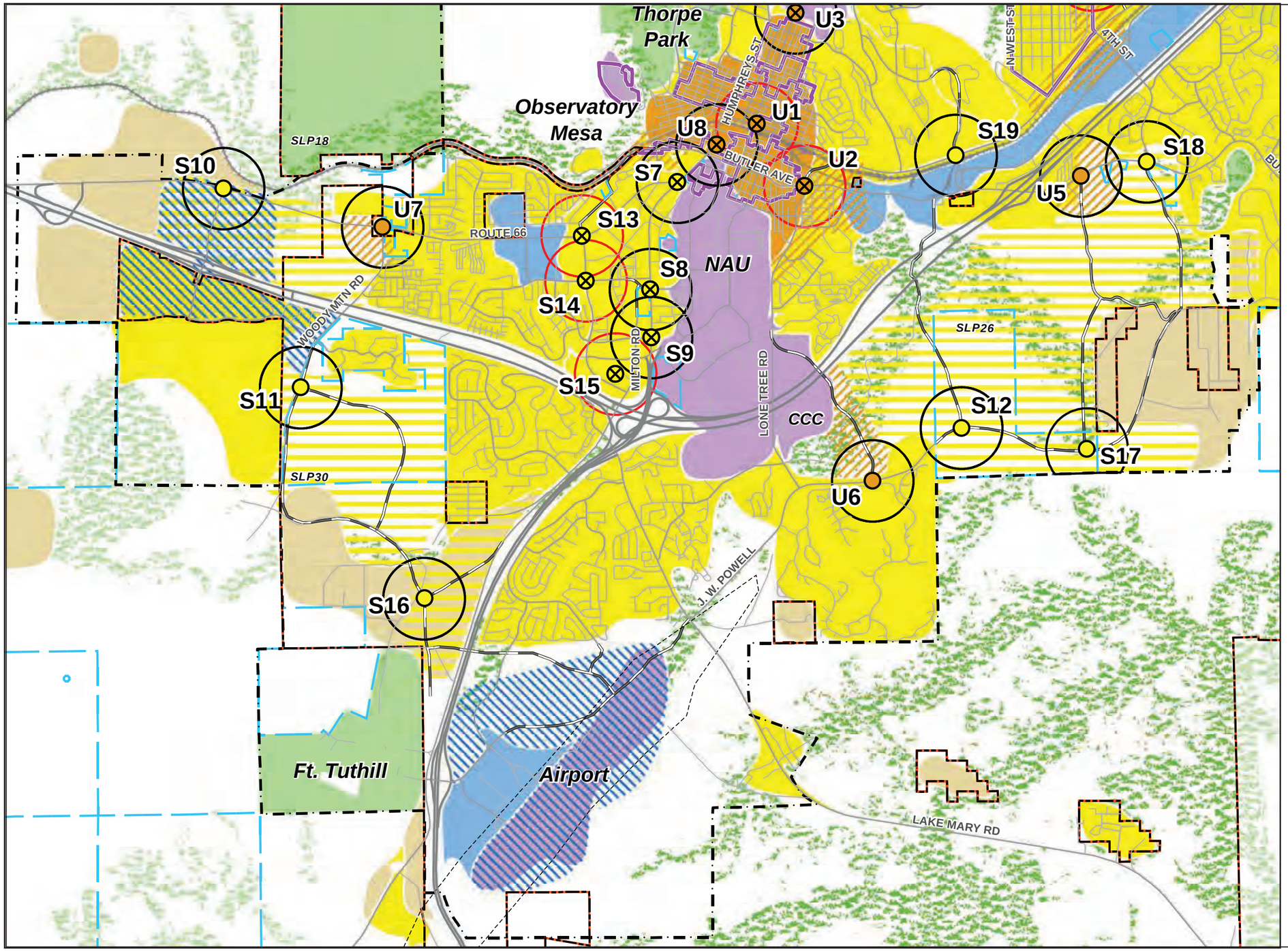
Population is one of the most important socioeconomic factors to consider when planning for future needs of an airport. Trends in population provide an indication of the potential of the region to sustain growth in aviation activity. Historical population data for the City of Flagstaff is presented in **Table 1E**. Additional population data for the Coconino County/MSA, the State of Arizona, and the United States is also included.

As shown in the table, all reporting entities have experienced positive growth in population since 1970. During this time, the population of the City of Flagstaff has increased at an compound annual growth rate (CAGR) of 2.2 percent. During the same time period, Coconino County and the State of Arizona had CAGRs of 2.5 percent and 3.2 respectively. As a point of comparison, the United States population grew at 1.1 percent. These positive growth trends have been attributed to the availability of affordable quality homes, excellent educational institutions, and enjoyable recreational amenities in the Flagstaff area.

TABLE 1E
Historic Population Trends

Year	City of Flagstaff	Coconino County	Arizona	United States
1970	26,117	48,326	1,775,399	204,053,325
1980	34,743	75,008	2,718,425	226,548,632
1990	45,857	96,591	3,665,228	248,709,873
2000	52,894	116,320	5,130,632	281,421,906
2010	65,870	134,421	6,392,017	308,745,538
2015	70,643	141,602	6,758,251	321,449,752
CAGR	2.2%	2.5%	3.2%	1.1%

Source: U.S. Census Bureau; Arizona State Demographer Office
CAGR – Compound Annual Growth Rate



LEGEND

- Urban Growth Boundary
- City of Flagstaff

Future Activity Center

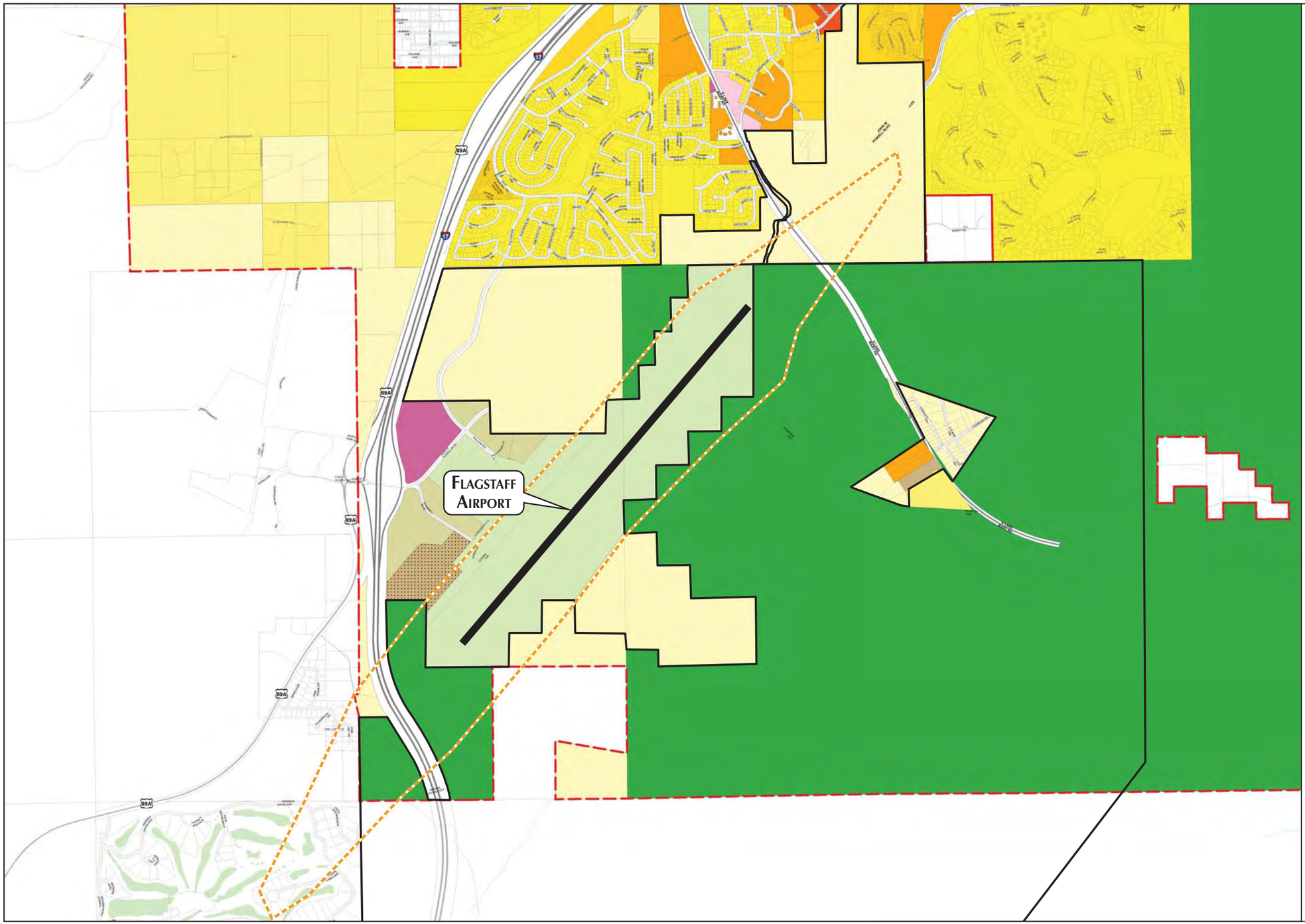
- Suburban Activity Center (S1) 'x' symbol identifies existing center
- Urban Activity Center (U1) 'x' symbol identifies existing center
- Rural Activity Center
- Rural - Existing
- Rural - Future
- Suburban - Existing
- Suburban - Future
- Urban - Existing
- Urban - Future
- Special Planning Area
- Existing Employment/Industrial
- Future Employment
- Park/Open Space
- Concentration of Natural Resources (see Figure 8)
- RTP Future Road Network
- Areas in white retain their existing entitlements
- Fly Zone

NORTH

NOT TO SCALE

Source: Flagstaff Regional Plan Vision 2030: Place Matters
As amended, May 5th, 2016

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Zoning:

Residential Zones:

- Rural Residential (RR)
- Estate Residential (ER)
- Single-family Residential (R1)
- Medium Density Residential (MR)
- High Density Residential (HR)
- Manufactured Housing (MH)

Commercial Zones:

- Highway Commercial (HC)
- Suburban Commercial (SC)

Industrial Zones:

- Research and Development (RD)
- Light Industrial (LI)
- Light Industrial Open (LI-O)

Resource and Open Space:

- Public Facility (PF)
- Public Lands Forest (PLF)

- Airport Overlay Zone
- City Limits
- Resource Overlay Protection Zone

NORTH

0 2,000 4,000

SCALE IN FEET

Source: City of Flagstaff Zoning Map, 11/01/2011

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EMPLOYMENT

Analysis of a region's employment base can be valuable in determining the overall well-being of the general area. In most cases, the area's makeup and health is significantly impacted by the availability of jobs, variety of employment opportunities, and types of wages provided by local employers. **Table 1F** provides historical employment characteristics beginning in 1970 for Coconino County, the State of Arizona, and the United States.

TABLE 1F
Historical Employment Statistics

	1970	1980	1990	2000	2010	2015	CAGR
Coconino County	20,147	35,164	48,543	70,051	83,135	88,252	3.3%
State of Arizona	746,651	1,282,614	1,894,107	2,808,565	3,208,327	3,536,249	3.5%
United States	91,277,573	113,983,152	138,330,928	165,370,857	173,034,656	188,866,185	1.6%

Source: Woods & Poole Complete Economic Demographic Data (2016)
CAGR – Compound Annual Growth Rate

As indicated in the table, total employment in Coconino County has grown by 3.3 percent annually since 1970. This is slightly slower growth than what has occurred at the state level, which has grown at a compound annual growth rate of 3.5 percent. As noted in the table, employment growth in the State of Arizona has outpaced nationwide employment growth during the same time period.

According to information available from the City of Flagstaff Economic Development Department, the employers with more than 250 employees within the City of Flagstaff are presented in **Table 1G**. As indicated in the table, Northern Arizona University is the largest employer, with more than 2,500 employees. Other major employers include local government offices for the City of Flagstaff and Coconino County, the Flagstaff Unified School District, Flagstaff Medical Center, and several manufacturing and warehousing entities.

TABLE 1G
Top Employers by Number of Employees

Name	Description	Employees
Northern Arizona University	Education	2,571
Flagstaff Medical Center	Health Services	2,200
W.L. Gore	Manufacturing	1,950
Flagstaff Unified School District	Education	1,375
Coconino County	Government	1,200
City of Flagstaff	Government	657
Wal-Mart	Warehousing	630
Walgreens Distributing	Warehousing	407
SCA Tissue	Manufacturing	255
Dell Systems	Warehousing	250

Source: City of Flagstaff Economic Development Department

PER CAPITA PERSONAL INCOME

Table 1H presents the per capita personal income (PCPI) for Coconino County since 1970. The PCPI for the State of Arizona and United States is also provided for this time period. PCPI is determined by dividing the total income by population. In order for PCPI to grow, income growth must outpace population growth significantly. As shown in the table, the region has experienced positive growth in PCPI since 1970.

TABLE 1H
Per Capita Personal Income (adjusted to 2009 dollars)

	1970	1980	1990	2000	2010	2015	CAGR
Coconino County	$14,602	$17,961	$20,936	$29,042	$33,6541	$36,615	2.1%
State of Arizona	$17,875	$21,911	$25,511	$31,942	$33,629	$35,375	1.5%
United States	$18,777	$23,086	$29,050	$36,812	$39,622	$42,928	1.9%

Source: Woods & Poole Complete Economic Demographic Data (2016)
CAGR – Compound Annual Growth Rate

ENVIRONMENTAL INVENTORY

This Environmental Inventory addresses the existing conditions at Flagstaff Airport and is intended to help identify relevant environmental issues that should be considered during preparation of the Airport Master Plan. The inventory is organized using the 14 resource categories contained in Federal Aviation Administration (FAA) Order 1050.1F, *Environmental Impact: Policies and Procedures.* Available information regarding the existing environmental conditions at the airport has been derived from internet resources, agency maps, and existing literature.

AIR QUALITY

Under the *Clean Air Act*, the United States (U.S.) Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) based on health risks for the following pollutants:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Lead (Pb)
- Ozone (O_3)
- Particulate matter (PM) measuring 10 micrometers or less in diameter (PM_{10})
- PM measuring two and a half micrometers or less in diameter ($PM_{2.5}$)

An area with ambient air concentrations exceeding the NAAQS for a criteria pollutant is said to be a nonattainment area for the pollutant's NAAQS, while an area where ambient concentrations are below the NAAQS is considered to be an attainment area. EPA requires that areas designated as nonattainment

demonstrate how they will attain the NAAQS by an established deadline. To accomplish this, states are required to prepare State Implementation Plans (SIPs). SIPs are typically a comprehensive set of reduction strategies and emissions budgets designed to bring the area into attainment.

The airport is located in Coconino County, Arizona. According to EPA's Green Book Nonattainment Areas, Coconino County is in attainment for all of the NAAQS standards.[3]

BIOLOGICAL RESOURCES (INCLUDING FISH, WILDLIFE AND PLANTS)

The U.S. Fish and Wildlife Service (USFWS) is charged with overseeing the requirements of the *Federal Endangered Species Act* (FESA), specifically Section 7, which sets forth requirements for consultation to determine if a proposed action "may affect" a federally endangered or threatened species. If an agency determines that an action "may affect" a federally protected species, then Section 7(a)(2) requires the agency to consult with USFWS to ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of any federally listed endangered or threatened species, or result in the destruction or adverse modification of critical habitat. If a species has been listed as a candidate species, Section 7(a)(4) states that each agency must confer with USFWS.

Additional federal laws protecting fish, wildlife, and plants include the *Migratory Bird Treaty Act* (MBTA), which prohibits activities that would harm migratory birds, their eggs, or nests; and the *Bald and Golden Eagle Protection Act*, which prohibits the take (defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb") of bald and golden eagles, including their parts, nests, or eggs, without a permit. Executive Order (E.O.) 13312, *Invasive Species,* aims to prevent the introduction of invasive species as a result of a proposed action. (E.O. 11990, *Protection of Wetlands,* is discussed under the Water Resources section of this report.)

According to USFWS, there are five threatened or endangered species in the vicinity of the airport:

- California Condor (*Gymnogyps californianus*) – Endangered, Bird
- Mexican Spotted Owl (*Strix occidentalis lucida*) – Threatened, Bird
- Yellow-billed Cuckoo (*Coccyzus amercanus*) – Threatened, Bird
- Roundtail Chub (*Gila robusta*) – Proposed Threatened, Fish
- Northern Mexican Gartersnake (*Thamnophis eques megalops*) – Threatened, Reptile

Although there are no areas of designated critical habitat in the airport environs, the potential exists for some of these threatened and endangered species to occur near or on airport property. Much of the airport property is considered forested land, which is habitat for the California Condor, Mexican Spotted Owl, and Yellow-billed Cuckoo.[4] In addition, Bald Eagles (*Haliaeetus leucocephalus*) are known to winter at Lake Mary and Mormon Lake, located approximately five miles southeast of the airport. The forested areas around the airport could also be used for roosting or foraging. The Roundtail Chub can be found

[3] https://www3.epa.gov/airquality/greenbook/anayo_az.html
[4] www.audubon.org – Audubon Bird Guide

in several rivers in Arizona, mostly in cool to warm waters over a wide range of elevations in rivers and streams.[5] The Northern Mexican Gartersnake is more commonly found in or near rivers, streams or cienegas (wet, marshy areas).[6] Waterways near the airport, including Bow and Arrow Wash and other unnamed streams, tend to be seasonally dry. Therefore, these areas are not prime habitat to support species which rely on aquatic habitat, such as the Roundtail Chub or Mexican Gartersnake.

There are 27 species of migratory birds protected by the MBTA that could potentially occur within Coconino County. These species are listed in **Table 1J**.

TABLE 1J
Birds Protected Under the *Migratory Bird Treaty Act*
Coconino County, Arizona

Bald Eagle	Olive-sided Flycatcher
Black-chinned Sparrow	Peregrine Falcon
Black-throated Gray Warbler	Phainopepla
Brewer's Sparrow	Pinyon Jay
Burrowing Owl	Red-faced Warbler
Flammulated Owl	Rufous-crowned Sparrow
Fox Sparrow	Short-eared Owl
Golden Eagle	Sonoran Yellow Warbler
Grace's Warbler	Swainson's Hawk
Gray Vireo	Virginia's Warbler
Lewis's Woodpecker	Western Grebe
Loggerhead Shrike	Williamson's Sapsucker
Lucy's Warbler	Willow Flycatcher
Olive Warbler	

Source: Information for Planning and Conservation (USFWS), September 2016.

CLIMATE

According to the EPA, U.S. aircraft are responsible for 11 percent of greenhouse gas (GHG) emissions in the U.S. transportation sector and three percent of the total U.S. GHG emissions.[7] While there is still some uncertainty on the exact impact the aviation industry has on climate change, a goal of reducing GHG emissions is a national priority.[8]

GHGs are those emissions that trap heat in the earth's atmosphere. They include: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). GHGs are both naturally occurring and anthropogenic (man-made). Aircraft jet engines, similar to other vehicle engines, produce CO_2, H_2O, nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), volatile organic compounds (VOCs), particulates, and other trace compounds. Due to its

[5] https://www.fws.gov/nevada/protected_species/fish/species/pahranagat_roundtail_chub.html
[6] http://www.reptilesofaz.org/Snakes-Subpages/h-t-eques.html
[7] https://www3.epa.gov/otaq/documents/aviation/420f15023.pdf
[8] https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref/media/3-climate.pdf

innate properties, CO_2 is the most important GHG to monitor. It remains in the atmosphere for up to 100 years, causing both short- and long-term impacts, locally and internationally. Climate change impacts include: increased air temperatures, sea level rise, and more frequent and intense storms.

The FAA is currently leading or participating in several efforts intended to clarify the role that commercial aviation plays relative to GHGs and climate change. The most comprehensive and multi-year program geared towards quantifying the climate change effects of aviation is the Aviation Climate Change Research Initiative (ACCRI), funded by the FAA and the National Aeronautics and Space Administration (NASA). ACCRI hopes to reduce key scientific uncertainties in quantifying aviation-related climate impacts and to provide timely scientific input to inform policy-making decisions.

The FAA also funds ASCENT, the Aviation Sustainability Center, also known as the Center of Excellence for Alternative Jet Fuels and Environment. The goal of ASCENT is to craft scientific solutions for the aviation industry's largest challenges, ranging from alternative jet fuel supply to altitude and speed optimization.[9] Finally, the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP) project 02-06 published a guidebook on preparing airport GHG emission inventories in September 2008.

Federal regulations specific to the aviation sector under the *Clean Air Act* regarding the reduction of GHG emissions have yet to be approved. However, in May 2014, the Obama Administration released the third U.S. National Climate Assessment (NCA), which discussed Arizona and the Southwest region. The NCA is a deliverable of President Obama's Climate Action Plan to cut carbon pollution, prepare America's communities for climate change impacts, and lead international efforts to address this global challenge. Arizona is part of the NCA's U.S. Southwest Region. As a region, the Southwest is considered the hottest and driest in the country, affecting 56 million people (expected to increase to 94 million by 2050).[10]

The NCA cites five main areas where climate change will have the greatest impact in Arizona, including agriculture, water resources, human health, ecosystems, and tribes. To address these issues – and others associated with climate change – Arizona is working toward state-wide GHG emissions reductions. The state is currently focusing all efforts on the EPA's Clean Power Plan (CPP) program, which was announced on August 3, 2015. The CPP requires states to develop and implement a plan that will reduce CO_2 emissions from existing fossil fuel-fired power plants to levels established by the EPA. The CPP required Arizona to lower their CO_2 emissions rate for affected power plants. The Arizona Department of Environmental Quality's (ADEQ) Air Quality Division's current focus is to create a CPP that is made by the ADEQ as opposed to adopting a federally issued CPP.[11]

[9] https://ascent.aero/
[10] https://www.whitehouse.gov/sites/default/files/docs/state-reports/arizona_nca_2014.pdf
[11] http://azdeq.gov/node/571

COASTAL RESOURCES

Federal activities involving or affecting coastal resources are governed by the *Coastal Barriers Resource Act* (CBRA), the *Coastal Zone Management Act* (CZMA), and E.O. 13089, *Coral Reef Protection*. The airport is not located near any coastal resources.

DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Section 4(f) of the U.S. *Department of Transportation Act* (DOT Act), which was recodified and renumbered as Section 303(c) of Title 49 United States Code (USC), states that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a historic site, public park, recreation area, or waterfowl and wildlife refuge of national, state, regional, or local importance unless there is no feasible and prudent alternative to the use of such land, and the project includes all possible planning to minimize harm resulting from the use.

The following list summarizes the nearest properties of each type that may be protected under Section 4(f) of the DOT Act. Those in map view are shown on **Exhibit 1M**.

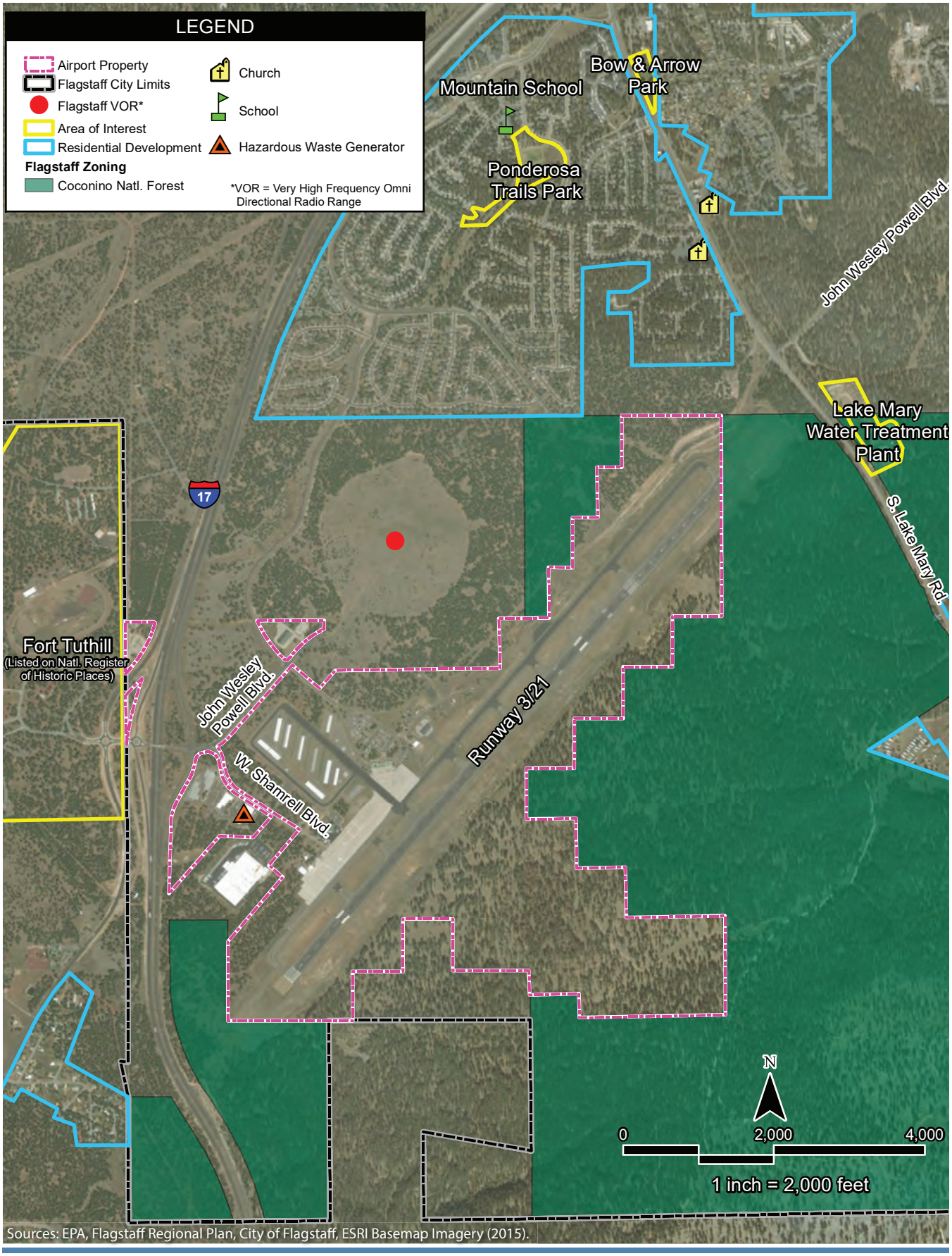
- Fort Tuthill, just northwest of the airport on the west side of Interstate 17 - includes County Fairgrounds, recreation areas, an extreme adventure course, and campgrounds
- Bow and Arrow Park, 0.8 mile north of the airport
- Ponderosa Trails Park, 0.9 miles north of the airport
- Coconino National Forest, located south, east, and northeast of the airport – includes passive recreational opportunities, such as hiking

The only property registered under the *National Historic Preservation Act* within two miles of the airport is Fort Tuthill, as noted in the Historical, Architectural, Archaeological, and Cultural Resources section.

FARMLANDS

The *Farmland Protection Policy Act* (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. For the purpose of the FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can also be forest land, pastureland, or other land, but not water or urban built-up land.

Based on the U.S. Department of Agriculture, Natural Resources Conservation Service – Web Soil Survey (NRCS-WSS), none of the soils on airport property are classified as prime farmland, unique farmland, or land of statewide or local importance.


LEGEND
Airport Property
Flagstaff City Limits
Flagstaff VOR*
Area of Interest
Residential Development
Flagstaff Zoning
Coconino Natl. Forest
Church
School
Hazardous Waste Generator
*VOR = Very High Frequency Omni Directional Radio Range
Mountain School
Bow & Arrow Park
Ponderosa Trails Park
John Wesley Powell Blvd.
Lake Mary Water Treatment Plant
S. Lake Mary Rd.
17
Fort Tuthill
(Listed on Natl. Register of Historic Places)
John Wesley Powell Blvd.
W. Shamrell Blvd.
Runway 3/21
N
0
2,000
4,000
1 inch = 2,000 feet
Sources: EPA, Flagstaff Regional Plan, City of Flagstaff, ESRI Basemap Imagery (2015).

HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

Federal, state, and local laws, including the *Resource Conservation Recovery Act* (RCRA) and the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), as amended (also known as the Superfund), regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. Disturbing areas that contain hazardous materials or contaminates can cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources.

According to the EPA's EJSCREEN website, there are no Superfund or Brownfield sites in proximity to the airport. However, there is one facility on airport property that generates hazardous waste. Located at 2901 West Shamrell Boulevard, SenesTech, Inc. operates a research and development business in the physical, engineering, and life sciences (shown on **Exhibit 1M**).[12] According to the *Coconino County Comprehensive Plan* (2015), SenesTech, Inc. is part of a Bioscience Tech Park located on airport property.

HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources. Impacts may occur when the proposed project causes an adverse effect on a property which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance. Fort Tuthill is the only property within two miles of the airport listed on the National Register of Historic Places (shown on **Exhibit 1M**).

LAND USE

Compatible land use evaluations for airports must consider the land uses in the vicinity of an airport to ensure those uses do not adversely affect safe aircraft operations. In addition, if an airport action would result in impacts exceeding FAA thresholds of significance which have land use ramifications, such as disruption of communities, relocation of businesses or residences, and induced socioeconomic impacts, the effects of the land use impacts shall be discussed.

As previously discussed, the City of Flagstaff has adopted an Airport Overlay Zone to, "ensure that land uses in the airport area are mutually compatible with the operation of the airport and that any public investment in the airport is protected." The city also designated a Resource Protection Overlay Zone, which encompasses the airport, given the presence of Coconino National Forest north, east, and south

[12] https://ofmpub.epa.gov/enviro/rcrainfoquery_3.facility_information?pgm_sys_id=AZR000508655

of the property. This Resource Protection Overlay Zone establishes a minimum forest resource protection threshold. The thresholds are set as a percentage of the site area and are used to determine the minimum amount of forest resources that must be retained on-site given the type of development (residential, commercial, industrial, etc.). **Exhibit 1L** shows zoning around the airport, as well as the two overlay zones discussed. **Exhibit 1M** shows what the City of Flagstaff has zoned as Coconino National Forest; however, this National Forest covers the entire area in view on **Exhibit 1M**.

NATURAL RESOURCES AND ENERGY SUPPLY

According to the *Flagstaff Regional Plan* (as amended 2015), the City of Flagstaff is the primary water provider within the region, serving most properties within the city's jurisdictional boundary. The Flagstaff region relies on surface water, groundwater, and reclaimed water to serve residential, commercial, industrial, and recreational needs. The city has increasingly relied upon groundwater as its primary water supply in the last 60 years. To help combat water scarcity issues, Coconino County and Flagstaff allow gray water and rainwater harvesting systems. The county's Landscape Ordinance and the city's Zoning Code also use principles of Xeriscape, which is a landscape design requiring little or no irrigation, and require appropriate low-water consumptive and native vegetation.

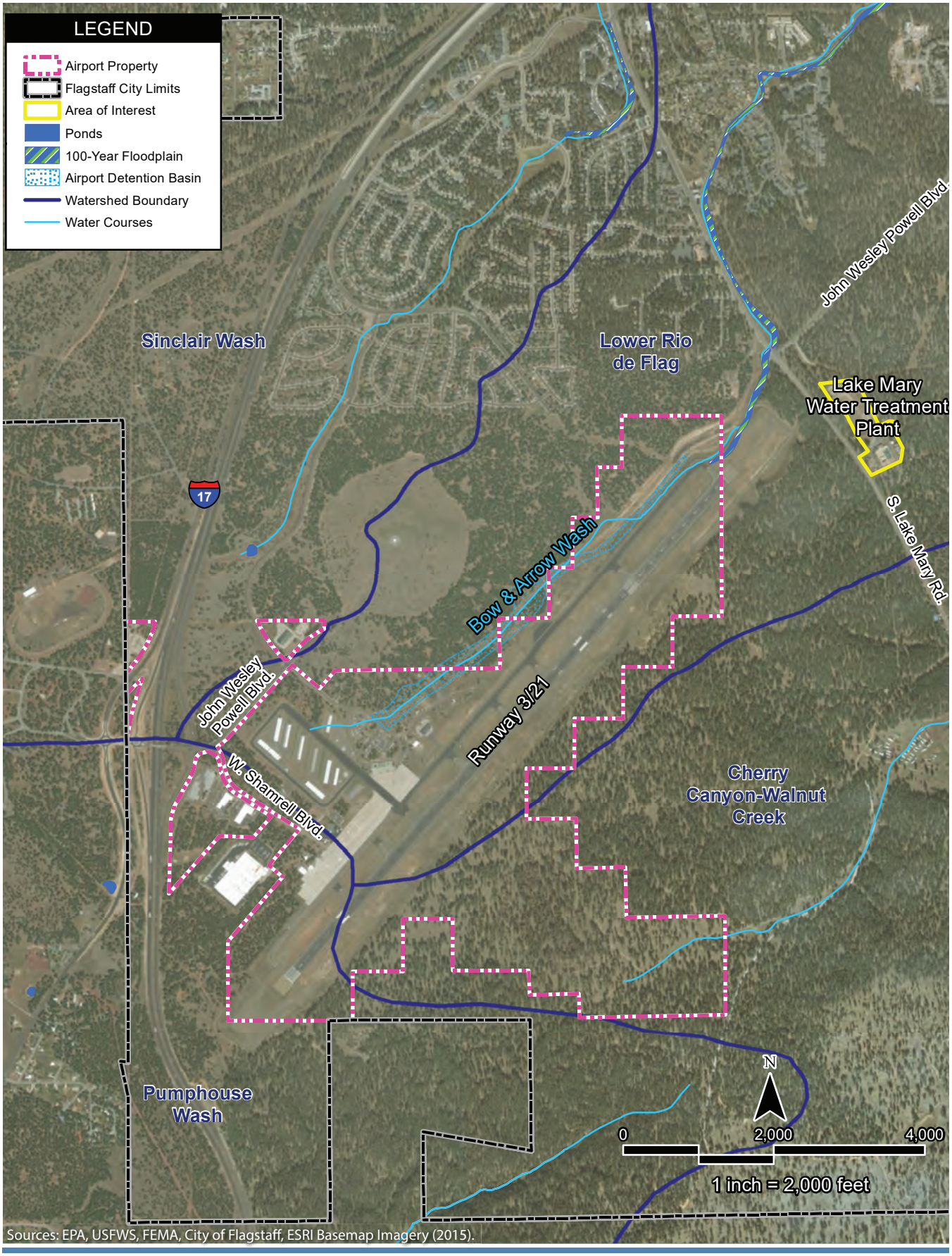
There are also two water treatment plants that the City of Flagstaff owns and operates. Depending on the source of the water – surface water or groundwater from wells – the water treatment process varies. Lake Mary Water Treatment Plant is located just east of Runway 21 on South Lake Mary Road (shown on **Exhibit 1M** and **Exhibit 1N**). This facility can treat up to eight million gallons of water per day, which comes from Upper Lake Mary (12 miles southeast from the plant). It is a conventional water treatment plant that includes coagulation, flocculation, sedimentation, filtration, and disinfection.[13] Additional information on water can be found in the Water Resources section.

NOISE AND COMPATIBLE LAND USE

Noise is considered to be unwanted sound that can disrupt activities, such as sleeping and student learning, in addition to causing annoyance. Aviation noise is caused primarily from aircraft operations, like departures, arrivals, overflights, taxiing, and engine run-ups. Most often, it is rural and suburban residential areas that are affected by airport noise exposure due to their inherently low noise level, as compared to more urbanized areas. There are also special noise sensitivities regarding certain uses, such as national parks.[14]

Federal land use compatibility guidelines are established under Title 14 Code of Federal Regulations (CFR) Part 150, *Airport Noise Compatibility Planning*. According to 14 CFR 150, residential land uses and

[13] http://www.flagstaff.az.gov/index.aspx?NID=96
[14]https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref/media/11-noise.pdf


LEGEND
Airport Property
Flagstaff City Limits
Area of Interest
Ponds
100-Year Floodplain
Airport Detention Basin
Watershed Boundary
Water Courses
Sinclair Wash
Lower Rio de Flag
John Wesley Powell Blvd.
Lake Mary Water Treatment Plant
S. Lake Mary Rd.
17
Bow & Arrow Wash
John Wesley Powell Blvd.
Runway 3/21
W. Shamrell Blvd.
Cherry Canyon-Walnut Creek
Pumphouse Wash
N
0
2,000
4,000
1 inch = 2,000 feet
Sources: EPA, USFWS, FEMA, City of Flagstaff, ESRI Basemap Imagery (2015).

schools are not considered compatible with a 65 decibel (dB) Day-Night Sound Level (DNL) noise exposure contour or higher. Religious facilities, hospitals, or nursing homes located within a 65 dB DNL contour are generally compatible if an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure.[15]

The previously discussed AO Zone, adopted following completion for the airport's Part 150 study, helps control conflicts between land uses and noise generated by aircraft and protects the public health, safety, and welfare from adverse impacts associated with excessive noise.

SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations,* and the accompanying Presidential Memorandum, and Order DOT 5610.2, *Environmental Justice*, require FAA to provide for meaningful public involvement by minority and low-income populations, as well as analysis that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse. Per the U.S. Census Bureau, 2010-2014 American Community Survey (ACS) 5-Year Estimates, the population count in the block group[16] that contains the airport has a population of 3,754 (Table B01003). Of this total population, 806 people (21.5%) are estimated to have an income below the poverty level (Table B17021). This block group contains a mix of minorities, including: Black or African American (32 people, <1%); American Indian and Alaska Native (148 people, 4.0%); and Asian (282 people, 7.5%) (Table B02001). According to the EPA's EJSCREEN online tool, there are no public or subsidized housing development within two miles of the airport.

VISUAL EFFECTS (INCLUDING LIGHT EMISSIONS)

Flagstaff was recognized as the world's first International Dark Sky City on October 24, 2001. The Dark Sky certification is available to any town, city, municipality, or other legally organized community that has shown efforts to preserve the night sky through implementation and enforcement of a quality outdoor lighting ordinance, dark sky education, and citizen support of the initiative. The overall goal of the International Dark Sky Association, the organization overseeing the certification process, is to advocate

[15] Noise-sensitive receptors are generally residences, churches/places of worship, hospitals and healthcare facilities, and educational facilities. Churches/places of worship are defined as permanently established facilities intended solely for use as places of worship and not meant to be converted to other potential uses. For a hospital/health care facility to be considered a noise-sensitive medical facility, it must provide for overnight stays or provide for longer recovery periods, where rest and relaxation are key considerations for use of the facility. Schools are facilities that provide full time use for instruction and training to students.

[16] Block Groups are statistical divisions of census tracts that generally contain between 600 and 3,000 people and are used to present data and control block numbering (U.S. Census Bureau, https://www.census.gov/geo/reference/gtc/gtc_bg.html). The airport is in Block Group 2, Census Tract 9.

for the protection of the night sky, educate the public and policymakers, promote environmentally responsible outdoor lighting, and empower the public with tools to bring back the night.[17] In an effort to protect the resources that support the Naval Observatory and Flagstaff's unique natural resources, Section 10-50.70.010 of the Flagstaff Zoning Code addresses lighting practices that minimize light pollution, glare, and light trespass; conserve energy and resources while maintaining night time safety, utility, security, and productivity; and curtail the degradation of the night time visual environment.

The Flagstaff Zoning Code (adopted April 4, 2017; effective May 5, 2017) established three Lighting Zones with varying development standards specific to their location within City limits. The airport is located in Lighting Zone II**.** Section 10-50.70.050 of the Code includes general requirements applicable to all lighting zones. Specific to Zone II, industrial facilities like the airport must adhere to the standards outlined in **Table 1K** and **Table 1L**. For all facilities in Zone II, there are time limits to when outdoor lights must be turned off. For the airport, 11:00 p.m. is the latest that outdoor lights can be illuminated. However, Section 10-50.70.080 lists exemptions, of which airport lighting is subject to the following:

- Required navigational lighting systems for the safe and efficient movement of aircraft during flight, take off, landing and taxiing is exempt.
- Lighting used for illumination of aircraft loading, unloading, and servicing areas is exempt from the lumens per acre limits.

TABLE 1K
Maximum Total Outdoor Light Output Standards
City of Flagstaff

Commercial, Industrial, and Multi-Family Residential (lumens per net acre)	Zone II
Total (Fully Shielded and Partially Shielded)	50,000
Partially Shielded only	5,500
Non-LPS and non-narrow spectrum amber LED	5,000

Source: City of Flagstaff Zoning Code

TABLE 1L
Lamp Type and Shielding Standards for Non-Residential Outdoor Lighting
City of Flagstaff

Lamp Type and Lighting Class	Zone II
Class I Lighting (Color Rendition)	
All lamp types and output	FS
Class 2 Lighting (General Illumination)	
All lamp types and outputs	FS
Class 3 Lighting (Decorative)	
All lamp types 2,500 lumens or above per fixture	X
All lamp types below 2,500 lumens per fixture	A

Key
FS: Allowed; only fully shielded fixtures permitted
A: Allowed; fully shielded fixtures preferred and partially shielded fixtures permitted subject to the amount listed in **Table 1K.**
X: Prohibited

Source: City of Flagstaff Zoning Code

[17] http://darksky.org/about/

The airport is also involved with a pilot project that the City's Engineering division is spearheading, called Street Lighting for Enhancing Dark Skies (SLEDS). This pilot project is testing out replacements for the street lighting that the City has been using for dark skies.

The *Flagstaff Regional Plan* (as amended 2015) addresses scenic resources, citing the importance of preserving and enhancing viewsheds and scenic vistas to, within, and from urbanized areas. The *Flagstaff Regional Plan* (as amended 2015) promotes strategies to protect scenic viewsheds by managing the amount and character of development, including regulating the type and intensity of development, design requirements, landscaping, and more. Although there is no section of the Flagstaff Zoning Code specific to protecting visual resources, it is incorporated in the code on sections relating to the development of land, including lot size, landscaping, building placement, outdoor signs, and lighting.

WATER RESOURCES (INCLUDING WETLANDS, FLOODPLAINS, SURFACE WATERS, GROUNDWATER, AND WILD AND SCENIC RIVERS)

Water resources are considered to be surface waters and groundwater that society relies upon for drinking, recreation, transportation, industry, agriculture, and aquatic ecosystems. Wetlands, surface waters, and floodplains operate as a single, integrated natural system and disruption to any part can affect the entire system. This section will look at five primary water systems, including wetlands, floodplains, surface waters, groundwater, and Wild and Scenic Rivers. Water resources in proximity to the airport are shown on **Exhibit 1N**.

The majority of the airport is located in the Lower Rio de Flag Watershed (HUC12 150200150104), but the property lines fall within three additional watersheds. Cherry Canyon-Walnut Creek Watershed (HUC12 150200150204) in the southeast quadrant of the property, Pumphouse Wash Watershed (HUC 12 150602020502) in the southwestern portion of the property, and Sinclair Wash Watershed in the northwest (HUC 12 150200150101). Pumphouse Wash Watershed drains into Oak Creek, which then drains into the Verde River.

The *Flagstaff Regional Plan* (as amended 2015) shows a regional detention basin project on airport property. This airport basin is part of a traditional storm drainage system originally designed to reduce 100-year peak flows during storm events. The traditional systems do not always address volume increases, stormwater quality, and groundwater recharge adequately, which prompted the city to incorporate low-impact development techniques to complement the traditional stormwater systems.

Wetlands

The U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material into waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*. Wetlands are defined in Executive Order 11990, *Protection of Wetlands*, as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would



support a prevalence of vegetation or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction." Wetlands can include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: the soil is inundated or saturated to the surface at some time during the growing season (hydrology), has a population of plants able to tolerate various degrees of flooding or frequent saturation (hydrophytes), and soils that are saturated enough to develop anaerobic conditions during the growing season (hydric).

According to the USFWS, which manages the National Wetlands Inventory on behalf of all federal agencies, there are no wetlands on airport property. The USFWS does indicate the presence of several freshwater ponds surrounding the airport. According to the NRCS-WSS, there are no hydric soils on airport property.

Floodplains

Executive Order 11988 directs federal agencies to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains. Based on a review of Federal Emergency Management Agency (FEMA) maps dated September 3, 2010 (map number 04005C6818G), the nearest 100-year floodplain is along Bow and Arrow Wash, which runs onto airport property along Runway 21 when it is not dry (see **Exhibit 1N**).

Surface Waters

The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often involve the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc. Examples of this include any in-water work resulting from expansion of an existing FAA facility adjacent to surface waters, or a withdrawal of water from a surface water for construction or operations. Additionally, Congress has mandated (under the *Clean Water Act*) the National Pollutant Discharge Elimination System. Through the use of permits, certain procedures are required to prevent contamination of water bodies from stormwater runoff.

According to the EPA's MyWATERS Mapper, there are no impaired waters on or near airport property, nor are there any waters with Total Maximum Daily Loads (TMDLs) or sediment impairments (including clay, silt, and sand). TMDLs have been established for Upper Lake Mary, which is located approximately eight miles to the southeast, given its primary function as a drinking water source.[18]

[18] *Flagstaff Regional Plan 2030* (Adopted January 14, 2014; Amended December 31, 2015)

The U.S. Geological Survey (USGS) National Water Information System Mapper shows no surface waters or springs on or near airport property. However, the EPA MyWATERS Mapper indicates the presence of two water sources flowing through airport property, an unnamed stream and Bow and Arrow Wash (**Exhibit 1N**). These might be considered waters of the U.S. under the *Clean Water* Act, depending on their connectivity to traditional navigable waters and the presence of indicators, such as ordinary high-water marks (OHWMs). All of these water resources appear to be dry unless there is enough precipitation to fill them. In addition to these water sources, there are two streams/rivers near the airport. There are three small ponds scattered west and northwest of the airport.

Groundwater

Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. The term aquifer is used to describe the geologic layers that store or transmit groundwater, such as to wells, springs, and other water sources. Examples of direct impacts to groundwater could include withdrawal of groundwater for operational purposes, or reduction of infiltration or recharge area due to new impervious surfaces. The Upper Santa Cruz and Avra Basin is the closest sole source aquifer, which is 158.6 miles south of the airport.

National Wild and Scenic Rivers and National River Inventory

The National Wild and Scenic Rivers System was created in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values[19]. Verde River is classified as a Wild and Scenic River. It is 45.5 miles south of the airport and is the closest such resource.

The Nationwide Rivers Inventory (NRI) is managed by the U.S. Department of the Interior's National Park Service. The NRI contains more than 3,400 rivers in the U.S. that are believed to have one or more natural or cultural characteristics deemed to be of more than local or regional importance.[20] Located 9.4 miles south of the airport, Oak Creek is the closest resource in the NRI.

SUMMARY

This chapter has presented comprehensive data related to the airport, the community, and surrounding area. This information provides the foundation upon which the remaining elements of the Master Plan can be accomplished and is important to forecast future aviation activity and facility needs.

[19] http://www.rivers.gov/wsr-act.php
[20] http://www.nps.gov/ncrc/programs/rtca/nri/index.html

DOCUMENT SOURCES

A variety of different sources were utilized in the inventory process. The following listing reflects a partial compilation of these sources. This does not include data provided by airport management as part of their records, nor does it include airport drawings or photographs which were referenced for information. On-site inventory and interviews with airport staff and tenants contributed to the inventory effort.

Flagstaff Regional Plan 2030 - Place Matters, City of Flagstaff, As Amended 2015.

Digital Chart Supplement (d-CS), U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, November 2016.

Phoenix Aeronautical Chart, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, October 2016.

National Plan of Integrated Airport Systems (NPIAS), U.S. Department of Transportation, Federal Aviation Administration, 2017-2021.

U.S. Terminal Procedures, Southwest, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, November 2016.
Arizona State Airports System Plan 2008. ADOT-MPD – Aeronautics Group.

Woods & Poole Economics, *The Complete Economic and Demographic Data Source, 2016*.

A number of internet websites were also used to collect information for the inventory. These include the following:

U.S. Census Bureau
http://www.census.gov

City of Flagstaff
www.flagstaff.az.gov/

City of Flagstaff Economic Development Department

http://www.chooseflagstaff.com/

Coconino County
www.coconino.az.gov/

FAA Terminal Area Forecast (January 2016)
https://aspm.faa.gov/main/taf.asp

FAA 5010 Data:
http://www.airnav.com
http://www.gcr1.com/5010Web

FLAGSTAFF AIRPORT

CHAPTER TWO

Forecasts







FLAGSTAFF AIRPORT

Chapter Two
FORECASTS







After an inventory of existing conditions, facility planning begins with defining the expected needs over the specified planning period. In airport master planning, this involves projecting potential aviation activity for a 20-year timeframe. Aviation demand forecasting at a commercial service airport such as Flagstaff Airport should consider commercial passenger service projections, general aviation forecasts for based aircraft, and aircraft operational activity projections by aggregate annualized totals and by specific categories. These will serve as the basis for facility planning and needs of the airport through the year 2035.

The objective of forecasting is to predict the magnitude of change expected over the next two decades. Many factors at the local, regional, and national levels can influence aviation activity making, it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Planning must remain flexible enough to respond to a range of potential developments, some unforeseen. Therefore, it is important to remember that forecasts serve simply as basic guidelines.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. The FAA reviews individual airport forecasts with the objective of comparing them to its *Terminal Area Forecast* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). In addition, aviation activity forecasts provide important input to the benefit-cost analyses associated with airport development, and the FAA reviews these analyses when federal funding requests are submitted.



Only two components of a Master Plan are approved by the FAA: the aviation demand forecasts and the Airport Layout Plan (ALP). The ALP will be updated later in this study.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, dated December 4, 2004, states that forecasts should be:

- Realistic;
- Based on the latest available data;
- Reflective of current conditions at the airport;
- Supported by information in the study; and
- Able to provide adequate justification for airport planning and development

The forecast process for an Airport Master Plan consists of a series of basic steps that vary in complexity depending upon the issues to be addressed and the type of airport being studied. The steps include a review of previous forecasts, determination of data needs, identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results. FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines seven standard steps involved in the forecast process, including:

1) **Identify Aviation Activity Measures**: The level and type of aviation activities likely to impact facility needs. For commercial service this is primarily passengers and operations; for general aviation, this typically includes based aircraft and operations.

2) **Review Previous Airport Forecasts**: May include the FAA *Terminal Area Forecast*, state or regional system plans, and previous master plans.

3) **Gather Data**: Determine what data is required to prepare the forecasts, identify data sources, and collect historical and forecast data.

4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.

5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.

6) **Summarize and Document Results**: Provide supporting text and tables as necessary.

7) **Compare Forecast Results with FAA's TAF**: Follow guidance in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*. In part, the Order indicates that forecasts should not vary significantly (more than 10 percent) from the TAF. When there is a greater than 10 percent variance, supporting documentation should be supplied to the FAA.

As mentioned earlier, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis for Flagstaff Airport was produced following these basic guidelines. Existing forecasts are examined and compared against current and historic activity. The historical aviation activity is then examined along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation demand projections for the airport that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

NATIONAL AVIATION TRENDS AND FORECASTS

The FAA updates and publishes a national aviation forecast on annual basis. This is comprised of forecasts for the large air carriers, regional/commuter air carriers, air cargo, general aviation, and FAA workload measures. The forecasts are used for FAA budget and planning as well as to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition when this chapter was prepared was FAA *Aerospace Forecasts – Fiscal Years 2016-2036*, published in March 2016. The FAA primarily uses the economic performance of the United States as an indicator of future aviation industry growth. Similar economic analyses are applied to the outlook for aviation growth in international markets. The following discussion is summarized from the FAA Aerospace Forecasts.

In 1978, the airline industry in the United States was deregulated. Since that time, the industry has gone through ups and downs primarily related to the economy, oftentimes very volatile. For over two decades after deregulation, the airlines were capital intensive as they competed for market share, but were left cash poor. While profits could be seen in good economic times, the economic cycle (and the price of oil) inevitably would turn, and airlines would suffer significant losses, sometimes resulting in bankruptcies or mergers.

The aftermath of the events of September 11, 2001 brought about a new round of airline restructuring and consolidation, and changes to airline business models were beginning to take shape. The "Great Recession" that began in 2007 and carried into 2009, however, brought about perhaps the most deliberate change in how the U.S. airlines manage their operations and finances.

The focus fully shifted from increasing market share to boosting returns on invested capital. The airlines worked to minimize losses through lowering operating costs, focusing on profitable routes, and removing older, less fuel-efficient aircraft from their fleets. A key to this was capacity discipline, which has become an industry buzz phrase in recent years. This discipline, combined with some airlines charging separately for certain services, has resulted in six consecutive years of profits for the U.S. airline industry.

U.S. ECONOMIC OUTLOOK

According to the FAA forecast report, as the economy recovers from the most serious economic downturn and slow recovery since the Great Depression, aviation will continue to grow over the long run. Fundamentally, demand for aviation is driven by economic activity. As economic growth picks up, so will growth in aviation activity. The FAA forecast calls for passenger growth over the next 20 years to average 2.1 percent annually. The steep decline in the price of oil in 2014 and 2015 sparked an uptick in passenger growth; however, forecasts are for oil to grow from $43 to $100 a barrel by 2023 and to $150 by 2035. That, combined with recessions in Brazil and Russia, a "hard landing" in China, inconsistent performance by emerging economies, and lack of stimulus in advanced economies, suggest that, while another recession has been avoided, fast economic growth is not likely on the horizon either.

U.S. economic performance in 2015 continued to be mixed, with modest growth in real gross domestic product (GDP) and real incomes, a slowly falling unemployment rate, and oil prices and consumer inflation remaining in check. In the medium term, (the three-year period between 2016 and 2020), U.S. economic growth is projected to average 2.6 percent per year. For the balance of the forecast period, annual average growth of U.S. real GDP is projected to grow at a rate of 2.3 percent. The long-term stability of U.S. economic growth depends on sustained growth in the workforce and capital stock, along with improved productivity and competitiveness.

U.S. TRAVEL DEMAND

By year end of federal fiscal year (FY) 2015, four airlines, American, Delta, Southwest, and United controlled over 70 percent of the U.S. domestic commercial aviation market. Mainline air carriers use large passenger jets (over 90 seats) and regional carriers that use smaller piston, turboprop, and regional jet aircraft (up to 90 seats) to provide connecting passengers to the larger carriers. Mainline and regional carriers offer domestic and international passenger service between the U.S. and foreign destinations, although regional carrier international service is confined to the border markets in Canada, Mexico, and the Caribbean. All-cargo carriers such as FedEx and UPS provide domestic and/or international air cargo service.

According to the FAA, there are three distinct trends shaping today's commercial air carrier industry: (1) continuing industry consolidation and restructuring; (2) continued capacity discipline in response to external shocks; and (3) the proliferation of ancillary revenues.

The restructuring and consolidation of the U.S. airline industry that began in the aftermath of the terror attacks of September 11, 2001 continued in 2015. During 2014, Southwest continued to integrate the former AirTran network into its operations. In 2015, American Airlines and U.S. Airways merged. Consequently, when compared to 2007, 1.3 percent fewer domestic available seat miles (ASMs) were flown and 1.0 percent more passengers were carried domestically in 2015. This has had clear implications with both the average size of aircraft and load factors increasing.

One of the most striking outcomes of industry restructuring has been the unprecedented period of capacity discipline (achieving higher passenger loads through scheduled flight and fleet mix consolidation primarily), especially in domestic markets. Between 1978 and 2000, ASMs in domestic markets increased at an average annual rate of four percent per year, recording only two years of decline. Even though domestic ASMs shrank by 6.9 percent in FY 2002, following the events of September 11, 2001, growth resumed, and by FY 2007, domestic ASMs were 3.6 percent above the FY 2000 level. However, between FY 2007 and 2015, ASMs in the U.S. domestic market are still down 1.2 percent, as the industry responded first to the sharp rise in oil prices (up 155 percent between 2004 and 2008) and then the Great Recession that followed (2008-2009). Finally, a 4.6 ASM percent growth in 2015 was the first strong year since 2004.

The reduction in domestic capacity was not shared equally between the mainline and regional carriers. To better match demand to capacity, the mainline carriers contracted out "thin" routes to their regional counterparts because they could provide lift at a lower cost, or simply removed the capacity altogether. In 2015, the mainline carrier group provided 0.9 percent less capacity than it did in 2007 (and carried 2.1 percent more passengers). Capacity flown by the regional group was still 3.0 percent lower than in 2007 (with passengers carried decreasing by 2.1 percent).

The most recent trend to take hold is that of ancillary revenues. Carriers generate ancillary revenues by selling products and services beyond that of an airplane ticket to customers. This includes the un-bundling of services previously included in the ticket price, such as checked bags and on-board meals, and by adding new services, such as boarding priority. As a result of capacity reduction, the introduction of ancillary revenue sources, and the help of very low oil prices, U.S. passenger carriers posted net profits for the sixth consecutive year in 2015.

FAA COMMERCIAL AIR CARRIER FORECASTS

Although the recession has been officially over for several years, in 2015, carriers continued to deal with economic uncertainties as wages remained stagnate, growth in household income was weak, and government spending levels also remained flat. At the same time, the unemployment rate fell and consumer spending was up. In such an uncertain but slowly improving economic environment, industry capacity growth was somewhat restrained (up 3.9 percent in 2015), after only a 2.3 percent increase in 2014. Despite the slow growth in demand, carriers were still able to raise airfares. This, coupled with ancillary revenue and falling fuel prices, resulted in U.S. carriers netting strong profits in 2015.

According to the FAA, domestic system capacity is projected to increase at a modest annual average of 2.2 percent through 2036. In the international sector, capacity is forecast to increase fastest in the Latin market, and slower in the Atlantic and Pacific markets, resulting in an overall international capacity increase of 3.4 annually percent through 2036.

Passenger demand growth is in line with capacity growth. Supported by growing U.S. and world economies, year over year revenue passenger miles (RPM) growth is forecast to be 2.6 percent on average through 2036. Over the same time period, system capacity growth averages 2.5 percent per year.

System passengers are projected to increase an average of 2.2 percent per year. By 2036, U.S. commercial air carriers are projected to fly 1.81 trillion ASMs and transport 1.24 billion enplaned passengers – a total of 1.53 trillion passenger miles.

Planes will remain crowded, with load factors projected to grow moderately during the early years of the forecast period, then leveling during the mid to latter years at 84.7 percent (up 0.5 points compared to the beginning of the forecast period in 2016).

Exhibit 2A presents the annual historical and forecast enplanement totals for both large air carriers and commuter airlines in the U.S., as forecast by the FAA.

FAA COMMERCIAL AIRCRAFT FLEET FORECASTS

The commercial passenger carrier fleet is undergoing transformation. The mainline carriers are retiring older, less fuel-efficient aircraft (e.g., 737-300/400/500, 757/767, and MD-80) and replacing them with more technologically advanced A319/320 and 737-700/800/900 aircraft. The regional carriers are growing their fleet of 70-90 seat regional jet aircraft and reducing their fleet of 50-seat jet aircraft. The total number of aircraft in the U.S. commercial fleet (including regional carriers) is estimated at 6,871 for 2015, an increase of 144 aircraft from 2014. This total includes 3,946 mainline air carrier passenger aircraft (over 90 seats), 781 mainline air cargo aircraft, and 2,144 regional carrier aircraft (jets, turboprops, and pistons).

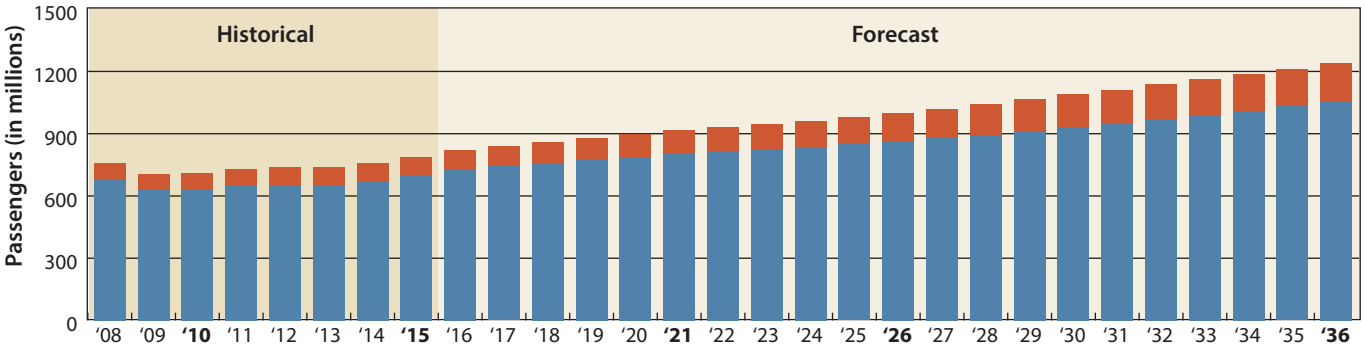
The number of passenger jets in the mainline fleet is forecast to grow to 5,339 by 2036, an average of 66 per year. The mainline narrow-body fleet (including the E-series aircraft) is projected to grow by an average of 51 aircraft annually from 2016-2036. The wide-body fleet (including the Boeing 787 and Airbus A-350) is projected to grow by 15 aircraft annually over the same period.

The regional passenger aircraft fleet is forecast to decrease by 448 aircraft (from 2,144 to 1,696) between 2015 and 2022 as the carriers continue to remove 50-seat regional jets and retire older turboprop and piston aircraft. By 2025, only a few 50-seat aircraft will remain. By 2036, the number of regional jets in the fleet are projected to recover to 1,786, up from 1,628 in 2015. The propeller fleet, however, is forecast to continue to shrink from 516 in 2015 to just 175 in 2036, leaving a total of 1,961 regional aircraft that year. All the growth in regional jets over the forecast period will occur in the larger, 70- to 90-seat aircraft category. During the forecast period, all regional jets of 50 or less seats are projected to be retired from the fleet.

FAA GENERAL AVIATION FORECASTS

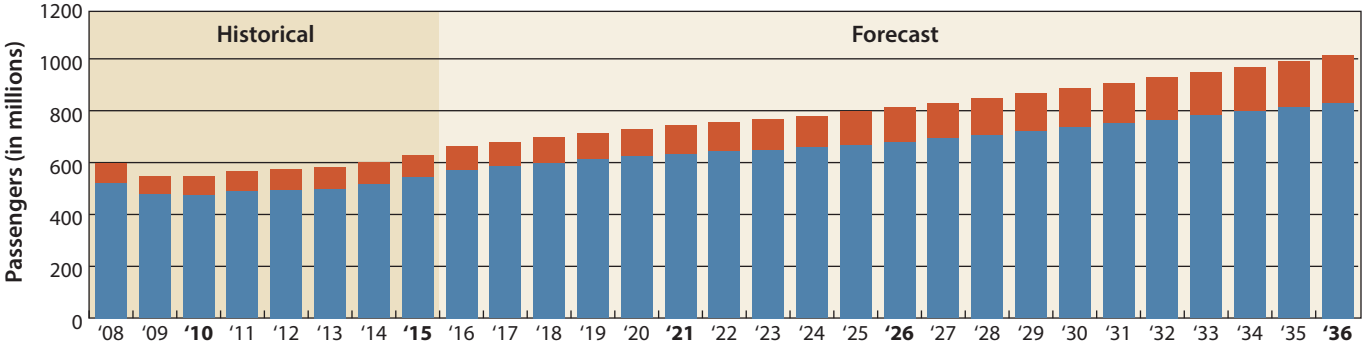
The FAA forecasts for general aviation include the fleet mix and hours flown for single engine piston aircraft, multi-engine piston aircraft, turboprops, business jets, piston and turbine helicopters, light sport, experimental, and others (gliders and balloons). The projections are made for “active aircraft,” rather than total aircraft. An active aircraft is one that has flown at least one hour during the year. From

U.S. AIR CARRIER PASSENGER ENPLANEMENTS[1]



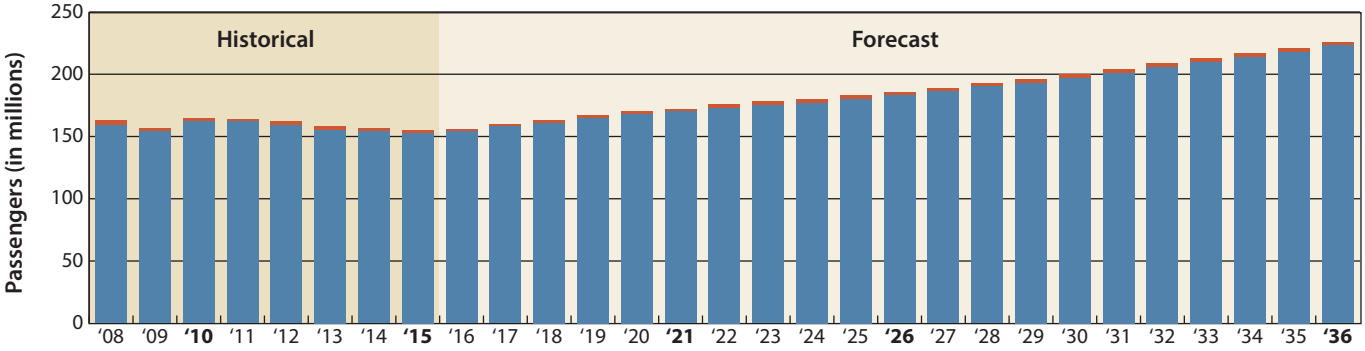
SOURCE	2015	2021	2026	2036	AAGR 2015-2036
Domestic Revenue Enplanements	696	803	863	1,052	2.0%
International Revenue Enplanements	89	113	135	188	3.6%
TOTAL	786	916	998	1,240	2.2%

U.S. MAINLINE AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2015	2021	2026	2036	AAGR 2015-2036
Domestic Revenue Enplanements	543	633	680	829	2.0%
International Revenue Enplanements	87	111	132	185	3.6%
TOTAL	631	743	812	1,014	2.3%

U.S. REGIONAL AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2015	2021	2026	2036	AAGR 2015-2036
Domestic Revenue Enplanements	153	170	183	223	1.8%
International Revenue Enplanements	2	2	3	3	1.8%
TOTAL	155	173	185	226	1.8%

Source: FAA Aerospace Forecast - Fiscal Years 2016-2036

Note: All figures measured in millions

2010 through 2013, an effort was undertaken within the FAA to have all aircraft owners re-register their aircraft. This effort resulted in a 10.5 percent decrease in the number of active general aviation aircraft, mostly in the piston category.

As previously discussed, the 2008-2009 economic recession had a negative impact on general aviation aircraft production, and the industry has been slow to recover. Aircraft manufacturing declined for three straight years from 2008 through 2010. According to the General Aviation Manufacturers Association (GAMA), there is optimism that aircraft manufacturing will stabilize and return to growth, which has been evidenced since 2011, even though 2015 saw a slight decline from the previous year. **Table 2A** presents historical data related to general aviation aircraft shipments.

TABLE 2A
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
1994	1,132	544	77	233	278	3,749
1995	1,251	605	61	285	300	4,294
1996	1,437	731	70	320	316	4,936
1997	1,840	1043	80	279	438	7,170
1998	2,457	1508	98	336	515	8,604
1999	2,808	1689	112	340	667	11,560
2000	3,147	1,877	103	415	752	13,496
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,962	1,999	52	319	592	12,093
2005	3,590	2,326	139	375	750	15,156
2006	4,054	2,513	242	412	887	18,815
2007	4,277	2,417	258	465	1,137	21,837
2008	3,974	1,943	176	538	1,317	24,846
2009	2,283	893	70	446	874	19,474
2010	2,024	781	108	368	767	19,715
2011	2,120	761	137	526	696	19,042
2012	2,164	817	91	584	672	18,895
2013	2,353	908	122	645	678	23,450
2014	2,454	986	143	603	722	24,499
2015	2,331	946	110	557	718	24,120

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet

Source: General Aviation Manufacturers Association *2015 General Aviation Statistical Databook & 2016 Industry Outlook*

Worldwide shipments of general aviation airplanes decreased in 2015, with a total of 2,331 units delivered around the globe compared to 2,454 units in 2014. Worldwide general aviation billings were also lower than the previous year. In 2015, $24 billion in new general aviation aircraft were shipped, but year-end results were mixed across the market segments. Results were impacted by economic uncertainty in key markets including Brazil, Europe, and China; however, the U.S. experienced stronger delivery numbers, which is cause for cautious optimism.

Business Jets: General aviation manufacturers delivered 718 business jets in 2015, as compared to 722 units in 2014. The industry's continued investment in new products helped maintain the delivery rate for business jets.

Turboprops: In 2015, 557 turboprop airplanes were delivered to customers around the world, a decline from the 603 delivered in 2014. Overall, the turboprop market is still significantly stronger over the past five years compared to years prior to 2011.

Pistons: Piston deliveries declined from 1,129 units during 2014 to 1,056 in 2015. Two-thirds of piston shipments were to North American customers, a significant increase from the 2014 North American market share of 55.1 percent.

The long-term outlook for general aviation is favorable, led by gains in turbine aircraft activity. The active general aviation fleet is forecast to increase 0.2 percent a year between 2015 and 2036, equating to an absolute increase in the fleet of about 7,000 units. While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed wing piston aircraft – continues to shrink over the FAA's forecast.

In 2015, the FAA estimated there were 138,135 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.7 percent from 2015-2036, resulting in 118,855 by 2036. This includes -0.7 percent annually for single engine pistons and -0.5 percent for multi-engine pistons.

Total turbine aircraft are forecast to grow at an annual growth rate of 2.1 percent through 2036. The FAA estimates there were 29,040 turbine-powered aircraft in the national fleet in 2015, and there will be 44,655 by 2036. This includes annual growth rates of 1.3 percent for turboprops, 2.5 percent for business jets, and 2.3 percent for turbine helicopters.

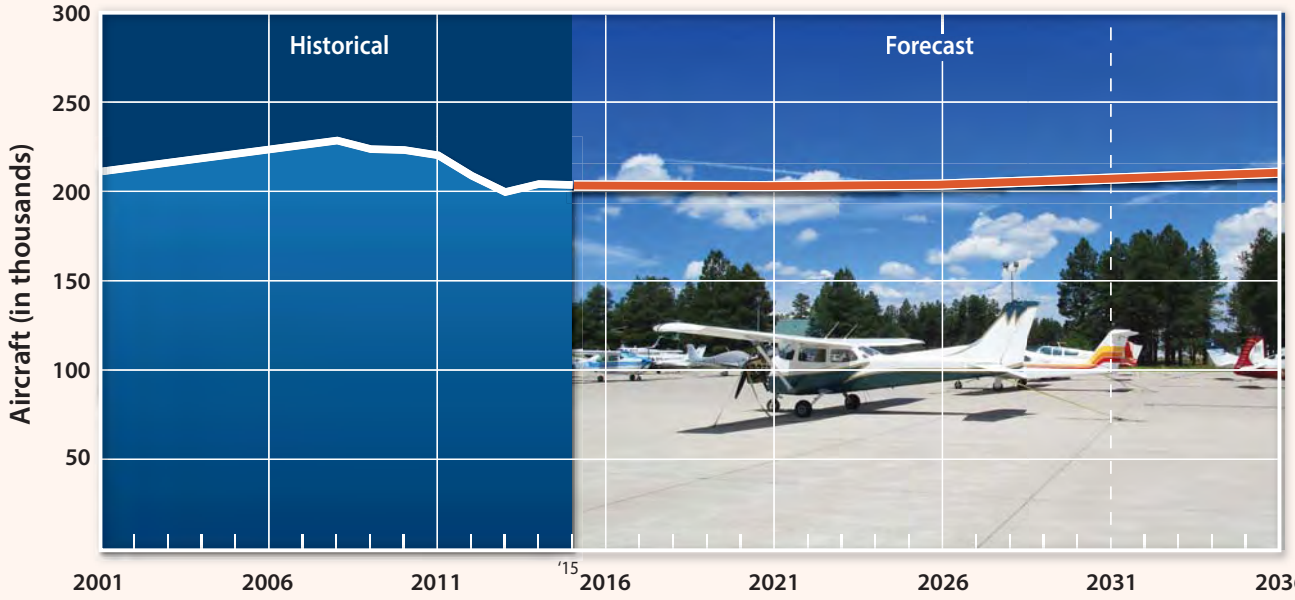
While comprising a much smaller portion of the general aviation fleet, experimental aircraft, typically identified as home-built aircraft, are projected to grow annually by 0.9 percent through 2036. The FAA estimates there were 26,435 experimental aircraft in 2016, and these are projected to grow to 31,640 by 2036. Sport aircraft are forecast to grow 4.5 percent annually through the long term, growing from 2,410 in 2015 to 6,100 by 2036. **Exhibit 2B** presents the historical and forecast U.S. active general aviation aircraft.

The FAA also forecasts total operations based upon activity at control towers across the U.S. Operations are categorized as air carrier, air taxi/commuter, general aviation, and military.

General aviation operations, both local and itinerant, declined significantly with the 2008-2009 recession and subsequent slow recovery. Through 2036, total general aviation operations are forecast to grow 0.3 percent annually. Air taxi/commuter operations are forecast to decline by 3.4 percent through 2025, and then increase slightly through the remainder of the forecast period. Overall, air taxi/commuter operations are forecast to decline by 1.1 percent annually from 2015 through 2036.

U.S. ACTIVE GENERAL AVIATION AIRCRAFT

	2015	2021	2026	2036	AAGR 2015-2036
Fixed Wing					
Piston					
Single Engine	125,050	119,585	115,045	107,160	-0.7%
Multi-Engine	13,085	12,760	12,480	11,695	-0.5%
Turbine					
Turboprop	9,570	9,215	9,775	12,635	1.3%
Turbojet	12,475	13,975	15,735	20,770	2.5%
Rotorcraft					
Piston	3,245	3,770	4,170	5,005	2.1%
Turbine	6,995	8,215	9,185	11,250	2.3%
Experimental					
	26,435	27,690	28,735	31,640	0.9%
Sport Aircraft					
	2,410	3,490	4,410	6,100	4.5%
Other					
	4,615	4,525	4,495	4,440	-0.2%
Total Pistons	**141,380**	**136,115**	**131,695**	**123,860**	**-0.6%**
Total Turbines	**29,040**	**31,405**	**34,695**	**44,655**	**2.1%**
Total Fleet	**203,880**	**203,225**	**204,030**	**210,695**	**0.2%**



Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.
Source: FAA Aerospace Forecast - Fiscal Years 2016-2036

AIRPORT SERVICE AREA

The next step in determining the aviation demand for an airport is to define its generalized service area for various segments of aviation the airport can accommodate. The service area is determined primarily by evaluating the location of competing airports, their capabilities, their services, and their relative attraction and convenience. In determining the aviation demand for an airport, it is necessary to identify the role of the airport as well as the specific areas of aviation demand the airport is intended to serve. For Flagstaff Airport, the primary roles are to accommodate commercial passenger airline service as well as general aviation demand in the region.

The service area for an airport is a geographic region from which an airport can be expected to attract the largest share of its activity. The definition of the service area can then be used to identify other factors, such as socioeconomic and demographic trends, which influence aviation demand at the airport. Moreover, aviation demand will be impacted by the proximity of competing airports, the surface transportation network, and the strength of commercial airline and/or general aviation services provided by the airport and competing airports.

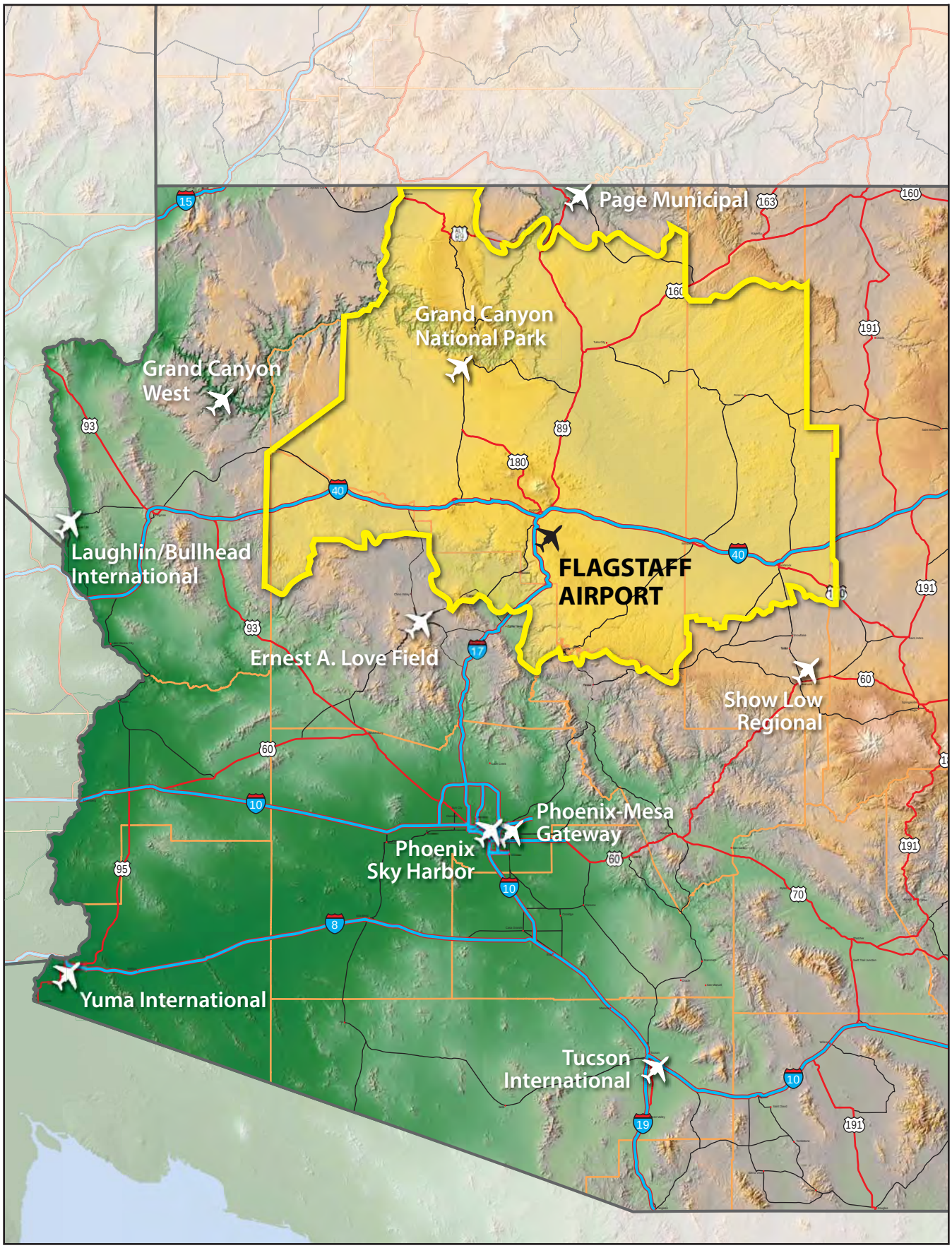
As in any business enterprise, the more attractive the facility is in terms of service and capabilities, the more competitive it will be in the market. If an airport's attractiveness increases in relation to nearby airports, so will the size of its service area. If facilities and services are adequate and/or competitive, some level of aviation activity might be attracted to the airport from more distant locales.

COMMERCIAL SERVICE

As of late 2016, Flagstaff Airport was one of only nine airports in Arizona with scheduled commercial air service. The closest options outside of Flagstaff are Ernest Love Field in Prescott (93 miles southwest); Page Municipal (130 miles north); Show Low Regional (134 miles southeast); and Phoenix Sky Harbor International (148 miles south). Sky Harbor is the only one of the four offering a higher level of service than Flagstaff Airport.

Classified as a large-hub airport, Sky Harbor offers non-stop domestic and international service. It is served by 12 U.S. airlines, including all the "big four" major airlines (American, Delta, Southwest, and United), as well as four international airlines. In 2015, the airport enplaned over 22 million passengers and had over 440,000 takeoffs and landings. Thus, the service at Sky Harbor International Airport will generally provide a high level of schedule flexibility, choice of airlines, more non-stop destinations, and potentially lower fares.

A Passenger Demand Study completed in 2015 for Flagstaff Airport defined the airport's commercial service area, as depicted in **Exhibit 2C.** The commercial service area for Flagstaff Airport encompasses 22 zip codes in north central Arizona, including portions of Coconino, Yavapai, and Navajo Counties. Flagstaff is the largest city within the service area. The service area had an estimated population of 176,940 in 2015.


Page Municipal
Grand Canyon National Park
Grand Canyon West
Laughlin/Bullhead International
FLAGSTAFF AIRPORT
Ernest A. Love Field
Show Low Regional
Phoenix-Mesa Gateway
Phoenix Sky Harbor
Yuma International
Tucson International

GENERAL AVIATION

General aviation describes a diverse range of aviation activities including all segments of the industry, except for commercial air carriers and military. General aviation is the largest component of the national aviation system and includes common activities such as pilot training, recreational flying, agricultural applications, medical support, and other business and corporate uses. General aviation aircraft can range from small glider and single engine aircraft to large turboprop and jet-powered aircraft. In fact, some larger commercial airline aircraft models such as the Boeing 737, known as the Boeing Business Jet (BBJ), have been converted to private general aviation uses. Moreover, many retired military aircraft are now in service with general aviation functions.

The general aviation service area for regionalized airports is generally considered to approximately 30 miles. The proximity and level of general aviation services are largely the defining factors when describing the general aviation service area. A description of airports within an approximate 50-nautical mile radius of Flagstaff Airport was discussed in Chapter One. Six public-use airports were included in this proximity.

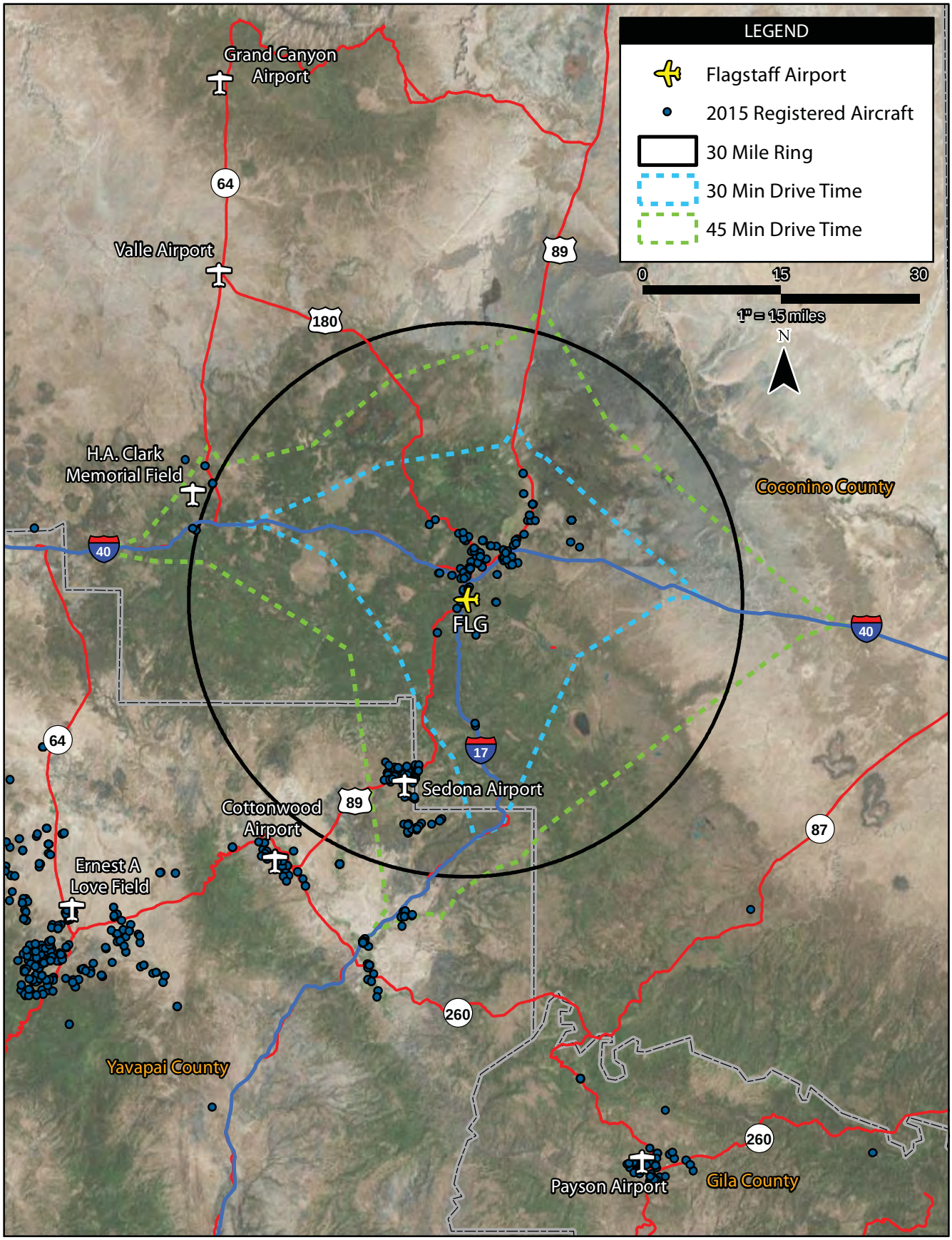
Flagstaff Airport's location south of the City near the interchange of Interstates 17 and 40 makes it an important facility serving the needs of general aviation in the southwestern portions of Coconino County. Existing airport facilities, its 8,800 foot-long runway, precision instrument approach capabilities, high quality aviation service providers, and hangar space situates the airport as the region's premier general aviation option.

In addition to attracting transient aircraft visiting the area, an airport's ability to attract based aircraft is important. As long as reasonably priced hangars and aviation services are offered, most aircraft owners and operators will choose to base at an airport nearest their home or business. On this premise, the general aviation service area will tend to be more compact than a commercial service area. The corporate aviation component of the service area can extend a bit farther, depending on competing airports.

Exhibit 2D depicts the location of registered aircraft in the region at the end of 2015. The majority of registered aircraft are concentrated in and around regional population centers. In fact, many are located very close to an existing airport. Besides the 30-mile ring mentioned previously, **Exhibit 2D** also indicates 30-minute and 45-minute drive times from the airport.

Most significant population centers in the region are served by local general aviation airports. While many of these airports may have more limited facilities and offer fewer services, they are closer to their local aircraft owners and airport users. Most general aviation operators will elect to operate at a closer airport unless facilities or services cannot be provided. Another example could include an aircraft operator choosing a more distant airport location with preferable rate and fee structures.

For planning purposes, the primary general aviation service area for Flagstaff Airport will be the immediate Flagstaff area. Airports serving the population centers of Williams, Sedona, and Winslow effectively limit the service area. Furthermore, Valle Airport located to the northwest will limit general aviation demand coming from the more sparsely populated areas north.



Source: ESRI Basemap Imagery (2014), FAA Registered Aircraft Database

SOCIOECONOMIC TRENDS

The socioeconomic conditions for the Flagstaff area provide an important baseline for preparing aviation demand forecasts. Local socioeconomic variables such as population, employment, and income are indicators for understanding the dynamics of the area and, in particular, trends in aviation growth.

POPULATION

Population data and forecasts for Flagstaff and Coconino County, which is also the Flagstaff Metropolitan Statistical Area (MSA), are presented in **Table 2B**. The data was obtained from the Arizona Department of Administration – Employment and Population Statistics.

In 1970, the City comprised 54 percent of the County population. By 1980, the ratio had declined to 46.3 percent. From 1990 through 2004, the ratio remained relatively constant at 47.1 percent. By 2015, Flagstaff had grown to contain nearly half (49.9 percent) of the County population. Going forward, Flagstaff is forecast to continue to grow at a slightly faster rate than the rest of the County, ultimately comprising 53.4 percent of the population

Table 2B
Population
City of Flagstaff and Coconino County

	Population		City %
Year	City	County	of County
1970	26,117	48,326	54.0%
1980	34,743	75,008	46.3%
1990	45,857	96,591	47.5%
2000	52,894	116,320	45.5%
2001	57,527	122,255	47.1%
2002	58,840	124,509	47.3%
2003	60,273	126,876	47.5%
2004	60,869	128,211	47.5%
2005	60,726	128,907	47.1%
2006	61,453	130,269	47.2%
2007	63,489	132,512	47.9%
2008	63,867	132,864	48.1%
2009	64,581	133,626	48.3%
2010	65,870	134,421	49.0%
2011	66,013	134,162	49.2%
2012	66,322	134,313	49.4%
2013	67,502	135,695	49.7%
2014	69,391	139,372	49.8%
2015	70,643	141,602	49.9%
Forecast			
2020	76,122	149,769	50.8%
2025	81,044	156,363	51.8%
2035	87,951	164,844	53.4%

Source: Arizona Department of Administration - Employment and Population Statistics

Total resident population for Coconino County in 2015 was estimated at 141,602. As presented in **Table 2C**, the County has experienced a compound annual growth rate (CAGR) of 1.83 percent since 1980. The population for the area is forecast to increase to 164,844 by 2035, representing a 0.76 percent CAGR over the planning period.

EMPLOYMENT

Historical and forecast employment data for Coconino County are also presented in **Table 2C**. Between 1980 and 2014, Coconino County employment grew by an average of 2.50 percent annually. Through the next 20 years, the County's employment is forecast to grow at a 2.07 average annual pace to reach 125,497 by 2035.

PER CAPITA PERSONAL INCOME

Table 2C also compares per capita personal income (PCPI), adjusted to 2009 dollars, for the County. Coconino County's adjusted PCPI for 2015 was $36,615 compared to $17,961 in 1980 for an CAGR of 2.03 percent. The County is projected to continue to show gains in PCPI through the planning period of this study, increasing at a 1.51 percent CAGR.

Table 2C
Socioeconomic Statistics
Coconino County

Year	Population	Employment	PCPI (2009$)
1980	75,008	35,165	$17,961
1990	96,591	48,543	$20,936
2000	116,320	69,832	$29,042
2010	134,421	76,443	$33,654
2015	141,602	83,350	$36,615
CAGR 1980-2015	1.83%	2.50%	2.06%
Forecast			
2020	149,769	97,417	$39,855
2025	156,363	106,746	$43,218
2035	164,844	125,497	$49,395
CAGR 2015-2035	0.76%	2.07%	1.51%

Sources: Arizona Department of Administration - Employment and Population Statistics; Woods & Poole Complete Economic Demographic Data (2016)

FORECASTING APPROACH

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast.

The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered in the aviation industry include trend line projections, correlation/regression analysis, and market share analysis. By developing several projections for each aviation demand indicator, a reasonable planning envelope will emerge. The selected forecast may be one of the individual projections or a combination of several projections based on local conditions. The selected forecast will almost always fall within the planning envelope. Some combination of the following forecasting techniques is utilized to develop the planning envelope for each demand indicator.

Trend line projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical demand data, then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Correlation analysis provides a measure of the direct relationship between two separate sets of historic data. Should there be a reasonable correlation between the data, further evaluation using regression analysis may be employed.



Regression analysis measures the statistical relationship between dependent and independent variables, yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures associations between the changes in a dependent variable and independent variable(s). If the r-squared (r^2) value (coefficient determination) is greater than 0.90, it indicates good predictive reliability. A value below 0.90 may be used with the understanding that the predictive reliability is lower.

Market share analysis involves a historical review of aviation activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections, but can provide a useful check on the validity of other forecasting techniques.

It is important to note that forecasts will age, and the farther a forecast is from the base year, the less reliable it may become, particularly due to changing local and national conditions. Nonetheless, the FAA indicates that a Master Plan include a 20-year forecast for the airport. Facility and financial planning usually require at least a 10-year view, since it often takes more than five years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

A wide range of factors is known to influence the aviation industry and can have significant impacts on the extent and nature of air service provided in both the local and national markets. Technological advances in aviation have historically altered, and will continue to change, the growth rates in aviation demand over time. The most obvious example is the impact of jet aircraft on the aviation industry, which resulted in a growth rate that far exceeded expectations. Such changes are difficult, if not impossible, to predict, and there is simply no mathematical way to estimate their impacts.

Using a broad spectrum of local, regional, and national socioeconomic and aviation information and analyzing the most current aviation trends, forecasts are presented for the following demand indicators:

COMMERCIAL SERVICE
- Annual Enplaned Passengers
- Operations and Fleet Mix

GENERAL AVIATION
- Based Aircraft
- Based Aircraft Fleet Mix
- Aircraft Operations

OTHER AIR TAXI AND MILITARY
- Aircraft Operations

PEAKING CHARACTERISTICS
- Airline Activity
- General Aviation and Other Air Taxi Activity



COMMERCIAL SERVICE FORECASTS

Since deregulation of the airline industry in 1979, air service at Flagstaff Airport has been primarily comprised of regional/commuter service. Prior to deregulation, Frontier Airlines served Flagstaff Airport with Convair 580 turboprops and DC-9 jets. After Frontier discontinued service in August 1979, airline service was reduced to 19-seat turboprop and smaller aircraft.

In 1987, America West Airlines entered the market primarily using 37-seat De-Havilland Dash 8 aircraft, and an occasional Boeing 737. As a result of the larger aircraft, the airport saw enplanements grow from just 19,000 in 1985 to over 51,000 by 1990. In 1993, America West turned to a code sharing arrangement with Mesa Airlines to operate as America West Express. Service was once again reduced to 19-seat aircraft, with SkyWest also flying the smaller turboprops. The result was a drop in passenger traffic once more. By the summer of 1994, SkyWest dropped its service and America West converted back to the Dash 8 aircraft.

The Dash 8 continued in service until after the runway was extended to 8,800 feet in late 2007. During this time, Horizon Airlines started daily service to Los Angeles International Airport, and enplanements rose to over 68,000. By the end of 2012, 50-seat Canadair CRJ-200 regional jets were beginning to replace the Dash 8, as America West's name changed with the acquisition of USAirways. The recession brought a decline in passenger traffic to 56,000 in 2013. That year, the airline had moved its code sharing arrangement to SkyWest and was operating an all-regional jet fleet into Flagstaff Airport. USAirways was involved in yet another consolidation and name change when it acquired American Airlines in 2014. A new high for enplanements of 68,754 was also reached in 2014. In the final months of 2016, the airline converted its service to the airport to the larger 70-seat regional jet.

ENPLANEMENT FORECASTS

Table 2D depicts the annual enplaned passengers at Flagstaff Airport since 1995. Prior to deregulation in 1979, the airport's highest annual enplanement level was around 16,000. This has been exceeded every year since 1984 with a high of 68,754 in 2014. The events of 9-11 and an accompanying recession led to a period of uncertainty for many airports relying on regional carrier service. Enplanements at Flagstaff Airport in 2001 were at their lowest level since before America West began service in 1987. Traffic began to recover slowly after 2001, then made a jump back over 50,000 the year after the runway extension was completed. Traffic continued to grow through 2010 in spite of the Great Recession. It was not until 2011 that passenger enplanements at the airport declined as a result of the airlines' capacity reduction.

This fluctuation in activity created by various airline decisions and national events has made it very difficult to utilize trend line, correlation, and regression analyses because of the wide variety of complex factors involved. In addition, such a complex formula would still be at the ultimate mercy of the forecast of the multitude of independent variables. **Table 2D** examines the last 20 years of the airport's enplanements as a percentage of the domestic enplanements in the United States (market share), as well as the ratio of enplanements to population (travel propensity factor) in the Flagstaff MSA.

Market Share of Domestic Enplanements

Over the last 20 years, Flagstaff Airport's market share has fluctuated from 0.0050 percent in 2001 to a high of 0.0108 percent in 2010. In the seven years after 9-11, the airport's market share was relatively constant, averaging 0.0066% of domestic enplanements. Over the last seven years, the average has been 0.0100%.

TABLE 2D
Market Share and Travel Propensity Projections
Flagstaff Airport

Year	FLG Enplaned	U.S. Domestic Enplanements (millions)	FLG Market Share	Flagstaff MSA Population	Travel Propensity Factor
1995	39,213	531.1	0.0074%	110,954	0.35
1996	47,141	558.1	0.0084%	112,686	0.42
1997	46,704	579.1	0.0081%	114,444	0.41
1998	39,573	592.1	0.0067%	114,874	0.34
1999	36,656	613.3	0.0060%	115,307	0.32
2000	34,483	641.2	0.0054%	116,320	0.30
2001	31,370	625.3	0.0050%	122,255	0.26
2002	37,257	574.6	0.0065%	124,509	0.30
2003	36,400	587.3	0.0062%	126,876	0.29
2004	40,064	628.5	0.0064%	128,211	0.31
2005	41,180	669.5	0.0062%	128,907	0.32
2006	41,996	668.4	0.0063%	130,269	0.32
2007	45,770	688.5	0.0066%	132,512	0.35
2008	54,553	680.7	0.0080%	132,864	0.41
2009	68,056	630.8	0.0108%	133,626	0.51
2010	68,296	634.8	0.0108%	134,421	0.51
2011	63,136	650.1	0.0097%	134,162	0.47
2012	63,971	653.8	0.0098%	134,313	0.48
2013	56,875	654.4	0.0087%	135,695	0.42
2014	68,754	669.0	0.0103%	139,372	0.49
2015	67,421	696.0	0.0097%	141,602	0.48
FAA Terminal Area Forecast (TAF)					
2020	77,324	790.0	0.0098%	149,769	0.52
2025	86,678	848.0	0.0102%	156,363	0.55
2035	108,940	1,031.0	0.0106%	164,844	0.66
Mid-Range Retention (Selected Forecast)					
2020	80,000	790.0	0.0101%	149,769	0.53
2025	95,000	848.0	0.0112%	156,363	0.61
2035	125,000	1,031.0	0.0121%	164,844	0.76
High Range Retention					
2020	85,000	790.0	0.0108%	149,769	0.57
2025	105,000	848.0	0.0124%	156,363	0.67
2035	155,000	1,031.0	0.0150%	164,844	0.94

Source: Arizona Department of Administration – Population Statistics; Woods & Poole Complete Economic Demographic Data (2016); Airport Records; U.S. Department of Transportation (USDOT) TransStats website.

Travel Propensity Factor

There are a variety of local factors that affect the potential for passengers within an area. A key statistic is the relationship between an airport's enplanement levels to the populace it serves. This ratio of enplanements to population is often termed the Travel Propensity Factor (TPF). **Table 2D** presents a review of the TPF for the Flagstaff MSA over the last 20 years. The TPF is generally impacted by the proximity of an airport to other airports in the region with higher levels of service or "hub" airports. Regional airports with higher TPFs tend to be located farther from hub airports and in relatively isolated areas. These airports tend to have a service area that extends into adjacent, well-populated regions, or have some type of air service advantage that attracts more passengers that might otherwise choose to drive to a more distant hub airport for commercial service needs.

As with market share, the TPF reached a peak in 2009 and 2010 of 0.51, recovering from a low of 0.26 in 2001. From 2002 to 2008, the TPF averaged 0.33. With the integration of regional jet service, the TPF has averaged 0.48 since 2009.

Terminal Area Forecast

The FAA annually publishes an updated set of activity forecasts for each airport in the national system. The *Terminal Area Forecast* (TAF) is used as a starting point for reasonableness of the Master Plan and other airport planning forecasts. **Table 2D** presents the 2016 TAF for enplanements, and as a check for reasonableness, both the market share and the TPF are shown based upon the FAA Aerospace Forecasts 2016-2036, as well as the State of Arizona population forecasts for the Flagstaff MSA. With the TAF, the market share would grow to .0106% by 2035, while the TPF would grow to 0.66.

Market Comparisons

The market share and travel propensity analyses indicate that the two factors have grown in the Flagstaff market with the runway extension and the change in air service to regional jets. Essentially, this upgraded service has allowed Flagstaff Airport to capture additional portions of its own market share. The *Passenger Demand Analysis* prepared in 2015 for Flagstaff Airport estimated that there were over 693,000 annual passengers (346,500 enplanements) generated from the airport service area. Thus, approximately 20 percent of the airline passengers generated from the service area use the Flagstaff Airport. Approximately 78 percent drove to Phoenix, and two percent drove to Las Vegas, according to the analysis.

Due to the large difference in the level of service (LOS) between the airports in Phoenix and Flagstaff, Sky Harbor will continue to draw market share from Flagstaff. **Exhibit 2E** depicts the location of seven markets in the western United States with similarities to the Flagstaff market. **Table 2E** further compares the markets in relation to enplanements, population, economics, and distance from a larger airport hub:



Airport Market State	COU Columbia MO	SGU St. George UT	SAF Santa Fe NM	GJT Grand Jct CO	IDA Idaho Falls ID	FLG Flagstaff AZ	MSO Missoula MT	MHK Manhattan KS
Travel Propensity Factor								
2015	0.37	0.45	0.51	1.44	1.07	**0.48**	3.07	0.67
2010	0.24	0.28	0.30	1.50	1.08	**0.46**	2.65	0.48
2000	0.25	0.47	0.34	1.14	1.23	**0.27**	2.33	0.19
Highway Distance to Closest Medium/Large Hub Airport								
Miles	112	140	67	269	216	**148**	374	128
Hub	STL	LAS	ABQ	DEN	SLC	**PHX**	BOI	MCI

- All currently have jet service.
- Three have metropolitan area populations within 10 percent of Flagstaff's (Santa Fe, NM; Grand Junction, CO; and Idaho Falls, ID).
- One is within 100 miles of the closest medium or large hub airport (Santa Fe).
- Three are 100 to 150 miles from the closest medium and large hub (Columbia, MO; St. George, UT; and Manhattan, KS).
- Three are more than 200 miles from a medium or large hub (Grand Junction; Idaho Falls; and Missoula, MT).

The table presents the population for each market for 2000, 2010, and 2015, as well as the enplanements at each in-market commercial service airport. The subsequent TPF as calculated for each year is also presented at the bottom of the table. In addition, the PCPI and the per capita gross regional product (GRP) for 2015 are shown for each metropolitan area.

TABLE 2E
Market Comparisons
Flagstaff Airport

Airport Market State	COU Columbia MO	SGU St. George UT	SAF Santa Fe* NM	GJT Grand Jct CO	IDA Idaho Falls ID	FLG Flagstaff AZ	MSO Missoula MT	MHT Manhattan KS
MSA Population								
2015	174,974	155,602	148,686	148,513	139,747	**139,097**	114,181	98,545
2010	162,642	138,115	144,508	146,723	133,265	**134,421**	109,299	92,719
2000	145,666	90,354	127,966	116,255	101,677	**116,320**	98,802	81,052
Per Capita Household Income								
2015	$42,302	$31,368	$50,684	$38,863	$37,873	**$41,018**	$40,803	$40,455
Per Capita Gross Regional Product								
2015	$47,453	$29,935	$49,884	$36,556	$41,282	**$39,454**	$45,279	$33,670
Highway Distance to Closest Medium Hub Airport								
Miles	112	140	67	269	216	**148**	374	128
Hub	STL	LAS	ABQ	DEN	SLC	**PHX**	BOI	MCI
Annual Enplanements								
2015	64,707	69,680	75,460	214,404	149,923	**67,419**	350,172	66,263
2010	38,293	38,061	43,699	219,358	144,365	**62,109**	289,875	44,603
2000	36,573	42,733	43,687	132,930	125,023	**31,603**	230,065	15,490
Travel Propensity Factor								
2015	0.37	0.45	0.51	1.44	1.07	**0.48**	3.07	0.67
2010	0.24	0.28	0.30	1.50	1.08	**0.46**	2.65	0.48
2000	0.25	0.47	0.34	1.14	1.23	**0.27**	2.33	0.19

Sources: U.S. Bureau of Economic Analysis(BEA) website; U.S. Department of Transportation (USDOT) TransStats website.

The highest TPFs are associated with those markets that are more than a three-hour drive from the more dominant market. These include Missoula (3.07 TPF and 374 miles), Grand Junction (1.44 TPF and 269 miles), and Idaho Falls (1.07 TPF and 216 miles). Missoula's TPF of 3.07 TPF is more than six times that of Flagstaff, even though it has less population and a nearly identical PCPI. In fact, Missoula's enplanements in 2015 were slightly higher than those generated by Flagstaff's entire market area. Idaho Falls has a population nearly identical to Flagstaff, and a lower PCPI. The additional 68 miles to a medium hub airport appears to make an appreciable difference in the TPFs of the two airports.



Columbia has the largest MSA population on the list, yet its enplanements are slightly lower than Flagstaff's. Columbia is located 112 miles from St. Louis Lambert International Airport to the east, and slightly farther from Kansas City International to the west. Its PCPI is slightly higher than Flagstaff, while its GRP is significantly higher. Columbia's TPF has increased in the past five years with improved regional jet service.

St. George is experiencing a TPF similar to that of Flagstaff. It is a similar distance from a large hub, and has recently experienced an upgrade in regional jet service.

Like Flagstaff, both Santa Fe and Manhattan experienced upgrades to regional jet service at some point since the 2008 recession. Both have experienced somewhat similar growth in passenger levels to Flagstaff and are within 2.5 hours of large or medium hub airports. Santa Fe has higher PCPI and real per capita GRP. Flagstaff had a similar TPF to Santa Fe (0.51) in 2015, while Manhattan's was slightly higher at 0.67.

Master Plan Forecast

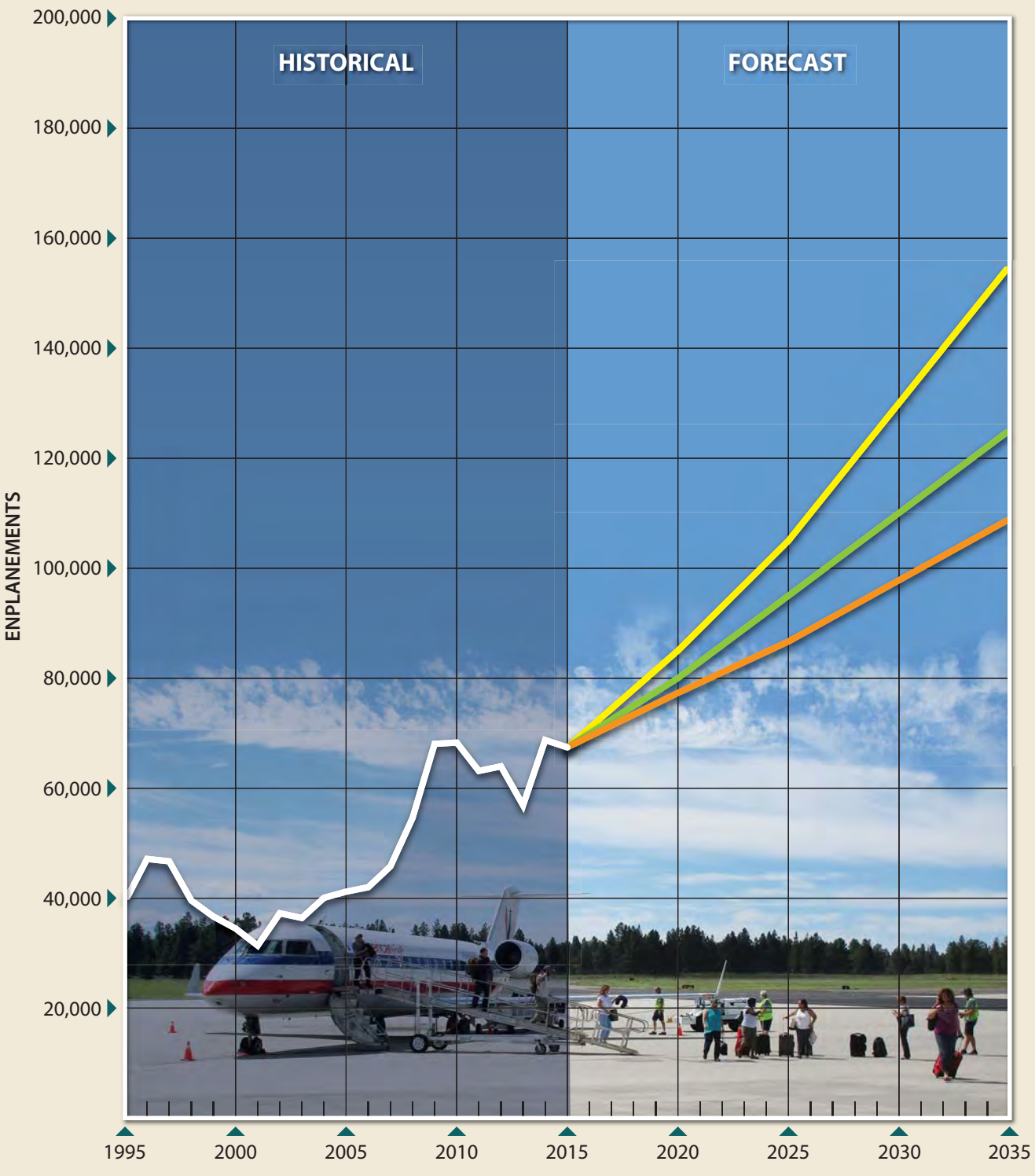
Table 2D and **Exhibit 2F** present the recommended forecast for master planning purposes. Based upon the analysis of comparative airports, an additional increase in market retention still appears possible. The mid-range retention projection suggests increasing market retention up to approximately 25 percent over time. The high-range projection would achieve approximately 30 percent retention. For the purposes of this Master Plan, the mid-range projection will be utilized as the master planning forecast; however, the 20-year high range projection will be considered in terminal planning as well.

AIRLINE OPERATIONS FORECAST

The commercial service fleet mix defines a number of key parameters in airport planning, including critical aircraft (airfield design standards, pavement strength, and ramp geometry), terminal complex layout, and aircraft performance capabilities (affecting runway length evaluations). A projection of the fleet mix for Flagstaff Airport has been prepared through a review of the equipment used by the airline(s) serving or anticipated to serve the airport.

Changes in equipment, airframes, and engines have always had a significant impact on airlines and airport planning. There are many ongoing programs by the manufacturers to improve performance characteristics. These programs continue to focus primarily on improvements in fuel efficiency. Regional jets also became a larger factor as the airlines looked for ways to "right-size" service into an airport for capacity discipline, as well controlling costs. Many airlines replaced larger commercial jets, as well as commuter turboprops, on smaller emerging routes with regional jets.

Commuter airlines, such as the one serving Flagstaff, are transitioning to advanced turboprop aircraft and regional jets to fit their market needs. Many of these aircraft have greater seating capacity, lower operating costs, and are considerably more comfortable for the flying public. The regional jets made



LEGEND

- FAA Terminal Area Forecast
- High Range Retention
- 2016 Master Plan Forecast (Mid-Range Retention)

their initial impact in the 44- to 50-seat range. Regional jet aircraft eventually became available with as few as 37 seats and as many as 90 seats. This bridged a long-existing gap in seating capacity, making regional jets the aircraft of choice to serve many non-hub airports, such as Flagstaff Airport.

As the price of fuel rose, however, the 50-seat and smaller regional jets have been found to be less cost-effective than their counterparts over 60 seats. In fact, the higher seat capacity turboprops, such as the Bombardier Q400, have been more cost-effective than the 50-seat jet carrying the same number of passengers. Subsequently, the 50-seat regional jets are no longer in production, and can eventually be expected to be eliminated from the fleet through attrition. This will occur over time, however, as some regional carriers will maintain them for some services, as well as in agreements with major airlines that have scope clauses with pilot's unions that restrict code sharing on aircraft above a certain seating capacity.

In addition, the smaller seat turboprops that have been the workhorses for the small commuter markets are also no longer in production. In fact, the only commuter turboprops still in production are the ATR 42 in the 40- to 60-seat range and the Q-400 and ATR-72 above 60 seats. Unless there is a new aircraft manufactured in the range of 10 to 39 seats, smaller markets that cannot support the larger turboprops could lose service from anything over nine-seats.

The retirement of the 10- to 60-seat fleet is being hastened by the Commuter Safety Initiative where Congress placed 10- to 30-seat aircraft under the same standards as the larger aircraft. This requires pilots to have 1,500 hours for an ATP rating and imposes additional rest time for the pilots. Not only has this created a shortage of qualified pilots, but also the need for more pilots for commuter airlines to maintain the same schedules.

Table 2F compares the airline operational fleet mix by seat capacity at Flagstaff Airport in 2009, 2012, and 2015. The average seats per departure have increased from 39.3 in 2009 to 44.7 in 2012 as 50-seat regional jets began to serve the market. The turboprop aircraft were completely replaced by 50-seat regional jets in 2012. Because of the transition to regional jets, the boarding load factor (BLF) at the airport actually decreased from 81.8 percent in 2009 to 66.1 percent in 2012. The BLF is defined as the ratio of passengers boarding aircraft compared to the seating capacity of the aircraft. Over time, the change to an all-regional jet schedule reduced the number of flights but increased the enplanements per departure and, subsequently, the BLF to 77.1 percent.

Airlines generally are operating with 80 to 85 percent load factors today, compared to as low as 60 percent 20-plus years ago. Airports served exclusively by commuter airlines will tend to be on the lower end of that scale, but the airlines are very wary of flights with low profitability in their restructured business models.

At Flagstaff Airport, a load factor going forward of at least 80 percent should be expected. With 50-seat regional jets being removed from the fleet, Flagstaff Airport experienced a switch to the 70-seat Bombardier CRJ700. Although the seat capacity increased, the number of daily flights decreased, thus negating any increase in the airport's seat capacity. Over the long term, as traffic grows, the aircraft could see a transition begin to include aircraft of 75 seats or more (CRJ900, ERJ190, or the Q400) on the most

popular flights. **Table 2F** presents this operations fleet mix forecast. Because of the increase in seats per departure, the number of flights will not increase proportionally with passengers.

Table 2F
Airline Fleet Mix and Operations Forecast
Flagstaff Airport

Fleet Mix	Actual			Forecast			
Seating Capacity	2009	2012	2015	2020	2025	2035	High Range
85+	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	30.0%
75-84	1.0%	0.1%	0.0%	0.0%	35.0%	60.0%	55.0%
60-74	0.0%	0.0%	0.0%	100.0%	65.0%	25.0%	15.0%
50-59	7.4%	55.3%	100.0%	0.0%	0.0%	0.0%	0.0%
40-49	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-39	91.6%	44.6%	0.0%	0.0%	0.0%	0.0%	0.0%
<20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Seats per Departures	39.3	44.7	50.0	65.0	68.9	76.1	80.1
Boarding Load Factor	81.8%	66.1%	77.1%	80.0%	80.0%	80.0%	80.0%
Enplanements per Departure	32.1	29.5	38.5	52.0	55.1	60.9	64.0
Annual Enplanements	68,056	63,971	67,421	80,000	95,000	125,000	155,000
Annual Departures	2,120	2,167	1,749	1,500	1,700	2,100	2,400
Annual Operations	4,240	4,334	3,498	3,000	3,400	4,200	4,800

GENERAL AVIATION FORECASTS

General aviation encompasses all portions of civil aviation except commercial service and military operations. To determine the types and sizes of facilities that should be planned to accommodate general aviation activity at Flagstaff Airport, certain elements of this activity must be forecast. These indicators of general aviation demand include based aircraft, aircraft fleet mix, and annual operations.

BASED AIRCRAFT FORECAST

The number of based aircraft is the most basic indicator of general aviation demand. By first developing a forecast of based aircraft for Flagstaff Airport, other general aviation activities and demand can be projected. The process of developing forecasts of based aircraft begins with an analysis of aircraft ownership in the primary general aviation service area through a review of historical aircraft registrations.

Determining the number of based aircraft at an airport can be a challenging task because of the transient nature of based aircraft due to the availability and cost of aircraft storage. Airport records indicate there were a total of 139 aircraft based at the airport in 2016, up from 136 the year before. Historical based aircraft data was also obtained from the FAA TAF.

Table 2G outlines this history over the last twenty years. Between 1995 and 2005, based aircraft grew from 110 to 134. There was essentially no growth in the number of based aircraft for the next ten years. Maintaining the same level of based aircraft over that period was actually better than most airports were doing. The table also indicates the number of active aircraft in the United States each year and calculates the market share based at the airport. It can be seen that the market share was growing over this period as the number of active aircraft in the country declined.

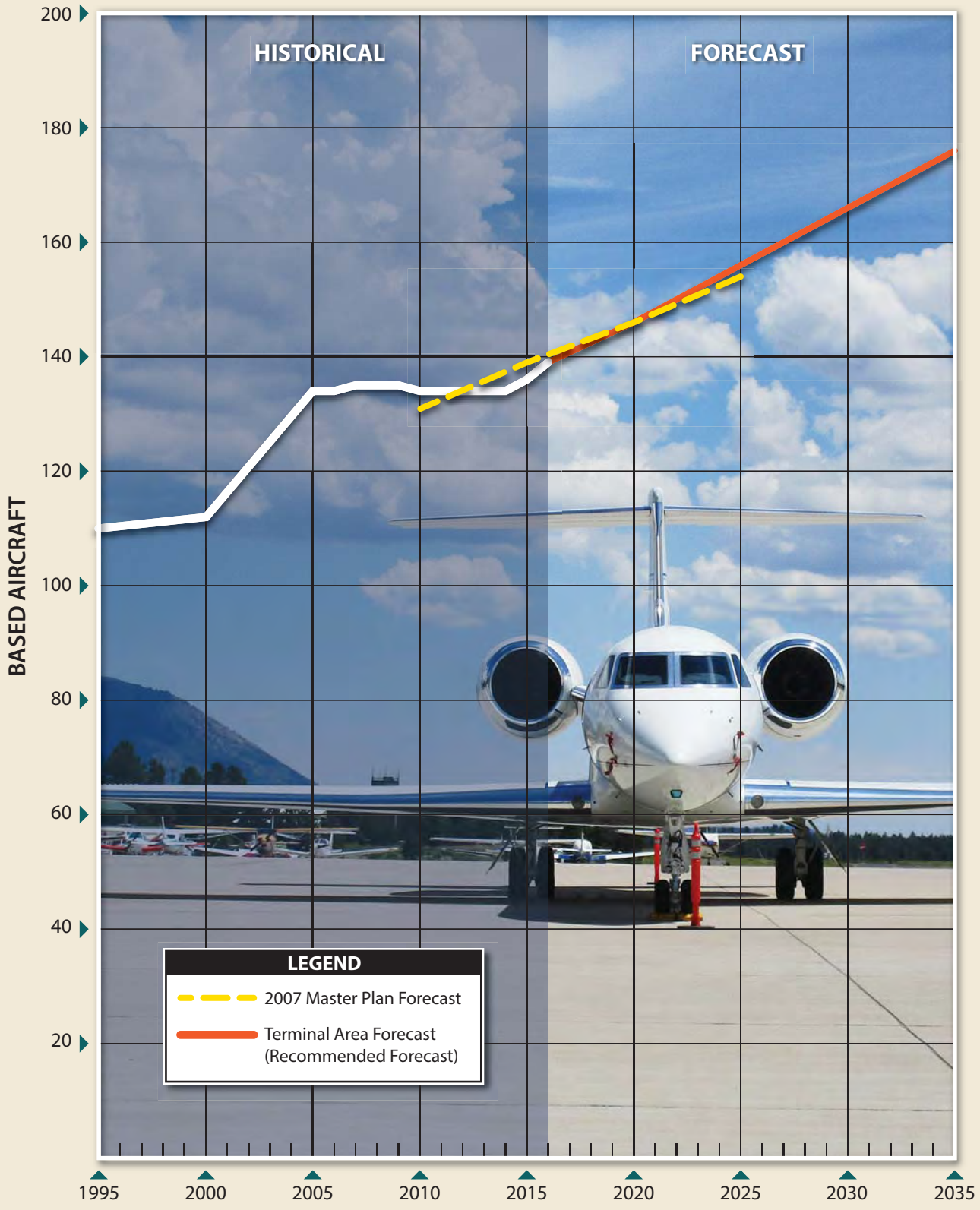
Similarly, the table also compares the number of based aircraft per 1,000 residents of Flagstaff. As Flagstaff has grown, based aircraft have remained basically static until recently, so the ratio declined between 2005 and 2015.

TABLE 2G
Based Aircraft Projections
Flagstaff Airport

Year	Flagstaff Based Aircraft[1]	U.S. Active Aircraft[2]	Market Share of U.S. Aircraft	City of Flagstaff Population[3]	Aircraft per 1,000 Residents
1995	110	188,089	0.0585%	53,711	2.05
2000	112	217,533	0.0515%	53,570	2.09
2005	134	224,350	0.0597%	60,726	2.21
2006	134	221,939	0.0604%	61,453	2.18
2007	135	231,606	0.0583%	63,489	2.13
2008	135	228,664	0.0590%	63,867	2.11
2009	135	223,876	0.0603%	64,581	2.09
2010	134	223,370	0.0600%	65,985	2.03
2011	134	220,453	0.0608%	66,013	2.03
2012	134	209,034	0.0641%	66,322	2.02
2013	134	199,927	0.0670%	67,502	1.99
2014	134	204,408	0.0656%	69,391	1.93
2015	136	203,880	0.0667%	70,643	1.93
2016	139	203,425	0.0683%	71,617	1.94
2007 Master Plan Forecast					
2015	139	203,880	0.0682%	70,643	1.97
2020	146	203,195	0.0719%	76,122	1.92
2025	154	203,745	0.0756%	81,044	1.90
FAA Terminal Area Forecast					
2020	146	203,195	0.0719%	76,122	1.92
2025	156	203,745	0.0766%	81,044	1.92
2035	176	209,685	0.0839%	87,951	2.00

Source:
[1]FAA Based Aircraft
[2]*FAA Aerospace Forecasts - Fiscal Years 2016-2036*
[3]Arizona Department of Administration – Employment and Population Statistics
Coffman Associates analysis

The based aircraft forecasts from the *2007 Airport Master Plan* are also presented in **Table 2G** as well as on **Exhibit 2G**. The base year for the previous Master Plan was 2005. The 10-year forecast for 2015 was 139 based aircraft, so that forecast is very close to the actual count of 139 in 2016.


HISTORICAL
FORECAST
BASED AIRCRAFT
200
180
160
140
120
100
80
60
40
20
1995
2000
2005
2010
2015
2020
2025
2030
2035
LEGEND
2007 Master Plan Forecast
Terminal Area Forecast
(Recommended Forecast)

The 20-year forecast projected 154 based aircraft by 2025. Comparing the previous forecasts to the current FAA Aerospace Forecasts of active aircraft and the city population forecast, the table indicates a continued growth in market share, and a slow decline in aircraft per population.

The FAA TAF published in January 2016 is also included on the table and exhibit for comparison. The TAF is the FAA's most current forecast of activity for the airport and matches the previous Master Plan forecast for 2020, and two aircraft higher in 2025. The TAF then projects 176 based aircraft by 2035.

Thus FAA TAF is essentially an extension of the previous Master Plan forecast which has proven to be relatively accurate after 10 years. In the next five years, 146 aircraft are projected. In 10 years, 156 aircraft are projected, and by 2035, 176 based aircraft are projected. This forecast results in a 1.25 percent annual average growth rate (CAGR) through the long term planning period. The forecasts are further depicted on **Exhibit 2G**.

Future aircraft basing at the airport will depend on several factors, including the state of the economy, fuel costs, available facilities, competing airports, and adjacent development potential. Forecasts assume a reasonably stable and growing economy, as well as reasonable development of airport facilities necessary to accommodate aviation demand. Competing airports may play a role in deciding demand; however, Flagstaff Airport should fare well in this competition as it is served by a runway capable of handling the majority of general aviation aircraft and the airport's capability to accommodate development as future demand may dictate.

BASED AIRCRAFT FLEET MIX

The fleet mix of the based aircraft is oftentimes more important to airport planning and design than the total number of aircraft. For example, the presence of one or a few large business jets can impact design standards more than a large number of smaller single engine piston-powered aircraft.

The based aircraft fleet mix at Flagstaff Airport, as presented in **Table 2H**, was compared to the existing and forecast U.S. general aviation fleet mix trends as presented in *FAA Aerospace Forecasts – Fiscal Years 2016-2036*. The FAA expects business jets will continue to be the fastest growing general aviation aircraft type in the future. The airport will readily accommodate business jets in the future; however, smaller single engine piston-powered aircraft will continue to dominate the overall fleet mix.

Although there have been jets based at the airport in the past, there are none currently. Still, there remains potential for jets to base at the airport in the future, with six forecast by 2035. Turboprops are forecast to increase from five currently to nine by 2035. Helicopters based at the airport are forecast to grow by the same numbers. Single engine piston aircraft are forecast to increase over the 20-year forecast period, but decrease in percentage. Multi-engine piston will also decrease in percentage and remain flat in numbers.

TABLE 2H
Based Aircraft Fleet Mix
Flagstaff Airport

	EXISTING		FORECAST					
Aircraft Type	**2016**	**%**	**2020**	**%**	**2025**	**%**	**2035**	**%**
Single Engine	113	81.3%	117	80.1%	122	78.2%	131	74.4%
Multi-Engine	15	10.8%	15	10.3%	15	9.6%	15	8.5%
Turboprop	4	2.9%	5	3.4%	6	3.8%	9	5.1%
Jet	0	0.0%	1	0.7%	3	1.9%	6	3.4%
Helicopter	4	2.9%	5	3.4%	6	3.8%	9	5.1%
Other	3	2.2%	3	2.1%	4	2.6%	6	3.4%
Totals	**139**	**100.00%**	**146**	**100.00%**	**156**	**100.00%**	**176**	**100.00%**

Source: FAA *Terminal Area Forecast*; FAA Form 5010-1; Coffman Associates analysis

GENERAL AVIATION OPERATIONS

General aviation operations are classified by the airport traffic control tower (ATCT) as either local or itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of the airport, or which executes simulated approaches or touch-and-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations. Typically, itinerant operations increase with business and commercial use, since business aircraft are operated on a higher frequency. A breakdown of general aviation operations, as well as overall operations at Flagstaff Airport, was detailed in Chapter One.

Itinerant Operations

Table 2J depicts general aviation itinerant operations at Flagstaff Airport dating back to 1995. General aviation itinerant operations at the airport experienced a general declining trend from 1995 through the most recent national recession in 2008. In 2011, itinerant GA operations increased at the airport and have been relatively steady, averaging around 20,700 since that time.

Nationally, general aviation itinerant operations at towered airports have been declining since at least 2000, but took a steeper decline with the recession. Since 2009, the trend has been slowed somewhat. The FAA forecasts a reversal by 2020. From 2015 through 2035, the FAA forecasts an annual growth rate of 0.28 percent for itinerant general aviation operations at towered airports in the United States.

The 2015 FAA TAF included an itinerant general aviation operation forecast for Flagstaff Airport, which is included in the table. The TAF forecasts a minimal growth rate of 0.21 percent annually. This results in a 2035 itinerant general aviation operations projection of 21,496.

In examining the reasonableness of the TAF, the Flagstaff Airport market share of the itinerant operations at towered airports was examined, along with the ratio of itinerant operations to based aircraft.

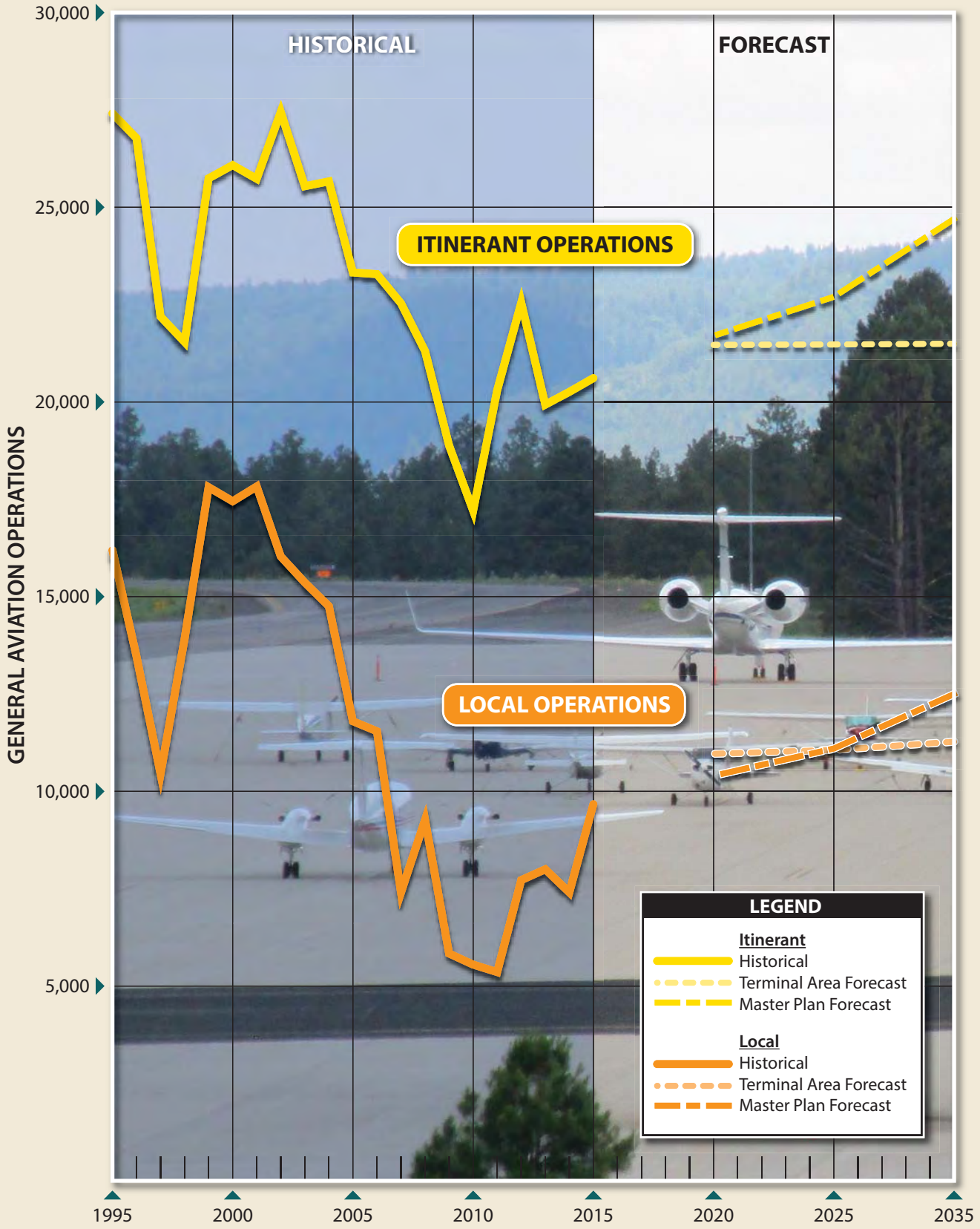
While relatively steady from 2005 through the recession, the airport market share increased significantly after 2010. Similarly, operations per based aircraft increased. The TAF forecast for itinerant operations indicates a growth in market share to 2020, then it will begin to decline through 2035. Operations per based aircraft will decline significantly with the TAF from 152 in 2015 to 122 in 2035.

While a continued decline in operations per based aircraft may be expected, the TAF projection appears to be more significant than might reasonably be expected. A second projection on **Table 2J** presents a slower decline in the operations per based aircraft, combined with a slow increase in market share. By 2035, itinerant general aviation operations reach 24,700, which corresponds to 140 operations per based aircraft, down from the current 152. This selected forecast equates to a 0.91 percent average annual growth rate. **Exhibit 2H** presents the itinerant general aviation operations forecast.

TABLE 2J
General Aviation Itinerant Operations Forecast
Flagstaff Airport

Year	FLG Itinerant GA Operations[1]	U.S. ATCT Itinerant GA Operations[2] (thousands)	Market Share of Itinerant Operations	FLG Based Aircraft[3]	Itinerant Operations per Based Aircraft
1995	27,412	20,900	0.131%	110	249
2000	26,082	22,844	0.114%	112	233
2005	23,324	19,303	0.121%	134	174
2006	23,283	18,707	0.124%	134	174
2007	22,534	18,575	0.121%	135	167
2008	21,307	17,493	0.122%	135	158
2009	18,883	15,571	0.121%	135	140
2010	17,207	14,864	0.116%	134	128
2011	20,299	14,528	0.140%	134	151
2012	22,549	14,522	0.155%	134	168
2013	19,931	14,117	0.141%	134	149
2014	20,259	13,979	0.145%	134	151
2015	20,612	13,887	0.148%	136	152
FAA Terminal Area Forecast					
2020	21,466	14,062	0.153%	146	147
2025	21,476	14,267	0.151%	156	138
2035	21,496	14,698	0.146%	176	122
Master Plan Forecast					
2020	21,700	14,062	0.154%	146	149
2025	22,700	14,267	0.159%	156	146
2035	24,700	14,698	0.168%	176	140

Source:
[1]Historical data from ATCT as reported to FAA
[2]*FAA Aerospace Forecasts - Fiscal Years 2016-2036*
[3]FAA *Terminal Area Forecast* (January 2016)
Coffman Associates analysis


HISTORICAL
FORECAST
ITINERANT OPERATIONS
LOCAL OPERATIONS
GENERAL AVIATION OPERATIONS
30,000
25,000
20,000
15,000
10,000
5,000
1995
2000
2005
2010
2015
2020
2025
2035
LEGEND
Itinerant
Historical
Terminal Area Forecast
Master Plan Forecast
Local
Historical
Terminal Area Forecast
Master Plan Forecast

Local Operations

A similar methodology was utilized to forecast local general aviation operations. **Table 2K** depicts the history of local operations at Flagstaff Airport and examines its historic market share of general aviation local operations at towered airports in the United States. Historical local operations range from a high of 17,811 in 1999 to a low of 5,359 in 2011.

As with national itinerant operations, local operations were declining for some time; however, the activity has appeared to stabilize since 2011. The FAA Aeronautical Forecasts projects estimate a modest annual growth rate going forward of approximately 0.42 percent.

TABLE 2K
General Aviation Local Operations Forecast
Flagstaff Airport

Year	FLG Local GA Operations[1]	U.S. ATCT Local GA Operations[2] (thousands)	Market Share of Local Operations	FLG Based Aircraft[3]	Local Operations per Based Aircraft
1995	16,192	15,100	0.107%	110	147
2000	17,450	17,034	0.102%	112	156
2005	11,800	14,844	0.079%	134	88
2006	11,544	14,365	0.080%	134	86
2007	7,403	14,557	0.051%	135	55
2008	9,270	14,081	0.066%	135	69
2009	5,836	12,448	0.047%	135	43
2010	5,551	11,716	0.047%	134	41
2011	5,359	11,437	0.047%	134	40
2012	7,721	11,608	0.067%	134	58
2013	7,999	11,688	0.068%	134	60
2014	7,405	11,675	0.063%	134	55
2015	9,669	11,691	0.083%	136	71
FAA Terminal Area Forecast					
2020	10,965	11,963	0.092%	146	75
2025	11,065	12,206	0.091%	156	71
2035	11,274	12,719	0.089%	176	64
Master Plan Forecast					
2020	10,400	11,963	0.087%	146	71
2025	11,100	12,206	0.091%	156	71
2035	12,500	12,719	0.098%	176	71

Source:
[1]Historical data from ATCT as reported to FAA
[2]*FAA Aerospace Forecasts - Fiscal Years 2016-2036*
[3]FAA *Terminal Area Forecast* (January 2016)
Coffman Associates analysis

The 2015 FAA TAF projection is also presented in the table. The TAF identifies a 2035 projection of 11,274 local general aviation operations. When compared to the actual number of local general aviation operations experienced at the airport in 2015, this represents an average annual growth rate of 0.77

over the planning period. The resulting market share, which has recovered since the recession, is projected by the TAF to grow from 0.083 percent in 2015 to 0.092 percent in 2020 before slowly declining to 0.089 percent in 2035. Local operations per based aircraft, which also recovered since the recession, would grow from 71 in 2015 to 75 in 2020, then decline to 64 by 2035.

Another projection considers a more stable relationship between based aircraft and local general aviation operations. In 2015, there were 71 local general aviation operations per based aircraft. When maintaining this ratio, a projection results in 12,500 itinerant general aviation operations by 2035. This represents an annual growth rate of 1.29 percent. Under this projection, the airport market share of towered local operations would increase from 0.083 percent to 0.98 percent by 2035. This would be similar to the market share experienced in 2000. For planning purposes, this forecast allows for some recovery in local operations should student training at the airport continue to recover as it appears to have in the last five years. **Exhibit 2H** presents the local general aviation operations forecast.

OTHER AIR TAXI AND MILITARY

Air taxi operations as reported by the ATCT include operations conducted for-hire with fewer than 60 passenger seats and/or less than 18,000 pounds of payload. Some operations by aircraft operated under fractional ownership programs are also counted as air taxi operations. Since the airline operations have been forecast earlier in this chapter, this section reviews the growth potential for the "other" air taxi operations at Flagstaff Airport.

According to ATCT records, there were 13,953 air carrier and air taxi operations at Flagstaff Airport in 2015. Of this total, 3,498 operations were conducted by scheduled commercial airline service as previously discussed, leaving 10,455 operations being included in the "other" air taxi activity. This is a significant growth from 4,281 "other" air taxi operations in 2010. According to the current *FAA Aerospace Forecasts – Fiscal Years 2016-2036*, air taxi operations are projected to remain steady over the next 20 years. The resulting forecast for Flagstaff Airport is presented in **Table 2L**.

Table 2L
Other Air Taxi Operations
Flagstaff Airport

Year	Other Air Taxi Operations
2010	4,281
2011	6,718
2012	7,749
2013	8,423
2014	9,319
2015	10,455
Forecast	
2020	11,600
2025	12,700
2035	15,500

Military operations are somewhat limited at Flagstaff Airport. In 2015, there were 1,822 military operations at the airport, the highest in the last 20 years. In the last 10 years, the airport has experienced an average of approximately 1,300 annual military operations. Developing a reliable forecast of military activity is inherently difficult, primarily because the military mission can change rapidly. Generally during peace time, civilian airports will experience higher levels of military operations. When there are overseas commitments, many of those pilots and equipment will be out of the country. The FAA recognizes these challenges to forecasting military activity and, therefore, provides only a flat forecast for both local and itinerant military activity.

Table 2M presents the history of military activity at the airport. The forecast presented considers a level growth scenario of 1,300 annual military operations based upon the average of the last nine years. These operations are then categorized as either local or itinerant based on historical trends.

TABLE 2M
Military Operations Forecast
Flagstaff Airport

Year	Military Itinerant Operations	Military Local Operations	Total[1]
2000	155	172	327
2001	405	283	688
2002	503	321	824
2003	430	525	955
2004	425	474	899
2005	443	450	893
2006	532	438	970
2007	661	511	1,172
2008	927	751	1,678
2009	655	506	1,161
2010	763	290	1,053
2011	739	404	1,143
2012	763	490	1,253
2013	545	359	904
2014	979	410	1,389
2014	1,193	629	1,822
Military Operations Forecast			
2020	850	450	1,300
2025	850	450	1,300
2035	850	450	1,300

Source:
[1]Historical data from ATCT as reported to FAA
Coffman Associates analysis

AIR CARGO

Air cargo in the Flagstaff region is transported to Phoenix Sky Harbor International Airport by two operators. Ameriflight serves as a cargo operator for United Parcel Service (UPS) and utilizes a single engine Cessna 208 Caravan and Empire Airlines serves as the cargo operator for FedEx and flies a multi-engine Piper Navajo. Air cargo in the area can also be transported by ground to Phoenix and handled by designated air cargo carriers. Due to the airport's proximity to Phoenix Sky Harbor International Airport, it is not anticipated to be served by major cargo carriers in the future.

Future air cargo in not anticipated to be significant; therefore, the development of a major air cargo facility at the airport is not being pursued. In the event that air cargo operations at the airport become more significant in the future, anticipated facility development could include additional office space for personnel and designated apron space for aircraft parking and vehicle staging.

TOTAL OPERATIONS ADJUSTMENT AND FORECAST

The Flagstaff Airport ATCT is not a 24-hour tower. Thus, its air traffic counts are not all-inclusive of aircraft operations at the airport. Some aspects of the Master Plan require that all airport activity be considered. For these evaluations, it is necessary to estimate and adjust for operations that occur when the tower is closed. The Flagstaff tower operates from 6:00 a.m. to 9:00 p.m. daily from April 1 through September 30, and from 7:00 a.m. to 7:00 p.m. daily from October 1 through March 31.

For planning purposes within this Master Plan, operations that occur when the tower has closed are estimated from FAA OPSNET data. The commercial service operations were previously derived from landing reports so they do not need to be adjusted. Approximately 2.8 percent of other air taxi operations occur when the tower is closed. Approximately 11.6 percent of general aviation itinerant operations occur during the closed hours, as 37.9 percent of military itinerant operations.

Table 2N presents a summary of the ATCT operations, as well as the adjusted operations, for all aircraft activity segments at Flagstaff Airport. The operational projections equate to a 1.14 percent CAGR.

TABLE 2N
Forecast Adjustment for ATCT After-Hours Operations
Flagstaff Airport

	Base Year 2015*	2020	2025	2035
ATCT OPERATIONS				
Air Carrier	3,498	3,000	3,400	4,200
General Aviation				
Itinerant	20,612	21,700	22,700	24,700
Local	9,669	10,400	11,100	12,500
Air Taxi	10,455	11,600	12,700	15,500
Military				
Itinerant	1,193	850	850	850
Local	629	450	450	450
Total ATCT Operations	***46,056***	***48,000***	***51,200***	***58,200***
ADJUSTED OPERATIONS**				
Air Carrier	3,498	3,000	3,400	4,200
General Aviation				
Itinerant	23,200	24,500	25,600	27,800
Local	9,669	10,400	11,100	12,500
Air Taxi	10,751	11,900	13,100	15,900
Military				
Itinerant	1,900	1,450	1,450	1,450
Local	629	450	450	450
Total Adjusted Operations	***49,647***	***51,700***	***55,100***	***62,300***

*ATCT records for period from January through December 2015
**Adjusted operations rounded to the nearest 100

COMPARISON TO THE FAA TAF

The FAA will review the forecasts presented in this Master Plan for comparison to the TAF. The local Airports District Office (ADO) of the FAA can approve the forecasts if they do not differ by more than 10 percent in the first five years and 15 percent for years 6-20. If the planning forecasts exceed these parameters, then the forecasts must be forwarded to FAA headquarters in Washington, D.C. for further review. Any deviation from these thresholds will require specific local documentation. **Table 2P** presents the direct comparison of the Master Plan forecasts with the TAF published in January 2016.

TABLE 2P
Forecast Comparison to the 2016 FAA *Terminal Area Forecast*
Flagstaff Airport

Year	Airport Activity	FAA TAF	Percent Difference
PASSENGER ENPLANMENTS			
2015	67,421	69,988	-3.7%
2020	80,000	77,324	3.5%
2025	95,000	86,678	9.6%
2035	125,000	108,940	14.7%
CAGR	3.31%	2.23%	1.08%
BASED AIRCRAFT			
2015	136	138	-1.4%
2020	146	146	0.0%
2025	156	156	0.0%
2035	176	176	0.0%
CAGR	1.29%	1.22%	0.07%
ANNUAL OPERATIONS			
2015	46,056	46,079	0.0%
2020	48,000	48,455	-0.9%
2025	51,200	49,950	2.5%
2035	58,200	53,328	9.1%
CAGR	1.18%	0.73%	0.45%

Source: FAA TAF (2016); Coffman Associates analysis

The reason the FAA allows this differential is because the TAF forecasts are not meant to replace forecasts developed locally (i.e., in this Master Plan). While the TAF can provide a point of reference for comparison, their purpose is much broader in defining FAA national workload measures.

The Master Plan forecast for passenger enplanements is within the tolerances of the TAF for the entire planning period. For the five-year timeframe, the Master Plan projects passenger enplanement levels that are 3.5 percent higher than the TAF. For the 20-year timeframe, the difference increases to 14.7 percent. Overall, both forecasts call for reasonable growth in passenger enplanements through 2035. The Master Plan projects enplanements to increase at approximately 3.31 percent annually, while the TAF exhibits a 2.23 percent CAGR.

Regarding based aircraft, the analysis found the TAF to be reasonable to adopt for master planning purposes. The average annual growth rate for based aircraft is 1.29 percent over the planning period.

The total annual operations forecast in the Master Plan are just 0.9 percent higher than the TAF in the five-year timeframe. The 20-year forecast is 9.1 percent higher than the TAF. The average annual growth rate for operations in the Master Plan forecast is 1.18 percent, compared to 0.73 percent in the TAF.

PEAKING CHARACTERISTICS

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

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

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

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

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

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

AIRLINE PEAKING

Peaking characteristics related to airline activity is important for planning and design of the passenger terminal building as well as associated facilities and services. The analysis is commonly used as a basis for determining the appropriate size of the terminal and the functional spaces therein.

Over the last several years, the peak month for enplanements has generally been October. The peak month over the last six years has ranged between 10.0 percent to 10.6 percent of annual enplanements. The average over the period has been 10.2 percent. Thus, 10.2 percent will be considered as the peak month factor for enplanements during the planning period.

The design day takes into account fluctuations in available flights during the week versus the weekend. Thus, the design day is factored slightly down from the 31 days to 30 days. The design hour is based upon the flight schedule and seating capacity during the design day. The operations projections follow a similar analysis and are presented in **Table 2Q**.

Table 2Q
Peaking Characteristics
Flagstaff Airport

		Forecast			High
	2015	2020	2025	2035	Range
ENPLANEMENTS					
Annual	67,421	80,000	95,000	125,000	155,000
Peak Month	6,789	8,160	9,690	12,750	15,810
Design Day	226	272	323	425	527
Design Hour	50	70	75	150	165
OPERATIONS					
Airline Operations					
Annual	1,749	1,500	1,700	2,100	2,420
Peak Month	150	129	146	181	208
Design Day	10	8	10	12	14
Design Hour	2	2	2	4	4
Air Taxi and General Aviation Itinerant Operations					
Annual	33,951	36,400	38,700	43,700	
Peak Month	3,769	4,004	4,257	4,807	
Busy Day	157	167	177	200	
Design Day	122	129	137	155	
Design Hour	24	26	27	31	
Total Airport Operations*					
Annual	49,647	51,700	55,100	62,300	
Peak Month	5,362	5,429	5,786	6,542	
Design Day	173	175	187	211	
Design Hour	31	31	33	38	

*Accounts for adjusted operations

GENERAL AVIATION AND OTHER AIR TAXI PEAKING

The peak periods forecast for general aviation itinerant and "other" air taxi operations are useful in estimating aircraft parking apron and general aviation terminal services. Since 2010, the peak month has typically occurred during the summer months and averaged 11.0 percent of the annual operations. The design day operations were calculated by dividing the peak month by the number of days in a month (31).

Daily operational counts from the ATCT were utilized to determine a busy day peaking factor for general aviation activity. The peak day of each week during the peak month average 18.4 percent of weekly operations. Thus, to determine the typical busy day, the design day is multiplied by the busy day factor of 1.29. Design hour operations were determined to be approximately 20 percent of the design day operations. The peaking characteristics are summarized in **Table 2Q** for general aviation itinerant and "other" air taxi.

TOTAL AIRPORT OPERATIONS PEAKING

Table 2Q also presents the peaking characteristics for total operations on the airfield. These peaking factors are used in evaluating airfield capacity. The peak month over the last six years has typically been May or August and average 10.5 percent of annual operations. The design day is calculated by dividing the peak month by 31. The design hour was determined to average 17.9 percent of the design day.

FORECAST SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the planning period. **Exhibit 2J** is a summary of the aviation forecasts prepared in this chapter. Actual activity is included for 2015, which was the base year for these forecasts. The forecasting effort extends through the next 20 years to the year 2035. Forecasts for aviation activity, including enplanements, based aircraft, and operations, is key to determining future facility requirements.

AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION

The FAA has established several aircraft classification systems that group aircraft types based on their performance (approach speed in landing configuration) and on design characteristics (wingspan and landing gear configuration). These classification systems are used to determine the appropriate airport design standards for specific airport elements, such as runways, taxiways, taxilanes, and aprons.

AIRCRAFT CLASSIFICATION

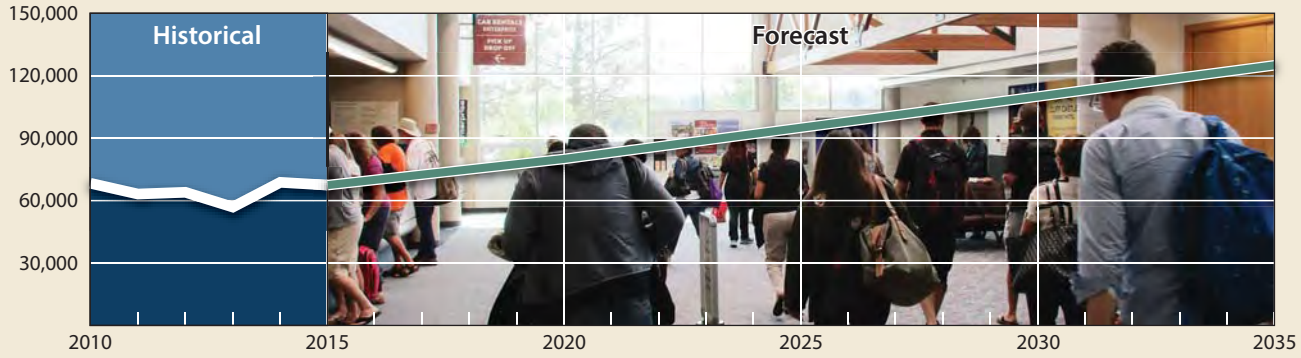
The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or a composite aircraft representing a collection of aircraft. The design aircraft is classified by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). FAA AC 150/5300-13A, Change 1, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2K**.

Aircraft Approach Category (AAC): A grouping of aircraft based on a reference landing speed (V_{REF}), if specified, or if V_{REF} if not specified, 1.3 times stall speed (V_{SO}) at the maximum certificated landing weight. V_{REF}, V_{SO}, and the maximum certificated landing weight are those values as established for the aircraft by the certification authority of the country of registry.

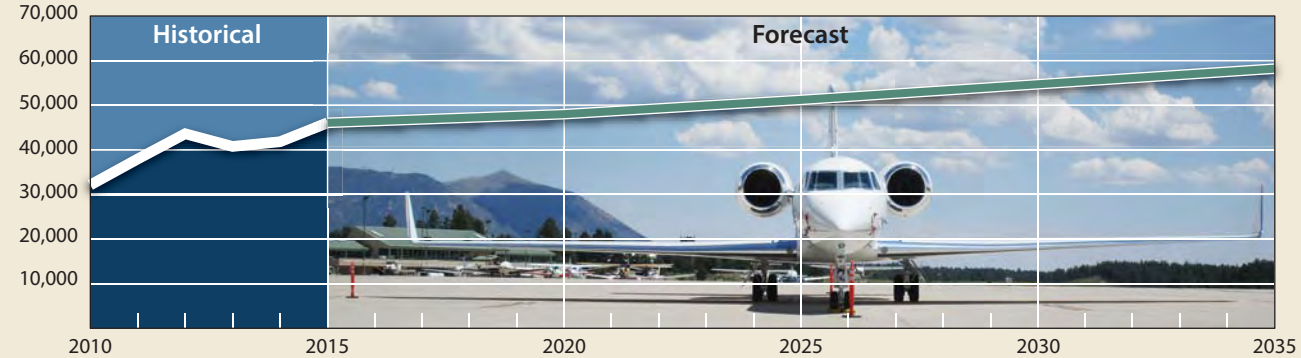
The AAC generally refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards. The AAC, depicted by a letter A

	ACTUAL	FORECASTS		
	2015	2020	2025	2035
ANNUAL ENPLANED PASSENGERS				
Enplaned	67,421	80,000	95,000	125,000
ANNUAL OPERATIONS				
General Aviation				
Itinerant	20,612	21,700	22,700	24,700
Local	9,669	10,400	11,100	12,500
Total General Aviation	**30,281**	**32,100**	**33,800**	**37,200**
Airline	3,498	3,000	3,400	4,200
Other Air Taxi	10,455	11,600	12,700	15,500
Military	1,822	1,300	1,300	1,300
Total Operations	**46,056**	**48,000**	**51,200**	**58,200**
BASED AIRCRAFT FLEET MIX				
Single Engine Piston	113	117	122	131
Multi-Engine Piston	15	15	15	15
Turboprop	4	5	6	9
Jet	0	1	3	6
Rotorcraft	4	5	6	9
Other	3	3	4	6
Totals	**139**	**146**	**156**	**176**

PASSENGER ENPLANEMENTS FORECAST



AIRCRAFT OPERATIONS FORECAST



AIRCRAFT APPROACH CATEGORY (AAC)

Category	Approach Speed
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

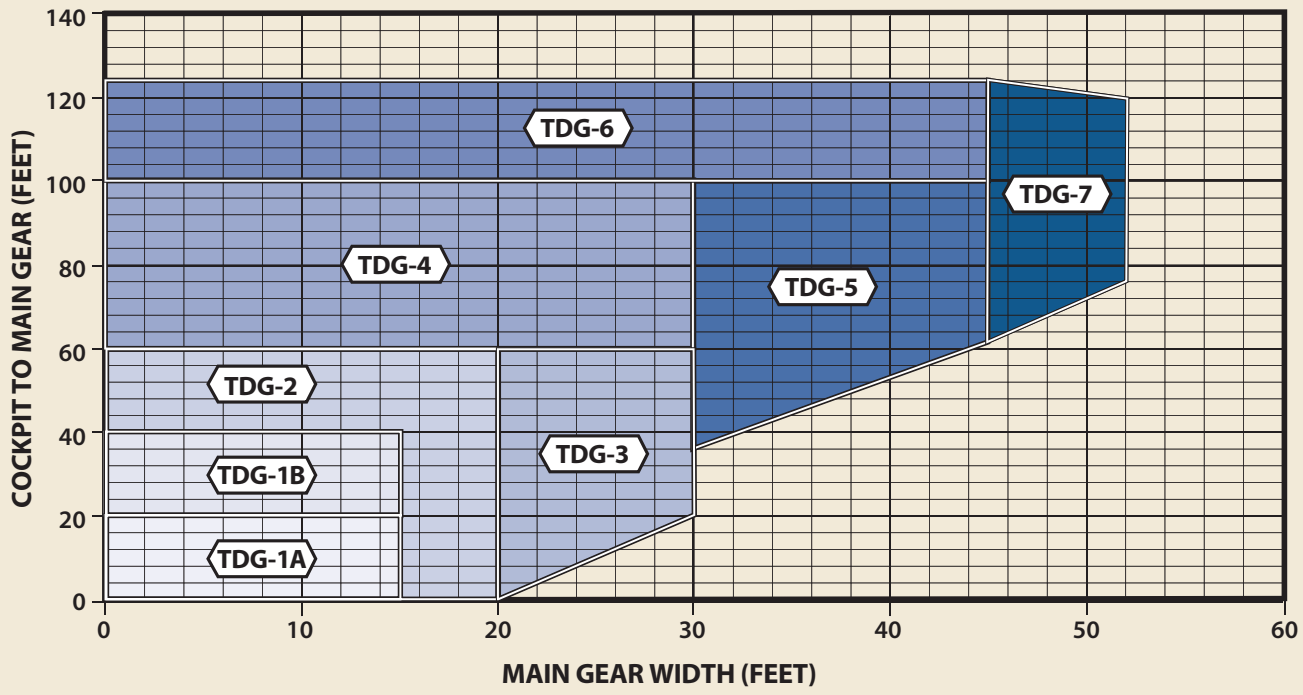
AIRPLANE DESIGN GROUP (ADG)

Group #	Tail Height (ft)	Wingspan (ft)
I	<20	<49
II	20-<30	49-<79
III	30-<45	70-<118
IV	45-<60	118-<171
V	60-<66	171-<214
VI	66-<80	214-<262

VISIBILITY MINIMUMS

RVR (ft)	Flight Visibility Category (statute miles)
VIS	3-mile or greater visibility minimums
5,000	Lower than 3 miles but not lower than 1-mile
4,000	Lower than 1-mile but not lower than ¾-mile (APV ≥ ¾ but < 1-mile)
2,400	Lower than ¾-mile but not lower than ½-mile (CAT-I PA)
1,600	Lower than ½-mile but not lower than ¼-mile (CAT-II PA)
1,200	Lower than ¼-mile (CAT-III PA)

TAXIWAY DESIGN GROUP (TDG)



KEY

APV: Approach Procedure with Vertical Guidance
PA: Precision Approach
RVR: Runway Visual Range
TDG: Taxiway Design Group

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

through E, is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The AAC generally applies to runways and runway-related facilities, such as runway width, runway safety area (RSA), runway object free area (ROFA), runway protection zone (RPZ), and separation standards.

Airplane Design Group (ADG): The ADG, depicted by a Roman numeral I through VI, is a classification of aircraft which relates to aircraft wingspan or tail height (physical characteristic). When the aircraft wingspan and tail height fall in different groups, the higher group is used. The ADG influences design standards for taxiway safety area (TSA), taxiway object free area (TOFA), taxilane object free area, apron wingtip clearance, and various separation distances.

Taxiway Design Group (TDG): A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the design aircraft. The taxiway design elements determined by the application of the TDG include the taxiway width, taxiway edge safety margin, taxiway shoulder width, taxiway fillet dimensions, and, in some cases, the separation distance between parallel taxiways/taxilanes. Other taxiway elements, such as the taxiway safety area (TSA), taxiway/taxilane object free area (TOFA), taxiway/taxilane separation to parallel taxiway/taxilanes or fixed or movable objects, and taxiway/taxilane wingtip clearances are determined solely based on the wingspan (ADG) of the design aircraft utilizing those surfaces. It is appropriate for taxiways to be planned and built to different TDG standards based on expected use.

Exhibit 2L summarizes the classification of the most common aircraft in operation today. Generally, most business jets will fall in approach categories B and C, while commercial aircraft will fall in C and D. Business jets typically have slower approach speeds as compared to commercial transport aircraft. Recreational and business piston and turboprop aircraft will generally fall in AACs A and B and ADGs I and II.

AIRPORT AND RUNWAY CLASSIFICATION

These classifications, along with the aircraft classifications defined previously, are used to determine the appropriate FAA design standards to which the airfield facilities are to be designed and built.

***Airport Reference Code (ARC)*:** An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only, and does not limit the aircraft that may be able to operate safely on the airport. The current Airport Layout Plan (ALP) for Flagstaff Airport, which will be updated as part of this master planning effort, identifies an existing and future ARC of C-III.

Runway Design Code (RDC): A code signifying the design standards to which the runway is to be built. The RDC is based upon planned development and has no operational component.

The AAC, ADG, and runway visual range (RVR) are combined to form the RDC of a particular runway. The RDC provides the information needed to determine certain design standards that apply. The first com-

A-I



- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- Eclipse 500/550
- Piper Archer
- Piper Seneca

B-I



- Beech Baron 58
- Beech King Air 100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I (525)

B-II



- Super King Air 200
- Cessna 441
- DHC Twin Otter
- Super King Air 350
- Beech 1900
- Citation Excel (560), Sovereign (680)
- Falcon 50, 900, 2000
- **Citation Bravo (550)**
- Embraer 120

A-III, B-III



- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

C-I, D-I



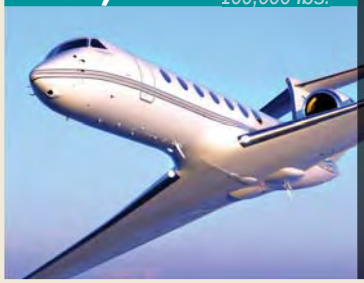
- Beech 400
- **Lear** 31, **35**, 45, 60
- Israeli Westwind

C-II, D-II



- Cessna Citation X (750)
- Gulfstream 100, 200,300
- Challenger 300/600
- **ERJ-135, 140, 145**
- CRJ-200/700
- Embraer Regional Jet
- Lockheed JetStar
- Hawker 800

C-III, D-III *less than 100,000 lbs.*



- ERJ-170
- CRJ 705, 900
- Falcon 7X
- **Gulfstream 500**, 550, 650
- Global Express, Global 5000
- Q-400

C-III, D-III *over 100,000 lbs.*



- ERJ-90
- Boeing Business Jet
- B-727
- **B-737**-300, **700**, 800
- MD-80, DC-9
- A319, A320

C-IV, D-IV



- **B-757**
- B-767
- C-130 Hercules
- DC-8-70
- MD-11

D-V



- **B-747-400**
- B-777
- B-787
- A-330, A-340

Note: Aircraft pictured is identified in bold type.

ponent, depicted by a letter, is the AAC and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the ADG and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by RVR values in feet of 1,200 (⅛-mile), 1,600 (¼-mile), 2,400 (½-mile), 4,000 (¾-mile), and 5,000 (1-mile). The RVR values approximate standard visibility minimums for instrument approaches to the runways. The third component should read "VIS" for runways designed for visual approach use only.

Approach Reference Code (APRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to landing operations. Like the RDC, the APRC is composed of the same three components: the AAC, ADG, and RVR. The APRC describes the current operational capabilities of a runway under particular meteorological conditions where no special operating procedures are necessary, as opposed to the RDC which is based upon planned development with no operational component. The APRC for a runway is established based upon the minimum runway to taxiway centerline separation.

Departure Reference Code (DPRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to takeoff operations. The DPRC represents those aircraft that can takeoff from a runway while any aircraft are present on adjacent taxiways, under particular meteorological conditions with no special operating conditions. The DPRC is similar to the APRC, but is composed of two components: ACC and ADG. A runway may have more than one DPRC depending on the parallel taxiway separation distance.

CRITICAL DESIGN AIRCRAFT

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft or a composite aircraft representing a collection of aircraft classified by the three parameters: AAC, ADG, and TDG. In the case of an airport with multiple runways, a design aircraft is selected for each runway.

The first consideration is the safe operation of aircraft likely to use an airport. Any operation of an aircraft that exceeds design criteria of an airport may result in either an unsafe operation or a lesser safety margin; however, it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently.

The design aircraft is defined as the most demanding aircraft type, in grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, excluding touch-and-go operations. Planning for future aircraft use is of particular importance since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the reasonable long range potential needs of the airport.

According to FAA AC 150/5300-13A, *Airport Design*, "airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft never likely to be served by the airport are not economical." Selection of the current and future critical design aircraft must be realistic in nature and supported by current data and realistic projections.

AIRPORT DESIGN AIRCRAFT

The airport experiences frequent activity by both commercial service and business jets. In the past, commercial service jets utilizing the airport included the 50-seat Bombardier CRJ-200 aircraft as operated by American Eagle. As previously detailed, the airport has more recently experienced enhanced commercial service activity that involves the larger 70-seat CRJ-700 aircraft. The airport also experiences activity by the largest business jets, including the Gulfstream 550, Gulfstream 650, and Bombardier Global 5000.

Flagstaff Airport is served by an ATCT; however, the ATCT only logs aircraft operations by operational type (air carrier, air taxi, general aviation, and military), but not by specific aircraft make and model. The FAA maintains the Traffic Flow Management System Count (TFMSC) database which documents certain aircraft operations at airports. Information is added to the TFMSC database when pilots file flight plans and/or when flights are detected by the National Airspace System, usually via radar. It includes documentation of commercial traffic (air carrier and air taxi), general aviation, and military aircraft. Due to factors, such as incomplete flight plans and limited radar coverage, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type. Therefore, it is likely that there are more operations at the airport than are captured by this methodology. TFMSC data is available for activity at Flagstaff Airport and was utilized in this analysis.

Exhibit 2M presents the TFMSC annual jet activity from 2012 through September 2016. It should be noted that 2016 totals include a 12-month period from October 2015 through September 2016. As can be seen, several types and sizes of jets can and do operate at the airport. The exhibit also shows the breakout of these jets by AAC and ADG. Over the sample period, the greatest number of operations in any single design family combined was 18,656 in C-II. These accounted for approximately 72 percent of logged jet activity. The most demanding jet, in terms of design standards, to operate at the airport regularly during the time period was the CRJ-200, which belongs in design category C-II. Other jet aircraft, including several Cessna Citation models, Learjet models, Falcon models, BAE HS-125 models, and the Challenger 300/600, also constituted significant operations at the airport over the time period. These aircraft represent design categories B-I, B-II, C-I, and C-II. Overall, the most demanding jets to utilize the airport in terms of AAC were the Gulfstream 200 and 400, and Boeing 737-800 series aircraft, as well as military jets, such as the F/A-18 and F-16. These aircraft fall in AACs D and E. The most demanding jets in terms of ADG were the Airbus A300/310 series, Boeing 757, C-17, KC-135, and DC-10, which fall in ADG IV. These jet aircraft have operated at the airport on a limited basis in the past.

Flagstaff Airport has exhibited a long term trend of significant jet aircraft activity. The majority of these operations have been conducted by commercial service jets; however, business jet aircraft have also



JET OPERATIONS BY AIRPORT REFERENCE CODE

ARC	Aircraft	2012	2013	2014	2015	2016*
A-I	Cessna Citation Mustang	40	32	28	50	76
A-I	Eclipse 400/500	26	14	20	30	30
TOTAL		**66**	**46**	**48**	**80**	**106**
B-I	Beechjet 400	128	114	74	106	112
B-I	Cessna Citation I/SP	18	8	12	20	22
B-I	Cessna CJ1	82	114	148	166	164
B-I	Dassault Falcon/Mystère 10	8	4	0	2	0
B-I	Embraer Phenom 100	24	62	60	58	52
B-I	Hawker 400/MU-300	0	4	0	2	0
B-I	Honda Jet	0	0	0	0	2
B-I	L-39 Albatross	0	0	0	6	0
B-I	North American Rockwell Sabre 40/60	0	0	10	0	0
B-I	Raytheon Premier I	6	20	36	44	32
B-I	Swearingen SJ-30	2	0	0	0	0
TOTAL		**268**	**326**	**340**	**404**	**384**
B-II	Cessna Citation Bravo/SP	66	78	92	68	56
B-II	Cessna Citation Excel/XLS	140	64	108	140	136
B-II	Cessna Citation III/VI/VII	26	8	30	42	40
B-II	Cessna Citation Sovereign	22	20	34	16	40
B-II	Cessna Citation V/Encore/Ultra	126	110	102	106	124
B-II	Cessna CJ2, CJ3, CJ4	78	76	76	166	192
B-II	Dassault Falcon 20/50	70	44	36	36	36
B-II	Dassault Falcon 2000	8	16	16	44	44
B-II	Dassault Falcon 900	18	26	14	40	48
B-II	Dornier 328	0	0	0	2	8
B-II	Embraer Phenom 300	6	14	24	70	98
TOTAL		**560**	**456**	**532**	**730**	**822**
C-I	AV-8B Harrier	2	4	0	4	2
C-I	BAE HS 125-1/2/3/125/400/600	68	90	86	74	122
C-I	Bae Systems Hawk	32	4	2	2	0
C-I	IAI 1124/1125 Westwind	70	32	6	10	8
C-I	Learjet 20 Series	2	0	2	6	2
C-I	Learjet 30 Series	40	62	54	64	90
C-I	Learjet 40/45/60	106	92	96	80	68
C-I	Learjet 55	2	18	22	10	8
TOTAL		**322**	**302**	**268**	**250**	**300**
C-II	Bombardier CRJ-200	2,562	3,674	3,682	3,680	3,866
C-II	Cessna Citation X	74	52	106	54	84
C-II	Challenger 300/600	92	66	156	106	186
C-II	Embraer ERJ 135/140/145/Legacy	4	0	0	2	0
C-II	Fairchild A-10	0	0	0	2	0
C-II	Gulfstream 300	14	8	12	6	4
C-II	Hawker 800/1000/4000	2	10	18	18	10
C-II	IAI 1126 Galaxy	24	38	26	10	8
TOTAL		**2,772**	**3,848**	**4,000**	**3,878**	**4,158**
C-III	Airbus A319/320 Series	24	26	24	18	14
C-III	Boeing 727/737 Series	2	20	2	8	12
C-III	Bombardier Global 5000	4	14	26	36	14
C-III	Dassault Falcon 7X	6	18	2	2	0
C-III	Embraer 170/190 Series	2	0	0	4	4
C-III	Gulfstream G550/650	12	22	24	26	36
C-III	Mcdonnell Douglas DC-9/MD-80 series	4	0	0	0	0
TOTAL		**54**	**100**	**78**	**94**	**80**

JET OPERATIONS BY AIRPORT REFERENCE CODE (continued)

ARC	Aircraft	2012	2013	2014	2015	2016*
C-IV	Airbus A300/310 Series	2	0	0	0	0
C-IV	Boeing 707	0	0	0	2	2
C-IV	Boeing 757 200 Series	0	6	2	0	0
C-IV	C-17 Globemaster	8	6	6	28	24
C-IV	KC-135 Stratotanker	0	0	0	2	2
C-IV	McDonnell Douglas DC-10	2	0	0	0	0
TOTAL		**12**	**12**	**8**	**32**	**28**
D-I	F/A-18 Hornet	6	0	0	8	0
D-I	Learjet 70 Series	0	0	0	0	6
D-I	T-38 Talon	2	0	0	0	0
TOTAL		**8**	**0**	**0**	**8**	**6**
D-II	Gulfstream 200/400	26	26	34	46	58
D-II	Gulfstream G-150	4	16	4	10	12
TOTAL		**30**	**42**	**38**	**56**	**70**
D-III	Boeing 737-800/900	6	10	4	0	2
TOTAL		**6**	**10**	**4**	**0**	**2**
E-I	F-16 Falcon	0	0	6	0	0
TOTAL		**0**	**0**	**6**	**0**	**0**
ANNUAL TOTAL		**4,098**	**5,142**	**5,322**	**5,532**	**5,956**

AIRPORT REFERENCE CODE OPERATIONS SUMMARY

Jet Operations by Airport Reference Code

ARC	2012	2013	2014	2015	2016*
A-I	66	46	48	80	106
B-I	268	326	340	404	384
B-II	560	456	532	730	822
C-I	322	302	268	250	300
C-II	2,772	3,848	4,000	3,878	4,158
C-III	54	100	78	94	80
C-IV	12	12	8	32	28
D-I	8	0	0	8	6
D-II	30	42	38	56	70
D-III	6	10	4	0	2
E-I	0	0	6	0	0
Total	**4,098**	**5,142**	**5,322**	**5,532**	**5,956**

Jet Operations By Approach Category

ARC	2012	2013	2014	2015	2016*
A	66	46	48	80	106
B	828	782	872	1,134	1,206
C	3,160	4,262	4,354	4,254	4,566
D	44	52	42	64	78
E	0	0	6	0	0
Total	**4,098**	**5,142**	**5,322**	**5,532**	**5,956**

Jet Operations By Airplane Design Group

ARC	2012	2013	2014	2015	2016*
I	664	674	662	742	796
II	3,362	4,346	4,570	4,664	5,050
III	60	110	82	94	82
IV	12	12	8	32	28
Total	**4,098**	**5,142**	**5,322**	**5,532**	**5,956**

*2016 Includes counts from October 2015 thru September 2016

Source: Traffic Flow Management System Counts

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utilized the airport on a regular basis and constitute a substantial number of operations. Between 2012 and 2016, total jet activity has averaged over 5,210 operations per year, and the trend has been increasing in recent years with the airport averaging nearly 5,750 annual jet aircraft operations over the past two years.

The aviation demand forecasts indicate the potential for continued growth in jet activity at the airport. This includes a forecast increase in based business jets and commercial service operations through the 20-year planning horizon. The type and size of jet aircraft using the airport regularly can impact the design standards to be applied to the airport system. Therefore, it is important to have an understanding of what type of aircraft may use the airport in the future. Factors such as population and employment growth in the airport service area, the proximity and level of service of other regional airports, and development at the airport can influence future activity.

RUNWAY DESIGN CODE

Each runway at an airport is assigned a RDC. The RDC relates to specific FAA design standards that should be planned in relation to each runway, regardless of whether or not the airport currently meets the appropriate design standards (to be discussed in Chapter Three).

Runway 3-21

Runway 3-21 is 8,800 feet long by 150 feet wide and has an instrument landing system (ILS) providing visibility minimums as low as ½-mile for instrument approaches to Runway 21. It should be noted that the visibility minimums were recently lowered from ¾-mile to ½-mile on Runway 21. The current ALP for the airport defines Runway 3-21 as an existing and ultimate ARC C-III. (Note: The updated AC would classify Runway 3-21 as existing and ultimate RDC C-III).

According to the TFMSC data, operations by aircraft in ADG III have not exceeded the 500 operations threshold in the recent past. Over the past five years, operations in ADG III have averaged approximately 85 annually, with the highest one-year total being 110 in 2013. Therefore, **the Master Plan will utilize an existing RDC of C-II-2400 for Runway 3-21**. Future planning should consider the increased use of larger business jets at the airport, in addition to the potential emergence of larger commercial service aircraft, including 90-seat regional jets, such as the CRJ-900 and Embraer E-190 aircraft. In addition, the 70-seat Embraer E-170 could also utilize the airport in the future depending on the regional carriers that operate in and out of the facility. All these aircraft exhibit ADG III characteristics. Furthermore, the airport continuing to achieve visibility minimums down to ¾-mile, associated with the ILS precision approach, should be sufficient for commercial service and general aviation operations. As a result, **the future RDC for Runway 3-21 is C-III-2400**.

AIRPORT DESIGN SUMMARY

Table 2R summarizes the design aircraft components to be applied at the airport. The ultimate RVR (visibility) component for Runway 3-21 may change based on analysis and recommendations regarding potential instrument approach capability. The APRC and DPRC are also noted for the runway system.

TABLE 2R
Design Aircraft Parameters
Flagstaff Airport

Runway Design Parameters	Runway Design Code (RDC)	Approach Reference Code (APRC)	Departure Reference Code (DPRC)
EXISTING			
Runway 3-21 (400' runway/taxiway separation)	C-II-2400	D/IV/2400 D/V/2400	D/IV D/V
ULTIMATE			
Runway 3-21 (400' runway/taxiway separation)	C-III-2400	D/IV/2400 D/V/2400	D/IV D/V

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

SUMMARY

Flagstaff Airport is a significant aviation facility that serves a vital function for the regional economy. As a general observation, the airport is well-positioned for growth in the future as demand would dictate. The next step in the planning process is to assess the capabilities of the existing facilities to determine what upgrades may be necessary to meet future demands. The range of forecasts developed here will be taken forward in the next chapter as planning horizon activity levels that will serve as milestones or activity benchmarks in evaluating facility requirements.

FLAGSTAFF AIRPORT

CHAPTER THREE

Facility Requirements







FLAGSTAFF AIRPORT

Chapter Three
FACILITY REQUIREMENTS







To properly plan for the future of Flagstaff Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve the identified demand. This chapter will evaluate the existing capacities of the airport and outline any new facilities needed to accommodate projected forecast levels. The existing capacity is compared to the forecast activity levels prepared in Chapter Two to determine where deficiencies currently exist or may be expected to materialize in the future. This chapter will analyze the following elements:

- Airfield Capacity
- Airport Physical Planning Criteria
- Airside and Landside Facility Requirements

As indicated previously in Chapter One, airport facilities include both airside and landside components. Airside facilities include those that are related to the arrival, departure, and ground movement of aircraft. The components include:

- Runways
- Taxiways
- Navigational and Approach Aids
- Airfield Lighting, Marking, and Signage

Landside facilities are needed for the interface between air and ground transportation modes. The general aviation elements analyzed include:

- Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Automobile Parking
- Airport Support Facilities

Once deficiencies in a component are identified, alternatives for meeting existing or proposed needs and/or proper design standards will be evaluated in Chapter Four. The alternatives analysis will determine the most practical, cost-effective, and efficient direction for future airport development.

The facility requirements at Flagstaff Airport were evaluated using guidance contained in several Federal Aviation Administration (FAA) publications, including the following:

- Advisory Circular (AC) 150/5300-13A, Change 1, *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4C, *Runway Length Requirements for Airport Design*
- Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS).

DEMAND-BASED PLANNING HORIZONS

An updated set of aviation demand forecasts for Flagstaff Airport has been established and was detailed in Chapter Two. These activity forecasts include passenger enplanements, annual operations, based aircraft, aircraft fleet mix, and peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more upon actual demand at an airport than on a time-based forecast figure. In order to develop a Master Plan that is demand-based rather than time-based, a series of planning horizon milestones have been established that take into consideration the reasonable range of aviation demand projections. The planning horizons are the short term (years 1-5), the intermediate term (years 6-10), and the long term (years 11-20).

It is important to consider that the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand by allowing airport management the flexibility to make decisions and develop facilities based upon need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program.

AIRFIELD CAPACITY

An airport's airfield capacity is expressed in terms of its annual service volume (ASV). ASV is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. As aircraft operations surpass the ASV, delay factors increase exponentially. The airport's ASV was examined utilizing the FAA's AC 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis considers specific factors about the airfield in order to calculate the airport's ASV. These various factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to Flagstaff Airport and include airfield layout, weather conditions, aircraft mix, and operations.

- **Runway Configuration** – The existing airfield configuration consists of a single runway supported by a full-length parallel taxiway. Runway 3-21 is 8,800 feet long and 150 feet wide.

- **Runway Use** – Runway use in capacity conditions will be controlled by wind and/or airspace conditions. For Flagstaff Airport, the direction of takeoffs and landings are generally determined by the speed and direction of the wind. It is generally safest for aircraft to takeoff and land into the wind, avoiding a crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components during these operations. Runway 21 is utilized most often, estimated at 70 percent of the time. The availability of instrument approaches is also considered. While each runway end provides instrument approach capabilities, Runway 21 is primarily utilized in instrument weather conditions since it is afforded an approach lighting system in the form of a medium intensity approach lighting system with runway alignment indicator lights (MALSR) and has the lower visibility minimums for instrument approaches.

- **Exit Taxiways** – Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determines the occupancy time of an aircraft on the runway. This range is based upon the mix index of the aircraft that use the runway. Based upon mix, only taxiways between 2,000 feet and 4,000 feet from the landing threshold count in the exit rating at Flagstaff Airport. The exits must be at least 750 feet apart to count as separate exit taxiways. Utilizing these standards, the exit taxiway rating is two for Runway 3 and two for Runway 21.

- **Weather Conditions** – Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather, when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft which can operate at the airport during any given period, thus reducing overall airfield capacity.

AIRFIELD LAYOUT

Runway Configuration



Runway Use



Number of Exits



WEATHER CONDITIONS

VMC
Visual Meteorological Conditions



IMC
Instrument Meteorological Conditions



PVC
Poor Visibility Conditions



AIRCRAFT MIX

Category A & B Aircraft



Category C Aircraft



Category D Aircraft



OPERATIONS

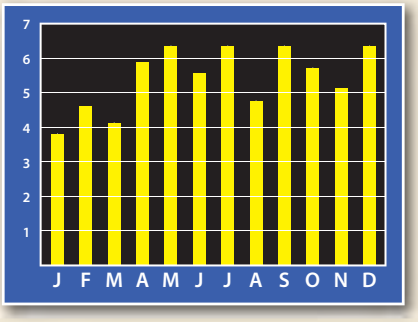
Arrivals



Departures



Total Annual Operations



Touch-and-Go Operations



According to meteorological data collected from the on-airport automated surface observation system (ASOS), the airport operates under visual meteorological conditions (VMC) approximately 96.55 percent of the time. VMC exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. According to the weather observations, IMC prevailed approximately 1.77 percent of the time. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. PVC conditions occur approximately 1.67 percent of the year. **Table 3A** summarizes the weather conditions experienced at the airport over a 10-year period of time.

TABLE 3A
Weather Conditions
Flagstaff Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	> 1,000' AGL	> 3 statute miles	96.55%
IMC	≥ 500' AGL and ≤ 1,000' AGL	1-3 statute miles	1.77%
PVC	< 500' AGL	< 1 statute mile	1.67%

VMC - Visual Meteorological Conditions
IMC - Instrument Meteorological Conditions
PVC - Poor Visibility Conditions
AGL - Above Ground Level

Source: National Oceanic and Atmospheric Administration (NOAA) - National Climatic Data Center. Airport observations from 2006 - 2015.

- **Aircraft Mix** – Aircraft mix for the capacity analysis is defined in terms of four aircraft classes. Classes A and B consist of small- and medium-sized propeller and some jet aircraft, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity. A large majority of aircraft operations at Flagstaff Airport are those in Classes A and B. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft. The Bombardier CRJ-200 and CRJ-700 regional jets are also categorized in Class C. Class D aircraft consists of large aircraft weighing more than 300,000 pounds. The airport experiences very few operations by Class D aircraft that include large military transport aircraft. In the future, aircraft in Class C will continue to constitute a substantial number of fixed-wing operations; however, Class D aircraft are not projected to contribute regular operational activity as part of the overall aircraft fleet mix at the airport.

- **Percent Arrivals** – The percentage of arrivals as they relate to total operations of the airport is important in determining airfield capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity. The aircraft arrival-departure percentage split is typically 50/50, which is the case at Flagstaff Airport.

- **Touch-And-Go Activity** – A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and

classified as a local operation. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occurs within a shorter time than individual operations. Touch-and-go operations at Flagstaff Airport account for approximately 20 percent of total annual operations. A similar ratio is expected in the future.

- **Peak Period Operations** – For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month are utilized. Typical operations activity is important in the calculation of an airport's ASV as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year.

CAPACITY ANALYSIS CONCLUSIONS

Given the factors outlined above, the airfield ASV will range between 150,000 and 200,000 annual operations. The ASV does not indicate a point of absolute gridlock for the airfield; however, it does represent the point at which operational delay for each aircraft operation will increase exponentially. The current operational level for the airport represents approximately 33 percent of the airfield's ASV, if the ASV is considered at the low end of the typical range of 150,000 annual operations. By the end of the planning period, total annual operations are expected to represent 42 percent of the airfield's ASV.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This is an approximate level to begin the detailed planning of capacity improvements. At the 80 percent level, the planned improvements should be made. While no significant capacity improvements will be necessary, options to improve airfield efficiency will still be considered in the Master Plan.

AIRSIDE FACILITY REQUIREMENTS

As indicated earlier, airport facilities include both airside and landside components. Airside facilities include those that are related to the arrival, departure, and ground movement of aircraft. These components include:

- Runway Configuration
- Safety Area Design Standards
- Runways
- Taxiways
- Navigational and Approach Aids
- Lighting, Marking, and Signage

RUNWAY ORIENTATION

For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off. Runway 3-21 at Flagstaff Airport is orientated in a northeast-southwest manner.

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

Weather data specific to the airport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the on-field ASOS over a continuous time period from 2006 to 2015. A total of 110,606 observations of wind direction and other data points were made. Of the total number of observations, 11,469 were made in instrument flight rules (IFR) conditions. IFR conditions exist when the visibility is below three miles or the cloud ceilings are below 1,000 feet.

Exhibit 3B presents both the all-weather and IFR wind rose for the airport. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a particular location. The table at the top of each wind rose indicates the percent of wind coverage for the runway and specific wind intensity. In all-weather conditions, Runway 3-21 provides 99.34 percent wind coverage for 10.5 knot crosswinds, 99.85 percent coverage at 13 knots, 99.99 percent at 16 knots, and 100 percent at 20 knots. Under IFR conditions, the crosswind component coverages for the runway system are nearly identical to the all-weather conditions. Therefore, the existing runway orientation at Flagstaff Airport should be maintained as it is properly orientated to meet predominant winds, and a crosswind runway is not needed.

SAFETY AREA DESIGN STANDARDS

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

The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. The RPZ should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in place which ensure the RPZ remains free of incompatible development. The various airport safety areas are graphically presented on **Exhibit 3C**.

Dimensional standards for the various safety areas associated with the runway are a function of the type of aircraft expected to use the runway as well as the instrument approach capability. **Table 3B** presents the FAA design standards as they apply to the Runway 3-21 at Flagstaff Airport. As identified in Chapter Two, the current critical design aircraft is classified as C-II. The future airfield design should be planned to C-III; therefore, the design standards for both conditions are examined.

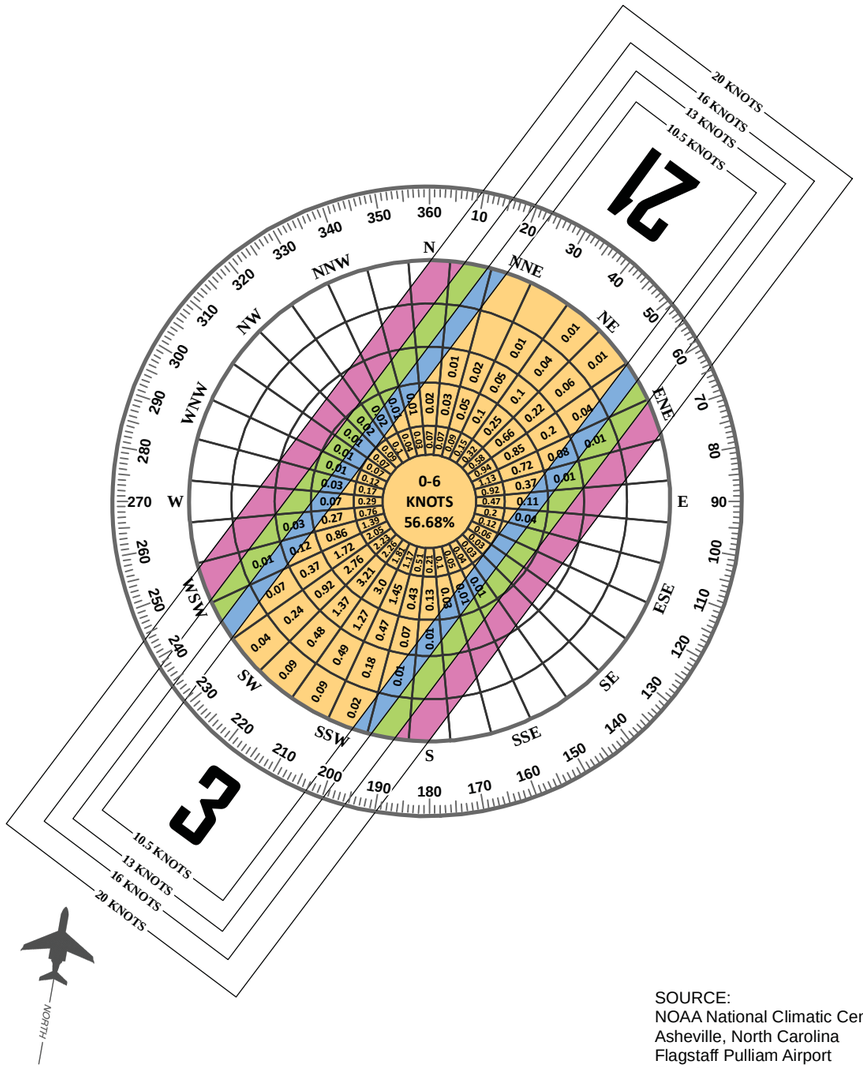
TABLE 3B
Runway Design Standards
Flagstaff Airport

	Runway 3-21	
	Current	Future
RUNWAY CLASSIFICATION		
Runway Design Code	C-II	C-III
Visibility Minimums	1 mile (Rwy 3) / ¾-mile (Rwy 21)	1 mile (Rwy 3) / ¾-mile (Rwy 21)
RUNWAY DESIGN		
Runway Width	150	150[1]
Blast Pad Length x Width	200 x 200 (Both Runway Ends)	200 x 200 (Both Runway Ends)
RUNWAY PROTECTION		
Runway Safety Area (RSA)		
Width	500[2]	500
Length Beyond Departure End	1,000	1,000
Length Prior to Threshold	600	600
Runway Object Free Area (ROFA)		
Width	800	800
Length Beyond Departure End	1,000	1,000
Length Prior to Threshold	600	600
Runway Obstacle Free Zone (ROFZ)		
Width	400	400
Length Beyond End	200	200
Precision Obstacle Free Zone (POFZ)[3]		
Width	800	800
Length	200	200
Approach Runway Protection Zone (RPZ)		
Length	1,700/2,500	1,700/2,500
Inner Width	1,000/1,000	1,000/1,000
Outer Width	1,510/1,750	1,510/1,750
Departure Runway Protection Zone (RPZ)		
Length	1,700/1,700	1,700/1,700
Inner Width	500/500	500/500
Outer Width	1,010/1,010	1,010/1,010
RUNWAY SEPARATION		
Runway Centerline to:		
Hold Position	250	321[4]
Parallel Taxiway	300	400
Aircraft Parking Area	400	500

[1] For airplanes with maximum certificated takeoff weight of 150,000 pounds or less and approach visibility minimums of not less than ¾-mile, the standard runway width is 100 feet
[2] RSA width of 400 feet is permissible
[3] POFZ does not currently apply to the airfield
[4] This distance is increased one foot for each 100 feet above sea level
Note: All dimensions in feet
Source: FAA AC 150/5300-13A, Change 1, *Airport Design*

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	99.34%	99.85%	99.99%	100.00%



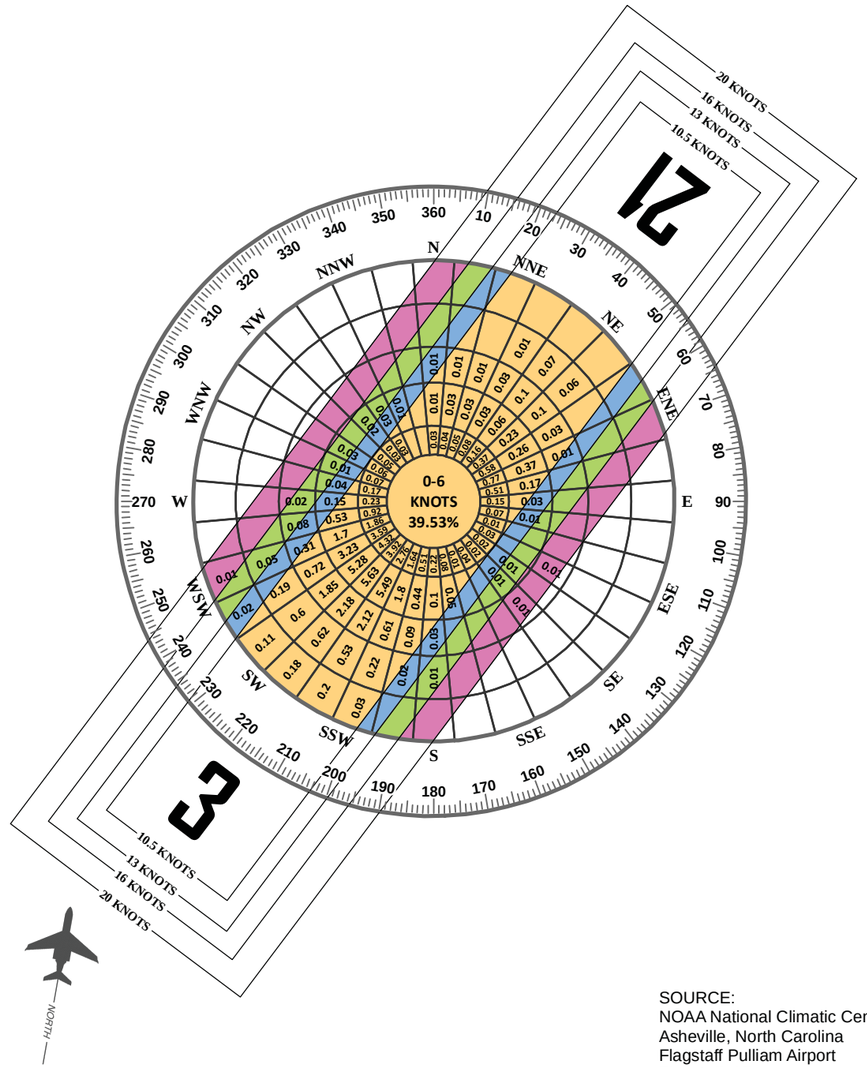
Magnetic Declination
10° 38' 00" East (Sept. 2016)
Annual Rate of Change
00° 06' 00" West (Sept. 2016)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Flagstaff Pulliam Airport
Flagstaff, AZ

OBSERVATIONS:
110,606 All Weather Observations
Jan. 1, 2006 - Dec, 31 2015

IFR WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	99.14%	99.78%	99.96%	100.00%

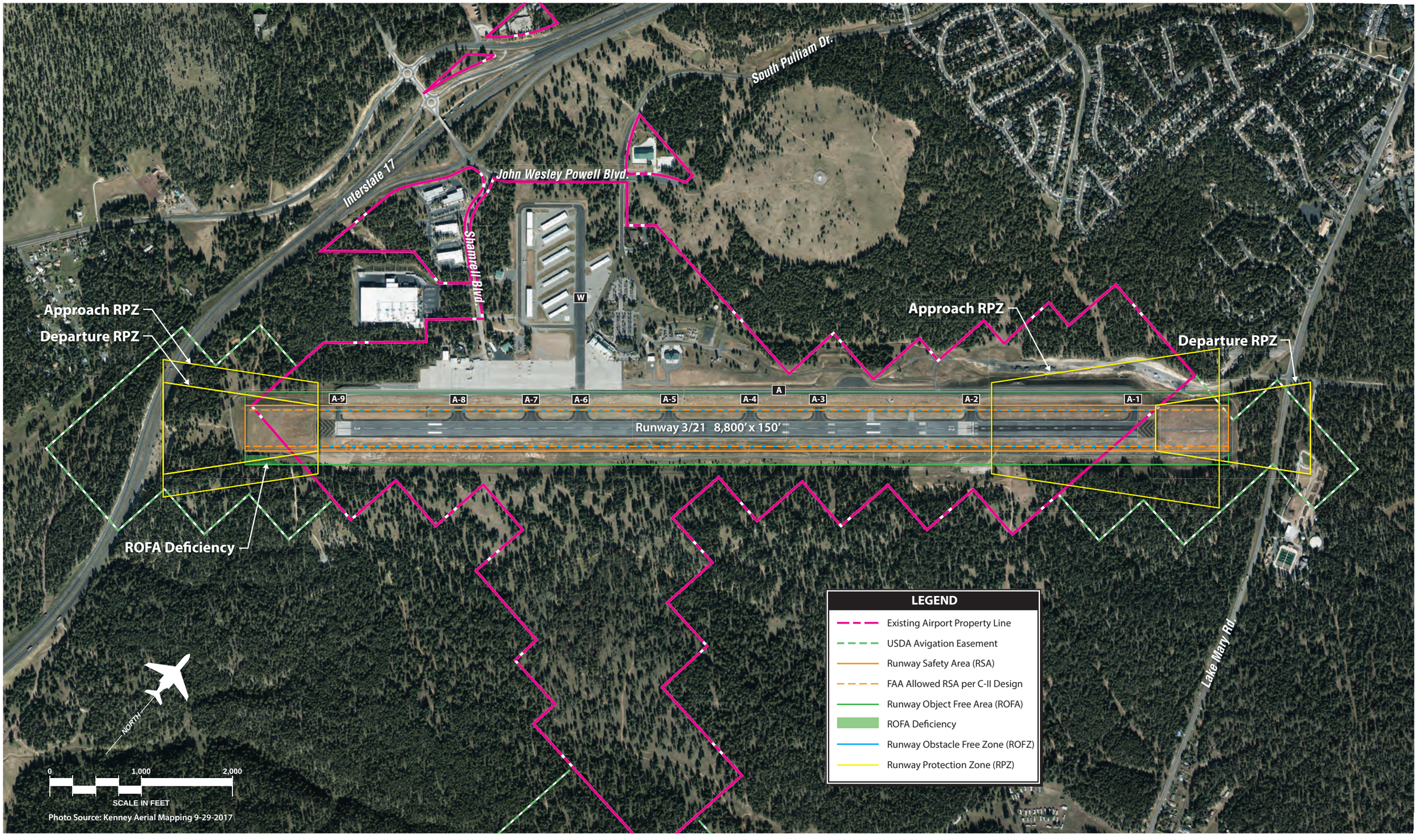


Magnetic Declination
10° 38' 00" East (Sept. 2016)
Annual Rate of Change
00° 06' 00" West (Sept. 2016)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Flagstaff Pulliam Airport
Flagstaff, AZ

OBSERVATIONS:
11,469 IFR Observations
Jan. 1, 2006 - Dec, 31 2015

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South Pulliam Dr.
Interstate 17
John Wesley Powell Blvd.
Shamrell Blvd.
W
A
A-9
A-8
A-7
A-6
A-5
A-4
A-3
A-2
A-1
Runway 3/21 8,800' x 150'
Approach RPZ
Departure RPZ
Approach RPZ
Departure RPZ
ROFA Deficiency
Lake Mary Rd.
LEGEND
Existing Airport Property Line
USDA Avigation Easement
Runway Safety Area (RSA)
FAA Allowed RSA per C-II Design
Runway Object Free Area (ROFA)
ROFA Deficiency
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
NORTH
0
1,000
2,000
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017

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Runway Safety Area

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

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

For RDC C-II design, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway ends. Analysis indicates that Runway 3-21 should be planned to accommodate aircraft in RDC C-III. The RSA for RDC C-III is also 500 feet wide and extends 1,000 feet beyond each runway end. It should be noted that only 600 feet of RSA is needed prior to the landing threshold on each runway end under RDC C-II and C-III standards.

As depicted on **Exhibit 3C**, it appears the airfield conforms to existing and ultimate RSA standards; however, portions of the RSA beyond the northeast and southwest ends of the runway encompass land not owned by the airport but controlled through an avigation easement with the U.S. Forest Service, which is an agency of the United States Department of Agriculture (USDA). To establish permanent control over this land, consideration should be given to acquiring this property from the USDA. A portion of the perimeter access road penetrates a portion of the RSA beyond the southwest end of the runway; however, the perimeter access road is restricted to authorized airport personnel and is not open to the public.

While the standard for RSA width is 500 feet for RDC C-II and C-III, AC 150/5300-13A, Change 1, *Airport Design*, allows for the application of a narrower RSA width of 400 feet for RDC C-II. As such, a 400-foot RSA is also presented on the exhibit. Under this scenario, the perimeter access road remains clear of the RSA beyond the southwest end of the runway.

Runway Object Free Area

The ROFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The ROFA does not have to be graded and level like the RSA; instead, the primary requirement for the ROFA is that

no object in the ROFA penetrates the lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance to the critical design aircraft utilizing the runway.

For RDC C-II and C-III design, the FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end. Similar to the RSA, only 600 feet is needed prior to the landing threshold. **Exhibit 3C** depicts one general area on the airfield that does not meet ROFA standards. An area of trees protrudes above the RSA elevation and serves as a ROFA deficiency in a portion of the ROFA beyond the southwest end of the runway. A detailed analysis of potential solutions to mitigating this ROFA deficiency will be examined during the alternatives analysis.

Like the RSA, the Runway 3-21 ROFA encompasses portions of land to the northeast and southwest of the runway that is subject to an avigation easement granted by the USDA. To establish permanent control over this property, consideration should be given to acquiring this property from the USDA.

Runway Obstacle Free Zone

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

The FAA's criterion for runways utilized by aircraft weighing more than 12,500 pounds requires a clear ROFZ to extend 200 feet beyond the runway ends and 400 feet wide (200 feet on either side of the runway centerline). The ROFZ standards are met on Runway 3-21 except for a small portion of the ROFZ that extends beyond airport property adjacent to the northeast end of the runway. Similar to the RSA and ROFA, this area is confined within the USDA avigation easement.

A precision obstacle free zone (POFZ) is further defined for runway ends with a precision approach, such as the instrument landing system (ILS) approach to Runway 21. The POFZ is 800 feet wide, centered on the runway, and extends from the runway threshold to a distance of 200 feet. The POFZ is in effect when the following conditions are met:

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

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. POFZ standards currently apply to the approach end of Runway 21 as this runway allows for instrument approach visibility minimums below ¾-mile. As previously detailed, this is a result of recent changes to the instrument approach procedures at the airport.

Runway Protection Zone

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

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

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

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

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



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

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

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

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

RPZs have been further designated as approach and departure RPZs. The approach RPZ is a function of the Aircraft Approach Category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements that the airport sponsor should pursue.

Currently, none of the approach and departure RPZs serving either end of Runway 3-21 are fully contained on airport property, as depicted on **Exhibit 3C**. Whenever possible, the airport should maintain positive control over the RPZs through fee simple acquisition; however, avigation easements can be pursued if fee simple acquisition is not feasible. Portions of the approach and departure RPZs serving each end of Runway 3-21 that extend beyond airport property are contained within avigation easements.

On the northeast side of Runway 3-21, portions of Lake Mary Road fall within the departure RPZ as does a portion of the City of Flagstaff's water treatment facility. On the southwest side of Runway 3-21, Interstate 17 impacts the southwest corner of the approach and departure RPZs. The approach RPZ serving Runway 21 is larger than the approach RPZ serving Runway 3 due to the precision ILS instrument approach procedure providing visibility minimums down to ½-mile.

Further examination of the RPZs associated with each runway end will be undertaken later in this study. The potential for improved instrument approach procedures and their effects on RPZ dimensions will also be considered.

Runway/Taxiway Separation

The design standard for the required separation between runways and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimum. The separation standard for RDC C-II with lower than ¾-mile visibility minimums is 400 feet from the runway centerline to the parallel taxiway centerline. For RDC C-III, the separation standard is 400 feet. Parallel Taxiway A is 400 feet from the runway (centerline to centerline); therefore, the location of the parallel taxiway meets the current and proposed design standards and should be maintained accordingly.

Hold Line Separation

Hold positions are markings on taxiways leading to runways. When instructed, pilots are to stop short of the hold line. For Runway 3-21, hold lines are situated 250 feet from the runway centerline, which meet the 250-foot separation for C-II design.

According to FAA AC 150/5300-13A, Change 1, *Airport Design*, the hold line location must be increased based on an airport's elevation and the RDC of the runway. For RDC C-III, the hold line position should be increased one foot for every 100 feet above sea level. With the airport's elevation at 7,014 feet above mean sea level (MSL), the hold lines for Runway 3-21 should be increased above 250 feet by 71 feet, or at 321 feet from the runway centerline, in order to meet RDC C-III standards.

Aircraft Parking Apron Separation

For Runway 3-21, aircraft parking areas should be at least 400 feet from the runway centerline for RDC C-II. For RDC C-III, parking aprons should be located 500 feet from the runway centerline. The aircraft parking aprons situated adjacent to the west side of parallel Taxiway A begin 500 feet from the runway centerline. This exceeds C-II design standards and adheres to C-III design standards.

RUNWAYS

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

Runway Length

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. A draft revision to this AC is currently available (150/5325-4C) and the FAA is utilizing the draft revision in most cases when evaluating runway length needs for airports.

The determination of runway length requirements for Flagstaff Airport is based on five primary factors:

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

Aircraft performance declines as elevations, temperature, and runway gradient factors increase. For Flagstaff Airport, the mean maximum daily temperature of the hottest month is 81.6 degrees Fahrenheit (F), which occurs in July. The airport's elevation is 7,014 feet MSL. The runway elevation difference is approximately 18 feet for Runway 3-21, which equates to a 0.2 percent gradient change. The gradient of the runway conforms to FAA design standards.

Airplanes operate on a wide variety of available runway lengths. Many factors will govern the suitability of those runway lengths for aircraft, such as elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, and any special operating procedures. Airport operators can pursue policies that can maximize the suitability of the runway length. Policies such as area zoning and height and hazard restrictions can protect an airport's runway length. Airport ownership (fee simple or easement) of land leading to the runway ends can reduce the possibility of natural growth or man-made obstructions. Planning of runways should include an evaluation of aircraft types expected to use the airport or a particular runway now and in the future. Future plans should be realistic and supported by the FAA approved forecasts and should be based on the critical design aircraft (or family of aircraft).

Commercial Service Aircraft

Runway length needs for commercial service aircraft must factor the local airport conditions described above and the load carried. The aircraft load is dependent upon the payload of passengers and/or cargo, plus the amount of fuel it has on board. For departures, the amount of fuel varies depending upon the length of non-stop flight or trip length.

Currently, scheduled air service from the airport is available to Phoenix Sky Harbor International Airport. **Table 3C** shows the current destination served from Flagstaff Airport and its haul length. Other general market locations and their distances from the airport are also included in the table.

TABLE 3C
Non-Stop Trip Lengths
Flagstaff Airport

General Market Locations	Air Miles
Phoenix (Current Non-Stop Service)	119
Las Vegas	206
Salt Lake City	391
Los Angeles	392
Denver	490
San Francisco	619

Source: http://www.landings.com

As previously detailed, commercial service aircraft operating at the airport in the past have included the Bombardier CRJ-200 regional jet. This aircraft is configured to accommodate approximately 50 passengers. More recently, the larger 70-seat CRJ-700 has begun operating at the airport. Forecasts anticipate that the 70-seat regional jets will continue to operate at the airport into the foreseeable future, and even larger aircraft capable of carrying up to 90 passengers should be considered through the long term planning period of this Master Plan. This could include the CRJ-900 as well as the Embraer E-170 and E-175. Furthermore, even larger aircraft such as the Boeing 737-series jet could operate at the airport on a non-scheduled basis in a charter capacity. **Table 3D** summarizes the runway length needs for these aircraft based on operating factors at Flagstaff Airport.

TABLE 3D
Runway Length Requirements for Select Commercial Aircraft
Flagstaff Airport

Aircraft	Runway Length at 60% Useful Load	Runway Length at 70% Useful Load	Runway Length at 80% Useful Load	Runway Length at 90% Useful Load	Runway Length at 100% Useful Load
CRJ-700	6,900	8,200	9,900	O/L	O/L
CRJ-900	6,100	6,800	8,900	8,900	O/L
E-170	7,200	8,400	O/L	O/L	O/L
E-190	6,100	7,300	8,000	O/L	O/L
Boeing 737-700	6,400	8,200	9,600	N/A	N/A

N/A - Exceeds maximum brake energy limit
O/L - % Useful Load exceeds runway length capabilities included in planning charts due to combination of elevation and temperature
Design Criteria: Elevation – 7,014 feet MSL; Temperature – 81.6 degrees F
Runway length rounded up to nearest 100 feet for values over 30 feet

Source: Aircraft Operating Manuals

The current length of 8,800 feet on Runway 3-21 is capable of handling operations that have been conducted previously by the CRJ-200 regional jet. In fact, the 1,800-foot extension on Runway 3-21 completed in 2007 was designed to help accommodate regional jets such as the CRJ-200 in meeting longer stage lengths of up to 500 nautical miles. It is important to note that many of the newer and larger regional jets such as the CRJ-700 and CRJ-900 exhibit improved airfield efficiency versus the smaller 50-seat regional jets under certain operating conditions. Furthermore, factors such as the existing airport elevation, aircraft departure limitations, and controlling obstacles beyond the runways could limit the effectiveness of any additional runway length. This is the case for many of the aircraft listed in **Table 3D**, as a combination of the airport's elevation and mean maximum temperature of the hottest month limit their operating abilities separate from runway length.

General Aviation Aircraft

The majority of operations at Flagstaff Airport are conducted using smaller single engine piston-powered aircraft weighing less than 12,500 pounds. Following guidance from AC 150/5325-4B, to accommodate 100 percent of these small aircraft, a runway length of 8,400 feet is recommended.

The airport is also utilized by aircraft weighing more than 12,500 pounds, including small to medium business jet aircraft. Runway length requirements for business jets weighing less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet). Business jets tend to need greater runway length when landing on a wet surface because of their increased approach speeds. AC 150/5325-4B stipulates that runway length determination for business jets consider a grouping of airplanes with similar operating characteristics. The AC provides two separate "family groupings of airplanes," each based upon their representative percentage of aircraft in the national fleet. The first grouping is those business jets that make up 75 percent of the national fleet, and the second group is those making up 100 percent of the national fleet. **Table 3E** presents a partial list of common aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3E
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW	75-100 percent of the national fleet	MTOW	Greater than 60,000 pounds	MTOW
Lear 35	20,350	Lear 55	21,500	Gulfstream II	65,500
Lear 45	20,500	Lear 60	23,500	Gulfstream IV	73,200
Cessna 550	14,100	Hawker 800XP	28,000	Gulfstream V	90,500
Cessna 560XL	20,000	Hawker 1000	31,000	Global Express	98,000
Cessna 650 (VII)	22,000	Cessna 650 (III/IV)	22,000		
IAI Westwind	23,500	Cessna 750 (X)	36,100		
Beechjet 400	15,800	Challenger 604	47,600		
Falcon 50	18,500	IAI Astra	23,500		

MTOW: Maximum Take-Off Weight

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Table 3F presents the results of the runway length analysis for business jets developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 7,600 feet is recommended. This length is derived from a raw length of 7,400 feet that is adjusted, as recommended, for runway gradient and consideration of landing length needs on a contaminated runway (wet and slippery). To accommodate 100 percent of the business jet fleet at 60 percent useful load, a runway length of 11,200 feet is recommended.

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at the airport. This could be documented activity by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 8,800 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 11,200 feet is recommended. It is important to note that the previous runway extension was also designed around larger general aviation business jets exhibiting the need for longer stage lengths from the airport.

TABLE 3F
Runway Length Requirements
Flagstaff Airport

Airport Elevation	7,014 feet above mean sea level
Average High Monthly Temp.	82 degrees (July)
Runway Gradient	18' Runway 3-21

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length With Gradient Adjustment (+180')	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
100% of small airplanes	8,400’	N/A	N/A	N/A
75% of fleet at 60% useful load	7,400’	7,580	5,500'	7,600’
100% of fleet at 60% useful load	11,000’	11,180’	5,500’	11,200’
75% of fleet at 90% useful load	8,600’	8,780’	7,000’	8,800’
100% of fleet at 90% useful load	11,000’	11,180’	7,000'	11,200’

*Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet conditions

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Another method to determine runway length requirements for jet aircraft at Flagstaff Airport is to examine aircraft flight planning manuals under conditions specific to the airport. Several aircraft were analyzed for takeoff length required with a design temperature of 81.6 degrees F at a field elevation of 7,014 feet MSL. The information presented on **Exhibit 3D** was obtained from Ultranav software which computes operational parameters for specific aircraft based on flight manual data. As presented, certain aircraft were evaluated for payload availability for the current runway length for dry and wet conditions. The analysis also presents takeoff length required by each aircraft departing under maximum takeoff weight. Nearly all the jet aircraft examined can operate from the existing runway length; however, several would be weight-restricted when using Runway 3-21. It is important to note that several aircraft were noted by the software program to be “climb restricted.” As such, any length beyond what is currently offered at the airport could not be utilized by these aircraft due to climb restrictions associated with the airport elevation.

The table also presents the runway length required for landing under three operational categories: Title 14 Code of Federal Regulations (CFR) Part 25, CFR Part 135, and CFR Part 91k. CFR Part 25 operations are those conducted by individuals or companies which own their aircraft. CFR Part 135 applies to all for-hire charter operations, including most fractional ownership operations. CFR Part 91k includes operations in fractional ownership which utilize their owned aircraft under direction of pilots specifically assigned to said aircraft.

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at Flagstaff Airport. The airport should strive to accommodate commercial service aircraft and business jets to the greatest extent possible.



Aircraft Name	Runway Length Required @ MTOW		% Useful Load for 8,800' Runway		Landing Length Required for:					
					C.F.R. Part 25		C.F.R. Part 135		C.F.R. Part 91k	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry (.6)	Wet (.6)	Dry (.8)	Wet (.8)
Citation X	8,091*	8,953	76.78%	75.01%	4,837	5,564	8,063	9,273	6,046	6,955
Citation VII	7,097*	7,468*	62.06%	62.06%	3,638	4,993	6,063	8,322	4,548	6,241
Challenger 604/605	10,927	11,692	65.58%	56.22%	3,434	5,547	5,723	9,245	4,293	6,934
Falcon 7X	8,786*	8,806	84.10%	84.04%	3,432	3,947	5,720	6,578	4,290	4,934
Falcon 900A	7,580*	8,180*	68.31%	68.31%	4,110	4,720	6,850	7,867	5,138	5,900
Falcon 2000	10,735	10,735	77.76%	77.76%	3,633	4,178	6,055	6,963	4,541	5,223
Gulfstream 450	10,349	11,608	78.75%	68.47%	3,832	6,673	6,387	11,122	4,790	8,341
Gulfstream 550	11,216	11,372	70.65%	69.11%	3,250	5,906	5,417	9,843	4,063	7,383
Gulfstream II/IISP	8,553*	N/A	53.15%	N/A	3,672	7,038	6,120	11,730	4,590	8,798
Global 5000	7,766*	7,860*	76.43%	76.43%	3,041	3,497	5,068	5,828	3,801	4,371
Global Express	7,791*	7,889*	68.12%	68.12%	3,041	3,497	5,068	5,828	3,801	4,371
Hawker 800XP	5,921*	6,929*	53.67%	53.67%	3,123	4,943	5,205	8,238	3,904	6,179
Lear 45	10,684	10,698	62.53%	62.29%	3,520	4,602	5,867	7,670	4,400	5,753
Lear 60	9,295	9,671	61.39%	53.17%	4,449	5,964	7,415	9,940	5,561	7,455

*Runway length required is less than existing, however climb restriction is in place due to temp & elevation. ***N/A*** - No Data Available

Source: Ultranav Flight Software based on aircraft operating manuals ***Note:*** Field Elevation 7,014'; Mean Max Temp 81.6°F(27.5°C)

Runway 3-21 is 8,800 feet long. As previously discussed, the runway was extended to its present-day length in 2007 in order to accommodate the types of aircraft that currently utilize the airport today. The runway can accommodate a large majority of business jets on the market under moderate loading conditions. Likewise, it accommodates the regularly scheduled commercial service regional jets that utilize the airport. Larger commercial service aircraft, such as the CRJ-700, CRJ-9000, and E-170 could support additional runway length; however, many of these regional jets would be climb restricted due to the airport's elevation being at over 7,000 feet. This could ultimately limit the usefulness of any additional runway length beyond what is currently offered at the airport. Given these factors as well as physical constraints beyond each end of the runway (i.e., Interstate 17, Lake Mary Road, and terrain factors), it is recommended that the existing runway length of 8,800 feet be maintained through the planning period of this study.

Runway Width

Runway width design standards are primarily based on the critical aircraft, but can also be influenced by the visibility minimums of published instrument approach procedures. For Runway 3-21, RDC C-II design criteria stipulate a runway width of 100 feet. Its current runway width of 150 feet exceeds this standard. RDC C-III design criteria calls for a width of 100 feet for design aircraft with maximum certificated takeoff weights of 150,000 pounds or less. If the runway is served by aircraft with maximum certificated takeoff weights of more than 150,000 pounds, C-III standards call for a 150-foot wide runway. The runway is utilized occasionally by larger commercial/charter aircraft, and the 150 feet of width provides added safety enhancements for these operations. As such, it is recommended that the existing width of Runway 3-21 be maintained in the future.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA reports the pavement strength for Runway 3-21 at 30,000 pounds single wheel loading (SWL), 95,000 pounds dual wheel loading (DWL), 120,000 pounds dual single wheel loading (2SWL), and 140,000 pounds dual tandem wheel loading (DTWL). This strength rating refers to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.

The strength rating of a runway does not preclude aircraft weighing more than the published strength rating from using the runway. All federally obligated airports must remain open to the public, and it is typically up to the pilot of the aircraft to determine if a runway can support their aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. On the other hand, the airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway, typically for 20 years.

According to the FAA publication, *Airport/Facility Directory*, "Runway strength rating is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights in excess of the published figures." The directory goes

on to say that those aircraft exceeding the pavement strength should contact the airport sponsor for permission to operate at the airport.

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing can increase the strength rating. The current runway strength is adequate to accommodate a large majority of aircraft that currently operate at the airport and are forecast to utilize the airport in the future. The current ALP calls for an ultimate pavement design strength of 150,000 pounds DWL in order to better accommodate larger commercial service and business jet aircraft that are forecast to utilize the airport on a regular basis through the long term planning period. As such, future consideration should be given to increasing the pavement strength on Runway 3-21 to approximately 150,000 pounds DWL.

Runway Blast Pads

A runway blast pad is a surface adjacent to the end of the runway provided to reduce the erosive effect of jet blast and propeller wash. At Flagstaff Airport, each end of Runway 3-21 is provided with a blast pad. The blast pads are currently dimensioned at approximately 200 feet long by 200 feet wide. The blast pads adhere to existing and ultimate runway design standards and should be maintained through the planning period.

TAXIWAYS

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the Airplane Design Group (ADG) of the critical design aircraft. As determined previously, the applicable ADG for Runway 3-21 is currently ADG II. Ultimate planning should conform to ADG III for the runway. **Table 3G** presents the various taxiway design standards related to ADGs II and III.

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards based on usage.

The current taxiway design for Runway 3-21 should be TDG 2. As such, the taxiways on the airfield should be at least 35 feet wide. Ultimate planning accounts for TDG 3. Thus, the taxiways associated with Runway 3-21 should be at least 50 feet to meet this standard.

The current taxiway system is composed of varying taxiway widths. Parallel Taxiway A serving Runway 3-21 is 50 feet wide. Entrance/exit Taxiways A1 through A9 range in width from 70 feet to 107 feet. Taxiway A1 is 70 feet wide, Taxiway A6 is 107 feet wide, and the remaining entrance/exit taxiways are 90 feet wide. While these widths exceed current and projected design needs on the taxiways, they could be maintained unless financial constraints dictate. As such, the width should remain until such time as

rehabilitation is needed and financial resources to support such are not available. FAA grant availability can only be provided if the project meets eligibility thresholds as determined by the FAA.

TABLE 3G
Taxiway Dimensions and Standards
Flagstaff Airport

STANDARDS BASED ON WINGSPAN	*ADG II*	*ADG III*
Taxiway Protection		
Taxiway Safety Area width (feet)	79	118
Taxiway Object Free Area width (feet)	131	186
Taxilane Object Free Area width (feet)	115	162
Taxiway Separation		
Taxiway Centerline to:		
Fixed or Movable Object (feet)	65.5	93
Parallel Taxiway/Taxilane (feet)	105	152
Taxilane Centerline to:		
Fixed or Movable Object (feet)	57.5	81
Parallel Taxilane (feet)	97	140
Wingtip Clearance		
Taxiway Wingtip Clearance (feet)	26	34
Taxilane Wingtip Clearance (feet)	18	23
STANDARDS BASED ON TDG	*TDG 2*	*TDG 3*
Taxiway Width Standard (feet)	35	50
Taxiway Edge Safety Margin (feet)	7.5	10
Taxiway Shoulder Width (feet)	10	20

ADG: Airplane Design Group
TDG: Taxiway Design Group

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

Taxiway W extends west beyond the parallel taxiway system, serving general aviation hangar development. This taxiway is 100 feet wide and is marked to allow for two-way movements by smaller aircraft. The separation between the taxiway centerlines is 70 feet, which adhere to separation criteria for ADG I aircraft. This is appropriate given the mix of smaller general aviation aircraft utilizing this area. Another taxiway connects with Taxiway W and traverses the south side of the hangar development area. This taxiway is 35 feet wide. As such, these current taxiway widths are sufficient to meet existing and planned TDG design criteria for general aviation aircraft serving this area of the airfield.

Taxiway Design Considerations

FAA AC 150/5300-13A, Change 1, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft."

The taxiway system at Flagstaff Airport generally provides for the efficient movement of aircraft; however, AC 150/5300-13A, Change 1, *Airport Design*, provides recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation.

1. **Taxi Method**: Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate "judgmental oversteering," which is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.

2. **Steering Angle**: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.

3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.

4. **Intersection Angles**: Turns should be designed to 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

5. **Runway Incursions**: Taxiways should be designed to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three node" concept.
   - *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
   - *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
   - *Avoid "High Energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
   - *Increase Visibility*: Right-angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage, but should not be used as runway entrance or crossing points. A right-angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
   - *Avoid "Dual Purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
   - *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.

- *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

6. **Runway/Taxiway Intersections**:
   - *Right-Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.

7. **Taxiway/Runway/Apron Incursion Prevention**: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.
   - *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and makes lighting and marking more difficult.
   - *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
   - *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

FAA AC 150/5300-13A, Change 1, *Airport Design*, states that "existing taxiway geometry should be improved whenever feasible, with emphasis on designated "hot spots." To the extent practicable, the removal of existing pavement may be necessary to correct confusing layouts. The FAA has not identified any "hot spots" at the airport.

For the most part, the taxiway system at Flagstaff Airport meets the recommended design and geometry standards set forth by the FAA. There are certain non-standard conditions that include:

- Taxiway A6 connects directly to Taxiway W which extends farther west serving general aviation development areas. This taxiway directly connects these areas to the runway system. In addition, Taxiway A6 could be considered a wide throat taxiway given its width of over 100 feet.
- Taxiways A7 and A8 provide for direct access from the general aviation aircraft parking apron to Runway 3-21.

In the alternatives chapter, potential solutions to these non-standard conditions will be presented. Analysis in the next chapter will also consider improvements which could be implemented on the airfield to minimize runway incursion potential, improve efficiency, and conform to FAA standards for taxiway design. Any future taxiways planned will also take into consideration the taxiway design standards.

Taxilane Design Considerations

Taxilanes are distinguished from taxiways in that they do not provide access to or from the runway system directly. Taxilanes typically provide access to hangar areas. As a result, taxilanes can be planned to varying design standards depending on the type of aircraft utilizing the taxilane. For example, a taxilane leading to a T-hangar area only needs to be designed to accommodate those aircraft typically accessing the T-hangar.

NAVIGATIONAL AND APPROACH AIDS

Navigational aids are devices that provide pilots with guidance and position information when utilizing the runway system. Electronic and visual guidance to arriving aircraft enhance the safety and capacity of the airfield. Such facilities are vital to the success of an airport and provide additional safety to passengers using the air transportation system. While instrument approach aids are especially helpful during poor weather, they are often used by pilots conducting flight training and operating larger aircraft when visibility is good. Flagstaff Airport employs the following navigational and approach aids.

Instrument Approach Aids

Instrument approaches are categorized as either precision or non-precision. Precision instrument approach aids provide an exact course alignment and vertical descent path for an aircraft on final approach to a runway, while non-precision instrument approach aids provide only course alignment information. In the past, most existing precision instrument approaches in the United States have been the ILS; however, with advances in global positioning system (GPS) technology, it can now be used to provide both vertical and lateral navigation for pilots under certain conditions.

Flagstaff Airport currently has straight-in instrument approach capabilities to each end of Runway 3-21. These include the ILS or localizer (LOC) approach to Runway 21, area navigation (RNAV) GPS approaches serving Runways 3 and 21, and a very high omnidirectional range (VOR) approach on Runway 21. The ILS approach provides for the lowest minimums with ½-mile visibility and 255-foot cloud ceilings. It should be noted that these straight-in approaches also provide circling minimums to the opposite runway end.

Runway 21 is served by a MALSR as previously detailed. This approach lighting system enhances safety at the airport, especially during inclement weather or nighttime activity. The MALSR, in conjunction with the localizer antenna and glide slope antenna, provides approach minimums on Runway 21 down to 255-

foot cloud ceilings and ½-mile visibility minimums. It is important to note that a portion of the existing MALSR system is built "in pavement" leading up to the 1,800-foot displaced threshold serving Runway 21. This was accomplished during the runway extension project, which extended the runway 1,800 feet to the north but maintained the Runway 21 landing threshold in its existing location.

Historically, a MALSR can allow for visibility minimums down to ½-mile in the event that proper obstacle clearances and land use compatibility can be obtained beyond the approach end of a runway. Analysis in the next chapter will consider improvements necessary for enhancing instrument approach capabilities to the runway system at Flagstaff Airport. As previously detailed, the airport has recently experienced enhancements to instrument approach capabilities, including the implementation of ½-mile visibility minimums on Runway 21.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Currently, Runway 3-21 is served by a four-box precision approach path indicator (PAPI-4).

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for a more sophisticated approach lighting system. Currently, REILs are not provided on the runway system. A REIL system should ultimately be considered on Runway 3.

Weather Reporting Aids

Flagstaff Airport has two lighted wind cones serving the airfield system. The wind cones provide information to pilots regarding wind speed and direction. Typically, a wind cone is "centralized" on the airfield system and co-located with a segmented circle. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. Historically, a segmented circle was located on the east side of Runway 3-21, approximately 2,000 feet from the Runway 3 landing threshold; however, there is currently no segmented circle on the airfield. In the future, one could be co-located with the wind cone serving the northern half of the runway system.

The airport is equipped with an ASOS which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. This information is then transmitted at regular intervals (usually once per hour) on the airport's automated terminal information service (ATIS). In addition, pilots and individuals can call a published

telephone number and receive the information via an automated voice recording. This system should be maintained through the planning period.

Communication Facilities

Flagstaff Airport has an operational ATCT located on the west side of Runway 3-21. The ATCT is staffed from 6:00 a.m. to 9:00 p.m. daily from April 1 through September 30, and from 7:00 a.m. to 7:00 p.m. from October 1 through March 31. The ATCT enhances safety at the airport and should be maintained through the planning period.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

There are several lighting and pavement marking aids serving pilots using Flagstaff Airport. These aids assist pilots in locating an airport and runway at night or in poor visibility conditions. They also assist in the ground movement of aircraft.

Airport Identification Lighting

The location of the airport at night is universally indicated by a rotating beacon. For civil airports, a rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The existing beacon, located at the east end of Shamrell Boulevard, adjacent to the fixed base operator (FBO) facility, should be maintained through the planning period.

Runway and Taxiway Lighting

Runway lighting provides the pilot with positive identification of the runway and its alignment. Runway 3-21 is served by high intensity runway lighting (HIRL). This system should be maintained through the planning period as it complements the runway's instrument approach capabilities during poor visibility conditions.

Medium intensity taxiway lighting (MITL) is provided on parallel Taxiway A and all associated entrance/exit taxiways serving Runway 3-21. This system is vital for safe and efficient ground movements and should be maintained in the future. Taxiway W, which leads to landside facilities on the west side of the airport, is currently not served with MITL. At a minimum, planning should consider edge reflectors on this taxiway. Future planning should also consider MITL on future taxiways that directly support the runway system at the airport.

Over time, the airport should consider removing the incandescent airfield signage and runway and taxiway edge lighting systems, and replacing them with light emitting diode (LED) technology. LEDs have many advantages, including lower energy consumption, longer lifetime, tougher construction, reduced

size, greater reliability, and faster switching. While a substantial initial investment is required upfront, the energy savings and reduced maintenance costs will outweigh any additional costs in the long run.

Pavement Markings

Runway markings are typically designed to the type of instrument approach available on the runway. FAA AC 150/5340-1K, *Standards for Airport Markings*, provides guidance necessary to design airport markings.

Runway 21 is served by precision markings. This aids in accommodating the ILS approach to the runway end. Runway 3 currently has non-precision markings. All runway markings should be maintained through the long term planning period. In the event that Runway 3 is provided enhanced instrument approach capabilities, precision markings should be considered on this runway end.

Airfield Signs

Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. Lighted signs are installed on the runway and taxiway system on the airfield. The signage system includes runway and taxiway designations, holding positions, routing/directional, distance remaining, and runway exits. All of these signs should be maintained throughout the planning period.

A summary of the airside facilities previously discussed at Flagstaff Airport is presented on **Exhibit 3E**.

LANDSIDE FACILITY REQUIREMENTS

Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each element was examined in relation to projected demand to identify future landside facility needs. At Flagstaff Airport, this includes components for commercial service and general aviation needs such as:

- Passenger Terminal Complex
- General Aviation Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities



	CURRENT	SHORT TERM	LONG TERM
RUNWAY 3-21			
	RDC C-II-2400	RDC C-II-2400 - Improve ROFA	RDC C-III-2400
	8,800' x 150'	Maintain	Maintain
	33,000 lbs. SWL / 95,000 lbs. DWL / 120 lbs. 2SWL / 140,000 lbs. DTWL	Maintain	Strengthen to 150,000 lbs. DWL
	Portions of RSA, ROFA, and ROFZ controlled by avigation easement	Consider acquisition of all property encompassed by RSA, ROFA, and ROFZ	Maintain
TAXIWAYS			
	All taxiways 50' - 107' wide	Re-evaluate width during future rehabilitation projects (Minimum 50' wide)	Re-evaluate width during future rehabilitation projects (Minimum 50' wide)
	Runway/Parallel Taxiway Separation - 400'	Maintain	Maintain
	Hold apron serving Runway 21	Examine hold apron serving Runway 3	Maintain
	Non-standard conditions associated with Taxiways A6, A7, and A8	Examine taxiway system for safety, efficiency, and proper geometry	Examine taxiway system for safety, efficiency, and proper geometry
NAVIGATIONAL AND APPROACH AIDS			
	ILS or LOC - Runway 21	Maintain	Maintain
	RNAV (GPS) - Runway 3 and Runway 21	Maintain	Maintain
	VOR - Runway 21	Maintain	Maintain
	ASOS	Maintain	Maintain
	ATCT	Maintain	Maintain
	Lighted Windcones	Maintain	Maintain
	PAPI-4 - Runway 3 and 21	Maintain	Maintain
	MALSR - Runway 21	Maintain	Maintain
		REILs - Runway 3	Maintain
		Co-locate Segmented Circle with Windcone	Maintain
LIGHTING, MARKING, AND SIGNAGE			
	Rotating Beacon	Maintain	Maintain
	Precision Markings - Rwy 21	Maintain	Maintain
	Non-Precision Markings - Runway 3	Maintain	Maintain
	HIRL - Runway 3-21	Consider gradual replacement with LED technology	Maintain
	MITL on Parallel and Entrance/Exit Taxiways	Consider gradual replacement with LED technology	Maintain
	Hold lines 250' from runway centerline	Maintain	Hold lines 321' from runway centerline
	Lighted Airfield Signs	Consider gradual replacement with LED technology	Maintain

ABBREVIATIONS

RDC - Runway Design Code
RSA - Runway Safety Area
ROFA - Runway Object Free Area
ROFZ - Runway Obstacle Free Zone
SWL - Single Wheel Loading
DWL - Dual Wheel Loading
2SWL - Dual Single Wheel Loading
DTWL- Dual Tandem Wheel Lo
ILS - Instrument Landing System
LOC - Localizer
RNAV - Area Navigation
GPS - Global Positioning System
VOR - Very High Frequency Omnidirectional Range
ASOS - Automated Surface Observing System
PAPI - Precision Approach Path Indicator
REIL - Runway End Identification Light
ATCT - Airport Traffic Control Tower
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
HIRL - High Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
LED - Light Emitting Diode

PASSENGER TERMINAL COMPLEX

Components of the passenger terminal complex include the terminal building, gate positions, and apron area. This section identifies the facilities required to meet the airport's needs through the planning period.

The review of the capacity and requirements for various terminal complex functional areas was performed with guidance from FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*. It should be noted that an updated version of this AC (AC 150/5360-13A, *Airport Terminal Planning and Design*), although still in draft format, was also consulted during this analysis. Facility requirements were updated to reflect the short, intermediate, and long term planning horizons for enplanement milestones. This included the levels of 80,000, 95,000, and 125,000 annual enplaned passengers. As detailed in Chapter Two, a high range passenger enplanement envelope was also considered that could realize the potential for 155,000 annual enplaned passengers through the long term planning period. The analysis to follow provides the passenger terminal requirements that would be associated with this high range enplanement forecast.

Airline terminal capacity and requirements were developed for the following functional areas:

- Airline Ticketing and Operations
- Security Screening
- Departure Facilities
- Baggage Claim
- Terminal Services
- Public Waiting and Circulation
- Building Support/Administration

Ticketing and Airline Operations

The first destination for enplaning passengers in the terminal building is usually the airline ticket counter. The ticketing area consists of the ticket counters, queuing area for passengers in line at the counters, and the ticket lobby which provides circulation.

The ticket lobby should be arranged so that the enplaning passenger has immediate access and clear visibility to the individual airline ticket counters upon entering the building. Circulation patterns should allow the option of bypassing the counters with minimum interference. Provisions for seating should be minimal to avoid congestion and to encourage passengers to proceed to the gate area. Airline ticket counter frontage, counter area, counter queuing area, ticketing lobby, and airline office and operations area requirements for each potential enplanement level have been calculated. The analysis of the airline ticketing spaces indicates that the existing space should be adequate both now and in the future in order to accommodate these types of activities, as shown on **Exhibit 3F**. In order to meet the high range enplanement forecast as previously discussed, certain components of the ticketing and airline operations area would likely need to be expanded, mainly in the form of ticket queueing and counter areas.



	Available	Short Term	Intermediate Term	Long Term	High Range Forecast
Annual Enplanement Horizon					
	67,421	80,000	95,000	125,000	155,000
Airline Operations/Ticketing					
Counter Area (s.f.)	320	260	330	400	530
Ticket Queue (s.f.)	930	410	510	700	840
Airline Operations/Makeup (s.f.)	3,570	2,200	2,500	2,800	3,010
Subtotal (s.f.)	**4,820**	**2,870**	**3,340**	**3,900**	**4,380**
Counter Frontage (l.f.)	62	32	40	48	56
Security Spaces					
Checkpoint/Queue Area (s.f.)	350	520	1,040	1,200	1,350
Office Space (s.f.)	320	700	1,400	1,400	1,400
Subtotal (s.f.)	**670**	**1,220**	**2,440**	**2,600**	**2,750**
Departure Facilities					
Holdroom Area (s.f.)	**4,300**	**2,100**	**2,500**	**3,700**	**4,100**
Baggage Claim					
Makeup and Handling (s.f.)	200	400	640	800	920
Inbound Baggage (s.f.)[1]	--	800	1,000	1,400	1,700
Claim Lobby/Circulation Area (s.f.)	1,630	2,430	3,620	4,500	5,000
Subtotal (s.f.)	**1,830**	**3,630**	**5,260**	**6,700**	**7,620**
Rental Car Counters					
Counter Office Area (s.f.)	1,500	700	840	1,000	1,100
Counter Queue Area (s.f.)	380	250	300	360	410
Subtotal (s.f.)	**1,880**	**950**	**1,140**	**1,360**	**1,510**
Food/Beverage and Other Concessions					
Total Concessions (s.f.)	**2,700**	**1,630**	**1,940**	**2,560**	**3,170**
Public Waiting/Circulation					
Circulation/Lobby Area (s.f.)	**1,200**	**2,500**	**3,000**	**3,800**	**4,500**
Restrooms					
Men's/Women's Restrooms (s.f.)	**850**	**600**	**750**	**900**	**960**
Administration Offices					
Administration Space (s.f.)	**890**	**800**	**1,000**	**1,200**	**1,300**
Internal Facilities					
Circulation/Building Support (s.f.)	**5,000**	**3,900**	**5,080**	**6,420**	**6,740**
Total Terminal Building Space (s.f.)	**24,140**	**20,200**	**26,450**	**33,140**	**37,030**

[1] Exterior Space









Security Screening

Security screening requirements are subject to Transportation Security Administration (TSA) regulations and the level of security may be changed by TSA security directive if unusual levels of threat are perceived. The screening checkpoints are a regulated requirement and must be designed to meet the TSA mandates for operational space and equipment support as specified in TSA's *Security Checkpoint Design Guide,* February 2006.

Current security screening is positioned adjacent to the entrance to the departure passenger hold room in the terminal building. The space available in the existing security areas, however, is not fully sufficient to efficiently process passengers both currently as well as into the long term horizon milestone. Obviously, this analysis reflects the possibility of overlapping departures, which would generate a high traffic volume in a short period of time. If future operations are spaced out to where there are not simultaneous departures, the current space would still be undersized but more manageable.

Departure Gates and Hold Rooms

Ground level loading and unloading of passengers is appropriate for Flagstaff Airport as regional jet aircraft are forecast to be the primary commercial service aircraft type serving the airport. Currently, there are three departure gates in the terminal building. This should be adequate to accommodate future demand projections.

The number of gates required to accommodate the combined peak hour activity and the aircraft seating capacities determine secure passenger hold room capacity requirements. Hold rooms should be sized to provide adequate space and area for the largest group of people that can use each gate. As previously discussed, the passenger hold room was expanded previously to its current size of approximately 4,300 square feet. Analysis indicates that the existing hold room space is adequate to serve current and projected demand.

The aircraft parking apron adjacent to the terminal is designed to accommodate three commercial service aircraft comfortably. This space should be adequate to accommodate aircraft larger than the CRJ-700 that is currently utilizing the commercial apron; however, the alternatives phase of the Master Plan will further evaluate this aircraft parking apron to best meet the demand and efficiency of future commercial service activities.

Baggage Claim

The passenger arrival process consists primarily of those facilities and functions that reunite the arriving passengers with their checked baggage. The baggage claim facility needs for each planning horizon are included on **Exhibit 3F**. The existing baggage claim area is limited and forecasts call for an increase in the size of the current baggage claim handling and lobby/pick-up area through the long term. This projection is based on serving two flights at the same time. It is also important to note that a portion of the

proposed baggage area need comes in the form of inbound baggage area, which could be provided in an exterior area of the terminal facility.

Terminal Services

Similar to airline ticketing, rental car counter facilities include office, counter area, and queue areas. There are multiple counters for rental car services. Approximately 1,800 square feet of rental car area is available. The current space should be capable of accommodating long term, and even the high range, passenger enplanement levels.

As shown on **Exhibit 3F**, there is approximately 2,700 square feet dedicated to food/beverages and other concession services in the terminal building. This space appears adequate through the long term planning period. In the event that the high range forecast levels are attained, additional space for food/beverages and other concessions should be planned that could accommodate an increase in passenger enplanements as well as the general public. Existing public restroom space should be adequate currently, but thought could be given to providing additional space for the general public by the long term planning horizon.

Public Waiting and Greeting Lobby/Circulation

The public lobby and circulation areas are where passengers or visitors may comfortably relax while waiting for arrivals or departures. The greeting lobby area is typically immediately outside security stations. In today's post-9/11 environment, visitors must remain outside of the secure departure areas, so a public lobby is important. There is no defined public lobby area currently inside the terminal building. For purposes of this analysis, areas in proximity to the arrival gate were allocated to existing public lobby and waiting area. Future planning should consider the addition of dedicated public waiting area and circulation in order to provide more efficiency within the terminal facility.

Building Support and Administration

Building support facilities include all miscellaneous spaces at the airport, including mechanical, telephone, business centers, walls/structures, and general circulation. Heating, ventilating, and air conditioning (HVAC) mechanical spaces are provided, but may be undersized to meet demands on the facility. As enplanement levels increase, stresses could be placed on the building, necessitating expansion of HVAC facilities. As other components of the airport increase in size, so will supporting spaces.

The administrative offices are located on the second level of the terminal building and separate from the passenger service areas. These offices include space for airport management and operations personnel. The administrative office space on the second floor of the terminal building appears adequate through the intermediate term planning horizon; however, each airport may have additional needs depending on the management structure at the airport.

Terminal Building Requirements Summary

The existing commercial passenger terminal building is approximately 24,140 square feet in area. Overall, this space is generally adequate to meet the short term passenger enplanement requirements. As presented in **Exhibit 3F**, by the long term planning horizon, a building approximately 33,140 square feet in size could be needed. The functional areas with the greatest need are the baggage claim area, security spaces, and public waiting and circulation.

There is sufficient space to allow the terminal to accommodate the initial change to 70-seat aircraft that has recently occurred at the airport. If passenger enplanements grow as forecast, the terminal would need approximately 10,000 square feet of additional space to accommodate different functional areas as previously outlined. A separate scenario that considers a high range passenger enplanement forecast was also presented for planning purposes. Such a forecast could yield a need for over 50 percent more space than what is currently being offered by the long term planning period. Analysis to be presented in the next chapter of this study will address possible solutions to potential terminal building deficiencies both now and in the future.

Terminal Access Roadway

The capacity of the airport access and terminal area roadways is the maximum number of vehicles that can pass over a given section of a lane or roadway during a given time period. It is normally preferred that a roadway operates below capacity to provide reasonable flow and minimize delay to the vehicles using it. As previously detailed, access to the terminal building is provided by South Pulliam Drive, which makes a loop road leading to the terminal building curb.

Terminal Curb Frontage and Vehicle Parking

The curb element is the interface between the terminal building and the ground transportation system. The length of curb required for the loading and unloading of passengers and baggage is determined by the type and volume of ground vehicles anticipated in the peak period on the design day.

A typical problem for terminal curb capacity is the length of dwell time for vehicles utilizing the curb. At airports where the curb front has not been strictly patrolled, vehicles have been known to be parked at the curb while the driver and/or riders are inside the terminal checking in, greeting arriving passengers, or awaiting baggage pick-up. Since most curbs are not designed for vehicles to remain curbside for more than two to three minutes, capacity problems can ensue. Since the events of September 11, 2001, most airports police the curb front much more strictly for security reasons. This alone has reduced the curb front capacity problems at most airports.

At Flagstaff Airport, the terminal roadway provides one lane for loading and unloading of passengers. The curb frontage totals approximately 300 feet in length, connected to the entrance road in a loop configuration, and is used by both enplaning and deplaning passengers. As presented in **Table 3H**, curb

lengths should be increased during the long term planning period to better accommodate projected passenger demand.

TABLE 3H
Commercial Terminal Vehicle Requirements
Flagstaff Airport

	Existing	Short Term	Intermediate Term	Long Term	High Range
Terminal Curb					
Enplane Curb (ft)	--	105	131	158	173
Deplane Curb (ft)	--	120	150	180	198
Total Curb (ft)	300	225	281	338	371
Auto Parking					
Total Public Parking	396	391	449	578	698
Rental Car Parking	56	96	114	150	186
Employee Parking	--	48	52	63	78
Total All Parking	**452**	**535**	**615**	**791**	**962**

Vehicle parking in the airline passenger terminal area of the airport includes those spaces utilized by passengers, visitors, and employees of the airline terminal facilities. Parking spaces are classified as public, rental car, and employee.

Public parking is located in surface lots adjacent to the north side of the terminal building. This parking area currently contains approximately 396 marked spaces. It should be noted that the public parking spaces can be utilized by employees serving different functions within the passenger terminal building. This even further constrains the existing vehicle parking needs at the airport. Future consideration will be given to providing additional vehicle parking areas to support the passenger terminal area.

To the northeast of the terminal building, a designated rental car lot contains 56 parking spaces. Rental car parking needs depend upon the operational requirements of the rental car agencies. If available, the rental car companies will utilize extra spaces for storage. Analysis indicates that additional rental car parking spaces are needed through the planning period. As a result, this study will also consider rental car parking needs in the alternatives analysis.

It should be noted that as part of this study process, an informal resident travel survey was conducted to gauge the modes of transportation being utilized to and from the airport terminal building. From the responses obtained, over 60 percent of passengers are utilizing the vehicle parking lot adjacent to the terminal building. The findings of this informal survey will be further considered in assessing vehicle parking requirements during the alternatives phase of the Master Plan.

GENERAL AVIATION TERMINAL FACILITIES

The general aviation facilities at the airport are often the first impression of the community that corporate officials and other visitors will encounter. General aviation terminal facilities at an airport provide

space for passenger waiting, pilots' lounge, pilot flight planning, concessions, management, storage, and various other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by FBOs and other specialty operators for these functions and services. At Flagstaff Airport, general aviation terminal services are provided by Wiseman Aviation, the local FBO.

The methodology used in estimating general aviation terminal facility needs was based upon the number of airport users expected to utilize general aviation facilities during the design hour. Space requirements for terminal facilities were based on providing 125 square feet per design hour itinerant passenger. A multiplier of 2.4 in the short term, increasing to 2.6 in the long term, was also applied to terminal facility needs in order to better determine the number of passengers associated with each itinerant aircraft operation. This increasing multiplier indicates an expected increase in business and recreational operations through the long term. These operations often support larger turboprop and jet aircraft which accommodate an increasing passenger load factor.

Table 3J outlines the space requirements for general aviation terminal services at Flagstaff Airport through the long term planning period. As shown in the table, up to 7,000 square feet of space could be needed in the long term for general aviation passengers. The amount of space currently offered by the FBO on the airfield is approximately 2,500 square feet. These spaces include designated areas for a passenger waiting lobby, flight planning, pilots' lounge, restroom facilities, and other amenities.

TABLE 3J
General Aviation Terminal Area Facilities
Flagstaff Airport

	Currently Available	Short Term Need	Intermediate Term	Long Term Need
General Aviation Services Facility Area (s.f.)	2,500*	5,400	6,000	7,000
Design Hour Passengers	43	48	52	61
Passenger Multiplier	2.3	2.4	2.5	2.6
Vehicle Parking Spaces	90**	112	124	150

*Includes approximate space offered by Wiseman Aviation
**Approximate number of marked vehicle parking spaces at the airport that accommodate general aviation and "other" air taxi activities

Source: Coffman Associates analysis

General aviation vehicular parking demands have also been determined for Flagstaff Airport. Space determinations for itinerant passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs.

The parking requirements of based aircraft owners should also be considered. Although some owners prefer to park their vehicles in their hangar, safety can be compromised when automobile and aircraft movements are intermixed. For this reason, separate parking requirements, which consider one-half of based aircraft at the airport, were applied to general aviation automobile parking space requirements. Utilizing this methodology, parking requirements for general aviation activity call for approximately 112 spaces in the short term, increasing to approximately 150 spaces in the long term planning horizon. It is estimated that there are 90 marked vehicle parking spaces at Flagstaff Airport currently serving various

airport activities, including the FBO and other general aviation functions. As previously detailed, future consideration in the Master Plan will be given to providing more vehicle parking in order to provide adequate space for commercial passenger service and general aviation activities.

AIRCRAFT HANGARS

The demand for aircraft hangars typically depends on local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and, consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tiedowns.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at an airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, hangar development should be based upon actual demand trends and financial investment conditions.

While the majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft will still use outdoor tiedown spaces (due to lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. At Flagstaff Airport, it is estimated that approximately eight percent of aircraft are currently based on aircraft parking aprons, with the remainder housed in hangar spaces.

Hangar types vary in size and function. T-hangars and shade hangars are popular with aircraft owners having only one small aircraft. These hangars provide individual spaces within a larger structure. There is an estimated 95,000 square feet of storage space at the airport comprised of T-hangars and shade hangars. For determining future aircraft storage needs, a planning standard of 1,000 square feet per aircraft is utilized.

Executive box hangars are open-space facilities with no interior supporting structure. These hangars can vary in size and typically house multi-engine, turboprop, or jet aircraft, in addition to helicopters. Executive box hangar space at Flagstaff Airport is estimated at 67,500 square feet. For future planning, a standard of 1,500 square feet per single engine aircraft is utilized for executive box hangars space and 2,500 square feet per multi-engine, turboprop, helicopter, and jet aircraft is utilized for executive box hangars.

Conventional hangars are open space facilities with no supporting structure interference that can store several aircraft. Often, other airport services are offered from the conventional hangars, such as FBO activities. For this analysis, conventional hangars are determined to be any open hangar that offers at least 10,000 square feet of space. As such, there are currently no conventional hangars at Flagstaff Airport. For future planning needs, 1,500 square feet per single engine aircraft is utilized for conventional hangars. For multi-engine, turboprop, helicopter, and jet aircraft, 2,500 square feet is utilized.

In total, there is approximately 162,500 square feet of hangar, maintenance, and office space provided on the airport for general aviation activities. Future hangar requirements for the airport are summarized in **Table 3K**. While some based aircraft will continue to utilize aircraft parking apron space instead of hangar facilities, the overall percentage of aircraft seeking hangar space is projected to increase during the long term planning period. Since portions of the hangars are known to be used for aircraft maintenance servicing, requirements for maintenance/service hangar area was estimated using a planning standard of 150 square feet per based aircraft.

TABLE 3K
Aircraft Hangar Requirements
Flagstaff Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Total Based Aircraft	139	146	156	176
Aircraft to be Hangared	128	134	145	167
Hangar Area Requirements				
T-Hangar/Shade Hangar Area (s.f.)	95,000	96,000	101,300	111,800
Executive Box Hangar Area (s.f.)	67,500	72,000	77,500	89,000
Conventional Hangar Area (s.f.)	--	7,500	16,000	30,500
Maintenance Area (s.f.)	--	21,900	23,400	26,400
Total Hangar Area (s.f.)	**162,500***	**197,400**	**218,200**	**257,700**

Note: *Includes total hangar and maintenance area currently at the airport
Source: Coffman Associates analysis

The analysis shows that future hangar requirements indicate that there is a potential need for over 250,000 square feet of hangar storage space to be offered through the long term planning period. This includes a mixture of hangar and maintenance areas. Due to the projected increase in based aircraft, annual general aviation operations, and hangar storage needs, facility planning will consider additional hangars at the airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types, to include the potential construction of larger conventional-style hangars that are better suited to accommodate larger turboprop and jet aircraft.

It should be noted that hangar requirements are general in nature and based on the aviation demand forecasts. The actual need for hangar space will further depend on the actual usage within hangars. For example, some hangars may be utilized entirely for non-aircraft storage, such as maintenance; yet from a planning standpoint, they have an aircraft storage capacity. Therefore, the needs of an individual user may differ from the calculated space necessary.

AIRCRAFT PARKING APRONS

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as the terminal building or FBO facilities. Ideally, the main apron is large enough to accommodate transient airport users, as well as a

portion of locally based aircraft. Often, smaller aprons are available adjacent to FBO hangars and at other locations around the airport. The apron layout at Flagstaff Airport includes parking apron space adjacent to the FBO facility, as well as additional apron space for the parking and circulation of aircraft in areas farther north and west. The parking apron located immediately adjacent to the passenger terminal building is utilized for commercial service aircraft operations and was not factored into this analysis.

The total aircraft parking apron area dedicated for general aviation activities at Flagstaff Airport is approximately 55,200 square yards. A planning criterion of 800 square yards was used for single and multi-engine itinerant aircraft, while a planning criterion of 1,600 square yards was used to determine the area for transient turboprop and jet aircraft.

A parking apron should also provide space for the number of locally based aircraft that are not stored in hangars. Locally based tiedowns typically will be utilized by smaller single engine aircraft; thus, a planning standard of 360 square yards per position is utilized. For local tiedown needs, an additional five spaces are identified for maintenance activities. Maintenance activities would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the apron.

The total apron parking requirements are presented in **Table 3L**. Currently, there are approximately 66 marked positions available for based and itinerant aircraft at Flagstaff Airport. A large majority of these positions are for small single and multi-engine aircraft. As shown in the table, it appears that there are adequate marked tiedown positions and apron space available through the planning period of this study. It should be noted that the airport does experience higher volumes of traffic, especially during the summer months. As a result, future facility planning will consider the potential for re-designating certain portions of parking apron space to accommodate the mix of aviation activity that occurs at the airport.

TABLE 3L
Aircraft Parking Apron Requirements
Flagstaff Airport

	Available	Short Term	Intermediate Term	Long Term
Transient Single and Multi-Engine Aircraft Positions		14	17	20
Apron Area (s.y.)		11,200	13,400	15,600
Transient Turboprop and Jet Positions		10	14	20
Apron Area (s.y.)		16,000	22,400	32,000
Locally-Based Aircraft Positions		17	16	14
Apron Area (s.y.)		6,100	5,800	5,000
Total Marked Positions	66	41	47	54
Total Apron Area (s.y.)	55,200	33,300	41,600	52,600

Source: Coffman Associates analysis

In addition to fixed-wing aircraft parking, areas should also be dedicated for helicopter parking. Helicopters also operate on various apron areas shared by fixed-wing aircraft at Flagstaff Airport. In addition, there are two marked helicopter parking areas on the south side of the main general aviation parking

apron. Helicopter operations should be segregated to the extent practicable to increase safety and efficiency of aircraft parking aprons. Long term facility planning will continue to consider dedicated helicopter activity areas at the airport.

A summary of the general aviation landside facilities previously discussed at Flagstaff Airport is presented on **Exhibit 3G**.

AIRPORT SUPPORT FACILITIES

Various other landside facilities that play a supporting role in overall airport operations have also been identified. These support facilities include:

- Aircraft Rescue and Firefighting (ARFF)
- Aviation Fuel Storage
- Perimeter Fencing and Gates

Aircraft Rescue and Firefighting

Requirements for aircraft rescue and firefighting (ARFF) services at an airport are established under Title 14 CFR Part 139, which applies to the certification and operation of airports served by any scheduled or unscheduled passenger operation of an air carrier using an aircraft with nine or more passenger seats. Paragraph 139.315 establishes ARFF Index ratings based on the length of the largest aircraft with an average of five or more daily departures.

The following indicates the requirements for each ARFF Index and the associated equipment requirements:

Index A - Includes aircraft less than 90 feet in length (Saab 340, Embraer ERJ-135).

Index B - Includes aircraft at least 90 feet but less than 126 feet in length (Embraer ERJ-145, Bombardier CRJ-700, Boeing 737).

Index C - Includes aircraft at least 126 feet but less than 159 feet in length (MD-83, Boeing 757).

Index D - Includes aircraft at least 159 feet but less than 200 feet in length (Boeing 767).

Index E - Includes aircraft at least 200 feet in length (Boeing 747).

The Flagstaff Airport ARFF facility must currently provide Index A for airline service according to the Airport Certification Manual. Based upon future commercial service forecasts, Index B should be applicable through the long term planning period as the airport is expected to accommodate daily departures with aircraft between 90 feet and 126 feet in length. **Table 3M** presents the vehicle requirements and



	Available	Short Term	Intermediate Term	Long Term
				
GENERAL AVIATION TERMINAL SERVICES				
General Aviation Services Facility Area (s.f.)	2,500[1]	5,400	6,000	7,000
Vehicle Parking Spaces	90[2]	112	124	150
 				
AIRCRAFT STORAGE HANGAR REQUIREMENTS				
Total Based Aircraft	139	146	156	176
Aircraft to be Hangared	128	134	145	167
T-Hangar/Linear Box Hangar/Shade Hangar (s.f.)	95,000	96,000	101,300	111,800
Executive Hangar (s.f.)	67,500	72,000	77,500	89,000
Conventional Hangar (s.f.)	--	7,500	16,000	30,500
Maintenance Area (s.f.)	--	21,900	23,400	26,400
Total Hangar Area (s.f.)	162,500[3]	197,400	218,200	257,700
				
AIRCRAFT PARKING APRON REQUIREMENTS				
Transient Single and Multi-Engine Aircraft Positions	--	14	17	20
Apron Area (s.y.)	--	11,200	13,400	15,600
Transient Turboprop and Jet Aircraft Positions	--	10	14	20
Apron Area (s.y.)	--	16,000	22,400	32,000
Locally-Based Aircraft Positions	--	17	16	14
Apron Area (s.y.)	--	6,100	5,800	5,000
Total Marked Positions	66	41	47	54
Total Apron Area (s.y.)	55,200	33,300	41,600	52,600
 				
SUPPORT FACILITIES				
Fuel Storage - 100LL	13,000 gal.	Based on Fixed Base Operator		
Fuel Storage - Jet A	17,500 gal.	Aircraft Demand		
	ARFF - Index A	ARFF - Index B	ARFF - Index B	ARFF - Index B
	Security Fencing/Gates	Maintain	Maintain	Maintain

[1]Includes approximate space offered by FBO

[2]Approximate number of marked vehicle parking spaces at the airport that accommodate general aviation and "other" air taxi activities

[3]Includes estimated hangar, maintenance, and office space at Flagstaff Airport

capacities for each index level. The existing ARFF facility, in conjunction with the airport operations center, is located approximately 700 feet northeast of the terminal building. This location provides desirable access to the airfield system.

TABLE 3M
ARFF Index Requirements

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

AFFF: Aqueous Film-Forming Foam
ARFF: Aircraft Rescue and Firefighting

Source: Title 14 Code of Federal Regulations Part 139

Aviation Fuel Storage

As previously discussed in Chapter One, there are currently four fuel farms located on airport property that store aviation fuel. Three of these fuel farms are owned and operated by private airport businesses and utilized for the sole purpose of providing fuel to the company's aircraft or helicopter operations, and are not associated with the re-sale of fuel for commercial aviation activities. Fuel trucks operated by the FBO on the airfield are also capable of handling additional fuel storage.

As presented in **Table 3N**, there is 30,500 gallons of fuel storage capacity on airport property utilized for the re-sale of fuel for commercial aviation activities. Approximately 57 percent of the storage capacity is dedicated to Jet A fuel.

Fuel storage requirements are typically based upon keeping a two-week supply of fuel during an average month; however, more frequent deliveries can reduce the fuel storage capacity requirements. Generally, fuel tanks should be of adequate capacity to accept a full refueling tanker, which is approximately 8,000 gallons, while maintaining a reasonable level of fuel in the storage tank. Future fueling demand experienced by the FBOs on airport property will determine the need for additional fuel storage capacity.

It is important that airport personnel work with the FBOs to plan for adequate levels of fuel storage capacity through the long term planning period of this study.

TABLE 3N
On-Airport Fuel Storage Capacity for Commercial Re-Sale
Flagstaff Airport

	Tank Storage Capacity (gallons)	Truck Storage Capacity (gallons)	Total Storage Capacity (gallons)
100LL	12,000	1,000	13,000
Jet A	12,000	5,500	17,500

Source: Airport records

Perimeter Fencing and Gates

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

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

Flagstaff Airport's perimeter is enclosed with nine-foot tall chain-link fence topped by three-strand barbed-wire. Several controlled-access and manual gates associated with the fencing lead to different areas on the airfield.

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at Flagstaff Airport for the next 20 years. In an effort to provide a more flexible Master Plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year timeframe, the intermediate term is approximately ten years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

In Chapter Four, potential improvements to the airside and landside systems will be examined through a series of airport development alternatives. Most of the alternatives discussion will focus on those capital improvements that would be eligible for federal and state grant funds. Other projects of local concern will also be presented. Ultimately, an overall airport development plan that presents a vision beyond the 20-year scope of this Master Plan will be developed.

FLAGSTAFF AIRPORT

CHAPTER FOUR

Airport Alternatives







FLAGSTAFF AIRPORT

Chapter Four
AIRPORT ALTERNATIVES







In the previous chapter, airport facilities required to satisfy the demand through the long range planning period were identified. The next step in the planning process is to evaluate reasonable ways these facilities can be provided. The purpose of this chapter is to formulate and examine rational airport development alternatives that can address the short, intermediate, and long term planning horizon levels. Because there are a multitude of possibilities and combinations, it is necessary to focus on those opportunities which have the greatest potential for success. Each alternative provides a differing approach to meet existing and future facility needs, and these layouts are presented for purposes of evaluation.

Some airports become constrained due to limited space availability, while others may become constrained due to adjacent land use development. Careful consideration should be given to the layout of future facilities and impacts they could have on potential airfield improvements at Flagstaff Airport, especially those related to the runway and taxiway system. Proper planning at this time can ensure the long term viability of the airport for both aviation and economic growth.

The primary goal of this planning process is to develop a viable plan for meeting the needs resulting from the projected market demand over the next 20 years. The plan of action should be developed in a manner that is consistent with the future goals and objectives of the City of Flagstaff, airport users, and citizens of Flagstaff, who have a vested interest in the development and operation of the Flagstaff Airport.

The ultimate goal is to develop the underlying rationale which supports the final recommended development concept. Through this process, an evaluation of the highest and best uses of airport property will be made while also weighing local development goals, physical and environmental constraints, and appropriate airport design standards.

The development alternatives for Flagstaff Airport can be categorized into two functional areas as previously outlined: **airside** (runways, taxiways, navigational aids, etc.) and **landside** (hangars, parking aprons, terminal area, and vehicle parking, etc.). Within each of these areas, specific capabilities and facilities are required or desired. In addition, the utilization of airport property to provide revenue support for the Airport, and to benefit the economic well-being of the community and surrounding region, must be considered.

Each functional area interrelates and affects the development potential of the other. Therefore, all relevant airside and landside areas are examined individually and then combined to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these functional areas on the existing airport must be evaluated to determine if investment in the airport will meet the needs of the community, both during and beyond the 20-year planning period.

The alternatives presented in this chapter are developed to meet projected aviation demand and comply with Federal Aviation Administration (FAA) design standards to the greatest extent practicable. While capital outlays necessary to implement a plan are important, the alternative analysis completed here will not limit or judge reasonable development plans based on projected costs. The investment necessary for each alternative is not considered at this point to ensure that the final plan first meets the needs of the airport and its users. The approach is intended to ensure that the best plan is put forth, not the lowest cost plan. Only where a project cost would be extraordinarily high is it considered as a limiting factor. Once a final plan is developed, cost estimates will be developed for each individual project considered during the next 20 years.

The Planning Advisory Committee (PAC), City of Flagstaff, and the general public will be asked to review these alternatives and to provide suggestions and comments. Following that review, a recommended concept will be developed. In most cases, the recommended concept will include the most appropriate elements from each applicable alternative.

NON-DEVELOPMENT ALTERNATIVES

Prior to presenting development alternatives for Flagstaff Airport, non-development alternatives were considered. Non-development alternatives include the “no-build” or “no-action” alternative, or the transfer of services to another existing airport or development of a new airport.

Flagstaff Airport plays a critical role in the economic development of the City of Flagstaff and the surrounding region, as well as an important role in the continuity of the national aviation network. There is significant public and private investment at the airport. The pursuit of a non-development alternative would slowly devalue these investments and lead to infrastructure deterioration and potentially the loss

of significant levels of federal and state funding for airport improvements. If facilities are not maintained and improved so that the airport provides a pleasant experience for the visitor or business traveler, or if delays become unacceptable, then these individuals may consider doing business elsewhere. Ultimately, the safety of aircraft, pilots, and persons on the ground could be jeopardized. Furthermore, non-development alternatives are inconsistent with the long term goals of the FAA and the Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group), which are to enhance local and interstate commerce. Therefore, the "no-build" or "no-action" alternative will not be considered further.

The alternative of shifting aviation services to another existing airport or development of a new airport site was also found to be an undesirable alternative. The development of a new airport is a very complex and expensive alternative. A new site will require substantial land area, duplication of investment in airport facilities, installation of supporting infrastructure that is already available, and significant environmental impacts. Furthermore, the City of Flagstaff, FAA, and ADOT-MPD – Aeronautics Group have all contributed to significant improvements at the airport in recent years. The continuing growth expected in the area demonstrates the need for a highly functional and convenient airport. Based upon the aviation demand forecasts developed in Chapter Two, it has been determined that the airport is capable of accommodating projected future demand in its current location. As a result, the transfer of aviation services is not a viable option for Flagstaff Airport.

AIRPORT DEVELOPMENT OBJECTIVES

It is the goal of this effort to produce a safe and efficient airfield as well as landside facilities, which includes appropriate commercial terminal space, aircraft storage mix, and aviation businesses to best serve forecast aviation demands. However, before defining and evaluating alternatives, specific airport development objectives will be considered. As owner and operator, the City of Flagstaff provides the overall guidance for the operation and development of the airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of the community and its users. With this in mind, the following development objectives have been defined for this planning effort:

- Conform to FAA and ADOT-MPD – Aeronautics Group design and safety standards, wherever practical, for the mix of aircraft that could potentially use the airport during the 20-year planning period.
- Preserve and protect public and private investments in existing airport facilities.
- Develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- Provide sufficient airport capacity which will meet the long term planning horizon demand levels (commercial airlines, general aviation, support facilities).
- Reflect and support the long term planning efforts currently applicable to the region.
- Identify any future land acquisition needs.
- Develop a facility with a focus on self-sufficiency in both operational and development cost recovery.
- Ensure that future development is environmentally compatible.

- Consider the initiatives set forth in the *Flagstaff Airport Sustainability Plan* and implement them when appropriate.

REVIEW OF PREVIOUS AIRPORT PLANS

The previous Master Plan for Flagstaff Airport was completed in 2007. As a part of this planning effort, the Airport Layout Plan (ALP) was also updated and approved by the FAA in 2008.

The Airport Layout Drawing and associated Airport Data Sheet are shown on **Exhibit 4A**. The Airport Data Sheet, detailed on the front of the exhibit, provides information on existing and ultimate conditions at Flagstaff Airport, including:

- Airport data related to airport category, Airport Reference Code (ARC), elevation, wind conditions, temperature, and navigational aids located at Flagstaff Airport.
- Runway data related to the critical design aircraft, safety areas, markings, lighting, and visual and navigational aids associated with the runway and taxiway system.

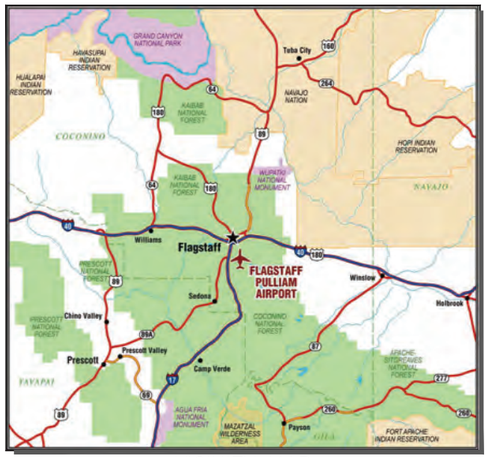
On the back of the exhibit, the Airport Layout Drawing graphically depicts information contained on the Airport Data Sheet and further outlines airside and landside recommendations based upon previous airport planning that include:

- Meeting ultimate ARC C-III design standards for Runway 3-21.
- Construct an ultimate parallel runway adjacent to the east side of the existing runway.
- Implement a medium intensity approach lighting system with runway alignment indicator lights (MALSR) on Runway 3.
- Enhanced visual approach aids in the form of precision approach path indicators (PAPIs) serving Runway 3.
- Expansion of the existing terminal area to include additional passenger terminal building space and associated vehicle parking.
- Additional landside development in the form of hangars, aircraft parking, and support facilities.
- Ultimate parcel layout in various areas on airport property that could support future development.

The assumptions made and conclusions drawn from the previous planning efforts will be independently evaluated in this Master Plan. Some elements from the previous planning efforts may continue to be viable and could be included in this planning effort. Other elements may no longer be viable based on changes to design standards (FAA published new design standards in September of 2012), changes in the long-term vision for the airport, environmental concerns, and/or financial considerations. The remainder of this chapter will present various alternatives to consider for both the airside and landside development of the airport.



FLAGSTAFF AIRPORT

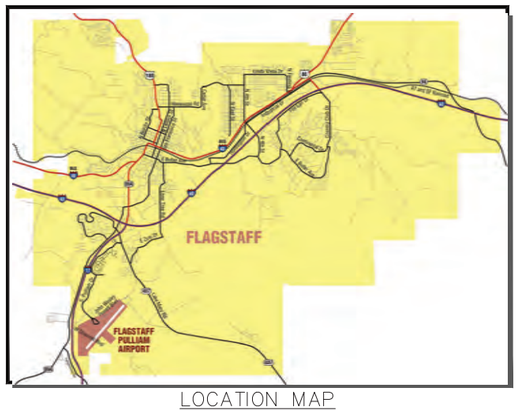


VICINITY MAP

RUNWAY DATA	RUNWAY 3 (L) -21 (R)		RUNWAY 3R-21L	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
RUNWAY CATEGORY/AIRCRAFT DESIGN GROUP	C-III	SAME	--	C-II
CRITICAL DESIGN AIRCRAFT	BOEING BUSINESS JET	SAME	--	CHALLENGER
WINGSPAN OF DESIGN AIRCRAFT	117.4	SAME	--	64.3'
APPROACH SPEED OF DESIGN AIRCRAFT	140KTS	SAME	--	125KTS
UNDER CARRIAGE WIDTH	18.9'	SAME	--	26.1'
MAXIMUM TAKE OFF WEIGHT	150,000	SAME	--	48,200
RUNWAY BEARING (TRUE)	N41°10'25.00"E	SAME	--	N41°10'25.00"E
RUNWAY AZIMUTH	221.170	SAME	--	221.170
RUNWAY DIMENSIONS	6,800' X 150'	SAME	--	7,000' X 100'
RUNWAY END ELEVATIONS (MSL) (NAVD 88)	7,014.5'/6,996.5'	SAME	--	7,016.0'/6,993.0'
ELEVATION OF RWY. TOUCH DOWN ZONE (MSL)	7,014.5'/7,003.1'	SAME	--	7,016.0'/7,002.8'
ELEVATION OF RUNWAY HIGH POINT (MSL)	7,014.5'	SAME	--	7,016.0'
ELEVATION OF RUNWAY LOW POINT (MSL)	6,996.5'	SAME	--	6,993.0'
WIND COVERAGE IN MPH	12-98.82%/15-99.60%	SAME	--	12-98.82%/15-99.60%
APPROACH VISIBILITY MINIMUMS	1/2 MILE/1/2 MILE	SAME	--	1 MILE/1 MILE
FAR PART 77 CATEGORY	NONPREC/PRECISION	PRECISION/PRECISION	--	NONPREC./NONPREC.
RUNWAY END MARKINGS	NONPREC/PRECISION	PRECISION/PRECISION	--	NONPREC./NONPREC.
RUNWAY APPROACH SURFACES	34:1/50:1	50:1/50:1	--	34:1/34:1
RUNWAY SAFETY AREA (RSA)	10,800' X 500'	SAME	--	9,000' X 500'
RSA DISTANCE BEYOND EACH RUNWAY END	1,000'/1,000'	SAME	--	1,000'/1,000'
RUNWAY OBJECT FREE AREA (OFA)	10,800' X 800'	SAME	--	9,000' X 800'
OFA DISTANCE BEYOND EACH RUNWAY END	1,000'/1,000'	SAME	--	1,000'/1,000'
RUNWAY OBSTACLE FREE ZONE (OFZ)	9,200' X 413'	SAME	--	7,400' X 400'
OFZ DISTANCE BEYOND EACH RUNWAY END	200'/200'	SAME	--	200'/200'
RUNWAY CL TO PARALLEL TAXIWAY CL	400'	SAME	--	300'
LINE OF SITE REQUIREMENT MET	YES	SAME	--	YES
RUNWAY PAVEMENT MATERIAL	ASPHALT	SAME	--	ASPHALT
RUNWAY PAVEMENT SURFACE TREATMENT	PFC	SAME	--	PFC
PAVEMENT STRENGTH (in thousand lbs.) [1]	30(S)95(D),140(DTW)	SAME	--	30(S),60(D)
RUNWAY EFFECTIVE GRADIENT (in %)	0.22%	SAME	--	0.33%
MAXIMUM GRADIENT (in %)	0.8%	SAME	--	0.8%
RUNWAY LIGHTING	HIRL	SAME	--	MIRL
TAXIWAY PAVEMENT MATERIAL	ASPHALT	SAME	--	ASPHALT
TAXIWAY LIGHTING	MITL	SAME	--	MITL
TAXIWAY MARKING	CENTERLINE, EDGE	SAME	--	CENTERLINE, EDGE
TAXIWAY OBJECT FREE AREA WIDTH	186.4'	SAME	--	110.1'
TAXIWAY SAFETY AREA WIDTH	117.4'	SAME	--	64.3'
TAXIWAY WINGTIP CLEARANCE	33.5	SAME	--	22.9'
DISTANCE from RWY. CL to HOLDLINE	250'	SAME	--	250'
TAXIWAY CL to FIXED or MOVEABLE OBJECT	93.0'	SAME	--	65.5'
NAVIGATIONAL AIDS	CAT 1 GPS ILS/DME VOR/DME --	SAME SAME SAME SAME	-- -- -- --	GPS -- -- --
VISUAL AIDS	VASI - 4 (3) PAPI - 4 (21) MALS (21) REILs (3)	PAPI-4 (3) SAME MALSR SAME	-- -- -- --	PAPI-4 REIL -- --

[1] Pavement strengths are expressed in Single(S), Dual(D), Dual Tandem(DT),and/or Double Dual Tandem(DDT) wheel loading capacities.

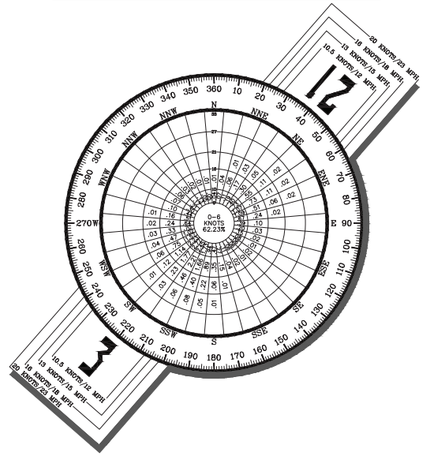
RUNWAY END COORDINATES NAD 83		EXISTING	ULTIMATE
RUNWAY 3(L)	Latitude	35°07'52.380"N	SAME
	Longitude	111°40'44.130"W	SAME
RUNWAY 21(R)	Latitude	35°08'57.91"N	SAME
	Longitude	111°39'34.38"W	SAME
RUNWAY 21(R) DISPLACEMENT	Latitude	35°08'44.51"N	SAME
	Longitude	111°39'48.65"W	SAME
RUNWAY 3R	Latitude	--	35°07'47.809"N
	Longitude	--	111°40'37.797"W
RUNWAY 21L	Latitude	--	35°08'39.921"N
	Longitude	--	111°39'42.310"W



LOCATION MAP

AIRPORT DATA			
FLAGGSTAFF PULLIAM AIRPORT (FLC)			
CITY: FLAGSTAFF, ARIZONA		COUNTY: COCONINO	
RANGE: 7E TOWNSHIP: 20N		CIVIL TOWNSHIP: Not Applicable	
		EXISTING	ULTIMATE
AIRPORT CATEGORY		COMMERCIAL SERVICE	SAME
DESIGN AIRCRAFT		BOEING BUS. JET	SAME
AIRPORT REFERENCE CODE		C-III	SAME
AIRPORT ELEVATION (MSL)		7014.5'	SAME
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH		81.1 ° F (JULY)	SAME
AIRPORT REFERENCE POINT	Latitude	35°08'25.145" N	35°08'20.140"N
(ARP) COORDINATES (NAD 83)	Longitude	111°40'09.261" W	111°40'09.619"W
AIRPORT and TERMINAL NAVIGATIONAL AIDS		ILS DME/TOR GPS ROTATING BEACON ASOS --	SAME SAME SAME SAME SAME SAME
GPS AT AIRPORT		YES	SAME

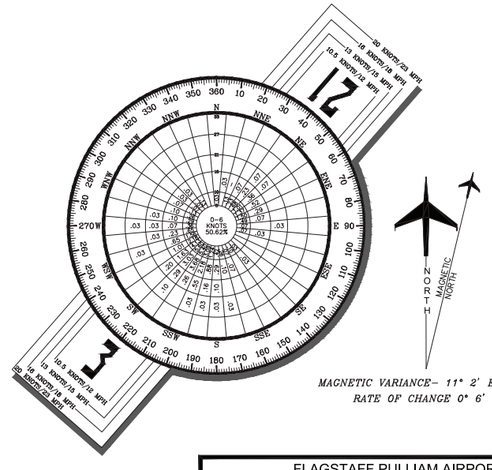
ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots 12 MPH	13 Knots 15 MPH	16 Knots 18 MPH	20 Knots 23 MPH
Runway 3-21	98.82%	99.60%	99.94%	99.99%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Flagstaff Pulliam Airport
Flagstaff, Arizona

OBSERVATIONS:
76,804 All Weather Observations
3,072 IFR Observations
1993-2002

IFR WIND COVERAGE				
Runways	10.5 Knots 12 MPH	13 Knots 15 MPH	16 Knots 18 MPH	20 Knots 23 MPH
Runway 3-21	99.04%	99.55%	99.88%	99.98%



MAGNETIC VARIANCE- 11° 2' E (2008)
RATE OF CHANGE 0° 6' W

No.	REVISIONS	DATE	BY	APP'D.
4	MASTER PLAN UPDATE, APPROVED BY CITY COUNCIL SEPT. 6, 2005, RUNWAY EXTENSION AND OTHER IMPROVEMENTS	05/29/08	MJB	JMH
3	ALP APPROVED BY FAA ON 2-28-02. ALP REVISED BY MICHAEL BAKER JR, INC. TO REFLECT NEWLY CONSTRUCTED PROJECTS AND PROPERTY LINE CHANGES.	02/28/02	JNP	BKL
2	ALP REVALIDATED BY FAA ON 9-29-00 AS CREATED BY COFFMAN ASSOCIATES	9/29/00	WEH	JMH
1	REVISED TO REFLECT NEWLY CONSTRUCTED PROJECTS AND PROPERTY LINE CHANGES	12/31/96	WEH	WLM

THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS.

FLAGSTAFF PULLIAM AIRPORT

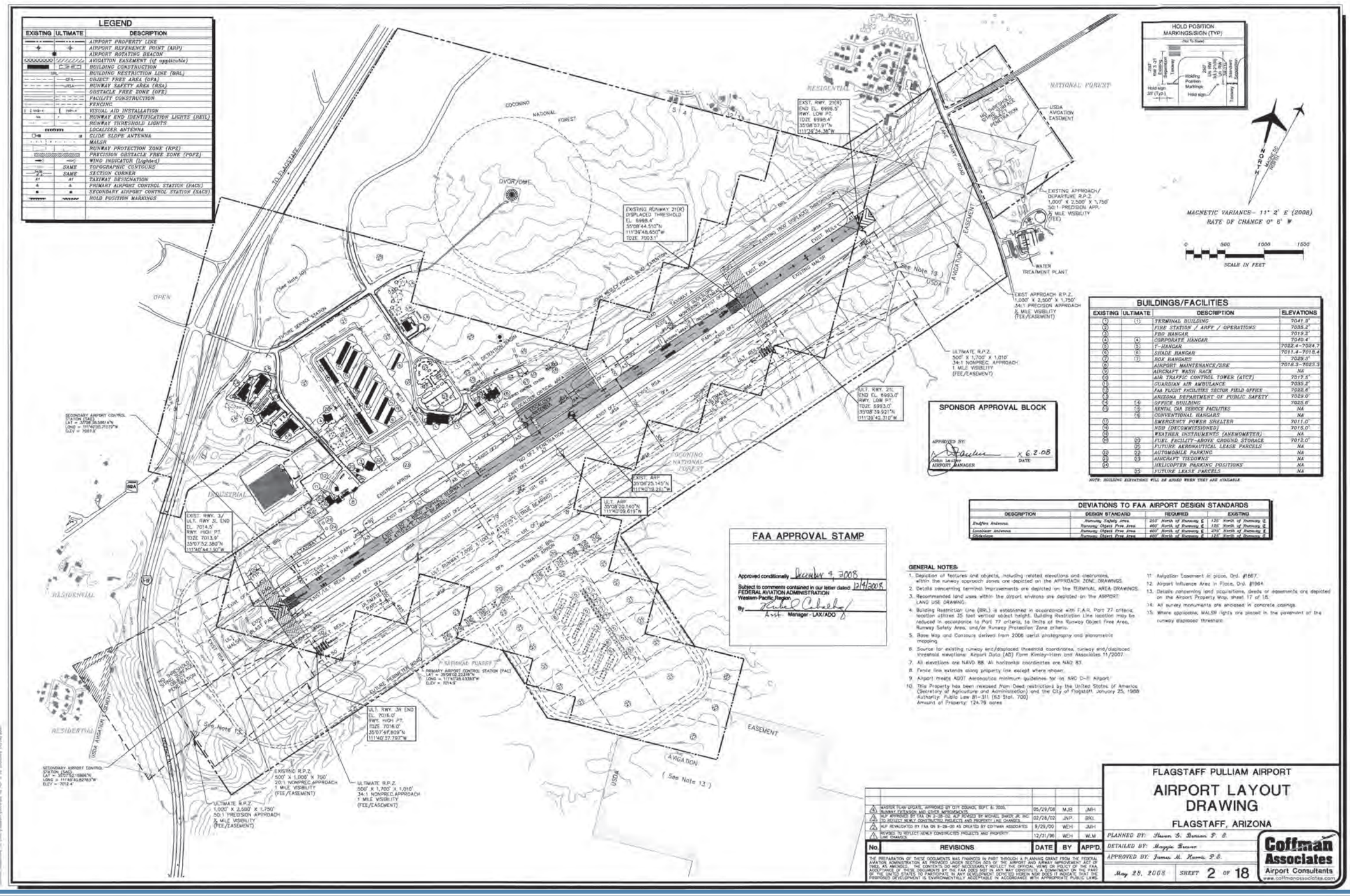
AIRPORT DATA SHEET

FLAGSTAFF, ARIZONA

PLANNED BY: Steven G. Benson P. E.
DETAILED BY: Maggie Brewer
APPROVED BY: James M. Harris P.E.

May 29, 2008 SHEET 1 OF 18

Coffman Associates
Airport Consultants
www.coffmanassociates.com


LEGEND
EXISTING | ULTIMATE | DESCRIPTION
AIRPORT PROPERTY LINE
AIRPORT REFERENCE POINT (ARP)
AIRPORT ROTATING BEACON
AVIGATION EASEMENT (if applicable)
BUILDING CONSTRUCTION
BUILDING RESTRICTION LINE (BRL)
OBJECT FREE AREA (OFA)
RUNWAY SAFETY AREA (RSA)
OBSTACLE FREE ZONE (OFZ)
FACILITY CONSTRUCTION
FENCING
VISUAL AID INSTALLATION
RUNWAY END IDENTIFICATION LIGHTS (REIL)
RUNWAY THRESHOLD LIGHTS
LOCALIZER ANTENNA
GLIDE SLOPE ANTENNA
MALSR
RUNWAY PROTECTION ZONE (RPZ)
PRECISION OBSTACLE FREE ZONE (POFZ)
WIND INDICATOR (Lighted)
SAME
TOPOGRAPHIC CONTOURS
SAME
SECTION CORNER
17
17
TAXIWAY DESIGNATION
A
A
PRIMARY AIRPORT CONTROL STATION (PACS)
SECONDARY AIRPORT CONTROL STATION (SACS)
HOLD POSITION MARKINGS
HOLD POSITION MARKINGS/SIGN (TYP.)
(Not To Scale)
MAGNETIC VARIANCE- 11° 2' E (2008)
RATE OF CHANGE 0° 6' W
0
500
1000
1500
SCALE IN FEET
BUILDINGS/FACILITIES
EXISTING | ULTIMATE | DESCRIPTION | ELEVATIONS
(1) | (1) | TERMINAL BUILDING | 7041.9'
(2) | | FIRE STATION / ARFF / OPERATIONS | 7035.2'
(3) | | FBO HANGAR | 7019.2'
(4) | (4) | CORPORATE HANGAR | 7040.4'
(5) | (5) | T-HANGAR | 7022.4-7034.7
(6) | (6) | SHADE HANGAR | 7011.4-7018.4
(7) | (7) | BOX HANGARS | 7029.3'
(8) | | AIRPORT MAINTENANCE/SRE | 7018.3-7023.3
(9) | | AIRCRAFT WASH RACK | NA
(10) | | AIR TRAFFIC CONTROL TOWER (ATCT) | 7019.5'
(11) | | GUARDIAN AIR AMBULANCE | 7033.2'
(12) | | FAA FLIGHT FACILITIES SECTOR FIELD OFFICE | 7022.6'
(13) | | ARIZONA DEPARTMENT OF PUBLIC SAFETY | 7029.0'
(14) | (14) | OFFICE BUILDING | 7025.6'
(15) | (15) | RENTAL CAR SERVICE FACILITIES | NA
| (16) | CONVENTIONAL HANGARS | NA
(17) | | EMERGENCY POWER SHELTER | 7011.0'
(18) | | NDB (DECOMMISSIONED) | 7015.0'
(19) | | WEATHER INSTRUMENTS (ANEMOMETER) | NA
(20) | (20) | FUEL FACILITY-ABOVE GROUND STORAGE | 7012.0'
| (21) | FUTURE AERONAUTICAL LEASE PARCELS | NA
(22) | (22) | AUTOMOBILE PARKING | NA
(23) | (23) | AIRCRAFT TIEDOWNS | NA
(24) | (24) | HELICOPTER PARKING POSITIONS | NA
| (25) | FUTURE LEASE PARCELS | NA
NOTE: BUILDING ELEVATIONS WILL BE ADDED WHEN THEY ARE AVAILABLE.
SPONSOR APPROVAL BLOCK
APPROVED BY:
John Lewis
AIRPORT MANAGER
DATE: 6.2.08
FAA APPROVAL STAMP
Approved conditionally December 9, 2008
Subject to comments contained in our letter dated 12/4/2008.
FEDERAL AVIATION ADMINISTRATION
Western-Pacific Region
By
Asst. Manager - LAX/ADO
DEVIATIONS TO FAA AIRPORT DESIGN STANDARDS
DESCRIPTION | DESIGN STANDARD | REQUIRED | EXISTING
Localizer Antenna | Runway Safety Area | 250' North of Runway ℄ | 125' North of Runway ℄
| Runway Object Free Area | 400' North of Runway ℄ | 335' North of Runway ℄
Localizer Antenna | Runway Object Free Area | 400' North of Runway ℄ | 279' North of Runway ℄
Obstruction | Runway Object Free Area | 400' North of Runway ℄ | 125' North of Runway ℄
GENERAL NOTES:
1. Depiction of features and objects, including related elevations and clearances, within the runway approach zones are depicted on the APPROACH ZONE DRAWINGS.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA DRAWINGS.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE DRAWING.
4. Building Restriction Line (BRL) is established in accordance with F.A.R. Part 77 criteria, location utilizes 35 foot vertical object height. Building Restriction Line location may be reduced in accordance to Part 77 criteria, to limits of the Runway Object Free Area, Runway Safety Area, and/or Runway Protection Zone criteria.
5. Base Map and Contours derived from 2006 aerial photography and photometric mapping.
6. Source for existing runway end/displaced threshold coordinates, runway end/displaced threshold elevations: Airport Data (AD) Form Kimley-Horn and Associates 11/2007.
7. All elevations are NAVD 88. All horizontal coordinates are NAD 83.
8. Fence line extends along property line except where shown.
9. Airport meets ADOT Aeronautics minimum guidelines for an ARC C-II Airport.
10. This Property has been released from Deed restrictions by the United States of America (Secretary of Agriculture and Administration) and the City of Flagstaff January 25, 1988 Authority: Public Law 81-311 (63 Stat. 700) Amount of Property: 124.79 acres
11. Avigation Easement in place, Ord. #867.
12. Airport Influence Area in Place, Ord. #1964.
13. Details concerning land acquisitions, deeds or easements are depicted on the Airport Property Map, sheet 17 of 18.
14. All survey monuments are encased in concrete casings.
15. Where applicable, MALSR lights are placed in the pavement of the runway displaced threshold.
No. | REVISIONS | DATE | BY | APP'D.
1 | MASTER PLAN UPDATE, APPROVED BY CITY COUNCIL SEPT. 6, 2005. RUNWAY EXTENSION AND LIGHTS IMPLEMENTED | 05/29/08 | MJB | JMH
2 | ALP APPROVED BY FAA ON 2-28-02. ALP REVISED BY MICHAEL BAKER JR, INC TO REFLECT NEWLY CONSTRUCTED PROJECTS AND PROPERTY LINE CHANGES. | 02/28/02 | JNP | BKL
3 | ALP REVALIDATED BY FAA ON 9-28-00 AS DRAWN BY COFFMAN ASSOCIATES | 9/29/00 | WEH | JMH
4 | REVISED TO REFLECT NEWLY CONSTRUCTED PROJECTS AND PROPERTY LINE CHANGES. | 12/31/96 | WEH | W.M
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FLAGSTAFF PULLIAM AIRPORT
AIRPORT LAYOUT DRAWING
FLAGSTAFF, ARIZONA
PLANNED BY: Steven S. Brenner, P. E.
DETAILED BY: Maggie Brenner
APPROVED BY: James A. Harris, P.E.
May 28, 2008
SHEET 2 OF 18
Coffman Associates
Airport Consultants
www.coffmanassociates.com
SECONDARY AIRPORT CONTROL STATION (SACS)
LAT = 35°08'26.5951"N
LONG = 111°40'05.7103"W
ELEV = 7003.9
SECONDARY AIRPORT CONTROL STATION (SACS)
LAT = 35°07'52.1986"N
LONG = 111°40'10.8763"W
ELEV = 7012.4'
PRIMARY AIRPORT CONTROL STATION (PACS)
LAT = 35°08'22.2336"N
LONG = 111°40'28.6383"W
ELEV = 7014.5'
EXIST. RWY. 21(R)
END EL. 6996.5'
RWY. LOW PT.
TDZE 6998.4'
35°08'57.91"N
111°39'34.36"W
EXISTING RUNWAY 21(R)
DISPLACED THRESHOLD
EL. 6988.4'
35°08'44.510"N
111°39'48.650"W
TDZE 7003.1'
ULT. RWY. 21L
END EL. 6993.0'
RWY. LOW PT.
TDZE 6993.0'
35°08'39.921"N
111°39'42.310"W
EXIST. ARP
35°08'25.145"N
111°40'18.261"W
ULT. ARP
35°08'02.140"N
111°40'09.619"W
EXIST. RWY. 3/
ULT. RWY 3L END
EL. 7014.5'
RWY. HIGH PT.
TDZE 7013.9'
35°07'52.380"N
111°40'44.130"W
ULT. RWY. 3R END
EL. 7016.0'
RWY. HIGH PT.
TDZE 7016.0'
35°07'47.809"N
111°40'37.797"W
EXISTING R.P.Z.
500' X 1,000' X 700'
20:1 NONPREC.APPROACH
1 MILE VISIBILITY
(FEE/EASEMENT)
ULTIMATE R.P.Z.
1,000' X 2,500' X 1,750'
50:1 PRECISION APPROACH
½ MILE VISIBILITY
(FEE/EASEMENT)
ULTIMATE R.P.Z.
500' X 1,700' X 1,010'
34:1 NONPREC.APPROACH
1 MILE VISIBILITY
(FEE/EASEMENT)
EXIST. APPROACH/
DEPARTURE R.P.Z.
1,000' X 2,500' X 1,750'
50:1 PRECISION APP.
½ MILE VISIBILITY
(FEE)
EXIST. APPROACH R.P.Z.
1,000' X 2,500' X 1,750'
34:1 PRECISION APPROACH
½ MILE VISIBILITY
(FEE/EASEMENT)
ULTIMATE R.P.Z.
500' X 1,700' X 1,010'
34:1 NONPREC.APPROACH
1 MILE VISIBILITY
(FEE/EASEMENT)
NO OBSTACLES ABOVE 34:1 SLOPE PENETRATION
USDA AVIGATION EASEMENT
LAKE MARY ROAD
WATER TREATMENT PLANT
RESIDENTIAL
NATIONAL FOREST
COCONINO NATIONAL FOREST
DVOR/DME
TO FLAGSTAFF
INDUSTRIAL
OPEN
FUTURE SERVICE STATION
FUTURE OFFICE/RESTAURANT
FUTURE HOTEL
FUTURE RETAIL
FUTURE PERIMETER ROAD
FUTURE ACCESS ROAD
EXISTING APRON
ULTIMATE APRON
EXIST. T-HANGARS
EXIST. BOX HANGARS
EXIST. SHADE HANGARS
EXIST. CORPORATE HANGAR
EXIST. FBO HANGAR
EXIST. ATCT
EXIST. ARFF
EXIST. FUEL FARM
EXIST. MALSR
EXIST. RUNWAY 3/21
7,000' X 100'
ULT. RUNWAY 3/21
7,700' X 100'
EXIST. RUNWAY 3L-21R
10,000' X 150'
ULT. RUNWAY 3L-21R
10,000' X 150'
EXIST. RUNWAY 3R-21L
7,000' X 100'
ULT. RUNWAY 3R-21L
7,700' X 100'
EXIST. TAXIWAY A
EXIST. TAXIWAY B
EXIST. TAXIWAY C
EXIST. TAXIWAY D
EXIST. TAXIWAY E
EXIST. TAXIWAY F
EXIST. TAXIWAY G
EXIST. TAXIWAY H
EXIST. TAXIWAY J
EXIST. TAXIWAY K
EXIST. TAXIWAY L
EXIST. TAXIWAY M
EXIST. TAXIWAY P
EXIST. TAXIWAY Q
EXIST. TAXIWAY R
EXIST. TAXIWAY S
EXIST. TAXIWAY T
EXIST. TAXIWAY U
EXIST. TAXIWAY V
EXIST. TAXIWAY W
EXIST. TAXIWAY Y
EXIST. TAXIWAY Z
EXIST. TAXIWAY AA
EXIST. TAXIWAY AB
EXIST. TAXIWAY AC
EXIST. TAXIWAY AD
EXIST. TAXIWAY AE
EXIST. TAXIWAY AF
EXIST. TAXIWAY AG
EXIST. TAXIWAY AH
EXIST. TAXIWAY AJ
EXIST. TAXIWAY AK
EXIST. TAXIWAY AL
EXIST. TAXIWAY AM
EXIST. TAXIWAY AN
EXIST. TAXIWAY AP
EXIST. TAXIWAY AQ
EXIST. TAXIWAY AR
EXIST. TAXIWAY AS
EXIST. TAXIWAY AT
EXIST. TAXIWAY AU
EXIST. TAXIWAY AV
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ON-AIRPORT LAND USE

Ultimately, the purpose of the alternatives analysis is to identify specific uses for airport property to create the safest and most efficient operating environment and allows the airport to market itself to developers and businesses so that it can maximize its revenue potential on-airport. Land use planning is a very common practice for communities across the country. The primary purpose of on-airport land use planning is to adequately plan for future needs in an organized, efficient, and beneficial manner. Airport planning also commonly considers land use planning concepts to ensure that development is orderly, efficient, safe, and maximizes available land inventories.

An on-airport land use plan has been prepared for future development at Flagstaff Airport. Obviously, this is a simple plan based on separation of activity levels and historic development. It should be taken in the intent it was developed, as simply a guide for the airport sponsor to consider. It is fully understood that the airport sponsor may modify the plan if necessary to satisfy its intended goals and needs. The landside land use plan depicted on **Exhibit 4B** includes six broad development categories:

- Airfield Operations
- Aviation Related – Commercial Passenger Service
- Aviation Related – General Aviation
- Aviation Support
- Aviation Reserve
- Non-Aviation Related

The **Airfield Operations** land use category is designated to delineate areas not available for landside development. The airfield operations area has been established based on existing airfield conditions and includes safety areas associated with each runway, as well as the clearances needed for taxiways. This area should remain clear of objects except for those fixed by navigational function. If changes are made in line with airside alternatives previously discussed, the airfield operations area would change, thereby changing landside use options as well.

Aviation Related – Commercial Passenger Service includes facilities necessary to accommodate the transition of passengers and/or cargo between air and ground. At Flagstaff Airport, this includes the commercial terminal building and parking apron, as well as areas to accommodate vehicle parking demand associated with commercial passenger service.

Aviation Related – General Aviation represents the full array of general aviation activities and includes users that provide aviation services or house aircraft. A good example of this type of use is a fixed base operator (FBO). These uses will generate a moderate activity level on both the airside and landside, including based aircraft and itinerant aircraft traffic. Facilities typical of general aviation uses range from T-hangars to larger conventional hangars. These users, however, are more commonly those that only have one primary hangar facility and are best suited for flight line access. This use is also characteristic of facilities which simply house based aircraft. The most common use is for T-hangars or executive box hangars. Daily activity for these areas is relatively low as the aircraft owners will commonly operate only sporadically throughout the week, or less often.

For the sake of this planning study, the area delineated as aviation related for commercial passenger service and general aviation will be the focus of future development options. These are the areas capable of serving the needs of future aviation facilities.

Aviation Reserve includes those areas on airport property that are currently undeveloped and should be dedicated for potential aviation related development in the future, given their location to the runway and taxiway system. These areas will also be further detailed during this alternatives analysis.

Aviation Support includes those facilities and functions used to support the overall maintenance, safety, and security on the airfield. This includes the aircraft rescue and firefighting (ARFF) facility and dedicated airport maintenance facilities that house operations and maintenance personnel and equipment.

Non-Aviation Related uses are allowed on airports for areas not required for aviation purposes. In some cases, airport land inventories allow for non-aviation uses as long as the areas are not accessible to the airfield. This use could support commercial, industrial, or business park development and would provide the airport with an opportunity to improve revenue streams on land that would otherwise remain vacant. The Flagstaff Airport Business Center, located in the west quadrant of the airport, is designated for non-aviation use and is currently home to several buildings that provide an array of business activities. A second Non-Aviation Related area is designated adjacent to the northwest side of the terminal area.

The Facility Requirements chapter of this Master Plan identified numerous considerations for improved or expanded facilities, including airfield geometry improvements, terminal facility needs, and new hangar facilities. The land needed to accommodate the 20-year landside facility requirements is not anticipated to exceed the undeveloped/vacant property currently available for development. With a surplus of property that is accessible to/from the airfield system, Flagstaff Airport has a great opportunity to market itself to potential developers and increase land lease revenues. For areas that are not easily accessible to the airfield system, such as land adjacent to the southwest side of Shamrell Boulevard and north side of South Pulliam Drive, these areas will continue to be possibilities for non-aviation related developments such as industrial parks or business centers that can increase land lease revenues for the airport.

AIRPORT ALTERNATIVE CONSIDERATIONS

As previously detailed, the development alternatives are categorized into two functional areas: airside and landside. Airside considerations relate to runways, taxiways, navigational aids, lighting and marking aids, etc. and require the greatest commitment of land area to meet the physical layout of the airport, as well as the required airfield safety standards. The design of the airfield also defines minimum setback distances from the runway and object clearance standards. These criteria are defined first to ensure that the fundamental needs of the airport are met. Landside considerations include hangars, aircraft parking aprons, terminal services, as well as utilization of remaining property to provide revenue support for the airport and to benefit the economic development and well-being of the regional area.



South Pulliam Dr.

Interstate 17

John Wesley Powell Blvd.

Shamrell Blvd.

John Wesley Powell Blvd
Future Extension

Lake Mary Rd.

W

A

A-9 A-8 A-7 A-6 A-5 A-4 A-3 A-2 A-1

Runway 3/21 8,800' x 150'

LEGEND

- Existing Airport Property Line
- USDA Avigation Easement
- 5-Foot Ground Contours
- Runway Protection Zone (RPZ)
- Proposed Roadway
- Airfield Operations
- Aviation Support
- Aviaiton Related - General Aviaition
- Aviation Related - Commercial Passenger Service
- Non-Aviation Related
- Aviation Reserve

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SCALE IN FEET

Photo Source: Kenney Aerial Mapping 9-29-2017

Exhibit 4B
FUTURE AIRPORT LAND-USE PLAN

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Exhibit 4C presents both airside and landside alternative considerations that will be specifically addressed in this analysis. These issues are the result of the findings of the aviation demand forecasts and facility requirements evaluations, as well as input from the PAC, airport management, City of Flagstaff, and the general public.

The remainder of this chapter will describe various development alternatives for airside and landside facilities. Although each area is treated separately, ultimate planning will integrate the individual requirements so that they can complement one another.

ANALYSIS OF AIRSIDE DEVELOPMENT CONSIDERATIONS

This section identifies and evaluates various airside development factors at Flagstaff Airport to meet the requirements set forth in Chapter Three. Airside facilities are, by nature, the focal point of an airport complex. Because of their primary role and the fact that they physically dominate airport land use, airfield facility needs are often the most critical factor in the determination of viable development options.

AIRPORT DESIGN CRITERIA

Applicable standards for airport design are outlined in FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, Change 1. The design of airfield facilities is primarily based on the physical and operational characteristics of the critical design aircraft using the airport.

As discussed in Chapter Two, a Runway Design Code (RDC) is applied to each runway at an airport in order to identify the appropriate design standards for the runway and associated taxiway system. The RDC is made up of the Aircraft Approach Category (AAC), the Airplane Design Group (ADG), and the approach visibility minimums expressed in runway visual range (RVR) values. It relates to the largest and fastest aircraft that regularly operates at the airport. The FAA has historically defined regular use as at least 500 annual operations at the airport. While this can, at times, be represented by one specific make and model of aircraft, most of the runways' RDC values are represented by several different aircraft, which collectively operate frequently at the airport.

Analysis in the Forecasts chapter indicated that the RDC for Runway 3-21 at Flagstaff Airport is currently C-II-2400. The airfield should continue to be planned for some of the most demanding regional commercial service and general aviation business jet aircraft on the market today, including the potential emergence of larger commercial service aircraft, such as the 90-seat regional jets. Runway 3-21 provides adequate runway length to support these aircraft operations and accommodates desirable instrument approaches serving the airport. Alternative analysis will evaluate facility development that could meet ultimate RDC standards for C-III-2400 on Runway 3-21. **Table 4A** summarizes the existing and planned RDC for Runway 3-21 at Flagstaff Airport.

AIRSIDE CONSIDERATIONS

- Evaluate improvements necessary for Runway 3-21 to meet appropriate existing and ultimate Federal Aviation Administration (FAA) design standards.
- Identify property encompassed by the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zones (RPZs) for potential acquisition.
- Analyze the taxiway system in meeting airfield safety, design, and geometry standards.
- Determine the ability to conform to ultimate hold line separation standards associated with Runway 3-21.
- Evaluate improvements necessary for enhanced instrument approaches to Runway 3-21.
- Improve visual approach aids to include the installation of runway end identification lights (REILs) on Runway 3.
- Construct aircraft hold apron serving Runway 3.
- Consider ultimate light emitting diode (LED) lighting on the runway and taxiway system.

LANDSIDE CONSIDERATIONS

- Examine the terminal area and associated vehicle parking lot (public and rental car) in meeting existing and future demand.
- Provide options for expanding the terminal building and associated aircraft parking apron to meet existing and ultimate commercial passenger activity.
- Identify locations for expanded hangar storage capacity.
- Identify locations to enhance revenue support through meeting the needs of aviation and non-aviation demand.
- Evaluate options to accommodate support facilities needed for aviation activities.



TABLE 4A
Runway Design Code
Flagstaff Airport

Runway	Existing Runway Design Code	Planned Runway Design Code
3-21	C-II-2400	C-III-2400

Furthermore, the airport achieving visibility minimums down to ½-mile associated with the instrument landing system (ILS) approach serving Runway 21 would be advantageous as would improved instrument approach capabilities to Runway 3, especially for scheduled commercial service operations. Alternative analysis later in this chapter will evaluate facility development that could meet ultimate RDC standards for C-III-2400 on Runway 3-21. As detailed in previous chapters, during the course of the Master Plan the airport has experienced changes to instrument approach procedures serving each end of Runway 3-21. Runway 3 now has not lower than ¾-mile visibility minimums and Runway 21 has ½-mile visibility minimums.

SAFETY AREAS

The design of airfield facilities includes both the pavement areas to accommodate landing and ground operations of aircraft, as well as the required safety areas to protect aircraft operational areas and keep them free of obstructions that could affect the safe operation of aircraft at the airport. The safety areas include the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zone (RPZ). The applicable design standards for the runway system were previously outlined in Chapter Three. As depicted on **Exhibit 4D**, there are areas on the airfield that do not conform to RSA, ROFA, and ROFZ design standards. The ROFZ standards are currently met on Runway 3-21.

Runway Safety Area

According to AC 150/5300-13A, Change 1, the FAA calls for the RSA to be 400 feet wide and extend 1,000 feet beyond each runway end for existing RDC C-II design. For ultimate RDC C-III design, the RSA is widened to 500 feet and extends 1,000 feet beyond each runway end. Only 600 feet of RSA is needed prior to the landing threshold on each runway end under RDC C-II and C-III standards.

Under the ultimate condition, a small portion of the RSA extending to the southwest of Runway 3-21 is penetrated by the perimeter access road. It is important to note that this roadway is restricted to authorized airport personnel only and is not open to the public. Future planning should consider the relocation of the portion of the access road outside the 500-foot wide RSA as directed by the FAA. In doing so, the full length of Runway 3-21 can continue to be utilized for takeoffs and landings.

Runway Object Free Area

The FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end for existing RDC C-II and ultimate C-III design, which is applicable to Runway 3-21. Similar to the RSA, only 600 feet is needed prior to the landing threshold.

The southwest side of Runway 3-21 lacks the proper ROFA to meet existing and future RDCs. A small area of the ROFA is obstructed by trees and portions of airport perimeter fencing. It is recommended that the ROFA be cleared and graded. Furthermore, under certain circumstances, the FAA may approve a Modification to Standard for non-standard conditions on the airfield related to certain safety areas such as the ROFA.

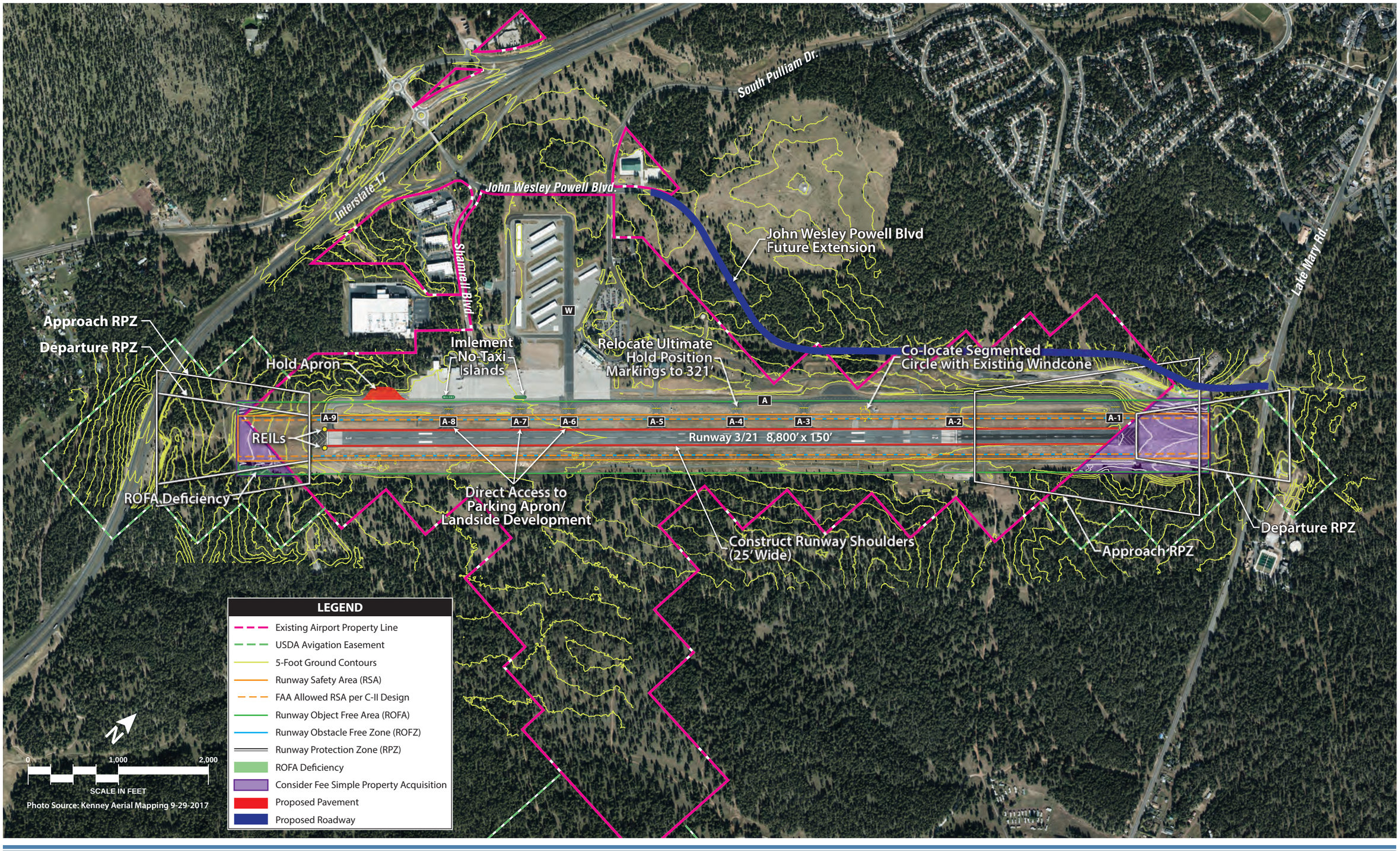
Runway Protection Zone

FAA AC 150/5300-13A, Change 1, defines the RPZ as "*An area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground.*" The goal of the RPZ standard is to increase safety for both pilots and people on the ground by maintaining the RPZ free of items that attract groupings of people or property.

The disposition of RPZs for each runway end should be considered individually. The FAA recommends that an airport have ownership of the RPZ lands where feasible. If outright ownership is not feasible, then easements can be acceptable. Easements in the RPZ should allow an airport to positively limit the height of structures. A third option for protection of the RPZs that extend beyond airport property is implementation of strict land use zoning that, at a minimum, prohibits residential development or other incompatible development and restricts structure heights.

All runway ends have two RPZs: an approach RPZ and a departure RPZ. The size of each is dependent upon the type of aircraft or RDC for which the runway is being designed. The approach RPZ is also sized according to the lowest visibility minimums provided by the approved instrument approach procedure(s). For runways without a displaced threshold, it is common for the approach and departure RPZs to be in the same location. This is currently the case for the approach and departure RPZs beyond the southwest end of Runway 3-21; however, the approach RPZ is larger, associated with ¾-mile instrument approach visibility minimums. On the northeast end of Runway 3-21, the approach RPZ serving the Runway 21 displaced threshold is larger than the departure RPZ associated with Runway 3 due to instrument approach procedures providing visibility minimums down to ½-mile on Runway 21. Furthermore, the 1,800-foot displaced threshold on Runway 21 calls for the approach and departure RPZs to be situated separately. FAA's RPZ criterion applies to both the approach and departure RPZ.

In the past, FAA guidance did not clearly identify all objects which could be located inside the RPZ except to qualify that the object could not be an attractant to a congregation of people. In newer guidance, however, the FAA stipulates that certain land uses are permissible without further evaluation and other land uses will require further evaluation and ultimate FAA approval. Chapter Three outlined the updated


South Pulliam Dr.
Interstate 17
John Wesley Powell Blvd.
Shamrell Blvd.
Lake Mary Rd.
John Wesley Powell Blvd
Future Extension
Approach RPZ
Departure RPZ
Hold Apron
Imlement
No-Taxi
Islands
Relocate Ultimate
Hold Position
Markings to 321'
Co-locate Segmented
Circle with Existing Windcone
W
A
A-9
A-8
A-7
A-6
A-5
A-4
A-3
A-2
A-1
REILs
Runway 3/21 8,800' x 150'
ROFA Deficiency
Direct Access to
Parking Apron/
Landside Development
Construct Runway Shoulders
(25' Wide)
Approach RPZ
Departure RPZ
LEGEND
Existing Airport Property Line
USDA Avigation Easement
5-Foot Ground Contours
Runway Safety Area (RSA)
FAA Allowed RSA per C-II Design
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
ROFA Deficiency
Consider Fee Simple Property Acquisition
Proposed Pavement
Proposed Roadway
N
0
1,000
2,000
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017

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guidance provided in AC 150/5300-13A, Change 1, and *Interim Guidance on Land Uses within a Runway Protection Zone* (September 27, 2012).

If an airport cannot fully control the entirety of the RPZ, the RPZ land use standards have recommendation status for that portion of the RPZ not controlled by the airport owner. In essence, this means that the FAA can require a change to the runway environment so the entirety of the RPZ can be properly secured. The FAA has always held that residences, businesses, and similar uses should be excluded from the RPZ, although this objective was not uniformly enforced. Objects such as public roads have been allowed under previous guidance unless it posed an airspace obstruction. However, FAA's current guidance does not readily allow for public roads in the RPZ.

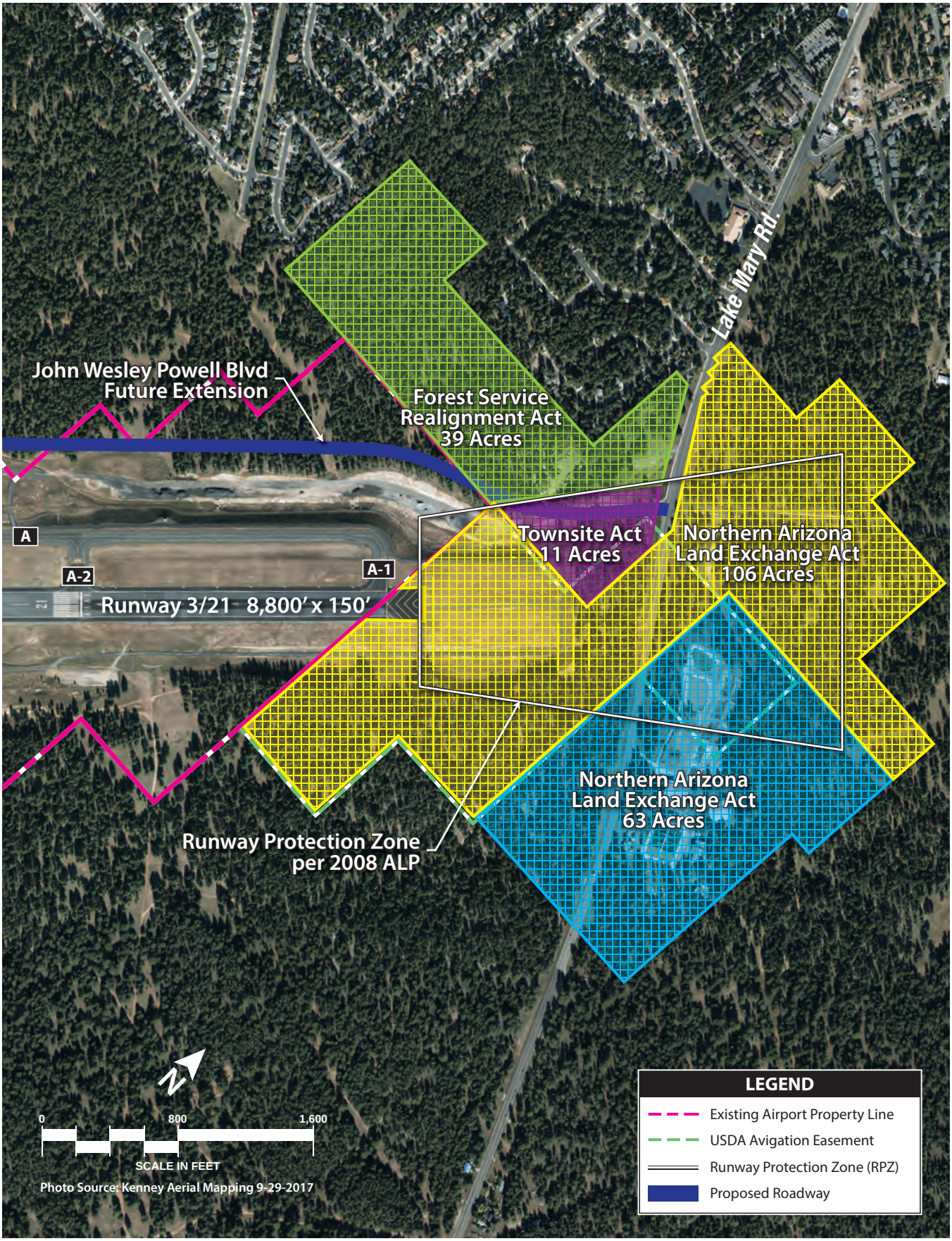
The majority of the RPZs associated with Runway 3-21 at Flagstaff Airport encompass vacant land; however, Lake Mary Road and a portion of the City of Flagstaff's water treatment facility penetrate the Runway 3 departure RPZ. Furthermore, a portion of the approach and departure RPZs serving the southwest side of the runway encompass Interstate 17. It is important to note that the proposed extension of John Wesley Powell Boulevard adjacent to the northwest side of the airport is also depicted on **Exhibit 4D**. The proposed roadway alignment remains clear of the existing Runway 3 departure RPZ in the area it would connect with Lake Mary Road.

As previously discussed in Chapter Three, since the new RPZ guidance addresses new or modified RPZs, existing incompatibilities may be grandfathered under certain conditions. For example, roads that are in the current RPZ are typically allowed to remain as grandfathered unless the runway environment changes. As such, Interstate 17 and Lake Mary Road could be considered acceptable since they have existed since before the RPZ standards were published. Alternatives discussed later in this chapter will evaluate the effects of the RPZs when considering instrument approach improvements associated with the runway system.

AIRPORT CONTROL OF SAFETY AREAS

As shown on **Exhibit 4D**, portions of the RSA, ROFA, and ROFZ beyond the northeast end of Runway 3-21 extend outside existing airport property and are contained within an avigation easement through the U.S. Forest Service, which is an agency of the United States Department of Agriculture (USDA). Likewise, beyond the southwest end of the runway, portions of the RSA and ROFA extend outside the airport property line but are contained within the USDA avigation easement. All total, approximately 25.3 acres of land is included within the RSA, ROFA, and ROFZ outside the current property line. Ideally, the airport can have positive control of these safety areas through fee simple property acquisition. In addition, none of the approach and departure RPZs associated with either end of Runway 3-21 are fully contained on airport property; however, those portions that are outside airport property are primarily contained within the same avigation easement.

In order to better control portions of these safety areas, the City of Flagstaff has historically recognized the need to acquire property adjacent to the airport. As depicted on **Exhibit 4E**, approximately 220 acres



Source: City of Flagstaff

of land has been identified for acquisition through various purchase agreements with the U.S. Forest Service that include the following:

- **Northern Arizona Land Exchange Act –** This Act allows cities, town, and camps to purchase land from the U.S. Forest Service. The City of Flagstaff has identified land adjacent to the north end of Flagstaff Airport to help protect the ultimate RPZ as depicted on the currently approved ALP. Furthermore, portions of the land could be utilized for a regional park and for the existing City of Flagstaff water treatment facility. The City and U.S. Forest Service has previously entered into an Agreement of Intent for a direct sale of the property back in 2009. All total, 169 acres of land has been identified for purchase through the Northern Arizona Land Exchange Act.

- **Townsite Act –** This Act allows the U.S. Forest Service to set aside and designate for townsite purposes up to 640 acres of National Forest System lands adjacent to or contiguous to an established community in certain states (including Arizona). Once designated, this land can then be sold under the Townsite Act for the purpose of expanding economic enterprises, providing space for expanded service industries, and more. All total, 11 acres of land have been identified for purchase through the Townsite Act.

- **Forest Service Realignment Act –** This Act allows the U.S. Forest Service to sell or exchange parcels up to 40 acres in size for administrative purposes. The City has identified a 39-acre parcel adjacent to the north side of the airport for purchase through the Forest Service Realignment Act.

Through the proposed acquisition of property adjacent to the north side of the airport as previously discussed, the RSA, ROFA, ROFZ, and RPZs would be fully contained and controlled by the airport and City of Flagstaff. Beyond the southwest end of the runway, it would be desirable for the airport to ultimately acquire portions of the RSA and ROFA that currently extend beyond the existing property line at a minimum.

RUNWAY LENGTH, WIDTH, AND STRENGTH

Analysis in Chapter Three indicated that the current length of Runway 3-21 (8,800 feet) can accommodate a large majority of the business jets on the market under moderate loading conditions as well as the regularly scheduled commercial service regional jets that utilize the airport. Given the elevation of the airport being over 7,000 feet mean sea level (MSL), many of the business and regional jets are climb-restricted on departure, thus limiting the usefulness of any additional runway length. This factor as well as the physical constraints beyond each end of the runway (i.e., Interstate 17, Lake Mary Road, and terrain factors) further complicate a runway extension. As such, this Master Plan recommends that the existing runway length of 8,800 feet be maintained through the long term planning period of the study.

Runway 3-21 is currently 150 feet wide. FAA standards call for a width of 100 feet to meet RDC C-II standards. In order to meet RDC C-III standards, the FAA standard calls for a 150-foot wide runway. As previously discussed, a runway width of 100 feet is adequate for C-III aircraft weighing 150,000 pounds or less. Since the runway is occasionally utilized by larger commercial/charter aircraft, the 150 feet of

width provides added safety enhancements for these operations. Furthermore, the current runway reconstruction/rehabilitation project accounts for the full 150-foot width. As such, the width of Runway 3-21 should continue to be maintained through the long term planning period.

The pavement strength for Runway 3-21 is reported at 30,000 pounds single wheel loading (SWL), 95,000 pounds dual wheel loading (DWL), 120,000 pounds dual single wheel loading (2SWL), and 140,000 pounds dual tandem wheel loading (DTWL). While aircraft weighing more than the certified strength can operate on the runways, the life span of the pavements can be shortened due to the utilization of these heavier loads over time. Future consideration should be given to increasing the pavement strength to 150,000 pounds DWL. This strength rating will better accommodate operations by commercial service aircraft and larger business jets that currently operate at the airport in addition to the potential for larger commercial service aircraft to utilize the airport in the future.

The FAA has recently moved to implementing the International Civil Aviation Organization (ICAO) pavement classification number (PCN) for identifying strength of airport pavements. The PCN is a five-part code described as follows:

1) PCN Numerical Value: Indicates the load-carrying capacity of the pavement expressed as a whole number. The value is calculated based on a number of engineering factors such as aircraft geometry and pavement usage.
2) Pavement Type: Expressed as either R for rigid pavement (most typically concrete) or F for flexible pavement (most typically asphalt).
3) Subgrade Strength: Expressed as A (High), B (Medium), C (Low), or D (Ultra Low). A subgrade of A would be considered very strong, like concrete-stabilized clay, and a subgrade of D would be very weak, like un-compacted soil.
4) Maximum Tire Pressure: Expressed as W (Unlimited/No Pressure Limit), X (High/254 psi), Y (Medium/181 psi), or Z (Low/72 psi). This indicates the maximum tire pressure the pavement can support. Concrete surfaces are usually rated W.
5) Process of Determination: Expressed as either T (technical evaluation) or U (physical evaluation). This indicates how the pavement was tested.

As a part of the ALP update associated with this Master Plan, the pavement strength and PCN value for Runway 3-21 will be determined based on the runway reconstruction/rehabilitation project.

RUNWAY SHOULDERS

Runway shoulders provide resistance to blast erosion and accommodate the passage of maintenance and emergency equipment and the occasional passage of an aircraft veering from the runway. Runway 3-21 currently does not have shoulders; however, the runway is currently undergoing a reconstruction/rehabilitation project that includes the implementation of paved runway shoulders. Paved shoulders are required for runways accommodating ADG IV and higher aircraft and are recommended for runways accommodating ADG III aircraft.

The FAA design for runway shoulders associated with ADG III aircraft is 25 feet. The paved runway shoulders being constructed will meet ultimate ADG III standards, as depicted on **Exhibit 4D**.

VISUAL APPROACH AIDS

Certain approach aids provide information to pilots to indicate if they are on the correct glide path to the runway for landing. Currently, each end of Runway 3-21 is equipped with a four-box precision approach path indicator (PAPI-4).

Runway end identification lights (REILs) should be considered for all runway ends not planned for a more sophisticated approach lighting system, such as the MALSR that exists on Runway 21. Facility planning considers the implementation of REILs on Runway 3.

Analysis in Chapter Three recommended a segmented circle be constructed on the airfield. As part of the airside analysis, a segmented circle is proposed with an existing windcone approximately 1,000 feet south of the Runway 21 displaced threshold. The segmented circle could be constructed at ground level so as not to interfere with the safety areas associated with the runway system.

HOLD LINE MARKINGS

The current hold line markings on taxiways associated with Runway 3-21 are located 250 feet from the runway centerline, which meet existing C-II standards. The standard for hold lines associated with ultimate RDC C-III standards is 250 feet, plus one foot for each additional 100 feet above sea level. As depicted on **Exhibit 4D**, planning should consider relocating the hold lines on the taxiways to a distance of 321 feet from the runway centerline to meet ultimate design standards.

HOLD APRONS

Exhibit 4D includes the construction of a hold apron adjacent to the south end of parallel Taxiway A that would serve Runway 3. This is a similar concept to the hold apron farther north serving aircraft departing Runway 21. It should be noted that a proposed hold apron on the south end of the airfield serving Runway 3 would require significant fill and grading as the terrain drops considerably when moving west of the parallel taxiway.

The FAA has provided updated guidance on the configuration of hold aprons. This guidance recommends that hold aprons be designed to allow aircraft to bypass one another to taxi to the runway. Under this concept, each parking area on the hold apron is independent, with the ability for aircraft to bypass others both on entrance and exit. This design would warrant a much deeper hold apron, and given the terrain constraints west of Taxiway A, this design configuration is not recommended.

Another option, although not depicted, would be to construct a bypass taxiway north of Taxiway A9. Bypass taxiways are common on airfields at busy airports that have an airport traffic control tower (ATCT). Bypass taxiways provide flexibility in runway use by permitting ground maneuvering of steady streams of departing aircraft. Although operational activity at Flagstaff Airport does not warrant a by-pass taxiway for capacity purposes, this is another option for aircraft desiring a holding location when considering the terrain constraints and costs associated with constructing a hold apron adjacent to the west side of Taxiway A.

AIRFIELD LIGHTING

During the course of the planning period, high intensity runway lighting (HIRL) should continue to be applied to Runway 3-21 and medium intensity taxiway lighting (MITL) should be provided on all existing and proposed taxiways serving the runway system. This includes Taxiway W, which currently is not served by MITL. At a minimum, edge reflectors should be implemented on Taxiway W as it serves significant general aviation activity on the airfield. In addition, the airport should consider removing the incandescent airfield lighting and signage systems, and replacing them with light emitting diode (LED) technology.

These lighting upgrades could be undertaken in the event of a reconstruction/rehabilitation pavement project associated with various pavements on the runway and taxiway system. LED lighting has many advantages, including lower energy consumption and longer lifetimes. Furthermore, the implementation of LED lighting on various airside and landside infrastructure is one of the key initiatives in the *Flagstaff Airport Sustainability Plan*.

TAXIWAY DESIGN

Taxiway design has historically followed the critical aircraft utilizing the runway and taxiway system. Common design issues have included parallel taxiway separation from the runway, taxiway width, and overall system efficiency. FAA AC 150/5300-13A, Change 1, *Airport Design*, instituted new design standards for taxiways, some of which impact planning for Flagstaff Airport. Most of the new or updated standards were enacted to mitigate the potential for runway incursion events. Changes were also aimed at improving pilot situational awareness. The FAA has indicated that all airfields should be planned to meet these standards. Actual changes will be made over time as grant funding is made available.

Flagstaff Airport is served by a taxiway system which includes a full-length parallel taxiway and nine entrance/exit taxiways serving Runway 3-21. While the existing taxiway system meets certain standards outlined in the AC, there are some issues that should be addressed. The following are the taxiway geometry concerns on the airfield:

- Taxiways A7 and A8 provide direct access to the runway system from an aircraft parking apron.
- Taxiway A6 connects directly to Taxiway W which extends farther west serving landside development areas.
- Taxiway A6 could be considered a wide throat taxiway given its width of over 100 feet.

Indirect Access

A new taxiway design standard put into place under AC 150/5300-13A, Change 1, is the prohibition of direct access between an aircraft parking area and a runway. At Flagstaff Airport, Taxiways A7 and A8 extend east of the aircraft parking apron and offer a direct pavement connection to Runway 3-21. Taxiway routing markings are not considered sufficient per FAA guidance. As such, the FAA recommends constructing "No Taxi Islands" or removing the taxiways and replacing them in a location that does not provide direct access.

"No Taxi Islands" can be developed using markings around the island, green paint to identify the island, and lighting around the island; or, the islands can be developed by removing the pavement altogether. Either option will present an obstruction which will require a pilot to navigate a turn prior to entering a runway environment. The FAA has found that requiring a turn prior to entering a runway can minimize runway incursion events. **Exhibit 4D** depicts the general location of the "No Taxi Islands" associated with Taxiways A7 and A8 in order to prevent direct access from the parking apron to the runways.

It should be noted that another option (not depicted) to improve taxiway geometry, although more significant, would be to eliminate Taxiway A7. The distance between Taxiways A7 and A8 are approximately 800 feet. When moving farther north along the runway system, Taxiway A6 is only 550 feet from Taxiway A7. As such, there would still be sufficient opportunities for aircraft to exit the runway system. Furthermore, a "No Taxi Island" would not be needed adjacent to Taxiway A7, thus maximizing space for general aviation aircraft parking needs.

Another geometry concern is related to Taxiway A6 and its connection to Taxiway W. This current configuration provides access to landside development to the west, including general aviation facilities as well as the commercial terminal complex and parking apron. Since Taxiway A6 is utilized frequently by aircraft exiting the runway system, one option (not depicted) would be to keep the taxiway in its current location and relocate the east portion of Taxiway W farther south in order to discontinue the direct connection between the two taxiways. This option would encroach upon the existing aircraft parking apron that currently serves general aviation activities, but could allow for increased aircraft parking for commercial service aircraft on the north side adjacent to the passenger terminal complex. A second option (not depicted) could include the removal of Taxiway A6 as an exit taxiway to the runway system; however, this is not preferred given the volume of activity that this taxiway experiences from aircraft exiting the runway system.

Wide Throat Taxiway / Wide Expanse of Pavement

Taxiway A6 is currently 107 feet wide. As detailed in Chapter 3, the FAA discourages wide throat taxiway entrances and wide expanses of pavement as they have been demonstrated to cause pilot confusion. Furthermore, given the geometry concern associated with Taxiways A6 and W as previously discussed, consideration should be given to narrowing the width of Taxiway A6 in the future if it is to remain in its current location. In order to meet Taxiway Design Group (TDG) III standards, a minimum taxiway width of 50 feet is required.

Taxiway Exit Analysis

An analysis of the taxiway exits serving Runway 3-21 was conducted to further evaluate taxiway geometry and to examine potential opportunities to improve circulation. **Exhibit 4F** presents an analysis of the current exit taxiways serving Runway 3-21. The exhibit shows the distance from the landing threshold to the exit taxiway in both directions. FAA AC 150/5300-13A, *Airport Design*, presents a methodology to assess the utilization percentages for taxiway exits based on location. The methodology considers both right-angled and acute-angled exits (which typically have a higher utilization rate for larger aircraft) and presents an approximate percentage of the small[1] single engine, small[1] twin-engine, large[2], and heavy[3] aircraft fleet that can utilize the exits under both wet and dry conditions.

For arrivals on Runway 3, most small single engine aircraft can exit the runway at Taxiway A7, and this percentage increases moving farther north. At Taxiway A4, it is estimated that 100 percent of small single engine aircraft can exit the runway system. For small twin-engine aircraft, Taxiway A5 can accommodate just over 50 percent of operations, increasing to 100 percent at Taxiway A3. Under dry conditions, the utilization percentages are even higher for small single engine and twin-engine aircraft on the exit taxiways closer to the Runway 3 landing threshold. Large and heavy aircraft are more likely to utilize Taxiways A3 and A2 or rollout to the end of the runway. Under wet conditions, most large and heavy aircraft utilize Taxiway A2 or rollout to the runway end.

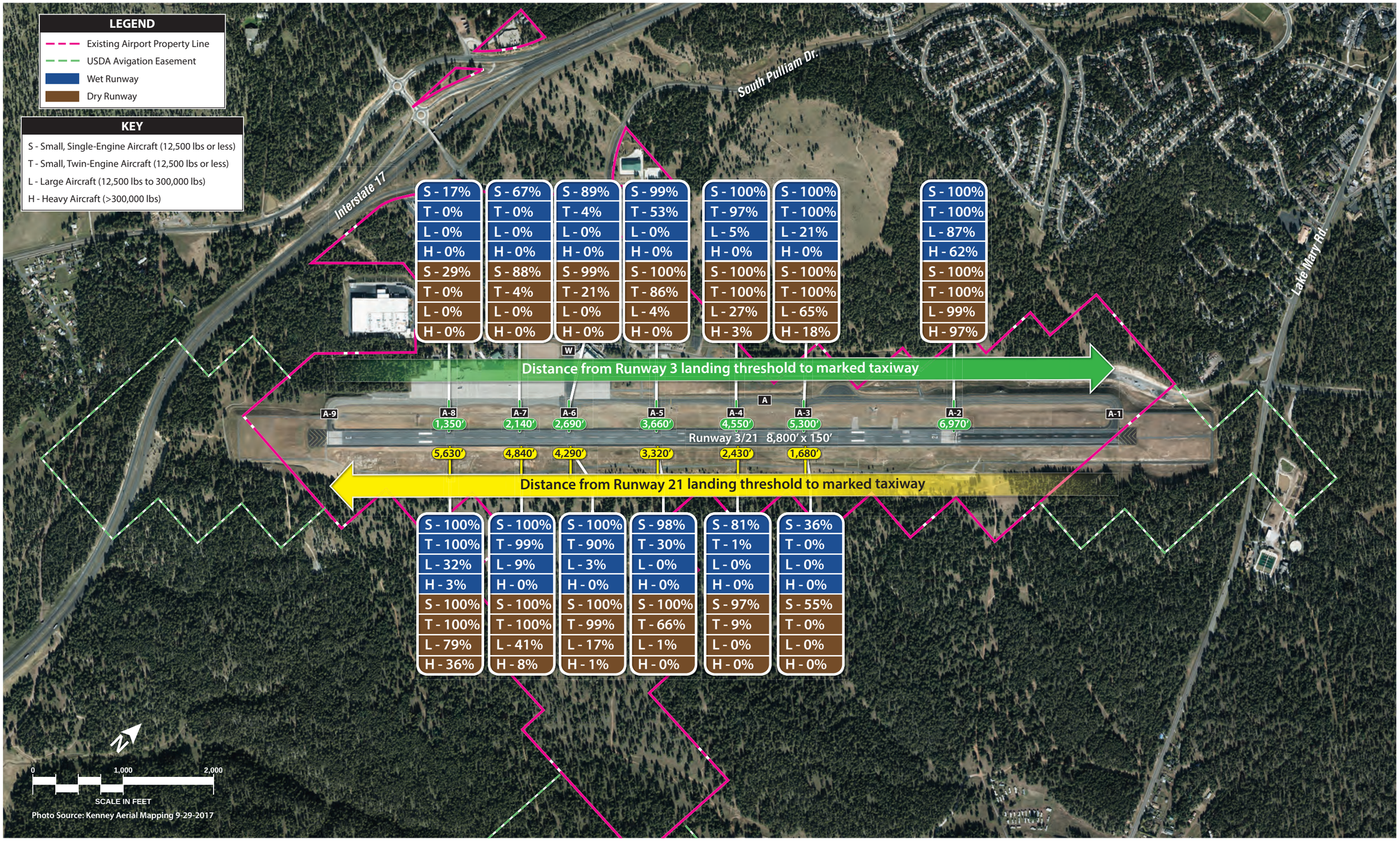
For arrivals on Runway 21, considering the 1,800-foot displaced landing threshold, the majority of small single engine aircraft can exit the runway at Taxiways A4 and A5 under wet conditions. Small twin-engine aircraft likely utilize Taxiway A6 under these same conditions. For dry conditions, these small aircraft can look to exit the runway system farther north, beginning with Taxiways A4 and A5. Large and heavy aircraft typically exit at Taxiway A8 or rollout to the end of the runway during dry and wet conditions.

INSTRUMENT APPROACH CONSIDERATIONS

The instrument approach capability at an airport is an important consideration that directly impacts the utility of the airport, with lower visibility minimums increasing the utility of an airport. From an economic development standpoint, it is important to achieve the lowest possible visibility minimums. The best approach minimums possible will prevent aircraft from having to divert to another airport, which can create additional operating costs and time delays for aircraft operators, their passengers and cargo, as well as on-airport businesses.

Flagstaff Airport is currently equipped with a ½-mile visibility minimum precision ILS approach to Runway 21. Each end of Runway 3-21 is equipped with an area navigation (RNAV) global positioning system (GPS) approach, which provides visibility minimums down to ½-mile on Runway 21 and ¾-mile on Runway 3. Runway 21 is also equipped with a non-precision very high omnidirectional range (VOR) approach with

[1] Small aircraft are defined as those weighing less than 12,500 pounds.
[2] Large aircraft are defined as those weighing between 12,500 and 300,000 pounds.
[3] Heavy aircraft are defined as those weighing greater than 300,000 pounds.


LEGEND
Existing Airport Property Line
USDA Avigation Easement
Wet Runway
Dry Runway
KEY
S - Small, Single-Engine Aircraft (12,500 lbs or less)
T - Small, Twin-Engine Aircraft (12,500 lbs or less)
L - Large Aircraft (12,500 lbs to 300,000 lbs)
H - Heavy Aircraft (>300,000 lbs)
Interstate 17
South Pulliam Dr.
Lake Mary Rd.
S - 17% T - 0% L - 0% H - 0% S - 29% T - 0% L - 0% H - 0%
S - 67% T - 0% L - 0% H - 0% S - 88% T - 4% L - 0% H - 0%
S - 89% T - 4% L - 0% H - 0% S - 99% T - 21% L - 0% H - 0%
S - 99% T - 53% L - 0% H - 0% S - 100% T - 86% L - 4% H - 0%
S - 100% T - 97% L - 5% H - 0% S - 100% T - 100% L - 27% H - 3%
S - 100% T - 100% L - 21% H - 0% S - 100% T - 100% L - 65% H - 18%
S - 100% T - 100% L - 87% H - 62% S - 100% T - 100% L - 99% H - 97%
W
A
A-9
A-8 1,350′ 5,630′
A-7 2,140′ 4,840′
A-6 2,690′ 4,290′
A-5 3,660′ 3,320′
A-4 4,550′ 2,430′
A-3 5,300′ 1,680′
A-2 6,970′
A-1
Runway 3/21 8,800′ x 150′
Distance from Runway 3 landing threshold to marked taxiway
Distance from Runway 21 landing threshold to marked taxiway
S - 100% T - 100% L - 32% H - 3% S - 100% T - 100% L - 79% H - 36%
S - 100% T - 99% L - 9% H - 0% S - 100% T - 100% L - 41% H - 8%
S - 100% T - 90% L - 3% H - 0% S - 100% T - 99% L - 17% H - 1%
S - 98% T - 30% L - 0% H - 0% S - 100% T - 66% L - 1% H - 0%
S - 81% T - 1% L - 0% H - 0% S - 97% T - 9% L - 0% H - 0%
S - 36% T - 0% L - 0% H - 0% S - 55% T - 0% L - 0% H - 0%
N
0
1,000
2,000
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017

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not lower than one-mile visibility minimums. It is important to note that the 2008 ALP calls for precision instrument approaches equipped with ½-mile visibility minimums (Category I or CAT-I) on both runway ends.

It should be noted that this alternatives analysis was prepared prior to the implementation of instrument approach enhancements at the airport. At the time of the analysis, Runway 21 was provided not lower than ¾-mile visibility minimums and Runway 3 was provided not lower than one-mile visibility minimums. Since this time, the approach visibility minimums have been lowered to ½-mile on Runway 21 and ¾-mile on Runway 3. The following analysis still analyzes improved visibility minimums on each end of Runway 3-21 at Flagstaff Airport so as to provide an understanding of the impacts associated with these recent changes. The dimensions of the RPZ will change in size if there are improvements to the instrument approach capabilities. **Table 4B** presents the dimensions of the RPZs based upon the approach visibility minimums that currently, or have the potential to, apply to the ends of Runway 3-21.

TABLE 4B
Runway Protection Zones

	Instrument Approach Capabilities		
Visibility Minimum	1-Mile	3/4-Mile	1/2-Mile
Approach Runway Protection Zone			
Inner Width	500	1,000	1,000
Outer Width	1,010	1,510	1,750
Length	1,700	1,700	2,500
Departure Runway Protection Zone			
Inner Width	500	500	500
Outer Width	1,010	1,010	1,010
Length	1,700	1,700	1,700

Source: FAA AC 150/5300-13A, Airport Design

Runway 21

Exhibit 4G illustrates two options for instrument approach procedures on Runway 21. Option 1 depicts the approach RPZ for a not lower than ¾-mile minimum approach associated with the ILS. As depicted, the RPZ remains on airport property, except for approximately 7.40 acres which is contained within the USDA avigation easement. The RPZ currently encompasses vacant land.

In Option 2, the approach RPZ would expand due to approach visibility minimums decreasing to lower than ¾-mile (½-mile). The proposed RPZ serving Runway 21 would extend farther northeast over currently vacant land and encompass 31.58 acres of land outside existing airport property. Most of this proposed RPZ would fall within the USDA avigation easement except for 3.4 acres in the northwest corner. An approach lighting system in the form of a MALSR is needed in order to achieve an approach providing less than ¾-mile visibility minimums; however, Runway 21 is currently served by a MALSR. This approach lighting system begins 200 feet from the landing threshold and extends approximately 2,400

feet in the approach area. As previously detailed, a portion of the existing MALSR system is built "in pavement" leading up to the 1,800-foot displaced threshold serving Runway 21.

Also presented in both options is the proposed extension of John Wesley Powell Boulevard. As detailed in Option 1, the proposed roadway alignment remains clear of the existing approach RPZ. In Option 2; however, the roadway alignment traverses the larger RPZ associated with a ½-mile visibility minimum approach. The FAA has further divided the RPZ into two areas: the Central Portion of the RPZ and the Controlled Activity Area. The Central Portion of the RPZ extends from the beginning to the end of the RPZ, centered on the runway centerline. Its width is equal to the width of the ROFA. The Controlled Activity Area is the remaining area of the RPZ on either side of the Central Portion of the RPZ.

Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ and it is desirable to clear the entire RPZ of all above-ground objects. Where this is impractical, airport owners, at a minimum, should maintain the RPZ clear of facilities supporting incompatible activities. This especially applies to the Central Portion of the RPZ.

Any change to the RPZ could require full compliance, including the proposed extension of John Wesley Powell Boulevard. It should be noted, however, that since the proposed roadway alignment is on the currently approved ALP from 2008, in certain circumstances the FAA could consider this condition to be grandfathered since the new RPZ guidance was issued after this timeframe. If the FAA determines this proposed roadway alignment not be grandfathered, the City of Flagstaff should work to realign a portion of the roadway to remain clear of the RPZ.

Runway 3

Exhibit 4H presents three options for instrument approach procedures on Runway 3. Option 1 depicts the approach RPZ for a not lower than one mile visibility minimum approach. The RPZ extends beyond the southwest end of the airport, encompassing 21.0 acres of land outside airport property in addition to a small portion of Interstate 17. Similar to the northeast end of Runway 3-21, an avigation easement is also in place to the southwest of the runway and fully encompasses the existing RPZ.

Option 2 depicts the approach RPZ associated with a not lower than ¾-mile visibility minimum approach on Runway 3. As depicted, the expanded RPZ would extend over 36.0 acres not currently owned by the airport. Almost the entirety of this RPZ would fall within the existing avigation easement previously discussed. A larger portion of Interstate 17 would be affected by the RPZ.

Option 3 presents the RPZ representative of a ½-mile visibility minimum instrument approach. The proposed RPZ serving Runway 3 would extend farther southwest encompassing 65.3 acres of land outside existing airport property. Of this, 5.1 acres would also fall outside the avigation easement and include residential land uses in the southwest corner of the RPZ's Controlled Activity Area. Under this option, a MALSR is depicted prior to the Runway 3 landing threshold in order to achieve visibility minimums below ¾-mile. The proposed MALSR extends beyond the existing airport property line and its placement would be affected by Interstate 17.

Option 1 - Not Lower than 3/4-Mile Visibility Minimums

Option 2 - Lower than 3/4-Mile Visibility Minimums

N

0 600 1,200

SCALE IN FEET

Photo Source: Kenney Aerial Mapping 9-29-2017

John Wesley Powell Blvd Future Extension

Lake Mary Rd.

A

A-2

A-1

Runway 3/21
8,800' x 150'

7.4 acres

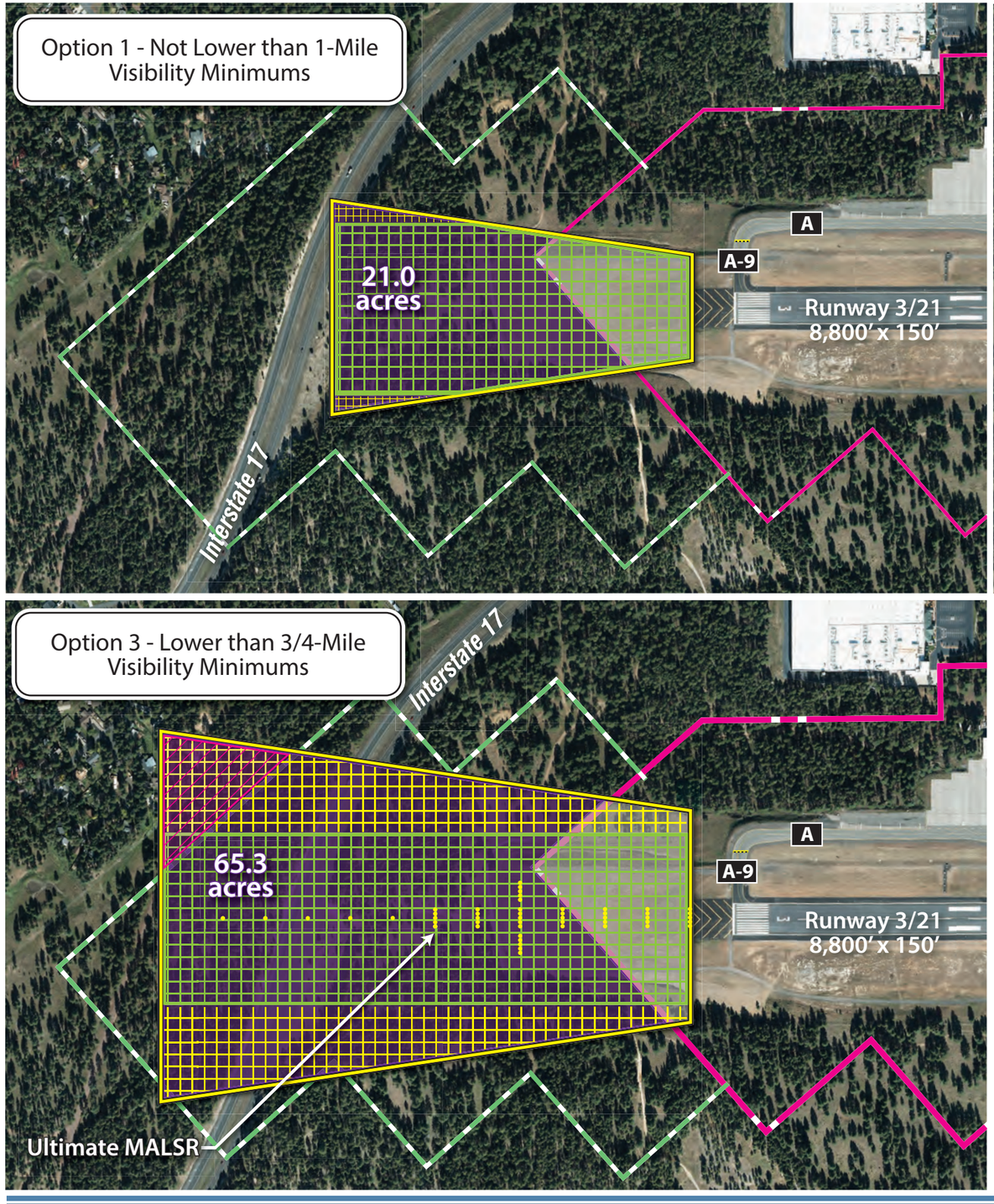
31.6 acres

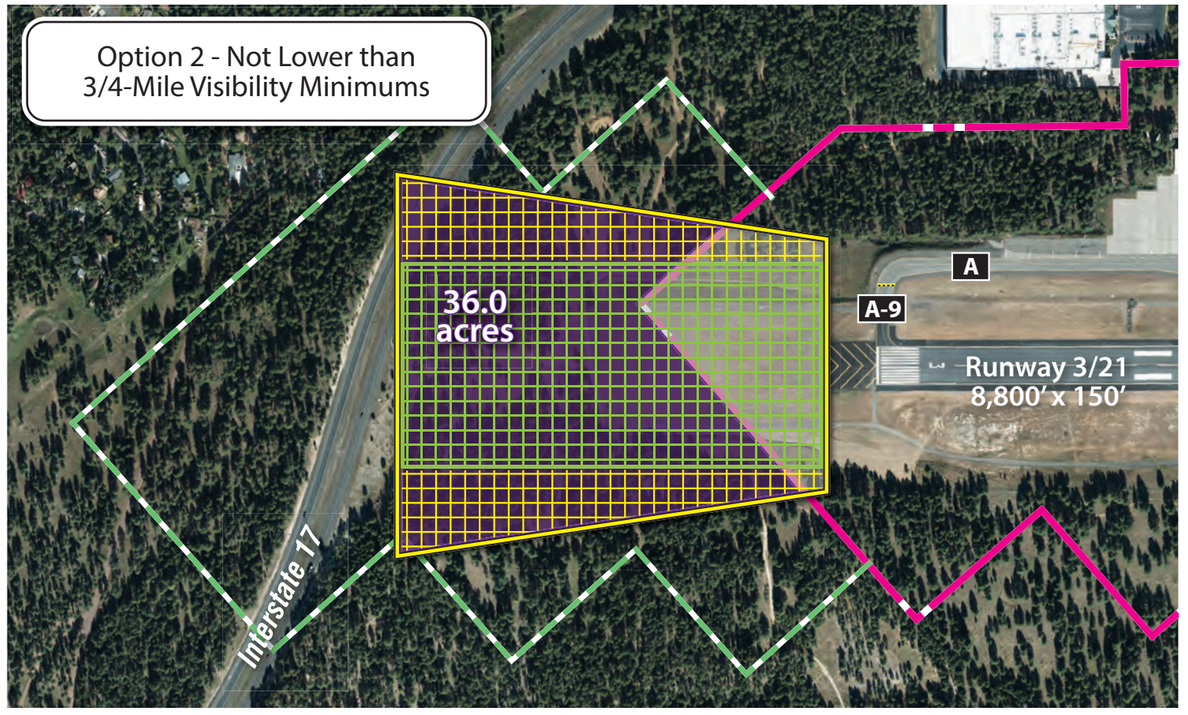
Existing MALSR

LEGEND

- Existing Airport Property Line
- USDA Avigation Easement
- Runway Protection Zone (RPZ)
- Consider Property Acquisition
- Proposed Roadway
- Central Portion of RPZ
- Controlled Activity Area
- MALSR — Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights

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LEGEND

- Existing Airport Property Line
- USDA Avigation Easement
- Runway Protection Zone (RPZ)
- Consider Property Acquisition
- Central Portion of RPZ
- Controlled Activity Area
- Residential Land Use
- **MALSR** Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights

N

0 600 1,200

SCALE IN FEET

Photo Source: Kenney Aerial Mapping 9-29-2017

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Instrument Approach Analysis Summary

In addition to the RPZs, the determination of airspace obstructions that may be associated with these improved approach procedures would need to be further evaluated. The two primary resources for determining airspace obstructions are Title 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace* and *Terminal Instrument Procedures* (TERPS). Part 77 is a filter which identifies potential obstructions, whereas TERPS is the critical tool in determining actual flight obstructions, as its analysis is used to evaluate and develop instrument approach procedures, including visibility minimums and cloud heights associated with approved approaches. Further determination by the FAA would be needed to determine the extent of removing or lowering potential obstructions that may exist in order to support an instrument approach procedure that could serve ultimate conditions proposed on Runway 3-21. The FAA has also set forth other various conditions and criteria for a runway to achieve lower visibility minimums. These conditions and criteria are outlined in **Table 4C**.

TABLE 4C
Standards for Instrument Approach Procedures

Criteria	Visibility Minimums	
	¾-mile to < 1 Mile	< ¾-mile
HATh	≥ 250 feet	<250 feet
TERPS GQS	Clear	Clear
PA final approach surfaces	Not Required	Clear
POFZ (PA & APV only)	Not Required	Required
TERPS Chapter 3, Section 3	20:1 Clear	34:1 Clear
ALP	Required	Required
Minimum Runway Length	3,200 feet	4,200 feet (paved)
Runway Markings	Non-precision	Precision
Holding Position Signs & Markings	Non-precision	Precision
Runway Edge Lights	HIRL/MIRL	HIRL/MIRL
Parallel Taxiway	Required	Required
Approach Lights	Recommended	MALSR, SSALR, or ALSF
Applicable Runway Design Standards, e.g. OFZ	≥ ¾-statute mile approach visibility minimums	< ¾-statute mile approach visibility minimums
Threshold Siting Criteria to be Met	20:1 Clear	34:1 Clear
Survey Required	VGS (PA & APV)/NVGS	VGS

HATh – Height Above Threshold
TERPS – United States Standard for Terminal Instrument Procedures
GQS – Glide Path Qualification Surface
OFZ – Obstacle Free Zone
PA – Precision Approach
POFZ – Precision Obstacle Free Zone
ALP – Airport Layout Plan
HIRL – High Intensity Runway Lights
MIRL – Medium Intensity Runway Lights
MALSR – Medium Intensity Runway Lights with Runway Alignment Indicator Lights
SSALR – Simplified Short Approach Lighting System with Runway Alignment Indicator Lights
ALSF – Approach Lighting System with Sequenced Flashing Lights
VGS – Vertically Guided Survey
NVGS – Non-Vertically Guided Survey
APV – Approach with Vertical Guidance
Source: FAA Advisory Circular 150/5300-13A, *Airport Design*

Due to advancements in technology associated with instrument approach procedures, the proposed instrument approach options would require minimal enhancements to ground-based navigational aids, as these runway ends are currently served by global positioning system (GPS) technologies. For Runway 3, the option of lowering visibility minimums below ¾-mile would require the installation of a MALSR, which can cost approximately $1 million to install. However, it should be noted that over 90 percent of the total cost could be eligible for FAA/ADOT-MPD – Aeronautics Group grant funding.

As previously detailed, any change to the runway environment that includes a new or revised instrument approach procedure that increases the RPZ dimensions is subject to a further evaluation of the RPZs meeting updated guidance from the FAA. If an airport cannot fully control the entirety of the RPZ from being free of incompatible land uses, the FAA can require a change to the runway environment to properly secure the RPZs. In the event that enhanced instrument approach procedures are pursued on either runway end at the airport, it is important that airport management properly coordinate with the FAA to ensure full use of the runway being affected.

AIRSIDE SUMMARY

The airside development considerations have focused on several elements that include mitigating safety area deficiencies, improving existing and future taxiway development on the airfield, enhancing instrument approach capabilities to the runway system, and analyzing other ancillary airfield support items. These alternatives will be considered by the PAC, airport management, City of Flagstaff, and the general public. Following discussion and review with these entities, a preferred recommended airside development concept will be drafted and presented in the next chapter.

ANALYSIS OF LANDSIDE DEVELOPMENT CONSIDERATIONS

Generally, landside issues are related to those facilities necessary or desired for the safe and efficient parking and storage of aircraft, movement of pilots and passengers to and from aircraft, airport support facilities, and overall revenue support functions. Landside planning considerations, summarized previously on **Exhibit 4C**, will focus on strategies following a philosophy of separating activity levels. To maximize airport efficiency, it is important to locate facilities together that are intended to serve similar functions. The best approach to landside facility planning is to consider the development to be like that of a community where land use planning is the guide. For airports, the land use guide in the terminal area should generally be dictated by aviation activity levels. Due to the amount of developable land available at Flagstaff Airport, consideration will also be given to non-aviation uses that can provide additional revenue support to the airport and support economic development for the region.

Landside planning issues focus on facility locating strategies following a philosophy of separating activity levels. The number of structures and the storage capacity available is limited. Therefore, it is important to plan for an appropriate mix of smaller T-hangars, executive hangars, and larger conventional hangars.

The orderly development of the airport terminal area (those areas parallel to the runway and along the flight line) can be the most critical, and probably the most difficult, development to control on an airport. A development approach of "taking the path of least resistance" can have a significant effect on the long-term viability of an airport. Allowing development without regard to a functional plan can result in a haphazard array of buildings and small ramp areas which will eventually preclude the most efficient use of valuable space along the flight line.

AVIATION ACTIVITY LEVELS

The aviation development areas should be divided into high, medium, and low activity levels at the airport. The high activity area should be planned and developed to provide aviation services on the airport. An example of the high activity areas is the airport terminal building and adjoining aircraft parking apron, which provides tiedown locations and circulation for aircraft. In addition, large conventional hangars used for FBOs, corporate aviation departments, or storing a large number of aircraft would be considered a high activity use area. The best location for high activity areas is along the flight line near midfield, for ease of access to all areas on the airfield. All major utility infrastructure would need to be provided to these areas.

The medium activity use category defines the next level of airport use and primarily includes smaller corporate aircraft that may desire their own executive hangar storage on the airport. The best location for medium activity use is off the immediate flight line, but still readily accessible to aircraft including corporate jets. Due to an airport's layout and other existing conditions, if this area is to be located along the flight line, it is best to keep it out of the midfield area of the airport, so as to not cause congestion with transient aircraft utilizing the airport. Parking and utilities, such as water and sewer, should also be provided in this area.

The low activity use category defines the area for storage of smaller single and multi-engine aircraft. Low activity users are personal or small business aircraft owners who prefer individual space in linear box hangars or T-hangars. Low activity areas should be located in less conspicuous areas. This use category will require electricity, but generally does not require water or sewer utilities.

In addition to the functional compatibility of the aviation development areas, the proposed development concept should provide a first-class appearance for Flagstaff Airport. As previously mentioned, the airport serves as a very important link to the entire region, whether it is for business or pleasure. Consideration to aesthetics should be given high priority in all public areas, as the airport can serve as the first impression a visitor may have of the community.

To allow for maximum development of the airport while keeping with mandated safety design standards, it is very important to devise a plan that allows for the orderly development of airport facilities. Typically, airports will reserve property adjacent to the runway system for aviation related activity exclusively. This will allow for the location of taxiways, aprons, and hangars.

SEPARATION STANDARDS

When planning landside facilities, consideration must be given to the design standards for separating structures. The separation standards are a function of the critical design aircraft for the future condition. Separation standards are directly related to the wingspan of the critical design aircraft, which ranges from 79 feet for ADG II to 118 feet for ADG III.

The taxiway object free area (TOFA) is the area required to be clear of object penetrations surrounding taxiways. For ADG II aircraft, the TOFA is 131 feet wide centered on the taxiway. For ADG III taxiways, the TOFA is 186 feet wide.

While these design standards should be implemented for all primary movement areas (e.g., parallel taxiways, aprons), facilities not intended to serve the critical design aircraft can be designed to different separation standards. For example, dual-lane Taxiway W that serves general aviation aircraft can apply separation standards for smaller single-engine aircraft in ADG I. As such, the TOFA associated with this taxiway is 89 feet wide.

HANGAR DEVELOPMENT

Analysis in the *Facility Requirements* chapter indicated that the airport should plan for the construction of additional aircraft hangars over the next 20 years. Hangar development takes on a variety of sizes corresponding with several different intended uses.

Commercial general aviation activities are essential to providing the necessary services on an airport. This includes privately owned businesses involved with, but not limited to, aircraft rental and flight training, aircraft charters, aircraft maintenance, line service, and aircraft fueling. These types of operations are commonly referred to as FBOs or specialized aviation service operators (SASOs). The facilities associated with businesses such as these include large conventional type hangars that hold several aircraft. High levels of activity often characterize these operations, with a need for apron space for the storage and circulation of aircraft. These facilities are best placed along ample apron frontage with good visibility from the runway system for transient aircraft. Utility services are needed for these types of facilities, as well as vehicle parking areas.

Aircraft hangars used for the storage of smaller aircraft primarily involve T-hangars, shade hangars, or linear box hangars. Since storage hangars often have lower levels of activity, these types of facilities can be located away from the primary apron areas in more remote locations of the airport. Limited utility services are needed for these areas.

Other types of hangar development can include executive hangars for accommodating either one larger aircraft or multiple smaller aircraft. Typically, these types of hangars are used by corporations with company-owned aircraft or by an individual or group of individuals with multiple aircraft. These hangar areas typically require all utilities and segregated roadway access.

Table 4D summarizes the aircraft hangar types and corresponding size and aviation uses that are typically associated with each facility. Currently, there is approximately 162,500 square feet of hangar space (including maintenance area) provided on the airport, made up of a combination of the hangar types previously discussed.

TABLE 4D
Aircraft Hangar Types

Hangar Type	Typical Size	Aviation Uses
Conventional	Clear span hangars greater than 10,000 square feet	FBOs, SASOs, and other commercial aviation activities resulting in high activity uses
Executive	Clear span hangars less than 10,000 square feet	SASOs, corporate flight departments, and private aircraft storage resulting in medium-to-high activity uses
T-Hangar/ Linear Box/ Shade	Individual storage spaces offering 1,200 - 1,500 square feet	Private aircraft storage resulting in low activity uses

FBO – Fixed Base Operator
SASO – Specialized Aviation Service Operator

AIRPORT SUPPORT FACILITIES

Airport support facilities are located in two separate areas on the airfield. Facilities located toward the south end of the general aviation aircraft parking apron house airport maintenance equipment and supplies. Farther north, the Airport Operations Center provides support equipment related to ARFF and snow removal. Consideration should be given to consolidating these support facilities in the future. As such, certain alternatives to follow will consider the construction of an airport support facility adjacent to the existing Airport Operations Center located north of the commercial passenger terminal area.

REVENUE SUPPORT LAND USES

Due to the amount of land on airport property exceeding the space needed for forecast aviation demand, consideration is given for Flagstaff Airport to utilize portions of its property for non-aviation purposes, to include commercial, industrial, or manufacturing development. It should be noted that the airport does not have the approval to use undeveloped property for non-aviation purposes at this time. Specific approval from the FAA will be required to utilize undeveloped property for non-aviation uses. This planning document does not gain approval for non-aviation uses, even if these uses are ultimately shown in the Master Plan and on the ALP. A separate request justifying the use of airport property for non-aviation uses will be required. This study can be a source for developing that justification.

An environmental determination will also be required. While FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, states that a release of an airport sponsor from federal obligations is normally categorically excluded and would not normally require an Environmental Assessment (EA), the issuance of a categorical exclusion is not automatic, and the FAA must determine that no extraordinary circumstances exist at the airport. Extraordinary circumstances would include a potentially significant

environmental impact to any of the environmental resources governed by federal law. An EA may be required if there are extraordinary circumstances. The generalized land use alternatives to follow outline areas on the airport which could be planned and ultimately developed for non-aviation related uses.

On-Airport Land Use Obligations

The airport has accepted grants for capital improvements from the FAA. As such, the City of Flagstaff (airport sponsor) has agreed to certain grant assurances. Grant assurances related to land use assure that airport property will be reserved for aeronautical purposes. If the airport sponsor wishes to sell (release) airport land or lease airport land for a non-aeronautical purpose (land use change), they must petition the FAA for approval. The ALP and the Airport Property Map must then be updated to reflect the sale or land use change of the identified property.

Release of Airport Property

A release of airport property would entail the sale of land that is not needed for aeronautical purposes currently or into the future. The following documentation is required to be submitted to the FAA for consideration of a land release:

1. What is requested.
2. What agreement(s) with the United States are involved.
3. Why the release, modification, reformation, or amendment is requested.
4. What facts and circumstances justify the request.
5. What requirements of state or local law or ordinance should be provided for in the language of an FAA-issued document if the request is consented to or granted.
6. What property or facilities are involved.
7. How the property was acquired or obtained by the airport owner.
8. What is the present condition and what present use is made of any property or facilities involved.
9. What use or disposition will be made of the property or facilities.
10. What is the appraised fair market value of the property or facilities. Appraisals or other evidence required to establish fair market value.
11. What proceeds are expected from the use or disposition of the property and what will be done with any net revenues derived.
12. A comparison of the relative advantage or benefit to the airport from sale or other disposition as opposed to retention for rental income.

Each request should have a scaled drawing attached showing all airport property and facilities which are currently obligated for airport purposes by agreements with the United States. Other exhibits supporting or justifying the request, such as maps, photographs, plans, and appraisal reports should be attached as appropriate. There are no areas of airport property currently planned for release from obligation and/or sale.

Land Use Change

A land use change permits land to be leased for non-aeronautical purposes; it does not authorize the sale of airport land. Leasing airport land to produce revenue from non-aeronautical uses allows the land to earn revenue for the airport, as well as serve the interests of civil aviation by making the airport as self-sustaining as possible. Airport sponsors may petition for a land use change for the following purposes:

- So that land not needed for aeronautical purposes can be leased to earn revenue from non-aviation uses. This is land that is clearly surplus to the airport's aviation needs.

- So that land which cannot be used for aeronautical purposes can be leased to earn revenue from non-aviation uses. This is land that cannot be used by aircraft or where there are barriers or topography that prevents an aviation use.

- So that land not presently needed for aeronautical purposes can be rented on a temporary basis to earn revenue from non-aviation uses.

A land use change shall not be approved by the FAA if the land has a present or future airport or aviation purpose, meaning the land has a clear aeronautical use. However, if land is not needed for aeronautical purposes until a long term condition is met, a land use change may be justified and granted for a short term use. Ordinarily, land on or in proximity to the flight line and airport operations area is needed for aeronautical purposes and should not be used or planned for non-aviation purposes.

The proceeds derived from the land use change must be used exclusively for the benefit of the airport. The proceeds derived from the land use change may not be used for a non-airport purpose, and they cannot be diverted to the airport sponsor's general fund or for general economic development unrelated to the airport.

Generally, a land use change of airport property will be reviewed on a case-by-case basis at the time that the change is necessary. However, the airport land use drawing, which is included as part of the ALP set, shows those areas likely eligible to be released from obligation.

PASSENGER TERMINAL COMPLEX AND SUPPORT

Terminal buildings serve as a central entrance to the community for air travelers, so aesthetics of design should be considered. A welcoming entrance to the City of Flagstaff may positively influence economic activity in the region. The terminal building at Flagstaff Airport currently serves two primary functions:

1. Commercial passenger airline service and support functions
2. Airport administration

The terminal building is currently utilized by American Airlines in offering commercial passenger services. American Airlines operates 70-seat Bombardier CRJ-700 regional jets. The terminal building provides

space for airline ticketing and operations, Transportation Security Administration (TSA) security screening services, a departure hold room, baggage claim area, and rental car counter facilities. Additional space in the terminal building is dedicated for airport administration, restaurant/vending services, and restrooms.

As detailed in Chapter Three, the review of the capacity and requirements for various terminal complex functional areas are inadequate to serve certain existing and projected commercial service demands at the airport, namely those related to security, baggage claim, and internal circulation. In 2015, Flagstaff Airport experienced approximately 67,400 passenger enplanements. More recently in 2016, the airport experienced slightly less than 65,000 enplanements. Aviation demand forecasts in this Master Plan indicate that the airport could potentially experience 125,000 annual enplanements by the long term planning horizon. It should be noted that a high range passenger enplanement envelope was also considered during this study that yields a potential for up to 155,000 annual enplanements through the long term planning period.

Terminal Design Concepts

Primary guidance on terminal design is provided in FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*. Additional guidance is provided in *Airport Passenger Terminal Planning and Design: Volume 1 Guidebook*, as published by the Airport Cooperative Research Program (ARCP - Report 25).

There are several basic terminal design concepts: simple, linear, pier finger, satellite, and transporter. A simple terminal design concept involves a single building accommodating all passenger processing functions (ticketing, bag claim, departure lounges). Aircraft parking is adjacent to the airside portion of the building and normally involves ground level boarding. A simple terminal design concept offers the advantage of close-in vehicle parking and reduced walking distances to the terminal. Additionally, walking distances within the terminal are minimized. With a single departure area, security screening is usually achieved through one location.

A linear terminal design concept builds upon the simple terminal design concept by providing for a longer building to provide for aircraft parking along the entire length of the building. A linear terminal design is distinguished from a simple terminal design as common facilities (such as departure areas, ticket counters, etc.) may be duplicated throughout the building. A linear terminal design can be easily expanded on either end to provide for additional space if needed. The existing terminal building is considered a combination simple-linear terminal design as some functions are consolidated (ticketing, security, passenger hold room, baggage claim).

The pier finger terminal design concept builds upon the simple terminal design by providing for aircraft gate and departure areas along a pier extending onto the apron from the building. In contrast to the simple/linear terminal design, the pier finger terminal design has the advantage of providing for centralized ticketing and bag claim functions without having to duplicate these features in other portions of the terminal. This offers operating efficiencies for the airlines and easier aircraft movements along the

apron. Walking distances become a factor in this design as some aircraft gates can be located a considerable distance from the main terminal. Apron design is an important component of the pier finger design as the apron must allow for the development of the pier finger while providing for adequate taxiway areas.

A comparison of the terminal building concepts to forecast enplanement levels is presented in **Table 4E**. Local factors must be taken into consideration when determining which design concept to select for an airport. Physical factors such as developable space, terrain, existing facilities, and roads should be considered. Other terminal building concepts include the satellite terminal design and transporter terminal design. These concepts are generally associated with larger airports that experience at least 500,000 annual enplanements.

With a long term forecast enplanement level of 125,000 (high range forecast of 155,000), FAA guidance suggests a simple/linear design with apron level boarding, which is what exists today. More modern facilities might also include second level boarding with loading bridges or a combination of passenger loading options. The following terminal area alternatives present different options for expanding the terminal building and associated aircraft parking apron to meet projected aviation demand.

TABLE 4E
Terminal Building Concepts Related to Enplanement Levels

Airport Size by Annual Enplanements	Design Concept	Simple	Linear	Pier Finger	Satellite	Transporter	Physical Concepts	Single Level Curb	Multi-Level Curb	Single Level Terminal	Multi-Level Terminal	Apron Level Boarding	Aircraft Level Boarding
Feeder under 25,000		X	X					X		X		X	
Secondary 25,000-75,000		X	X					X		X		X	
75,000-200,000		X	X					X		X		X	
200,000-500,000		X	X	X				X		X		X	

Source: FAA AC 150/5360-13, Planning and Design Guidelines for Airport Terminal Facilities

TERMINAL AREA VEHICLE PARKING

The existing terminal area provides a total of 452 vehicle spaces for public parking and rental cars. Existing demand has already placed a burden on current vehicle parking, and during peak travel seasons, the parking lot can exceed capacity, creating congestion. Forecast projections indicate a need to double the amount of terminal area vehicle parking over the next 20 years. Therefore, consideration is given to alternatives to alleviate terminal parking lot congestion.

Parking lot congestion can be alleviated in one of two ways: 1) suppress demand or 2) increase capacity. The simplest method of suppressing demand is by implementing parking fees. A nominal fee would

deter non-airport users from utilizing the lot and would create a revenue stream for the airport; however, free parking is utilized as an incentive to prevent passenger leakage to other airports such as Phoenix Sky Harbor International Airport. Furthermore, the airport experiences very little in the way of non-airport users utilizing the terminal lot for parking/storage of vehicles.

Another alternative is to construct additional parking capacity. The existing terminal area can accommodate parking lot expansion in areas adjacent to the existing parking lot as well as to the north of South Pulliam Drive. There are constraints and disadvantages to parking lot expansion that include drainage areas and the distance required to walk between the parking lot and ticketing area of the terminal building.

Another alternative is to construct a remote parking lot elsewhere on airport property and shuttle passengers to/from the terminal. For this alternative to work, the City of Flagstaff would need to identify property to accommodate remote parking, construct the parking lot, purchase shuttle vehicles, and hire drivers to shuttle passengers to/from the terminal. Operating a shuttle operation is costly and is typically the least desirable alternative to add vehicle parking capacity. As such, this alternative is no longer considered.

An additional alternative is to go vertical with the construction of a vehicle parking garage in the existing parking lot. A parking garage would allow for increased close-in parking capacity without the disturbance of undeveloped land and without the need to shuttle passengers. It would also help to protect vehicles from the seasonal weather elements, especially during the winter months when the region can experience significant snowfall. A garage can also be expanded with additional levels over time as demand dictates. A drawback to a parking garage is that it can be difficult to construct one that blends with the existing aesthetic of the terminal building. Furthermore, a parking garage would be significantly more expensive to construct than a standard surface lot, and would temporarily restrict the use of a substantial portion of the existing parking lot during construction. The terminal area alternatives to follow include a variety of options to expand terminal area parking that can better accommodate the current and long term demand of the general public as well as rental cars.

The *Flagstaff Airport Sustainability Plan* also identified initiatives related to studying and improving terminal parking needs that include keeping parking costs low and walk times to the terminal building short. These initiatives will be further evaluated during the alternatives analysis in order to best meet future vehicle parking requirements at Flagstaff Airport.

TERMINAL AREA ALTERNATIVES

The following section describes a series of landside alternatives as they relate to considerations detailed above. Commercial passenger activity at Flagstaff Airport is well established on the west side of the airport. This area can continue to accommodate the forecast demand for commercial service through the long term planning period of this Master Plan and is the most readily available for development given existing roadway access and utility infrastructure.

Four alternatives have been developed with emphasis given to expanding the existing terminal building to add more space for various functional areas. In addition, the associated aircraft parking apron immediately east of the terminal complex and vehicle parking and circulation west of the terminal complex are also evaluated in order to maximize space for these activities.

The alternatives provide potential development plans aimed at meeting the needs of commercial passenger service levels and support functions. The alternatives to be presented are not the only options for development. In some cases, a portion of one alternative could be intermixed with another. Also, some development concepts could be replaced with others. The final recommended plan only serves as a guide for the airport which will aid the City of Flagstaff in the strategic planning of airport property. Many times, airport operators change their plan to meet the need of specific users. The goal in analyzing landside development alternatives is to focus future development so that airport property can be maximized.

Terminal Area Alternative 1

Terminal Area Alternative 1 is depicted on the left side of **Exhibit 4J**. This alternative proposes a terminal expansion to the northeast totaling approximately 12,000 square feet. This expansion combined with the existing terminal building space would provide over 36,000 square feet of overall building area, meeting the projected needs through the long term planning period and even satisfying the high range enplanement forecasts. The northeasterly expansion could accommodate arriving passengers in the form of relocated baggage claim and rental car counters. This would be preferred as this alternative also maintains a portion of the existing rental car ready/return lot immediately northeast of the terminal expansion.

Portions of the existing terminal could be reconfigured to allow for increased security space and additional departure hold room area along the east side of the terminal building facing the aircraft parking apron. Other functional areas including concessions and internal circulation/public waiting could be accommodated with the proposed expansion.

Currently, enplaning and deplaning passengers use ground-level boarding associated with aircraft parking adjacent to the east side of the terminal complex, and this alternative continues with this concept. In order to improve the efficiency and circulation of aircraft movement within the terminal area, approximately 7,100 square yards of parking apron expansion is proposed to the northeast. This space would allow for up to four aircraft parking positions and provide space to store aircraft support and servicing equipment. It should be noted that this configuration meets FAA separation standards associated with the distance required from the runway centerline as well as the TOFAs for Taxiways A and W.

This alternative also addresses the demand for vehicle parking through the long term planning period. As previously mentioned, the proposed terminal expansion would necessitate the removal of a portion of the rental car ready/return lot. Demand currently realized at the airport calls for more rental car parking than what is currently available. In this alternative, a portion of the existing rental car ready/return lot could be utilized in addition to constructing a second lot immediately across South Pulliam Drive

in an area that is currently vacant. All total, approximately 140 parking spaces could be accommodated for rental cars in these two areas.

In order to satisfy general public parking demand, additional surface lot expansion would occur farther west in areas adjacent to the existing parking lot configuration. Furthermore, a new surface lot is proposed north of South Pulliam Drive. As proposed, over 260 additional vehicle parking spaces plus circulation would be offered within these expanded surface lots.

As previously discussed, the alternatives analysis also considers the expansion of airport support facilities. In this alternative, a new facility is proposed immediately northeast of the existing Airport Operations Center that would accommodate airport maintenance and snow removal equipment.

Terminal Area Alternative 2

Presented on the right side of **Exhibit 4J**, Terminal Area Alternative 2 considers a terminal expansion to the northeast as in Alternative 1. This expansion, however, does not encroach upon the existing rental car ready/return lot. In order to accommodate additional passenger demands in the terminal, this alternative also includes a building expansion to the east and proposes jet bridges leading to aircraft. The easterly expansion could allow for additional departure hold room area while portions of the northeasterly expansion could accommodate a shift of baggage claim and rental car counters in proximity to the rental car parking lot immediately northeast. This proposed expansion would also allow for the reconfiguration of portions of the existing terminal building to better accommodate other functional areas such as security, internal circulation/public waiting, and concessions. All total, over 39,000 square feet of terminal space would be offered. Like the previous alternative, Terminal Area Alternative 2 proposes a 7,100 square-yard aircraft parking apron expansion that would better accommodate the circulation of aircraft on the parking apron, especially with the proposed introduction of jet bridges.

As proposed, expansion of the rental car ready/return lot is called for immediately northeast of the existing rental car lot. This expansion in addition to the existing lot would provide space for approximately 130 rental cars, more than doubling the number of spaces currently offered in this area. As a result of the additional rental car parking planned in this alternative, the Arizona Department of Public Safety (DPS) hangar facility would need to be relocated. In this alternative, that relocation occurs north of the Airport Operations Center. Given the importance of this entity and the services it provides to the surrounding region, it is imperative that airport staff and the City of Flagstaff continue to dedicate a location on the airfield to accommodate the DPS in the event that future terminal support expansion would warrant its relocation.

Public vehicle parking expansion is also proposed in this alternative. Instead of constructing a surface parking lot on the north side of South Pulliam Drive as in the previous alternative, this alternative considers a new parking lot south of the entrance roadway in an area that currently accommodates general aviation and air cargo parking. Similar to the previous alternative, over 260 additional vehicle parking spaces plus circulation would be provided in this and other proposed parking expansion areas. In order to satisfy the aircraft parking that would be displaced, a new parking apron is proposed immediately

Alternative 1

South Pulliam Dr

John Wesley Powell Blvd
Future Extension

61,500 sf
(164 spaces)

Vehicle
Parking
Expansion

16,000 sf
(42 spaces)

15,300 sf
(40 spaces)

5,700 sf
(15 spaces)

DRAINAGE

W

Terminal Building
Expansion 12,000 sf

37,500 sf
(107 spaces)

Rental Car Ready/
Return Lots

Airport Maintenance/
Snow Removal
Equipment Facility

Airport
Operations
Center

CRJ-700

8,215 sf
(32 spaces)

89'

CRJ-900

Boeing
737

Aircraft Parking
Apron Expansion

186'

A

A-7

A-6

A-5

Runway Centerline
to Aircraft Parking
Area - 500'

Runway 3/21 8,800'x 150'

N

0 300 600

SCALE IN FEET

Photo Source: Kenney Aerial Mapping 9-29-2017

Alternative 2

South Pulliam Dr

John Wesley Powell Blvd
Future Extension

W

62,700 sf
(167 spaces)

Vehicle
Parking
Expansion

Terminal
Building
Expansion
15,000 sf

16,000 sf
(42 spaces)

15,300 sf
(40 spaces)

5,700 sf
(15 spaces)

DRAINAGE

General Aviation/
Air Cargo
Parking Apron

Rental Car Ready/
Return Lot

CRJ-700

12,600 sf
(40 spaces)

32,300 sf
(92 spaces)

Airport
Operations
Center

Relocated Arizona
Department of
Public Safety
Hangar Facility

H

89'

CRJ-900

Boeing
737

Aircraft Parking
Apron Expansion

186'

A

A-7

A-6

A-5

Runway Centerline
to Aircraft Parking
Area - 500'

Runway 3/21 8,800'x 150'

LEGEND

- Existing Airport Property Line
- 5-Foot Ground Contours
- Taxiway Object Free Area
- Proposed Pavement
- Proposed Building
- Proposed Roadway/Parking
- Pavement to be Removed

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south of Taxiway W in an area that is currently vacant. This parking apron could provide parking and circulation for general aviation and air cargo activities.

Terminal Area Alternative 3

Terminal Area Alternative 3, shown on the left side of **Exhibit 4K**, proposes an expansion to the northeast of the existing terminal building, similar to what is depicted in Alternative 2. This expansion could accommodate functional areas related to arriving passengers including baggage claim and rental car counters and would allow for the reconfiguration of other functional areas in the existing terminal space to better meet future demand.

Unlike the other alternatives, Alternative 3 also proposes a concourse expansion by extending a pier to the east into the existing aircraft parking apron. In order for this concept to work, the portion of Taxiway W that traverses the south side of the terminal parking apron would need to be relocated approximately 300 feet south, thus providing the space necessary for the circulation of commercial aircraft utilizing the pier-concept concourse. All total, approximately 11,500 square feet of additional terminal space is offered in Alternative 3 that would provide an overall building area of nearly 36,000 square feet.

An advantage of shifting dual-lane Taxiway W to the south as proposed would be to address the taxiway geometry concern detailed earlier in the chapter related to the direct access that Taxiway A6 offers to Taxiway W and landside development. Shifting Taxiway W to the south would discontinue the potential for direct access to the runway system. A "No Taxi Island" could then be implemented on the portion of pavement leading to Taxiway A6, increasing situational awareness for pilots.

Since this alternative expands commercial aircraft parking and circulation opportunities to the south side of the existing terminal building, expansion of the rental car ready/return lot is proposed immediately adjacent to the northeast side of the existing aircraft parking apron. With this configuration, approximately 165 rental car spaces could be achieved when combined with the existing rental car lot.

This alternative also takes a different approach to vehicle parking for the general public through the construction of a multi-level parking structure. As proposed, this multi-level structure would have the ability to provide more parking in a limited space and helps to minimize walking distances to the terminal building. Besides the cost to construct and maintain a multi-level parking structure, another disadvantage of this parking concept is that it would obstruct the view of the mountains to the north of Flagstaff that can currently be seen from the front of the terminal building. As detailed in the previous Master Plan, the angle and placement of the terminal was set, in part, to take advantage of the mountain view. Nonetheless, this multi-level parking structure could provide space for approximately 324 vehicles when considering two levels. Additional surface lot expansion could provide over 80 additional parking spaces.

With less impact to existing support facilities farther north, this alternative allows the DPS hangar to remain. It also proposes the construction of an airport maintenance/snow removal equipment facility north of the Airport Operations Center as on Alternative 1.

Terminal Area Alternative 4

The fourth and final terminal area alternative is depicted on the right side of **Exhibit 4K** and involves constructing a new terminal building in the same general location of the existing facility. The angle that the existing terminal building is set to does create challenges, especially as it relates to aircraft parking and circulation adjacent to the east side of the facility. In this alternative, a new terminal would replace the existing facility and be situated in a manner that is parallel to the existing parking apron and runway/taxiway system. The new facility would follow a simple/linear design with the concourse/departure hold room area on the east side of the facility facing the aircraft parking apron. The potential for jet bridges leading to aircraft is also a possibility with this design. Expanded aircraft parking would satisfy up to four loading gates/bridges and provide adequate demand to meet long term passenger enplanement projections. All total, approximately 40,000 square feet of terminal space is offered with this concept.

On the west side of the proposed terminal, the reconfiguration of South Pulliam Drive is depicted that would lead to rental car and public parking surface lots. In this alternative, the rental car ready/return lot is located in the east portion of the existing public parking lot. This space could provide for approximately 184 rental cars. Additional parking for the general public is identified in areas farther west of the proposed rental car ready/return lot. This includes an expansion area inside of the reconfigured entrance of South Pulliam Drive in addition to another surface lot on the north side of the roadway. All total, an additional 405 vehicles plus circulation could be accommodated within these surface expansion lots.

Similar to Alternative 2, Terminal Area Alternative 4 provides for the construction of a new aircraft parking apron that can accommodate general aviation and air cargo activities that would be affected by the reconfiguration of South Pulliam Drive entering the terminal area. In addition, an airport support facility is proposed in proximity to the Airport Operations Center.

Terminal Area Alternatives Summary

The four terminal area alternatives provide space to better meet the functional needs of commercial passenger service operations in the future, as well as accommodating support functions associated with aircraft and rental car/vehicle parking. The first three terminal alternatives would make use of certain functional areas within the existing facility, with the overall concept of segregating arriving and departing passengers to the greatest extent possible. The potential introduction of jet bridges to accommodate enplaning and deplaning passengers is also considered in certain alternatives. It should be noted; however, that the terminal alternatives presented could also accommodate ground level boarding which is currently being practiced for commercial service operations at the airport.

As previously discussed, the location (angle) of the existing facility places challenges on the terminal area, especially as it relates to the use and circulation of the aircraft parking apron. The fourth terminal alternative calls for a new terminal building to be situated parallel to the airside environment. Although

Alternative 3

South Pulliam Dr

John Wesley Powell Blvd Future Extension

Vehicle Parking Expansion

16,000 sf (42 spaces)

15,300 sf (40 spaces)

Multi-Level Vehicle Parking Expansion

Two Levels 121,800 sf (324 spaces)

DRAINAGE

Terminal Building Expansion 11,500 sf

Relocated Dual-Lane Taxiway

CRJ-700

Boeing 737

CRJ-900

13,600 sf (50 spaces)

40,000 sf (114 spaces)

Rental Car Ready/ Return Lot

Airport Operations Center

Airport Maintenance/ Snow Removal Equipment Facility

89'

Converted Parking Apron/Circulation

No-Taxi Island

186'

Runway Centerline to Aircraft Parking Area - 500'

W

A

A-7

A-6

A-5

N

0 300 600

SCALE IN FEET

Photo Source: Kenney Aerial Mapping 9-29-2017

Alternative 4

South Pulliam Dr

John Wesley Powell Blvd Future Extension

61,500 sf (164 spaces)

Vehicle Parking Expansion

69,700 sf (186 spaces)

15,300 sf (40 spaces)

5,700 sf (15 spaces)

Rental Car Ready/ Return Lot

64,400 sf (184 spaces)

DRAINAGE

General Aviation/ Air Cargo Parking Apron

New Terminal Building 40,000 sf

Boeing 737

CRJ-900

CRJ-700

Airport Operations Center

Airport Maintenance/ Snow Removal Equipment Facility

89'

Aircraft Parking Apron Expansion

186'

Runway Centerline to Aircraft Parking Area - 500'

W

A

A-7

A-6

A-5

LEGEND

- Existing Airport Property Line
- 5-Foot Ground Contours
- Taxiway Object Free Area
- Proposed Pavement
- Proposed Building
- Proposed Roadway/Parking

Runway 3/21 8,800' x 150'

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this concept would be considered a long term vision for the airport, the costs and logistics required to construct a new building would be significant.

As mentioned earlier, these alternatives are simply a starting point. The next phase of the Master Plan can include a recommended development concept for terminal area improvements that will provide further detail to the layout of facilities after consultation with the PAC, City of Flagstaff, and the general public.

Similar to evaluating vehicle parking expansion opportunities, sustainable initiatives should be considered in any future expansion of the terminal building. The City of Flagstaff has already implemented several key initiatives outlined in the *Flagstaff Airport Sustainability Plan* into the current terminal layout, and it will be important to carry these forward and continue to implement other initiatives into a potential facility expansion in the future.

GENERAL AVIATION AND SUPPORT LANDSIDE ALTERNATIVES

Similar to previous alternatives discussed, the options available for general aviation and airport support landside development are numerous. This applies even more for landside development where demand presents itself at different times and by widely ranging groups.

General aviation activity at Flagstaff Airport is well established on the west side of the airport and consists of a mix of hangar types serving a wide range of aviation activity. This area can continue to accommodate the forecast demand for general aviation activity through the long term planning period of this Master Plan and is the most readily available for development given existing roadway access and utility infrastructure. As such, primary focus is given to this area through the first two alternatives. A third alternative does consider future airport development on the east side of the airport that takes into consideration previous planning that analyzed this area. This would likely occur beyond the long term planning period of this study.

The intent of this analysis is to present alternatives that provide straightforward development concepts aimed at meeting the needs of several service levels. Additionally, the alternatives offer separation of activity levels. In some cases, a portion of one alternative could be intermixed with another. Also, some development concepts could be replaced with others. The final recommended plan only serves as a guide for the airport. Many times, airport operators change their plan to meet the needs of specific users. The goal in analyzing these landside alternatives is to focus on future development so that airport property can be maximized.

Landside Alternative A

Landside Alternative A is depicted on **Exhibit 4L**. As presented, the primary development items include the addition of:

- Six large clear span conventional hangars
- Seven executive hangars
- One linear executive box hangar
- Three T-hangars or Shade Hangars
- Expanded aircraft parking apron space adjacent to the south side of Taxiway W
- Existing airport property designed for two future aviation related development parcels with direct access to Taxiway W
- Non-aviation development parcels with access to existing roadway infrastructure including John Wesley Powell Boulevard, Shamrell Boulevard, and South Pulliam Drive

As proposed, this alternative would make use of vacant property adjacent to Taxiway W and the existing general aviation development area. A mix of conventional, executive, and T-hangars/shade hangars are being proposed. Two aviation related development parcels are also situated farther west with access to the taxiway network. These parcels could accommodate hangar facilities and/or apron space for specialty aviation operators. Farther west, a conventional hangar is depicted near the existing FBO complex and would open to the existing general aviation parking apron. The vacant area immediately northeast of this location could accommodate expanded aircraft parking.

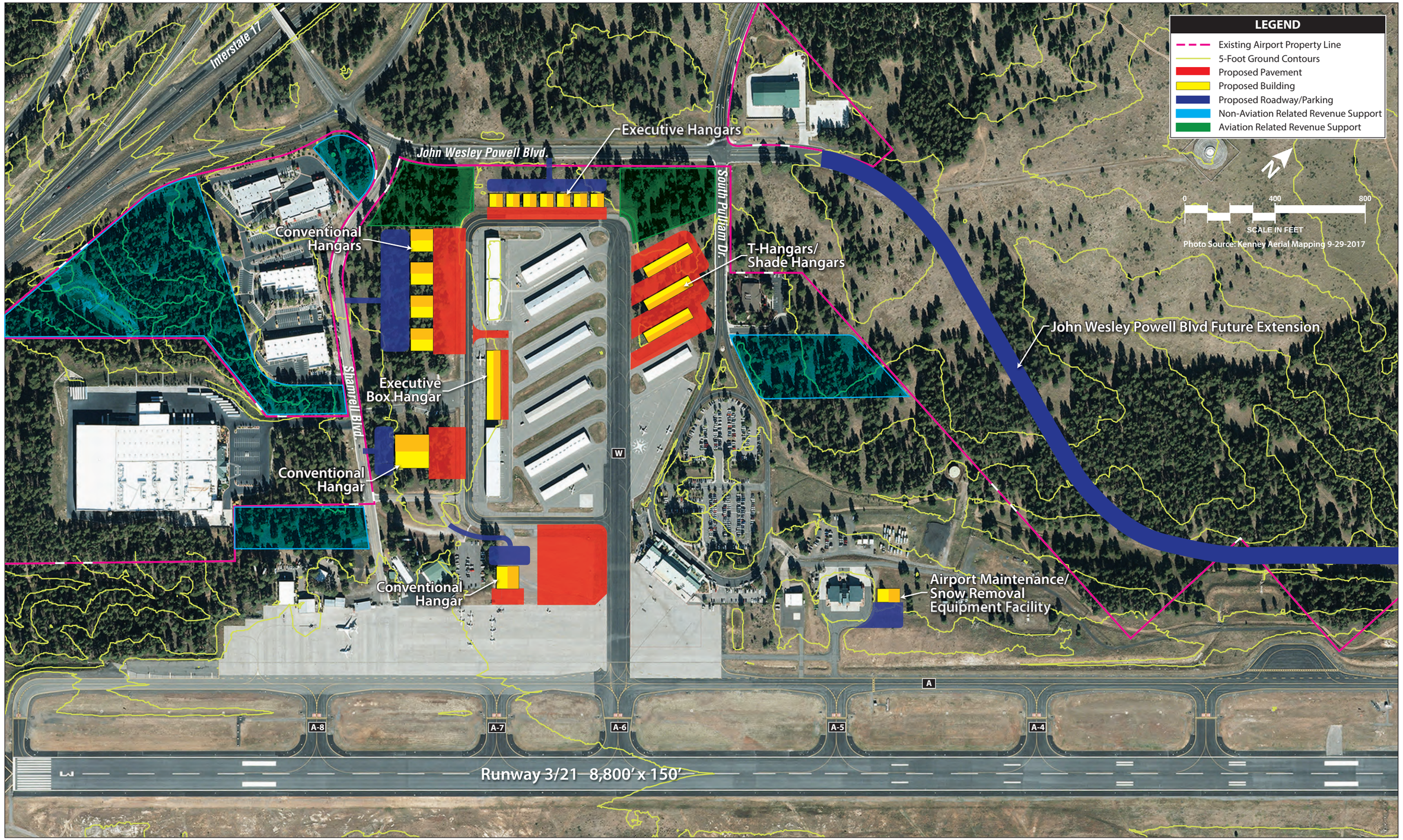
Four separate parcels are also included on this exhibit that could support non-aviation development in the form of commercial/industrial uses. Two of the four parcels are adjacent to the existing Flagstaff Airport Business Center. A third is farther northeast adjacent to South Pulliam Drive in close proximity to an existing non-aviation land use. The fourth parcel would be provided access near the east end of Shamrell Boulevard.

Landside Alternative B

Landside Alternative B as shown on **Exhibit 4M** presents a second development concept. The proposed improvements considered in this alternative differ from the previous alternative mainly in the distribution and location of hangar facilities and development parcels. It includes the addition of:

- Seven large clear span conventional hangars
- Eight executive hangars
- One linear executive box hangar
- Two T-hangars or shade hangars
- Expanded aircraft parking apron space adjacent to the south side of Taxiway W
- Existing airport property designed for one larger future aviation related development parcel with direct access to Taxiway W
- Non-aviation development parcels with access to existing roadway infrastructure including John Wesley Powell Boulevard, Shamrell Boulevard, and South Pulliam Drive

This alternative carries forward several of the same concepts from the previous alternative, except that their locations differ. In addition, this alternative sets aside the western portion of the general aviation development area for one large aviation related development parcel that could accommodate a specialty aviation operation such as air cargo. In addition, two conventional hangars are proposed in the


Interstate 17
John Wesley Powell Blvd.
Executive Hangars
South Pulliam Dr.
Conventional Hangars
T-Hangars/ Shade Hangars
John Wesley Powell Blvd Future Extension
Shamrell Blvd.
Executive Box Hangar
Conventional Hangar
Conventional Hangar
Airport Maintenance/ Snow Removal Equipment Facility
W
A
A-8
A-7
A-6
A-5
A-4
Runway 3/21 8,800' x 150'
LEGEND
Existing Airport Property Line
5-Foot Ground Contours
Proposed Pavement
Proposed Building
Proposed Roadway/Parking
Non-Aviation Related Revenue Support
Aviation Related Revenue Support
N
0
400
800
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017

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Interstate 17

John Wesley Powell Blvd.

South Pulliam Dr.

T-Hangar/
Shade Hangars

Executive
Hangars

Executive
Box Hangar

Conventional
Hangars

Conventional
Hangars

Conventional
Hangars

John Wesley Powell Blvd Future Extension

Airport Maintenance/
Snow Removal
Equipment Facility

Shamrell Blvd.

W

A

A-8

A-7

A-6

A-5

A-4

Runway 3/21 8,800' x 150'

LEGEND

- Existing Airport Property Line
- 5-Foot Ground Contours
- Proposed Pavement
- Proposed Building
- Proposed Roadway/Parking
- Non-Aviation Related Revenue Support
- Aviation Related Revenue Support

N

0 400 800

SCALE IN FEET

Photo Source: Kenney Aerial Mapping 9-29-2017

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area of the existing FBO complex that would open to a new parking apron proposed south of Taxiway W. This alternative also dedicates vacant airport property beyond the airfield access areas for non-aviation uses that could further bolster airport revenues.

East Landside Plan

Although the forecast demand for aviation activity can continue to be accommodated on the west side of the airport, the Master Plan has identified existing property east of Runway 3-21 as a reserve area that could satisfy future aviation activity most likely to occur beyond the long term planning period of this study. This east landside area was studied in the previous Master Plan completed in 2007.

As depicted on **Exhibit 4N**, a mix of high, medium, and low activity areas are proposed that could accommodate varying levels of aviation activity as demand would warrant. Farther east adjacent to the back side of the airport property line, an area of non-aviation development is identified. In order to provide airfield access to this area, a taxiway is proposed extending east of the airfield system. It is important to note that the previous Master Plan and current ALP include a parallel runway situated 700 feet east of the existing runway. Although this Master Plan effort does not warrant a parallel runway to meet long term capacity needs, the East Landside Plan depicts a parallel runway in order to determine the appropriate setbacks for potential landside development.

One of the main challenges to developing this area lies in granting vehicle access. Previous planning had a public roadway extending around the south side of the airport connecting this area to the west side of the airport. That roadway would traverse the existing RPZ that serves the south end of Runway 3-21. Given updated FAA guidance discouraging public roadways in RPZs, this plan should consider the extension of a roadway along the east side of airport property connecting to Lake Mary Road farther north. Any future development in this area could also warrant the potential for property acquisition through the U.S. Forest Service.

Landside Alternatives Summary

Table 4F presents a summary of the total hangar area proposed in Landside Alternatives A and B. Each alternative provides a significant amount of additional hangar storage space that can accommodate projected demand needed at the airport through the planning period of this study. The potential layouts presented allow development to follow a phased approach for each hangar type that could serve the airport well beyond the long term planning horizon. Prudent planning also considers the east side of the airport for ultimate build-out. These alternatives will provide a good starting point for discussions which will lead to a recommended development plan to be outlined in the next chapter.

TABLE 4F
Hangar Alternative Summary
Flagstaff Airport

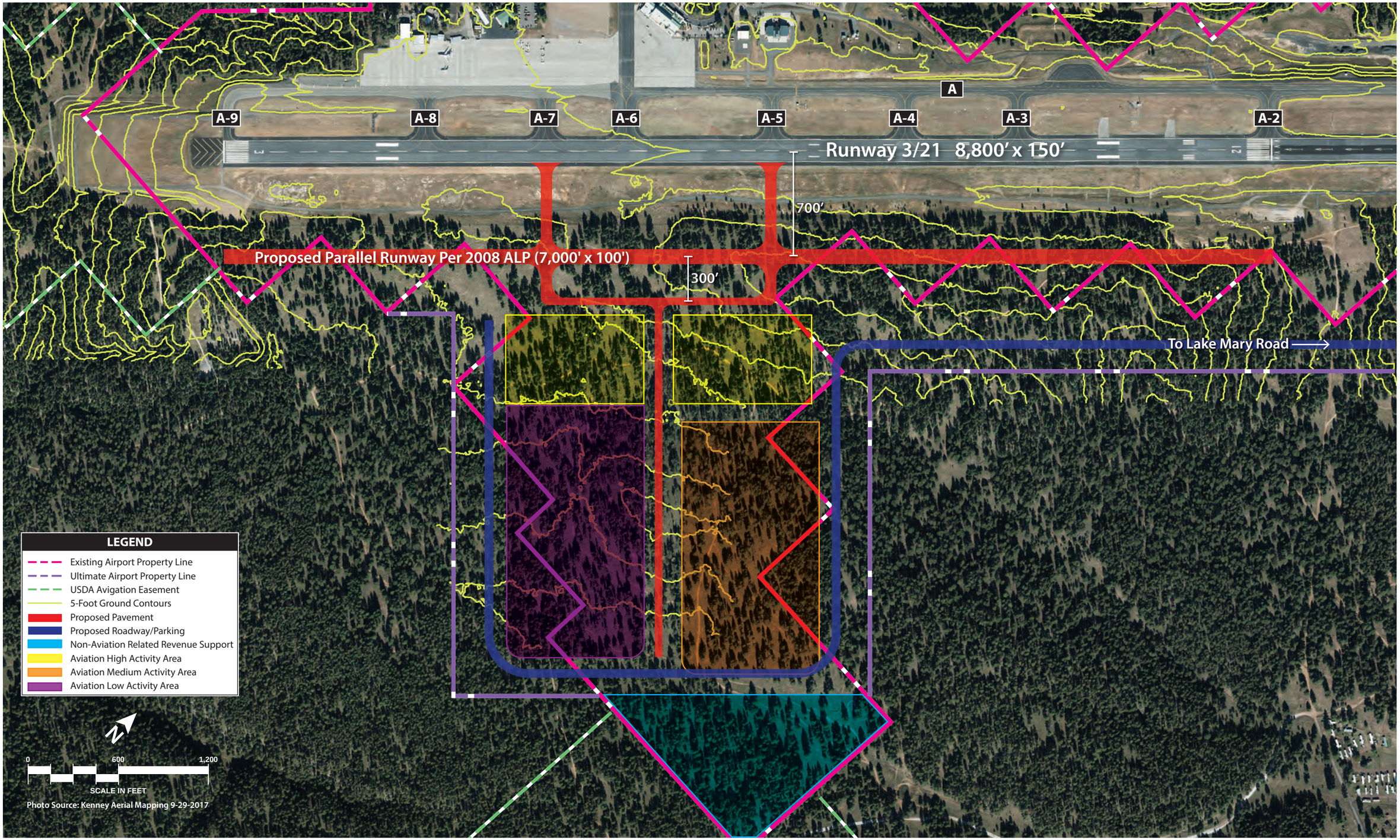
Hangar Type	Alternative A	Alternative B
Conventional Hangar (s.f.)	72,500	70,000
Executive Hangar (s.f.)	43,200	46,800
T-Hangar/Shade Hangar (s.f.)	34,500	25,000
Total Hangar Space (s.f.)	**150,200**	**141,800**

Source: Coffman Associates analysis

SUMMARY

Planning future development of both the airside and landside is important because individual actions taken in one area can impact the potential for other options in the future. Therefore, it is important to examine alternative development options in order to maximize a precious resource, which is land on an airport.

Several development alternatives related to both the airside and landside have been presented. The process utilized in assessing these alternatives involved a detailed analysis of short and long term requirements as well as future growth potential. After review and input from the PAC, airport management, City of Flagstaff, and interested local citizens, a recommended development concept for Flagstaff Airport to include a detailed capital improvement program and environmental overview will be presented in the next phase of this study. In addition, an Airport Sustainability Management Plan will be incorporated into this planning effort that takes into account the recommended development concept while considering the recommended goals, objectives, and policies that were realized in the *Flagstaff Airport Sustainability Plan* completed in 2015.


A
A-9
A-8
A-7
A-6
A-5
A-4
A-3
A-2
Runway 3/21 8,800' x 150'
700'
Proposed Parallel Runway Per 2008 ALP (7,000' x 100')
300'
To Lake Mary Road
LEGEND
Existing Airport Property Line
Ultimate Airport Property Line
USDA Avigation Easement
5-Foot Ground Contours
Proposed Pavement
Proposed Roadway/Parking
Non-Aviation Related Revenue Support
Aviation High Activity Area
Aviation Medium Activity Area
Aviation Low Activity Area
N
0
600
1,200
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017

FLAGSTAFF AIRPORT

CHAPTER FIVE

Recommended Master Plan Concept

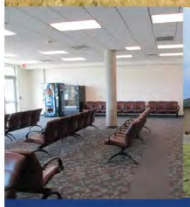





FLAGSTAFF AIRPORT











Chapter Five
RECOMMENDED MASTER PLAN CONCEPT

The process for the preparation of the Airport Master Plan has included technical efforts in the previous chapters intended to establish the role of Flagstaff Airport, forecast potential aviation demand, establish airside and landside facility needs, and evaluate options for improving the airport to meet those facility needs. The planning process has included the development of draft working papers that have been presented to the Planning Advisory Committee (PAC), which is comprised of stakeholders/constituents with an investment or interest in the airport and surrounding area. This diverse group has provided extremely valuable input into the Master Plan. Additionally, a series of Public Information Workshops have been conducted as part of this planning process, providing the public an opportunity to be involved and educated about the study.

The alternatives that outlined future growth and development scenarios in the previous chapter have been refined into a recommended development concept for the Master Plan, which is included for presentation in this chapter. Environmental conditions that need to be considered during development are also examined later in the chapter.

One of the objectives of the Master Plan is to allow decision-makers the ability to either accelerate or slow development goals based on actual demand. If demand slows, development of the airport beyond routine safety and maintenance projects could be minimized. If aviation demand accelerates, development could be expedited. Any plan can account for limited develop-

ment, but the lack of a plan for accelerated growth can sometimes be challenging. Therefore, to ensure flexibility in planning and development to respond to unforeseen needs, the Master Plan Concept considers the full and balanced development potential for the Flagstaff Airport.

MASTER PLAN CONCEPT

Flagstaff Airport is classified by the Federal Aviation Administration (FAA) as a nonhub, primary commercial service airport. The airport is also included in the FAA's *National Plan of Integrated Airport Systems* (NPIAS). NPIAS airports are considered important to the national aviation system and are eligible for development grant funding from the FAA. At the state level, the Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group) classifies Flagstaff Airport as a commercial service airport.

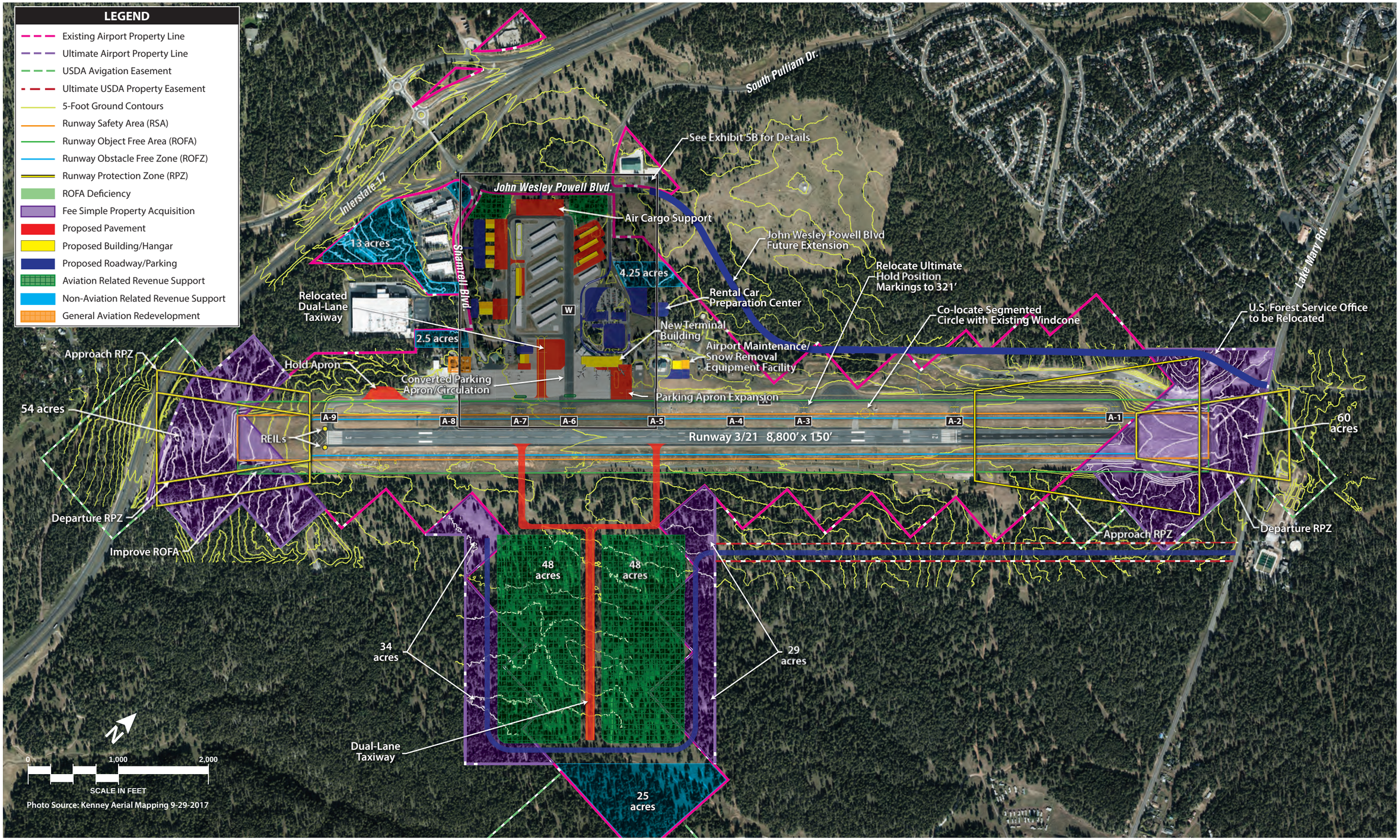
The Master Plan Concept, as shown on **Exhibit 5A**, presents the recommended configuration for Flagstaff Airport, which preserves and enhances the role of the facility while meeting FAA design and safety standards to the extent practicable. Furthermore, **Exhibit 5B** details the proposed development plan for the commercial service terminal area and general aviation complex on the west side of the airfield. It is important to note that the concept provides for anticipated facility needs over the next 20 years, as well as establishing a vision and direction for meeting facility needs beyond the 20-year planning period of this study. A phased program to achieve the recommended Master Plan Concept is presented in Chapter Six. When assessing development needs, this chapter has separated the airport into airside and landside functional areas.

While the Master Plan Concept makes recommendations for the future development of Flagstaff Airport, it is important to continue to gain local perspective and input on important development goals and objectives. This is especially important with landside functions, such as the terminal area and future redevelopment of the commercial passenger terminal complex. The following sections describe the Master Plan Concept in detail.

AIRSIDE DEVELOPMENT CONCEPT

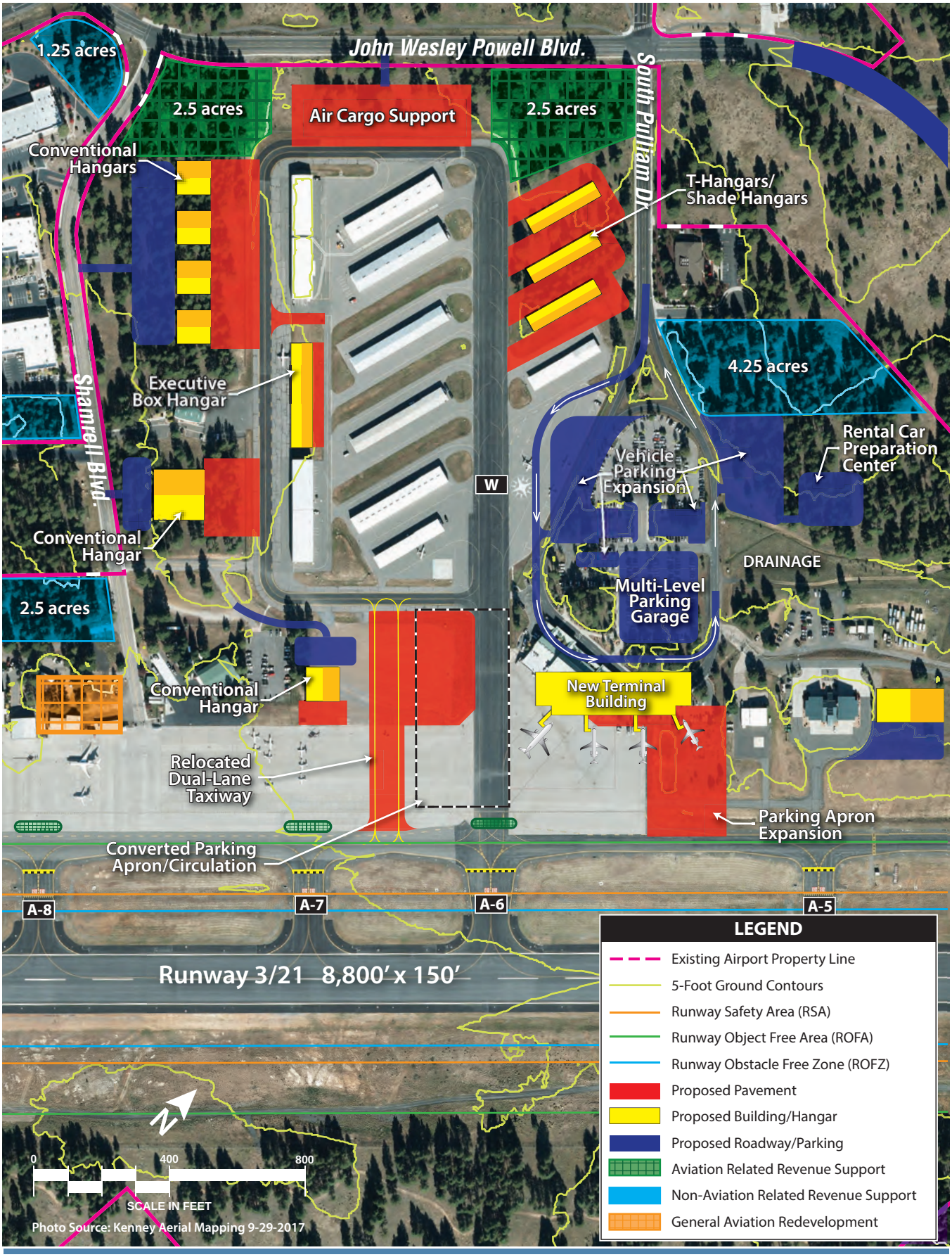
The airside plan generally considers those improvements related to the runway and taxiway system and often requires the greatest commitment of land area to meet the physical layout of an airport. Operational activity at Flagstaff Airport is anticipated to grow modestly through the 20-year planning horizon of this Master Plan, and the airport is projected to continue to serve the full range of aircraft operations, including commercial airline service, air charter, air taxi, general aviation, and military activities.

The major airside issues addressed in the Master Plan Concept include the following:


LEGEND
Existing Airport Property Line
Ultimate Airport Property Line
USDA Avigation Easement
Ultimate USDA Property Easement
5-Foot Ground Contours
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
ROFA Deficiency
Fee Simple Property Acquisition
Proposed Pavement
Proposed Building/Hangar
Proposed Roadway/Parking
Aviation Related Revenue Support
Non-Aviation Related Revenue Support
General Aviation Redevelopment
South Pulliam Dr.
See Exhibit 5B for Details
John Wesley Powell Blvd.
Interstate 17
Air Cargo Support
John Wesley Powell Blvd Future Extension
13 acres
Shamrell Blvd.
4.25 acres
Relocate Ultimate Hold Position Markings to 321'
Lake Mary Rd.
Relocated Dual-Lane Taxiway
Rental Car Preparation Center
Co-locate Segmented Circle with Existing Windcone
U.S. Forest Service Office to be Relocated
2.5 acres
New Terminal Building
Airport Maintenance/ Snow Removal Equipment Facility
Approach RPZ
Hold Apron
Converted Parking Apron/Circulation
Parking Apron Expansion
54 acres
A-9
A-8
A-7
A-6
A-5
A-4
A-3
A-2
A-1
Runway 3/21 8,800' x 150'
60 acres
REILs
Departure RPZ
Improve ROFA
Approach RPZ
Departure RPZ
48 acres
48 acres
34 acres
29 acres
Dual-Lane Taxiway
25 acres
N
0
1,000
2,000
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017

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1.25 acres
John Wesley Powell Blvd.
South Pulliam Dr.
2.5 acres
Air Cargo Support
2.5 acres
Conventional Hangars
T-Hangars/ Shade Hangars
4.25 acres
Executive Box Hangar
Shamrell Blvd.
Rental Car Preparation Center
Vehicle Parking Expansion
W
Conventional Hangar
DRAINAGE
Multi-Level Parking Garage
2.5 acres
New Terminal Building
Conventional Hangar
Relocated Dual-Lane Taxiway
Parking Apron Expansion
Converted Parking Apron/Circulation
A-8
A-7
A-6
A-5
Runway 3/21 8,800' x 150'
N
0
400
800
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017
LEGEND
Existing Airport Property Line
5-Foot Ground Contours
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Proposed Pavement
Proposed Building/Hangar
Proposed Roadway/Parking
Aviation Related Revenue Support
Non-Aviation Related Revenue Support
General Aviation Redevelopment

- Adhere to ultimate Runway Design Code (RDC) C-III standards on Runway 3-21.
- Improve safety area deficiencies that currently exist on Runway 3-21; in particular, the runway object free area (ROFA) south of the runway system.
- Implement "No Taxi Islands" at certain taxiway intersections in order to improve airfield geometry.
- Construct a hold apron adjacent to the south end of Taxiway A.
- Enhance visual approach aids on the runway system.
- Per FAA standards, locate hold line markings on all taxiways associated with Runway 3-21 at 321 feet from the runway centerline.
- Acquire land beyond the north and south sides of Runway 3-21 for approach/departure protection and positive control of safety areas.
- Provide enhanced instrument approach capabilities serving each end of Runway 3-21.
- Construct a taxiway network on the east side of Runway 3-21 that could provide access to future aviation development potential.
- Upgrade airfield lighting with light emitting diode (LED) technology and implement enhanced taxiway recognition.

RUNWAY DIMENSIONAL STANDARDS

The FAA has established design criteria to define the physical dimensions of the runway and taxiways, as well as the imaginary surfaces surrounding them which protect the safe operation of aircraft at airports. These design standards also define the criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on an airport's critical design aircraft. The critical design aircraft is the most demanding aircraft, or family of aircraft, which currently, or are projected to, conduct 500 or more operations (takeoffs or landings) per year at an airport. Factors included in airport design are an aircraft's wingspan, approach speed, tail height, and, in some cases, the instrument approach visibility minimums for each runway. The FAA has established the RDC to relate these design aircraft factors to airfield design standards. The most restrictive RDC is also considered the overall Airport Reference Code (ARC) for an airport with more than one runway.

Analyses at the end of Chapter Two concluded that the current RDC for Runway 3-21 is C-II. Future planning considers an ultimate RDC of C-III for Runway 3-21. The future RDC is planned to be C-III for the following reasons:

- The existing runway geometry has historically been planned to C-III standards;
- The runway should be planned for some of the most demanding regional commercial service and general aviation aircraft given its runway length;
- The runway meets the majority of C-III design standards except for those outlined in the following sections which are addressed in the Master Plan Concept; and
- The previously approved Airport Layout Plan (ALP) presented in Chapter Four indicates an existing and ultimate ARC C-III planning standard for Runway 3-21.

Table 5A provides a summary of the RDC for Runway 3-21 based upon the Master Plan Concept. In addition to the physical and operational components of an aircraft, the RDC also considers the instrument approach capabilities for each runway expressed in runway visual range (RVR) values. For Runway 3-21, the RVR value of 2,400 feet indicates approach visibility minimums lower than ¾-mile (down to ½-mile). As detailed in previous chapters, the precision instrument landing system (ILS) approach to Runway 21 was recently enhanced and now provides for lower than ¾-mile visibility minimums (down to ½-mile). Prudent planning considers enhanced approach visibility minimums which could be accommodated through existing approach aids serving the runway system. Additional discussion related to instrument approach capabilities is undertaken later in this chapter.

TABLE 5A
Ultimate Runway Design Code
Flagstaff Airport

Runway	Planned Runway Design Code*
3-21	C-III-2400

* The ultimate ARC for Flagstaff Airport is C-III based upon the RDC designation for Runway 3-21.

RUNWAY SAFETY ENHANCEMENTS

The existing ROFA beyond the south end of Runway 3-21 is currently penetrated by trees and a portion of the airport's perimeter fencing as highlighted on **Exhibit 5A**. The Master Plan Concept considers the removal of trees, relocation of portions of the perimeter fencing, and grading of terrain to conform to ROFA standards for RDC C-II and C-III design. In doing so, the utilization of Runway 3-21 will not be adversely impacted.

As previously detailed in Chapter Four, a small portion of the perimeter access road penetrates the ultimate runway safety area (RSA) adjacent to the south side of the runway system. Since this roadway is restricted to authorized personnel only and not open to the public, it is recommended that airport staff and airport traffic control tower (ATCT) personnel be vigilant of this issue. It should be noted that a capital improvement project is identified in the next chapter that calls for upgrades to the perimeter access road. This project could evaluate a slight realignment to the road so it clears the ultimate RSA.

TAXIWAY GEOMETRY AND DESIGN

A safety project involving taxiway geometry at Flagstaff Airport is planned to ensure that direct access from an aircraft parking apron to runway is not provided. Configurations that allow for direct access from an apron to runway have been targeted as they tend to increase risks for runway incursions. As depicted on **Exhibit 5A**, the Master Plan Concept ultimately calls for the implementation of three No Taxi Islands in proximity to Taxiways A6, A7, and A8, which directly connect the runway environment and parking aprons and landside development farther west. To enhance the presence of these No Taxi Is-

lands, medium intensity taxiway lighting (MITL) could be implemented adjacent to the affected pavement that would allow pilots to better distinguish the markings and increase airfield situational awareness.

Another area on the airfield that does not currently adhere to FAA-recommended geometry standards includes the wide expanse of pavement associated with Taxiway A6. The Master Plan Concept maintains the width of the pavement associated with Taxiway A6 per discussions with airport staff and ATCT personnel. The ultimate width of this taxiway can be evaluated during a future pavement rehabilitation project associated with the taxiway system.

The Master Plan Concept also considers improving airfield efficiency through the implementation of a stub taxilane on the west side of the airport in the vicinity of existing general aviation development. As proposed on **Exhibit 5A**, the taxilane would connect apron space associated with T-hangar and executive box hangar development to the Taxiway W loop that serves the general aviation hangar area. This taxilane would allow for additional hangar development to occur directly east as proposed on the development plan.

HOLD APRON

Exhibit 5A includes the construction of a hold apron adjacent to the south end of parallel Taxiway A that would serve Runway 3. This concept is supported by airport staff and ATCT personnel. As detailed in the previous chapter, the construction of this hold apron would require significant fill and grading as the terrain drops considerably when moving west of the parallel taxiway.

VISUAL APPROACH AIDS

Future planning considers an enhancement to visual approach aids in the form of runway end identification lights (REILs) serving Runway 3 at Flagstaff Airport, as depicted on **Exhibit 5A**. The FAA recommends that REILs be considered for implementation on runway ends not served by a more sophisticated approach lighting system, such as the medium intensity approach lighting system with runway alignment indicator lights (MALSR) that currently serves Runway 21.

Another visual approach aid enhancement to the airfield system includes the implementation of a segmented circle. The Master Plan Concept proposes a segmented circle be co-located with an existing wind cone, located approximately 1,000 feet south of the Runway 21 displaced threshold between the runway and parallel taxiway system.

HOLD LINE MARKINGS

The hold line markings on taxiways associated with Runway 3-21 are currently situated 250 feet from the runway centerline, which meet RDC C-II design standards. In the event that Runway 3-21 transitions

to RDC C-III as planned, the standard for runway centerline to hold line separation is 250 feet plus one additional foot for each 100 feet above MSL. Flagstaff Airport is situated at 7,014 feet MSL. As a result, the hold lines associated with these entrance/exit taxiways would need to be relocated to 321 feet from the runway centerline, as presented on **Exhibit 5A**.

APPROACH/DEPARTURE PROTECTION AND SAFETY AREA CONTROL

The FAA recommends that the airport sponsor own in fee simple the runway protection zone (RPZ) property. When fee simple ownership is not feasible, positive land use measures should be implemented to protect an airport from encroachment by incompatible land uses or obstructions. Currently, portions of property within the approach and departure RPZs associated with Runway 3-21 are positively controlled by the airport either through fee simple acquisition or an avigation easement through the U.S. Forest Service, which is an agency of the United States Department of Agriculture (USDA).

The Master Plan Concept considers acquiring 60 acres of land on the north side of the airport and 54 acres of land on the south side of the airport. In doing so, a large majority of the ultimate approach and departure RPZs, as depicted on **Exhibit 5A**, will be fully contained on airport property. A portion of the departure RPZ beyond the north end of the runway would extend beyond Lake Mary Road and over U.S. Forest Service property, most of which falls under the existing USDA avigation easement. It is important to note that the City of Flagstaff plans to acquire this property in the future and is aware that the portion of property within the departure RPZ should remain clear of incompatible land uses. On the south side of the runway, a small portion of the ultimate approach and departure RPZ would extend over Interstate 17 but remain in the existing USDA avigation easement.

In any event, airport officials and the City of Flagstaff should continue to monitor activity within the existing and proposed RPZs serving all runway ends at the airport and maintain them free of incompatible land uses to the extent practicable. Continued coordination with the FAA will be important when implementing projects that could require changes to the existing RPZs at the airport.

Consideration should also be given to maintaining a clear 40:1 instrument departure surface beyond each end of Runway 3-21 (when applicable). In the event that there are penetrations to the departure surface that cannot be mitigated, the takeoff distance available on either runway could be limited in order to mitigate penetrations to this surface.

Another important justification for acquiring land beyond the north and south ends of Runway 3-21, as previously outlined, involves the airport being able to gain positive control over the safety areas associated with the runway system. As detailed in Chapter Four, approximately 25.3 acres of land within the RSA, ROFA, and runway obstacle free zone (ROFZ) are outside the current airport property line. The proposed land acquisition as outlined on the Master Plan Concept would allow the airport to have full ownership of these safety areas, which the FAA strongly recommends.

INSTRUMENT APPROACHES

As detailed earlier, straight-in instrument approach procedures are offered on Runway 3-21 and recent enhancements to these approaches have been implemented. Currently, the ILS approach serving Runway 21 provides for approach visibility minimums down to ½-mile. Given that Runway 21 is the most utilized runway and accommodates a large majority of commercial service aircraft operations at the airport, it is preferred that approach visibility minimums be lower than ¾-mile. The Master Plan Concept considers the recent implementation of visibility minimums down to ½-mile on Runway 21. As a result, the approach RPZ associated with Runway 21 increases in size as depicted on **Exhibit 5A**. It is important to note that Runway 21 currently has the proper approach lighting system (MALSR) to accommodate a precision approach with ½-mile visibility minimums.

Likewise, enhanced instrument visibility minimums were recently implemented on Runway 3. Currently, this runway end is served by an area navigation (RNAV) global positioning system (GPS) approach that provides not lower than ¾-mile visibility minimums. The Master Plan Concept considers not lower than ¾-mile approach visibility minimums for this runway end. Historically, the FAA has required an approach lighting system to serve a runway end that accommodates visibility minimums below one mile. In recent years, however, many runways across the country have achieved instrument approach visibility minimums lower than one mile without implementing an approach lighting system.

In the event that visibility minimums tied to these various instrument approach procedures are not improved as previously discussed, it is still recommended that the ALP ultimately plan for ½-mile approach minimums on Runway 21 and not lower than ¾-mile approach minimums on Runway 3. In doing so, the airport is taking proactive steps to protect the RPZs and approach surfaces beyond each end of the runway.

TAXIWAY EXTENSION ON EAST SIDE OF AIRFIELD

As presented on **Exhibit 5A**, the development plan considers extending a taxiway network east of Runway 3-21 that would allow for future aviation development potential in the east area of the airport. As proposed, the taxiway network would extend east of Taxiways A5 and A7 and ultimately provide access to a dual lane taxiway extending approximately 2,400 feet farther east which could serve aviation-related development as demand would dictate. Future development on the east side of the airport will be a challenging endeavor given the site preparation and utilities needed and would likely occur during or beyond the long range planning period of this Master Plan.

AIRFIELD LIGHTING UPGRADES

As detailed in Chapter Four, future planning will consider replacing the existing incandescent airfield lighting and signage system with LED technology. This will help to lower energy consumption and provide a more efficient airfield electrical system. In addition, MITL should be considered on all existing and proposed taxiways, including Taxiway W which is currently not served with MITL. In the event that MITL

is not installed on existing and proposed taxiways, the airport should consider implementing elevated edge reflectors.

PARALLEL RUNWAY

As discussed in Chapter Four, the previous Master Plan and previously approved ALP include a parallel runway situated 700 feet east of the existing runway at Flagstaff Airport. This Master Plan does not warrant a parallel runway within the planning horizon of this study; however, the ALP being developed does maintain the parallel runway for planning purposes only.

LANDSIDE DEVELOPMENT CONCEPT

Landside components include terminal buildings, hangars, aircraft parking aprons, and aviation support services, as well as the utilization of remaining airport property to provide revenue support and to benefit the economic well-being of the regional area. The primary goal of landside facility planning is to provide adequate passenger terminal facilities and aircraft storage space to meet forecast needs, while also maximizing operational efficiencies and land uses. Also important is identifying the overall land use classification of airport property in order to preserve the aviation purpose of the facility well into the future. **Exhibit 5A** presents the view of the planned landside development for Flagstaff Airport. **Exhibit 5B** provides a more detailed layout of landside development within the terminal area and general aviation complex on the west side of the airfield.

There are numerous facility layout concepts that could be considered. Detailed layouts of potential landside facilities were presented in Chapter Four that included terminal building layouts, hangar development, and the placement of aviation support services. The Master Plan Concept provides the layout of proposed landside facilities which attempts to maximize potential aviation development space on the airfield.

The major landside issues addressed in the Master Plan Concept include the following:

- Upgrades/replacement of the passenger terminal building and associated infrastructure to meet future commercial passenger service needs.
- Expand terminal area vehicle parking and improve circulation.
- Implement a rental car preparation center to help alleviate congestion in the terminal area.
- Designate areas that can accommodate aviation development/redevelopment potential on the west side of the airport to include aircraft storage hangars and aviation development parcels.
- Expand parking apron space/circulation for various aircraft activities.
- Construct a dedicated airport maintenance and snow removal equipment facility.
- Acquire land and extend utility infrastructure on the east side of the airport to accommodate future aviation development potential.
- Designate non-aviation development on airport property to further enhance potential airport revenues.

PASSENGER TERMINAL BUILDING UPGRADES/REPLACEMENT

Flagstaff Airport has a dedicated terminal building that encompasses approximately 24,140 square feet of usable space for various commercial passenger service activities. Previous analysis has indicated that the existing layout of the facility does not provide adequate space and functionality to serve certain existing and projected commercial service demands. The Master Plan Concept recommends short term improvements to the existing terminal building as outlined in the capital program detailed in the next chapter.

In Chapter Four, alternatives were evaluated that presented four different options for expanding the terminal building at the airport which included:

1) A 12,000 square-foot expansion of the existing terminal building to the northeast.
2) A 15,000 square-foot expansion of the existing terminal building to the east and northeast.
3) An 11,500 square-foot expansion of the existing terminal building that incorporates a pier-concept design on the east side of the facility.
4) A new 40,000 square-foot terminal building that is aligned parallel to the runway and parallel taxiway system.

Through the alternatives evaluation and discussions with airport and City staff, the Master Plan Concept ultimately calls for a new terminal building as detailed on **Exhibit 5B**. This new terminal would follow a simple/linear design as previously detailed in Chapter Four that allows the concourse/departure hold room area on the east side of the facility facing the aircraft parking apron. The development concept depicts up to four loading gates/bridges which would provide adequate demand to meet long term passenger enplanement projections. While the concept of jet bridges is incorporated into the terminal design, ground-level boarding could be implemented which is the current practice at the airport.

As part of the Master Plan process, additional feedback can be obtained from the PAC, City of Flagstaff, and general public for input into the future expansion and/or construction of a new terminal facility. In addition to the terminal building, several support functions would need to be analyzed that include vehicle circulation and parking, rental car activities, and aircraft parking apron space, among others. It is anticipated that analysis and construction associated with the development of a new terminal building would not occur until at least the long term planning period of this study. While the Master Plan provides the support and potential layout for future passenger service needs, it is recommended that a more detailed terminal area study be undertaken prior to engaging in the environmental, design, and construction of a new terminal building and associated infrastructure.

It is important to consider sustainable solutions into the design of an expanded and/or new terminal facility. Appendix B of this study provides a Sustainability Management Plan that further details potential sustainable initiatives that could be incorporated into the design and construction of terminal building enhancements at Flagstaff Airport.

TERMINAL AREA VEHICLE PARKING EXPANSION/CIRCULATION

Exhibit 5B also details the planned terminal vehicle parking layout associated with the Master Plan Concept. It incorporates a combination of layouts as proposed in Terminal Area Alternatives 3 and 4 in Chapter Four. In an effort to make the best use of existing space immediately west of the terminal building, a multi-level parking garage is proposed that would minimize walking distances to the terminal building. The parking garage would be comprised of at least two levels and could accommodate a mix of general passenger vehicle and rental car parking. Farther west, additional surface-level parking lots are called for. In order to accommodate this expanded surface parking, South Pulliam Drive would need to be relocated farther south in an area that currently is comprised of aircraft parking apron space. As detailed later in this chapter, the Master Plan Concept dedicates additional aircraft parking apron space to help accommodate this displaced apron area.

All total, over 250,000 square feet of additional vehicle parking space is provided in the Master Plan Concept. This would allow for approximately 500 additional vehicle parking spaces through the course of the planning period. As outlined in the next chapter, the implementation of this vehicle parking plan would likely be split into multiple phases as funding would allow. In the near term, the airport should position itself to expand vehicle parking in some of the more remote areas west of the terminal building through the construction of additional surface parking.

RENTAL CAR PREPARATION CENTER

As presented on **Exhibit 5B**, the Master Plan Concept includes the construction of a rental car preparation center adjacent to the north side of the expanded terminal vehicle parking lot. This facility would provide a location for rental car companies to wash, fuel, and stage vehicles until they are needed near the terminal building for passenger use. The implementation of this facility could help alleviate congestion within the terminal area and is independent of the location of a future terminal building.

AVIATION DEVELOPMENT/REDEVELOPMENT

The landside development plan on **Exhibit 5B** also proposes the location of certain hangar types by primarily following the philosophy of separation of activity levels. The plan depicts hangar development / redevelopment items that include the following:

- Construction of six large clear span conventional hangars that could support high levels of aviation activity associated with fixed base operators (FBOs) or specialized aviation service operators (SASOs).
- Construction of one executive box hangar that could accommodate private aircraft storage and potential SASO activities.
- Construction of three T-hangars/shade hangars for private aircraft storage.
- Two separate parcels, each totaling 2.5 acres, directly east of John Wesley Powell Boulevard for aviation development potential.

- Redevelopment of approximately 40,000 square feet of space adjacent to the main aircraft parking apron south of the FBO facility for aviation development potential. This area currently accommodates airport maintenance activities.

Table 5B presents the total hangar and development/redevelopment areas proposed in the landside development plan on the west side of the airport. As can be seen from the table, the layout provides nearly 128,000 square feet of additional hangar space, which exceeds the amount of hangar space needed through the long term planning period based upon the aviation demand forecasts. Therefore, the hangar layout presented can represent a vision for the airport that extends beyond the scope of this study. The reason for this is to provide decision-makers with dedicated areas on the airport that should be reserved for certain hangar types. Furthermore, nearly six acres of land is highlighted for potential development and redevelopment, as demand would dictate, that could accommodate aircraft storage and other specialty aviation support services.

TABLE 5B
Aircraft Hangar and Development Space Planned
Flagstaff Airport

Aircraft Hangar and Development Parcels	Provided in Master Plan Concept
Conventional Hangar Area	72,500 s.f.
Executive Box Hangar Area	21,000 s.f.
T-Hangar/Shade Hangar Area	34,500 s.f.
Aviation Development Parcels Adjacent to John Wesley Powell Boulevard	5.0 acres
Aviation Redevelopment Parcel South of FBO	0.9 acre

AIRCRAFT PARKING APRON EXPANSION/CIRCULATION

Exhibit 5B considers the expansion of aircraft parking apron space in various locations on the airfield. Adjacent to the terminal building, an expanded apron area is called for on the north side of the existing commercial service parking apron. This apron could be constructed separate from an expansion or reconfiguration of the terminal building.

Another significant enhancement to the terminal area involves shifting a portion of dual-lane Taxiway W approximately 300 feet south of its existing location in order to provide additional space necessary for the circulation of commercial service aircraft utilizing the terminal building. An advantage of shifting dual-lane Taxiway W to the south as proposed would be to address the taxiway geometry concern detailed in Chapter Four related to the direct access from the runway that Taxiway A6 offers to Taxiway W and landside development farther west. Shifting Taxiway W to the south discontinues the potential for direct access to the runway system, thus improving airfield safety and geometry.

Finally, in order to accommodate the apron area that would be displaced by the realignment of South Pulliam Drive as previously proposed, the Master Plan Concept dedicates land in the west area of the airfield for a large apron area that could support air cargo and general aviation activities. A roadway

extending directly east of John Wesley Powell Boulevard could provide access to this area, which could help alleviate vehicle traffic in the existing terminal area comprised of larger trucks associated with air cargo activities.

AIRPORT MAINTENANCE/SNOW REMOVAL EQUIPMENT FACILITY

The development plan calls for the construction of a dedicated airport maintenance and snow removal equipment facility immediately north of the aircraft rescue and firefighting (ARFF) facility. The building would be granted direct access to the airfield via the same roadway that serves the ARFF facility. As previously discussed, this facility could accommodate the storage of equipment and supplies that are currently stored in facilities located toward the south end of the aircraft parking apron, thus allowing for this area to be redeveloped to accommodate future general aviation development.

EAST SIDE DEVELOPMENT POTENTIAL

While the Master Plan Concept dedicates property on the east side of the airport for ultimate build-out, actual demand will dictate the timeline for future development. There is still adequate space for aviation-related development on the west side of the airport, and it is likely that short and intermediate term development will continue to focus on this side of the airfield.

To prepare the east side of the airport to meet future aviation demand, **Exhibit 5A** calls for a roadway extending south from Lake Mary Road that would provide vehicle access to landside facility development on the east side of Runway 3-21. This roadway would allow for significant development opportunities and could help satisfy an array of aviation demands on the airport by the long term planning horizon and beyond. Land to the east of the airport is currently under the control of the U.S. Forest Service. As proposed, a property easement would be considered for the roadway. Furthermore, the Master Plan Concept calls for the acquisition of approximately 63 acres of land on the east side to better accommodate future demands that could be placed on this area. All total, over 95 acres of land are designated for potential aviation use pending access from a taxiway network extending east of the runway as detailed earlier in this chapter.

NON-AVIATION DEVELOPMENT POTENTIAL

Exhibits 5A and **5B** also detail portions of property on the west and east sides of the airport that could be utilized for non-aviation development. The location of these proposed non-aviation land uses consider access to existing roadway infrastructure and also account for land that is not readily granted access to the airfield system for aviation use. The area highlighted on the west side of the airport consists of 21 acres on four separate parcels. On the east side of the airport, a 25-acre parcel is highlighted for potential non-aviation development in the long term planning period.



It should be noted that the City of Flagstaff has not obtained specific approval from the FAA to use certain portions of airport property for non-aviation purposes. Chapter Four provided a detailed description of the steps that must be taken in order to allow non-aviation uses on airport property should City of Flagstaff officials desire to do so in the future.

ENVIRONMENTAL OVERVIEW

Analysis of the potential environmental impacts of recommended airport development projects, as discussed in this chapter and depicted on **Exhibit 5A**, is an important component of the Airport Master Plan process. The primary purpose of this Environmental Overview is to identify significance thresholds for the various resource categories contained in Federal Aviation Administration (FAA) Order 1050.1F, *Environmental Impacts: Policies and Procedures*, Exhibit 4-1 and FAA Order 5050.4B, *National Environmental Policy Act* (NEPA) *Implementation Instructions for Airport Actions*, Table 7.1. The environmental overview then evaluates the development program to determine whether proposed actions could individually or collectively significantly affect the quality of the environment.

The construction of any improvements depicted on the recommended development concept plan would require compliance with NEPA to receive federal financial assistance or to obtain a federal approval (i.e., a federal action). For projects not "categorically excluded" under FAA Order 1050.1F, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). An EA is prepared when the initial review of the proposed action indicates that it is not categorically excluded, involves at least one extraordinary circumstance, or the action is not one known normally to require an Environmental Impact Statement (EIS). If none of the potential impacts are likely to be significant, then the responsible FAA official prepares a Finding of No Significant Impact (FONSI), which briefly presents, in writing, the reasons why an action, not otherwise categorically excluded, would not have a significant impact on the human environment and the approving official may approve it. Issuance of a FONSI signifies that FAA would not prepare an EIS and has completed the NEPA process for the proposed action.

In instances where significant environmental impacts are expected, an EIS may be required. An EIS is a clear, concise, and appropriately detailed document that provides agency decision-makers and the public with a full and fair discussion of significant environmental impacts of the proposed action and reasonable alternatives, and implements the requirement in NEPA §102(2)(C) for a detailed written statement.

This portion of the Airport Master Plan process is not designed to satisfy the NEPA requirements for a Categorical Exclusion (CatEx), EA, or EIS, which is done on a project-by-project basis. Rather, it is intended to supply a preliminary review of environmental issues.

POTENTIAL ENVIRONMENTAL CONCERNS

Table 5C summarizes potential environmental concerns associated with implementation of the recommended Master Plan development concept. Analysis under NEPA includes direct, indirect, and cumulative impacts. Chapter Six provides the full capital improvement projects list, along with the anticipated NEPA evaluation for each proposed project.

TABLE 5C
Summary of Potential Environmental Concerns
Flagstaff Airport

Environmental Impact Category	Significance Threshold/ Factors to Consider	Potential Concern
Air Quality	**Threshold: The action would cause pollutant concentrations to exceed one or more of the National Ambient Air Quality Standards (NAAQS), as established by the United States (U.S.) Environmental Protection Agency (EPA) under the *Clean Air Act*, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations.**	None. As seen on Table 2D in Chapter Two, operations are anticipated to increase at the airport over the 20-year planning horizon of this Airport Master Plan. However, Coconino County currently meets federal NAAQS standards. Thus, general conformity review per the *Clean Air Act* is not required. According to the most recent FAA *Aviation Emissions and Air Quality Handbook* (2015), an emissions inventory under NEPA may be necessary for any proposed action that would result in a foreseeable increase in emissions due to its implementation. For construction emissions, a qualitative or quantitative emissions inventory under NEPA may be required, depending on the type of environmental review required for the project.
Biological Resources (including fish, wildlife, and plants)	**Threshold: The U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS) determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat.** FAA has not established a significance threshold for non-listed species. However, factors to consider are if an action would have the potential for: • Long term or permanent loss of unlisted plant or wildlife species; • Adverse impacts to special status species or their habitats; • Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or • Adverse impacts on a species' reproductive rates, non-natural mortality, or ability to sustain the minimum population levels required for population maintenance.	**For federally-listed species:** There are five species protected by the *Endangered Species Act* (ESA) that have the potential to be affected by airport projects: the Mexican spotted owl (*Strix occidentalis lucida)*; yellow-billed cuckoo (*Coccyzus americanus*); California condor (*Gymnogyps californianus*); roundtail chub (*Gila robusta*); and, northern Mexican gartersnake (*Thamnophis esques megalops*). Much of the airport property is considered forested land, which is habitat for the California condor, Mexican spotted owl, and yellow-billed cuckoo.[1] The forested areas around the airport could also be used for roosting or foraging. Thus, presence of these species should be evaluated prior to any development to ensure no harm to these protected species occur. Informal or formal ESA, Section 7 consultation may be required. **For designated critical habitat:** None. There is no designated critical habitat located at or near the airport. **For non-listed species:** Non-listed species of concern include those protected by the *Migratory Bird Treaty Act* and the *Golden and Bald Eagle Protection Act*. Specifically, bald eagles (*Haliaeetus leucocephalus*) are known to winter at Lake Mary and Mormon Lake, located approximately five miles southeast of the airport. Bald and golden eagle roosting sites have been observed in Pumphouse Wash (approx. 2 miles south of the airport), Fay Canyon (approx. 2.5 miles east), and Walnut Can-

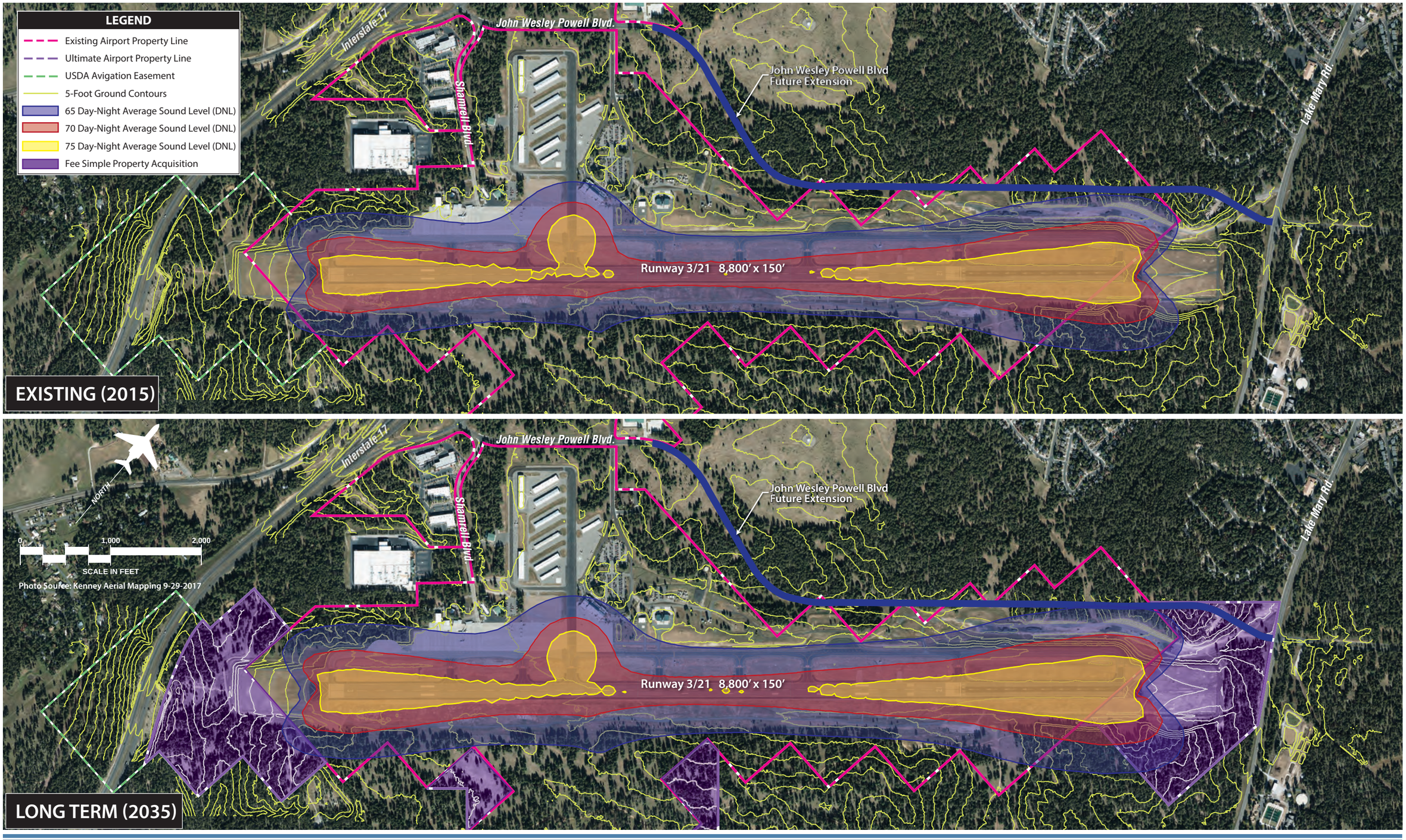
[1] www.audubon.org – Audubon Bird Guide

		yon (approx. 8 miles east). Additionally, the Anderson Mesa Important Birding Area is approximately 3 miles southeast of the airport, where migratory birds are known to travel. There is also potential for migratory birds to occur in the airport operations area (AOA) and immediately adjacent to airport property as much of the airport property is considered forested land that could be used for roosting and/or foraging. Conducting bird surveys prior to development may be required to identify mitigation for potential harm to nests and/or ground-dwelling birds and to ensure compliance with the *Migratory Bird Treaty Act* and *the Golden and Bald Eagle Protection Act*.
Climate	FAA has not established a significance threshold for Climate; refer to FAA Order 1050.1F's Desk Reference for the most up-to-date methodology for examining impacts associated with climate change.	An increase in greenhouse gas (GHG) emissions could occur over the 20-year planning horizon of the Airport Master Plan due to the projected increase in operations. Project-specific analysis may be required per the FAA Order 1050.1F Desk Reference.
Coastal Resources	FAA has not established a significance threshold for Coastal Resources.	None. The airport is not located within a designated coastal zone.
***Department of Transportation* (DOT) *Act*: Section 4(f)**	**Threshold: The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource. Resources that are protected by Section 4(f) are publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; and publicly or privately owned land from an historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.**	None. There are no wilderness areas, wildlife refuges, recreation areas, or locally owned public parks that would be impacted by proposed development. The nearest Section 4(f) property is Fort Tuthill (see Exhibit 1M), which is included in the National Register of Historic Places. Fort Tuthill is just northwest of the Airport along the west side of Interstate 17. Development in the northwestern area of the airport is all proposed to be on existing airport property, thus not significantly impacting this historic resource. The airport is surrounded by U.S. Forest Service (USFS) lands, which are used for passive recreational uses, like hiking, and are considered a Section 4(f) property. Many national forests under the jurisdiction of the USFS of the U.S. Department of Agriculture (USDA) serve as multiple-use land holdings. Since the development concept proposes use of national forest lands, coordination with the USDA as the official with jurisdiction over the resource would be appropriate to determine the purposes served by the land holding and the resulting extent of Section 4(f) applicability to the land holding. Most of the acquisitions proposed on the development concept depict non-development uses of U.S. Forest Service lands. However, in the southern portion of airport property, there are areas proposed for future aviation-related revenue potential. If this development moves forward, a Section 4(f) study

		may be required to ascertain that the Proposed Action complies with regulations protecting Section (f) resources.
Farmlands	**Threshold: The total combined score on Form AD-1006, *Farmland Conversion Impact Rating*," ranges between 200 and 260.** (Form AD-1006 is used by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) to assess impacts under the *Farmland Protection Policy Act* (FPPA).	None. Based on the U.S. Department of Agriculture, Natural Resources Conservation Service – Web Soil Survey (NRCS-WSS), none of the soils on airport property are classified as prime farmland, unique farmland, prime farmland if irrigated, or land of statewide or local importance.
Hazardous Materials, Solid Waste, and Pollution Prevention	FAA has not established a significance threshold for Hazardous Materials, Solid Waste, and Pollution Prevention. However, factors to be considered are if an action would have the potential to: • Violate applicable federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management; • Involve a contaminated site; • Produce an appreciably different quantity or type of hazardous waste; • Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity; or • Adversely affect human health and the environment.	None. There are no documented Superfund sites or brownfields on airport property; however, there is a facility on airport property that generates hazardous waste, as seen on Exhibit 1M. This facility is previously developed and paved, and therefore construction activities would not interfere with this use. The recommended Master Plan development concept does not anticipate land uses that would produce an appreciably different quantity or type of hazardous waste. However, should this type of land use be proposed, further NEPA review and/or permitting would be required. Construction and demolition waste would be generated because of development proposed in the Master Plan. Construction and demolition waste, along with all other types of non-hazardous solid waste, would be hauled to Cinder Lake Landfill, approximately 16 miles northeast of the airport.
Historical, Architectural, Archaeological, and Cultural Resources	FAA has not established a significance threshold for Historical, Architectural, Archaeological, and Cultural Resources. Factors to consider are if an action would result in a finding of "adverse effect" through the Section 106 process. However, an adverse effect finding does not automatically trigger preparation of an EIS (i.e., a significant impact).	The closest historical resource, Fort Tuthill, is northwest of the airport just across Interstate 17, as seen on Exhibit 1M. However, almost all proposed development on **Exhibit 5A** is within existing airport property boundaries, and thus would not impact this resource. Should any previously undisturbed areas of the airport be subject to ground disturbance, a cultural resources survey may be necessary to determine the potential presence of historic artifacts.
Land Use	FAA has not established a significance threshold for Land Use. There are also no specific independent factors to consider. The determination that significant impacts exist is normally dependent on the significance of other impacts.	None. The proposed development concept shows development primarily occurring within existing airport boundaries. There are two proposed roadway projects that would occur outside of airport property boundaries, as well as future aviation-related revenue support areas that could result in the development of select parcels outside of airport property limits. However, these projects are proposed within areas around the airport that are undeveloped, vacant lands, so surrounding land uses will not be significantly impacted. The John Wesley Powell Boulevard future extension is proposed to weave in and out of the northeastern and southeastern airport property line;

		however, the extension is in vacant, undeveloped land.[2] Similarly, the roadway extension from S Lake Mary Road to the future aviation development potential area would go through vacant, undeveloped land in the ultimate USDA property easement area and area proposed for fee simple property acquisition (see **Exhibit 5A**). There would be no business or home relocations because of these roadway projects. There are three areas of land proposed for acquisition: 60 acres on the north side of the airport, 54 acres on the south side of Runway 3-21, and 63 acres of land on the east side of the airport. Although tree clearing and grading would be necessary in some areas of land, there are no homes or businesses that would require relocation. Thus, no significant impacts to the community would occur. Further, as outlined in Chapter Four, the City of Flagstaff has several purchase agreements with the USFS that allow the City to acquire lands adjacent to the airport for projects like this. Lastly, the *Flagstaff Regional Plan 2030* (as amended December 31, 2015) has a goal of strengthening and expanding the role of the Flagstaff Pulliam Airport as the dominant hub for passenger, air freight, public safety, flights, and other services in northern Arizona (Goal T.10). A supporting policy of this goal is to plan and manage transportation infrastructure that discourages incompatible land uses with the airport and flight zones (Policy T.10.4). As such, the City discourages development near the airport that would reduce the goal of making it a strong part of the regional transportation network.
Natural Resources and Energy Supply	FAA has not established a significance threshold for Natural Resources and Energy Supply. However, factors to consider are if an action would have the potential to cause demand to exceed available or future supplies of these resources.	None. Planned development projects at the airport could increase demands on energy utilities, water supplies and treatment, and other natural resources during construction; however, long-term impacts to service providers are not anticipated.
Noise and Noise-Compatible Land Use	**Threshold: The action would increase noise by Day-Night Average Sound Level (DNL) 1.5 decibel (dB) or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe.** Another factor to consider is that special consideration needs to be given to the evaluation of the	None. The airport's existing (2015) and long-term (2035) DNL noise exposure contours are shown on **Exhibit 5C**. The contours include the 65, 70, and 75 Day-Night Sound Levels (DNL). The FAA's threshold for compatibility with noise-sensitive land uses is the 65 DNL contour. The City of Flagstaff adopted an Airport Overlay (AO) zone as part of their 14 CFR Part 150 Noise Compatibility Study to maintain compatibility between the uses at the airport and the nearby public.

[22] Note that the City of Flagstaff plans to extend High Country Trail south to the future extension of J.W. Powell Boulevard as part of this Master Plan (Flagstaff Metropolitan Planning Organization, *Blueprint 2040 Regional Transportation Plan*, page 178, May 2017).


LEGEND
Existing Airport Property Line
Ultimate Airport Property Line
USDA Avigation Easement
5-Foot Ground Contours
65 Day-Night Average Sound Level (DNL)
70 Day-Night Average Sound Level (DNL)
75 Day-Night Average Sound Level (DNL)
Fee Simple Property Acquisition
Interstate 17
John Wesley Powell Blvd
Shamrell Blvd.
John Wesley Powell Blvd
Future Extension
Lake Mary Rd.
Runway 3/21 8,800' x 150'
EXISTING (2015)
NORTH
0
1,000
2,000
SCALE IN FEET
Photo Source: Kenney Aerial Mapping 9-29-2017
LONG TERM (2035)

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	significance of noise impacts on noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in Title 14 Code of Federal Regulations (CFR) Part 150 are not relevant to the value, significance, and enjoyment of the area in question.	The existing (2015) noise contours extend off airport property on both runway ends. On the south end of Runway 3-21, the 65 DNL noise contour extends just beyond airport property; however, the area is vacant and undeveloped, and would not significantly impact any noise-sensitive land uses. The 65 DNL noise contour on the north end of Runway 3-21 extends onto a greater area of land than the contour on the south end of Runway 3-21; however, it still is in an area that is vacant and undeveloped and would not cause significant impacts on noise-sensitive land uses. The long-term (2035) noise contours extend off airport property in the same areas. For both runway ends, the 65 DNL noise contour goes beyond airport property limits; however, both contours would still be on vacant, undeveloped land. The areas that the 65 DNL noise contours extend onto are proposed for future acquisition, which is shown on **Exhibit 5C**. These areas are not proposed to be developed, but will be acquired for purposes of protecting airport approach and safety zones from incompatible land uses. As discussed previously, the surrounding forest lands are considered a Section 4(f) resource. The change anticipated in noise exposure contours during the Master Plan's 20-year horizon is minor, though, and not expected to substantially impair the forest's value, significance, or enjoyment.
Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks		
Socioeconomics	FAA has not established a significance threshold for socioeconomics. However, factors to consider are if an action would have the potential to: • Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area); • Disrupt or divide the physical arrangement of an established community; • Cause extensive relocation when sufficient replacement housing is unavailable; • Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities; • Disrupt local traffic patterns and substantially reduce the levels of service of roads serving the airport and its surrounding communities; or • Produce a substantial change in the community tax base.	Proposed development projects would occur primarily on airport property, except for the John Wesley Powell Boulevard future extension, the roadway extension from S Lake Mary Road, and select areas in the southern part of the airport for aviation development potential. The John Wesley Powell Boulevard extension is proposed to weave in and out of the airport's northeastern property line, which is currently undeveloped, forested land. Thus, it would not impact any residents or businesses near the airport. The other roadway project would extend south from S Lake Mary Road to support future aviation development potential. The future aviation-related revenue support projects in the southern portion of airport property could occur outside of existing property limits in some areas; however, the area is vacant, forested land, and no homes or businesses would be displaced. Disruption of local traffic patterns are not anticipated during either of these road extensions. Alt-

		hough traffic volumes on and around airport property may increase during construction, there would not be long-term congestion. As discussed in Land Use, there are three areas of land proposed for acquisition; however, they are currently undeveloped and would not displace any residences or businesses. There is potential for increased economic activity with the proposed aviation and non-aviation related revenue support, which could create a substantial change in the community tax base. These potential impacts to the community tax base should be evaluated further as these proposed projects progress.
Environmental Justice	FAA has not established a significance threshold for Environmental Justice. However, factors to consider are if an action would have the potential to lead to a disproportionately high and adverse impact to an environmental justice population (i.e., a low-income or minority population) due to: • Significant impacts in other environmental impact categories; or • Impacts on the physical or natural environment that affect an environmental justice population in ways that FAA determines are unique to the environmental justice population and significant to that population.	Since the Environmental Inventory (Chapter One) was conducted, the population metrics in the block group[3] (040050009002) that contains the airport has changed and new data has become available.[4] Within this block group, there is a total population of 4,067, of which 1,215 persons (29.9%) are a minority and 382 households (9.4%) are living below the federal poverty level.[5] The closest residence is one-half mile south of the nearest proposed project, on the west side of Interstate 17. In addition, construction is proposed primarily within airport property bounds. It is therefore not expected that construction would result in disproportionately high and/or adverse impacts to any environmental justice populations residing near the airport.
Children's Environmental Health and Safety Risks	FAA has not established a significance threshold for Children's Environmental Health and Safety Risks. However, factors to consider are if an action would have the potential to lead to a disproportionate health or safety risk to children.	None. The nearest education facility is Mountain School, which is approximately one mile north of the airport.
Visual Effects		
Light Emissions	FAA has not established a significance threshold for Light Emissions. However, a factor to consider is the degree to which an action would have the potential to: • Create annoyance or interfere with normal activities from light emissions; and • Affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resources.	The primary recommendations related to lighting include: • Enhancing the medium intensity taxiway lights (MITL) with light-emitting diode (LED) technology on Taxiway A, including entrance/exit Taxiways A1 – A6; • Incorporating MITL with LED technology to the Taxiway W loop; and, • Runway 3 runway end identifier lights (REILs).

[3] Block Groups are statistical divisions of census tracts that generally contain between 600 and 3,000 people and are used to present data and control block numbering (U.S. Census Bureau, https://www.census.gov/geo/reference/gtc/gtc_bg.html).
[4] The Environmental Inventory data is based on 2010 – 2014 American Community Survey estimates.
[5] 2011 – 2015 American Community Survey estimates.

		As mentioned previously, the closest residence is one-half mile away from the nearest proposed lighting project. Thus, these projects are not likely to cause impacts. The addition of lighting to proposed buildings, like the snow removal equipment building, terminal building expansion (and ultimate new terminal building), terminal vehicle parking expansion, rental car preparation center, and aviation and non-aviation revenue support facilities, could increase the amount of light emissions on the airport. This additional lighting would likely not cause significant impacts to nearby residents given the distance between the airport and nearby sensitive receptors, including residences (the closest of which is one-half mile away). Light-sensitive species that hunt, migrate, or mate at night near the airport are likely already acclimated to airport lights. The incremental change in lighting due to recommended Master Plan projects is not anticipated to cause undue stress. There are other areas within the forest to which sensitive species can move that are less affected by the airport. Flagstaff is a Dark Sky City, as certified by the International Dark Sky Association[6] in 2001. In addition to this certification, the Flagstaff Zoning Code designates the airport in Lighting Zone II, which has lighting requirements that industrial facilities, like the airport, must adhere to (see Tables 1K and 1L in Chapter One for complete lighting standards). To ensure no loss of the visual character of Flagstaff's night sky, airport development should be consistent with the City of Flagstaff's lighting ordinance, as well as any standards necessary to conform to the International Dark Sky Association requirements.
Visual Resources/Visual Character	FAA has not established a significance threshold for Visual Resources/Visual Character. However, a factor to consider is the extent an action would have the potential to: • Affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources; • Contrast with the visual resources and/or visual character in the study area; and	None. Development planned in the recommended Master Plan development concept would not significantly change the overall visual character of the airport. Additionally, all development is primarily on airport property, and improvements to the airside and/or landside facilities would not obstruct or interfere with any visual resources nearby.

[6] The International Dark Sky Association is a United States based non-profit organization whose mission is to protect the night skies for present and future generations.

	• Block or obstruct the views of the visual resources, including whether these resources would still be viewable from other locations.	
Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)		
Wetlands	**Threshold: The action would:** **1. Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;** **2. Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;** **3. Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);** **4. Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands.** **5. Promote development of secondary activities or services that would cause the circumstances listed above to occur; or** 6. **Be inconsistent with applicable state wetland strategies.**	None. There are no wetlands on or near airport property.
Floodplains	**Threshold: The action would cause notable adverse impacts on natural and beneficial floodplain values. Natural and beneficial floodplain values are defined in Paragraph 4.k of DOT Order 5650.2, *Floodplain Management and Protection.***	None. There is a 100-year floodplain along Bow and Arrow Wash. However, there is no development proposed in or near the floodplain. The floodplain terminates at the Runway 21 end where development is not permitted as it contains both the approach and departure RPZs.
Surface Waters	**Threshold: The action would:** **1. Exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or** **2. Contaminate public drinking water supply such that public health may be adversely affected.** Factors to consider are when a project would have the potential to:	Airport projects, such as additional apron, parking lots, buildings and other impervious surfaces, could increase the amount of runoff from the Airport. The Airport's stormwater drainage system would need to be upgraded to handle additional runoff quantities, if necessary. Per the City of Flagstaff's Zoning Code,[7] all new developments are required to comply with xeriscape and low impact development (LID) principles identified in the City's *Stormwater Regulations and LID Manual.* The purpose of this requirement is to preserve and mimic nature

[7] Title 10, Division 10-50.60: Landscaping Standards, Sections 10-50.60.010 – 10-50.60.080 (http://www.codepublishing.com/AZ/Flagstaff/, accessed December 4, 2017).

	• Adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values; • Adversely affect surface water such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or • Present difficulties based on water quality impacts when obtaining a permit or authorization.	through the use of stormwater planning and management techniques on project sites. Proposed airport projects would be required to adhere to the standards set in the Zoning Code, as well as the *Stormwater Regulations and LID Manual.* Further, the *Flagstaff Regional Plan* (as amended 2015) shows a regional detention basin on airport property near parts of the future John Wesley Powell Boulevard extension, as well as the proposed snow removal equipment facility, future rental car preparation center and associated parking, and proposed hangars/buildings (see Exhibit 1N). This airport basin is part of a traditional storm drainage system originally designed to reduce 100-year peak flows during storm events. The traditional systems do not always address volume increases, stormwater quality, and groundwater recharge adequately, which prompted the City of Flagstaff to incorporate low-impact development techniques, like this detention basin, to complement the traditional stormwater systems.[8] The placement of this detention basin would need to be evaluated as projects in its vicinity are proposed on airport property. There are two streams on airport property, Bow and Arrow Wash and an unnamed stream. Bow and Arrow Wash, when wet, runs through some areas proposed for development, and the unnamed stream on the southern area of airport property runs into future aviation-related revenue support. When construction is proposed in and around these two surface waters, FAA's Advisory Circular 150/5370-10G, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control* should be implemented. If Bow and Arrow Wash is deemed jurisdictional by the U.S. Army Corps of Engineers, a Section 404 Permit and 401 Certification may be required, in addition to a Section 402 National Pollutant Discharge Elimination System permit.
Groundwater	**Threshold: The action would:** **1. Exceed groundwater quality standards established by federal, state, local, and tribal regulatory agencies: or** **2. Contaminate an aquifer used for public water supply such that public health may be adversely affected.**	Indirect. The master plan concept demonstrates future revenue-generating opportunities on airport property that could increase the amount of water used on-site. The aviation and non-aviation related revenue support areas could result in increased water use as these properties are developed in the future. As these properties are developed, water scarcity impacts should be addressed during design.

[8] http://www.flagstaff.az.gov/DocumentCenter/View/48421

	Factors to consider are when a project would have the potential to: • Adversely affect natural and beneficial groundwater values to a degree that substantially diminishes or destroys such values; • Adversely affect groundwater quantities such that the beneficial uses and values of such groundwater are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or • Present difficulties based on water quality impacts when obtaining a permit or authorization.	
Wild and Scenic Rivers	FAA has not established a significance threshold for Wild and Scenic Rivers.	None. There are no Wild and Scenic Rivers within 45 miles of the airport.

MASTER PLAN CONCEPT SUMMARY

This chapter has been prepared to help the City of Flagstaff in making decisions on the future growth and development of Flagstaff Airport by describing narratively and graphically the Master Plan Concept and detailing the environmental conditions that must be taken into consideration when implementing the development plan. The plan represents an airfield facility that fulfills aviation needs for the airport, while conforming to safety and design standards to the extent practicable. It also provides a landside complex that can be developed as demand dictates and is subject to further refinement pending comments from the PAC, City of Flagstaff, and general public.

Flexibility will be very important to future development at the airport, as activity may not occur as predicted. The Master Plan Concept provides airport stakeholders with a general guide that, if followed, can maintain the airport's long term viability and allow the airport to continue to provide air transportation service to the region. The next chapter of this Master Plan will consider strategies for funding the recommended improvements and will provide a reasonable schedule for undertaking the projects based on safety and demand over the course of the next 20 years.

FLAGSTAFF AIRPORT

CHAPTER SIX

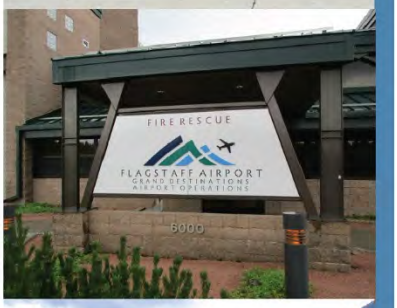
Capital Plan

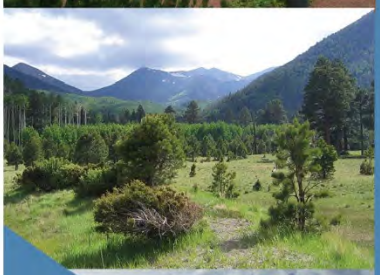


FLAGSTAFF AIRPORT

Chapter Six
CAPITAL PLAN









The analyses completed in previous chapters evaluated development needs at Flagstaff Airport over the next 20 years, based on forecast activity, facility requirements, safety standards, and operational efficiency. Now that the recommended Master Plan Concept has been developed and specific needs and improvements for the airport have been established, the next step is to determine a realistic schedule for project implementation as well as the associated costs for the plan. This chapter will provide a description and overall cost for each project identified in the capital improvement program (CIP) and development schedule. The program has been evaluated from a variety of perspectives and represents a comparative analysis of basic budget factors, demand, and priority assignments.

The presentation of the capital program has been organized into three sections. First, the airport's capital program needs are identified by various categories ranging from meeting safety and design standards to satisfying demand. Second, the airport development schedule and CIP cost estimates are presented in narrative and graphic form. The CIP has been developed following Federal Aviation Administration (FAA) guidelines for Master Plans and identifies those projects that are likely eligible for FAA and Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group) grant funding. Third, capital improvement funding sources on the federal, state, and local levels are identified and discussed.

AIRPORT DEVELOPMENT NEEDS

In an effort to identify capital needs at the airport, this section provides analysis regarding the associated development needs of those projects included in the CIP. While some projects will be demand-based, others will be dictated by design standards, safety, or rehabilitation needs. Each development need is categorized according to this schedule. The applicable category (or categories) included are presented on **Exhibit 6A**. The proposed projects can be categorized as follows:

1) **Safety/Security (SS)** – these are capital needs considered necessary for operational safety and protection of aircraft and/or people and property on the ground near the airport.

2) **Environmental (EN)** – these are capital needs which are identified to enable the airport to operate in an environmentally acceptable manner or meet needs identified in the Environmental Overview outlined in Appendix B.

3) **Maintenance (MN)** – these are capital needs required to maintain the existing infrastructure at the airport.

4) **Efficiency (EF)** – these are capital needs intended to optimize aircraft ground operations or passengers' use of the terminal building.

5) **Demand (DM)** – these are capital needs required to accommodate levels of aviation demand. The implementation of these projects should only occur when demand for these needs is verified.

6) **Opportunities (OP)** – these are capital needs intended to take advantage of opportunities afforded by the airport setting. Typically, this will involve improvements to property intended for lease to aviation or non-aviation related development.

AIRPORT DEVELOPMENT SCHEDULE AND COST SUMMARIES

Now that the specific needs and improvements for Flagstaff Airport have been established, the next step is to determine a realistic schedule and the associated costs for implementing the recommended Master Plan Concept. The capital program considers the interrelationships among the projects in order to determine an appropriate sequence of projects while remaining within reasonable fiscal constraints.

This section will examine the overall cost of each item in the capital program. The CIP, programmed by years, has been developed to cover the first five years of the plan. The remaining projects are grouped into intermediate (years 6-10) and long term (years 11-20) planning horizons. More detailed information is provided for the five-year horizon, with less detail provided for the intermediate and long term planning periods. By utilizing planning horizons instead of specific years for intermediate and long term development, the City of Flagstaff will have greater flexibility to adjust capital needs as demand dictates. **Table 6A** summarizes the key milestones for each of the three planning horizons. The forecasts associated with these planning horizons have been approved by the FAA for purposes of this Master Plan.



	Project Description*	Development Category	Total Project Cost	FAA Eligible	State Eligible	Airport/Local Share
	Short Term Program (Years 0-5)					
2018	1 Equipment Purchase - ARFF Truck and Associated Equipment	SS	$800,000	$728,480	$35,760	$35,760
	2 Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Short Term Program**	EN	$750,000**	$682,950**	$33,525**	$33,525**
	2018 Total		**$1,550,000**	**$1,411,430**	**$69,285**	**$69,285**
2019	3 Design - Snow Removal Equipment Facility	SS/EF	$500,000	$455,300	$22,350	$22,350
	4 Conduct Drainage Master Plan	SS/MN	$400,000	$364,240	$17,880	$17,880
	5 Clear ROFA on South Side of Runway 3-21	SS	$285,000	$259,521	$12,740	$12,740
	2019 Total		**$1,185,000**	**$1,079,061**	**$52,970**	**$52,970**
2020	6 Construct - Snow Removal Equipment Facility	SS	$5,000,000	$4,553,000	$223,500	$223,500
	7 Purchase 60 Acres of Land on North Side of Airport for Airfield Safety and Approach Protection	SS	$690,000	$0	$621,000	$69,000
	8 Design and Construct - Implement REILs on Runway 3	SS	$42,000	$38,245	$1,877	$1,877
	2020 Total		**$5,732,000**	**$4,591,245**	**$846,377**	**$294,377**
2021	9 Design and Construct - Rehabilitate Taxiway A (Northern 6,000') Including Entrance/Exit Taxiways A1-A6 (Include Enhancing MITL with LED Technology)	MN	$2,000,000	$1,821,200	$89,400	$89,400
	10 Design and Construct - Rehabilitate Taxiway W Loop (Include MITL Utilizing LED Technology)	MN	$500,000	$0	$450,000	$50,000
	11 Equipment Purchase - Snow Removal Equipment	SS	$500,000	$455,300	$22,350	$22,350
	2021 Total		**$3,000,000**	**$2,276,500**	**$561,750**	**$161,750**
2022	12 Design - Terminal Building Expansion and Security Upgrades	SS/DM	$400,000	$364,240	$17,880	$17,880
	13 Design - Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron)	SS/MN/EF	$400,000	$0	$360,000	$40,000
	14 Design and Construct - Implement No-Taxi Islands Adjacent to Taxiways A6, A7, and A8	SS	$84,000	$76,490	$3,755	$3,755
	2022 Total		**$884,000**	**$440,730**	**$381,635**	**$61,635**
2023	15 Construct - Terminal Building Expansion and Security Upgrades	SS/DM	$4,000,000	$3,642,400	$178,800	$178,800
	16 Construct - Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron)	SS/MN/EF	$2,200,000	$2,003,320	$98,340	$98,340
	17 Design - Terminal Vehicle Parking Expansion	DM	$580,000	$0	$0	$580,000
	18 Design and Construct - Runway 3-21 Rehabilitation	MN	$500,000	$0	$450,000	$50,000
	2023 Total		**$7,280,000**	**$5,645,720**	**$727,140**	**$907,140**
	Short Term Program Total		**$19,631,000**	**$15,444,687**	**$2,639,157**	**$1,547,157**
	Intermediate Term Program (Years 6-10)					
	1 Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Intermediate Term Program**	EN	$750,000**	$682,950**	$33,525**	$33,525**
	2 Construct Terminal Vehicle Parking Expansion - Phase I (Surface Lot)	DM	$675,000	$0	$0	$675,000
	3 Construct Rental Car Preparation Center	DM/EF	$75,000	$0	$0	$75,000
	4 Construct Hold Apron Adjacent to South Side of Taxiway A	SS/EF	$668,000	$608,281	$29,860	$29,860
	5 Clear and Prepare Property for General Aviation Redevelopment Adjacent to South Side of Aircraft Parking Apron	DM/OP	$253,000	$0	$0	$253,000
	6 Upgrade Perimeter Access Road on East and West Sides of Airfield	SS/MN	$4,500,000	$4,097,700	$201,150	$201,150
	7 Co-Locate Segmented Circle with Existing Windcone on West Side of Runway	SS/EF	$35,000	$31,871	$1,565	$1,565
	8 Purchase 54 Acres of Land on South Side of Airport for Airfield Safety and Approach Protection	SS	$621,000	$0	$558,900	$62,100
	9 Construct Air Cargo Support Apron	DM/EF	$1,359,000	$1,237,505	$60,747	$60,747
	10 Construct Terminal Vehicle Parking Expansion - Phase II (Road Realignment and Surface Lot)	DM	$1,655,000	$0	$0	$1,655,000
	11 General Airfield Pavement Maintenance	MN	$500,000	$455,300	$22,350	$22,350
	Intermediate Term Program Total		**$11,091,000**	**$7,113,607**	**$908,096**	**$3,069,297**
	Long Term Program (Years 11-20)					
	1 Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Long Term Program**	EN	$1,000,000**	$910,600**	$44,700**	$44,700**
	2 Relocate Hold Line Markings to 321' to Meet RDC C-III Design Standards	SS	$68,000	$61,921	$3,040	$3,040
	3 Conduct Terminal Area Study to Analyze Ultimate Terminal Building Replacement***	DM/OP	$300,000	$273,180	$13,410	$13,410
	4 Construct Terminal Vehicle Parking Expansion - Phase III (Parking Garage)	DM	$2,140,000	$0	$0	$2,140,000
	5 Construct Stub Taxilane Serving General Aviation Development on West Side of Airport	DM/EF	$77,000	$70,116	$3,442	$3,442
	6 Environmental Documentation (CatEx or EA) - New Terminal Building	EN	***	***	***	***
	7 Design and Construction - New Terminal Building	DM/OP	***	***	***	***
	8 Purchase 63 Acres of Land on East Side of Airport for Future Airport Development Potential	DM/OP	$724,500	$659,730	$32,385	$32,385
	9 Implement Infrastructure Development on East Side of Airfield - Multiple Phases	DM/OP	$6,950,000	$1,512,000	$0	$5,438,000
	10 Construct Taxiway Network Extending East from Runway 3-21 to Serve Aviation Development Potential - Multiple Phases	DM/OP	$8,045,000	$7,325,777	$359,612	$359,612
	11 General Airfield Pavement Maintenance	MN	$1,000,000	$910,600	$44,700	$44,700
	Long Term Program Total		**$20,304,500**	**$11,723,924**	**$501,288**	**$8,079,288**
	TOTAL PROGRAM COSTS		**$51,026,500**	**$34,282,218**	**$4,048,541**	**$12,695,742**

*Project implementation is dependent on federal and state grant funding and availability. The CIP is based on FAA fiscal year programming.
**Actual costs would be determined on a per project basis throughout the course of the planning period.
***The Terminal Area Study will further define the project and associated costs for the environmental, design, and construction of a new terminal building.
Note: Several projects are eligible for federal and state funding assistance; however, certain projects are designated for state/local funding only per the Airport's current CIP and allocations are subject to change. **A detailed listing of acronyms are provided in Chapter 6 of the Master Plan.**

TABLE 6A
Planning Horizon Activity Levels
Flagstaff Airport

	Base Year	Short Term	Intermediate Term	Long Term
ENPLANED PASSENGERS*	**67,421**	**80,000**	**95,000**	**125,000**
BASED AIRCRAFT				
Single Engine Piston	113	117	122	131
Multi-Engine Piston	15	15	15	15
Turboprop	4	5	6	9
Jet	0	1	3	6
Helicopter	4	5	6	9
Other	3	3	4	6
TOTAL BASED AIRCRAFT	**139**	**146**	**156**	**176**
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	3,498	3,000	3,400	4,200
General Aviation	20,612	21,700	22,700	24,700
Air Taxi	10,455	11,600	12,700	15,500
Military	1,193	850	850	850
Total Itinerant	**35,758**	**37,150**	**39,650**	**45,250**
Local				
General Aviation	9,669	10,400	11,100	12,500
Military	629	450	450	450
Total Local	**10,298**	**10,850**	**11,550**	**12,950**
TOTAL OPERATIONS*	**46,056**	**48,000**	**51,200**	**58,200**

* A high range retention forecast for passenger enplanements was also prepared during the forecast analysis that calls for the potential of 155,000 annual enplanements through the long term planning horizon.

A key aspect of this planning document is the use of demand-based planning milestones. The short term planning horizon contains items of highest need and/or priority. As short term horizon activity levels are reached, it will then be time to program for the intermediate term based upon the next activity milestones. Similarly, when the intermediate term milestones are reached, it will be time to program for the long term activity milestones.

Many development items included in the recommended concept will need to follow demand indicators which essentially establish triggers for key improvements. For example, the Master Plan Concept includes the expansion of terminal area vehicle parking. Growth in passenger enplanements is the trigger for this project. If growth slows or does not occur as projected, the terminal area vehicle parking expansion can be delayed. As a result, the capital expenditures will be undertaken as needed, which leads to a responsible use of capital assets. Some development items do not depend on demand, such as pavement maintenance. These types of projects typically are associated with day-to-day operations and should be monitored and identified by airport management.

Because of economic realities, few airports are constructing hangars on their own, and instead are relying on private developers. In some cases, private developers can keep construction costs lower, which in turn lowers the monthly lease rates necessary to amortize a loan. To the greatest extent possible,

private development of all hangar types should be supported and promoted by the airport sponsor. The CIP for the airport assumes that all future hangars would be constructed through public/private partnerships. This assumption does not preclude the possibility of the airport constructing new hangars. The airport sponsor's responsibility related to new hangars can be to provide public access taxiways, typically in conjunction with FAA and/or state development grants. These taxiways are then able to be utilized by hangar tenants for aircraft access to the runway/taxiway system.

Not all projects identified are necessary to meet projected demand. Other projects are necessary to enhance the safety of the airport, maintain existing infrastructure, or meet FAA design standards. These projects need to be programmed in a timely manner regardless of changes in demand indicators.

As a Master Plan is a conceptual document, implementation of the capital projects should only be undertaken after further refinement of their design and costs through architectural or engineering analyses. Moreover, some projects may require additional infrastructure improvements (i.e., drainage improvements, extension of utilities, etc.) that may increase the estimated cost of the project or increase the timeline for completion.

Once a list of necessary projects was identified and refined, project-specific cost estimates were prepared. The cost estimates also include design, construction administration, and contingencies that may arise on the project. Capital costs presented here should be viewed only as "order-of-magnitude" estimates subject to further refinement during design. Nevertheless, they are considered sufficient for planning purposes. Cost estimates for certain projects included in the Master Plan CIP were provided by airport staff and have been coordinated with the FAA during routine planning meetings. Other cost estimates have been prepared by the planning consultant. Cost estimates for each of the development projects in the CIP are in current (2017) dollars. Adjustments will need to be applied over time as construction costs or capital equipment costs change.

Exhibit 6A presents the proposed 20-year CIP for Flagstaff Airport and **Exhibit 6B** graphically depicts the development staging by overlaying each project onto the aerial photograph of the airport. An estimate of FAA and ADOT-MPD – Aeronautics Group funding eligibility has been included, although actual funding is not guaranteed. For those projects that would be eligible for federal funding, Airport Improvement Program (AIP) reauthorization provides for 91.06 percent of the total project cost at Flagstaff Airport. The remaining amount (8.94 percent) would be equally shared (4.47 percent) between ADOT-MPD – Aeronautics Group and City of Flagstaff. This eligibility breakdown is based upon the airport's classification, in addition to the amount of public land within the State of Arizona.

As detailed in the CIP, the majority of projects listed are eligible for federal and state funding. Obviously, demand and justification for these projects must be provided prior to a grant being issued by either the FAA and/or ADOT-MPD – Aeronautics Group. It should be noted that certain projects listed in the CIP, while eligible for federal and state funding, are designated for state funding assistance only per the airport's current CIP on file with the FAA and ADOT-MPD – Aeronautics Group.

The FAA utilizes a national priority rating system to help objectively evaluate potential airport projects. Projects are weighted toward safety, infrastructure preservation, meeting design standards, and capacity enhancement. The FAA will participate in the highest priority projects before considering lower priority projects, even if a lower priority project is considered a more urgent need by the local sponsor. Nonetheless, the project should remain a priority for the airport and funding support should continue to be requested in subsequent years.

Some projects identified in the CIP will require environmental documentation. The level of documentation necessary for each project must be determined in consultation with the FAA and ADOT-MPD – Aeronautics Group. There are three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA) that include categorical exclusions (CatEx), Environmental Assessments (EA), and Environmental Impact Statements (EIS). Each level requires more time to complete and more detailed information. Guidance on what level of documentation is required for a specific project is provided in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The Environmental Overview presented in Chapter Five addresses NEPA and provides an evaluation of various environmental categories for Flagstaff Airport. The level of environmental documentation that could be required for future projects in the CIP is further addressed later in this chapter.

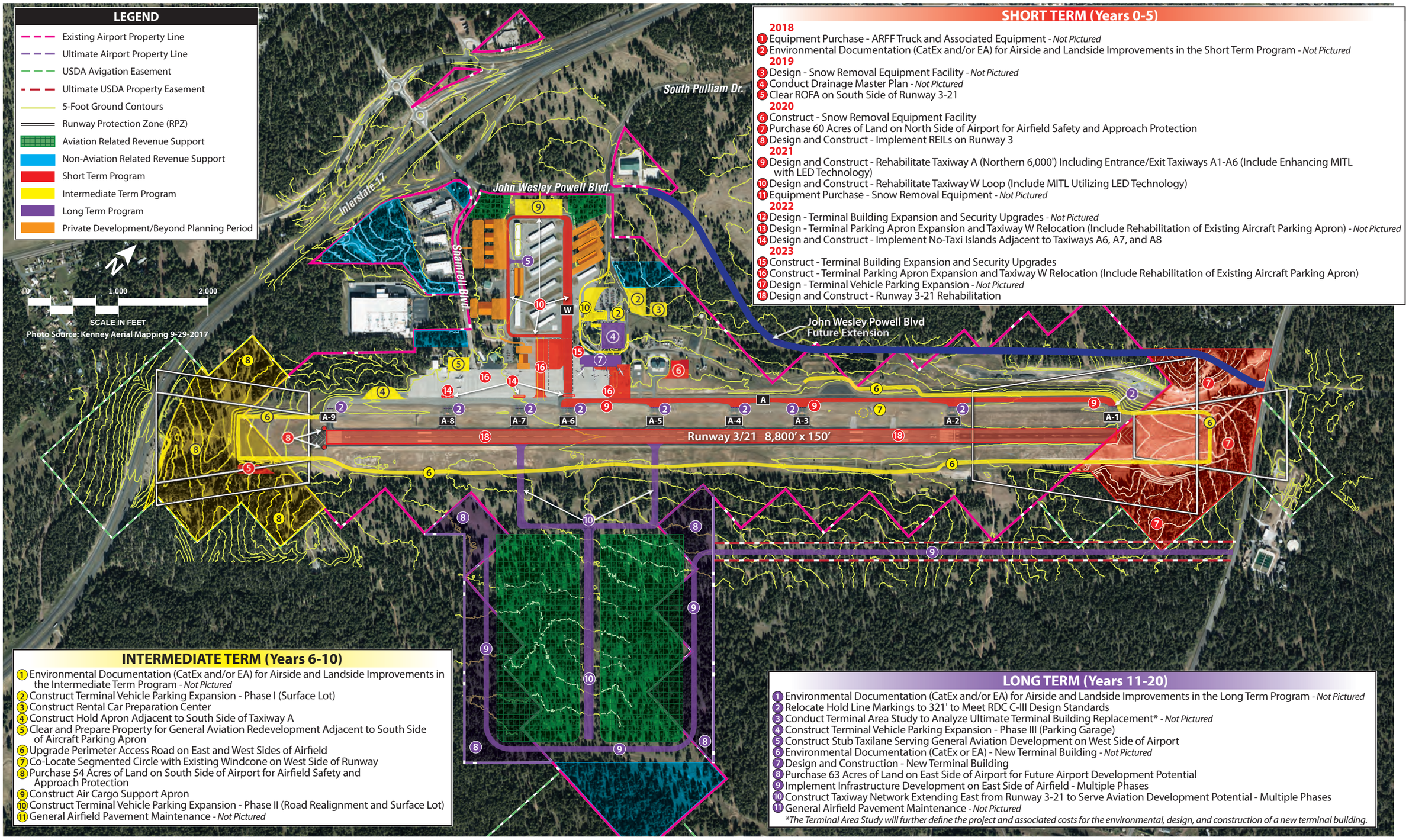
The following sections will describe in greater detail the projects identified for the airport over the next 20 years. The projects are grouped based upon a detailed evaluation of existing and projected demand, safety, rehabilitation needs, and local priority. While the CIP identifies the priority ranking of the projects, the list should be evaluated and revised on a regular basis. It is also important to note that certain projects, while listed separately for purposes of evaluation in this study, could be combined with other projects during time of construction/ implementation.

SHORT TERM PROGRAM

The short term projects are those anticipated to be needed during the first five years of the 20-year CIP. The list of projects is further divided into yearly timeframes and are prioritized based on the needs of Flagstaff Airport. Projects related to safety and maintenance generally have the highest priority. This applies to many of the projects identified in the short term CIP that are associated with maintaining existing airfield pavements, improving airfield safety and geometry standards, and enhancing terminal facilities. The short term program considers 18 projects for the planning period as presented on **Exhibit 6A** and depicted on **Exhibit 6B**. The following provides a detailed breakdown of each project.

Project #1: Equipment Purchase – Aircraft Rescue and Firefighting (ARFF) Truck and Associated Equipment

Description: A new ARFF truck and associated equipment is programmed that will allow the airport to improve safety on the airfield. Equipment for the truck will also be purchased.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.



LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- USDA Avigation Easement
- Ultimate USDA Property Easement
- 5-Foot Ground Contours
- Runway Protection Zone (RPZ)
- Aviation Related Revenue Support
- Non-Aviation Related Revenue Support
- Short Term Program
- Intermediate Term Program
- Long Term Program
- Private Development/Beyond Planning Period

SHORT TERM (Years 0-5)

2018

1. Equipment Purchase - ARFF Truck and Associated Equipment - *Not Pictured*
2. Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Short Term Program - *Not Pictured*

2019

3. Design - Snow Removal Equipment Facility - *Not Pictured*
4. Conduct Drainage Master Plan - *Not Pictured*
5. Clear ROFA on South Side of Runway 3-21

2020

6. Construct - Snow Removal Equipment Facility
7. Purchase 60 Acres of Land on North Side of Airport for Airfield Safety and Approach Protection
8. Design and Construct - Implement REILs on Runway 3

2021

9. Design and Construct - Rehabilitate Taxiway A (Northern 6,000') Including Entrance/Exit Taxiways A1-A6 (Include Enhancing MITL with LED Technology)
10. Design and Construct - Rehabilitate Taxiway W Loop (Include MITL Utilizing LED Technology)
11. Equipment Purchase - Snow Removal Equipment - *Not Pictured*

2022

12. Design - Terminal Building Expansion and Security Upgrades - *Not Pictured*
13. Design - Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron) - *Not Pictured*
14. Design and Construct - Implement No-Taxi Islands Adjacent to Taxiways A6, A7, and A8

2023

15. Construct - Terminal Building Expansion and Security Upgrades
16. Construct - Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron)
17. Design - Terminal Vehicle Parking Expansion - *Not Pictured*
18. Design and Construct - Runway 3-21 Rehabilitation

INTERMEDIATE TERM (Years 6-10)

1. Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Intermediate Term Program - *Not Pictured*
2. Construct Terminal Vehicle Parking Expansion - Phase I (Surface Lot)
3. Construct Rental Car Preparation Center
4. Construct Hold Apron Adjacent to South Side of Taxiway A
5. Clear and Prepare Property for General Aviation Redevelopment Adjacent to South Side of Aircraft Parking Apron
6. Upgrade Perimeter Access Road on East and West Sides of Airfield
7. Co-Locate Segmented Circle with Existing Windcone on West Side of Runway
8. Purchase 54 Acres of Land on South Side of Airport for Airfield Safety and Approach Protection
9. Construct Air Cargo Support Apron
10. Construct Terminal Vehicle Parking Expansion - Phase II (Road Realignment and Surface Lot)
11. General Airfield Pavement Maintenance - *Not Pictured*

LONG TERM (Years 11-20)

1. Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Long Term Program - *Not Pictured*
2. Relocate Hold Line Markings to 321' to Meet RDC C-III Design Standards
3. Conduct Terminal Area Study to Analyze Ultimate Terminal Building Replacement* - *Not Pictured*
4. Construct Terminal Vehicle Parking Expansion - Phase III (Parking Garage)
5. Construct Stub Taxilane Serving General Aviation Development on West Side of Airport
6. Environmental Documentation (CatEx or EA) - New Terminal Building - *Not Pictured*
7. Design and Construction - New Terminal Building
8. Purchase 63 Acres of Land on East Side of Airport for Future Airport Development Potential
9. Implement Infrastructure Development on East Side of Airfield - Multiple Phases
10. Construct Taxiway Network Extending East from Runway 3-21 to Serve Aviation Development Potential - Multiple Phases
11. General Airfield Pavement Maintenance - *Not Pictured*

**The Terminal Area Study will further define the project and associated costs for the environmental, design, and construction of a new terminal building.*

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Project #2: Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Short Term Program

Description: This includes a line item in the CIP that provides the necessary environmental reviews needed for several projects outlined in the short term program. These environmental reviews, whether a CatEx or EA, would likely be programmed separately and in conjunction with a particular project at least one to two years in advance of actual construction and/or implementation.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #3: Design – Snow Removal Equipment Facility

Description: The design of the snow removal equipment facility as detailed in the Master Plan Concept will occur prior to actual construction.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #4: Conduct Drainage Master Plan

Description: This study will aid in the design of a plan for the airport to improve airfield drainage, especially in the areas adjacent to the runway and taxiway system.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #5: Clear Runway Object Free Area (ROFA) on South Side of Runway 3-21

Description: In an effort to improve airfield safety, the ROFA beyond the south end of the runway system will be cleared of trees and perimeter fencing.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #6: Construct – Snow Removal Equipment Facility

Description: Construct the snow removal equipment facility which will provide storage for snow removal equipment critical to airport safety and functionality.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #7: Purchase 60 Acres of Land on North Side of Airport for Airfield Safety and Approach Protection

Description: This project calls for the purchase of land on the north side of Runway 3-21 that will allow the airport to own all safety areas and a large majority of the approach and departure runway protection zones (RPZs) which is highly recommended by the FAA.
Funding Breakdown: FAA – 0 percent / ADOT – 90 percent / Airport-Local – 10 percent.

Project #8: Design and Construct – Implement REILs on Runway 3

Description: This project calls for the implementation of REILs on Runway 3, further enhancing airfield safety.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #9: Design and Construct – Rehabilitate Taxiway A (Northern 6,000') Including Entrance / Exit Taxiways A1-A6 (Include Enhancing Medium Intensity Taxiway Lighting [MITL] with Light Emitting Diode [LED] Technology)

Description: Rehabilitate the north portion of parallel Taxiway A, including entrance/exit Taxiways A1 through A6 as these pavements are reaching their useful life. It is suggested that this project include the implementation of LED lighting along the taxiway system.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #10: Design and Construct – Rehabilitate Taxiway W Loop (Include MITL Utilizing LED Technology)

Description: This project calls for the rehabilitation and sealcoat of Taxiway W in order to accommodate the fleet mix and operational activity of aircraft utilizing the hangars in the west area of the airfield. Similar to the previous project, it is recommended that this project include the implementation of LED lighting along Taxiway W. This project is eligible for FAA grant funding; however, per the airport's CIP, it is to be funded through the ADOT and local share.
Funding Breakdown: FAA – 0 percent / ADOT – 90 percent / Airport-Local – 10 percent.

Project #11: Equipment Purchase – Snow Removal Equipment

Description: The airport is in need of a broom and additional snow removal equipment. This equipment purchase will allow the airport to better adhere to updated runway condition reporting allowances set forth by the FAA.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #12: Design – Terminal Building Expansion and Security Upgrades

Description: This project calls for the design of short term enhancements to the existing terminal facility.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #13: Design – Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron)

Description: The design of the terminal apron expansion and relocation of Taxiway W, as detailed in the Master Plan Concept, will occur prior to actual construction. This project is eligible for FAA grant funding; however, per the airport's CIP, it is to be funded through the ADOT and local share.
Funding Breakdown: FAA – 0 percent / ADOT – 90 percent / Airport-Local – 10 percent.

Project #14: Design and Construct – Implement No-Taxi Islands Adjacent to Taxiways A6, A7, and A8

Description: In an effort to improve airfield safety, the implementation of No Taxi Islands at various locations on the aircraft parking apron are called for.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #15: Construct – Terminal Building Expansion and Security Upgrades

Description: Once the design is completed, this project entails the implementation of existing terminal building enhancements, which could include upgrading security locks and adding access controls and closed-circuit security cameras. Other enhancements could address some insufficient space needs for improved terminal functionality, including restroom facilities in the secure hold room area.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #16: Construct – Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron)

Description: This project follows the design previously programmed and calls for the construction of the terminal apron expansion and relocation of a portion of Taxiway W to the south. In addition, the rehabilitation of the existing aircraft parking apron on the west side of the airfield is programmed to allow for improved functionality of the apron during snow/ice conditions.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #17: Design – Terminal Vehicle Parking Expansion

Description: In order to address insufficient vehicle parking adjacent to the terminal building, the first phase is to design the proposed expansion of vehicle parking on the west side of the terminal facility. The status of airport parking (parking fee versus no fee) at the time of this project will determine its funding eligibility. It is currently programmed for 100 percent responsibility of the airport sponsor.
Funding Breakdown: FAA – 0 percent / ADOT – 0 percent / Airport-Local – 100 percent.

Project #18: Design and Construct – Runway 3-21 Rehabilitation

Description: In order to maintain essential airfield pavements for aircraft operations, the rehabilitation of Runway 3-21 is programmed at the end of the short term. This project is eligible for FAA grant funding; however, per the airport's CIP, it is to be funded through the ADOT and local share.
Funding Breakdown: FAA – 0 percent / ADOT – 90 percent / Airport-Local – 10 percent.

Short Term Program Summary

The short term CIP includes projects that enhance the overall safety and maintenance of the airfield, while also implementing landside improvements to the existing terminal area. The total investment necessary for the short term CIP is approximately $19.63 million as detailed on **Exhibit 6A**. Of this total, approximately $18.08 million is eligible for federal and state funding assistance. The remaining $1.55 million is to be provided through local funding outlets.

INTERMEDIATE TERM PROGRAM

The intermediate term projects are those that are anticipated to be necessary in years six through 10 of the Master Plan. These projects are not tied to specific years for implementation; instead, they have been prioritized so that airport management has the flexibility to determine when they need to be pursued based on current conditions. It is not unusual for certain projects to be delayed or advanced based

on changing conditions, such as funding availability or changes in the aviation industry. This planning horizon includes 11 projects for the five-year timeframe as listed on **Exhibit 6A** and depicted on **Exhibit 6B**. The following section includes a description of each project.

Project #1: Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Intermediate Term Program

Description: This includes a line item in the CIP that provides the necessary environmental reviews needed for several projects outlined in the intermediate term program. These environmental reviews, whether a CatEx or EA, would likely be programmed separately and in conjunction with a particular project at least one to two years in advance of actual construction and/or implementation.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #2: Construct Terminal Vehicle Parking Expansion – Phase I (Surface Lot)

Description: Following the design of terminal vehicle parking expansion toward the end of the short term program, the first phase of construction is programmed. This entails constructing approximately 76,000 square feet of additional surface-level parking space.
Funding Breakdown: FAA – 0 percent / ADOT – 0 percent / Airport-Local – 100 percent.

Project #3: Construct Rental Car Preparation Center

Description: Construct the rental car preparation center to enhance terminal area services and help alleviate congestion in the terminal area. This project is not eligible for FAA or ADOT funding.
Funding Breakdown: FAA – 0 percent / ADOT – 0 percent / Airport-Local – 100 percent.

Project #4: Construct Hold Apron Adjacent to South Side of Taxiway A

Description: A new hold apron is proposed toward the south end of Taxiway A that would serve aircraft utilizing Runway 3. The design of this hold apron is similar to the existing hold apron farther north along the parallel taxiway system that serves Runway 21.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #5: Clear and Prepare Property for General Aviation Redevelopment Adjacent to South Side of Aircraft Parking Apron

Description: The relocation of the snow removal equipment facility will allow for the existing space to be utilized for general aviation purposes. The redevelopment of this area could involve site preparations associated with making space for specific aviation user demands. This project is not eligible for FAA funding.
Funding Breakdown: FAA – 0 percent / ADOT – 0 percent / Airport-Local – 100 percent.

Project #6: Upgrade Perimeter Access Road on East and West Sides of Airfield

Description: This involves upgrading approximately 4.5 miles of internal perimeter access road that serves the airfield. The upgrades include widening and paving the road to satisfy various demands placed on it related to airfield inspections, perimeter checks, and accessing navigational aids.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #7: Co-Locate Segmented Circle with Existing Windcone on West Side of Runway

Description: In an effort to enhance airfield safety, a segmented circle is programmed in proximity to an existing wind cone on the west side of Runway 3-21.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #8: Purchase 54 Acres of Land on South Side of Airport for Airfield Safety and Approach Protection

Description: This project calls for the purchase of land on the south side of Runway 3-21 that will allow the airport to own all safety areas and a large majority of the approach and departure runway protection zones (RPZs) which is highly recommended by the FAA.
Funding Breakdown: FAA – 0 percent / ADOT – 90 percent / Airport-Local – 10 percent.

Project #9: Construct Air Cargo Support Apron

Description: Construct a large apron area on the west side of the airfield that is provided access via Taxiway W. This pavement could accommodate air cargo activities, as well as other aviation-related functions.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #10: Construct Terminal Vehicle Parking Expansion – Phase II (Road Realignment and Surface Lot)

Description: The Phase II construction of the terminal vehicle parking expansion is called for during this time. This phase includes approximately 74,000 square feet of additional surface-level parking that would require the realignment of South Pulliam Drive.
Funding Breakdown: FAA – 0 percent / ADOT – 0 percent / Airport-Local – 100 percent.

Project #11: General Airfield Pavement Maintenance

Description: This includes a line item in the CIP that allocates a certain amount of funding for the general maintenance of various pavements not specifically identified by project in the CIP and could include crack sealing and other routine maintenance.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Intermediate Term Program Summary

The total costs associated with the intermediate term program are estimated at $11.09 million as presented on **Exhibit 6A**. Of this total, approximately $8.02 million could be eligible for federal/state funding, and the local share is projected at $3.07 million. Approximately $2.33 million of the local share is associated with the terminal vehicle parking expansion projects.

LONG TERM PROGRAM

The long term planning horizon considers 11 projects for the 10-year period that are mainly demand-driven. The projects and their associated costs are listed on **Exhibit 6A** and graphically depicted on **Exhibit 6B** as appropriate. Airport management and the City of Flagstaff should assess the need and timing for these projects based on actual demand and growth at Flagstaff Airport.

Project #1: Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Long Term Program

Description: This includes a line item in the CIP that provides the necessary environmental reviews needed for several projects outlined in the long term program. These environmental reviews, whether a CatEx or EA, would likely be programmed separately and in conjunction with a particular project at least one year in advance of actual construction and/or implementation.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #2: Relocate Hold Line Markings to 321' to Meet RDC C-III Design Standards

Description: Relocate the hold lines on all taxiways associated with Runway 3-21 to 321 feet in order to meet ultimate RDC C-III design standards.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #3: Conduct Terminal Area Study to Analyze Ultimate Terminal Building Replacement

Description: The airport will engage in further evaluation of the future disposition of the terminal area through a separate study that will assess the expansion/relocation potential of the terminal building and associated infrastructure.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #4: Construct Terminal Vehicle Parking Expansion - Phase III (Parking Garage)

Description: The final phase of the terminal vehicle parking expansion will include the construction of a multi-level parking garage adjacent to the west side of the terminal building in an area currently dedicated to surface-level parking. The findings of the terminal area study could impact the future disposition of such a parking structure.
Funding Breakdown: FAA – 0 percent / ADOT – 0 percent / Airport-Local – 100 percent.

Project #5: Construct Stub Taxilane Serving General Aviation Development on West Side of Airport

Description: This project includes the construction of a taxilane serving general aviation development in the west area of the airfield.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #6: Environmental Documentation (CatEx or EA) – New Terminal Building

Description: Based on the terminal area study conducted in a prior year, this project will provide the necessary environmental reviews needed to improve the existing terminal building/terminal area. It is important to note that this project, along with other subsequent projects associated with the new facility, will be dependent on justification (demand) and further coordination with the FAA.
Funding Breakdown: The terminal area study will further define the project and associated costs for terminal area improvements.

Project #7: Design and Construction – New Terminal Building

Description: The final phases of the new terminal building will include the design and construction of the facility and associated infrastructure based on the course of action determined in the prior study and environmental phases.

Funding Breakdown: The terminal area study will further define the project and associated costs for terminal area improvements.

Project #8: Purchase 63 Acres of Land on East Side of Airport for Future Airport Development Potential

Description: This entails acquiring approximately 63 acres of land on the east side of the airport to allow access and site preparations for future airport development. As previously detailed, development on the east side of the airport is likely a long term proposition.

Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #9: Implement Infrastructure Development on East Side of Airfield – Multiple Phases

Description: The implementation of infrastructure development could be needed as aviation demand dictates in the northwest area of the airport. This project would include roadway construction and utility enhancements and is likely to be implemented in multiple phases. The access roadway is programmed for FAA funding assistance as it would serve aviation-related activities.

Funding Breakdown: FAA – Participation with constructing the access roadway / ADOT – 0 percent / Airport-Local – Remaining share associated with local match for access roadway and utility infrastructure.

Project #10: Construct Taxiway Network Extending East from Runway 3-21 to Serve Aviation Development Potential – Multiple Phases

Description: The construction of a taxiway network is programmed at the end of the long term to serve aviation-related development that could occur on the east side of the airfield. The construction of this taxiway would likely be phased over several projects as demand dictates.

Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project #11: General Airfield Pavement Maintenance

Description: This includes a line item in the CIP that allocates a certain amount of funding for the general maintenance of various pavements not specifically identified by project in the CIP and could include crack sealing and other routine maintenance.

Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Long Term Program Summary

The total investment necessary for the long term CIP is approximately $20.30 million; however, this does not include the costs associated with the new terminal building being proposed in this planning horizon. This project alone could range in the tens of millions of dollars. As previously discussed, the terminal area study will further define the project and associated costs for terminal area improvements at Flagstaff Airport. Of the total long term program detailed on **Exhibit 6A**, approximately $12.23 million is eligible for federal/state funding assistance. The airport's matching share is projected at $8.08 million.

CAPITAL IMPROVEMENT PROGRAM SUMMARY

The list of projects needed to accomplish the vision for Flagstaff Airport has been prioritized and cost estimates have been developed. Projects considered for the short term planning horizon (years 0-5) have been divided into yearly increments. Projects considered for the intermediate (years 6-10) and long term (years 11-20) have been prioritized and grouped together. The grouping of projects is necessary to provide the needed flexibility for the airport to make adjustments as necessary. In addition, on an annual basis, the airport, FAA, and ADOT-MPD – Aeronautics Group assemble and review a five-year CIP. Therefore, the list of projects and the prioritization of the projects can and likely will change in the future.

The total CIP proposes approximately $51.03 million in airport development needs. Of this total, approximately $38.33 million could be eligible for federal/state funding assistance. The local funding estimate for the proposed CIP is approximately $12.70 million. As detailed above, it is important to consider that certain projects included in the CIP were not assigned project costs due to further study and coordination being needed. This includes the potential for a new terminal building in the long term planning horizon. Nonetheless, the CIP can serve as a road map of airport improvements to help guide the City of Flagstaff, the FAA, and ADOT-MPD – Aeronautics Group.

ENVIRONMENTAL OVERVIEW SUMMARY OF AIRPORT DEVELOPMENT SCHEDULE

As a follow-up to the Environmental Overview provided in Chapter Five, **Table 6B** lists the future development projects previously detailed and the most likely NEPA documentation that might be required by the FAA. Some of the projects are actions normally requiring an EA. However, most of the proposed improvements, unless involving extraordinary circumstances, could be evaluated in terms of NEPA compliance using one of the CatExes listed in FAA Order 1050.1F. In addition, some of the projects would not require a federal action or federal funding.

TABLE 6B
Anticipated Environmental Review for Future Development Projects
Flagstaff Airport

PROJECT DESCRIPTION	Initial NEPA Action
SHORT TERM PROGRAM (0-5 YEARS)	
2018	
Equipment Purchase - ARFF Truck and Associated Equipment	CatEx
2019	
Conduct Drainage Master Plan	CatEx
Clear ROFA on West Side of Runway 3-21	CatEx or EA
2020	
Construct - Snow Removal Equipment Facility	CatEx
Purchase 60 Acres of Land on North Side of Airport for Airfield Safety and Approach Protection	CatEx
Design and Construct - Implement REILs on Runway 3	CatEx

TABLE 6B (Continued)

2021	
Design and Construct - Rehabilitate Taxiway A (Northern 6,000') Including Entrance/Exit Taxiways A1-A6 (Include Enhancing MITL with LED Technology)	CatEx
Design and Construct - Rehabilitate Taxiway W Loop (Include MITL Utilizing LED Technology)	CatEx
Equipment Purchase - Snow Removal Equipment	CatEx
2022	
Design and Construct - Implement No-Taxi Islands Adjacent to Taxiways A6, A7, and A8	CatEx
2023	
Construct - Terminal Building Expansion and Security Upgrades	CatEx
Construct - Terminal Parking Apron Expansion and Taxiway W Relocation (Include Rehabilitation of Existing Aircraft Parking Apron)	CatEx
Design and Construct - Runway 3-21 Rehabilitation	CatEx
INTERMEDIATE TERM PROGRAM (6-10 YEARS)	
Construct Terminal Vehicle Parking Expansion - Phase I (Surface Lot)	CatEx or EA
Construct Rental Car Preparation Center	CatEx or EA
Construct Hold Apron Adjacent to South Side of Taxiway A	CatEx
Clear and Prepare Property for General Aviation Redevelopment Adjacent to South Side of Aircraft Parking Apron	CatEx
Upgrade Perimeter Access Road on East and West Sides of Airfield	CatEx
Co-Locate Segmented Circle with Existing Windcone on West Side of Runway	CatEx
Purchase 54 Acres of Land on South Side of Airport for Airfield Safety and Approach Protection	EA or EIS
Construct Air Cargo Support Apron	CatEx
Construct Terminal Vehicle Parking Expansion - Phase II (Road Realignment and Surface Lot)*	CatEx or EA
General Airfield Pavement Maintenance	CatEx
LONG TERM PROGRAM (11-20 YEARS)	
Relocate Hold Line Markings to 321' to Meet RDC C-III Design Standards	CatEx
Conduct Terminal Area Study to Analyze Ultimate Terminal Building Replacement**	CatEx
Construct Terminal Vehicle Parking Expansion - Phase III (Parking Garage)*	CatEx or EA
Construct Stub Taxilane Serving General Aviation Development on West Side of Airport	CatEx
Design and Construction - New Terminal Building	CatEx or EA
Purchase 63 Acres of Land on East Side of Airport for Future Airport Development Potential***	EA or EIS
Implement Infrastructure Development on East Side of Airfield - Multiple Phases***	EA
Construct Taxiway Network Extending East from Runway 3-21 to Serve Aviation*** Development Potential - Multiple Phases	EA
General Airfield Pavement Maintenance	CatEx

* All three phases of the terminal vehicle parking expansion project could be combined into one EA.
** The Terminal Area Study will further define the project and associated costs for the environmental, design, and construction of a new terminal building.
*** All three phases of the potential east side development could be combined into one EA.

KEY
ARFF - Aircraft Rescue and Firefighting
ROFA - Runway Object Free Area
REIL - Runway End Identification Light
MITL - Medium Intensity Taxiway Lighting
LED - Light Emitting Diode
RDC - Runway Design Code
CatEx - Categorical Exclusion
EA - Environmental Assessment

CAPITAL IMPROVEMENT FUNDING SOURCES

There are generally four sources of funds used to finance airport capital development projects: airport revenues, revenue/general obligation bonds, federal/state/local grants, and passenger facility charges (PFCs), which are reserved for commercial service airports. Access to these sources of financing varies widely among airports, with some large airports maintaining substantial cash reserves and most small commercial service and general aviation airports often requiring subsidies from their sponsors (local and state governments) to fund operating expenses and to finance modest improvements.

Financing capital improvements at Flagstaff Airport will not rely solely on the financial resources of the City of Flagstaff. Capital improvement funding is available through various grant-in-aid programs on both the state and federal levels. While during some years, more federal/state funding could be available, the CIP for this Master Plan was developed with project phasing in order to appropriately space projects. The following discussion outlines key sources of funding potentially available for capital improvements at the airport.

FEDERAL GRANTS

Through federal legislation over the years, various grant-in-aid programs have been established to develop and maintain a system of public use airports across the United States. The purpose of this system and its federally based funding is to maintain national defense and to promote interstate commerce. The most recent legislation affecting federal funding was enacted on February 17, 2012 and is titled, the *FAA Modernization and Reform Act of 2012*.

Several projects identified in the CIP are eligible for FAA funding through the AIP, which provides entitlement funds to airports based, in part, on their annual enplaned passengers and pounds of landed cargo weight. Additional AIP funds, designated as discretionary, may also be used for eligible projects, based on the FAA's national priority system. Although the AIP has been reauthorized several times and the funding formulas have been periodically revised to reflect changing national priorities, the program has remained essentially the same. Public use airports that serve civil aviation, like Flagstaff Airport, may receive AIP funding for eligible projects, as described in FAA's *Airport Improvement Program Handbook.* The airport must fund the remaining project costs using a combination of other funding sources, as discussed further below.

The law that authorized the AIP at $3.35 billion for fiscal years 2012 through 2016 has been extended through 2017. Eligible airports, which include those in the *National Plan of Integrated Airport Systems* (NPIAS), such as Flagstaff Airport, can apply for airport improvement grants. **Table 6C** presents the approximate distribution of the AIP funds. Currently, the airport is eligible to apply for grants which may be funded through several categories.

TABLE 6C
Federal AIP Funding Distribution

Funding Category	Percent of Total	Funds*
Apportionment/Entitlement		
Passenger Entitlements	29.19%	$977,865,000
Cargo Entitlements	3.00%	$100,500,000
Alaska Supplemental	0.65%	$21,775,000
State Apportionment for Nonprimary Entitlements	10.35%	$346,725,000
State Apportionment Based on Area and Population	9.65%	$323,275,000
Carryover	10.77%	$360,795,000
Small Airport Fund		
Small Hubs	1.67%	$55,945,000
Nonhubs	6.68%	$223,780,000
Nonprimary (GA and Reliever)	3.34%	$111,890,000
Discretionary		
Capacity/Safety/Security/Noise	11.36%	$380,560,000
Pure Discretionary	3.79%	$126,965,000
Set Asides		
Noise	8.40%	$281,400,000
Military Airports Program	0.99%	$33,165,000
Reliever	0.16%	$5,360,000
Totals	100.00%	$3,350,000,000

* FAA *Modernization and Reform Act of 2012*
AIP: Airport Improvement Program
Source: FAA Order 5100.38D, *Airport Improvement Program Handbook*

Funding for AIP-eligible projects is undertaken through a cost-sharing arrangement in which the FAA share varies by airport size and is generally 75 percent for large- and medium-hub airports and 90 percent for all other airports. Since the early days of federal participation in airport infrastructure projects, Congress has provided a higher federal share for airports located in states with more than five percent of their geographic acreage comprised of public lands and nontaxable Indian lands. For states that qualify, such as Arizona, the federal share is increased depending on the airport classification. As a nonhub commercial service airport, the federal share of eligible capital improvement projects for Flagstaff Airport is 91.06 percent. In exchange for this level of funding, the airport sponsor is required to meet various Grant Assurances, including maintaining the improvement for its useful life, usually 20 years.

The source for AIP funds is the Aviation Trust Fund. The Aviation Trust Fund was established in 1970 to provide funding for aviation capital investment programs (aviation development, facilities and equipment, and research and development). The Aviation Trust Fund also finances the operation of the FAA. It is funded by user fees, including taxes on airline tickets, aviation fuel, and various aircraft parts.



Apportionment (Entitlement) Funds

AIP provides funding for eligible projects at airports through an apportionment (entitlement) program. Primary commercial service airports receive a guaranteed minimum level of federal assistance each year, based on their enplaned passenger levels and Congressional appropriation levels. A primary airport is defined as any commercial service airport enplaning at least 10,000 passengers annually.

An airport enplaning 10,000 or more passengers annually will receive the higher of $1,000,000 or an amount based upon the entitlement formula. The entitlement formula is $7.80 per enplaned passenger for the first 50,000 enplanements, and $5.20 per enplanement for the next 50,000 enplanements. The next 400,000 enplanements provide $2.60 each, and an airport receives $0.65 for the next 500,000 enplanements. For each annual enplanement above one million, the airport receives $0.50.

Under the authorizing statute, individual entitlements are doubled (with a maximum of $26 million and a minimum of $1.0 million per airport sponsor) if Congressional AIP funding in a fiscal year is at least $3.2 billion. The FAA utilizes the official enplanement totals from the Air Carrier Activity Information System (ACAIS) database, which is two years behind the current date for determination of entitlement funds.

Small Airport Fund

If a large- or medium-hub commercial service airport chooses to institute a passenger facility charge (PFC), discussed in more detail below, which is a fee of up to $4.50 on each airline ticket, for funding of capital improvement projects, then their apportionment is reduced. A portion of the reduced apportionment goes to the small airport fund. The small airport fund is reserved for small-hub primary commercial service airports, nonhub commercial service airports, and general aviation airports. As a nonhub commercial service airport, Flagstaff Airport is eligible for funds from this source.

Discretionary Funds

In a number of cases, airports face major projects that will require funds in excess of the airport's annual entitlements. Thus, additional funds from discretionary apportionments under AIP become desirable. The primary feature about discretionary funds is that they are distributed on a priority basis. The priorities are established by the FAA, utilizing a priority code system. Under this system, projects are ranked by their purpose. Projects ensuring airport safety and security are ranked as the most important priorities, followed by maintaining current infrastructure development, mitigating noise and other environmental impacts, meeting standards, and increasing system capacity.

It is important to note that competition for discretionary funding is not limited to airports in the State of Arizona or those within the FAA Western-Pacific Region. The funds are distributed to all airports in the country and, as such, are more difficult to obtain. High priority projects will often fare favorably, while lower priority projects may not receive discretionary grants.

Set-Aside Funds

Portions of AIP funds are set-asides designed to achieve specific funding minimums for noise compatibility planning and implementation, select former military airfields (Military Airports Program), and select reliever airports. It is not anticipated that Flagstaff Airport will be eligible for this funding category.

PASSENGER FACILITY CHARGE

The *Aviation Safety and Capacity Expansion Act of 1990* contained a provision for airports to levy a passenger facility charge, which is a user fee, for the purposes of preserving, enhancing, or making a significant contribution to airport safety, capacity, security, or to reduce or mitigate noise impacts, improve local air quality, enhance competition, or reduce current or anticipated congestion. PFC revenue may be used on a "pay-as-you-go" basis or leveraged to pay debt service on bonds or other debt used to pay for PFC-eligible projects.

Title 14 Code of Federal Regulations (CFR), Part 158, of May 29, 1991, establishes the regulations that must be followed by airports choosing to levy PFCs. Passenger facility charges may be imposed by public agencies controlling a commercial service airport with at least 2,500 annual passengers with scheduled service. Authorized agencies were initially allowed to impose a charge of $1.00, $2.00, or $3.00 per enplaned passenger. Legislation (AIR-21) passed in 2000 allowed the cap to increase to $4.50, which remains the current cap level. Prior approval is required from the Department of Transportation (DOT) before an airport can levy a PFC. The DOT must find that the projected revenues are needed for specific, approved projects. Although FAA is required to approve the collection and use of PFCs, the program permits local collection of PFC revenue through the airlines operating at an airport and provides more flexibility to airport sponsors than AIP funds.

Any AIP-eligible project, whether development or planning related, is eligible for PFC funding. Gates and related areas for the movement of passengers and baggage are eligible, as are on-airport ground access projects. Any project approved must preserve or enhance safety, security, or capacity; reduce/mitigate noise impacts; or enhance competition among carriers.

PFCs may be used only on approved projects. However, PFCs can be utilized to fund 100 percent of a project. They may also be used as matching funds for AIP grants or to augment AIP-funded projects. PFCs can be used for debt service and financing costs of bonds for eligible airport development. These funds may also be commingled with general revenue for bond debt service. Before submitting a PFC application, an airport must give notice and an opportunity for consultation with airlines operating at an airport.

PFCs are treated similar to other airport improvement grants, rather than as airport revenues, and they are administered by the FAA. Airlines retain up to 11 cents per passenger for collecting PFCs. It should also be noted that only revenue passengers pay PFCs. Non-revenue passengers, such as those using frequent flier rewards or airline personnel, are counted as enplanements but do not generate PFCs. Flagstaff Airport has imposed a $4.50 PFC to fund projects.

Table 6D estimates the potential entitlements and PFC collection for each planning horizon based upon the current AIP formula. This assumes that the short term horizon activity level of 80,000 enplanements would be maintained for the first five years. Similarly, the intermediate horizon of 95,000 enplanements would be reached in the following five years, and the long term ten years after that. A slower rate of growth would not result in fewer entitlement funds, unless enplanements fall below 10,000. PFC funds were projected on a rate of $4.39 per enplanement based on the collection rate of $4.50 per passenger minus the $0.11 collection charge allowed for administrative fees to the airlines.

TABLE 6D
Projected Entitlements and PFCs for Each Planning Horizon
Flagstaff Airport

Planning Period	Annual Average Passenger Enplanements	Total Term AIP Entitlements[1]	Total Term Potential PFC[1]	Net PFCs & Entitlements[1]
Short Term	80,000	$5,000,000	$1,756,000	$6,756,000
Intermediate	95,000	$5,000,000	$2,085,250	$7,085,250
Long Term	125,000	$10,000,000	$5,487,500	$15,487,500

[1] Figures represent total entitlements and PFCs for each planning horizon at $1,000,000 per year entitlements and $4.39 per enplanement PFC, respectively, for five years in short and intermediate terms and 10 years for long term; Figures also consider airport remains as a primary commercial service airport retaining eligibility for such entitlement funds.

STATE FUNDING PROGRAMS

The ADOT-MPD – Aeronautics Group recognizes the valuable contribution to the state's transportation economy that airports make. Therefore, it administers several programs to aid in maintaining airports in the state. The source for state airport improvement funds is the Arizona Aviation Fund. Taxes levied by the state on aviation fuel, flight property, aircraft registration tax, and registration fees (as well as interest on these funds) are deposited in the Arizona Aviation Fund. The State Transportation Board establishes the policies for distribution of these state funds.

Under the State of Arizona's grant program, an airport can receive funding for one-half (currently 4.47 percent) of the local share of projects receiving federal AIP funding. The state also provides 90 percent funding for projects which are typically not eligible for federal AIP funding or have not received federal funding. Flagstaff Airport is eligible for these funding allocations.

Pavement Maintenance Program

The airport system in Arizona is a multi-million-dollar investment of public and private funds that must be protected and preserved. State aviation fund dollars are limited and the State Transportation Board recognizes the need to protect and extend the maximum useful life of the airport system's pavement. The Arizona Pavement Management System (APMS) has been established to assist in the preservation of Arizona airports' system infrastructure.



Public Law 103-305 requires that airports requesting federal AIP funding for pavement rehabilitation or reconstruction have an effective pavement maintenance program system. To this end, ADOT-MPD – Aeronautics Group maintains the APMS.

The Arizona APMS uses the Army Corps of Engineers' "Micropaver" program as a basis for generating a Five-Year Arizona Pavement Preservation Program (APPP). The APMS consists of visual inspections of all airport pavements. Evaluations are made of the types and severities observed and entered into a computer program database. Pavement Condition Index (PCI) values are determined through the visual assessment of pavement conditions in accordance with the most recent FAA Advisory Circular 150/5380-7, *Pavement Management System*, and range from 0 (failed) to 100 (excellent). Every three years, a complete database update with new visual observations is conducted. Individual airport reports from the update are shared with all participating system airports. ADOT-MPD – Aeronautics Group ensures that the APMS database is kept current, in compliance with FAA requirements.

Every year, ADOT-MPD – Aeronautics Group, utilizing the APMS, will identify airport pavement maintenance projects eligible for funding for the upcoming five years. These projects will appear in the state's Five-Year Airport Development Program. Once a project has been identified and approved for funding by the State Transportation Board, the airport sponsor may elect to accept a state grant for the project and not participate in the APPP, or the airport sponsor may sign an Inter-Government Agreement (IGA) with ADOT-MPD – Aeronautics Group to participate in the APPP. Flagstaff Airport is eligible to participate in this program.

State Airport Loan Program

The ADOT Airport Loan Program was established to enhance the utilization of state funds and provide a flexible funding mechanism to assist airports in funding revenue-generating projects, such as hangars and fuel storage facilities. Projects which are not currently eligible for the State Airport Loan Program are considered if the project would enhance the airport's ability to be financially self-sufficient.

LOCAL FUNDING

The balance of project costs, after consideration has been given to grants, must be funded through local resources. A goal for any airport is to generate enough revenue to cover all operating and capital expenditures, if possible. There are several local financing options to consider when funding future development at airports, including airport revenues, issuance of a variety of bond types, leasehold financing, implementing a customer facility charge (CFC), pursuing non-aviation development potential, and collecting from special events. These strategies could be used to fund the local matching share, or complete a project if grant funding cannot be arranged. Below is a brief description of the most common local funding options.

Airport Revenues

The airport's daily operations are conducted through the collection of various rates and charges. These airport revenues are generated specifically by airport operations. There are restrictions on the use of revenues collected by the airport. All receipts, excluding bond proceeds or related grants and interest, are irrevocably pledged to the punctual payment of operating and maintenance expenses, payment of debt service for as long as bonds remain outstanding, or for additions or improvements to airport facilities.

All airports should establish standard basis rates for various leases. All lease rates should be set to adjust to a standard index, such as the consumer price index (CPI), to assure that fair and equitable rates continue to be charged into the future. Many factors will impact what the standard lease rate should be for a particular facility or ground parcel. For example, ground leases for aviation-related facilities should have a different lease rate than for non-aviation leases. When airports own hangars, a separate facility lease rate should be charged. The lease rate for any individual parcel or hangar can vary due to availability of utilities, condition, location, and other factors. Nonetheless, standard lease rates should fall within an acceptable range.

Bonding

Bonding is a common method to finance large capital projects at airports. A bond is an instrument of indebtedness of the bond issuer to the bond holders, thus a bond is a form of loan or IOU. While bond terms are negotiable, typically the bond issuer is obligated to pay the bond holder interest at regular intervals and/or repay the principal at a later date.

Leasehold Financing

Leasehold financing refers to a developer or tenant financing improvements under a long term ground lease. The advantage of this arrangement is that it relieves the airport of the responsibility of having to raise capital funds for the improvement. As an example, a fixed base operator (FBO) might consider constructing hangars and charging fair market lease rates, while paying the airport for a ground lease. A fuel farm can be undertaken in the same manner with the developer of the facility paying the airport a fuel flowage fee.

Customer Facility Charge (CFC)

A CFC is the imposition of an additional fee charged to customers for the use of certain facilities. The most common example is when an airport constructs a consolidated rental car facility and imposes a fee for each rental car contract. That fee is then used by the airport to pay down the debt incurred from building the facility.

Non-Aviation Development

In addition to generating revenue from traditional aviation sources, airports with excess land can permit compatible non-aviation development. Generally, an airport will extend a long-term lease for land not anticipated to be needed for aviation purposes in the future. The developer then pays the monthly lease rate and constructs and uses the compatible facility. Certain areas at Flagstaff Airport are available for non-aviation development. It should be noted that each individual proposed non-aviation development must be reviewed and approved by the FAA.

Special Events

Another common revenue-generating option is permitted use of airport property for temporary or single events. Airports can also permit portions of their facility to be utilized for non-aviation special events, such as car shows or video production of commercials. This type of revenue generation must be approved by the FAA.

MASTER PLAN IMPLEMENTATION

To implement the Master Plan recommendations, it is key to recognize that planning is a continuous process and does not end with approval of this document. The airport should implement measures that allow it to track various demand indicators, such as passenger enplanements, based aircraft, hangar demand, and operations. The issues that this Master Plan is based on will remain valid for a number of years. The primary goal is for Flagstaff Airport to best serve the air transportation needs of the region, while achieving economic self-sufficiency.

In addition, the airport has been proactive in establishing a sustainability program, as detailed in the *Flagstaff Airport Sustainability Plan*, which was completed in 2015. Appendix B of this document outlines a Sustainability Management Plan showing how the airport can incorporate recommendations from the 2015 plan into this Master Plan's CIP.

The actual need for facilities is best established by activity levels rather than a specified date. For example, projections have been made as to when additional hangars may be needed at the airport. In reality, the timeframe in which the development is needed may be substantially different. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate development. Although every effort has been made in this master planning process to conservatively estimate when facility development may be needed, aviation demand will dictate timing of facility improvements.

In addition, numerous projects have been identified that will not depend on increased demand. These include meeting FAA safety design standards, enhancing airfield geometry, and regular pavement maintenance.

The value of this study is keeping the issues and objectives at the forefront of managers and decision-makers. In addition to adjustments in aviation demand, when to undertake the improvements recommended in this Master Plan will impact how long the plan remains valid. The format of this plan reduces the need for formal and costly updates by simply adjusting the timing of project implementation. Updating can be done by airport management, thereby improving the plan's effectiveness.

In summary, the planning process requires the City of Flagstaff to consistently monitor the progress of the airport. The information obtained from continually monitoring airport activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.

FLAGSTAFF AIRPORT

APPENDIX A

Glossary of Terms



Glossary of Terms

A

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of nonregulatory material providing for the recommendations relative to a policy, guidance and information relative to a specif c aviation subject.

AIR CARRIER: An operator which: (1) performs at least f ve round trips per week between two or more points and publishes f ight schedules which specify the times, days of the week, and places between which such f ights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certif ed in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for f ight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing conf guration at their maximum certif cated landing weight. The categories are as follows:

- Category A: Speed less than 91 knots.
- Category B: Speed 91 knots or more, but less than 121 knots.
- Category C: Speed 121 knots or more, but less than 141 knots.
- Category D: Speed 141 knots or more, but less than 166 knots.
- Category E: Speed greater than 166 knots.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specif ed national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT IMPROVEMENT PROGRAM: A program authorized by the Airport and Airway Improvement Act of 1982 that provides funding for airport planning and development.

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of exis. ng and proposed airport facilities.

AIRPORT LAYOUT PLAN (ALP): A scaled drawing of the existing and planned land and facilities necessary for the operation and development of the airport.

AIRPORT LAYOUT PLAN DRAWING SET: A set of technical drawings depicting the current and future airport conditions. The individual sheets comprising the set can vary with the complexities of the airport, but the FAA-required drawings include the Airport Layout Plan (sometimes referred to as the Airport Layout Drawing (ALD), the Airport Airspace Drawing, and the Inner Portion of the Approach Surface Drawing, On-Airport Land Use Drawing, and Property Map.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulf llment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airf eld at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment def ning the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument f ight rule (IFR) room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER: A facility which provides en route air traffic control service to aircraft operating on an IFR f ight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certif cated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specif c trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious f ow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR f ight plan within controlled airspace and principally during the en route phase of f ight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central f ow control, the central altitude reservation system, the airport reservation position system, and the air traffic service contingency command for the air traffic control system.

AIR TRAFFIC HUB: A categoriza. on of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR f ight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his f nal approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface def ned in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specif ed portion of the airf eld used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a f ight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATIC WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed f ight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a f xed point (as the observer's heading).

B

BASE LEG: A f ight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specif c airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of elimina. ng the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identif es suitable building area locations on the airport.

C

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specif ed national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

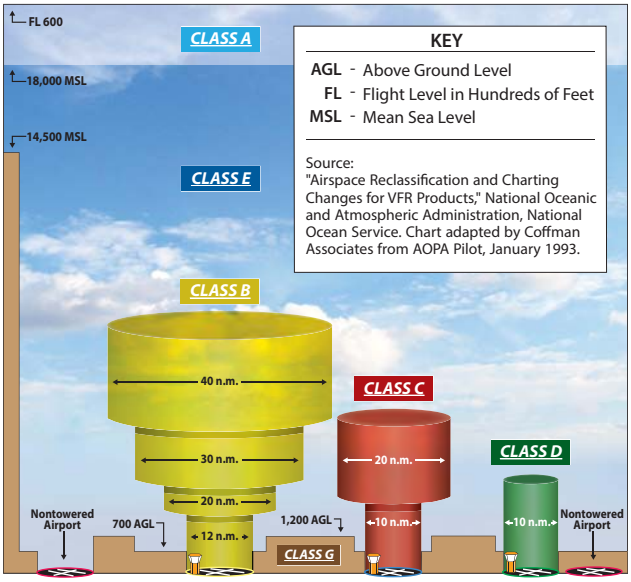
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specif ed above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when f ying a predetermined circling instrument approach under IFR.



CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identif ed in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: An imaginary obstruction-limiting surface def ned in FAR Part 77 that extends

from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an opera. ng airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of def ned dimensions within which air traffic control services are provided to instrument f ight rules (IFR) and visual f ight rules (VFR) f ights in accordance with the airspace classif cation. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including f ight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B**:
  Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The conf guration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traff c control clearance is required for all aircraft to operate in the area.

- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a f ve nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.

- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and conf gured to encompass published instrument approach procedure. Unless otherwise authorized, all persons must establish two-way radio communication.

- **CLASS E**: Generally, controlled airspace that is not classif ed as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be conf gured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument f ight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classif ed as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended f ight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended f ight path of an aircraft.

CROSSWIND LEG: A f ight path at right angles to the landing runway off its upwind end. See "traffic pattern."

D

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT/ DECISION ALTITUDE: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off.

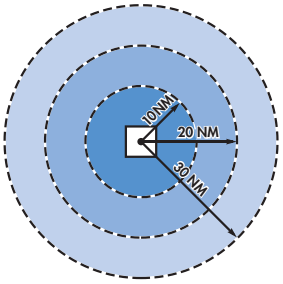
- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.
- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the accelera. on and deceleration of an aircraft aborting a takeoff.
- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specif ed national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.



DNL: The 24-hour average sound level, in Aweighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A f ight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

E

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specif ed form of development or activity, as well as any other legal rights in the property that may be specif ed in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and nonscheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would signif cantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects are legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

F

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the execu. ve departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FEDERAL INSPECTION SERVICES: The provision of customs and immigration services including passport inspection, inspection of baggage, the collection of duties on certain imported items, and the inspections for agricultural products, illegal drugs, or other restricted items.

FINAL APPROACH: A f ight path in the direction of landing along the extended runway centerline. The f nal approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A def ned area over which the f nal phase of the helicopter approach to a hover, or a landing is completed and from which the takeoff is initiated.

FINAL APPROACH FIX: The designated point at which the f nal approach segment for an aircraft landing on a runway begins for a non-precision approach.

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a signif cant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, f ight training, repair, and maintenance.

FLIGHT LEVEL: A measure of altitude used by aircraft f ying above 18,000 feet. Flight levels are indicated by three digits representing the pressure altitude in hundreds of feet. An airplane f ying at f ight level 360 is f ying at a pressure altitude of 36,000 feet. This is expressed as FL 360.

FLIGHT SERVICE STATION: An operations facility in the national f ight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-f ight and in-f ight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

G

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certif cate of convenience and necessity, and large aircraft commercial operators.

GENERAL AVIATION AIRPORT: An airport that provides air service to only general aviation.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or

2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 48 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

H

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classif cation in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircra. turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface def ned in FAR Part 77 that is specif ed as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specif c horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

I

INITIAL APPROACH FIX: The designated point at which the initial approach segment begins for an instrument approach to a runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument f ight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of f ight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to def ne weather conditions and the type of f ight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specif c visibility and ceiling conditions that are less than the minimums specif ed for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specif ed airport.

K

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certif ed takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from f ights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two f xed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classif ca. on in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

M

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classif cation in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military f ight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The f ight route to be followed if, after an instrument approach, a landing is not affected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or

2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

N

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certif cates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NAVIGATIONAL AID: A facility used as, available for use as, or designed for use as an aid to air navigation.

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction f nding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: A notice containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System, the timely knowledge of which is considered essential to personnel concerned with f ight operations.

O

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircra. operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

ONE-ENGINE INOPERABLE SURFACE: A surface emanating from the runway end at a slope ratio of 62.5:1. Air carrier airports are required to maintain a technical drawing of this surface depicting any object penetrations by January 1, 2010.

OPERATION: The take-off, landing, or touch-and-go procedure by an aircraft on a runway at an airport.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin f nal approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specif ed radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I)**: A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.
- **CATEGORY II (CAT II)**: A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.
- **CATEGORY III (CAT III)**: A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the f nal approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface def ned in FAR Part 77 that is specif ed as a rectangular surface longitudinally centered about a runway. The specif c dimensions of this surface are a function of the types of approaches existing or planned for the runway.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

R

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve f ight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering en route clearances, issuing departure authorizations, and acknowledging instrument f ight rules cancellations or departure/ landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits f ights over determined tracks within prescribed accuracy tolerances without the need to overf y ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A def ned rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially f ashing lights installed on the extended centerline of the runway usually in conjunc. on with an approach lighting system.

RUNWAY DESIGN CODE: A code signif ying the design standards to which the runway is to be built.

RUNWAY END IDENTIFICATION LIGHTING (REIL): Two synchronized f ashing lights, one on each side of the runway threshold, which provide rapid and positive identif cation of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY REFERENCE CODE: A code signifying the current operational capabilities of a runway and associated taxiway.

RUNWAY SAFETY AREA (RSA): A def ned surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line of- site from any point f ve feet above the runway centerline to any point f ve feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

S

SCOPE: The document that identif es and def nes the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transi. on between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRCRAFT: An aircraft that has a maximum certif ed takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of def ned dimensions identif ed by a surface area wherein activities must be conf ned because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classif cations include:

- **ALERT AREA**: Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
- **CONTROLLED FIRING AREA**: Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.
- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with def ned vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument f ight rule (IFR) traffic and to identify for visual f ight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA**: Designated airspace within which the f ight of aircraft is prohibited.
- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the f ight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.
- **WARNING AREA:** Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD INSTRUMENT DEPARTURE PROCEDURES: A published standard f ight procedure to be utilized following takeoff to provide a transition between the airport and the terminal area or en route airspace.

STANDARD TERMINAL ARRIVAL ROUTE (STAR): A preplanned coded air traffic control IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the f nal approach course following completion of an instrument approach.

T

TACTICAL AIR NAVIGATION (TACAN): An ultrahigh frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA):
See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA):
See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A def ned path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY DESIGN GROUP: A classif cation of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

TAXIWAY SAFETY AREA (TSA): A def ned surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published f ight procedures for conducting instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

THRESHOLD: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and go is recorded as two operations: one operation for the landing and one operation for the takeoff.

TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

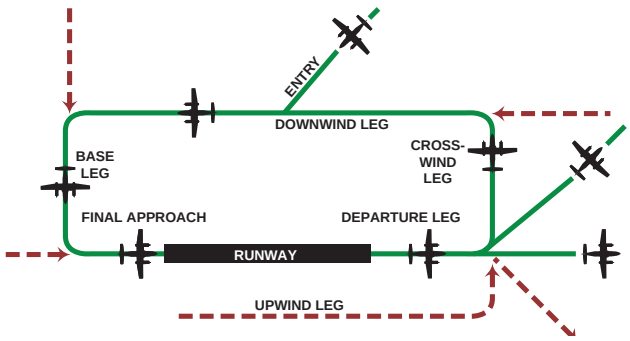
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The f rst 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100- foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic f ow that is prescribed for aircra. landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and f nal approach.



U

UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM):
A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

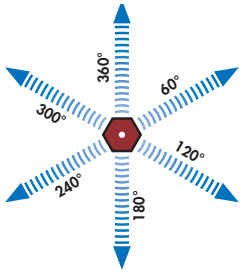
UPWIND LEG: A f ight path parallel to the landing runway in the direction of landing. See "traffic pattern."

V

VECTOR: A heading issued to an aircraft to provide navigational guidance by radar.

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identif es itself by Morse Code and may have an additional voice identif cation feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A naviga. on aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.



VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is def ned by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR f ight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/ white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting f ight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of f ight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specif c visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

W

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of f ight.

Abbreviations

AC: advisory circular

ADF: automatic direction f nder

ADG: airplane design group

AFSS: automated f ight service station

AGL: above ground level

AIA: annual instrument approach

AIP: Airport Improvement Program

AIR-21: Wendell H. Ford Aviation Investment and Reform Act for the 21st Century

ALS: approach lighting system

ALSF-1: standard 2,400-foot high intensity approach lighting system with sequenced f ashers (CAT I conf guration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced f ashers (CAT II conf guration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircra. rescue and f re f ghting

ARP: airport reference point

ARTCC: air route traffic control center

ASDA: accelerate-stop distance available

ASR: airport surveillance radar

ASOS: automated surface observation station

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100LL)

AWOS: automatic weather observation station

BRL: building restriction line

CFR: Code of Federal Regulation

CIP: capital improvement program

DME: distance measuring equipment

DNL: day-night noise level

DWL: runway weight bearing capacity of aircraft with dual-wheel type landing gear

DTWL: runway weight bearing capacity of aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: f xed base operator

FY: f scal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument f ight rules (FAR Part 91)

ILS: instrument landing system

IM: inner marker

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at middle marker

LOM: compass locator at outer marker

LORAN: long range navigation

MALS: medium intensity approach lighting system with indicator lights

MIRL: medium intensity runway edge lighting

MITL: medium intensity taxiway edge lighting

MLS: microwave landing system

MM: middle marker

MOA: military operations area

MSL: mean sea level

NAVAID: navigational aid

NDB: nondirectional radio beacon

NM: nautical mile (6,076.1 feet)

NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rule making

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory commi. ee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: poor visibility and ceiling

RCO: remote communications outlet

RRC: Runway Reference Code

RDC: Runway Design Code

REIL: runway end identif cation lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: runway safety area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplif ed short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TDG: Taxiway Design Group

TLOF: Touchdown and lift-off

TDZ: touchdown zone

TDZE: touchdown zone elevation

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual f ight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated

FLAGSTAFF AIRPORT

APPENDIX B

Airport Sustainability Management Plan



Appendix B
AIRPORT SUSTAINABILITY MANAGEMENT PLAN

The *Flagstaff Airport Sustainability Plan* (Sustainability Plan)[1], completed in 2015, contains many recommendations for Flagstaff Airport to create a more economically viable, socially equitable, and environmentally aware facility. More specifically, Chapter Three of the Sustainability Plan contains ten sustainability resource categories, which include:


Air Quality


Land Use & Transportation


Community Well-Being


Planned Development


Energy


Resiliency & Preparedness


Dark Skies


Waste Management


Natural Resource Management


Water

[1] Full *Flagstaff Airport Sustainability Plan* available on the City of Flagstaff's website.

The Sustainability Plan provides guidelines of how to put sustainability initiatives and projects into action, with progress tracking methods and ways to overlap with City and Regional Plans, as well as this Airport Master Plan. The goal of this Sustainability Management Plan is to marry the goals and implementation approach of the Sustainability Plan with the projects proposed within this Airport Master Plan. **Exhibit B1** illustrates the airport capital improvement program (CIP) alongside sustainability initiatives, showing how the airport can incorporate recommendations from the Sustainability Plan with the Master Plan CIP.

The Sustainability Plan set overarching goals for each sustainability category. These goals are outlined below, along with recommendations on how projects proposed within the Master Plan can incorporate sustainability initiatives to help achieve the sustainability goals.

Air Quality



- Reduce criteria air pollutants emitted from airport owned and controlled sources to improve public health and reduce environmental impact.
- Reduce airport owned and controlled greenhouse gas emissions by 5% below current levels by 2020.

Projects at the airport that help reduce carbon dioxide emissions (CO_2) positively impact Air Quality goals. Opportunities exist for the airport to reduce emissions in certain capital improvement projects, like the airfield equipment reconfiguration. By locating airfield equipment close together, there is increased efficiency in terms of accessing it for routine service or maintenance, reducing on-airport vehicular emissions. Although a more expensive option, there is technology available that would allow the airport to use warm mix asphalt as opposed to the traditional hot mix asphalt for projects like parking lots, taxiways, runways, and aprons. Warm mix asphalt lowers greenhouse gas emissions and other air pollutants during production and reduces energy consumption by lowering the temperature required to produce and place asphalt.

Community Well-Being



- Enhance awareness of the community benefits of the airport.
- Enhance user experience at the airport.
- Provide a safe and efficient airport.
- Build and maintain community partnerships.
- Support the community by being an economic driver.

Several projects within the airport's CIP will positively influence the surrounding community and the patrons at the airport. Approximately 180 acres of land is proposed for acquisition within the Master Plan to protect the runway protection zone (RPZ). Having ownership control over this property enhances the operational safety and efficiency of the airport. The airport plans to purchase a new aircraft rescue and firefighting (ARFF) vehicle and associated equipment, which improves operational safety, thus providing a safer and more efficient airport for users and the community. Within the terminal building, there are plans to improve security by upgrading security locks, adding access controls, and closed-circuit security cameras. These improvements also support the airport's efforts toward providing a safe and efficient facility. There are plans to eventually update the existing terminal building, which could



PROJECT	Project Description	Sustainability Considerations	Categories Impacted
Short Term Projects (0 - 5 years)			
ARFF Truck and Equipment Purchase	Acquire ARFF vehicle and equipment.	Consider ARFF equipment that uses the NoFoam System technology to eliminate foam laden wastewater from periodic aircraft hangar fire suppression foam system nozzle discharge checks.	
Snow Removal Equipment Building	Design & construct snow removal equipment building and acquire associated equipment.	Incorporate sustainability principles into the design of the building and develop the facility to support long term, compatible, efficient, and flexible growth. Purchase snow removal equipment that relies on less energy than traditional snow removal equipment.	
Conduct Drainage Master Plan	Design plan to address drainage issues throughout the airport.	Design a drainage plan that minimizes wildlife strikes by harvesting rainwater to reduce water pooling.	
Clear Runway Object Free Area	Clear the ROFA on the west side of Runway 3-21.	Consider relocating and/or replacement vegetation in other areas of the airport or community to replace the areas that are cleared.	
Acquire Land for Safety Areas	Purchase 60 acres of land on the north side of the airport to enhance airfield safety and approach protection.	Continue to encourage land use compatibility around the airport through necessary property acquisition.	
Runway 3 REILs	Implement REILs on Runway 3.	Use LEDs in the REILs.	
Taxiway A Rehabilitation	Mill and overlay Taxiway Alpha from A-1 to A-6 including entrance/exit Taxiways A1 - A6. This project includes enhancing the MITL with LED technology.	Incorporate sustainable practices into the contract for the work and construction of the project.	
Taxiway W Loop Rehabilitation	Restoration/sealcoat of Taxiway W including LED technology addition to the MITL.	Incorporate sustainable practices into the contract for the work and construction of the project.	
Implement No-Taxi Islands	Design and construct the implementation of no-taxi islands adjacent to Taxiways A6, A7, and A8.	This project will reduce energy consumption and harmful emissions by reducing taxiing time.	
Design & Construct Terminal Building Expansion & Security Upgrades	Upgrade security locks, add access control and closed circuit security cameras. Put in positive exit control lanes from ramp to terminal.	Choose equipment that is energy efficient to help the airport meet its Net Zero goal by 2030, as well as updating security measures to make the airport safe and efficient for passengers.	
Design & Construct Terminal Parking Apron Expansion & Taxiway W Relocation	Design & construct a terminal parking apron expansion to accommodate larger aircraft in addition to rehabilitating the existing aircraft parking apron. This project also includes Taxiway W relocation.	Incorporate sustainable practices into the contract for the design and construction of all project phases.	
Design Terminal Vehicle Parking Expansion	Design the expansion of the terminal vehicle parking area.	Consider a sustainable design that incorporates permeable pavement to reduce the amount of impermeable hardscapes at the airport.	
Runway Rehabilitation	Restoration/sealcoat of Runway 3-21.	Maintain the structural strength of the original pavement to prepare airport facilities for the future.	
Intermediate Term Projects (6 - 10 years)			
Construct Terminal Vehicle Parking Expansion - Phases I & II	Construct the surface lot and realign the road to support the terminal vehicle parking expansion as previously designed.	Constructing this new facility increases the airport's resiliency for the future, especially when it incorporates sustainable design principles, like using permeable pavement for the surface lot and road realignment. In addition, the airport should incorporate designated parking spaces for alternatively-fueled vehicles.	
Construct Rental Car Preparation Center	Construct the rental car preparation center to support rental car operations.	Incorporate sustainability into the construction of the rental car preparation center, reusing and recycling materials when possible. This facility also adds convenience to airport patrons, enhancing the user experience.	
Construct Hold Apron	Construct the hold apron adjacent to the south side of Taxiway A.	Construct the hold apron to maintain its structural integrity far into the future and consider reusing materials from other airport projects to supplement the use of new, raw materials for the hold apron.	
Property Clearing & Acquisition	Clear property for general aviation redevelopment adjacent to the south side of the aircraft parking apron.	Consider relocating and/or replacement vegetation in other areas of the airport or community to replace the areas that are cleared.	

KEY

Air Quality · *Community Well-Being* · *Energy* · *Dark Sky* · *Natural Resource Management* · *Land Use* · *Planned Development* · *Resiliency and Preparedness* · *Waste Management* · *Water*

ARFF - Aircraft Rescue and Firefighting Facility
RPZ: Runway Protection Zone
LED: Light-Emitting Diode
RDC: Runway Design Code
CatEx: Categorical Exclusion
EA: Environmental Assessment
MITL: Medium Intensity Taxiway Lights
NEPA: National Environmental Policy Act
REIL: Runway End Identifier Lights
ROFA: Runway Object Free Area
LEED: Leadership in Energy and Environmental Design

Exhibit B1
SUSTAINABLE AIRPORT CAPITAL IMPROVEMENT PROGRAM OPPORTUNITIES

Source: Sustainable Aviation Guidance Alliance; Airport Management ***NOTE:*** Project implementation is dependent on federal and state grant funding and availability. The CIP is based on FAA fiscal year programming.



PROJECT	Project Description	Sustainability Considerations	Categories Impacted
Intermediate Term Projects (6 - 10 years) continued			
Perimeter Access Road Upgrade	Upgrade the perimeter access road on the east and west sides of the airfield to provide better access for operations and emergency vehicles to all areas of the airport.	Consider permeable pavement during construction.	
Airfield Equipment Reconfiguration	Co-locate the segmented circle with the existing windcone on the west side of the runway.	Increasing airfield efficiency reduces energy use associated with driving to and from the equipment for service, maintenance, etc., which lowers the emission of climate changing emissions.	
Acquire Land for Safety & Approach	Purchase 54 acres of land on the south side of the airport to improve airfield safety and promote approach protection.	Acquiring land protects the airport from incompatible development while protecting the community from the hazards of residing too close to an airport.	
Construct Air Cargo Support Apron	Construct the air cargo support apron.	Consider using a warm mix asphalt for the taxilane construction in place of hot mix asphalt, which lowers GHG emissions by lowering the temperature at which the asphalt mixtures are produced and placed.	
Airfield Pavement Maintenance	Perform general airfield pavement maintenance.	Upkeep of airport facilities maintains the integrity of the airport for its patrons. Specifically, pavement maintenance maintains the proper pavement condition index rating.	
Long Term Projects (11 - 20 years)			
Relocate Hold Lines	Relocate the hold line markings to 321 feet to meet RDC C-III.	Consider using a zero- or low-volatile organic compound paint and coating when repainting hold line markings to minimize the chemical input into the stormwater system.	
Terminal Area Study	Conduct the terminal area study to analyze the ultimate terminal building replacement.	During the study, look for ways to realistically incorporate sustainability into the ultimate terminal building, including site selection, construction management practices, and design.	
Construct Terminal Vehicle Parking Expansion - Phase III	Construct the terminal vehicle parking garage - Phase III.	This expansion prepares the airport for the future by providing proper accommodations for anticipated passengers. By incorporating dedicated spaces for those who carpool and/or use alternatively fueled vehicles, posting no-idling signs to reduce unnecessary emissions, and using permeable pavement, the airport can meet many of its sustainability goals.	
Construct Stub* Taxilane	Construct the stub taxilane that supports general aviation development on west side of the airport.	Consider using a warm mix asphalt for the taxilane construction in place of hot mix asphalt, which lowers GHG emissions by lowering the temperature at which the asphalt mixtures are produced and placed.	
CatEx or EA for New Terminal Building	Complete the environmental documentation necessary for the new terminal building (CatEx or EA).	Performing the required NEPA documentation ensures that the new construction is done in the most environmentally-sensitive way possible, protecting the environment of the airport, as well as its neighboring communities.	
Design & Construct New Terminal Building	The existing terminal building was built in 1993 and will not meet future travel needs at the airport.	Pursue LEED certification for the new terminal building, infusing sustainability into pre- and post-construction phases of the development.	
Property Acquisition	Purchase 63 acres of land on the east side of the airport to support future airport development potential.	Acquiring property can reduce noise complaints by creating a larger buffer between airport activities and nearby neighbors.	
Airfield Infrastructure Development	Implement the infrastructure development on the east side of the airfield, which will be done in multiple phases.	Using this project as the catalyst, develop and implement an Infrastructure Management Plan that incorporates a systematic set of activities through which the airport can sustainably manage its assets and their associated performance including risks and expenditures over their lifetime.	
Taxiway Construction	Construct the taxiway network that extends east from Runway 3-21 to serve future aviation development potential (to be done in multiple phases).	Consider warm versus hot mix asphalt to reduce emissions. If there is leftover material from previous construction projects, reuse materials where possible.	
Airfield Pavement Maintenance	Perform general airfield pavement maintenance.	Upkeep of airport facilities maintains the integrity of the airport for its patrons. Specifically, pavement maintenance maintains the proper pavement condition index rating.	

KEY: *Air Quality* · *Community Well-Being* · *Energy* · *Dark Sky* · *Natural Resource Management* · *Land Use* · *Planned Development* · *Resiliency and Preparedness* · *Waste Management* · *Water*

ARFF - Aircraft Rescue and Firefighting Facility
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Exhibit B1
SUSTAINABLE AIRPORT CAPITAL IMPROVEMENT PROGRAM OPPORTUNITIES

Source: Sustainable Aviation Guidance Alliance; Airport Management ***NOTE:*** Project implementation is dependent on federal and state grant funding and availability. The CIP is based on FAA fiscal year programming. *A stub taxilane is a taxiway that connects a runway to a parallel taxiway or a taxiway to an adjacent apron area (FAA).

incorporate sustainable design elements that would enhance passenger experience. The use of low-emitting materials would improve air quality, and additional windows would allow for increased natural light and improved outside views. Overall, any capital improvement project that would reduce incompatibility between airport operations and its surrounding community, and create a greater user experience while at the airport, will positively impact the Community Well-Being category.

Energy



- Reduce electricity use at the airport by 15 percent below 2013 levels by 2020.
- Reduce natural gas use at the airport by 2 percent below 2013 levels by 2020.
- Secure 35 percent of electricity used in buildings and operations from renewable sources by 2020.
- Net Zero by 2030.

Projects that incorporate energy reduction measures, as well as renewable energy technology, are ways the airport can reduce its reliance on fossil fuels. Projects proposed within the Master Plan, including the construction of a snow removal equipment building (SREB) and the purchase of new security equipment for the terminal, can incorporate energy-efficient design/equipment, which would help the airport meet its energy goals. The new terminal building also offers opportunities for increased energy efficiency by considering the incorporation of solar panels and/or other renewable energy sources, as well as operable windows that, on temperate days, would allow for the use of passive, free cooling. Any project that better connects the airfield and/or the landside facilities to the airside, will help the airport reduce its energy consumption simply by increasing the efficiency of which patrons and airport employees can get from one place to another.

Dark Skies



- Become the most "International Dark Sky Compliant" commercial service airport in the nation.
- Improve lighting in areas at the airport to meet and, if possible, exceed the goals of the International Dark Sky Association and the City of Flagstaff Outdoor Lighting Standard, as permitted by FAA regulations.

The construction of the Snow Removal Equipment Building (SREB) should incorporate into its design lighting that helps the airport support the City of Flagstaff's goal of protecting the night skies. Further, the design of any new facility at the airport should include lighting that conforms to Dark Skies standards. In addition to new facility projects, the airport should actively replace all non-conforming lighting with options that adhere to the Dark Skies standards.

Natural Resource Management



- Manage the airport property to protect habitat, where able, while ensuring the safe and efficient operation of the airport.
- Minimize wildlife hazards to enhance safety for aircraft operations.
- Reduce potential for fire hazards on-airport through community partnerships.

Meeting the airport's natural resource management goals means protecting the airport from wildlife, potential fire hazards, and maintaining safety and efficiency. Designing a drainage plan that minimizes the amount of pooling water is a project that works toward these goals because it would eliminate a current wildlife attractant. Using building materials that are less toxic will also positively impact the Natural Resource Management category, like using zero- or low- volatile organic compound paint for the relocation of the hold lines. Projects that can incorporate permeable pavement, reducing the amount of hardscapes on airport property, will reduce the burden on the local stormwater system and natural waterways. Again, the construction of a new terminal building offers ways for the airport to work in concert with the surrounding forests. Options to consider include reducing light pollution by using downlighting and harvesting gray water that could be reused in landscaping and toilets.

Land Use and Transportation



- Continue to encourage local jurisdictions to enable aviation/land use compatibility around the airport currently and in the future.
- Work with surrounding communities to proactively address aircraft noise issues.
- Increase connectivity between the airport and the community to allow for multi modal alternatives for transportation.

To meet this goal, the airport is taking on projects that secure its compatibility with the surrounding community while providing increased access to the airport. The project that involves acquiring approximately 180 acres of property for safety areas will help protect the airport from incompatible encroachment to ensure it can continue operating safely and efficiently into the future. The expansion of the terminal vehicle parking lot will increase accessibility for airport patrons, with the opportunity to encourage alternative transportation modes by designating spaces for carpool, hybrid vehicles, and charging stations.

Planned Development



- Develop and maintain facilities and infrastructure at the airport to support long term, compatible, efficient, and flexible growth.
- Integrate sustainability into all major airport planning documents and contracts, where applicable.
- Enhance sustainability practices for all airport activities (i.e., operations and maintenance, administration, procurement, design/construction/post-construction) as conducted by all involved in the operation of the airport.

Projects that incorporate sustainable elements into the construction design and post-construction operations help the airport achieve its goal of creating an environmentally-conscious facility into the future. Projects like the construction of a new terminal building, the SREB, milling and overlay work on Taxiway A, ramp expansion to accommodate larger aircraft, and the rehabilitation of Runway 3-21, among many others, are all projects that the airport plans to pursue in the future. Establishing a precedent of incorporating sustainability into the design, construction, and ultimate operation of these facilities reduces the airport's footprint in the future. The incorporation of sustainability within this Master Plan is evidence the airport is following through with its goal to integrate sustainability into all major planning projects.

Resiliency and Preparedness



- Increase operational resiliency and preparedness to the changing climate.
- Enhance the level of organizational and individual preparedness through education and training.
- Incorporate resiliency and preparedness principles into airport operations.

There are several projects the airport is undertaking that help secure a safe and flexible future for itself, including the purchase of an updated ARFF vehicle, Taxiway A rehabilitation, constructing a ramp expansion to accommodate larger aircraft, and rehabilitation of Runway 3-21. Each of these projects maintain the airport's long-term viability and financial resiliency. By incorporating resiliency into airport improvement projects, the airport is protecting itself against the uncertainty of the future, especially with a changing climate. Further, the airport can create new plans and protocols to better prepare themselves for the future; for example, by developing an infrastructure management plan.

Waste Management



- Reduce the volume of solid waste (per enplanement) sent to a landfill by the airport by 50 percent by 2025.
- Promote sustainable procurement in airport operations, including for tenants.
- Become zero waste by 2035.

All proposed construction projects within the Master Plan should incorporate initiatives to reuse/recycle materials and reduce the amount of ultimate construction and demolition waste. Once operational, the new terminal building should incorporate an internal recycling, and possibly composting, policy that reduces the amount of products that end up in the landfill. Practices like these will help the airport achieve its goal of becoming zero waste by 2035.

Water



- Reduce potable water consumption to 5 percent below 2013 levels by 2020.

Preparing a drainage plan that incorporates rainwater harvesting could help the airport meet its goal of reducing potable water consumption. Captured rainwater could be used for non-potable water needs, like landscaping and in toilet fixtures. On-site rainwater treatment facilities should also be considered as an alternative to reduce potable water consumption at the airport. Low-flow fixtures and toilets should be implemented in the ultimate terminal building, reducing the building's water use.

FLAGSTAFF AIRPORT

APPENDIX C

Economic Benefit Analysis



Appendix C
ECONOMIC BENEFIT ANALYSIS

This section presents an analysis of economic benefits created by Flagstaff Airport. The airport is the primary aviation gateway for the Northern Arizona region, welcoming commerce and visitors while providing residents with access for outward travel to national and intercontinental destinations. The airport creates significant benefits that extend beyond the aviation community to impact economic growth and development as well as the quality of life of Northern Arizona residents. The availability of air transport is invariably listed by business executives as a key criterion for business location and expansion. Public safety and national security objectives are supported by aviation operations of police officers and government agencies. Medical transport, search and rescue, aerial mapping, air cargo and express delivery services are all essential functions provided at Flagstaff Airport every day of the year.

Airline travelers come to Flagstaff to conduct business, meet with clients and suppliers and place orders for goods and services produced in the region. Even greater numbers come for personal reasons, to visit friends and relatives, or to hike, fish, hunt or simply vacation in the midst of world class scenery and recreation opportunities. General aviation flyers based at Flagstaff Airport enjoy the benefits of on-demand flight schedules to destinations within the state or any of the nearly 3,000 general aviation airports that provide access to large and small communities across the country.

DEFINITIONS AND METHODOLOGY

Although qualitative advantages created by an airport are important, they are also challenging to measure. In studying the economic benefits of airports and aviation, aviation analysts have emphasized economic benefits that can be quantified:

- **Employment** is the number of jobs supported by economic activity created by the presence of Flagstaff Airport.

- **Payroll** includes income to workers as employee compensation (the dollar value of payments received by workers as wages and benefits) and proprietor's income to business owners.

- **Output** is the value of the production of private firms and public agencies. For a private firm, output is equal to the annual value of revenue or gross sales at producer prices (before addition of further margins or transportation costs), including sales or excise taxes. Output, revenue, and sales are interchangeable synonymous terms used throughout this study and in turn, these are equal to spending or expenditures from the perspective of the buyer. For government units, the agency budget is used as the measure of output.

Economic benefit studies differ from cost-benefit analyses, which are often used to support a "go-no-go" decision to undertake a proposed project. Analysis of economic benefits is related to measurement of the economic contribution of an industry or a particular component of the economy. This methodology was standardized in the publication by the Federal Aviation Administration, *Estimating the Regional Economic Significance of Airports*, Washington DC, 1992, and has been closely followed in recent years by public and private sector aviation analysts. Consistent with the FAA methodology, this study views Flagstaff Airport as a source of measurable benefits that impact Flagstaff and the residents of Northern Arizona. Aviation activity creates revenues for firms and employment and income for workers on and off the airport.

On-airport activity by private aviation related firms and government agencies located on the airport is one source of output, jobs, and worker payrolls. Business spending on the airport injects revenues into the community when firms and public sector agencies buy products from local and regional suppliers and again when employees of the airport spend for goods and services in their communities. Included in on-airport economic benefits are capital improvement projects that provide for growth and enhance air safety.

Off-airport spending by visitors that arrive via airliner or general aviation aircraft is a second source of economic benefits. Air visitor spending creates jobs, income, and revenues in the region's lodging, food service, ground transportation, retail, and recreation industries.

DIRECT, SECONDARY AND TOTAL ECONOMIC BENEFITS

Economic activity (such as purchase of fuel by an aircraft pilot) creates an initial economic impact or benefit when the purchase is made. The spending by the pilot provides revenue to the fixed base operator (FBO), a portion of which is retained as margin, and the remainder is used for payments to suppliers or to pay salaries to workers (who then spend their wages in their home communities). As payments are received by suppliers or spent by workers, the initial direct spending from the fuel purchase recirculates in the economy in a series of successive transactions known as multiplier or secondary benefits, illustrated in **Figure A**. These combined direct and secondary benefits summed together provide a measure of total economic benefits.



Figure A. Direct, Secondary, and Total Economic Benefits

The terminology is explained in greater detail below.

- **Direct benefits** measure the initial output, employment, and payroll when businesses and agencies on the airport generate sales and revenues, hire workers, and make payments to employees. Off-airport direct benefits result when visitors that arrive by air spend for goods and services including lodging, restaurants, auto rental, retail items, or recreational activity.

- **Secondary benefits** (often known as "ripple effects") are created when the initial spending on system airports or by visitors circulates and recycles through the economy. The secondary benefits measure the magnitude of successive rounds of re-spending in the broader regional economy.

- **Total economic benefits** are the combined sum of direct and secondary benefits created both on and off the airport. The on-airport direct benefits are tabulated by obtaining data on revenues received by airport employers, the number of workers, and compensation paid. Air visitor direct spending benefits are based on surveys of passengers. These initial direct benefit figures are the "inputs" to the input-output model to estimate secondary benefits. The sum of the direct plus secondary benefits provides a measure of total economic benefits.

In turn, two components make up secondary benefits.

- **Indirect benefits** include activity by suppliers and vendors who sell to airport or hospitality businesses, along with the jobs created and incomes paid to workers by these suppliers. For example, businesses and agencies on the airport purchase services such as insurance and hard goods such as tools or office furniture from off-airport providers. The revenues to suppliers and jobs supported as well as wages paid are indirect benefits.

- **Induced benefits** measure the consumer spending of workers who produced both the direct or indirect goods and services. For example, when an aircraft technician's salary is spent for consumer goods such as groceries or medical services, this contributes to additional employment and income in the general economy for providers of these goods and services.

Economic benefit studies rely on multiplier factors from input-output models to estimate how direct spending on the goods and services of a particular industry or set of industries creates secondary indirect and induced benefits or multiplier effects. An input-output model incorporates interindustry relationships within a state or region that account for changes in employment, payroll, and output in related industries set off by a change in demand in an initial industry.

The indirect and induced spending coefficients used for this study were from the IMPLAN input-output model based on data on the Flagstaff/Coconino County economy from the U. S. Bureau of Economic Analysis. This model is frequently used for studying the economic benefits of airports and aviation across the nation, as well as economic impacts associated with changes in regional economies, such as closing of a military base or construction of a major sports venue. Because the airport is an existing facility, the current IMPLAN application is a contribution study, analyzing the benefits the airport creates annually for the local economy. The time period studied is calendar year 2016 and figures are expressed in 2016 dollars.

SUMMARY OF FINDINGS

The direct benefits of on-airport and air visitor activity related to Flagstaff Airport consisted of economic output of $137.0 million, employment of 783 workers, and payroll of $40.0 million in 2016. The total economic benefits of Flagstaff Airport included 1,365 jobs with payroll of $61.6 million and output of $200.3 million, incorporating all multiplier or secondary benefits. The direct, secondary, and total economic benefits created by on-airport, commercial service and general aviation activity are set out in **Table C1.**

SUMMARY: ON-AIRPORT DIRECT BENEFITS

On-airport direct benefits include employment, payroll, and output created by private firms and government agencies on the airport. Capital improvement projects are also included in on-airport benefits since these outlays generate employment and payroll when private contractors earn revenues from their on-airport activity. Including non-aviation firms, private employment accounted for nine out of every ten jobs on the airport in 2016.

There were 27 on-airport tenants employing 498 workers in combined private aviation, non-aviation, construction firms, and government units. Payroll for on-airport workers was $32.7 million. The direct output created by on-airport tenants, public agencies, and capital improvement project spending was $112.8 million.

SUMMARY: AIR VISITOR DIRECT BENEFITS

Air visitors arrive at Flagstaff Airport by commercial service carrier or by general aviation aircraft. According to the Origin and Destination (O&D) database of the U.S. Department of Transportation, 35,454 commercial service visitors enplaned at the airport in 2016. In addition, 10,532 itinerant general aviation aircraft arrived at the airport during the year. Of these, 2,422 remained overnight and the remaining 8,110 stayed for one day or less. The direct spending on lodging, food and drink, retail, and recreation

and entertainment off the airport by combined commercial service and general aviation visitors was $24.2 million in the Northern Arizona hospitality industry, creating 285 private sector jobs with payroll to workers of $7.3 million.

Table C1
Summary of Economic Benefits
Flagstaff Airport

SOURCE	EMPLOYMENT	PAYROLL	OUTPUT
Direct Economic Benefits			
On-Airport Benefits: ***Aviation & Non-Aviation Private Firms, Government Agencies & Capital Improvement Projects***	**498**	**$32,661,000**	**$112,802,000**
Air Visitor Benefits: ***Commercial Service & General Aviation Travelers***	**285**	**$7,320,000**	**$24,165,000**
Direct Benefits	**783**	**$39,981,000**	**$136,967,000**
Secondary Economic Benefits			
Indirect Benefits: ***Activity by Suppliers & Vendors***	**198**	**$6,582,000**	**$23,070,000**
Induced Benefits: ***Activity by Workers as Consumers***	**384**	**$15,085,000**	**$40,292,000**
Secondary Benefits	**582**	**$21,667,000**	**$63,362,000**
Total Economic Benefits			
Total Benefits	**1,365**	**$61,648,000**	**$200,329,000**

Note: On-airport spending for auto rental is included as on-airport benefits and not included as air visitor spending off-airport. Secondary benefits were computed from the IMPLAN input-output model. Values are in 2016 dollars.

SUMMARY: SECONDARY BENEFITS

The production of goods and services on the airport and for air visitors requires intermediate inputs from suppliers and vendors, creating secondary benefits in the form of additional output, employment, and payroll in the regional economy. As the initial direct benefits of Flagstaff Airport recirculated, secondary benefits as estimated by the IMPLAN model added output of $63.4 million and 582 additional jobs with payroll of $21.7 million. Each 100 direct jobs supported 74 secondary jobs in other sectors of the economy, and each one million dollars of direct output created an additional $453,000 of secondary spending in the general economy.

Of the 582 secondary jobs due to the presence of the airport, 198 were indirect jobs in supplier industries for airport employers or visitor service firms. These suppliers included firms in the general economy such as finance and insurance, business services, transportation and warehousing, information and communication. Indirect benefits included output in the regional economy of $23.1 million and payroll to workers of $6.6 million.

In addition, on-airport and tourism industry direct employees and the secondary employees of suppliers created induced benefits as they spent their payroll in their home communities. There were 384 additional jobs induced by employee household spending across a broad spectrum of consumer industries including health care, food service, retail trade, and personal services. These induced benefits added $40.3 million of output to the Northern Arizona economy.

SUMMARY: TOTAL ECONOMIC BENEFITS

The total benefits are the sum of the direct and secondary benefits. Including benefits from on-airport economic activity, air visitor spending, and all multiplier effects, Flagstaff Airport contributed total economic benefits as shown in **Figure B**.



Figure B. Flagstaff Airport Total Economic Benefits

A DAY AT FLAGSTAFF AIRPORT

Airports are available to serve the flying public and support the economy every day of the year. The Flagstaff Airport is a "24/7" source of revenues, employment and income for the service area economy. During an average day, the Flagstaff Airport generated $549,000 of total economic benefits (including direct plus secondary benefits) and supported 1,365 workers bringing home daily income of $169,000 for spending in their home communities (**Table C2**).

On an average day at the airport, there were 127 operations by aircraft involved in local or itinerant activity including touch and go operations, corporate travel on business jets, or commercial flights bringing passengers visiting the area for personal travel or on business. The average number of enplanements daily was 177 passengers, and 97 of these were visitors. On an average day, 440 air visitors were in the

area spending for lodging, food and drink, retail goods and services, recreation and ground transportation. Visitor spending injected $77,000 per day into the regional economy.

Table C2
Economic Benefits for an Average Day
Flagstaff Airport

Activity	Average Day
All Aircraft Operations	**127 Daily Aircraft Operations**
On-Airport Employment	**498 Workers on the Airport**
Commercial Service Passengers	**177 Daily Enplanements**
Air Visitors (Commercial Service + GA)	**440 Air Visitors in the Area Daily**
Air Visitor Spending	**$77,000 Daily Visitor Spending***
Total Employment	**1,365 Total Jobs Supported**
Total Payrolls	**$169,000 Daily Pay for Workers**
Total Economic Benefits	**$549,000 Daily Economic Benefits**

***Includes spending at on-airport auto rental agencies**
Sources: Flagstaff Airport; FAA Air Carrier Activity Information System (ACAIS) 2016; Flagstaff Airport Visitor Survey; IMPLAN Input-Output model.

ON-AIRPORT ECONOMIC BENEFITS

The on-airport sources of economic benefits include employment, payroll, and output for private firms and public agencies located on the airport, as well as capital improvement projects undertaken by private contractors **(Table C3)**.

Airport staff provided considerable data and collaboration in support of this study. Airport staff facilitated on-site interviews with airport tenants who provided information on their operations, including average employment levels during the prior 12 months. Telephone follow-up contact was made as necessary. Respondents were informed that the individual employer results were confidential and only aggregate totals would appear in the written report.

There were eleven private aviation tenants on the airport, including commercial air service; a full service FBO providing aircraft fueling, maintenance and repair; and medical transport and specialized aviation services. Within the terminal are passenger services including ticketing and auto rental. Concession outlets available to airport passengers feature general merchandise and food services. The private sector aviation firms reported employment of 136 workers with compensation of $9.6 million and output (revenues) of $19.0 million.

There were nine non-aviation private employers on the airport, including manufacturing, biotech and medical research, express parcel services, management consulting, and various business and technical services. The non-aviation firms created direct employment of 286 workers with compensation of $19.3 million and output of $85.2 million.

There were seven governmental units on-site including the City of Flagstaff airport staff; state and local police personnel; a seasonal fire response unit; the Federal Aviation Administration Air Traffic Control Tower; U.S. Department of Homeland Security employees from the Transportation Security Administration (TSA); and the Federal Bureau of Investigation. These government agencies reported combined budgets of $5.2 million, with 52 employees and payrolls of $2.9 million.

Table C3
On-Airport Economic Benefits
Flagstaff Airport

SOURCE	EMPLOYMENT	PAYROLL	OUTPUT
Direct Economic Benefits			
Private Aviation Employers (11) ***Commercial Service*** ***Auto Rental*** ***Airport Concessions*** ***FBO Services*** ***Medical Air Transport***	**136**	**$9,582,000**	**$19,004,000**
Non-Aviation Employers (9) ***Manufacturing*** ***Biomedical Firms*** ***Express Delivery Services*** ***Energy & Utility Services***	**286**	**$19,286,000**	**$85,231,000**
Capital Improvement Projects (10 Year Average Value) ***Construction, Upgrades, Equipment Acquisitions***	**24**	**$916,000**	**$3,317,000**
Government Agencies (7) ***Airport Administration*** ***FAA Control Tower*** ***Dept. Homeland Security*** ***Fire Control (seasonal)*** ***FBI Unit***	**52**	**$2,877,000**	**$5,250,000**
Direct Benefits	**498**	**$32,661,000**	**$112,802,000**
Secondary Economic Benefits			
Indirect Benefits: *Activity by Suppliers & Vendors*	**155**	**$5,360,000**	**$18,487,000**
Induced Benefits: *Activity by Workers as Consumers*	**299**	**$11,608,000**	**$31,684,000**
Secondary Benefits	**454**	**$16,968,000**	**$50,171,000**
Total Economic Benefits			
Total Benefits	**952**	**$49,629,000**	**$162,973,000**

Note: On-airport spending for auto rental is included as on-airport benefits and not included as air visitor spending off-airport. Secondary benefits were computed from the IMPLAN input-output model. Values are in 2016 dollars.

CAPITAL IMPROVEMENT PROJECTS

Capital improvement projects are also included as a source of airport economic benefits, since construction activity generates spending and employment both on and off the airport. Runway improvements, fencing, drainage projects, and building construction are all examples of capital improvements that enhance safety and provide for growth.

Major capital improvement projects that begin at a particular point in time can extend over more than one year and reported outlays can vary sharply from year to year when larger projects are underway. In order to smooth out the annual variation in capital improvement spending, economic benefit studies average outlays over a multi-year period.

For this study, figures on capital improvements and equipment acquisitions were obtained from Airport records and averaged over the ten-year period from 2007 through 2016. The ten-year average annual outlay was $3.3 million. This value was used to obtain the employment estimate of 24 workers and payroll of $916,000 as representative annual figures for airport capital improvement activity.

DIRECT, SECONDARY AND TOTAL ON-AIRPORT BENEFITS

The combined direct benefits of on-airport private firms, government agencies, and capital improvement projects were 498 direct jobs with payroll of $32.7 million and $112.8 million output. The ratio of private sector on-airport jobs to all direct on-airport jobs was 452/498 = 90 percent private sector jobs.

Secondary benefits as estimated by the IMPLAN model added employment of 454 jobs and output of $50.2 million as the initial direct spending recirculated within the regional economy. As noted earlier, secondary effects come from two sources. On-airport private firms and public agencies make purchases from suppliers and vendors, who in turn purchase inputs and hire employees to support production of goods and services for airport customers. This effect is known as the indirect benefit. Simultaneously, employees of airport firms and agencies and employees of their suppliers are also consumers who spend incomes in their home communities. This spending stimulates additional jobs and output in the sectors serving consumers, creating induced benefits.

Of the 454 secondary jobs created by airport operations, 155 were indirect jobs adding to the number of workers in supplier industries to on-airport activity, such as finance and insurance, business services, transportation and warehousing, information and communication, and government agencies. There were 299 additional jobs induced by airport and supplier employee household spending across a broad spectrum of consumer industries including health care, food service, retail trade, and personal services.

The total benefits of on-airport operations are the sum of the combined direct and secondary benefits. The total benefits were 952 jobs supported, with payroll of $49.6 million, and output of $163.0 million added to the economy.

Comparison of total benefit figures with the initial direct benefits gives insight into the multiplier values for each component. For example, the 498 direct on-airport jobs support total employment of 952, a multiple of 1.91. The economic interpretation is that, on average, each 100 on-airport jobs support an additional 91 jobs in the general economy.

The output multiplier is the ratio of total output ($163.0 million) to direct output ($112.8 million), or 1.44. Every million dollars of direct output on the airport results in $440,000 of additional output as the initial direct spending recirculates in the regional economy.

COMMERCIAL SERVICE VISITOR ECONOMIC BENEFITS

Visitors travel to the Northern Arizona area for diverse purposes, including business and personal reasons. Some come to camp, hike, or vacation. Others come to meet business clients or as customers of Flagstaff firms and suppliers. Many others come to visit friends and relatives, renewing and strengthening relationships by personal contact.

Table C4
Commercial Service Visitors
Flagstaff Airport

Category	Value*
Enplanements	**64,578**
Percent Visitors	**54.9%**
Number of Visitors	**35,454**
Spending Per Trip	**$612**
Visitor Spending**	**$21,698,000**

*** Some figures are rounded**

****Includes on-airport auto rental spending**

Source: FAA Air Carrier Activity System; U.S. Department of Transportation; Flagstaff Airport Visitor Survey, 2016

One common characteristic among travelers to the region is that, while away from home, they make expenditures on a daily basis, creating employment, incomes, and revenues for workers, businesses, and governments. A recent study by Northern Arizona University for the Flagstaff Convention & Visitors Bureau reported the total economic contribution of visitor spending was $575 million in 2014, supporting some 7,311 jobs in the Flagstaff area.

Flagstaff Airport contributes to the visitor industry of Northern Arizona by providing commercial service links for air travelers coming from within the state and across the country. According to the FAA Air Carrier Activity Information System (ACAIS), there were 64,578 airline enplanements at Flagstaff Airport in 2106 (**Table C4**).

Analysis of passenger origination data from the U. S. Department of Transportation revealed that 54.9 percent or 35,454 enplaning airport passengers were visitors to the area during calendar year 2016**.** The greatest number of visitors came from Los Angeles, followed by New York, San Francisco, Seattle, Denver, Dallas/Ft. Worth, San Diego, Phoenix, Portland (Oregon), and Santa Ana, rounding out the top 10 originating airports.

Average spending per visitor per trip was $612. Multiplied over all visitors, the annual commercial service direct visitor spending benefit was calculated as $21,698,000 for 2016.

COMMERCIAL SERVICE VISITOR SURVEY

Visitor spending per trip is a function of length of stay and the distribution of spending over lodging, food, auto rental, other transport, retail, and entertainment/recreation. Business travelers tend to have shorter stays but spend more on lodging and auto rental compared to those traveling to visit relatives, for example, who may stay longer and have no lodging expenses but spend more on retail or entertainment.

To obtain information on spending patterns by airport commercial service travelers, surveys were administered to a sample of more than 500 enplaning visitors in the terminal during 2016. Surveys were distributed at various hours of the day and during each day of the week, including weekends, to passengers who identified themselves as visitors to Northern Arizona.

One individual for each travel party completed the survey for the visitors in the party. Travel party information on air visitor spending for lodging, food, retail goods and services, recreation and ground transportation was provided by responding visitors, as well as party size, length of stay in the Flagstaff area, and purpose of the trip.

COMMERCIAL SERVICE VISITOR SPENDING

Table C5 presents summary information from the commercial service visitor survey. Travelers responding to the surveys identified the main purpose of their travel as either business, personal, or tourist/vacation. Surveys were analyzed within these three categories, along with a separate grouping of travelers who were part of larger, organized travel parties (10 or more persons).

The greatest number of estimated visitors (20,526) in 2016 were tourists, accounting for 58 percent of total air visitors. The remaining air visitors were distributed over the business, personal and large group categories, each accounting for 14 percent of the total.

Those traveling for personal reasons, typically visiting friends or relatives, had the longest stay (4.5 days). Those traveling as part of a large group had the shortest stay (2.4 days), most likely because their ultimate destination was a major attraction beyond the Flagstaff area, such as the Grand Canyon. Business and tourist travel parties each reported an average stay of 3.5 days.

Applying the survey results to the total population of air visitors, there were 123,440 visitor days for the 2016 calendar year. On an average day, there were 338 commercial service passengers visiting in Northern Arizona and spending for lodging, auto rental and various other goods and services.

Visitors who identified as tourists reported the highest spending per person per trip ($743). Ninety-two percent of travel parties in this category reported lodging expenses of $100 or more on their trip. In comparison, only 40 percent of those traveling to visit friends or family spent this amount during their trip. Business travelers reported the second highest spending per person per trip ($564), followed by those traveling for personal reasons ($510). The least spending per person per trip was reported for the large group category ($229). Those traveling in a large group had the shortest stay and likely had the least opportunity for independent entertain activities and retail shopping. While those in the tourist category accounted for 58 percent of visitor days, spending by tourists of $15.3 million made up 70 percent of total air visitor spending in the region ($21.7 million).

Table C5
Commercial Service Visitor Characteristics and Spending
Flagstaff Airport

	BUSINESS	PERSONAL	TOURIST	LARGE GROUP	OVERALL
Commercial Service Visitor Characteristics					
Number of Visitors	4,838	4,986	20,526	5,114	35,454
Percent by Purpose of Travel	*14%*	*14%*	*58%*	*14%*	*100%*
Length of Stay (Days)	3.5	4.5	3.5	2.4	3.7
Number of Visitor Days	16,993	22,392	71,841	12,274	123,440
Percent of Visitor Days	*14%*	*18%*	*58%*	*10%*	*100%*
Commercial Service Visitor Spending by Purpose of Travel					
Accommodations	$294	$154	$304	$73	$248
Food & Drink	$109	$143	$129	$57	$118
Retail Goods & Services	$56	$77	$66	$61	$65
Recreation & Entertainment	$28	$89	$148	$8	$104
Ground Transportation	$77	$47	$97	$30	$77
Spending per Person per Trip	$564	$510	$743	$229	$612
Visitor Direct Spending	$2,728,000	$2,537,000	$15,261,000	$1,172,000	$21,698,000
Percent of Visitor Spending	*13%*	*12%*	*70%*	*5%*	*100%*

Source: Compiled from Flagstaff Airport Visitor Survey, 2016

GENERAL AVIATION VISITOR ECONOMIC BENEFITS

Visitors travel on general aviation aircraft to Flagstaff Airport for the same purposes as those arriving by commercial service flights - as vacationers, to visit friends and relatives, and for business. Although general aviation travel is sometimes viewed as a luxury mode of transport, the efficiencies and flexibility of general aviation are highly desirable, especially to corporate travelers. Studies of companies that use business aviation find that these firms outperform other firms on key financial measures such as earnings and share price growth.

General aviation flights to Flagstaff Airport can originate at any of some 5,000 public use airport facilities across the nation, while commercial service travelers are limited to flights originating at approximately 500 commercial service airports. Moreover, users of general aviation face fewer restrictions on transportability of baggage, more efficient security checks, and flexibility of arrival and departure schedules.

According to the FAA Air Traffic Activity System (ATADS), there were 10,532 itinerant general aviation arrivals at the airport in 2016 **(Table C6**). Of these, an estimated 2,422 remained overnight while the

general aviation travel party conducted business or visited in the area. The remaining 8,110 stayed one day or less.

To compute a conservative estimate of economic benefits of general aviation visitors, one-day aircraft were further partitioned into those staying less than 4 hours and 4 hours or more, based on arrival and departure time as reported in the FAA flight plan data.

Visitor spending estimates were computed only for those aircraft staying 4 hours or longer at the airport, reflecting the fact that many aircraft stop only for fuel and travelers do not spend for food, retail shopping, or ground transportation off the airport. There were 1,896 general aviation aircraft that stayed on the ground 4 hours or more during the year and 6,214 that stayed fewer than 4 hours.

Table C6
General Aviation Itinerant Aircraft
Flagstaff Airport

Category	Value
Itinerant General Aviation Arrivals	**10,532**
Overnight Aircraft	**2,422**
Aircraft with > 4 Hour Stay	**1,896**
Aircraft with < 4 Hour Stay	**6,214**

Source: Derived from FAA flight plan arrival and departure records as compiled by the Airport IQ Data Center, 2016

GENERAL AVIATION VISITOR SPENDING

From analysis of the FAA flight plan data base, it was determined that the average length of stay of overnight general aviation aircraft was 3.2 days. The length of stay for those day visitor aircraft that were on the airport for more than four hours was 5.3 hours and for those that stayed less than four hours the time of stay was 58 minutes. The average number of passengers per aircraft was based on 4,857 jet arrivals, 4,959 turboprop, and 716 piston aircraft arrivals. Average passenger counts were set at five for the jet category (including crew), three for turboprop, and two for piston aircraft. The weighted average over all aircraft type was 3.8 persons per arriving aircraft.

A specific survey for general aviation visitors was not used. Visitors arriving on general aviation aircraft were assumed to spend the same average per person amounts for accommodations, restaurants, auto rental, and other outlays as reported by commercial service travelers. The expenditures per person from the commercial service passenger survey are reported in Table C6 in the "Overall" summary column.

Applying these average values for lodging and other expenditures, spending per aircraft was based on average number of passengers for each type of aircraft and length of stay. Spending estimates per aircraft by aircraft type (jet, turboprop and piston) were then combined to derive an overall figure for general aviation spending per aircraft, using percentage of each aircraft type as the weighting factor.

Passengers on overnight general aviation aircraft spent an average of $2,170 per aircraft on their 3.2 day visit and one day general aviation visitors staying four or more hours spent $406 per aircraft (**Table C7**).

Lodging accounted for 40 percent of overnight general aviation visitor spending, averaging $876 per aircraft travel party. The second largest spending category for overnight travelers was food and drink, at $419 per party. Food and drink also was the largest spending category for one day visitors ($131 per party).

Multiplication of 2,422 overnight general aviation aircraft by spending per trip of $2,160 yields total expenditures of $5.3 million for those with an overnight stay in the Flagstaff area. Similarly, the 1,892 one-day aircraft parties spent a total of $768,000. The sum of direct general aviation visitor spending benefits was $6.0 million.

Table C7
Spending Per General Aviation Aircraft Per Trip
Flagstaff Airport

Category	Overnight General Aviation Aircraft	Day Visit General Aviation Aircraft
Accommodations	**$876**	
Food & Drink	**$419**	**$131**
Retail Goods & Services	**$234**	**$74**
Recreation & Entertainment	**$370**	**$116**
Ground Transportation	**$271**	**$85**
Spending per Trip Per AC	***$2,170***	***$406***
Number of Aircraft	**2,422**	**1,892**
Direct GA Spending	***$5,258,000****	***$768,000****

*Source: Derived from FAA operations data and Flagstaff Airport visitor survey. *Spending figures by category are rounded and may not compute exactly.*

COMBINED COMMERCIAL SERVICE AND GENERAL AVIATION VISITOR BENEFITS

Commercial service and general aviation visitors combined to spend $24.2 million off the airport in the Northern Arizona region during 2016, creating 285 direct jobs off the airport with earnings to workers of $7.3 million (see **Table C8**).

There were 160,624 visitor days attributable to combined commercial and general aviation travelers during the year. Seventy-seven percent of visitor days (123,440) were due to commercial air travelers and twenty-three percent of days (37,184) were contributed by general aviation visitors. On an average day, there were 440 air visitors in the service area. Average daily off-airport spending by all air travelers was $66,200 (the on-airport portion of auto rental expenditures is excluded from these figures and Table C9).

The largest spending category by aviation visitors was expenditures for hotel or other accommodation, with outlays of $10.9 million. The level of lodging employment associated with this spending level was 113 jobs and payroll of $3.1 million. The second greatest spending category was food and drink, with outlays of $5.4 million, creating 91 jobs with payroll of $2.1 million.

The total economic benefits from air visitor spending were $37.4 million in output (revenues) and 413 jobs supported throughout the economy, with payroll income to workers of $12.0 million. The indirect benefits created by purchase of intermediate goods and services from suppliers to the hospitality industry were output of $4.6 million and 43 additional jobs across the regional economy.

Table C8
Combined Economic Benefits: Commercial Service and General Aviation Visitors
Flagstaff Airport

Category	Employment	Payroll	Output
Direct Economic Benefits			
Accommodations	113	$3,083,000	$10,925,000
Food & Drink	91	2,090,000	5,449,000
Retail Goods & Services	14	334,000	3,029,000
Recreation & Entertainment	67	1,813,000	4,762,000
Direct Benefits	285	7,320,000	24,165,000
Secondary Economic Benefits			
Indirect Activity by Suppliers & Vendors	43	1,222,000	4,583,000
Induced Spending by Workers & Proprietors of Businesses	85	3,477,000	8,608,000
Secondary Benefits	128	4,699,000	13,191,000
Total Economic Benefits			
Total Benefits	413	$12,019,000	$37,356,000

Source: FAA passenger statistics; Flagstaff Airport passenger survey; FAA flight plan data base; employment estimates from IMPLAN input-output model based on coefficients from U.S. Bureau of Economic Analysis; on-airport auto rental is included in on-airport economic benefit tables. Figures are rounded.

The induced spending by workers as consumers created benefits of $8.6 million revenues and 85 jobs. Both the indirect and induced spending recirculated within the Northern Arizona economy to increase revenues to business, create jobs for workers, and provide payroll for further expenditures. The secondary benefits due to multiplier effects summed to $13.2 million of revenues, 128 jobs, and $4.7 million of payroll.

The overall output multiplier for combined commercial service and general aviation visitor spending was $37.4/$24.2 = 1.54, indicating that each one million dollars of direct air visitor spending recycled in the economy to create total final output of $1.54 million (or $540,000 of secondary spending benefits per million dollars of direct spending). The employment multiplier (comparing total employment of 413 with direct employment of 285) was 1.45. Each 100 direct jobs related to air visitor spending created an additional 45 jobs in the overall economy. Moreover, each one million dollars of direct spending by air visitors created 11.8 jobs in the hospitality industry. This figure is obtained from 285 jobs/$24.2 million. By visitor spending category, the employment benefits from spending on food and drink are greatest, with 16.8 jobs created per one million dollars of outlays. For lodging, the figure is 10.8 jobs per million. Benefits from retail spending are smaller (4.6 jobs per million) and recreation spending creates the fewest jobs (3.3 per million dollars of spending).

BENEFITS OF A DEPARTING COMMERCIAL AIRCRAFT

The figures for spending per person per trip can be applied to illustrate the economic value of visitor expenditures from a typical commercial service aircraft operation at Flagstaff Airport (**Table C9**).

Airport flight records show there were 1,759 commercial service departures during the 2016 calendar year. There were an average of 37 passenger enplanements per departure during the period. Drawing from the U.S. Department of Transportation Origin and Destination data base, the average proportion of visitors among enplaning passengers was 54.9 percent at Flagstaff Airport.

The computed average number of visitors on a typical departing commercial service flight were estimated as 20 (54.9 percent of 37, rounded). These 20 visitors per aircraft will have spent on average $612 per person during their trip, based on figures from the airport passenger survey. A direct economic benefit of $12,240 was injected into the local economy for each of 1,759 departing commercial aircraft on average, during 2016.

Table C9
Benefits of a Commercial Departure
Flagstaff Airport

Activity	Value
Commercial Service Departures	**1,759**
Enplaning Passengers	**64,461**
Enplanements per Departure	**37**
Percent Visitors	**54.9%**
Average Visitors/Aircraft	**20**
Trip Expenditures/Person	**$612**
Departing Aircraft Benefit	**$12,240**

Source: Airport IQ Data Center and Flagstaff Airport Visitor Survey. Some figures are rounded.

FUTURE ECONOMIC BENEFITS

Coconino County and Flagstaff area socioeconomic indicators including population, employment, and income, have consistently grown more rapidly than the nation as a whole. For example, the compound annual population growth rate of 2.2 percent for the City of Flagstaff between 1970 and 2015 was twice the U.S. pace of 1.1 percent over the same period. By 2035, Coconino County is projected to add an additional 42,000 jobs over the 2015 base of 83,350, an increase of 50 percent (*Flagstaff Airport Master*

Plan, Table 2C). As the regional economy grows, the demand and supply of aviation services will rise, bringing an increase in future economic benefits.

Table C10 shows a baseline summary of current economic benefits associated with the presence of Flagstaff Airport. **Tables C11 through C13** illustrate the future benefits of the airport based on projections for the short, intermediate, and long-term growth periods. The methodology for estimating future economic benefits is a linear extrapolation of current baseline values of the direct on-airport and visitor benefits in **Table C10** using growth rates for aviation activity developed in Chapter 2 of the *Flagstaff Airport Master Plan*. All figures are expressed in 2016 dollars. On-airport aviation revenues, employment, and income increase by the forecast growth rate of combined annual operations: 4.2 percent by 2020, 6.7 percent between 2020 and 2025, and 13.7 percent from 2025 to 2035. Non-aviation employment, payroll, and output are outside the model and assumed to remain constant in 2016 dollars.

Air visitor spending, employment, and income increase by the forecast growth rate of passenger enplanements: 19.0 percent by 2020, 18.7 percent from 2020 to 2025, and 31.6 percent from 2025 to 2035. These extrapolations are based on the standard assumption of "ceteris paribus" or no change in economic relationships (including the multiplier value of IMPLAN coefficients for secondary benefits) in the years ahead.

Table C10
Baseline Economic Benefits
Flagstaff Airport

Source	Employment	Payroll	Output
On-Airport	**498**	**$32,661,000**	**$112,802,000**
Air Visitors	**285**	**$7,320,000**	**$24,165,000**
Direct Benefits	**783**	**$39,981,000**	**$136,967,000**
Secondary Benefits	**582**	**$21,667,000**	**$63,362,000**
Total Benefits	**1,365**	**$61,648,000**	**$200,329,000**

Source: On-airport employer interviews, passenger surveys, and IMPLAN input-output model based on coefficients from the U. S. Bureau of Economic Analysis. Figures shown are in 2016 dollars and some are rounded.

The time periods (short, intermediate, and long term) are demand driven but generally correspond to forecast activity levels five, ten and twenty years from the base year. The short term is associated with enplanements of 80,000 and total annual operations of approximately 48,000, expected by 2020. The intermediate term is associated with 95,000 enplanements and 51,200 operations by 2025. There are 125,000 annual enplanements forecast in the long term, along with 58,200 operations projected by 2035.

Airport direct benefits from on-airport activity are projected to rise from $112.8 million output and 498 on-site jobs in 2016 to $113.7 million output and 505 jobs in the short term (**Table C11**). The increase is due to aviation-related growth, as non-aviation employment and output remain fixed. The rise in enplanements to 80,000 increases air visitor spending to $27.8 million. Assuming no changes in the inter-industry relationships of the IMPLAN model, the ratios of indirect and induced benefits to initial direct

benefits remain stable while the economy and airport related activity grow. By 2020, total benefits include employment of 1,451 with payroll of $64.1 million and output in the region of $206.2 million.

Table C11
Projected Economic Benefits: Short Term
Flagstaff Airport

Source	Employment	Payroll	Output
On-Airport	**505**	**$33,111,000**	**$113,729,000**
Air Visitors	**327**	**$8,412,000**	**$27,768,000**
Direct Benefits	**832**	**$41,523,000**	**$141,497,000**
Secondary Benefits	**618**	**$22,595,000**	**$64,700,000**
Total Benefits	**1,451**	**$64,118,000**	**$206,197,000**

Source: Based on 48,000 annual operations and passenger enplanements of 80,000.

At the intermediate milestone (approximately 2025), on-airport output is projected to be $115.6 million, with 520 on-site jobs. Output from air visitor spending is projected to rise to $33 million, creating 389 hospitality sector jobs. By 2020, total benefits increase to 1,583 jobs in the region with payroll of $68 million and output of $216.5 million **(Table C12)**.

Table C12
Projected Economic Benefits: Intermediate Term
Flagstaff Airport

Source	Employment	Payroll	Output
On-Airport	**520**	**$34,033,000**	**$115,629,000**
Air Visitors	**389**	**$9,989,000**	**$32,975,000**
Direct Benefits	**909**	**$44,022,000**	**$148,604,000**
Secondary Benefits	**675**	**$23,955,000**	**$67,949,000**
Total Benefits	**1,583**	**$67,977,000**	**$216,553,000**

Source: Based on 51,200 annual operations and passenger enplanements of 95,000.

In the long term, aviation demand levels rise to 58,200 operations and 125,000 annual enplanements. At this level of activity, on-airport employment increases to 552 workers, with payroll of $36 million and output of $120 million **(Table C13)**. Visitor spending is projected to rise to $43.4 million, creating 512 jobs. Total output is forecast to be $237.8 million, an increase of $37.4 million over baseline total output of $200.3 million. In the long term, total regional employment due to the presence of the airport increases to 1,853 workers with payroll of $76 million.

Table C13
Projected Economic Benefits: Long Term
Flagstaff Airport

Source	Employment	Payroll	Output
On-Airport	**552**	**$36,049,000**	**$119,785,000**
Air Visitors	**512**	**$13,143,000**	**$43,388,000**
Direct Benefits	**1,063**	**$49,192,000**	**$163,173,000**
Secondary Benefits	**790**	**$26,768,000**	**$74,611,000**
Total Benefits	**1,853**	**$75,960,000**	**$237,784,000**

Source: Based on 58,200 annual operations and passenger enplanements of 125,000.

GOVERNMENT REVENUE BENEFITS

Because of the output, jobs, and income created by the presence of Flagstaff Airport, the facility is an important source of public revenues. As airport activity expands, tax revenues will continue to grow. Estimated tax revenue potential is set out in **Table C14**. The table shows the revenues for each tax category derived from the IMPLAN model. The model uses current average tax rates for Coconino County and Arizona for profits, personal income, property, and sales taxes and applies these rates to direct and secondary economic activity. Federal taxes are applied using current federal rates for Social Security taxes, income, profits, and federal excise taxes and fees.

The first column of the table shows tax revenues associated with the 2016 baseline level of total output of $200.3 million (as seen in Table C10). The total economic benefits include direct and secondary benefits from on-airport activity and air visitor spending. The 1,365 total workers supported by airport activity receive payrolls of $61.6 million. Employers and workers are subject to various federal, state, and local taxes. The largest federal component is the social security tax, with contributions from employers and workers of $6.4 million in 2016. The second largest federal tax category is the personal income tax paid by workers and proprietors of $4.1 million. The federal corporate profits tax is $2.2 million. Overall, federal tax revenues estimated due to economic activity associated with Flagstaff Airport are calculated to be $13.6 million for 2016.

State and local tax revenues, shown in the lower portion of the table, sum to $8.4 million for 2016. The largest state and local component is sales taxes of $4.0 million. Property taxes for homeowners and businesses are estimated to be $2.4 million. Combined federal, state, and local government tax revenues created by the presence of Flagstaff Airport are $22.0 million at the 2016 level of airport activity and visitor spending.

Table C14
Government Revenue Benefits
Flagstaff Airport

Source	2016	Short Term	Intermediate Term	Long Term
Federal Taxes				
Corporate Profits Tax	$2,201,000	$2,266,000	$2,380,000	$2,613,000
Personal Income Tax	$4,117,000	$4,237,000	$4,450,000	$4,887,000
Social Security Tax	$6,381,000	$6,568,000	$6,898,000	$7,574,000
All Other Federal Taxes	$910,000	$937,000	$984,000	$1,081,000
Total Federal Taxes	$13,609,000	$14,008,000	$14,712,000	$16,155,000
State and Local Taxes				
Corporate Profits Tax	$249,000	$256,000	$269,000	$295,000
Property Tax	$2,403,000	$2,473,000	$2,598,000	$2,852,000
Sales Tax	$4,029,000	$4,147,000	$4,356,000	$4,783,000
Personal Income Tax	$699,000	$720,000	$756,000	$830,000
All Other State & Local	$1,034,000	$1,064,000	$1,118,000	$1,227,000
Total State & Local Taxes	$8,414,000	$8,660,000	$9,097,000	$9,988,000
Total Federal, State and Local Taxes				
Total Taxes	$22,023,000	$22,668,000	$23,809,000	$26,143,000

Source: Calculations from the IMPLAN input-output model based on tax rates for Coconino County and Arizona and current federal rates. All figures are in 2016 dollars.

Projected tax revenues rise as future airport activity increases. In the short term, total economic benefits created by the presence of Flagstaff Airport are projected to be $206.2 million, with 1,451 jobs supported in the region and worker compensation of $64.1 million. At the federal level, the rise in employment and income will be accompanied by an increase of business and employee social security contributions paid to $6.6 million. Federal personal income taxes will rise to $4.2 million. All figures assume constant 2016 tax rates. Short term state and local government revenues will be $8.7 million, and combined total annual state and federal tax collections will be $22.7 million in the short term.

Total economic benefits due to the presence of the airport are projected to increase to $216.5 million in the intermediate term. Jobs supported will rise to 1,583 and worker and proprietor income will be $68.0 million. Total state and federal tax collections will be $23.8 million in in the intermediate term.

Within the long term time horizon (to 2035), total economic benefits from activity at Flagstaff Airport are projected to increase to output of $237.8 million, with 1,853 jobs supported and payroll of $76.0 million. Annual federal tax collections in the long term are estimated to be $16.1 million, with social security contributions of $7.6 million and personal income taxes paid of $4.9 million (assuming rates under current law). At the state and local level, annual sales tax collections increase to $4.8 million and property tax collections rise to $2.8 million. Combined state and federal tax collections will be $26.1 million, an increase of 18 percent over the 2016 base year revenues.

BASED AIRCRAFT BENEFITS

A survey of owners of aircraft based at Flagstaff Airport was conducted to compile information on private aircraft usage patterns, including number of hours flown per year, purpose of travel, and hours flown per trip. Contact information for aircraft owners was obtained through the assistance of Flagstaff Airport staff and public records.

There were 139 aircraft based at Flagstaff Airport in 2016 **(Table C15)**. Of these, 113 or 81 percent were single engine, 15 were multi-engine, four were turboprop, four were helicopters, and three were gliders or experimental aircraft.

The average reported value for an aircraft was $143,000 and annual outlays were $12,700 for maintenance, storage, and other expenses such as insurance.

Those responding to the survey reported 150 average (non-training) hours flown per year, or, 20,850 hours of flight travel by Flagstaff Airport based aircraft. Based aircraft were used for business for 10,286 hours, or 49.3 percent of the total hours flown.

Table C15
Based Aircraft Usage and Business Activity
Flagstaff Airport

Category	Based AC
Average Aircraft Market Value	**$143,000**
Average Maintenance Expenses per Year	**$12,700**
Total Hours Flown per Year	**20,850**
Total Business Hours Flown per Year	**10,286**
Business Hours as Percent of All Hours	**49.3%**
Total Personal Hours Flown per Year	**10,564**
Employment at Firms with Based Aircraft	**726**
Annual Sales at Firms with Based Aircraft	**$72,000,000**

Source: Aircraft Owner Survey, Flagstaff Airport

Business aircraft are viewed by business firms as investments that provide returns through enhanced revenues and time savings when compared to scheduled airline travel. Local firms with based aircraft at Flagstaff Airport accounted for 726 employees in the Northern Arizona region, with sales of $72 million.

Business travel on private aircraft reduces costs and increases effectiveness in individual firms. Annual studies by the National Business Aviation Association show that those firms with business aircraft outperform those without aircraft with earnings 230 percent higher and average revenue growth 22 percent greater.

Among Business Week's "50 Most Innovative Companies," 95 percent of the S&P 500 companies listed were users of business aircraft (*National Business Aviation Association Fact Book*, *2014*).

The importance of the airport and general aviation for economic vitality of the region can be seen from these written notes from aircraft owner surveys:

- Large employer: "The airport is very important to enable us to connect with our businesses without going through Phoenix."

- Self-employed analyst: "Our airport is exceptional for a city our size, and is one reason we moved here. Without it, we would need to leave."

- Medical doctor: "The airport is critical for referral of patients to Flagstaff for surgery."

FLAGSTAFF AIRPORT

APPENDIX D

Forecast Approval



U.S. Department
of Transportation
**Federal Aviation
Administration**

Western-Pacific Region
Airports Division
Phoenix Airports District Office

3800 N Central Ave.
Suite 1025
Phoenix, AZ 85012

February 28, 2017

Mr. Barney Helmick AAE
Airport Director
Flagstaff Pulliam Airport
6200 S. Pulliam Dr. #204
Flagstaff, AZ 86005

Dear Mr. Helmick:

Flagstaff Pulliam Airport (FLG), Flagstaff, Arizona
Aviation Activity Forecast Approval

The Federal Aviation Administration (FAA) has reviewed the aviation forecast for the airport master plan dated February 6, 2017. The FAA approves these forecasts for airport planning purposes, including Airport Layout Plan development.

In summary, while the difference between the FAA TAF and the Flagstaff Pulliam Airport forecast update regarding total operations is above the 10 percent and 15 percent allowance for 5 and 10 year planning horizons, the airport forecast update appropriately explains these differences due to the most current conditions at the airport and the available data when the forecasts were developed which include an estimated 3.4% compound growth rate due to an increase in airline activity using larger 70 seat aircraft, which began operating out of the airport in November 2016. Therefore, approval of this forecast doesn't need to be sent to FAA Headquarters for review because the 5 and 10 year forecasts do not exceed benchmarks established in the FAA's Guidance on Review & Approval of Local Aviation Forecasts published in 2008.

The forecast was formulated using current data and appropriate methodologies; therefore, the FAA locally approves this forecast for planning purposes at the Flagstaff Pulliam Airport. It is important to note that the approval of this forecast does not guarantee future funding for large-scale capital improvements as future projects will need to be justified by current activity levels reached at the time the projects are proposed for implementation.

If you have any questions about this forecast approval, please call me at 602-792-1072.

Sincerely,

Jared M. Raymond
Airport Planner

cc: FAA Grant File
Matt Quick – Coffman Associates

FLAGSTAFF AIRPORT

APPENDIX E

Airport Layout Plans



Appendix E
AIRPORT LAYOUT PLANS

As part of this Master Plan, the Federal Aviation Administration (FAA) requires the development of Airport Layout Plan (ALP) drawings detailing specific parts of Flagstaff Airport and its environs. The ALP drawings are created on a computer-aided drafting (CAD) system and serve as the official depiction of the current and planned condition at the airport. The ALP drawings are delivered to the FAA and Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group) for their review. These entities critique the drawings from a technical perspective to be sure all applicable federal regulations are met. Ultimately, the FAA will approve the ALP drawing set. The ALP will then be used as the basis for justification for funding decisions.

It should be noted that the FAA requires any changes to the airfield (i.e., runway and taxiway system, navigational aids, etc.) to be presented on the ALP. The landside configuration developed during the master planning process is also depicted on the ALP, but the FAA recognizes that landside development is much more fluid and dependent on developer needs. Thus, an updated ALP set is typically not necessary for future landside development.

The five primary functions of the ALP that define its purpose are provided in Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, as follows:

1) An approved plan is necessary for the airport to receive financial assistance under the terms of the *Airport and Airway Improvement Act of 1982* (AIP), as amended, and to be able to receive specific Passenger Facility Charge funding. An airport must keep its ALP current and follow that plan, since those are grant assurance requirements of the AIP and previous airport development programs, including the 1970 Airport Development Aid Program (ADAP) and Federal Aid Airports Program (FAAP)

2) of 1946, as amended. While ALPs are not required for airports other than those developed with assistance under the aforementioned federal programs, the same guidance can be applied to all airports.

3) An ALP creates a blueprint for airport development by depicting proposed facility improvements. The ALP provides a guideline by which the airport sponsor can ensure that development maintains airport design standards and safety requirements and is consistent with airport and community land use plans.

4) The ALP is a public document that serves as a record of aeronautical requirements, both present and future, and as a reference for community deliberations on land use proposals and budget resource planning.

5) The approved ALP enables the airport sponsor and the FAA to plan for facility improvements at the airport. It also allows the FAA to anticipate budgetary and procedural needs. The approved ALP will also allow the FAA to protect the airspace required for facility or approach procedure improvements.

6) The ALP can be a working tool for the airport sponsor, including its development and maintenance staff.

AIRPORT LAYOUT PLAN SET

The ALP set includes several technical drawings which depict various aspects of the current and future layout of the airport. The following is a description of the ALP drawings included with this Master Plan.

AIRPORT DATA SHEET

The Airport Data Sheet provides existing and ultimate conditions for the airport as they relate to the runways, taxiways, navigational aids, and wind data tabulations.

AIRPORT LAYOUT PLAN DRAWING

An official ALP Drawing has been developed for Flagstaff Airport. The ALP Drawing graphically presents the existing and ultimate airport layout. The ALP Drawing includes such elements as the physical airport features, location of airfield facilities (i.e., runways, taxiways, navigational aids), and existing aviation development. Also presented on the ALP Drawing are the runway safety areas, airport property boundary, and revenue support areas.

The computerized plan provides detailed information on existing and future facility layouts on multiple layers that permit the user to focus on any section of the airport at a desired scale. The plan can be used as base information for design and can be easily updated in the future to reflect new development and more detail concerning existing conditions as made available through design surveys. The ALP Drawing is used by the FAA to determine funding eligibility for future capital projects.

TERMINAL AREA DRAWING

The Terminal Area Drawing is a larger scale plan view drawing of existing and planned aprons, buildings, hangars, parking lots, and other landside facilities.

AIRPORT AIRSPACE DRAWING

Title 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace*, was established for use by local authorities to control the height of objects near airports. The Part 77 Airspace Drawing is a graphic depiction of this regulatory criterion. The Airspace Drawing is a tool to aid local authorities in determining if proposed development could present a hazard to aircraft using the airport. It can be a critical tool for the airport sponsor's use in reviewing proposed development in the vicinity of the airport and for establishing locally enforceable height and hazard zoning regulations.

The Airspace Drawing assigns three-dimensional imaginary surfaces associated with the airport. These imaginary surfaces emanate from the runway centerline(s) and are dimensioned according to the visibility minimums associated with the approach to the runway end and size of aircraft to operate on the runway. The Part 77 imaginary surfaces include the primary surface, horizontal surface, approach surface, transitional surface, and conical surface.

Penetrations to the Part 77 surfaces are considered obstructions to the airport airspace. Further analysis by the FAA, through an aeronautical survey, is necessary to determine if any obstructions are hazards to air navigation. It should be noted that the Part 77 drawings are based on ultimate planning recommendations and not necessarily existing conditions.

APPROACH SURFACE PROFILE DRAWINGS

The Approach Surface Profile Drawings present the entirety of the Part 77 approach surface to the end of each runway. It also depicts the runway centerline profile with elevations. This drawing provides profile details that the Airspace Drawings do not.

The Approach Surface Profile Drawings include identified penetrations to the approach surface. Penetrations to the approach surface are considered obstructions. The FAA will determine if any obstructions are also hazards which require mitigation. The FAA utilizes other design criteria such as the threshold siting surface (TSS) and various surfaces defined in FAA Order 8260.3B, *Terminal Instrument Procedures* (TERPS), to determine if an obstruction is a hazard.

If an obstruction is a hazard, the FAA can take many steps to protect air navigation. The mitigation options range from the airport owner removing the hazard to installing obstruction lighting, to the FAA adjusting the instrument approach minimums.

The drawing set includes the following approach surface drawings:

- Approach profile drawings for each runway end
- Inner portion of the approach surface drawings for each runway end

LAND USE DRAWING

The objective of the Land Use Drawing is to coordinate uses of the airport property in a manner compatible with the functional design of the airport facility. Airport land use planning is important for orderly development and efficient use of available space. There are two primary considerations for airport land use planning. These are to secure those areas essential to the safe and efficient operation of the airport and to determine compatible land uses for the balance of the property which would be most advantageous to the airport and community. In essence, this drawing depicts the suggested highest and best potential uses for airport property.

The Land Use Drawing presents generalized proposed uses of property for the future. The on-airport land uses on this drawing become the official FAA acceptance of current and future land uses. The map also depicts the existing and ultimate noise exposure limits.

EXHIBIT "A" AIRPORT PROPERTY MAP

The Airport Property Map provides information on property under airport control and is, therefore, subject to FAA grant assurances. The various recorded deeds that make up the airport property are listed in tabular format. The primary purpose of the drawing is to provide information for analyzing the current and future aeronautical use of land acquired with federal funds.

DEPARTURE SURFACE DRAWING

The Departure Surface Drawing provides detailed analysis of the existing and ultimate departure surface for each corresponding runway end. A composite profile of the extended ground line is depicted. Obstructions are shown where appropriate.

APPROVED ALP

The ALP drawing set has been developed in accordance with accepted FAA standards. The ALP set has been approved by the FAA in a letter dated August 16, 2018.

U.S. Department
of Transportation
Federal Aviation Administration

Western Pacific Region
Office of Airports
Phoenix Airports District Office

3800 N. Central Ave.
Suite 1025 10th Floor
Phoenix, AZ 85012

August 16, 2018

Mr. Barney Helmick A.A.E.
Airport Director
Flagstaff Pulliam Airport
6200 S. Pulliam Dr. #204
Flagstaff, AZ 86005

Dear Mr. Helmick:

The Flagstaff Pulliam Airport, Airport Layout Plan (ALP), prepared by Coffman Associates, and bearing your signature, is approved. A signed copy of the approved ALP is enclosed.

An aeronautical study (no. 2018-AWP-1672-NRA) was conducted on the proposed development. This determination does not constitute FAA approval or disapproval of the physical development involved in the proposal. It is a determination with respect to the safe and efficient use of navigable airspace by aircraft and with respect to the safety of persons and property on the ground.

In making this determination, the FAA has considered matters such as the effects the proposal would have on existing or planned traffic patterns of neighboring airports, the effects it would have on the existing airspace structure and projected programs of the FAA, the effects it would have on the safety of persons and property on the ground, the effects that existing or proposed manmade objects (on file with the FAA), and known natural objects within the affected area would have on the airport proposal.

The FAA has only limited means to prevent the construction of structures near an airport. The airport sponsor has the primary responsibility to protect the airport environs through such means as local zoning ordinances, property acquisition, avigation easements, letters of agreement or other means.

Approval of the plan does not indicate that the United States will participate in the cost of any development proposed. Additionally, the United States will only participate in the cost of projects that meet the standards for which that airport is designed. Associated costs for any projects that exceed the appropriate airport design standard will be the responsibility of the airport sponsor.

This ALP approval is conditioned on acknowledgement that any development on airport property requiring Federal environmental approval must receive such written approval from FAA prior to commencement of the subject development. This ALP

approval is also conditioned on acceptance of the plan under local land use laws. We encourage appropriate agencies to adopt land use and height restrictive zoning based on the plan.

AIP funding requires evidence of eligibility and justification at the time a funding request is ripe for consideration. When construction of any proposed structure or development indicated on the plan is undertaken, such construction requires normal 45-day advance notification to FAA for review in accordance with applicable Federal Aviation Regulations (i.e., Parts 77, 157, 152, etc.). More notice is generally beneficial to ensure that all statutory, regulatory, technical and operational issues can be addressed in a timely manner. Additionally, any future development that will require amendments to instrument flight procedures must be coordinated by the airport district office and the airport manager to ensure those changes are made in a timely manner.

Please attach this letter to the Airport Layout Plan and retain it in the airport. We wish you great success in your plans for the development of the airport. If we can be of further assistance, please do not hesitate to call Mr. Jared Raymond, Airport Planner, at 602-792-1072.

Sincerely,

Mike N. Williams
Manager,
Phoenix Airports District Office

Enclosure: Updated Airport Layout Plan

FLAGSTAFF AIRPORT



ARIZONA



AIRPORT LAYOUT PLAN SET
INDEX OF DRAWINGS

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11. DEPARTURE SURFACE RUNWAY 3-21
12. EXHIBIT "A" AIRPORT PROPERTY MAP

PREPARED FOR

THE CITY OF FLAGSTAFF



SUBMITTED BY:
Coffman Associates
FOR APPROVAL BY:

APPROVED BY: Barry S. McDonald
ON THE DATE OF: 8-9-2018
Airport Director

No.	REVISIONS	DATE	BY	APP'D
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	MASTER PLAN ALP UPDATE	12/2008	CA	JH

THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT OF THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH THE APPROPRIATE PUBLIC LAWS.

FLAGSTAFF AIRPORT

TITLE SHEET

FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018 | SHEET 1 OF 12

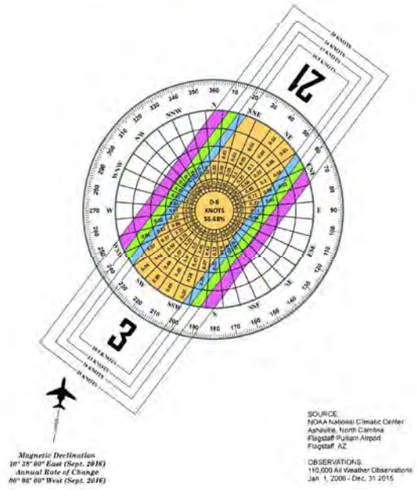
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RUNWAY DATA	RUNWAY 3(L)-21(R)				RUNWAY 3R-21L[3]			
	EXISTING		ULTIMATE		EXISTING		ULTIMATE	
	3	21	3L	21R	3R	21L	3R	21L
RUNWAY DESIGN CODE (RDC)	C-II-2400		C-III-2400		NA		C-III-5000	
APPROACH REFERENCE CODE	D/IV/2400&D/V/2400		SAME		NA		B/III/5000&D/III/5000	
DEPARTURE REFERENCE CODE	D/IV&D/V		SAME		NA		B/III&D/III	
RUNWAY AZIMUTH (TRUE)	41°	221°	SAME	SAME	NA	NA	41°	221°
RUNWAY BEARING (TRUE)	41°10'25.00" E		SAME		NA		41°10' 25.00"E	
APPROACH TYPE	NONPREC	PRECISION	SAME	SAME	NA	NA	NONPREC	NONPREC
PART 77 APPROACH CATEGORY	34:1	50:1	SAME	SAME	NA	NA	34:1	34:1
APPROACH VISIBILITY MINIMUMS	3/4 MILE	1/2 MILE	SAME	SAME	NA	NA	1 MILE	1 MILE
RUNWAY DEPARTURE SURFACE	40:1	40:1	SAME	SAME	NA	NA	40:1	40:1
TYPE OF AERONAUTICAL SURVEY REQUIRED	VERTICALLY GUIDED		SAME		NA		NON-VERTICALLY GUIDED	
THRESHOLD SITING SURFACE	20:1	34:1	SAME	SAME	NA	NA	20:1	20:1
DESIGN AIRCRAFT	BOMBARDIER CRJ-700		BOMBARDIER CRJ-900		NA		CHALLENGER 604	
DESIGN AIRCRAFT UNDERCARRIAGE WIDTH (FEET)	49,25'		56,76'		NA		26,21'	
DESIGN AIRCRAFT WINGSPAN	76,27'		81,53'		NA		64,33'	
DESIGN AIRCRAFT TAIL HEIGHT	24,83'		24,12'		NA		26,71'	
RUNWAY LENGTH	8,800'		SAME		NA		7,000'	
RUNWAY WIDTH	150'		SAME		NA		100'	
PERCENT OF WIND COVERAGE (IFR) 10.5 knots	99,14%		SAME		NA		99,14%	
PERCENT OF WIND COVERAGE (IFR) 13 knots	99,78%		SAME		NA		99,78%	
PERCENT OF WIND COVERAGE (IFR) 16 knots	99,96%		SAME		NA		99,96%	
RUNWAY END ELEVATION [1]	7,014,7'	6,996,4'	SAME	SAME	NA	NA	7,016,0'	6,993,0'
TOUCH DOWN ZONE ELEVATION [1]	7,014,7'	7,003,8'	SAME	SAME	NA	NA	7,016.0'	7,020.0'
DISPLACED THRESHOLD [1]	NONE	1,800,0'	SAME	SAME	NA	NA	NONE	NONE
EFFECTIVE RUNWAY GRADIENT	0,33%		SAME		NA		0,30%	
MAXIMUM GRADIENT	2.0%		SAME		NA		2.0%	
RUNWAY SURFACE TYPE	ASPHALT		SAME		NA		ASPHALT	
RUNWAY PAVEMENT STRENGTH (in thousand lbs.)[2]	30(S), 95(D),140(DT)		SAME		NA		30(S), 95(D),140(DT)	
PCN NUMBER	37/F/D/W/T		SAME		NA		NA	
RUNWAY SURFACE TREATMENT	PFC		SAME		NA		NONE	
RUNWAY LIGHTING	HIRL		SAME		NA		MIRL	
RUNWAY MARKING	NONPREC	PRECISION	SAME	SAME	NA	NA	NONPREC	NONPREC
VISUAL AND NAVIGATIONAL AIDS	ILS or LOC/DME - RWY 21 RNAV (GPS) - RWY 3-21 VOR/DME- RWY 21 ASOS ATCT LIGHTED WINDCONES PAPI - 4 - RWY 3-21 MALSR – RWY 21 --		SAME SAME SAME SAME SAME SAME SAME SAME REILs - RWY 3L		NA NA NA NA NA NA NA NA NA		RNAV (GPS) - RWY 3R-21L PAPI - 4 - RWY 3R-21L REILs - RWY 3R - 21L ASOS ATCT LIGHTED WINDCONES -- -- --	
RUNWAY SAFETY AREA BEYOND STOP END	1,000'	1,000'	SAME	SAME	NA	NA	1,000'	1,000'
RUNWAY SAFETY AREA WIDTH	500'		SAME		NA		500'	
OBJECT FREE AREA BEYOND STOP END	1,000'	1,000'	SAME	SAME	NA	NA	1,000'	1,000'
OBJECT FREE AREA WIDTH	800'		SAME		NA		800'	
OBSTACLE FREE ZONE BEYOND STOP END	200'	200'	SAME	SAME	NA	NA	200'	200'
OBSTACLE FREE ZONE WIDTH	400'		SAME		NA		400'	
APPROACH RUNWAY PROTECTION ZONE	1,700'x1,000' x1,510'	2,500'x1,000' x1,750'	SAME	SAME	NA	NA	1,700'x500' x1,010'	1,700'x500' x1,010'
DEPARTURE RUNWAY PROTECTION ZONE	1,700'x500' x1,010'	1,700'x500' x1,010'	SAME	SAME	NA	NA	1,700'x500' x1,010'	1,700'x500' x1,010'
TAXIWAY DESIGN GROUP (TDG)	TDG-2		TDG-3		NA		TDG-2	
TAXIWAY WIDTH	50' - 107'		SAME		NA		35' - 50'	
TAXIWAY OBJECT FREE AREA WIDTH	131'		186'		NA		131'	
TAXIWAY SAFETY AREA WIDTH	79'		118'		NA		79'	
TAXIWAY WING TIP CLEARANCE	26'		34'		NA		26'	
TAXIWAY CL TO FIXED OR MOVEABLE OBJECT	65,5'		93'		NA		65,5'	
TAXIWAY LIGHTING	MITL		SAME		NA		MITL	
TAXIWAY SURFACE MATERIAL	ASPHALT		SAME		NA		ASPHALT	
PARALLEL TAXIWAY TO RUNWAY SEPARATION	400'		SAME		NA		300'	
HOLD MARKINGS TO RUNWAY CENTERLINE DISTANCE	250'		321'		NA		250'	
RUNWAY CENTERLINE TO AIRCRAFT PARKING	500'		SAME		NA		400'	
THRESHOLD SITING SURFACE OBJECT PENETRATIONS	NONE		SAME		NA		--	

NOTES:
1. RUNWAY END ELEVATIONS, COORDINATES, DISTANCES, AND BEARING NOTED IN THIS ALP ARE FROM THE AVN DATASHEET.
2. SW-SINGLE WHEEL, DW-DUAL WHEEL, AND DT-DUAL TANDEM WHEEL.
3. ULTIMATE RUNWAY 3R-21L IS A CARRY OVER FROM THE PREVIOUSLY APPROVED ALP AND IS DEPICTED FOR PLANNING PURPOSES ONLY.

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	99.14%	99.85%	99.99%	100.00%

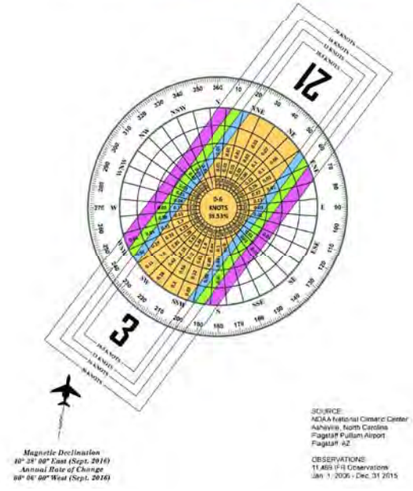


SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Flagstaff Pulliam Airport
Flagstaff, AZ

OBSERVATIONS:
110,000 All Weather Observations
Jan 1, 2006 - Dec. 31 2015

IFR WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	99.14%	99.78%	99.96%	100.00%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Flagstaff Pulliam Airport
Flagstaff, AZ

OBSERVATIONS:
11,469 IFR Observations
Jan 1, 2006 - Dec. 31 2015

AIRPORT DATA

FLAGSTAFF AIRPORT			
CITY: FLAGSTAFF, ARIZONA		COUNTY: COCONINO COUNTY, ARIZONA	
RANGE: 7E TOWNSHIP: 20N		CIVIL TOWNSHIP: N/A	
		EXISTING	ULTIMATE
NPIAS SERVICE LEVEL		NON - HUB PRIMARY COMMERCIAL SERVICE	SAME
STATE SERVICE ROLE		COMMERCIAL SERVICE	SAME
CRITICAL DESIGN AIRCRAFT		BOMBARDIER CRJ-700	BOMBARDIER CRJ-900
AIRPORT REFERENCE CODE (ARC)		C-II	C-III
AIRPORT ELEVATION (ABOVE MEAN SEA LEVEL)		7,014,0'	SAME
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH		81,6°F (July)	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES (NAD 83)	Latitude	35°08'25.1000"N	35°08'20.1400"N
	Longitude	111°40'09.3000"W	111°40'09.619"W
AIRPORT INSTRUMENT NAVIGATIONAL AIDS		GPS VOR/DME ILS OR LOC/DME	SAME SAME SAME
MISCELLANEOUS FACILITIES		PAPI - 4s (RWY 3-21) LIGHTED WIND CONES ASOS ATCT MALSR	SAME SAME SAME SAME SAME REILs - RWY 3L

RUNWAY END COORDINATES (NAD 83)

		EXISTING	ULTIMATE
RUNWAY 3(L)	Latitude	35°07'52.3859"N	SAME
	Longitude	111°40'44.1283"W	SAME
RUNWAY 21(R)	Latitude	35°08'57.8836"N	SAME
	Longitude	111°39'34.4013"W	SAME
RUNWAY 21(R) DISPLACEMENT	Latitude	35°08'44.4883"N	SAME
	Longitude	111°39'48.6669"W	SAME
RUNWAY 3R	Latitude	--	35°07'47.809"N
	Longitude	--	111°40'37.797"W
RUNWAY 21L	Latitude	--	35°08'39.921"N
	Longitude	--	111°39'42.310"W

No.	REVISIONS	DATE	BY	APP'D
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FLAGSTAFF AIRPORT

AIRPORT DATA SHEET

FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018

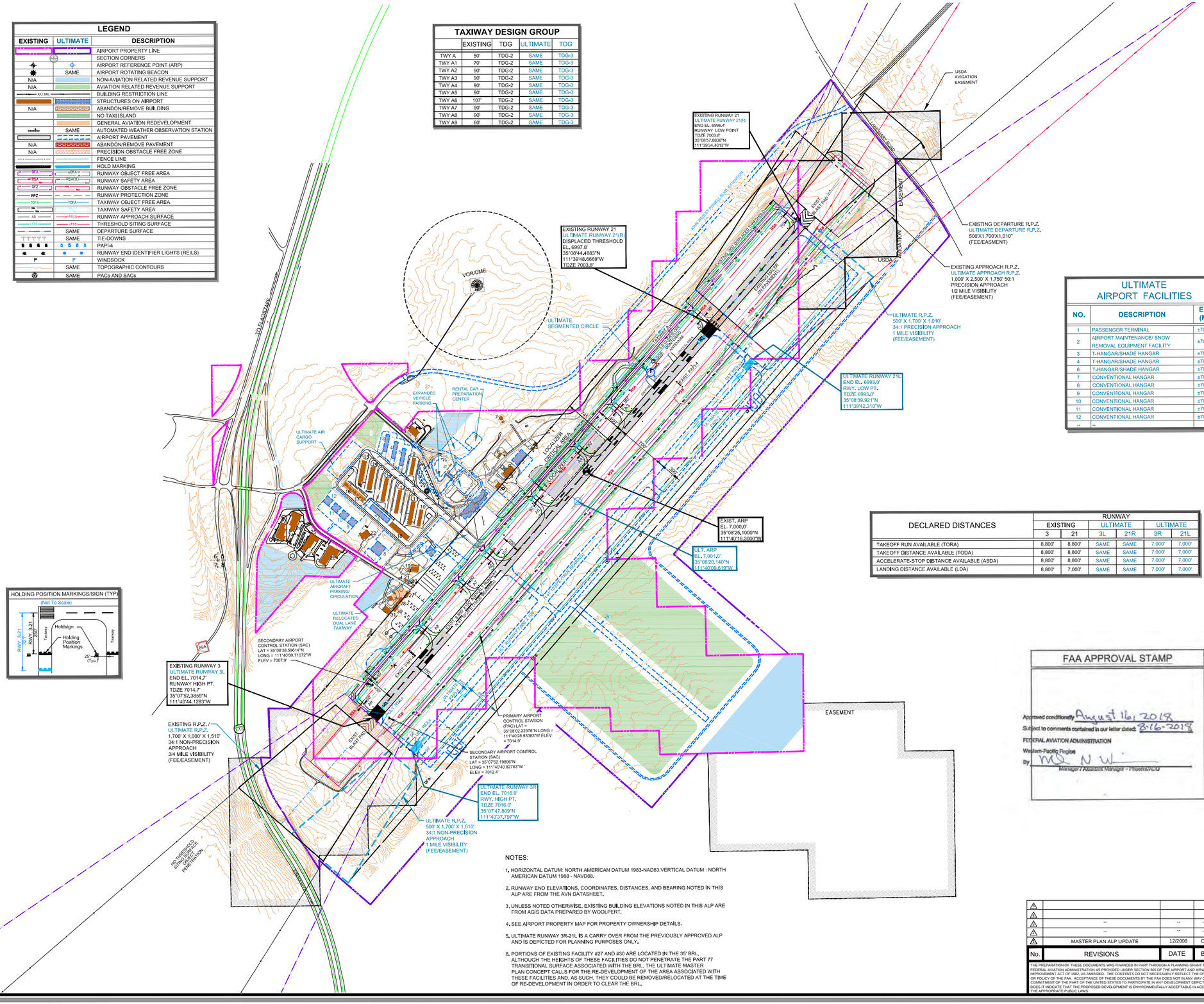
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LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
	SAME	AIRPORT ROTATING BEACON
N/A		NON-AVIATION RELATED REVENUE SUPPORT
N/A		AVIATION RELATED REVENUE SUPPORT
XXU BRL		BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
N/A		ABANDON/REMOVE BUILDING
		NO TAXI ISLAND
		GENERAL AVIATION REDEVELOPMENT
	SAME	AUTOMATED WEATHER OBSERVATION STATION
		AIRPORT PAVEMENT
N/A		ABANDON/REMOVE PAVEMENT
N/A		PRECISION OBSTACLE FREE ZONE
		FENCE LINE
		HOLD MARKING
OFA	OFA	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ		RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA	TAXIWAY OBJECT FREE AREA
		TAXIWAY SAFETY AREA
A5	A5(U)	RUNWAY APPROACH SURFACE
TTZ	TTZ	THRESHOLD SITING SURFACE
	SAME	DEPARTURE SURFACE
	SAME	TIE-DOWNS
		PAPI-4
		RUNWAY END IDENTIFIER LIGHTS (REILS)
		WINDSOCK
	SAME	TOPOGRAPHIC CONTOURS
	SAME	PACs AND SACs

TAXIWAY DESIGN GROUP

	EXISTING	TDG	ULTIMATE	TDG
TWY A	50'	TDG-2	SAME	TDG-3
TWY A1	70'	TDG-2	SAME	TDG-3
TWY A2	90'	TDG-2	SAME	TDG-3
TWY A3	90'	TDG-2	SAME	TDG-3
TWY A4	90'	TDG-2	SAME	TDG-3
TWY A5	90'	TDG-2	SAME	TDG-3
TWY A6	107'	TDG-2	SAME	TDG-3
TWY A7	90'	TDG-2	SAME	TDG-3
TWY A8	90'	TDG-2	SAME	TDG-3
TWY A9	60'	TDG-2	SAME	TDG-3



HOLDING POSITION MARKINGS/SIGN (TYP.)

(Not To Scale)

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	PASSENGER TERMINAL	±7044.00'
2	AIRPORT MAINTENANCE/ SNOW REMOVAL EQUIPMENT FACILITY	±7029.00'
3	T-HANGAR/SHADE HANGAR	±7010.00'
4	T-HANGAR/SHADE HANGAR	±7011.00'
6	T-HANGAR/SHADE HANGAR	±7008.00'
7	CONVENTIONAL HANGAR	±7038.00'
8	CONVENTIONAL HANGAR	±7038.00'
9	CONVENTIONAL HANGAR	±7038.00'
10	CONVENTIONAL HANGAR	±7038.00'
11	CONVENTIONAL HANGAR	±7038.00'
12	CONVENTIONAL HANGAR	±7038.00'
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EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	PASSENGER TERMINAL	±7044.77'
2	ARIZONA DEPARTMENT OF PUBLIC SAFETY	±7029.21'
3	AIRPORT OPERATIONS CENTER & ARFF	±7043.17'
4	EMERGENCY GENERATOR	±7014.88'
5	AIRPORT TRAFFIC CONTROL TOWER (ACTC)	±7062.39'
6	RENTAL CAR SERVICE STATION	±7008.86'
7	WATER TANK & BOOSTER STATION	UNKNOWN
8	OFFICE BUILDING	±7025.60'
9	SHADE HANGAR	±7011.15'
10	SHADE HANGAR	±7019.37'
11	T-HANGAR	±7023.09'
12	SHADE HANGAR	±7017.54'
13	SHADE HANGAR	±7018.24'
14	T-HANGAR	±7024.73'
15	T-HANGAR	±7024.23'
16	EXECUTIVE BOX HANGAR	±7035.02'
17	EXECUTIVE BOX HANGAR	±7035.02'
18	EXECUTIVE BOX HANGAR	±7035.77'
19	WISEMAN AVIATION (FBO)	±7033.41'
20	ROTATING BEACON	±7073.13'
21	FUEL STORAGE & SELF SERVICE FUEL FACILITY	±7015.90' -±7019.56'
22	PEABODY COAL HANGAR	±7038.42'
23	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
24	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
25	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
26	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
27	BUILDING	±7022.78'
28	AIRPORT MAINTENANCE	±7023.98'
29	GUARDIAN AIR AMBULANCE	±7022.92'
30	GUARDIAN AIR AMBULANCE	±7029.94'
31	GUARDIAN AIR AMBULANCE	±7033.41'

DECLARED DISTANCES

DECLARED DISTANCES	RUNWAY					
	EXISTING		ULTIMATE		ULTIMATE	
	3	21	3L	21R	3R	21L
TAKEOFF RUN AVAILABLE (TORA)	8,800'	8,800'	SAME	SAME	7,000'	7,000'
TAKEOFF DISTANCE AVAILABLE (TODA)	8,800'	8,800'	SAME	SAME	7,000'	7,000'
ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)	8,800'	8,800'	SAME	SAME	7,000'	7,000'
LANDING DISTANCE AVAILABLE (LDA)	8,800'	7,000'	SAME	SAME	7,000'	7,000'

NOTES:

1. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983-NAD83:VERTICAL DATUM : NORTH AMERICAN DATUM 1988 - NAVD88.
2. RUNWAY END ELEVATIONS, COORDINATES, DISTANCES, AND BEARING NOTED IN THIS ALP ARE FROM THE AVN DATASHEET.
3. UNLESS NOTED OTHERWISE, EXISTING BUILDING ELEVATIONS NOTED IN THIS ALP ARE FROM AGIS DATA PREPARED BY WOOLPERT.
4. SEE AIRPORT PROPERTY MAP FOR PROPERTY OWNERSHIP DETAILS.
5. ULTIMATE RUNWAY 3R-21L IS A CARRY OVER FROM THE PREVIOUSLY APPROVED ALP AND IS DEPICTED FOR PLANNING PURPOSES ONLY.
6. PORTIONS OF EXISTING FACILITY #27 AND #30 ARE LOCATED IN THE 35' BRL, ALTHOUGH THE HEIGHTS OF THESE FACILITIES DO NOT PENETRATE THE PART 77 TRANSITIONAL SURFACE ASSOCIATED WITH THE BRL. THE ULTIMATE MASTER PLAN CONCEPT CALLS FOR THE RE-DEVELOPMENT OF THE AREA ASSOCIATED WITH THESE FACILITIES AND, AS SUCH, THEY COULD BE REMOVED/RELOCATED AT THE TIME OF RE-DEVELOPMENT IN ORDER TO CLEAR THE BRL.

FAA APPROVAL STAMP

Approved conditionally August 16, 2018
Subject to comments contained in our letter dated: 8-16-2018
FEDERAL AVIATION ADMINISTRATION
Western-Pacific Region
By _____
Manager / Assistant Manager – Phoenix ADO

SUBMITTED BY:
Coffman Associates
FOR APPROVAL BY:
APPROVED BY: _____ ON THE DATE OF: 8-9-2018
Airport Director

No.	REVISIONS	DATE	BY	APP'D
1				
2				
3				
4	--	--	--	--
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AIRPORT LAYOUT PLAN DRAWING

FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018 | SHEET 3 OF 12

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LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
	SAME	AIRPORT ROTATING BEACON
N/A		NON-AVIATION RELATED REVENUE SUPPORT
N/A		AVIATION RELATED REVENUE SUPPORT
XXU BRL		BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
N/A		ABANDON/REMOVE BUILDING
		NO TAXI ISLAND
		GENERAL AVIATION REDEVELOPMENT
	SAME	AUTOMATED WEATHER OBSERVATION STATION
		AIRPORT PAVEMENT
N/A		ABANDON/REMOVE PAVEMENT
N/A		PRECISION OBSTACLE FREE ZONE
		FENCE LINE
		HOLD MARKING
OFA	uOFA	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	uOFZ	RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA	TAXIWAY OBJECT FREE AREA
TSA	TSA	TAXIWAY SAFETY AREA
AS	AS(U)	RUNWAY APPROACH SURFACE
TSS	TSS	THRESHOLD SITING SURFACE
	SAME	DEPARTURE SURFACE
	SAME	TIE-DOWNS
		PAPI-4
		RUNWAY END IDENTIFIER LIGHTS (REILS)
		WINDSOCK
	SAME	TOPOGRAPHIC CONTOURS
	SAME	PACs AND SACs

EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	PASSENGER TERMINAL	±7044.77'
2	ARIZONA DEPARTMENT OF PUBLIC SAFETY	±7029.21'
3	AIRPORT OPERATIONS CENTER & ARFF	±7043.17'
4	EMERGENCY GENERATOR	±7014.88'
5	AIRPORT TRAFFIC CONTROL TOWER (ACTC)	±7062.39'
6	RENTAL CAR SERVICE STATION	±7008.86'
7	WATER TANK & BOOSTER STATION	UNKNOWN
8	OFFICE BUILDING	±7025.60'
9	SHADE HANGAR	±7011.15'
10	SHADE HANGAR	±7019.37'
11	T-HANGAR	±7023.09'
12	SHADE HANGAR	±7017.54'
13	SHADE HANGAR	±7018.24'
14	T-HANGAR	±7024.73'
15	T-HANGAR	±7024.23'
16	EXECUTIVE BOX HANGAR	±7035.02'
17	EXECUTIVE BOX HANGAR	±7035.02'
18	EXECUTIVE BOX HANGAR	±7035.77'
19	WISEMAN AVIATION (FBO)	±7033.41'
20	ROTATING BEACON	±7073.13'
21	FUEL STORAGE & SELF SERVICE FUEL FACILITY	±7015.90' -±7019.56'
22	PEABODY COAL HANGAR	±7038.42'
23	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
24	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
25	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
26	FLAGSTAFF AIRPORT BUSINESS CENTER	UNKNOWN
27	BUILDING	±7022.78'
28	AIRPORT MAINTENANCE	±7023.98'
29	GUARDIAN AIR AMBULANCE	±7022.92'
30	GUARDIAN AIR AMBULANCE	±7029.94'
31	GUARDIAN AIR AMBULANCE	±7033.41'

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	PASSENGER TERMINAL	±7044.00'
2	AIRPORT MAINTENANCE/ SNOW REMOVAL EQUIPMENT FACILITY	±7029.00'
3	T-HANGAR/SHADE HANGAR	±7010.00'
4	T-HANGAR/SHADE HANGAR	±7011.00'
6	T-HANGAR/SHADE HANGAR	±7008.00'
7	CONVENTIONAL HANGAR	±7038.00'
8	CONVENTIONAL HANGAR	±7038.00'
9	CONVENTIONAL HANGAR	±7038.00'
10	CONVENTIONAL HANGAR	±7038.00'
11	CONVENTIONAL HANGAR	±7038.00'
12	CONVENTIONAL HANGAR	±7038.00'
--	--	--

NOTES:

1. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983-NAD83:VERTICAL DATUM : NORTH AMERICAN DATUM 1988 - NAVD88.
2. RUNWAY END ELEVATIONS, COORDINATES, DISTANCES, AND BEARING NOTED IN THIS ALP ARE FROM THE AVN DATASHEET.
3. UNLESS NOTED OTHERWISE, EXISTING BUILDING ELEVATIONS NOTED IN THIS ALP ARE FROM AGIS DATA PREPARED BY WOOLPERT.
4. SEE AIRPORT PROPERTY MAP FOR PROPERTY OWNERSHIP DETAILS.
5. ULTIMATE RUNWAY 3R-21L IS A CARRY OVER FROM THE PREVIOUSLY APPROVED ALP AND IS DEPICTED FOR PLANNING PURPOSES ONLY.
6. PORTIONS OF EXISTING FACILITY #27 AND #30 ARE LOCATED IN THE 35' BRL, ALTHOUGH THE HEIGHTS OF THESE FACILITIES DO NOT PENETRATE THE PART 77 TRANSITIONAL SURFACE ASSOCIATED WITH THE BRL. THE ULTIMATE MASTER PLAN CONCEPT CALLS FOR THE RE-DEVELOPMENT OF THE AREA ASSOCIATED WITH THESE FACILITIES AND, AS SUCH, THEY COULD BE REMOVED/RELOCATED AT THE TIME OF RE-DEVELOPMENT IN ORDER TO CLEAR THE BRL.

NORTH
MAGNETIC NORTH

Magnetic Declination
10° 38' East (2016)
Annual Rate of Change
00° 06' West (2016)

0 200 400
SCALE IN FEET

TO PHOENIX
TO FLAGSTAFF
JOHN WESLEY POWELL BLVD
JOHN WESLEY POWELL BLVD. EXTENTION
SOUTH PLUM DRIVE
KITTY HAWK
EXPANDED VEHICLE PARKING
RENTAL CAR PREPARATION CENTER
ULTIMATE AIR CARGO SUPPORT
WEST LIBERATOR ROAD
LOCALIZER CRITICAL AREA
LOCALIZER
ULTIMATE AIRCRAFT PARKING/ CIRCULATION
SQ. GRUMMAN LANE
SHAMRELL BLVD
ULTIMATE RELOCATED DUAL LANE TAXIWAY
EXIST. 8,892' X 150' ASPHALT RUNWAY 3L-21R N 41°10'25"E (TRUE BEARING)
ULTIMATE RUNWAY 3R-21L N 41°10'25"E (TRUE BEARING)
EXIST. ARP
EL. 7,000.0'
35°08'25.1000"N
111°40'19.3000"W
ULT. ARP
EL. 7,001.0'
35°08'20.140"N
111°40'09.619"W
89A
I-17

No.	REVISIONS	DATE	BY	APP'D
	--	--	--	--
	--	--	--	--
	MASTER PLAN ALP UPDATE	12/2008	CA	JH

THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT OF THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH THE APPROPRIATE PUBLIC LAWS.

FLAGSTAFF AIRPORT

TERMINAL AREA PLAN DRAWING

FLAGSTAFF, ARIZONA

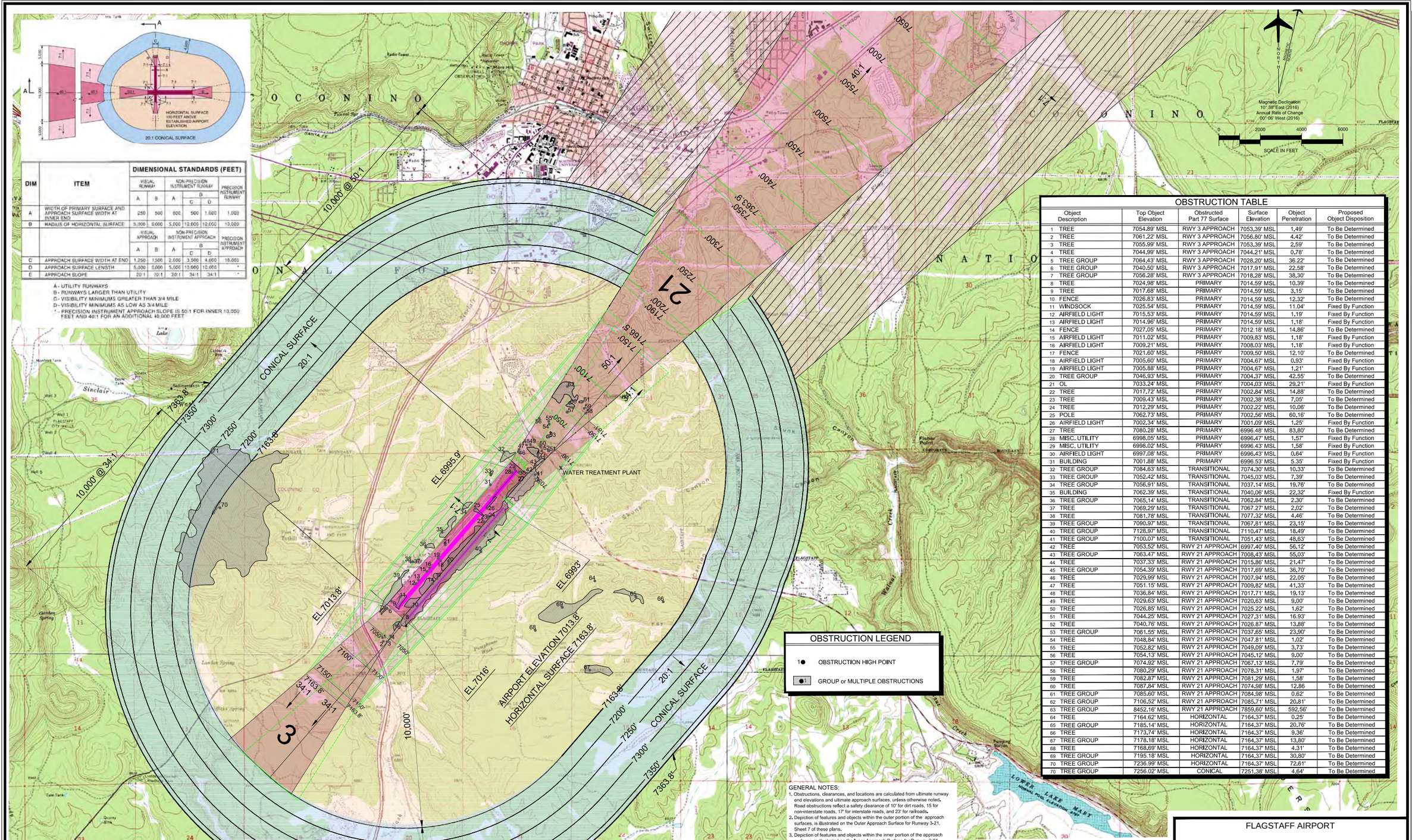
PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018 | SHEET 4 OF 12

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DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
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		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
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
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1	TREE	7054.89' MSL	RWY 3 APPROACH	7053,39' MSL	1,49'	To Be Determined
2	TREE	7061.22' MSL	RWY 3 APPROACH	7056.80' MSL	4.42'	To Be Determined
3	TREE	7055.99' MSL	RWY 3 APPROACH	7053,39' MSL	2,59'	To Be Determined
4	TREE	7044,99' MSL	RWY 3 APPROACH	7044,21' MSL	0,78'	To Be Determined
5	TREE GROUP	7064,43' MSL	RWY 3 APPROACH	7028,20' MSL	36.22'	To Be Determined
6	TREE GROUP	7040.50' MSL	RWY 3 APPROACH	7017,91' MSL	22,58'	To Be Determined
7	TREE GROUP	7056.28' MSL	RWY 3 APPROACH	7018,28' MSL	38,30'	To Be Determined
8	TREE	7024,98' MSL	PRIMARY	7014,59' MSL	10,39'	To Be Determined
9	TREE	7017,68' MSL	PRIMARY	7014,59' MSL	3,15'	To Be Determined
10	FENCE	7026,83' MSL	PRIMARY	7014,59' MSL	12,32'	To Be Determined
11	WINDSOCK	7025,54' MSL	PRIMARY	7014,59' MSL	11,04'	Fixed By Function
12	AIRFIELD LIGHT	7015,53' MSL	PRIMARY	7014,59' MSL	1,19'	Fixed By Function
13	AIRFIELD LIGHT	7014,96' MSL	PRIMARY	7014,59' MSL	1,18'	Fixed By Function
14	FENCE	7027,05' MSL	PRIMARY	7012.18' MSL	14,86'	To Be Determined
15	AIRFIELD LIGHT	7011,02' MSL	PRIMARY	7009,83' MSL	1,18'	Fixed By Function
16	AIRFIELD LIGHT	7009,21' MSL	PRIMARY	7008,03' MSL	1,18'	Fixed By Function
17	FENCE	7021,60' MSL	PRIMARY	7009,50' MSL	12,10'	To Be Determined
18	AIRFIELD LIGHT	7005,60' MSL	PRIMARY	7004,67' MSL	0,93'	Fixed By Function
19	AIRFIELD LIGHT	7005,88' MSL	PRIMARY	7004,67' MSL	1,21'	Fixed By Function
20	TREE GROUP	7046,93' MSL	PRIMARY	7004,37' MSL	42,55'	To Be Determined
21	OL	7033,24' MSL	PRIMARY	7004,03' MSL	29,21'	Fixed By Function
22	TREE	7017,72' MSL	PRIMARY	7002,84' MSL	14,88'	To Be Determined
23	TREE	7009,43' MSL	PRIMARY	7002,38' MSL	7,05'	To Be Determined
24	TREE	7012,29' MSL	PRIMARY	7002,22' MSL	10,06'	To Be Determined
25	POLE	7062,73' MSL	PRIMARY	7002,56' MSL	60,16'	To Be Determined
26	AIRFIELD LIGHT	7002,34' MSL	PRIMARY	7001,09' MSL	1,25'	Fixed By Function
27	TREE	7080,28' MSL	PRIMARY	6996.48' MSL	83,80'	To Be Determined
28	MISC. UTILITY	6998,05' MSL	PRIMARY	6996,47' MSL	1,57'	Fixed By Function
29	MISC. UTILITY	6998,02' MSL	PRIMARY	6996,43' MSL	1,58'	Fixed By Function
30	AIRFIELD LIGHT	6997,08' MSL	PRIMARY	6996,43' MSL	0,64'	Fixed By Function
31	BUILDING	7001,88' MSL	PRIMARY	6996.53' MSL	5.35'	Fixed By Function
32	TREE GROUP	7084,63' MSL	TRANSITIONAL	7074,30' MSL	10,33'	To Be Determined
33	TREE GROUP	7052,42' MSL	TRANSITIONAL	7045,03' MSL	7,39'	To Be Determined
34	TREE GROUP	7056,91' MSL	TRANSITIONAL	7037,14' MSL	19,76'	To Be Determined
35	BUILDING	7062,39' MSL	TRANSITIONAL	7040,06' MSL	22,32'	Fixed By Function
36	TREE GROUP	7065,14' MSL	TRANSITIONAL	7062,84' MSL	2,30'	To Be Determined
37	TREE	7069,29' MSL	TRANSITIONAL	7067,27' MSL	2,02'	To Be Determined
38	TREE	7081,78' MSL	TRANSITIONAL	7077,32' MSL	4,46'	To Be Determined
39	TREE GROUP	7090,97' MSL	TRANSITIONAL	7067,81' MSL	23,15'	To Be Determined
40	TREE GROUP	7128,97' MSL	TRANSITIONAL	7110,47' MSL	18,49'	To Be Determined
41	TREE GROUP	7100,07' MSL	TRANSITIONAL	7051,43' MSL	48,63'	To Be Determined
42	TREE	7053,52' MSL	RWY 21 APPROACH	6997,40' MSL	56,12'	To Be Determined
43	TREE GROUP	7063,47' MSL	RWY 21 APPROACH	7008,43' MSL	55,03'	To Be Determined
44	TREE	7037,33' MSL	RWY 21 APPROACH	7015,86' MSL	21,47'	To Be Determined
45	TREE GROUP	7054,39' MSL	RWY 21 APPROACH	7017,69' MSL	36,70'	To Be Determined
46	TREE	7029,99' MSL	RWY 21 APPROACH	7007,94' MSL	22,05'	To Be Determined
47	TREE	7051.15' MSL	RWY 21 APPROACH	7009,82' MSL	41,33'	To Be Determined
48	TREE	7036,84' MSL	RWY 21 APPROACH	7017,71' MSL	19,13'	To Be Determined
49	TREE	7029,63' MSL	RWY 21 APPROACH	7020,63' MSL	9,00'	To Be Determined
50	TREE	7026,85' MSL	RWY 21 APPROACH	7025.22' MSL	1,62'	To Be Determined
51	TREE	7044,25' MSL	RWY 21 APPROACH	7027,31' MSL	16,93'	To Be Determined
52	TREE	7040,76' MSL	RWY 21 APPROACH	7026,87' MSL	13,88'	To Be Determined
53	TREE GROUP	7061,55' MSL	RWY 21 APPROACH	7037,65' MSL	23,90'	To Be Determined
54	TREE	7048,84' MSL	RWY 21 APPROACH	7047,81' MSL	1,02'	To Be Determined
55	TREE	7052,82' MSL	RWY 21 APPROACH	7049,09' MSL	3,73'	To Be Determined
56	TREE	7054,13' MSL	RWY 21 APPROACH	7045,12' MSL	9,00'	To Be Determined
57	TREE GROUP	7074,92' MSL	RWY 21 APPROACH	7067,13' MSL	7,79'	To Be Determined
58	TREE	7080,29' MSL	RWY 21 APPROACH	7078,31' MSL	1,97'	To Be Determined
59	TREE	7082,87' MSL	RWY 21 APPROACH	7081,29' MSL	1,58'	To Be Determined
60	TREE	7087,84' MSL	RWY 21 APPROACH	7074,98' MSL	12,86	To Be Determined
61	TREE GROUP	7085,60' MSL	RWY 21 APPROACH	7084,98' MSL	0,62'	To Be Determined
62	TREE GROUP	7106,52' MSL	RWY 21 APPROACH	7085,71' MSL	20,81'	To Be Determined
63	TREE GROUP	8452,16' MSL	RWY 21 APPROACH	7859,60' MSL	592,56'	To Be Determined
64	TREE	7164,62' MSL	HORIZONTAL	7164,37' MSL	0,25'	To Be Determined
65	TREE GROUP	7185,14' MSL	HORIZONTAL	7164,37' MSL	20,76'	To Be Determined
66	TREE	7173,74' MSL	HORIZONTAL	7164,37' MSL	9,36'	To Be Determined
67	TREE GROUP	7178,18' MSL	HORIZONTAL	7164,37' MSL	13,80'	To Be Determined
68	TREE	7168,69' MSL	HORIZONTAL	7164,37' MSL	4,31'	To Be Determined
69	TREE GROUP	7195.18' MSL	HORIZONTAL	7164,37' MSL	30,80'	To Be Determined
70	TREE GROUP	7236.99' MSL	HORIZONTAL	7164,37' MSL	72,61'	To Be Determined
70	TREE GROUP	7256.02' MSL	CONICAL	7251,38' MSL	4,64'	To Be Determined

OBSTRUCTION LEGEND

1● OBSTRUCTION HIGH POINT

(6) GROUP or MULTIPLE OBSTRUCTIONS

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads, 15 for non-interstate roads, 17' for interstate roads, and 23' for railroads.
2. Depiction of features and objects within the outer portion of the approach surfaces, is illustrated on the Outer Approach Surface for Runway 3-21, Sheet 7 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the Inner Approach Surface for Runway 3-21, Sheet 8 of these plans.
4. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated PART 77 Airspace Plan.
5. Base map USGS Quadrangle maps Sunset Crater, Humphreys Peak, Flagstaff East, Flagstaff West, Bellemont, Lower Lake Mary, Mountainaire, Dutton Hill.
6. Surveys used for obstruction data are a combination of Woolpert 18B survey dated 2016.
7. Obstruction Data for tree groups represent the tallest tree in the group.
8. Ultimate Runway 3R-21L is a carry over from the Previously Approved ALP and is depicted for planning purposes only.

No.	REVISIONS	DATE	BY	APP'D
1				
2				
3	--	--	--	--
4	--	--	--	--
5	MASTER PLAN ALP UPDATE	12/2008	CA	JH

THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SEC 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT OF THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH THE APPROPRIATE PUBLIC LAWS.

FLAGSTAFF AIRPORT

AIRPORT AIRSPACE DRAWING

FLAGSTAFF, ARIZONA

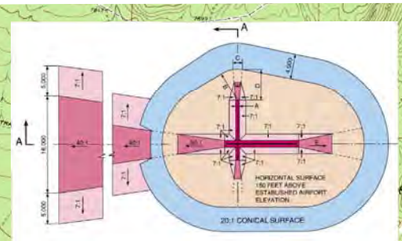
PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018 | SHEET 5 OF 12

Coffman Associates
Airport Consultants
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OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1	TREE	7054.89' MSL	RWY 3 APPROACH	7053.39' MSL	1.49'	To Be Determined
2	TREE	7061.22' MSL	RWY 3 APPROACH	7056.80' MSL	4.42'	To Be Determined
3	TREE	7055.99' MSL	RWY 3 APPROACH	7053.39' MSL	2.59'	To Be Determined
4	TREE	7044.99' MSL	RWY 3 APPROACH	7044.21' MSL	0.78'	To Be Determined
5	TREE GROUP	7064.43' MSL	RWY 3 APPROACH	7028.20' MSL	36.22'	To Be Determined
6	TREE GROUP	7040.50' MSL	RWY 3 APPROACH	7017.91' MSL	22.58'	To Be Determined
7	TREE GROUP	7056.28' MSL	RWY 3 APPROACH	7018.28' MSL	38.30'	To Be Determined
8	TREE	7024.98' MSL	PRIMARY	7014.59' MSL	10.39'	To Be Determined
9	TREE	7017.68' MSL	PRIMARY	7014.59' MSL	3.15'	To Be Determined
10	FENCE	7026.83' MSL	PRIMARY	7014.59' MSL	12.32'	To Be Determined
11	WINDSOCK	7025.54' MSL	PRIMARY	7014.59' MSL	11.04'	Fixed By Function
12	AIRFIELD LIGHT	7015.53' MSL	PRIMARY	7014.59' MSL	1.19'	Fixed By Function
13	AIRFIELD LIGHT	7014.96' MSL	PRIMARY	7014.59' MSL	1.18'	Fixed By Function
14	FENCE	7027.05' MSL	PRIMARY	7012.18' MSL	14.86'	To Be Determined
15	AIRFIELD LIGHT	7011.02' MSL	PRIMARY	7009.83' MSL	1.18'	Fixed By Function
16	AIRFIELD LIGHT	7009.21' MSL	PRIMARY	7008.03' MSL	1.18'	Fixed By Function
17	FENCE	7021.60' MSL	PRIMARY	7009.50' MSL	12.10'	To Be Determined
18	AIRFIELD LIGHT	7005.60' MSL	PRIMARY	7004.67' MSL	0.93'	Fixed By Function
19	AIRFIELD LIGHT	7005.88' MSL	PRIMARY	7004.67' MSL	1.21'	Fixed By Function
20	TREE GROUP	7046.93' MSL	PRIMARY	7004.37' MSL	42.55'	To Be Determined
21	OL	7033.24' MSL	PRIMARY	7004.03' MSL	29.21'	Fixed By Function
22	TREE	7017.72' MSL	PRIMARY	7002.84' MSL	14.88'	To Be Determined
23	TREE	7009.43' MSL	PRIMARY	7002.38' MSL	7.05'	To Be Determined
24	TREE	7012.29' MSL	PRIMARY	7002.22' MSL	10.06'	To Be Determined
25	POLE	7062.73' MSL	PRIMARY	7002.56' MSL	60.16'	To Be Determined
26	AIRFIELD LIGHT	7002.34' MSL	PRIMARY	7001.09' MSL	1.25'	Fixed By Function
27	TREE	7080.28' MSL	PRIMARY	6996.48' MSL	83.80'	To Be Determined
28	MISC. UTILITY	6998.05' MSL	PRIMARY	6996.47' MSL	1.57'	Fixed By Function
29	MISC. UTILITY	6998.02' MSL	PRIMARY	6996.43' MSL	1.58'	Fixed By Function
30	AIRFIELD LIGHT	6997.08' MSL	PRIMARY	6996.43' MSL	0.64'	Fixed By Function
31	BUILDING	7001.88' MSL	PRIMARY	6996.53' MSL	5.35'	Fixed By Function
32	TREE GROUP	7084.63' MSL	TRANSITIONAL	7074.30' MSL	10.33'	To Be Determined
33	TREE GROUP	7052.42' MSL	TRANSITIONAL	7045.03' MSL	7.39'	To Be Determined
34	TREE GROUP	7056.91' MSL	TRANSITIONAL	7037.14' MSL	19.76'	To Be Determined
35	BUILDING	7062.39' MSL	TRANSITIONAL	7040.06' MSL	22.32'	Fixed By Function
36	TREE GROUP	7065.14' MSL	TRANSITIONAL	7062.84' MSL	2.30'	To Be Determined
37	TREE	7069.29' MSL	TRANSITIONAL	7067.27' MSL	2.02'	To Be Determined
38	TREE	7081.78' MSL	TRANSITIONAL	7077.32' MSL	4.46'	To Be Determined
39	TREE GROUP	7090.97' MSL	TRANSITIONAL	7067.81' MSL	23.15'	To Be Determined
40	TREE GROUP	7128.97' MSL	TRANSITIONAL	7110.47' MSL	18.49'	To Be Determined
41	TREE GROUP	7100.07' MSL	TRANSITIONAL	7051.43' MSL	48.63'	To Be Determined
42	TREE	7053.52' MSL	RWY 21 APPROACH	6997.40' MSL	56.12'	To Be Determined
43	TREE GROUP	7063.47' MSL	RWY 21 APPROACH	7008.43' MSL	55.03'	To Be Determined
44	TREE	7037.33' MSL	RWY 21 APPROACH	7015.86' MSL	21.47'	To Be Determined
45	TREE GROUP	7054.39' MSL	RWY 21 APPROACH	7017.69' MSL	36.70'	To Be Determined
46	TREE	7029.99' MSL	RWY 21 APPROACH	7007.94' MSL	22.05'	To Be Determined
47	TREE	7051.15' MSL	RWY 21 APPROACH	7009.82' MSL	41.33'	To Be Determined
48	TREE	7036.84' MSL	RWY 21 APPROACH	7017.71' MSL	19.13'	To Be Determined
49	TREE	7029.63' MSL	RWY 21 APPROACH	7020.63' MSL	9.00'	To Be Determined
50	TREE	7026.85' MSL	RWY 21 APPROACH	7025.22' MSL	1.62'	To Be Determined
51	TREE	7044.25' MSL	RWY 21 APPROACH	7027.31' MSL	16.93'	To Be Determined
52	TREE	7040.76' MSL	RWY 21 APPROACH	7026.87' MSL	13.88'	To Be Determined
53	TREE GROUP	7061.55' MSL	RWY 21 APPROACH	7037.65' MSL	23.90'	To Be Determined
54	TREE	7048.84' MSL	RWY 21 APPROACH	7047.81' MSL	1.02'	To Be Determined
55	TREE	7052.82' MSL	RWY 21 APPROACH	7049.09' MSL	3.73'	To Be Determined
56	TREE	7054.13' MSL	RWY 21 APPROACH	7045.12' MSL	9.00'	To Be Determined
57	TREE GROUP	7074.92' MSL	RWY 21 APPROACH	7067.13' MSL	7.79'	To Be Determined
58	TREE	7080.29' MSL	RWY 21 APPROACH	7078.31' MSL	1.97'	To Be Determined
59	TREE	7082.87' MSL	RWY 21 APPROACH	7081.29' MSL	1.58'	To Be Determined
60	TREE	7087.84' MSL	RWY 21 APPROACH	7074.98' MSL	12.86	To Be Determined
61	TREE GROUP	7085.60' MSL	RWY 21 APPROACH	7084.98' MSL	0.62'	To Be Determined
62	TREE GROUP	7106.52' MSL	RWY 21 APPROACH	7085.71' MSL	20.81'	To Be Determined
63	TREE GROUP	8452.16' MSL	RWY 21 APPROACH	7859.60' MSL	592.56'	To Be Determined
64	TREE	7164.62' MSL	HORIZONTAL	7164.37' MSL	0.25'	To Be Determined
65	TREE GROUP	7185.14' MSL	HORIZONTAL	7164.37' MSL	20.76'	To Be Determined
66	TREE	7173.74' MSL	HORIZONTAL	7164.37' MSL	9.36'	To Be Determined
67	TREE GROUP	7178.18' MSL	HORIZONTAL	7164.37' MSL	13.80'	To Be Determined
68	TREE	7168.69' MSL	HORIZONTAL	7164.37' MSL	4.31'	To Be Determined
69	TREE GROUP	7195.18' MSL	HORIZONTAL	7164.37' MSL	30.80'	To Be Determined
70	TREE GROUP	7236.99' MSL	HORIZONTAL	7164.37' MSL	72.61'	To Be Determined
70	TREE GROUP	7256.02' MSL	CONICAL	7251.38' MSL	4.64'	To Be Determined



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B C	B D	
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		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B C	B D	
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
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

OBSTRUCTION LEGEND

1● OBSTRUCTION HIGH POINT

GROUP or MULTIPLE OBSTRUCTIONS

Magnetic Declination
10° 38' East (2019)
Annual Rate of Change
00° 06' West (2016)

0 2000 4000 6000
SCALE IN FEET

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads, 15 for non-interstate roads, 17' for interstate roads, and 23' for railroads.
2. Depiction of features and objects within the outer portion of the approach surfaces, is illustrated on the Outer Approach Surface for Runway 3-21, Sheet 7 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the Inner Approach Surface for Runway 3-21, Sheet 8 of these plans.
4. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated PART 77 Airspace Plan.
5. Base map USGS Quadrangle maps Sunset Crater, Humphreys Peak, Flagstaff East, Flagstaff West, Bellemont, Lower Lake Mary, Mountainaire, Dutton Hill.
6. Surveys used for obstruction data are a combination of Woolpert 18B survey dated 2016.
7. Obstruction Data for tree groups represent the tallest tree in the group.
8. Ultimate Runway 3R-21L is a carry over from the Previously Approved ALP and is depicted for planning purposes only.

No.	REVISIONS	DATE	BY	APP'D
1				
2				
3	--	--	--	--
4	--	--	--	--
5	MASTER PLAN ALP UPDATE	12/2008	CA	JH

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FLAGSTAFF AIRPORT

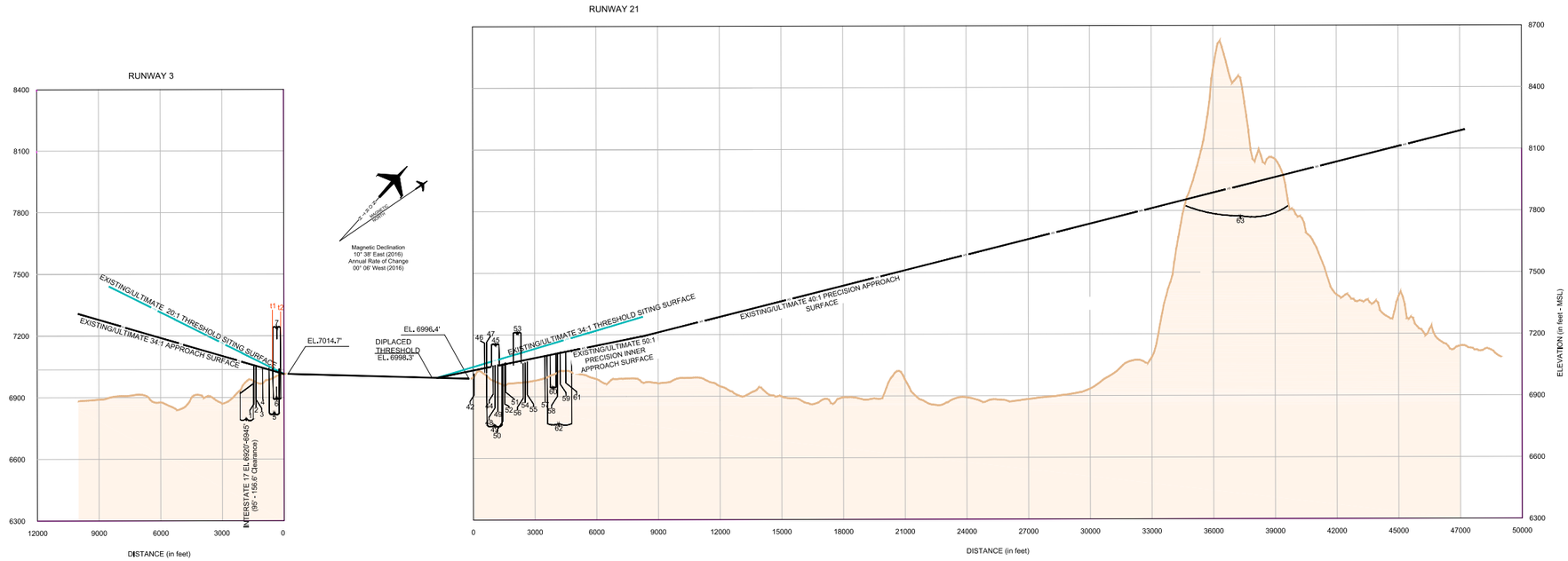
RUNWAY 21 APPROACH FAN

FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018 | SHEET 6 OF 12

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RUNWAY 3-21

HORIZONTAL

0 3000 6000 9000

SCALE IN FEET

VERTICAL

0 300 600 900

SCALE IN FEET

RUNWAY 3 APPROACH OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1	TREE	7054.89' MSL	RWY 3 APPROACH	7053.39' MSL	1.49'	To Be Determined
2	TREE	7061.22' MSL	RWY 3 APPROACH	7056.80' MSL	4.42'	To Be Determined
3	TREE	7055.99' MSL	RWY 3 APPROACH	7053.39' MSL	2.59'	To Be Determined
4	TREE	7044.99' MSL	RWY 3 APPROACH	7044.21' MSL	0.78'	To Be Determined
5	TREE GROUP	7064.43' MSL	RWY 3 APPROACH	7028.20' MSL	36.22'	To Be Determined
6	TREE GROUP	7040.50' MSL	RWY 3 APPROACH	7017.91' MSL	22.58'	To Be Determined
7	TREE GROUP	7056.28' MSL	RWY 3 APPROACH	7018.28' MSL	38.30'	To Be Determined

RUNWAY 3 TSS OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
t1	TREE	7040.50' MSL	THRESHOLD SITING SURFACE	7020.38' MSL	20.12'	To Be Determined
t2	TREE	7049.02' MSL	THRESHOLD SITING SURFACE	7042.07' MSL	6.95'	To Be Determined

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads, 15' for non-interstate roads, 17' for interstate roads, and 23' for railroads.
2. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the Inner Approach Surface for Runway 3-21, Sheet 8 of these plans.
3. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated PART 77 Airspace Plan.
4. Surveys used for obstruction data are a combination of Woolpert 18B survey dated 5 2017.
5. Obstruction Data for tree groups represent the tallest tree within the group.

RUNWAY 21 APPROACH OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
41	TREE GROUP	7100.07' MSL	TRANSITIONAL	7051.43' MSL	48.63'	To Be Determined
42	TREE	7053.52' MSL	RWY 21 APPROACH	6997.40' MSL	56.12'	To Be Determined
43	TREE GROUP	7063.47' MSL	RWY 21 APPROACH	7008.43' MSL	55.03'	To Be Determined
44	TREE	7037.33' MSL	RWY 21 APPROACH	7015.86' MSL	21.47'	To Be Determined
45	TREE GROUP	7054.39' MSL	RWY 21 APPROACH	7017.69' MSL	36.70'	To Be Determined
46	TREE	7029.99' MSL	RWY 21 APPROACH	7007.94' MSL	22.05'	To Be Determined
47	TREE	7051.15' MSL	RWY 21 APPROACH	7009.82' MSL	41.33'	To Be Determined
48	TREE	7036.84' MSL	RWY 21 APPROACH	7017.71' MSL	19.13'	To Be Determined
49	TREE	7029.63' MSL	RWY 21 APPROACH	7020.63' MSL	9.00'	To Be Determined
50	TREE	7026.85' MSL	RWY 21 APPROACH	7025.22' MSL	1.62'	To Be Determined
51	TREE	7044.25' MSL	RWY 21 APPROACH	7027.31' MSL	16.93'	To Be Determined
52	TREE	7040.76' MSL	RWY 21 APPROACH	7026.87' MSL	13.88'	To Be Determined
53	TREE GROUP	7061.55' MSL	RWY 21 APPROACH	7037.65' MSL	23.90'	To Be Determined
54	TREE	7048.84' MSL	RWY 21 APPROACH	7047.81' MSL	1.02'	To Be Determined
55	TREE	7052.82' MSL	RWY 21 APPROACH	7049.09' MSL	3.73'	To Be Determined
56	TREE	7054.13' MSL	RWY 21 APPROACH	7045.12' MSL	9.00'	To Be Determined
57	TREE GROUP	7074.92' MSL	RWY 21 APPROACH	7067.13' MSL	7.79'	To Be Determined
58	TREE	7080.29' MSL	RWY 21 APPROACH	7078.31' MSL	1.97'	To Be Determined
59	TREE	7082.87' MSL	RWY 21 APPROACH	7081.29' MSL	1.58'	To Be Determined
60	TREE	7087.84' MSL	RWY 21 APPROACH	7074.98' MSL	12.86	To Be Determined
61	TREE GROUP	7085.60' MSL	RWY 21 APPROACH	7084.98' MSL	0.62'	To Be Determined
62	TREE GROUP	7106.52' MSL	RWY 21 APPROACH	7085.71' MSL	20.81'	To Be Determined
63	TREE GROUP	8452.16' MSL	RWY 21 APPROACH	7859.60' MSL	592.56'	To Be Determined

RUNWAY 21 TSS OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
t3	TREE	7082.77' MSL	THRESHOLD SITING SURFACE	7037.46' MSL	45.21'	To Be Determined
t4	TREE	7053.52' MSL	THRESHOLD SITING SURFACE	7052.87' MSL	0.64'	To Be Determined
t5	TREE	7064.47' MSL	THRESHOLD SITING SURFACE	7052.87' MSL	1.53'	To Be Determined
t6	TREE	7077.04' MSL	THRESHOLD SITING SURFACE	7058.72' MSL	18.31'	To Be Determined

No.	REVISIONS	DATE	BY	APP'D
1	--	--	--	--
2	--	--	--	--
3	MASTER PLAN ALP UPDATE	12/2008	CA	JH
4				
5				

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FLAGSTAFF AIRPORT

OUTER APPROACH SURFACE FOR RUNWAY 3-21

FLAGSTAFF, ARIZONA

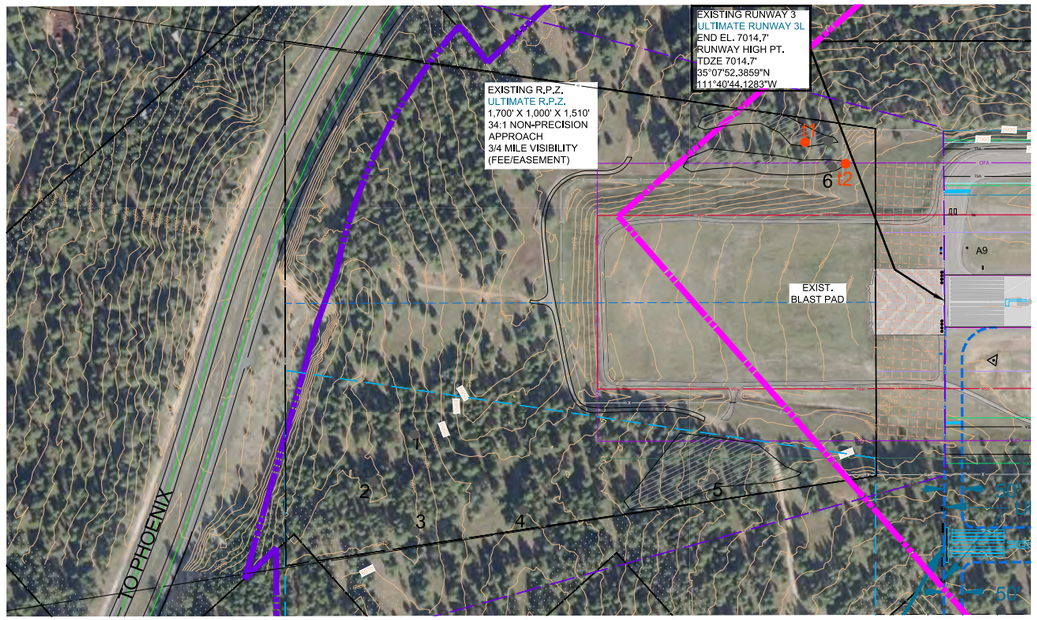
PLANNED BY: Matt Quick

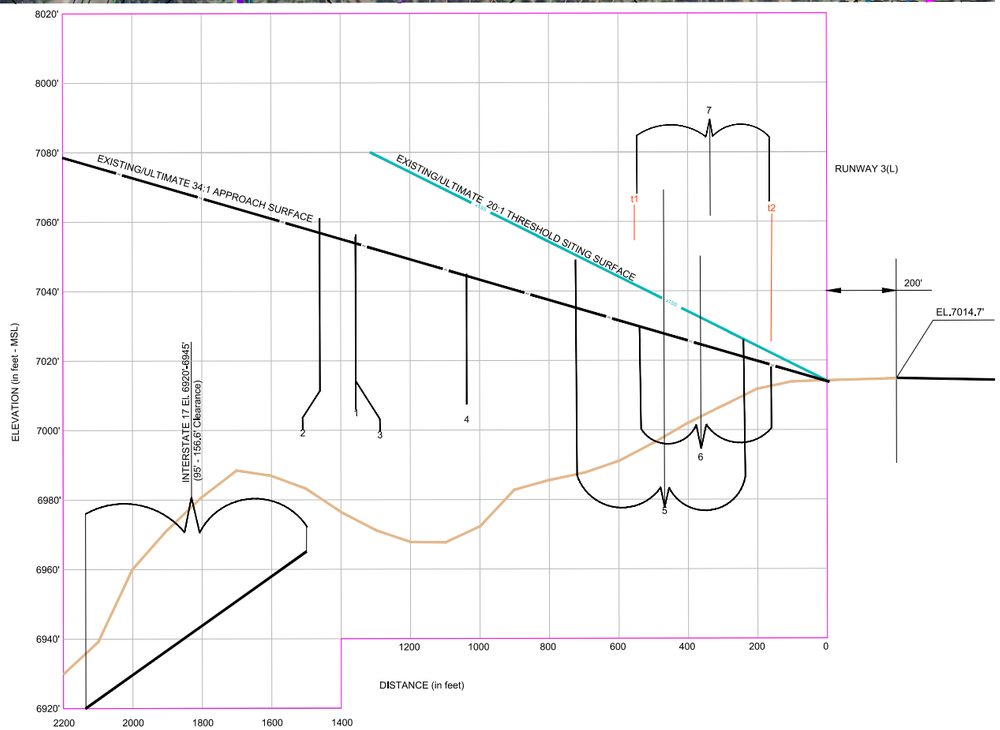
DETAILED BY: Maggie Beaver

APPROVED BY: Jim Harris P.E.

JULY 2018

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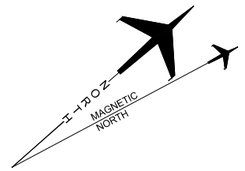


RUNWAY 3 APPROACH OBSTRUCTION TABLE

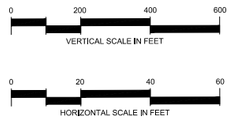
	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1	TREE	7054.89' MSL	RWY 3 APPROACH	7053.39' MSL	1.49'	To Be Determined
2	TREE	7061.22' MSL	RWY 3 APPROACH	7056.80' MSL	4.42'	To Be Determined
3	TREE	7055.99' MSL	RWY 3 APPROACH	7053.39' MSL	2.59'	To Be Determined
4	TREE	7044.99' MSL	RWY 3 APPROACH	7044.21' MSL	0.78'	To Be Determined
5	TREE GROUP	7064.43' MSL	RWY 3 APPROACH	7028.20' MSL	36.22'	To Be Determined
6	TREE GROUP	7040.50' MSL	RWY 3 APPROACH	7017.91' MSL	22.58'	To Be Determined
7	TREE GROUP	7056.28' MSL	RWY 3 APPROACH	7018.28' MSL	38.30'	To Be Determined

RUNWAY 3 TSS OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
t1	TREE	7040.50' MSL	THRESHOLD SITING SURFACE	7020.38' MSL	20.12'	To Be Determined
t2	TREE	7049.02' MSL	THRESHOLD SITING SURFACE	7042.07' MSL	6.95'	To Be Determined

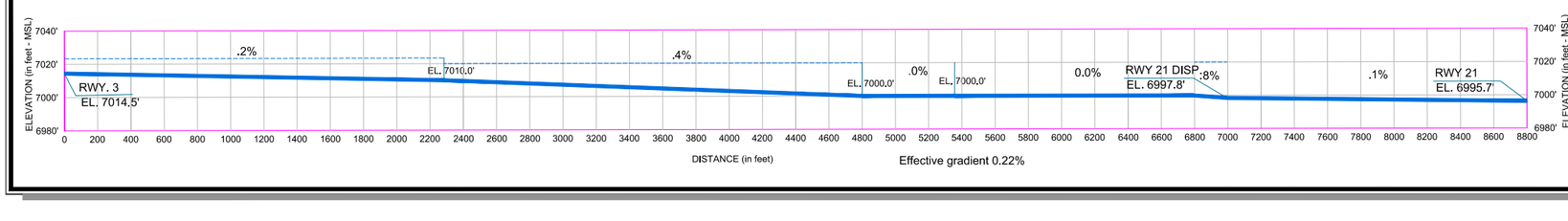


Magnetic Declination
10° 38' East (2016)
Annual Rate of Change
00° 06' West (2016)



GENERAL NOTES:

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4. Surveys used for obstruction data are a combination of Woolpert 18B survey dated 5 2017.
5. Obstruction Data for tree groups represent the tallest tree within the group.



Effective gradient 0.22%

No.	REVISIONS	DATE	BY	APP'D
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2				
3		--	--	--
4		--	--	--
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FLAGSTAFF AIRPORT

INNER APPROACH SURFACE FOR RUNWAY 3

FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018

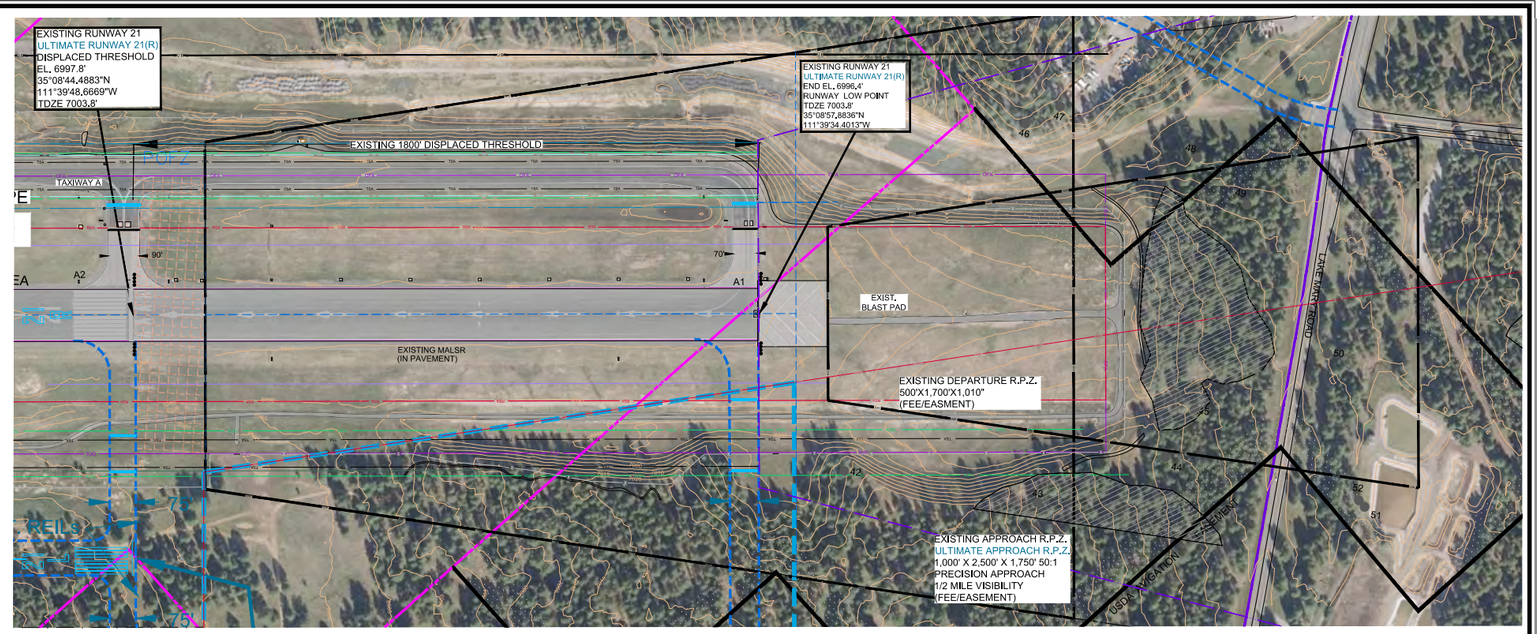
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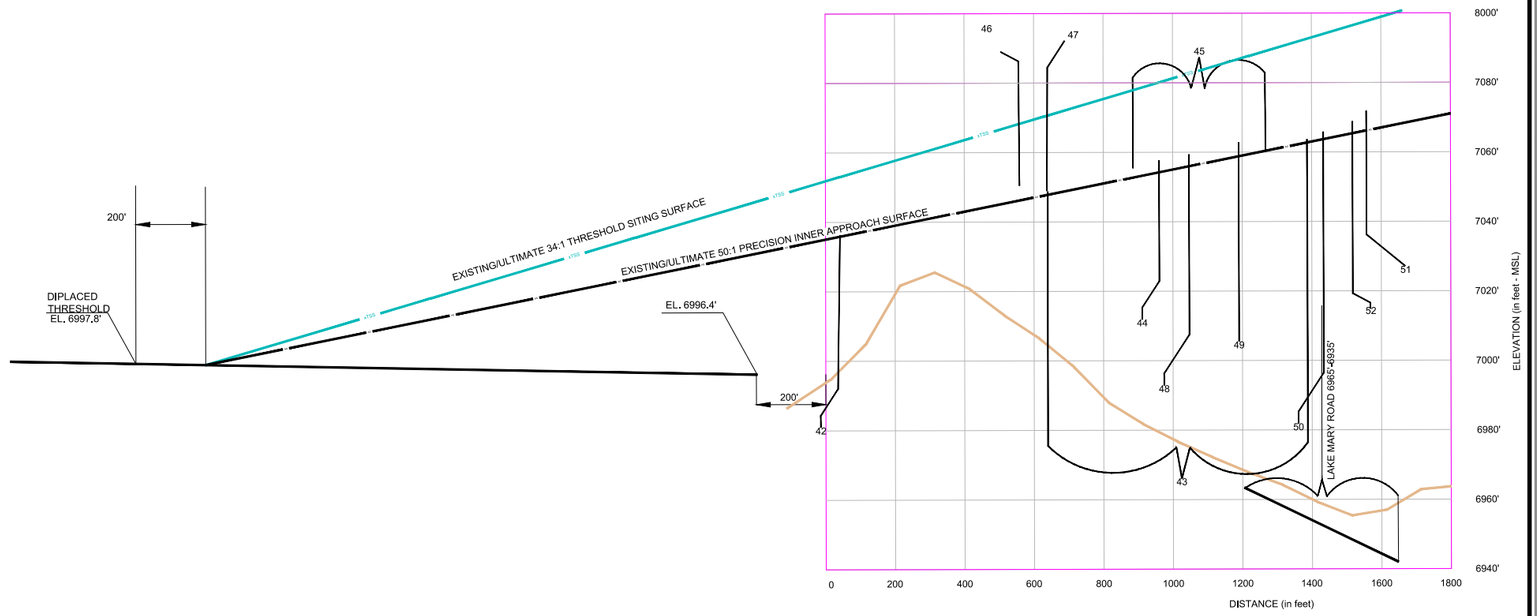
RUNWAY 21 APPROACH OBSTRUCTION TABLE

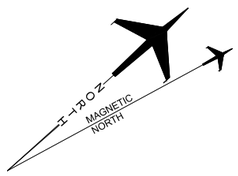
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RUNWAY 21 TSS OBSTRUCTION TABLE

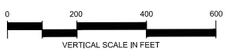
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t6	TREE	7077.04' MSL	THRESHOLD SITING SURFACE	7058.72' MSL	18.31'	To Be Determined







Magnetic Declination
10° 38' East (2016)
Annual Rate of Change
00° 06' West (2016)





GENERAL NOTES:

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4. Surveys used for obstruction data are a combination of Woolpert 18B survey dated 5 2017.
5. Obstruction Data for tree groups represent the tallest tree within the group.
6. Ultimate Runway 3R-21L is a carry over from the Previously Approved ALP and is Depicted for planning purposes only.

No.	REVISIONS	DATE	BY	APP'D
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2				
3	--	--	--	--
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5	MASTER PLAN ALP UPDATE	12/2008	CA	JH

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FLAGSTAFF AIRPORT

INNER APPROACH SURFACE FOR RUNWAY 21

FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018

Coffman Associates
Airport Consultants
www.coffmanassociates.com

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
	SAME	AIRPORT ROTATING BEACON
N/A		NON-AVIATION RELATED REVENUE SUPPORT
N/A		AVIATION RELATED REVENUE SUPPORT
XXU BRL		BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
N/A		ABANDON/REMOVE BUILDING
		NO TAXI ISLAND
		GENERAL AVIATION REDEVELOPMENT
	SAME	AUTOMATED WEATHER OBSERVATION STATION
		AIRPORT PAVEMENT
N/A		ABANDON/REMOVE PAVEMENT
N/A		PRECISION OBSTACLE FREE ZONE
		FENCE LINE
		HOLD MARKING
OFA	OFA	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ	RUNWAY OBSTACLE FREE ZONE
RPZ	RPZ	RUNWAY PROTECTION ZONE
TOFA	TOFA	TAXIWAY OBJECT FREE AREA
TSA		TAXIWAY SAFETY AREA
AS	RSA(U)	RUNWAY APPROACH SURFACE
TTS	TTS	THRESHOLD SITING SURFACE
SAME		DEPARTURE SURFACE
SAME		TIE-DOWNS
		PAPI-4
		RUNWAY END IDENTIFIER LIGHTS (REILS)
		WINDSOCK
SAME		TOPOGRAPHIC CONTOURS
SAME		PACs AND SACs

NORTH
MAGNETIC NORTH

Magnetic Declination
10° 38' East (2016)
Annual Rate of Change
00° 06' West (2016)

0 600 1200
SCALE IN FEET

VOR/DME

EXIST. ARP
EL. 7,000.0'
35°08'25.1000"N
111°40'19.3000"W

ULT. ARP
EL. 7,001.0'
35°08'20.140"N
111°40'09.619"W

EASEMENT

USDA

AVIATION EASEMENT

EASEMENT

LEGEND

- Airfield Operations
- Aviation Support
- Aviation Related - General Aviation
- Aviation Related - Commercial Passenger Service
- Future Aviation Development
- Non - Aviation Related
- Existing Airport Property Line
- Ultimate Property Line
- 65 2035 DNL Noise Contour

NOTES:

1. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983-NAD83:VERTICAL DATUM : NORTH AMERICAN DATUM 1988 - NAVD88.
2. RUNWAY END ELEVATIONS, COORDINATES, DISTANCES, AND BEARING NOTED IN THIS ALP ARE FROM THE AVN DATASHEET.
3. UNLESS NOTED OTHERWISE, EXISTING BUILDING ELEVATIONS NOTED IN THIS ALP ARE FROM AGIS DATA PREPARED BY WOOLPERT.
4. SEE AIRPORT PROPERTY MAP FOR PROPERTY OWNERSHIP DETAILS.
5. ULTIMATE RUNWAY 3R-21L IS A CARRY OVER FROM THE PREVIOUSLY APPROVED ALP AND IS DEPICTED FOR PLANNING PURPOSES ONLY.
6. PORTIONS OF THE EXISTING FACILITY #27 AND #30 ARE LOCATED IN THE 35' BRL, ALTHOUGH THE HEIHTS OF THESE FACILITIES DO NOT PENETRATE THE ASSOCIATED PART 77 TRANSITIONAL SURFACE ASSOCIATED WITH THE BRL, THE ULTIMATE MASTER PLAN CONCEPT CALLS FOR THE REDEVELOPMENT OF THE AREA ASSOCIATED WITH THESE FACILITIES AND, AS SUCH, THEY COULD BE REMOVED/RELOCATED AT THE TIME OF RE-DEVELOPMENT IN ORDER TO CLEAR THE BRL.

No.	REVISIONS	DATE	BY	APP'D
	--	--	--	--
	--	--	--	--
	MASTER PLAN ALP UPDATE	12/2008	CA	JH

THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT OF THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH THE APPROPRIATE PUBLIC LAWS.

FLAGSTAFF AIRPORT

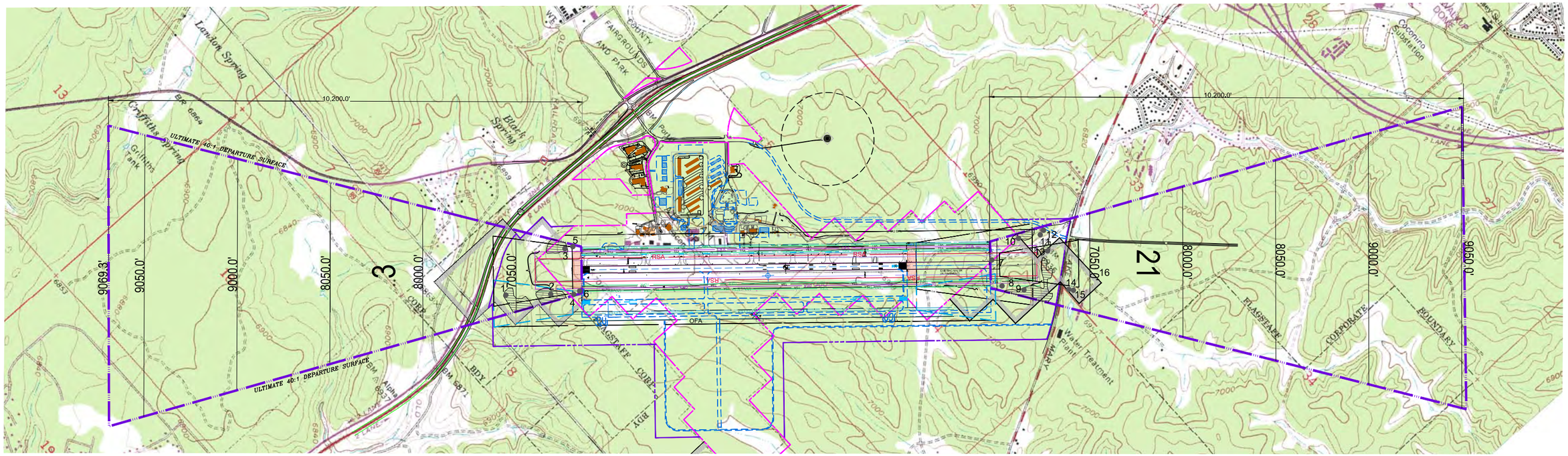
ON-AIRPORT LAND USE DRAWING

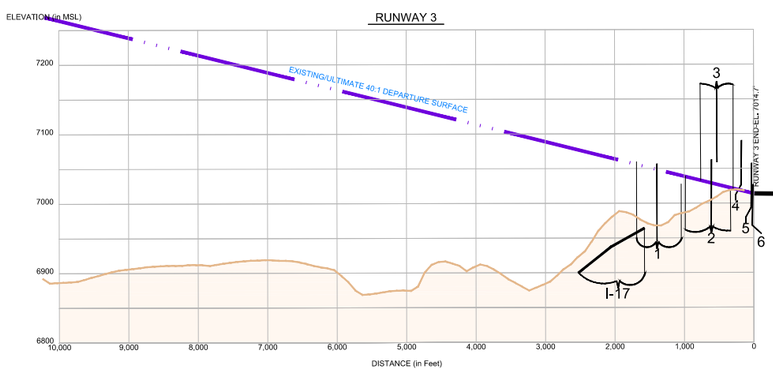
FLAGSTAFF, ARIZONA

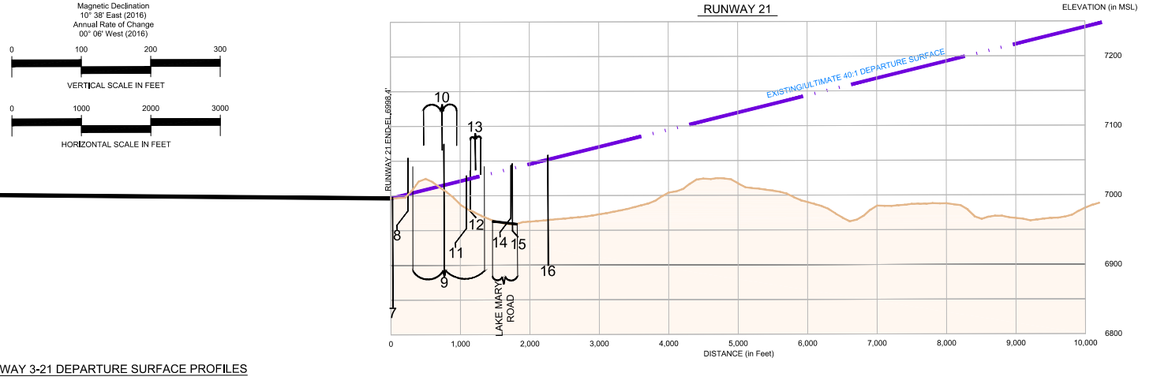
PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

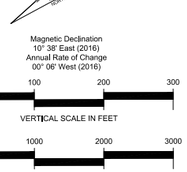
JULY 2018

Coffman Associates
Airport Consultants
www.coffmanassociates.com









RUNWAY 3-21 DEPARTURE SURFACE PROFILES

RUNWAY 3 DEPARTURE OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1	TREE GROUP	7061.22' MSL	RWY. 3 Departure	7055.43' MSL	5.78'	To Be Determined
2	TREE GROUP	7064.43' MSL	RWY. 3 Departure	7031.13' MSL	33.30'	To Be Determined
3	TREE GROUP	7056.59' MSL	RWY. 3 Departure	7022.70' MSL	33.88'	To Be Determined
4	TREE	7083.15' MSL	RWY. 3 Departure	7018.74' MSL	64.40'	To Be Determined
5	TREE	7057.58' MSL	RWY. 3 Departure	7018.48' MSL	39.10'	To Be Determined
6	TREE	7024.98' MSL	RWY. 3 Departure	7014.75' MSL	10.23'	To Be Determined

RUNWAY 21 DEPARTURE OBSTRUCTION TABLE

	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
7	MISC. UTILITY	6998.02' MSL	RWY. 21 Departure	6997.08' MSL	0.93'	Fixed By Function
8	TREE	7053.52' MSL	RWY. 21 Departure	7002.65' MSL	50.87'	To Be Determined
9	TREE GROUP	7077.04' MSL	RWY. 21 Departure	7007.63' MSL	69.41'	To Be Determined
10	TREE GROUP	7064.47' MSL	RWY. 21 Departure	7011.22' MSL	53.24'	To Be Determined
11	TREE	7024.76' MSL	RWY. 21 Departure	7023.75' MSL	1.01'	To Be Determined
12	TREE	7032.11' MSL	RWY. 21 Departure	7025.21' MSL	6.90'	To Be Determined
13	TREE GROUP	7037.09' MSL	RWY. 21 Departure	7026.16' MSL	10.92'	To Be Determined
14	TREE	7040.76' MSL	RWY. 21 Departure	7039.50' MSL	1.26'	To Be Determined
15	TREE	7044.25' MSL	RWY. 21 Departure	7040.04' MSL	4.21'	To Be Determined
16	TREE	7061.55' MSL	RWY. 21 Departure	7052.97' MSL	8.57'	To Be Determined

No.	REVISIONS	DATE	BY	APP'D
1				
2				
3	--	--	--	--
4	--	--	--	--
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FLAGSTAFF AIRPORT

DEPARTURE SURFACE RUNWAY 3-21

FLAGSTAFF, ARIZONA

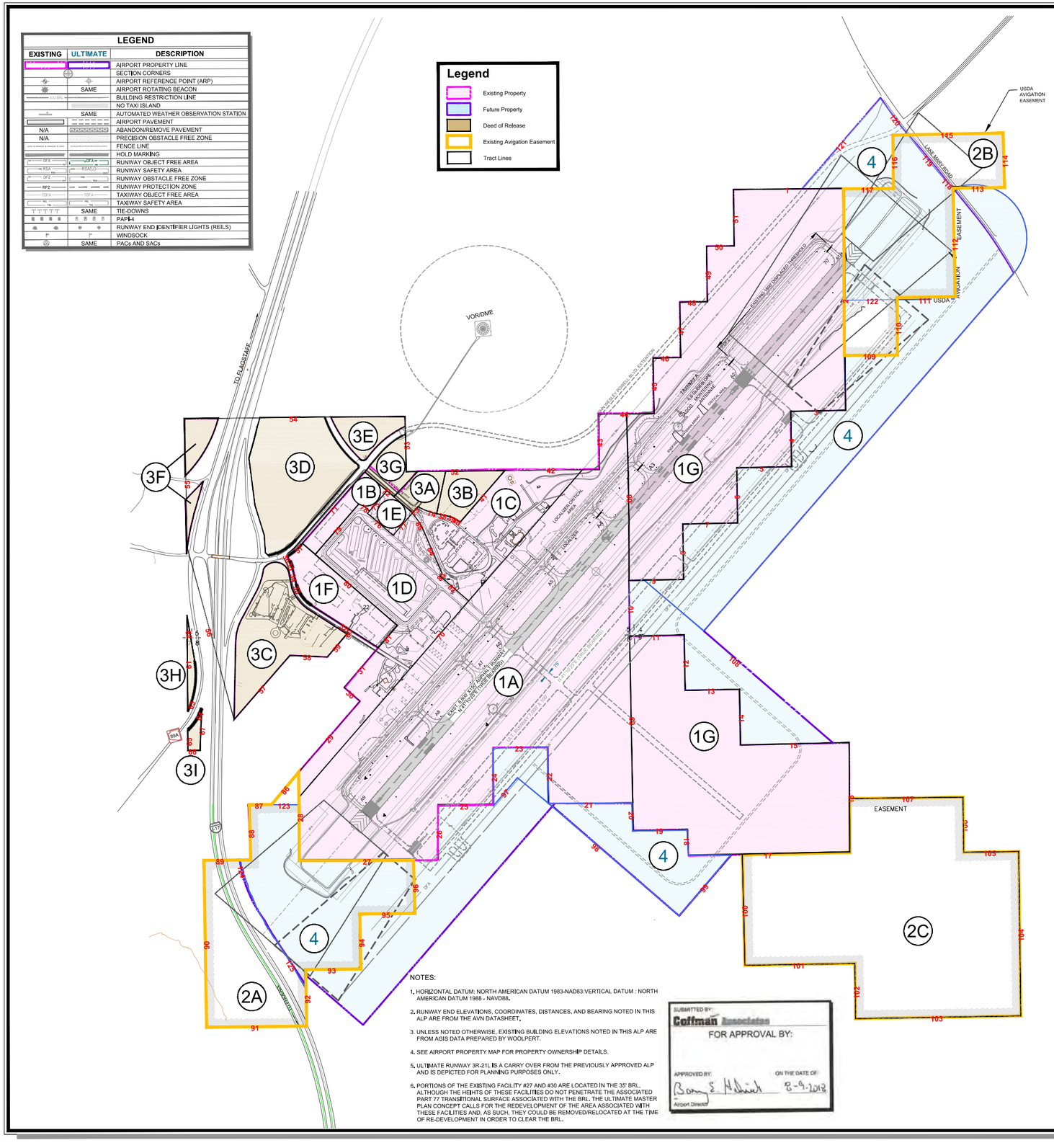
PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018

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LEGEND

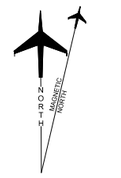
EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
	SAME	AIRPORT ROTATING BEACON
		BUILDING RESTRICTION LINE
		NO TAXI ISLAND
	SAME	AUTOMATED WEATHER OBSERVATION STATION
		AIRPORT PAVEMENT
N/A		ABANDON/REMOVE PAVEMENT
N/A		PRECISION OBSTACLE FREE ZONE
		FENCE LINE
		HOLD MARKING
OFA	OFA	RUNWAY OBJECT FREE AREA
RSA	RSA/OFZ	RUNWAY SAFETY AREA
OFZ		RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA	TAXIWAY OBJECT FREE AREA
TSA	TSA	TAXIWAY SAFETY AREA
	SAME	TIE-DOWNS
		PAPI-4
		RUNWAY END IDENTIFIER LIGHTS (REILS)
		WINDSOCK
	SAME	PACs AND SACs



NOTES:

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SUBMITTED BY: Coffman Associates
FOR APPROVAL BY:
APPROVED BY: ON THE DATE OF: 8-9-2018
Airport Director



Magnetic Declination
10° 38' East (2016)
Annual Rate of Change
00° 06' West (2016)

0 600 1200
SCALE IN FEET

EXISTING PROPERTY DATA

TRACT	APN	GIS ACRE	GRANTOR	GRANTEE	TYPE OF INTEREST	INSTRUMENT	BOOK/PAGE	DATE	FAA GRANT	PURPOSE OF ACQUISITION	EASEMENT TYPE
1A	116-61-001	232.54	UNITED STATES OF AMERICA	CITY OF FLAGSTAFF	FEE SIMPLE/ FEDERAL TRANSFER[1]	QUITCLAIM DEED	5/187-191	07/30/1948	N/A	AIRPORT USE	N/A
1B	116-61-008A	6.41					5/187-191		N/A	AIRPORT USE	N/A
1C	116-61-004	31.08					5/187-191		N/A	AIRPORT USE	N/A
1D	116-61-003A	51.16					5/187-191		N/A	AIRPORT USE	N/A
1E	116-61-002	3.31					5/187-191		N/A	AIRPORT USE	N/A
1F	116-61-005A	14.38					5/187-191		N/A	AIRPORT USE	N/A
1G	115-01-012	274.89					5/187-191		N/A	AIRPORT USE	N/A
2A	FEDERAL LAND	94.83	USDA	CITY OF FLAGSTAFF	EASEMENT		103/344-350	06/09/1954	N/A	EXISITING EASEMENT	AVIGATION EASEMENT
2B	FEDERAL LAND	69.43					103/344-350		N/A	EXISITING EASEMENT	AVIGATION EASEMENT
2C	FEDERAL LAND	150.79					103/344-350		N/A	EXISITING EASEMENT	AVIGATION EASEMENT
3A	116-61-010	4.15	UNITED STATES OF AMERICA	CITY OF FLAGSTAFF		DEED RELEASE	1279/54-82	01/25/1988	N/A	N/A	N/A
3B	116-61-009	6.66					1279/54-82		N/A	N/A	N/A
3C	116-61-013	25.58					1279/54-82		N/A	N/A	N/A
3D	116-61-006	32.15					1279/54-82		N/A	N/A	N/A
3E	116-61-012	6.23					1279/54-82		N/A	N/A	N/A
3F	116-13-001W	5.27					1279/54-82		N/A	N/A	N/A
3G	116-61-011	4.28					1279/54-82		N/A	N/A	N/A
3H	116-13-001C	1.50					1279/54-82		N/A	N/A	N/A
3I	116-13-001G	1.20					1279/54-82		N/A	N/A	N/A

GENERAL NOTE:
1. ACREAGE MAPPED DIFFERS FROM TRANSFER DOCUMENT.

ULTIMATE PROPERTY DATA

TRACT	APN	GIS ACRE	GRANTOR	GRANTEE	TYPE OF INTEREST	INSTRUMENT	BOOK/PAGE	DATE	FAA GRANT	PURPOSE OF ACQUISITION	EASEMENT TYPE
4	FEDERAL LAND	TBD	UNITED STATES OF AMERICA		FUTURE FEE SIMPLE		N/A	N/A	N/A	AVIATION DEVELOPMENT AND SAFETY AREAS	N/A

Metes & Bounds Descriptions

Label	Direction	Distance	Delta	Radius	Tangent	Arclength	Label	Direction	Distance	Delta	Radius	Tangent	Arclength
1	N 89-51-10 E	1317.229'	N/A	N/A	N/A	N/A	64	S 52-38-17 W	211.48'	29-17-2	414.467	181.164	211.281
2	S 0-13-9 E	2985.749'	N/A	N/A	N/A	N/A	65	S 0-13-9 E	243.509'	N/A	N/A	N/A	N/A
3	S 89-28-47 W	606.576'	N/A	N/A	N/A	N/A	66	S 89-59-38 E	145.655'	N/A	N/A	N/A	N/A
4	S 0-14-44 E	663.976'	N/A	N/A	N/A	N/A	67	N 2-25-14 E	506.78'	N/A	N/A	N/A	N/A
5	S 88-50-34 W	696.67'	N/A	N/A	N/A	N/A	68	S 0-40-49 E	1992.08'	N/A	N/A	N/A	N/A
6	S 0-15-7 E	657.046'	N/A	N/A	N/A	N/A	69	S 0-58-31	2015.102'	N/A	N/A	N/A	N/A
7	S 89-24-30 W	655.988'	N/A	N/A	N/A	N/A	70	S 41-0-4 W	5188.794'	N/A	N/A	N/A	N/A
8	S 0-17-01	665.141'	N/A	N/A	N/A	N/A	71	N 41-15-36 E	1137.539'	N/A	N/A	N/A	N/A
9	S 89-1-54 W	637.903'	N/A	N/A	N/A	N/A	72	S 49-30-25 E	752.309'	N/A	N/A	N/A	N/A
10	S 0-47-4 E	674.838'	N/A	N/A	N/A	N/A	73	N 41-9-20 E	95.61'	N/A	N/A	N/A	N/A
11	N 88-33-22 E	651.047'	N/A	N/A	N/A	N/A	74	S 70-4-28 E	266.931'	18-38-51	823.801	135.252	268.113
12	S 0-52-43 E	657.029'	N/A	N/A	N/A	N/A	75	S 41-2-28 W	356.637'	N/A	N/A	N/A	N/A
13	N 89-26-47 E	651.159'	N/A	N/A	N/A	N/A	76	S 48-59-46 E	404.366'	N/A	N/A	N/A	N/A
14	S 1-11-32 E	665.906'	N/A	N/A	N/A	N/A	77	N 41-2-56 E	361.125'	N/A	N/A	N/A	N/A
15	N 89-4-23 E	1303.722'	N/A	N/A	N/A	N/A	78	N 48-59-47 W	151.481'	N/A	N/A	N/A	N/A
16	S 0-15-44 E	1311.797'	N/A	N/A	N/A	N/A	79	S 41-2-45 W	818.91'	N/A	N/A	N/A	N/A
17	S 88-48-31 W	1937.535'	N/A	N/A	N/A	N/A	80	S 48-59-46 E	1504.54'	N/A	N/A	N/A	N/A
18	N 2-9-57 W	323.145'	N/A	N/A	N/A	N/A	81	S 80-58-9 W	354.325'	N/A	N/A	N/A	N/A
19	S 89-13-3 W	686.557'	N/A	N/A	N/A	N/A	82	N 48-59-46 W	453.373'	N/A	N/A	N/A	N/A
20	N 2-56-43 W	938.501'	N/A	N/A	N/A	N/A	83	N 40-57-41 E	33.55'	N/A	N/A	N/A	N/A
21	N 89-48-21 W	1008.762'	N/A	N/A	N/A	N/A	84	N 23-18-0 W	554.636'	N/A	N/A	N/A	N/A
22	N 0-4-12 E	675.282'	N/A	N/A	N/A	N/A	85	N 32-45-11 W	254.42'	18-55-51	713.533	128.966	255.581
23	S 88-48-13 W	958.133'	N/A	N/A	N/A	N/A	86	S 39-59-48 W	506.745'	N/A	N/A	N/A	N/A
24	S 0-13-17 W	686.148'	N/A	N/A	N/A	N/A	87	S 89-36-41 W	265.495'	N/A	N/A	N/A	N/A
25	S 89-16-40 W	657.313'	N/A	N/A	N/A	N/A	88	S 1-12-56 E	663.419'	N/A	N/A	N/A	N/A
26	S 0-44-58 W	604.42'	N/A	N/A	N/A	N/A	89	S 89-59-10 W	590.821'	N/A	N/A	N/A	N/A
27	S 89-59-41 W	1652.242'	N/A	N/A	N/A	N/A	90	S 0-46-50 E	2000.373'	N/A	N/A	N/A	N/A
28	N 0-18-4 W	1061.214'	N/A	N/A	N/A	N/A	91	N 89-36-36 E	1200.201'	N/A	N/A	N/A	N/A
29	N 40-59-27 E	1122.609'	N/A	N/A	N/A	N/A	92	N 0-46-45 W	680.127'	N/A	N/A	N/A	N/A
30	N 48-31-26 W	246.129'	N/A	N/A	N/A	N/A	93	N 89-36-39 E	660.119'	N/A	N/A	N/A	N/A
31	N 40-17-35 E	623.643'	N/A	N/A	N/A	N/A	94	N 0-46-50 W	660.114'	N/A	N/A	N/A	N/A
32	N 57-9-23 W	970.728'	N/A	N/A	N/A	N/A	95	N 89-36-32 E	660.116'	N/A	N/A	N/A	N/A
33	S 37-41-37 E	329.267'	46-46-33	414.741	179.373	338.591	96	N 1-30-8 W	636.45'	N/A	N/A	N/A	N/A
34	N 13-21-33 W	142.342'	N/A	N/A	N/A	N/A	97	N 42-11-43 E	439.657'	N/A	N/A	N/A	N/A
35	S 17-36-59 E	143.389'	14-37-45	563.123	72.283	143.779	98	S 48-50-3 E	2549.297'	N/A	N/A	N/A	N/A
36	N 30-39-8 W	74.976'	N/A	N/A	N/A	N/A	99	N 40-21-26 E	579.219'	N/A	N/A	N/A	N/A
37	N 50-12-7 E	242.423'	35-55-51	667.309	123.263	243.775	100	S 1-11-29 E	1322.465'	N/A	N/A	N/A	N/A
38	S 77-26-22 E	128.798'	N/A	N/A	N/A	N/A	101	N 89-12-13 E	1320.206'	N/A	N/A	N/A	N/A
39	S 63-35-5 E	697.77'	25-32-50	302.133	54.763	108.35	102	S 0-34-4 E	660.11'	N/A	N/A	N/A	N/A
40	S 53-45-35 E	86.691'	N/A	N/A	N/A	N/A	103	N 89-12-9 E	1980.328'	N/A	N/A	N/A	N/A
41	N 41-15-35 E	842.678'	N/A	N/A	N/A	N/A	104	S 0-38-5 E	7969.74'	N/A	N/A	N/A	N/A
42	N 89-55-19 E	1310.58'	N/A	N/A	N/A	N/A	105	S 89-25-51 W	660.09'	N/A	N/A	N/A	N/A
43	S 0-20-6 E	667.558'	N/A	N/A	N/A	N/A	106	N 0-34-10 W	660.105'	N/A	N/A	N/A	N/A
44	N 89-37-59 E	658.732'	N/A	N/A	N/A	N/A	107	S 89-26-11 W	1359.483'	N/A	N/A	N/A	N/A
45	S 0-28-44 E	664.458'	N/A	N/A	N/A	N/A	108	N 48-34-0 W	2070.536'	N/A	N/A	N/A	N/A
46	N 89-33-0 E	328.452'	N/A	N/A	N/A	N/A	109	N 39-53-2 E	636.668'	N/A	N/A	N/A	N/A
47	S 0-17-25 E	665.113'	N/A	N/A	N/A	N/A	110	N 0-7-20 W	662.441'	N/A	N/A	N/A	N/A
48	N 89-37-33 E	328.846'	N/A	N/A	N/A	N/A	111	N 89-10-25 E	685.558'	N/A	N/A	N/A	N/A
49	S 0-20-18 E	665.148'	N/A	N/A	N/A	N/A	112	N 0-34-30 W	1328.757'	N/A	N/A	N/A	N/A
50	N 89-39-18 E	329.714'	N/A	N/A	N/A	N/A	113	N 39-32-23 E	918.513'	N/A	N/A	N/A	N/A
51	S 0-16-26 E	875.97'	N/A	N/A	N/A	N/A	114	N 1-29-12 W	654.415'	N/A	N/A	N/A	N/A
52	S 88-48-12 W	1299.22'	N/A	N/A	N/A	N/A	115	S 89-3-47 W	1320.211'	N/A	N/A	N/A	N/A
53	S 1-7-36 E	660.553'	N/A	N/A	N/A	N/A	116	S 0-20-24 E	642.496'	N/A	N/A	N/A	N/A
54	S 89-33-7 W	2641.452'	N/A	N/A	N/A	N/A	117	S 89-58-23 W	596.918'	N/A	N/A	N/A	N/A
55	S 1-3-37 E	1543.512'	N/A	N/A	N/A	N/A	118	N 44-21-32 W	137.11'	N/A	N/A	N/A	N/A
56	S 15-5-22 E	2136.67'	N/A	N/A	N/A	N/A	119	N 39-33-28 W	588.821'	N/A	N/A	N/A	N/A
57	N 41-15-5 E	1021.053'	N/A	N/A	N/A	N/A	120	N 37-18-48 W	856.124'	N/A	N/A	N/A	N/A
58	S 87-20-23 E	446.953'	N/A	N/A	N/A	N/A	121	S 41-9-17 W	1435.491'	N/A	N/A	N/A	N/A
59	N 40-31-46 E	362.226'	N/A	N/A	N/A	N/A	122	S 89-41-53 W	671.483'	N/A	N/A	N/A	N/A
60	N 20-47-9 E	63.384'	N/A	N/A	N/A	N/A	123	S 89-25-2 E	333.079'	N/A	N/A	N/A	N/A
61	S 0-18-59 E	1153.752'	N/A	N/A	N/A	N/A	124	S 24-44-38 E	1105.994'	24-48-12	2574.217	566.055	1114.375
62	S 9-28-21	504.443'	N/A	N/A	N/A	N/A	125	S 31-4-32 E	638.49'	4-6-19	8011.125	319.379	638.485
63	S 6-38-7 W	660.54'	87-1-16	1040.288	348.289	672.172							

No.	REVISIONS	DATE	BY	APP'D
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	MASTER PLAN ALP UPDATE	12/2008	CA	JH

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FLAGSTAFF AIRPORT
EXHIBIT "A"
AIRPORT PROPERTY MAP
FLAGSTAFF, ARIZONA

PLANNED BY: Matt Quick
DETAILED BY: Maggie Beaver
APPROVED BY: Jim Harris P.E.

JULY 2018 | SHEET 12 OF 12

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