AIRPORT MASTER PLAN

LAKE HAVASU CITY MUNICIPAL AIRPORT
Lake Havasu City

Prepared for
Lake Havasu City

By

Coffman Associates
Airport Consultants

Adopted by the City Council
of Lake Havasu City
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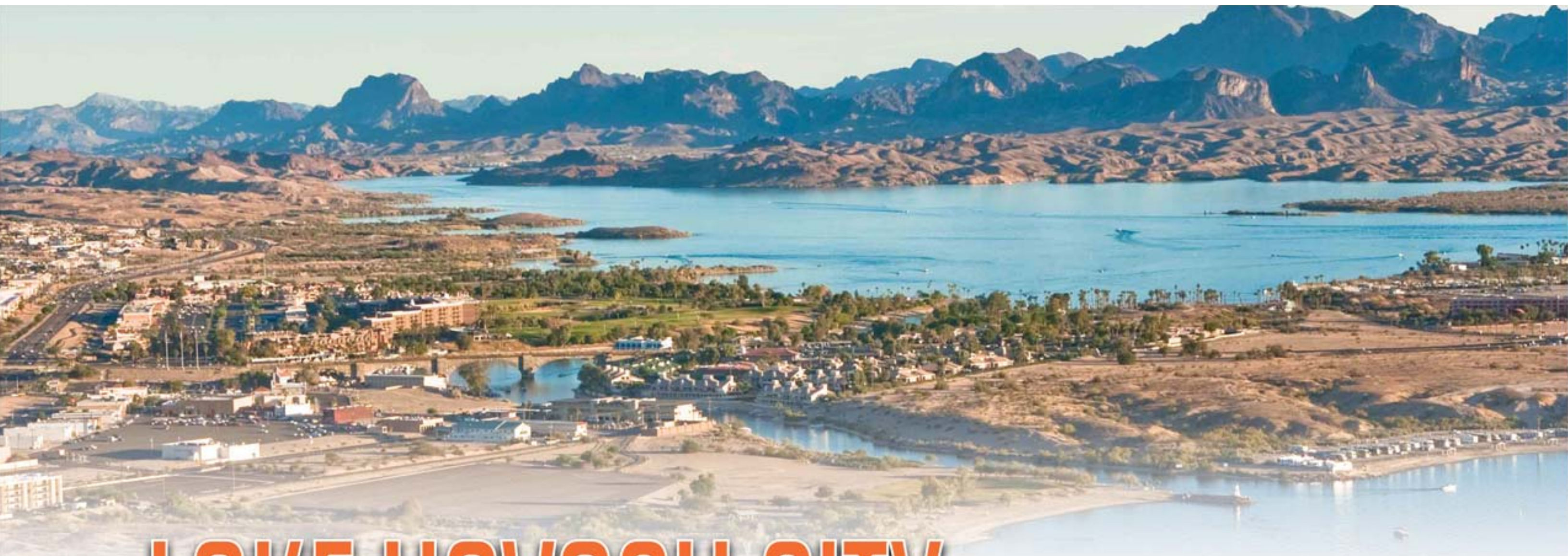

LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

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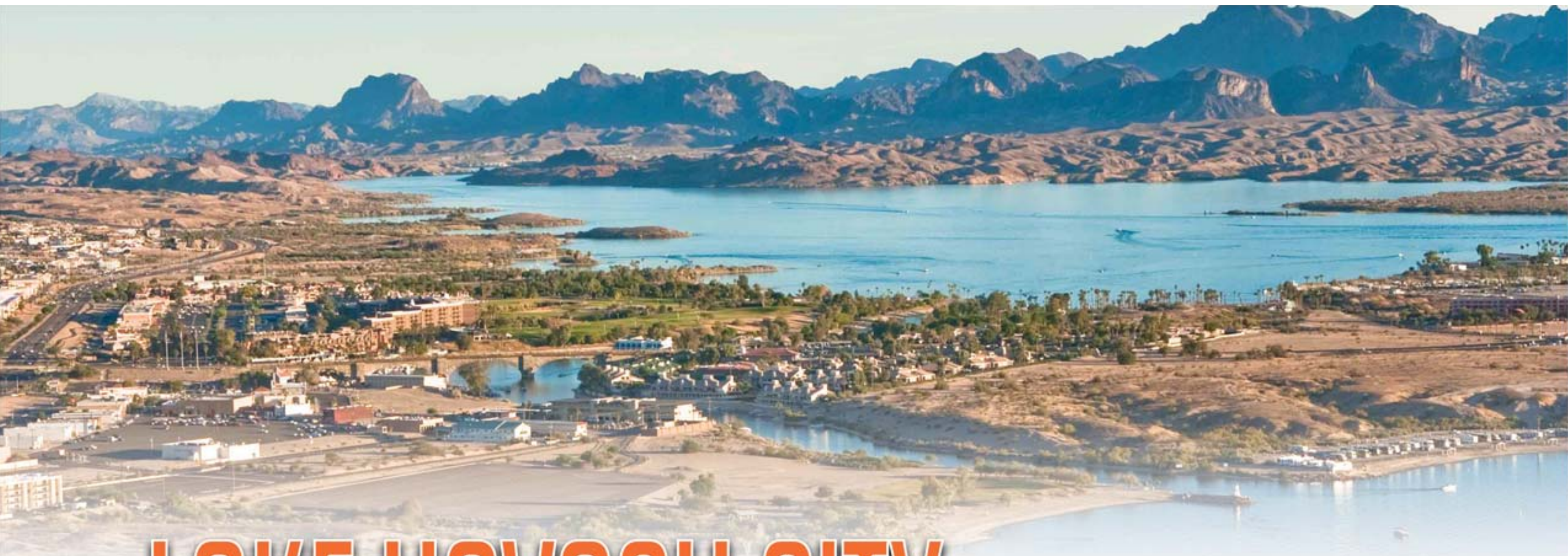
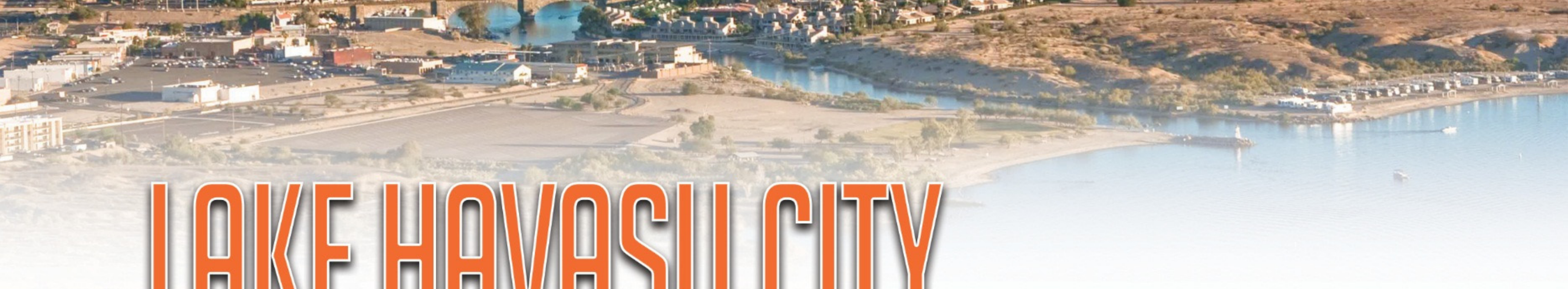


LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

INTRODUCTION



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

INTRODUCTION

The Lake Havasu City Municipal Airport Master Plan Update 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 also establishes development objectives and provides a 20-year planning period that details specific study elements, including airfield configuration, facility development, on-airport land use development recommendations, and support facilities. It also serves as a tool for evaluating airport improvement priorities, as well as justifying the need for federal and state funding assistance.

The Federal Aviation Administration (FAA) recommends that airports update their master plan every 7 to 10 years, or as necessary to address local changes. The last master plan prepared for Lake Havasu City Municipal Airport was completed in 2009. This master plan update is a necessary evaluation of the airport's overall development direction, its ability to meet the needs of local and regional economies, and its role in the air transportation industry.

This master plan has been undertaken to evaluate the airport's capabilities, to forecast future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand. The goal of the master plan is to provide systematic guidelines for the airport's overall maintenance, development, and operation. It is intended to be a proactive document, which identifies and then plans for future facility needs well in advance of the actual need. This is done to ensure that Lake Havasu City can coordinate project approvals, design, financing, and construction in a timely manner, prior to experiencing the detrimental effects of inadequate facilities.

Lake Havasu City recognizes the importance of air transportation to the community, as well as the associated challenges inherent in maintaining a safe and efficient airport environment. The cost of maintaining an airport is an investment which yields impressive benefits to the community. With a sound and realistic master plan, Lake Havasu City Municipal Airport can maintain its role as an important link to the national air transportation system for the community and maintain the existing public and private investments in its facilities.

STUDY OVERVIEW

Lake Havasu City is responsible for funding capital improvements at the airport, as well as obtaining FAA and Arizona Department of Transportation (ADOT) development grants. Additionally, the city oversees private entities' facility enhancements and infrastructure development on airport property to ensure compliance with federal, state, and local regulations. The master plan provides guidance for future development and justification for funding airport projects through the FAA's and ADOT's Airport Capital Improvement Program (ACIP).

The airport master plan process will follow a systematic approach outlined by the FAA to identify existing and future airport needs in advance of actual need for improvements in order to prepare city officials and airport staff with a timeline for environmental reviews, project approvals, design, financing, and construction. The master plan is intended to be used as a recommended development concept which outlines the proposed future maintenance and improvement projects at the airport.

The Lake Havasu City has contracted with the airport planning firm of Coffman Associates, Inc. to undertake the airport master plan. Coffman Associates specializes in master planning and environmental studies. 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 Lake Havasu City Municipal Airport Master Plan is to develop and maintain a financially feasible, long-term development program which will satisfy aviation demand and be compatible with community development, other transportation modes, and the environment. The accomplishment of this objective requires an evaluation of the existing airport and determination of actions necessary to maintain an adequate, safe, and reliable airport facility, while meeting the air transportation needs of the area. A completed master plan provides an outline of the necessary development and gives responsible officials notice of future needs to aid in planning, scheduling, and budgeting.

This master plan will provide guidance through an updated ACIP to outline for the airport sponsor (Lake Havasu City) what investments may be required for future development and maintenance of the airport facilities. The study will be coordinated with other regional, state, and federal planning studies. It will also take into consideration historical planning documents, including the Lake Havasu City Municipal

Airport Master Plan (2009) and the most recently updated Airport Layout Plan (ALP) approved in 2010. The goal of this master plan update is to provide the framework needed to guide future airport development that will cost-effectively satisfy aviation demand, while considering potential environmental and socioeconomic impacts.

The master plan will meet the following general objectives:

- Justify proposed development through the technical, economic, and environmental investigation of concepts and alternatives.
- 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 (1-5 years) ACIP.
- Provide sufficient project definition and detail for subsequent environmental evaluations that may be required before the project is approved.
- Present a plan that adequately addresses the issues and satisfies local, state, and federal regulations.
- Set the stage and establish the framework for a continuing planning process. Such a process should monitor key conditions and permit changes in plan recommendations as required.
- Research and evaluate socioeconomic factors likely to affect the air transportation demand in the region.
- Determine the projected facility needs of airport users through the year 2037 by which to support airport development alternatives.
- Recommend improvements that will enhance the airport's safety capabilities and capacity to the maximum extent possible.
- Produce current and accurate airport base maps and ALP Drawings consistent with FAA standards which will be utilized by the FAA and ADOT in determining airport grant eligibility and funding.
- Develop a robust and productive public involvement program throughout the planning process.
- Conduct an aeronautical survey that is compliant with Airport Geographic Information System (AGIS) standards and includes airspace and obstruction information submitted to and approved by the FAA.
- Consider sustainability efforts through an energy assessment of city-owned airport facilities and by analyzing waste and recycling improvements.

MASTER PLAN TASKS

This master plan specifically addresses the following tasks:

- Assist Lake Havasu City, through a Planning Advisory Committee (PAC)—made up of a group of stakeholders, including government representatives, airport users and tenants, local community leaders—to determine a vision for the airport.

- Conduct a series of public information workshops to allow the general public an opportunity to be informed on the airport and provide input related to the study process.

- Conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, identifying strengths, weaknesses, realistic markets, goals, resources, and strategies to move forward. This analysis will factor the strengths and weaknesses of the airport to include physical and operational features. The analysis will also present the same for competing airports in the region.

- Establish goals and priorities for the airport based on the realistic evaluation of the facility in terms of configuration, condition, amenities, location, competition, and forecasted aviation demand.

- Identify airfield alternatives based on goals and opportunities, as well as applicable airport design standards. The analysis will include an evaluation of the airfield geometry to address potential runway incursion hot spots and nonstandard conditions, along with providing recommendations for conformance and improvement.

- Provide a landside development plan that identifies areas for accommodating the forecasted growth of aviation, and aviation-related businesses and, if appropriate, areas for non-aviation revenue-producing opportunities. Consideration will be given to the potential new or expanded aviation facilities, including, but not limited to, aircraft storage hangar capacity, aircraft parking apron space, and support facilities.

- Assess compatible land uses near the airport.

- Prioritize pavement/facility preservation and rehabilitation recommendations in order of greatest overall positive impact.

BASELINE EXPECTATIONS

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

- The airport will continue to operate as a publicly owned facility through the 20-year period;

- The airport will continue to serve general aviation tenants and itinerant and/or local aircraft operations by general aviation, air taxi, and military operators;

- The general aviation industry will grow through the planning period as projected by the FAA. Specifics of projected growth in the national general aviation industry are contained in chapter two of this master plan; and

- 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 master plan is being prepared in a fashion pursuant to the scope of services that has been coordinated with Lake Havasu City and the FAA. The study has 11 specific elements that are intended to assist in the identification of future facility needs and which provides 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 the study materials 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, populations, and socioeconomic 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 detailed airport and aeronautical data.

Element 3. Forecasts examines the potential aviation demand for general aviation, air taxi, and military activity at the airport over a 20-year period. Specific indicators for based aircraft, aircraft operations, and peaking characteristics will be required to meet the projected aviation demand at the airport through the planning period. It is important to note that the airport has historically been served by scheduled commercial passenger service; however, it is not currently accommodating these services. This analysis also examines the potential for commercial service during the planning period of this master plan.

Element 4. Facility Requirements converts aviation demand needs into types and volumes of actual physical facilities required to meet existing and forecast aviation 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

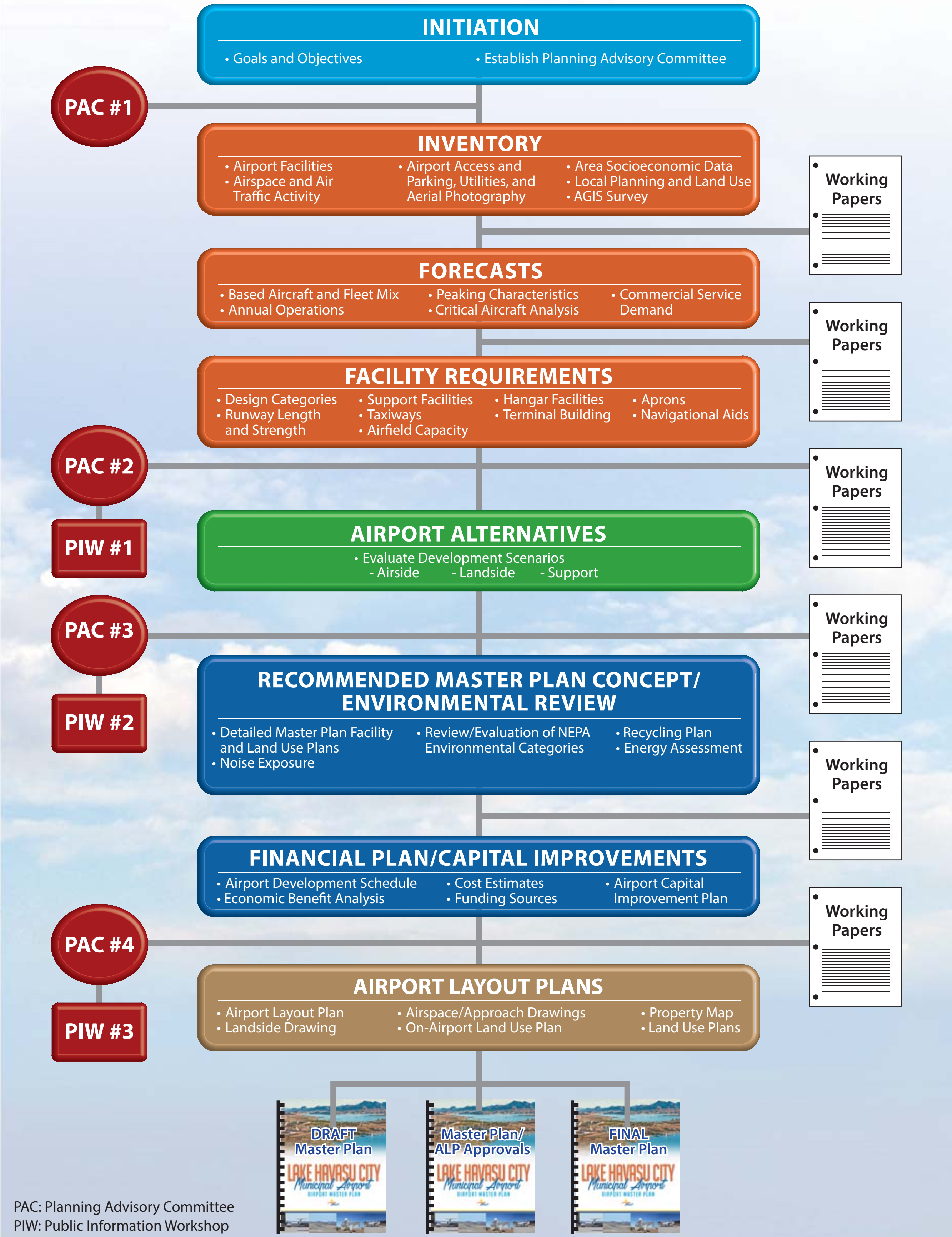


Exhibit iA
PROJECT WORK FLOW

strengths and weaknesses of each proposed development alternative, with the intention of determining a single direction for development.

Element 6. Master Plan Concept and Capital Financial Plan provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the airport. A detailed ACIP 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 the airport.

Element 7. Airport Layout Plan 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 in determining grant eligibility and funding.

Element 8. Environmental Evaluation provides the city with proper guidance regarding, and 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 the implementation of the NEPA.

Element 9. Sustainability Plan consists of two tasks, a recycling plan and an energy assessment. The recycling plan explores existing recycling efforts at the airport and outlines opportunities to improve the diversion of waste from landfills. The energy assessment focuses on measures to improve energy efficiencies throughout the airport and identifies the potential for on-site renewable energy generation. With a sound sustainability plan, the airport can potentially reduce its operating costs and reduce its impact on the environment. The sustainability plan element will be included in this master plan as a stand-alone chapter or appendix.

Element 10. 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 workshops are also planned during the process to discuss study findings.

Element 11. 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.

In addition, an economic benefit analysis is being prepared that will measure and analyze the economic benefits created by aviation operations and activity at Lake Havasu City Municipal Airport. The key economic benefit measures are employment, payrolls, and output (defined as total private revenues and government agency operating budgets). Other important activity measures will be identified, including tax revenues generated, airport operations, and spending by visitors arriving via general aviation aircraft. The methodology used to evaluate economic benefits will be consistent with guidelines set out in the FAA publication, *Estimating the Regional Economic Significance of Airports*. This methodology is the standard widely followed by private and public sector analysts who study aviation and airport economic benefits. The economic benefit analysis will be included as an appendix in this master plan.

STUDY PARTICIPATION

The Lake Havasu City Municipal Airport Master Plan is a collaborative effort within the airport's community and region. This community includes local citizens, businesses, community organizations, city officials, airport users, airport tenants, as well as aviation organizations. As a component of the region, state, and national aviation systems, the master plan is of importance to both state and federal agencies responsible for overseeing the air transportation system.

TABLE A
Planning Advisory Committee
Lake Havasu City Municipal Airport Master Plan

Representing Entities
Airport Administration
Lake Havasu City Engineering Division
Lake Havasu City Public Works Division
Lake Havasu City Planning Division
Lake Havasu City Partnership for Economic Development
Lake Havasu City Council
Lake Havasu City Manager's Office
Airport Advisory Board
Federal Aviation Administration
Arizona Department of Transportation- Aeronautics Group
Arizona State Land Department
Arizona Military Airspace Working Group
Arizona Pilots Association
The Ninety-Nines
Experimental Aircraft Association
Civil Air Patrol
Airport Tenants / Users/ Pilots
Local Businesses

In order to assist in the development of this master plan, Lake Havasu City has identified a group of stakeholders, including government representatives, airport users and tenants, and the local community leaders to act in an advisory role in the development of the master plan. Members of this Planning Advisory Committee (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 is developed. **Table A** provides a list of those entities that are represented by the PAC.

A series of open house public workshops are also conducted as part of the study coordination effort. These workshops are designed to allow any and all interested parties to become involved 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 study can be found online at: **www.lhc.airportstudy.com.**

SWOT ANALYSIS

A SWOT analysis is a strategic business planning tool. SWOT is an acronym for **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats. This tool is applied to an action or a plan and it is used to identify internal and external forces and what effect they may have on the goal or objective of the plan. For this study, the SWOT analysis will be applied to the airport and its master planning effort. As a result, it provides a continuous vision and direction for the development of the Lake Havasu City Municipal Airport Master Plan.

SWOT DEFINITIONS

This SWOT analysis will group information into two categories**:**

- **Internal -** attributes of the airport and market area that may be considered strengths or weaknesses to the action, objective, or element.

- **External** - attributes of the aviation industry that may pose as opportunities or threats to the action, objective, or element, which, in this case, is the airport master plan.

The SWOT analysis further categorizes information into one of the following:

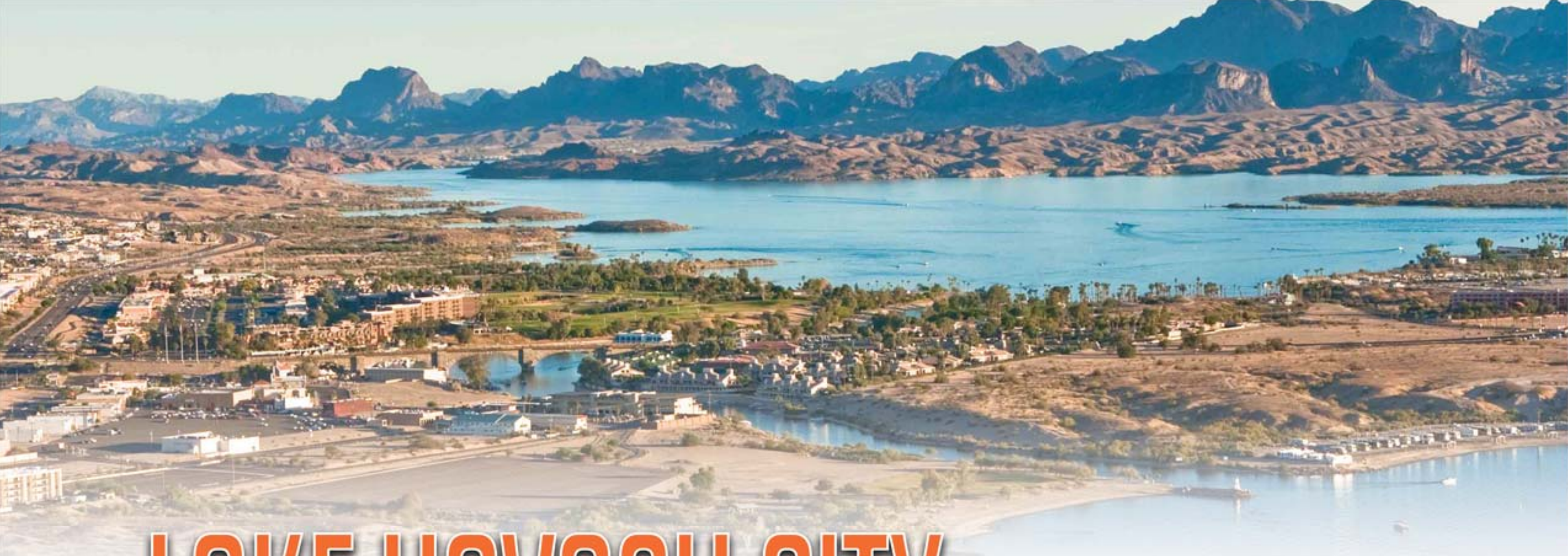
- **Strengths** - internal attributes of the airport that are helpful to achieving the action, objective, or element.
- **Weaknesses** - internal attributes of the airport that are harmful to achieving the action, objective, or element.
- **Opportunities** - external attributes of the industry that are helpful to achieving the action, objective, or element.
- **Threats** - external attributes of the industry that are harmful to achieving the action, objective, or element.

SWOT ANALYSIS EXERCISE

The SWOT analysis for the airport is based upon information gathered during the first PAC meeting that was conducted in October of 2018. As previously discussed, the PAC is a diversified group of stakeholders, community leaders, and governmental agencies that represent several interests in the airport. A SWOT analysis was conducted with this group to identify key factors that might be addressed in the master plan. A summary of the results from the SWOT analysis exercise is shown in **Table B** on the next page. These results were used to frame the subjective or judgmental processing of the data presented in the master plan.

TABLE B
SWOT ANALYSIS
Lake Havasu City Municipal Airport Master Plan

	Strengths	Weaknesses
Internal	Runway Length	Communicating the role of the airport
	Availability of developable land	Hangar availability
	Proximity to highway infrastructure	Accessibility to developable property (terrain)
	FBO's that provide a high level of service	Pavement strength/condition
	Favorable weather conditions for flight	Lack of designated helicopter parking areas
	Airport cleanliness/upkeep of airport	Fuel prices
	Wide array of aviation services offered	Lack of vehicle parking
	Facility capabilities	Inability to communicate with ATC on the ground
	Adequate separation from residential areas	Airport operating costs vs. airport revenue
	Accessibility of city services	
	Opportunities	**Threats**
External	Potential to expand hangars (hangar waiting list)	National pilot shortage
	Commercial/charter service	Impacts of worldwide events (oil prices, etc.)
	Education potential (flight training)	Encroachment of incompatible land uses around the airport
	Diversified economy that serves the local area (tourism)	Future funding eligibility
	Better communicate the value of the airport	Competition at nearby airports
	Partner with Economic Development	General aviation activity declining nationally



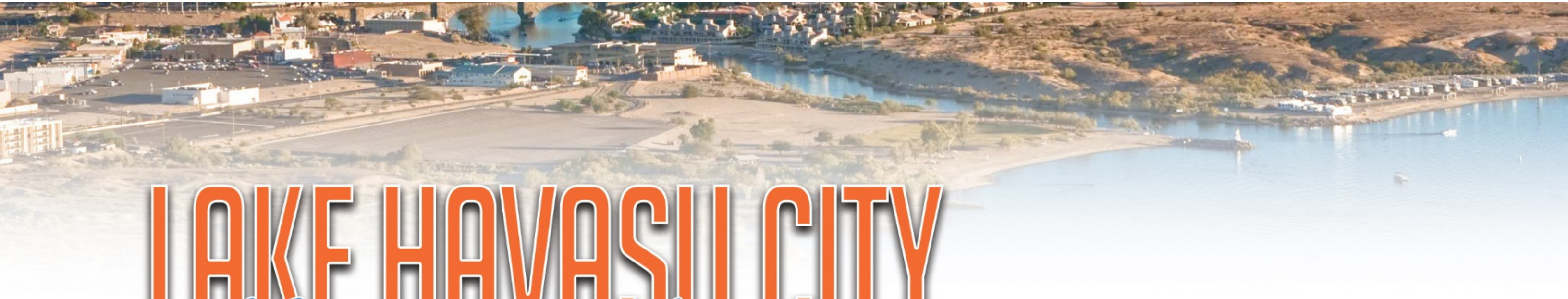
LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER ONE

INVENTORY



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER ONE INVENTORY

The inventory chapter for the Lake Havasu City Municipal Airport Master Plan is intended to give a summary of the existing facilities and conditions at the airport. Serving as a baseline for the preparation of the master plan, the inventory will outline the airport's current role in the national, regional, and local aviation system and provide an overview of the airport's physical and operational features. Specific, detailed information related to airport facilities, users, air traffic activity, land use, community socioeconomic data, and environmental conditions helps to provide an understanding of the future development potential for the facility.

The information outlined in this chapter provides a foundation for all subsequent chapters. Some of the information was obtained through on-site inspections of the airport and interviews with airport staff and tenants, as well as aerial and ground photography and project record drawings. Other useful sources of information include documents prepared by the Federal Aviation Administration (FAA), Arizona Department of Transportation – Aeronautics Group (ADOT), and Lake Havasu City. Also, pertinent online data has been collected as it relates to the airport and areas served by the airport. This inventory was conducted using the following sources of information:

- *Lake Havasu City General Plan*, adopted July 2015
- *Lake Havasu City Municipal Airport Master Plan,* February 2009
- *National Plan of Integrated Airport Systems,* October 2018
- *State Aviation System Plan Update*, October 2018
- *General Aviation Airports: A National Asset*, May 2012
- Lake Havasu City Visitors Bureau website
- Lake Havasu Partnership for Economic Development website
- Lake Havasu City website
- Arizona Commerce Authority
- Lake Havasu City Chamber of Commerce website

AIRPORT SYSTEM PLANNING ROLES

Airport planning exists on many levels: national, state, and local. Each level has a different emphasis and purpose. On a national level, Lake Havasu City Municipal Airport is included in the *National Plan of Integrated Airport Systems* (NPIAS). At the state level, the airport is included in the Arizona *State Aviation System Plan* (SASP). The local planning document is primarily the airport master plan, which was last updated and approved by Lake Havasu City in 2009.

FEDERAL AIRPORT PLANNING

The nationwide system of airports which exists today is a direct result of federal policy that promotes the development of civil aviation. Much of the nation's network of existing airports was initially constructed by the federal government. In most cases, maintenance and development of airports is still primarily funded through various federal grant programs that aid communities in the care of their respective airfields. As part of the continuing effort to maintain a thriving national airport system in the United States, Congress maintains a plan for development and maintenance of airports called the NPIAS.

Lake Havasu City Municipal Airport is classified in the current NPIAS (2019-2023) as a "regional" general aviation airport. Approximately 88 percent of airports included in the NPIAS are classified as general aviation facilities. Regional airports such as Lake Havasu City Municipal Airport are considered necessary in rural areas and small communities to support regional economies by connecting communities to regional and national markets. These airports generally have high levels of activity and account for approximately 37 percent of all general aviation airports. There is typically a substantial amount of charter (air taxi), private jet traffic, and helicopter activity at regional airports. These airports also serve emergency responders such as firefighting aircraft and air ambulance services. Approximately 11 percent of regional airports also have limited scheduled commercial service. **Table 1A** outlines and describes the different categories of general aviation airports.

TABLE 1A NPIAS General Aviation Airport Roles	
Role	**Description**
National	Supports the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.
Regional	**Supports regional economies by connecting communities to statewide and interstate markets.**
Local	Supplements communities by providing access to primarily intrastate and some interstate markets.
Basic	Links the community with the national airport system and supports general aviation activities (e.g., emergency services, charter or critical passenger service, cargo operations, flight training and personal flying).
Unclassified	Provides access to the aviation system.
Source: 2019-2023 National Plan of Integrated Airport Systems	

STATE AIRPORT PLANNING

Lake Havasu City Municipal Airport is included in the 2018 update of the Arizona SASP. **Table 1B** outlines and describes the roles of the public-use airports in the state as defined by the SASP. The SASP identifies Lake Havasu City Municipal Airport as a General Aviation – Community Airport, which is highlighted in **Table 1B**. The purpose of the SASP is to provide a framework for the integrated planning, operation, and development of Arizona's aviation assets. The 2018 SASP provides important insight into how Arizona's airports can remain highly advanced, safe, and responsive to the public's needs today and throughout the 20-year planning horizon.

The SASP outlines three basic goals for the 67 public use airports located in Arizona. They are as follows:

1. **Safety and Security**
   Arizona should maintain a safe and secure airport system as measured by compliance with applicable safety and security standards while supporting health and safety-related services and activities

2. **Fiscal Responsibility**
   Arizona should implement cost-effective investment strategies to meet current and projected demand while remaining adequately accessible to Arizona citizens, visitors, and businesses.

3. **Economic Support**
   Arizona should advance a system of airports that promotes Arizona's growth and development.

TABLE 1B State Airport Roles		
Role	**Role Parameters**	**Function**
Commercial Service - International	International commercial service	Year-round scheduled commercial service to international destinations for people and cargo. High levels of activity with many jets and multi-engine propeller aircraft.
Commercial Service - National	Domestic commercial service	Scheduled commercial service to domestic destinations for people and cargo. May provide seasonal scheduled commercial service to a limited number of international destinations. Moderate to high levels of activity with jets and multi-engine propeller aircraft.
Reliever	FAA-designated airport that relieves congestion at a commercial service airport	Serves to relieve congestion at commercial service airports. Supports the national air system and provides access to markets across the U.S. Moderate to high levels of activity with jets and multi-engine propeller aircraft.
General Aviation - Community	**250 instrument operations, 10 based aircraft or one based jet, and aircraft fuel**	**Supports regional economies and provides access to markets in Arizona and nearby states. Moderate levels of activity with jets and multi-engine propeller aircraft.**
General Aviation - Rural	2,500 operations or 10 based aircraft and aircraft fuel	Serves a supplemental role in local economies, primarily serving smaller business, recreational, and personal flying.
General Aviation - Basic	All other general aviation airports	Serves a limited role in the local economy, primarily serving recreational and personal flying.
Source: 2018 Arizona State Aviation System Plan Update		

LOCAL AIRPORT PLANNING

Locally, the master plan is the primary planning document for an airport. The master plan is intended to provide a 20-year projection for airport development based on aviation demand forecasts and facility needs. As previously detailed, Lake Havasu City Municipal Airport's last master plan was approved in 2009. As time passes, the forecast element of a master plan becomes less reliable due to changes in aviation activity and/or the economy. The FAA recommends that airports update their master plan every 7 to 10 years, or as necessary, to address any changes that may have occurred during the timeframe.

Another component of the master plan is the Airport Layout Plan (ALP) drawing set. The ALP drawings are used to depict existing and future development on the airfield.

AIRPORT HISTORY

Lake Havasu was formed by the construction of the Parker Dam from 1934-1938. The reservoir created nearly 450 miles of shoreline and was filled to its capacity of 211 billion gallons of water in 1940-1942. In 1963, Robert McCulloch, owner of McCulloch Motors, was flying over Lake Havasu looking for a place to test his outboard engines. He noticed that the land surrounding Lake Havasu had great potential for an emerging city. Lake Havasu City was established on September 30, 1963, as McCulloch and developer

C.V. Wood joined efforts and founded what would be a thriving community. After four years, a total of 16,520 acres were acquired and prepared for lease.

Lake Havasu City has a rich history of aviation that is responsible, in part, for the success of the community as it is known today. In 1964, the land had only one unimproved road into the city. McCulloch needed a way to get prospective buyers to the new city, so he chose air charter. Originally, the community had been served by an airport located at Pittsburg Point which was built in 1944, near the present-day city center and London Bridge. Between 1964 and 1978, 2,702 flights brought 137,000 potential land buyers to Lake Havasu City in a huge sales push that targeted mainly people from colder climates. In 1978, the last parcel of land was sold, and the city was incorporated later that year. By 1981, Lake Havasu City boasted a population of 17,000. In subsequent years, the city experienced population growth at a steady increase of about 1,000 people annually. Most came in search of refuge from big cities and to enjoy Lake Havasu City's beautiful weather and laid-back lifestyle. Over 50 years after Robert McCulloch's initial visit, Lake Havasu City is now home to over 54,000 people and a thriving tourism industry that attracts over 775,000 visitors annually.

In 1989, land area had been acquired by the city from the Bureau of Land Management (BLM) to build a new airport to replace the original airport located at Pittsburg Point. The present-day airport was commissioned on June 1, 1991. Designed and intended to serve the community as a commercial service airport, the facility was originally equipped with instrument approach capabilities, an automated weather observation station, and a 5,500-foot long runway. It also featured a parallel taxiway system, a terminal area apron, a terminal building, a fuel storage facility with three 12,000-gallon fuel tanks, and an airport rescue and firefighting (ARFF) facility.

CAPITAL IMPROVEMENTS

Significant improvements have been made to the present-day airport since its establishment in 1991. To assist in funding capital improvements, the FAA and ADOT have provided funding assistance to Lake Havasu City through the Airport Improvement Program (AIP). Airport improvement funds are collected through user fees, additional taxes on airline airfares, and aviation fuel taxes. As airports grow, or safety standards change over time, funding is needed to maintain a safe and efficient airport environment. The *Airport and Airway Development and Revenue Act* of 1970 established the Aviation Trust Fund which funds the AIP. Generally, federal AIP grants fund 91.06 percent of FAA-approved airport improvement projects for general aviation airports in the State of Arizona. Airport sponsors are responsible for the remaining 8.94 percent; however, through Arizona's State Aviation Fund, airport sponsors are eligible to receive state matching grants for 50 percent of the sponsor's share. As a result, a typical project cost is broken out as 91.06 percent federal funding, 4.47 percent state funding, and 4.47 percent airport sponsor funding. **Table 1C** summarizes approximately $3.76 million in grant-aided capital improvement projects undertaken at the airport since 2007. Of this total, the airport has received approximately $1.78 million in federal grants and $1.98 million in state grants. This has included funding for a variety of airport improvement projects such as taxiway construction, airport guidance signs, weather observation equipment, and other miscellaneous airport improvements.

TABLE 1C
Capital Improvement History
Lake Havasu City Airport

Year	Grant Number	Project Description	Grant Amount
FEDERAL GRANTS			
2007	AIP19	Install Airfield Guidance Signs	$389,819
2008	AIP20	Install Weather Reporting Equipment	$35,685
2009	AIP21	Construct Taxiway, Improve Airport Erosion Control	$60,800
2010	AIP22	Airport Miscellaneous Improvements, Install Airfield Guidance Signs, Install Taxiway Lighting, Rehabilitate Apron	$350,200
2011	AIP23	Install Miscellaneous NAVAIDS [Relocate airport rotating beacon], Rehabilitate Runway 14-32 Lighting	$204,077
2012	AIP24	Install Apron Lighting	$196,210
2016	AIP25	Acquire Emergency Generator, Airport Miscellaneous Improvements	$40,000
2017	AIP26	Miscellaneous Airport Improvements, Install Emergency Generator	$500,000
Subtotal Federal Grants			**$1,776,791**
STATE GRANTS			
2008	8F71	Install Airfield Guidance Signs	$9,607
2008	8S17	Design a New Terminal Building and Adjacent Ramp at Taxiway C.	$0
2008	8S88	Design and Install Weather Reporting Equipment	$112,500
2009	9F45	Install Weather Reporting Equipment	$939
2010	10F06	Install Guidance Signs, Improve Utilities at Electrical Vault and Fire Hydrant Protection, Install Taxiway B Lighting, Improve Airport Erosion Control on a Slope Between Taxiway A and North Apron Area, Construct North Apron Connecting Taxiway (Design Only)	$1,456
2011	1F23	Install Airfield Guidance Signs, Install Taxiway Lighting and Markings, Rehabilitate Apron, and Miscellaneous Airport Improvements	$9,188
2012	2F1D	Design/Construct Relocation of the Rotating Beacon, Design Electrical Vault Building and Security Lights	$5,529
2012	2S2X	Replace Precision Approach Path Indicator Units on Runway 14	$38,588
2013	3S1R	Thin Asphalt Overlay	$1,269,393
2013	3F2P	Install Main Apron Lighting	$8,716
2015	5S1Q	Relocate Existing Fire Hydrant	$36,000
2015	5S1R	Construct Erosion and FOD Control Improvements Near Runway 14 and Taxiway A, Construct Drainage Improvement for Runway 14/32	$465,769
2018	7F3H	Replace Electrical Vault and Acquire Emergency Generator (Design Only)	$1,444
2018	8M16	Replace Electrical Vault and Acquire Emergency Generator	$24,545
Subtotal State Grants			**$1,983,674**
TOTAL ALL GRANTS			**$3,760,465**

Source: FAA and ADOT-MPD - Aeronautics Group

AIRPORT ADMINISTRATION

Lake Havasu City Municipal Airport is owned, operated, and maintained by Lake Havasu City. Daily operations are managed by an airport manager whose staff perform a variety of supporting roles. All airport staff members are employed by Lake Havasu City and are supported by an Airport Advisory Board which consists of seven members. The board provides citizen input to the city council for the improvement of Lake Havasu City Municipal Airport to ensure the airport's fiscal health and prosperity. The committee meets to discuss airport matters monthly and make recommendations to the city council regarding airport business. Board members serve three-year terms and elect a chairperson and vice-chairperson to serve the committee.

REGIONAL SETTING

Lake Havasu City is located on the border of Arizona and California in the southwest corner of Mohave County, Arizona. Mohave County is located at the northern and western borders of the Sonoran Desert. The city is situated at the base of the Mohave Mountains and on the eastern shore of Lake Havasu. Elevations range between 450 feet above mean sea level (MSL) at the lake shore to as high as 1,500 feet in the foothills of the Mohave Mountain Range. The nearest metropolitan areas are Las Vegas, Nevada which is 150 miles northwest; Phoenix, Arizona located 200 miles southeast; and Los Angeles, California located 320 miles southwest.

AIRPORT LOCATION

As depicted on **Exhibit 1A**, Lake Havasu Municipal Airport is located six miles north of Lake Havasu City. It is accessible by road via Arizona State Highway 95 and Airport Center Boulevard to the west. The airport consists of approximately 646 acres of property owned by Lake Havasu City and is situated at an elevation of 783 feet MSL.

Lake Havasu City Municipal Airport Entrance Sign

TRANSPORTATION NETWORK

Primary regional access to Lake Havasu City is provided by State Highway 95. Highway 95 runs north/south between Interstate 40 and Interstate 10 and parallels airport property immediately to the west. Direct access to the airport is provided via Airport Centre Boulevard and Retail Centre Boulevard.

Driving directions from Phoenix, Arizona: Drive west on Interstate 10. Take Exit 19 marked Parker/Yuma to Arizona Highway 95 north. Continue driving on Highway 95 until arriving in Lake Havasu City.

Driving Directions from Las Vegas, Nevada: Drive Highway 93 south to Kingman, Arizona. Then take Interstate 40 west to Highway 95 south to Lake Havasu City, which is about 60 miles from Kingman, Arizona.

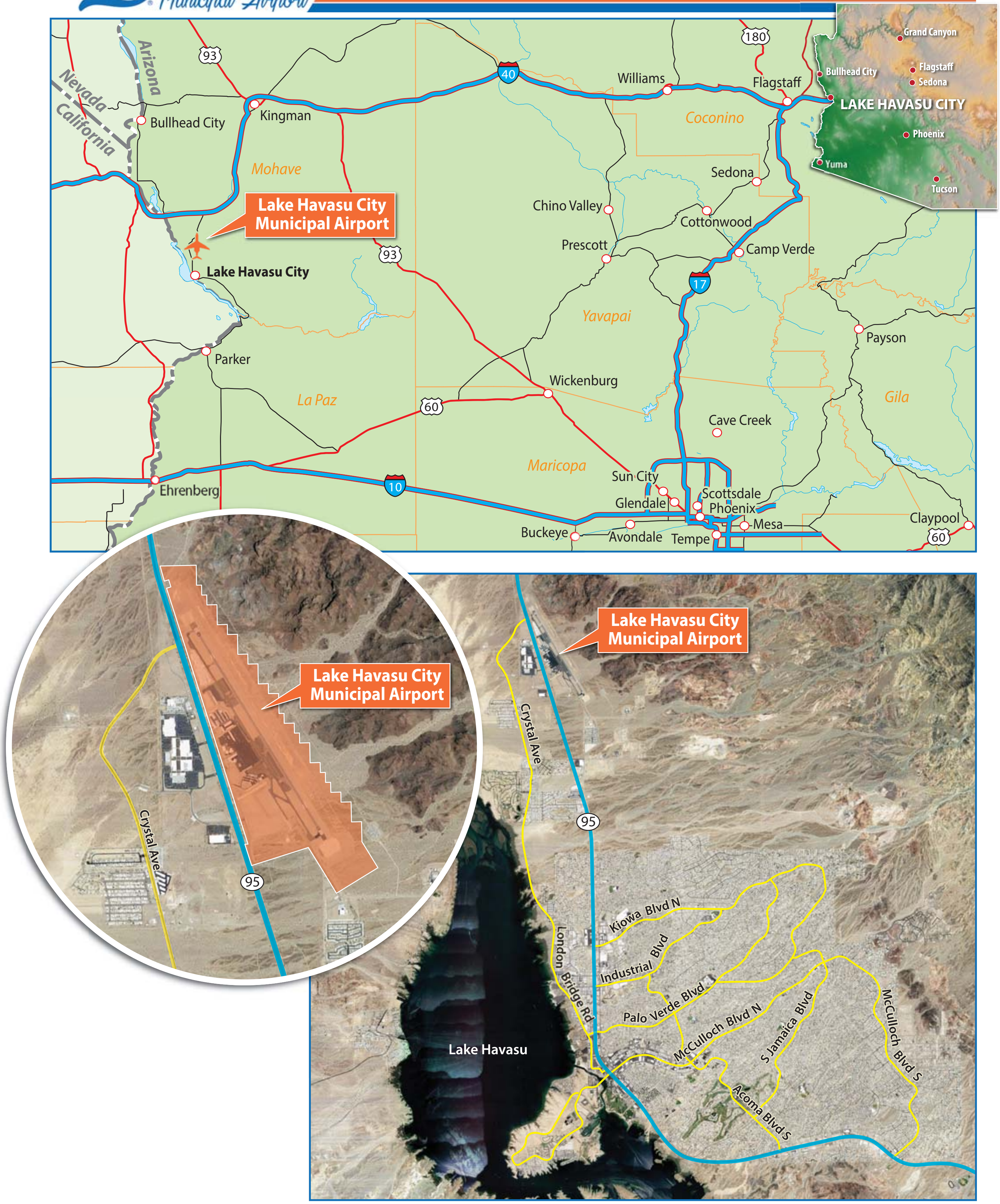


Exhibit 1A
LOCATION MAP

REGIONAL CLIMATE AND WEATHER CONDITIONS

Climate must be a consideration when preparing an airport master plan. Weather and climate can affect what types of operations can be conducted at an airfield. Average temperatures are an important part of determining runway length requirements, while prevailing wind patterns determine runway orientation, and It is also necessary to consider weather extremes such as harsh winters or excessive summer heat.

The climate for Lake Havasu City has historically been observed as generally warm and dry, which is common for its location in the Sonoran Desert of the American Southwest. Summers are very warm with little precipitation and occasional thunderstorms occurring during the late summer, which is often referred to as “monsoon” season. Spring and fall are typically drier, while winters are usually mild and are generally when the region receives most of its average annual rainfall. Snowfall is very rare. Historical data shows January as the month in which the most precipitation occurs in the region. Daily temperature variations can be up to 30 degrees Fahrenheit. The National Oceanic Atmospheric Administration (NOAA) notes an average annual high temperature of 109.2 degrees in the month of July and an average annual low temperature of 43.0 degrees in December. Wind patterns in the region are typically from the southwest, and wind speeds are consistently between six to eight knots with peak average wind speeds occurring in the springtime. Graphs of monthly average temperature, precipitation, and windspeed can be found on **Exhibit 1B**. Historical weather data presented in the exhibit was observed from a nearby weather observation system located at the Needles Airport. Historical weather data from Lake Havasu City Municipal Airport is not available.

Table 1D
Weather Conditions
Lake Havasu City Municipal Airport

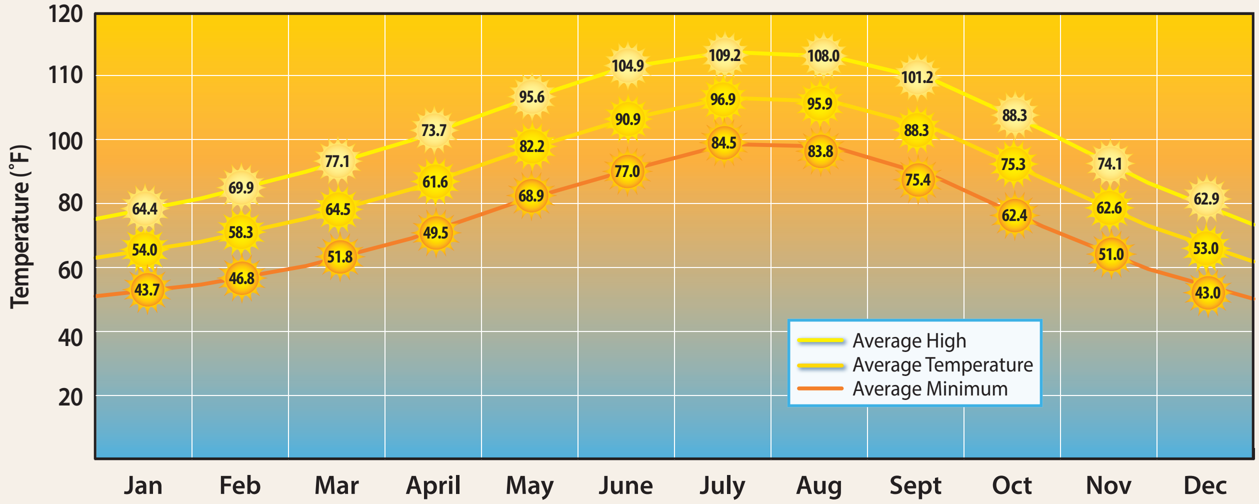
Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1000' AGL	> 3 statute miles	99.60%
IMC	≥ 500' AGL to < 1000' AGL	1-3 statute miles	0.23%
PVC	< 500' AGL	< 1 statute miles	0.17%

VMC- Visual Meteorological Conditions
IMC- Instrument Meteorological Conditions
PVC- Poor Visibility Conditions
AGL- Above Ground Level
Note: Weather observations obtained from Needles Airport
Source: NOAA National Climatic Data Center January 2008 - December 2017

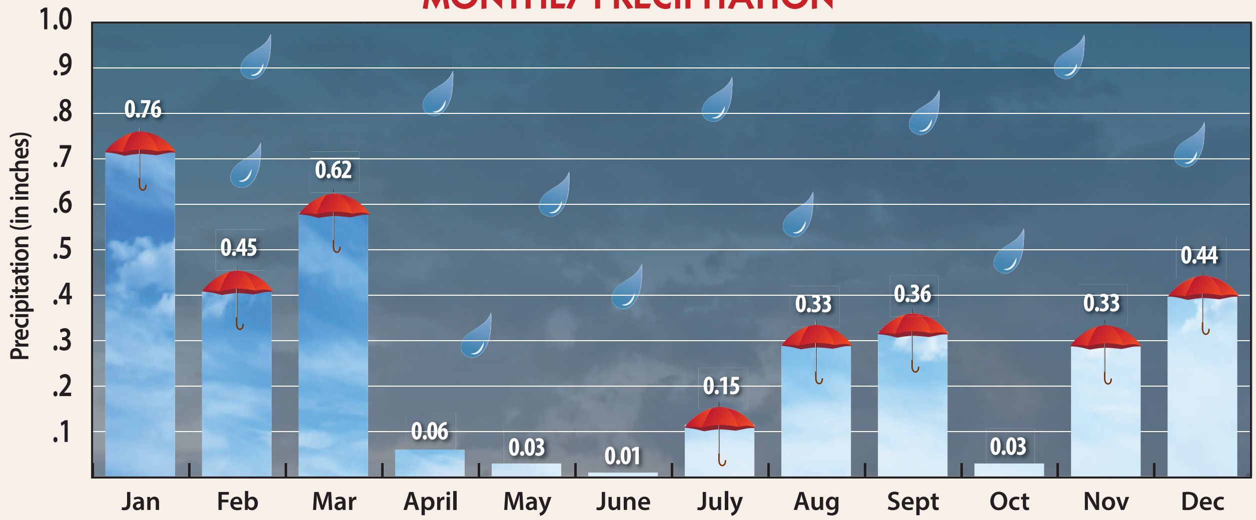
There are three basic types of weather conditions recognized by the aviation community: visual meteorological conditions (VMC), instrument meteorological conditions (IMC), and poor visibility conditions (PVC). In VMC, a pilot may elect to fly under visual flight rules (VFR), which means he/she is responsible for their own separation from other aircraft traffic. If conditions are not favorable for VFR flight, such as conditions that exist under IMC, a pilot must fly under instrument flight rules (IFR) and file an instrument flight plan. Flying in IMC would make it necessary for the pilot to rely on instrumentation to safely conduct a flight under these conditions. IMC indicates that cloud ceilings are below 1,000 feet above the ground and visibility less than three miles. Any weather conditions less than IMC are known as PVC.

According to the Needles Airport weather observations, VMC occurs 99.6 percent of the time. Combined, IMC and PVC conditions occur less than one percent of the time. A breakdown of weather condition data is available in **Table 1D**.

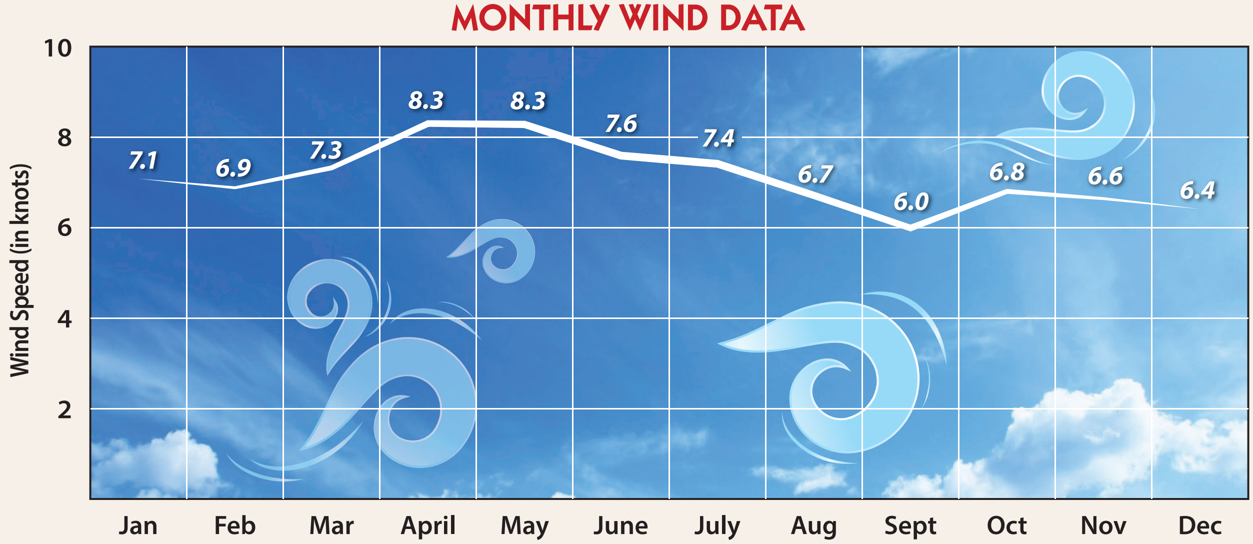
MONTHLY TEMPERATURES



MONTHLY PRECIPITATION



MONTHLY WIND DATA



Source: NOAA temperature and precipitation climate normal, Station ID: GHCND:USW00013964 (1981-2010). Wind data, Needles Airport ASOS.

AIRPORT ACTIVITY

Records of airport operations are essential for determining required facilities (types and sizes), as well as eligibility for federal funding. Airport staff and the FAA record key operational statistics, including aircraft operations and based aircraft. Analysis of historical activity levels aid in projecting future trends which will enhance the airport's ability to plan for future facility demands. The following sections detail specific operational activities.

BASED AIRCRAFT

Identifying the current number of based aircraft is important to the master planning analysis. An accurate number of based aircraft helps determine existing demand for facilities at the airport, including aircraft storage needs, parking apron space, pilot and passenger services, and other support facilities. **Table 1E** provides a summary of based aircraft for Lake Havasu Municipal Airport as reported by airport management. As presented, there are currently 163 reported aircraft based at the airport which includes single engine, multi-engine, turboprop, jet, helicopter, and ultralight aircraft.

Based Aircraft

AIRCRAFT OPERATIONS

Aircraft operations (takeoffs and landings) are another indicator of aeronautical activity at Lake Havasu City Municipal Airport. Aircraft operations are classified as local or itinerant. Local operations often consist of touch-and-go or pilot training activity. Itinerant operations consist of aircraft that arrive from or depart to destination airports outside the local operating area.

Aircraft operations can be separated into four general categories: air carrier, air taxi, general aviation, and military. Due to the absence of an airport traffic control tower (ATCT) at the airport, it can be difficult to maintain an accurate count of the airport's operations. An estimated account of annual activity is available via the FAA *Terminal Area Forecast* (TAF) publication. The most current data estimates that Lake Havasu City Municipal Airport has approximately 45,000 operations per year. The TAF provides a breakdown of estimated operation totals for the airport by type. **Table 1E** further details the operations totals identified in the TAF.

- **Air Taxi** - operations associated with aircraft originally designed to have no more than 60 passenger seats or a cargo payload of 18,000 pounds, carries cargo or mail on either a scheduled or charter basis, and/or carries passengers on an on-demand basis or limited scheduled basis.
- **General Aviation** - civil aviation operations other than scheduled air services that can range from ultralights to large business jets.
- **Military** - operations conducted by aircraft and helicopters with a military designation.

It is important to note that there are no commercial air carrier operations currently taking place at the airport. This master plan is tasked with analyzing the future potential for commercial air carrier activity at the airport. Analysis related to this activity segment will be conducted when preparing forecasts of aviation demand in the next chapter.

TABLE 1E
Based Aircraft and Annual Operations
Lake Havasu City Municipal Airport

Based Aircraft	2018
Single Engine	124
Multi-engine	9
Turboprop	5
Jet	7
Helicopter	5
Other (Ultralight)	10
Total	**160**
Annual Operations	
Itinerant	
Air Taxi	1,700
General Aviation	21,950
Military	350
Total Itinerant	**24,000**
Local	
General Aviation	21,000
Total Local	**21,000**
Total Operations	**45,000**

Source: Airport Records; *Terminal Area Forecast* (January 2019)

ON-AIRPORT FACILITIES INVENTORY

This section provides a description of the existing facilities at Lake Havasu Municipal Airport. Airport facilities can be classified under two broad categories: airside facilities and landside facilities. The airside category includes facilities directly related to aircraft operations such as runways, taxiways, lighting, marking, navigational aids, and weather reporting. The landside category includes those facilities necessary to provide a safe transition from surface to air transportation and support aircraft parking, servicing, storage, maintenance, and operational safety.

AIRSIDE FACILITIES

The airside facilities are depicted and detailed on an aerial photograph for visual reference on **Exhibit 1C**. Airside facility data is discussed in the following sections.

Runway 14-32

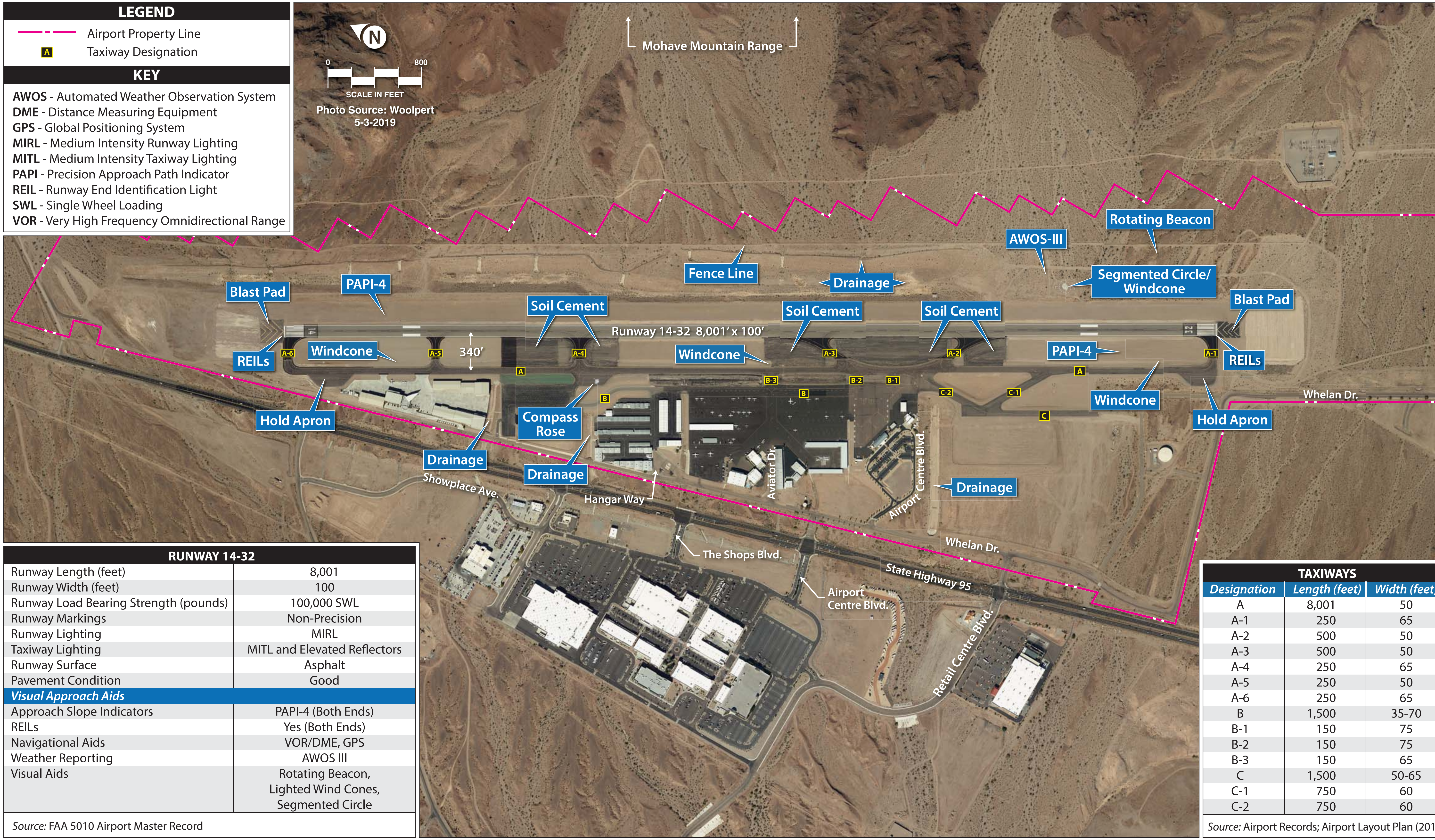
Lake Havasu City Municipal Airport has a single runway orientated northwest-southeast. Runway 14-32 is designated as such based on the magnetic heading a pilot would be reading when departing from or on final approach to the runway. The asphalt-paved runway is 8,001 feet in length and 100 feet wide. The runway pavement is considered by the FAA 5010 *Airport Master Record* to be in “good” condition.

LEGEND

- Airport Property Line
- Taxiway Designation

KEY

AWOS - Automated Weather Observation System
DME - Distance Measuring Equipment
GPS - Global Positioning System
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
PAPI - Precision Approach Path Indicator
REIL - Runway End Identification Light
SWL - Single Wheel Loading
VOR - Very High Frequency Omnidirectional Range



RUNWAY 14-32	
Runway Length (feet)	8,001
Runway Width (feet)	100
Runway Load Bearing Strength (pounds)	100,000 SWL
Runway Markings	Non-Precision
Runway Lighting	MIRL
Taxiway Lighting	MITL and Elevated Reflectors
Runway Surface	Asphalt
Pavement Condition	Good
Visual Approach Aids	
Approach Slope Indicators	PAPI-4 (Both Ends)
REILs	Yes (Both Ends)
Navigational Aids	VOR/DME, GPS
Weather Reporting	AWOS III
Visual Aids	Rotating Beacon, Lighted Wind Cones, Segmented Circle

Source: FAA 5010 Airport Master Record

TAXIWAYS

Designation	*Length (feet)*	*Width (feet)*
A	8,001	50
A-1	250	65
A-2	500	50
A-3	500	50
A-4	250	65
A-5	250	50
A-6	250	65
B	1,500	35-70
B-1	150	75
B-2	150	75
B-3	150	65
C	1,500	50-65
C-1	750	60
C-2	750	60

Source: Airport Records; Airport Layout Plan (2010)

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Runway Strength

Based on the design construction of the pavement, a runway can provide differing load-bearing capacities. Pavement strength is an indication of the runway material's ability to withstand repeated use by aircraft on a regular basis. There are different aircraft landing gear configurations that displace aircraft weight differently, thereby affecting a runway's ability to handle the load. Single wheel loading (SWL) refers to having one wheel per landing gear strut. Dual wheel loading (DWL) and dual tandem wheel loading (2D) include the design of aircraft with additional wheels on each landing gear strut which help distribute the aircraft's weight on the runway surface. Information attained from the FAA 5010 Airport Master Record indicates Runway 14-32 has a weight-bearing capacity of 100,000 pounds SWL. No other weight-bearing information is listed for other types of gear configuration. This runway strength rating is usually acceptable for all types of general aviation aircraft operating in the current fleet mix.

Runway Blast Pad

Runway 14-32 has been outfitted with runway blast pads serving each end. Blast pads are designed to reduce erosion created by jet blast or propeller wash. Runway 14 has an asphalt blast pad that measures 200 feet long by 200 feet wide. Runway 32 has a similar pad which measures 200 feet long by 140 feet wide. Both pads are marked with yellow chevrons so that pilots do not mistake the pads for usable runway length.

Runway Markings

Pavement markings are important to aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. Runway 14-32 has non-precision runway markings that include runway designations, centerline, edges, aiming points, and threshold markings.

Runway Markings

Soil Stabilization Areas

Soil cement is used in areas adjacent to the runway environment. It is a construction material consisting of a mix of pulverized natural soil with small amounts of portland cement and water compacted to high density. The material is used to stabilize the area, reduce erosion, and prevent jet blast from creating foreign object debris (FOD) on the runway.

Taxiways

Lake Havasu City Municipal Airport features several taxiways for transitioning aircraft. Taxiway A is a full-length parallel taxiway situated adjacent to the west side of Runway 14-32 and separated from the runway centerline by 340 feet. There are six entrance/exit taxiways connecting parallel Taxiway A and Runway 14-32 that are sequentially designated in order from south to north, beginning with Taxiway A1 at the south end of the runway through Taxiway A6 at the north end. Taxiways A2 and A3 provide high-speed angled exits. Angled taxiways allow aircraft to exit the runway area more efficiently and increase airfield capacity. Two hold aprons are situated adjacent to Taxiway A at each end of the runway. Hold aprons serve as run-up areas for departing aircraft to complete equipment checks prior to takeoff. Taxiway B is located 200 feet west of Taxiway A, and the two are connected by Taxiways B1, B2, and B3. Taxiway B provides access to various aircraft parking aprons, the terminal area, and other aviation-related facilities. Taxiways C1 and C2 extend west from Taxiway A and lead to Taxiway C, which provides access to vacant land intended for future airport development to the south. Further information related to airfield taxiways is presented on **Exhibit 1C**.

Taxiway Markings

Compass Rose

Airport Markings

Pavement markings aid in the movement of aircraft along the airport surfaces and identify closed or hazardous areas on the airport. Taxiway, taxilane, and apron centerline markings are provided to assist pilots in maintaining proper clearance from pavement edges and objects near the taxiway edges. Holding positions are also marked on the connector taxiways leading directly to Runway 14-32. The hold lines serve as alert markings to prevent pilots from entering the runway environment inadvertently. Several helicopter parking areas are available on the main apron, and aircraft tiedown positions are also identified on various apron surfaces. Adjacent to the intersection of parallel Taxiway A and Taxiway A4, the airport features a compass rose. The compass rose is used by pilots to ensure that an aircraft's magnetic compass is calibrated accurately, or it can be used to re-calibrate as needed.

Airfield Lighting and Signage


Airport Rotating Beacon

Airfield 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 are categorized by function and include the following:

- **Airport Identification Lighting:** Identification lighting is provided by the airport rotating beacon. Rotating beacons are used to identify an airport from long distances at night or during IMC weather conditions and give the pilot information about the type of airport they are approaching. The airport beacon identifies types of airport facilities by color and frequency of light output. For example, alternating white and green for civilian land airports; alternating white and yellow for seaplane airports; flashing white, yellow, and green for a heliport; and two quick white flashes alternating with a green flash identifies a military airport. Lake Havasu City Municipal Airport is a civilian land airport and, as such, emits two beams of light, one white and one green, visible for 180 degrees with each rotation of the beacon. The rotating beacon is located in the southeast area of the airport approximately 800 feet northeast of the Runway 32 threshold.

- **Runway and Taxiway Lighting/Signage:** Runway and taxiway lighting utilize 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 poor visibility conditions. These lights provide guidance on the airport to maintain safe and efficient access from the runway to the aircraft parking areas. Runway 14-32 is equipped with medium intensity runway lights (MIRL). The runway also features threshold lighting similar to the edge lighting fixtures, except these lights are designed with lenses to appear green on approach and red on departure from either end of the runway. Taxiway A and connector Taxiways A1, A2, A3, A4, A5, and A6 are served with medium intensity taxiway lighting (MITL). Taxiway B and connector Taxiways B1, B2, B3,


Threshold Lighting

C1, and C2 are also equipped with MITL. Taxiway C is only equipped with elevated edge reflectors.

Signage is another important feature of the airport movement areas. Airport movement area signage consists of signs noting runway and taxiway designations, holding positions, routing/directional, runway end and exits, and runway distance remaining.

- **Visual Approach Lighting:** Each end of Runway 14-32 is equipped with visual approach lighting in the form of a four-box precision approach path indicator (PAPI-4). The PAPI consists of a system of lights located approximately 800 feet from each runway end threshold. These lights give an indication of being above, below, or on the designated descent path to the runway threshold. A PAPI system has a range of five miles during the day and up to 20 miles at night. The PAPI system serving Runway 14 provides a 3.50-degree glide path which is greater than normal, to allow a higher aircraft descent path. The PAPI system associated with Runway 32 has a normal 3.00-degree glide path.

PAPI-4 serving Runway 14

- **Runway End Identifier Lights:** Runway 14-32 is also equipped with runway end identifier lights (REILs) at each end. REILs provide rapid and positive identification of the end of the runway. The system consists of two synchronized, unidirectional flashing lights. The lights are positioned on each corner of the runway landing threshold, facing the approach area and aimed at an angle of 10 to 15 degrees.

REIL serving Runway 14

All runway and taxiway lighting systems can be controlled at Lake Havasu City Municipal Airport by using an aircraft's radio transmitter. The lighting can be adjusted to the pilot's preference by tuning the radio to the airfield's common traffic advisory frequency (CTAF). This system, which is referred to as pilot-controlled lighting, allows pilots to increase or decrease the intensity of the airfield lighting system from the aircraft.

Weather and Communication Aids

The airport is equipped with an Automated Weather Observation System III (AWOS-III). An AWOS automatically records weather conditions such as wind speed, wind gusts, wind direction, temperature, dew point, altimeter setting, density altitude, visibility, precipitation, and cloud height. This information is then transmitted at regular intervals on radio frequency 119.025 MHz. The same information is also available through a dial-in telephone number (928-764-2309). The AWOS is located approximately 500 feet east of Runway 14-32 in the southeast area of the airfield.

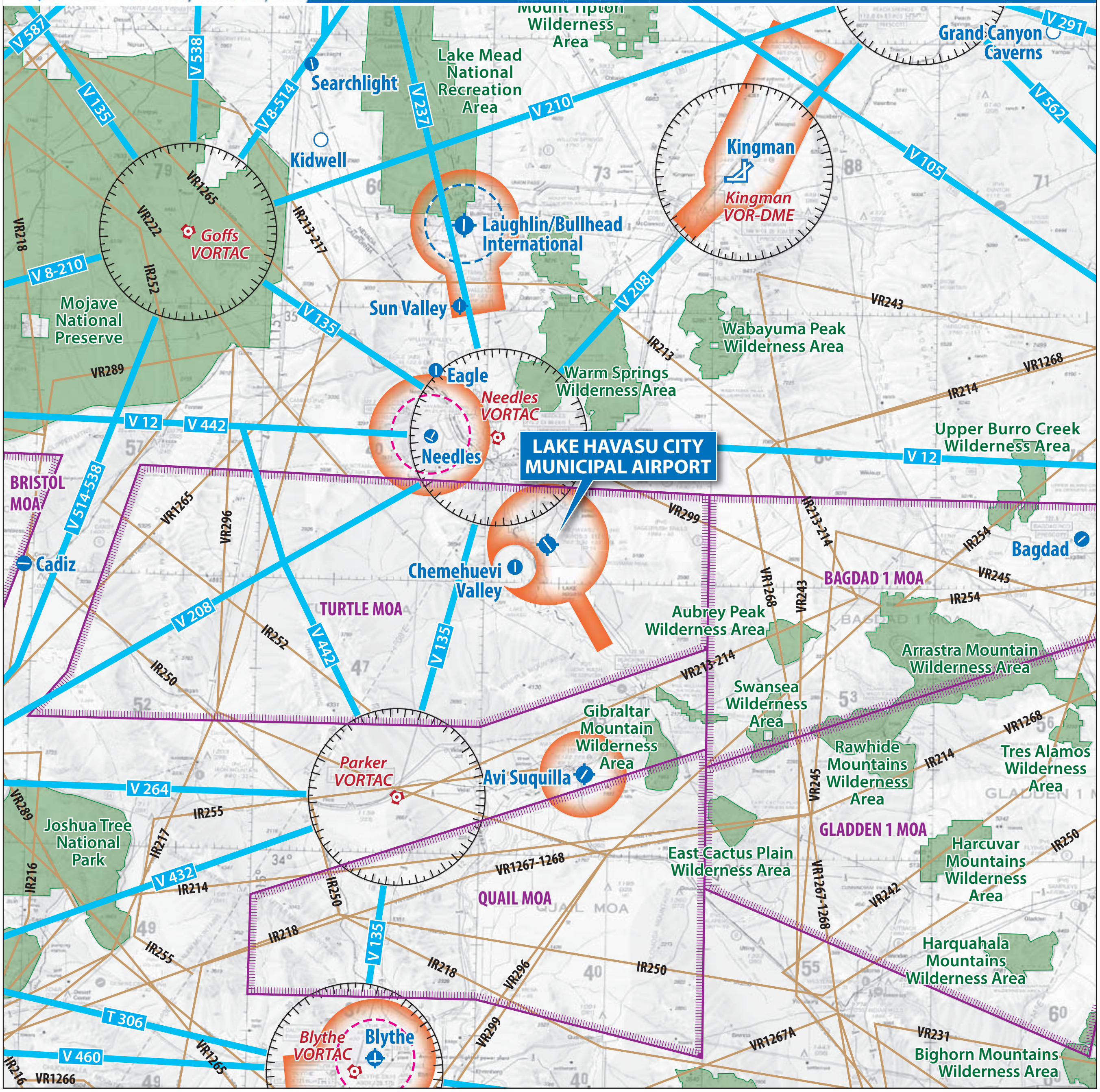
Automated Weather Observation System (AWOS)

The airport is also equipped with a lighted wind cone and segmented circle approximately 400 feet east of the runway, near the AWOS. The wind cone indicates wind speed and direction information to pilots, and the segmented circle indicates aircraft traffic pattern information. Three supplemental wind cones are also situated in areas between Runway 14-32 and parallel Taxiway A.

Lake Havasu City Municipal Airport utilizes a CTAF, which was briefly discussed in the previous section. This radio frequency (122.7 MHz) is used by pilots in the vicinity of the airport to communicate with each other in order to maintain proper aircraft separation at the airport. In addition, a UNICOM frequency, which shares the same frequency as the CTAF, can be used to contact ground services upon arrival.

Navigational Aids

Navigational aids are electronic devices that transmit radio frequencies into point-to-point guidance and position information. Aircraft operating in the vicinity of Lake Havasu City Municipal Airport can utilize the network of very-high frequency omni-directional range (VOR) facilities. Military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. Another system that is commonly combined with VORs is Distance Measuring Equipment (DME). A VOR/DME gives pilots bearing information to or from a station, and the DME provides distance information to aircraft that are equipped with the necessary equipment and instrumentation. Three facilities nearby serve the airport with ground-based navigational aids. The Needles VORTAC is located 13 nautical miles northwest of the airport, the Parker VORTAC is 32 nautical miles southwest of the airport, and the Kingman VOR/DME is located 46 nautical miles northeast of the airport. Each station is active and available for use. **Exhibit 1D** provides a graphical depiction of nearby ground-based navigational aids.



LEGEND

- Airports with other than hard-surfaced runways
- Airports 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
- Wilderness Area
- Class D Airspace
- Class E Airspace
- Class E Airspace with floor 700' above surface
- Military Training Routes
- Victor Airways
- Alert Area and MOA - Military Operations Area

Source: Phoenix Sectional Chart, US Department of Commerce, National Oceanic and Atmospheric Administration, April 26, 2018

The most commonly used navigational aid is the global positioning system (GPS). GPS is a "constellation" of approximately 30 satellites orbiting Earth, making it possible for users with ground receivers to pin-point their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Most aircraft today are equipped with GPS receivers, and GPS is the primary navigational aid used by modern aviators. GPS allows pilots to determine altitude, speed, and location so they can directly navigate to a specified point without using any ground-based navigational facility.

LANDSIDE FACILITIES

At a general aviation airport like Lake Havasu City Municipal Airport, landside facilities support the aircraft and pilot/passenger handling functions, as well as other non-aviation facilities typically providing a revenue stream to the airport. These facilities can often include a terminal building, general aviation facilities, and support facilities such as fuel storage, vehicle parking, roadway access, and ARFF. As mentioned, non-aviation related facilities such as restaurants and industrial parks may also constitute landside development. The primary landside facilities at the airport are identified on **Exhibit 1E**.

Terminal Building

The terminal building at Lake Havasu City Municipal Airport was built in 1991 and provides approximately 5,700 square feet. The terminal building can be accessed via Airport Centre Boulevard, a loop road that provides access from the west side of the terminal. The terminal building is situated in a desirable mid-field location west of Runway 14-32.

The terminal building was originally designed to serve commercial passenger functions. As such, it offers offices for airline management and staff, airline ticketing counters, baggage claim, and a secured area for passenger boarding. These areas are currently vacant, as no scheduled commercial airline services are offered at the airport. Also available in the terminal building are several rental car service counters, offices for airport management, restrooms, waiting areas, and a vending area.

Terminal Building

Aircraft Parking Aprons

Lake Havasu City Municipal Airport maintains several general aviation aircraft parking aprons. Combined, aircraft parking aprons for Lake Havasu City Municipal feature a total of 192 individual marked tiedown spaces on approximately 128,000 square yards of apron pavement.


Terminal Ramp Apron

The terminal apron is located immediately adjacent to the east side of the terminal building and measures approximately 11,000 square yards. This apron area has historically been designated and marked for commercial aircraft parking. Since the airport does not currently accommodate commercial airline activities, the apron area can be utilized by other aviation-related activities to include general aviation, air taxi, and military as needed. Two designated helicopter parking pads are located on the terminal apron southwest of the intersection of Taxiway B and B2.


Main Aircraft Tiedown Apron

The main aircraft tiedown apron is located to the north of the terminal ramp apron in the midfield area of the airport. This apron area encompasses approximately 80,000 square yards and provides 142 individual aircraft parking positions. Included in the total number of spaces, and parallel to Taxiway B on the main general aviation apron, are eight larger marked tie-downs used for corporate jet parking or helicopter parking. The remainder of the tiedowns are for transient and permanent aircraft parking.


North Ramp Apron

The north ramp apron is located north of the private storage hangar area. This apron area encompasses approximately 17,500 square yards and provides 48 marked aircraft parking positions.

The Havasu Air Center complex on the north side of the airfield provides approximately 19,400 square yards of additional apron space and is marked with six aircraft parking tiedowns. In addition, there is one helicopter parking pad on the northernmost part of the facility's apron adjacent to the fuel farm.

ID	Hangar/Row Type	# of Units	Hangar Size (sf)
1	Linear Box Hangars	3	18,000
2	Conventional Hangar	1	11,200
3	Linear Box Hangars	4	14,400
4	Linear Box Hangars	2	9,200
5	Conventional Hangar	1	12,000
6	Conventional Hangar	1	10,000
7	Linear Box Hangars	2	12,800
8	Linear Box Hangars	3	14,800
9	Linear Box Hangars	3	5,200
10	Linear Box Hangars	3	5,200
11	Port-a-Port Hangars	8	12,000
12	Executive Box Hangar	1	2,500
13	Executive Box Hangars	10	18,000
14	Executive Box/Port-a-Ports	13	18,800
15	Executive Box Hangars	8	14,800
16	Executive Box Hangar	1	6,000
17	Executive Box Hangars	6	14,000
18	Executive Box Hangars	5	20,000
19	Linear Box Hangars	12	20,000
20	Linear Box Hangars	6	10,800
21	Executive Box Hangars	2	5,700
22	Executive Box Hangar	1	3,000
23	Conventional Hangar	1	15,000
24	Executive Box Hangar	1	8,000
25	Executive Box Hangar	1	4,900
26	Linear Box Hangars	6	20,000
27	Executive Box Hangar	1	3,300
28	Executive Box Hangar	1	3,000
29	Executive Box Hangar	1	6,600
30	Shade Port	1	4,000
31	Shade Ports	16	18,700
32	Shade Ports	7	4,800
	Under Construction		
33	T-Hangars	9	10,000
34	Executive/Box Hangars	5	10,000
35	Shade Ports	6	10,000
	Total	152	376,700

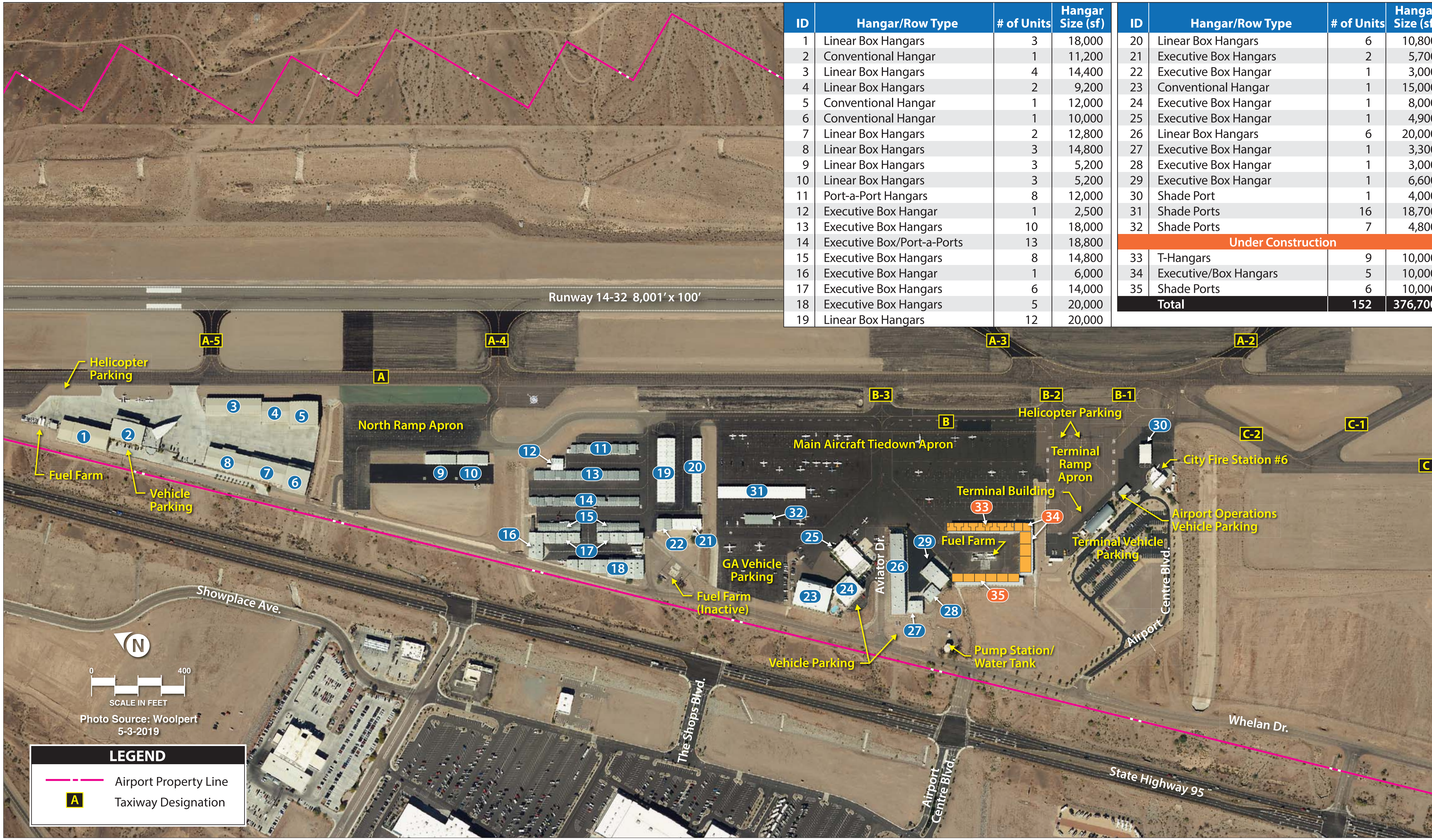


Exhibit 1E
EXISTING LANDSIDE FACILITIES

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Aircraft Hangar Facilities

Hangar facilities at Lake Havasu City Municipal Airport are comprised of conventional hangars, executive box hangars, linear box hangars, Port-a-Port hangars, and shade port hangars. Conventional hangars are large hangars, 10,000 square feet or more, and are used to accommodate multiple large aircraft for storage, maintenance activities, or various services. Executive box hangars are smaller than conventional hangars and range from 1,500 to 10,000 square feet. Executive box hangars are often able to hold multiple smaller aircraft or larger multi-engine or turbine aircraft. Linear box hangars provide for aircraft storage within a larger hangar complex. Port-A-Port hangars are smaller, fully enclosed individual hangars intended to store a single small aircraft. Port-a-Port hangars are also portable and can be relocated. Shade port hangars are open tiedown spaces with a protective roof structure to protect the aircraft from sun or weather damage and are not fully enclosed. The building inventory table on **Exhibit 1E** outlines hangar storage facilities at Lake Havasu City Municipal Airport.

Conventional Hangar

Shade Port Hangars

There are 122 individual enclosed aircraft hangars of various types and sizes and 30 shade port hangars providing a total of 152 hangars and approximately 376,700 total square feet of sheltered aircraft storage space at the airport. There are four conventional hangars at the airport that total approximately 48,200 square feet. Executive box hangar space consists of 35 units totaling approximately 129,000 square feet. Linear box and Port-a-Port hangars consist of 82 units totaling approximately 162,000 square feet, and 30 shade ports provide an additional 37,500 square feet of covered aircraft storage.

Executive Box Hangars

Port-a-Port Hangars

General Aviation Services

Businesses that choose to locate on an airport provide a significant impact not only to the airport, but also to the region. Encouraging businesses to locate in the vicinity of an airport is good practice for a number of reasons. First, the business will benefit from being near a commerce and transportation hub. Second, the community will benefit because the airport will develop a buffer of industry and manufacturing that will restrict incompatible land uses, such as residential housing, from locating too close to the airport. Third, business development on and around airports can generate a direct revenue stream to the airport. Some airports have done this successfully, leading to airport self-sufficiency.

Fixed Base Operators (FBO) are the primary providers of various aviation-related services. Some of the services that FBOs provide include aircraft fueling, flight training, aircraft maintenance, aircraft rental, hangars, aircraft parking and storage, and flight planning as well as pilot lounge areas, pilot supplies, courtesy vehicles, catering, and charter services.

There are two full-service FBOs that provide general aviation fueling services at Lake Havasu City Municipal Airport. They include Desert Skies Executive Air Terminal and Havasu Air Center. A list of services provided by each business is outlined below.

Desert Skies Executive Air Terminal: Desert Skies Executive Air Terminal is a full-service FBO offering a multitude of aviation-related services to airport users. Desert Skies Executive Air consists of three buildings and a portion of the main aircraft tiedown apron at Lake Havasu City Municipal Airport. The FBO features three multi-use hangars totaling approximately 28,000 square feet. Desert Skies also leases space to the restaurant at the airport. The following amenities are offered by Desert Skies Executive Air Terminal:

- Aircraft full-service fueling (100LL and Jet A)
- Aircraft self-service fueling (100LL)
- Wireless high-speed internet access
- Conference room
- Hangar storage
- Pilot lounge
- Swimming pool
- Catering
- On-site flight instruction
- Oxygen service
- Aircraft parts
- Transient aircraft parking
- Monthly tiedown rental parking
- Aircraft hangar storage space
- Courtesy vehicle
- Lavatory service
- Pilot supplies

Desert Skies Executive Air Terminal

- Aircraft maintenance
- Aircraft detailing
- Charter services

Havasu Air Center: Havasu Air Center features a 5,500 square-foot executive FBO facility and over 100,000 square feet of hangar space. The executive terminal includes a large canopy extending off the front of the building to shelter aircraft and passengers while they are loading and unloading. The facility also includes an executive conference room, flight planning services room, a reception area, and private pilot's lounge and movie theater.

Havasu Air Center has approximately 19,000 square yards of secure aircraft apron area that can accommodate most medium to large business jets. While Havasu Air Center provides fueling and customer services, a large part of its business focuses on aircraft maintenance, and it has become a regional hub primarily servicing Beechcraft King Air and Cessna Citation aircraft. Some of the other amenities and services provided by Havasu Air Center include:

- Aircraft maintenance
- Aircraft sales
- Aircraft charter service
- Wireless high-speed internet access
- Flight planning room
- Executive conference room
- Private crew lounge
- Secure private ramp
- Private movie theater
- Overnight hangar storage
- Oxygen service
- Aircraft cleaning and restocking
- Cargo handling
- Fueling 100LL and Jet-A
- Courtesy vehicles
- Gourmet catering
- Concierge services
- Transportations arrangements - Limousine / Sedan / Van
- Rental car


Havasu Air Center

Other aviation service providers, businesses, and organizations located at the airport include:

- D2 Aero Aviation Services
- Arizona Aircraft Maintenance
- Hangar 24 Brewery and Grill

- Cinema Aircraft Restorations
- Lake Havasu Seaplane
- Arizona Aviation Services
- Hangin' Over Havasu
- Avis Car Rental
- Budget Car Rental
- Rio Colorado 99s
- Experimental Aircraft Association - London Bridge Chapter 681
- Civil Air Patrol - London Bridge Composite Squadron 501

These businesses and organizations listed above play an important role to the overall activity and vitality of the airport. As airport tenants, they support the overall airport operation financially and draw aviation activity to the area.

Vehicle Parking

Lake Havasu City Municipal Airport features several vehicle parking areas. The terminal building has a designated vehicle parking lot located directly to the west and is encircled by Airport Centre Boulevard. There are 168 marked parking spaces and four handicapped parking spaces. Twenty additional spaces are reserved for rental cars.

Another parking lot is composed of 126 marked parking spaces primarily used for airport customers and staff, general aviation tenants and their passengers, as well as transient pilots. This parking area is located west of the airport's main tiedown area apron. This lot is accessible from Whelan Drive. Users must have gate access to utilize this vehicle parking area.

Desert Skies Executive Air and Hangar 24 Brewery and Grill restaurant provide vehicle parking accessible from Aviator Drive. This parking area features 21 marked spaces and three handicapped

D2 Aero General Aviation Hangars

Hangar 24 Brewery and Grill

Terminal Vehicle Parking

General Aviation Vehicle Parking

spaces. An additional unpaved parking area adjacent to Aviator Drive is designated for overflow parking only and is unmarked.

Havasu Air Center provides parking for their customers on the north side of the airfield which is also accessible from Whelan Drive. There are 16 marked spaces and one handicapped space available.

Fuel Facilities and Equipment

There are two operational fuel farms located on the airport. Each fuel farm is privately owned and operated. Additionally, there is one fuel farm owned by Lake Havasu City that is no longer in use. The non-operational fuel farm is expected to be removed by the city in the future. Each FBO offers full-service fueling. Full-service fueling refers to a level of service in which fuel is delivered by a fuel truck to an aircraft. Each FBO owns, operates, and maintains its fuel delivery vehicles. To avoid any fuel contamination, separate fuel delivery vehicles are used for transport of 100LL fuel and Jet A fuel.

Havasu Air Center owns and operates one fuel farm that is located on the north side of its associated apron area. The fuel farm consists of two aboveground storage tanks with capacities of 12,000 gallons each. The tanks are each dedicated to a specific type of aviation fuel. One tank is used exclusively for Jet A fuel and the other is used exclusively for 100LL fuel. Havasu Air Center operates two fueling vehicles: one with a capacity of 3,000 gallons to deliver Jet A, and the other with a capacity of 750 gallons to deliver 100LL.

Desert Skies Executive Air Terminal operates a fuel farm which is leased from D2 Aero Aviation Services. The fuel farm is located in the southwest corner of the main apron area and features two aboveground storage tanks with capacities of 10,000 gallons each, one for Jet A fuel and the other for 100LL. This fuel farm is also equipped with a self-service pump for 100LL fuel service. Desert Skies Executive Air Terminal operates two fuel delivery vehicles, each with a fuel storage capacity of 2,000 gallons.

Havasu Air Center Fuel Farm

D2 Aero Fuel Farm (Leased to Desert Skies Executive Air Terminal)

Lake Havasu City Fire Station #6

Aircraft Rescue and Fire Fighting (ARFF)

Lake Havasu City Fire Station #6 is located to the south of the airport terminal building. The facility has approximately 4,400 square feet and includes an office area, living quarters, and an equipment storage area. A primary ARFF vehicle is kept at the facility. The ARFF vehicle is a 1999 Emergency One Titan and has a storage capacity of 1,575 gallons of water, 200 gallons of aqueous film-forming foam (AFFF), and 500 pounds of Purple K dry chemical. Certified ARFF facilities are categorized under five indices, designated as A through E, with A applicable to the smallest aircraft and E to the largest (based on wingspan). ARFF equipment at the airport meets Index B level ARFF capability; however, the airport does not currently maintain any ARFF certification and city fire department staff are not certified operators of the ARFF vehicle.

Security Fencing and Gates

Lake Havasu City Municipal Airport's operations areas are completely enclosed by an eight-foot chain link fence topped by three-strand barbed wire. The fence does not always follow the airport boundary due to the layout of physical features and actual boundary lines. There are currently five controlled access gates located at the airport. The locations of these entrances include one south of the airport

Apron Access Gate and Apron Fencing

terminal building, one at Aviator Drive, one at the entrance of the lease automobile parking area, one at Hangar Way, and one at the north end of the airport leading to the north ramp apron.

Utilities

Utility availability and capacities can have a major impact when determining future development capability of an airport. The airport is presently supplied by electricity, water, sanitary sewer, solid waste disposal, as well as phone and internet services. **Table 1F** details the service providers of each utility.

TABLE 1F
Utility Services
Lake Havasu City Municipal Airport

Utility	Service Provider
Electricity	Unisource
Water	Lake Havasu City
Sanitary Sewer	Lake Havasu City
Phone	Frontier
Internet	Frontier
Solid Waste Disposal	Lake Havasu City via Allied Waste

Source: Airport Records

PAVEMENT MANAGEMENT PROGRAM

Preservation of pavements at airports is one of the largest challenges faced by federal, state, and local governments. ADOT monitors pavement conditions at airports through its Airport Pavement Preservation Program (APPP). Pavements are inspected on a three-year cycle and are assigned rating of 0-100, with 100 being excellent condition based on the pavement condition index (PCI). It is a statistical measure and requires manual survey of the pavement. PCI is an accepted method of visually assessing pavement conditions. PCI surveying processes and calculation methods have been standardized for both roads and airport pavements. PCI is widely used in transportation civil engineering.

Exhibit 1F depicts the pavement conditions based on ADOT's Lake Havasu City Municipal Airport Pavement Management Report dated November 2017. Runway 14-32 was found to have a PCI rating of 66. The runway connector Taxiways A1 through A6 were given a PCI rating of 65. Parallel Taxiway A was given a PCI rating of 49, and Taxiway B was given a PCI ranging from 49 to 78. Taxiway C and its connectors C1 and C2 also have a PCI of 49. The terminal apron possesses a PCI of 51, and the main aircraft tiedown apron was found to have a PCI of 49. The pavement surrounding the general aviation hangars was assigned a PCI of 52. The north ramp apron was found to be in slightly better condition with a PCI rating of 58. Overall, the airport's pavements are in serviceable condition. Conditions must continue to be monitored and maintained in order to extend the pavement's useful life and structural integrity.

ARIZONA AIRPORT PAVEMENT MANAGEMENT SYSTEM

Grant assurances for projects funded under the FAA AIP require a pavement maintenance system be utilized. To meet this requirement and ensure that the limited pavement maintenance funds are spent in the most cost-effective manner, ADOT developed the Airport Pavement Management System (APMS) in 2003.

The program provides pavement evaluation, design services, construction administration, and construction management at more than 60 airports statewide. The system prioritizes preventative maintenance projects with the greatest benefit for pavement dollar expended. The system also identifies pavement sections that require rehabilitation, based on their PCI.

Between 2013 and 2016, 39 airports in Arizona received pavement maintenance projects through the APMS program. The total APMS construction costs during this time period are presented in **Table 1G**.

As of May 2017, ADOT suspended APMS rehabilitations through 2018 due to funding shortfalls. PCI evaluations will continue to monitor the status of airport pavement in Arizona. The program has resumed in fiscal year 2019 and is funded at $5 million per year for five years for a total of $25 million.

Table 1G
APMS Construction Costs

Year	Annual Cost ($)
2013	$5,252,543
2014	$4,801,721
2015	$6,304,774
2016	$4,675,111
Total	**$21,034,149**

Source: Arizona Airport Pavement Management System 2017

AREA AIRSPACE

The *Federal Aviation Administration Act* of 1958 established the FAA as the responsible agency for the control and use of navigable airspace within the United States. The FAA has established the National Aerospace System (NAS) to protect persons and property on the ground and to establish a safe environment for civil, commercial, and military aviation. The NAS is defined as the common network of U.S. airspace, including air navigational facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. System components shared jointly with the military are also included as part of this system.

AIRSPACE STRUCTURE

To ensure a safe and efficient airspace environment for all aspects of aviation, the FAA has established an airspace structure that regulates and establishes procedures for aircraft using the National Airspace System. The U.S. airspace structure provides for categories of airspace, controlled and uncontrolled, and identifies them as Classes A, B, C, D, E, and G as described below. **Exhibit 1G** generally illustrates each airspace type in three-dimensional form. Airspace within the vicinity of Lake Havasu City Municipal Airport is also depicted on **Exhibit 1D**.

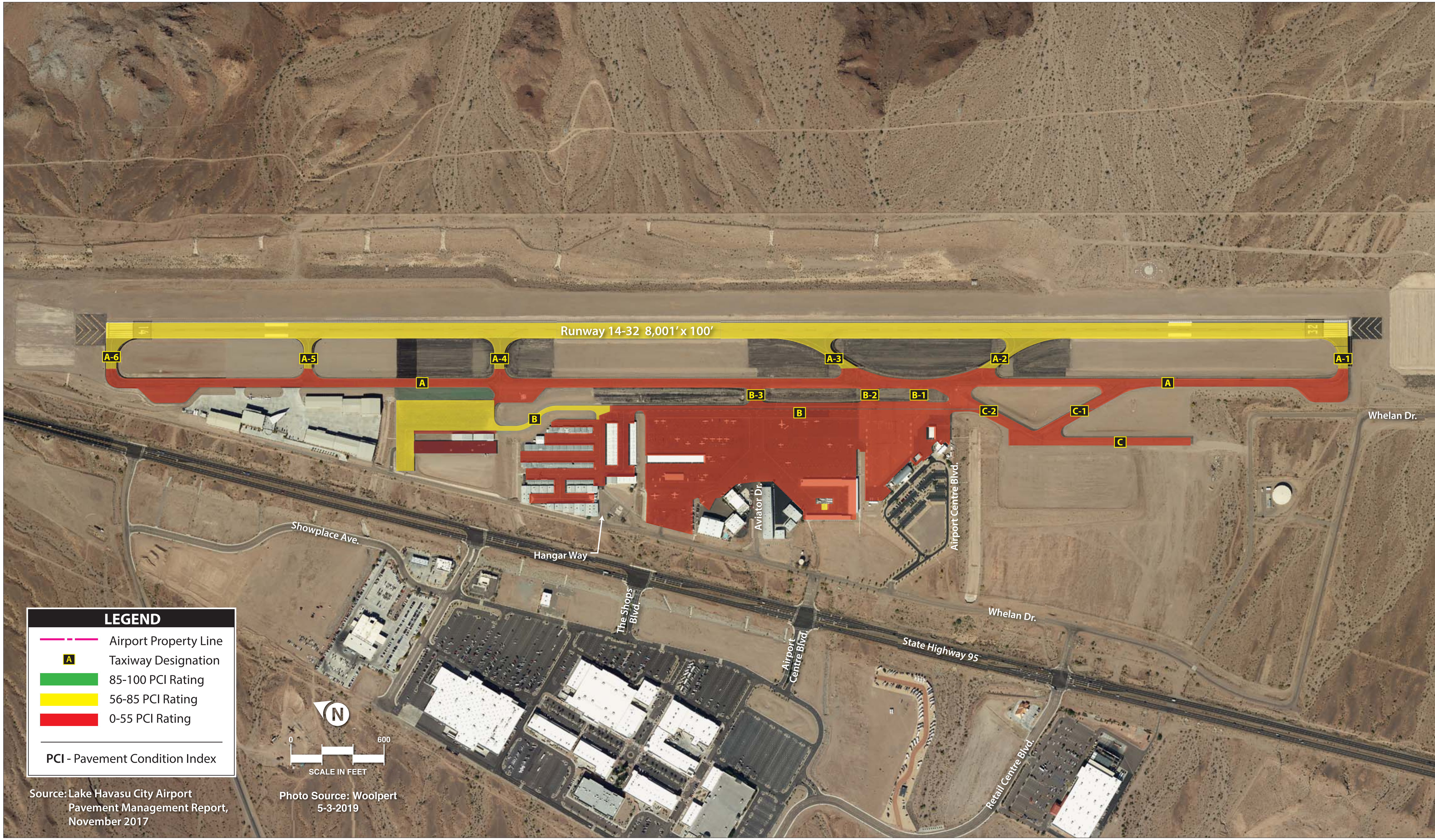

Exhibit 1F
2017 ADOT PAVEMENT PRESERVATION PROGRAM PAVEMENT CONDITIONS

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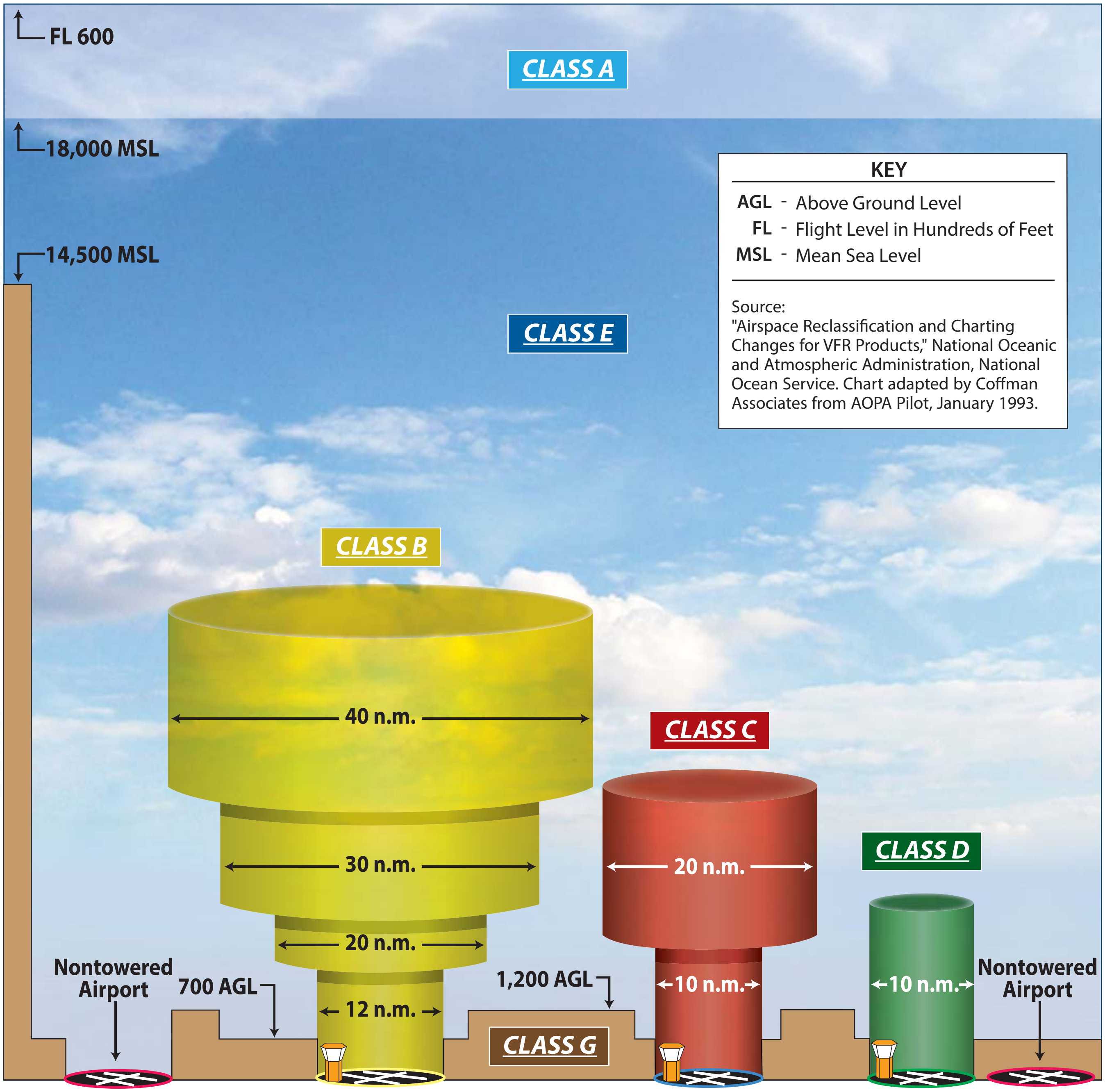


DEFINITION OF AIRSPACE CLASSIFICATIONS

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.

Exhibit 1G
AIRSPACE CLASSIFICATION

Class A: Class A is controlled airspace and includes all airspace from 18,000 feet mean sea level (MSL) to Flight Level 600 (approximately 60,000 feet MSL). This airspace is designed in Federal Aviation Regulation (F.A.R) Part 71.193, for positive control of aircraft. The Positive Control Area (PCA) allows flights governed only under instrument flight rules (IFR) operations. The aircraft must have special radio and navigational equipment, and the pilot must obtain clearance from an air traffic control (ATC) facility to enter Class A airspace. In addition, the pilot must possess an instrument rating.

Class B: Class B is controlled airspace surrounding high-activity commercial service airports (i.e., 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 major airports. 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. A pilot is required to have at least a private pilot certificate or be a student pilot who has met the requirements of F.A.R. Part 61.95, which requires special ground and flight training for the Class B airspace. Aircraft are also required to utilize a Mode C transponder within a 30 nautical-mile range of the center of the Class B airspace. A Mode C transponder allows air traffic control to track the location and altitude of the aircraft. There are no Class B airspaces within 50 nautical miles of Lake Havasu City Municipal Airport. The nearest Class B airspace is centered on Las Vegas-McCarran International Airport which is approximately 98 nautical miles northwest of Lake Havasu City Municipal Airport.

Class C: Class C is controlled airspace surrounding lower-activity commercial service and some military airports. 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 major airports. To operate inside Class C airspace, the aircraft must be equipped with a two-way radio, an encoding transponder, and the pilot must have established communication with ATC.

Class D: Class D is controlled airspace surrounding most airports with an operating ATCT and not classified under B or C airspace designations. The Class D airspace typically constitutes a cylinder with a horizontal radius of four or five nautical miles from the airport extending from the surface up to a designated vertical limit, typically set at approximately 2,500 feet above the airport elevation. If an airport has an instrument approach or departure, the Class D airspace sometimes extends along the approach or departure path.

Note: All aircraft operating within Classes A, B, C, and D airspace must be in constant radio contact with the air traffic control facility responsible for that airspace sector.

Class E: Class E is controlled airspace surrounding an airport that encompasses all instrument approach procedures and low-altitude federal airways. Only aircraft conducting instrument flights are required to be in contact with the appropriate air traffic control facility when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio contact with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist.

Class G: Class G is uncontrolled airspace typically in rural areas that do not require communication with an air traffic control facility. Class G airspace lies between the surface and the overlaying Class E airspace (700 to 1,200 feet above ground level (AGL). While aircraft may technically operate within this Class G airspace without any contact with ATC, it is unlikely that many aircraft will operate this low to the ground. Furthermore, F.A.R. Part 91.119, *Minimum Safe Altitudes*, specify minimum altitudes for flight.

Airspace within the vicinity of Lake Havasu City Municipal Airport is depicted on **Exhibit 1D**. The airport is in Class G airspace, with Class E airspace directly above with a floor 700 feet over the surface extending to Class A airspace at 18,000 feet MSL.

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. Special use airspace identifies for other users the areas where these non-standard operations may be occurring by outlining active times and/or altitudes to provide separation information in the area. Most special use airspace is designated on FAA aeronautical charts. The special use airspace in the vicinity of Lake Havasu City Municipal Airport is depicted on **Exhibit 1D**.

Victor Airways: Victor airways are for aircraft arriving or departing the regional area and navigating by using very high frequency omni-directional range (VOR) facilities. This system of federal airways, referred to as victor airways, has been established. Victor airways are corridors of airspace eight miles wide that extend upward from 12,000 feet AGL to 18,000 feet MSL and extend between VOR facilities. There are many victor airways surrounding Lake Havasu City Municipal Airport, and they are identified with blue lines marked with a "V" preceding a designation number on **Exhibit 1D**.

Military Operations Area (MOA): Lake Havasu City Municipal Airport is located inside the Turtle MOA. A MOA is an area of airspace designated for military training use. This is not restricted airspace; however, pilots who use this airspace should be on alert for the possibility of military traffic. A pilot may need to be aware that military aircraft can be found in high concentrations, conducting aerobatic maneuvers, and possibly operating at high speeds and/or at lower elevations. The Turtle MOA typically will have activity from 11,000 feet MSL to 18,000 feet MSL. It is published as "in use" from 6:00 a.m. to 5:00 p.m. Monday through Friday. There are several other MOAs in the vicinity of the airport including Quail MOA, Bagdad 1 MOA, Bristol MOA, and the Gladden 1 MOA. Each MOA will have its own designated airspace block and hours of operation. The activity status of a MOA is advertised by a Notice to Airmen (NOTAM) and notated on sectional charts.

Restricted Airspace: Restricted airspace is an area (volume) of airspace typically used by the military in which the local controlling authorities have determined that air traffic must be restricted (if not continually prohibited) for safety or security concerns. It is depicted on aeronautical charts with the letter "R" followed by a serial number. 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 airspace zones may always not be active; in such cases, there are typically schedules of local dates and times available to aviators specifying when the zone is active, and at other times, the airspace is subject to normal operation for the applicable airspace class. There is no restricted airspace in the vicinity of Lake Havasu City Municipal Airport, as depicted on **Exhibit 1D**. The nearest restricted airspace can be found approximately 80 nautical miles west surrounding Twentynine Palms Airport.

Alert Areas: Alert areas are depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity, such as military operations. Pilots should be particularly alert when flying in these areas. Military activities or other flight training in these areas typically operate at lower altitudes and may occur at any time of the day or night. General aviation flights are not restricted within these areas, but pilots are strongly cautioned to be alert for high-speed military training aircraft.

Military Training Routes: Military Training Routes (MTRs) are designated airspace established for use by high performance military aircraft to train below 10,000 feet AGL and in excess of 250 knots. There are visual (VR) and instrument (IR) designated MTRs. MTRs with no segment above 1,500 feet AGL will be designated with the VR or IR, followed by a four-digit number. MTRs with one or more segments above 1500 feet AGL are identified by the route designation, followed by a 3-digit number. The arrows on the route show the direction of travel. MTRs surrounding the Lake Havasu City Municipal Airport are depicted on **Exhibit 1D** using a beige colored line and associated with their identifying number. There are numerous MTRs in the region due to the airport's proximity to several MOAs.

Wilderness Areas: Several wilderness areas exist in proximity to Lake Havasu City Municipal Airport. Aircraft are requested to maintain a minimum altitude of 2,000 feet AGL over National Park areas, which include all wilderness areas and breeding grounds. FAA Advisory circular (AC) 91-36C defines the surface as the highest terrain within 2,000 feet laterally of the route of flight or the uppermost rim of the canyon or valley. Wilderness areas surrounding Lake Havasu City Municipal Airport are depicted in green on **Exhibit 1D**. The nearest wilderness area, Warm Springs Wilderness Area, is 12 nautical miles northeast and consists of approximately 112,000 acres of protected wilderness.

AIRSPACE CONTROL

The FAA has established 21 Air Traffic Control Centers (ARTCCs) throughout the continental United States to control aircraft operating under IFR within controlled airspace and while enroute. An ARTCC assigns specific routes and altitudes along federal airways to maintain separation and orderly traffic flow. The Los Angeles ARTCC controls IFR air traffic enroute to and from Lake Havasu City Municipal Airport.

Flight service stations (FSS) are air traffic facilities which provide pilot briefings, flight plan processing, in-flight radio communications, search and rescue (SAR) services, and assistance to lost aircraft in emergency situations. FSS also relay ATC clearances, process NOTAMs, broadcast aviation metrological and aeronautical information, and notify Customs and Border Protection of trans-border flights. The Prescott Flight Service Station is the nearest FSS to the airport.

Lake Havasu City Municipal Airport is a Class G airport which is non-towered airspace, meaning there is no ground-based airport traffic control tower (ATCT) on the airfield. Pilots will give position reports when in the vicinity of the airport to all other air traffic monitoring the CTAF. Aircraft operating to/from the airport can be provided separation clearance by the Los Angeles ARTCC.

INSTRUMENT APPROACH PROCEDURES

An instrument approach procedure (IAP) is defined as a series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually. There are three categories of IAPs: precision approach (PA), approach with vertical guidance (APV), and non-precision approach (NPA).

Precision Approach: A PA uses a navigation system that provides both course and glidepath deviation. There are no published PAs available at Lake Havasu City Municipal Airport.

Approach with Vertical Guidance: An APV also uses a navigation system for both course and glidepath deviation, but not to the same standards as a precision approach. There is one APV approach procedure available for use at Lake Havasu City Municipal Airport. The RNAV (GPS) Runway 32 approach features a localizer performance with vertical guidance (LPV) component that allows pilots of properly equipped aircraft to descend to a decision altitude.

Non-Precision Approach: An NPA uses a navigation system for course deviation but does not provide glidepath information. The other approach procedures at the airport are considered NPAs and include components associated with the RNAV (GPS) Runway 14, RNAV (GPS) Runway 32, and VOR/DME-A.

The FAA creates and publishes airport-specific instrument approach procedures designed to each individual airport environment and available navigational aids. The capability of an instrument approach procedure is defined by the visibility and the cloud ceiling minimums associated with the approach. Visibility minimums define the horizontal distance a pilot must be able to see in order to complete the approach. A cloud ceiling is defined as the height of the lowest layer of clouds, above the surface, that are either broken or overcast. If the observed visibility and/or cloud ceiling are below the prescribed minimums for the approach, the pilot cannot complete the approach. **Exhibit 1H** contains the FAA-approved instrument approach procedures, including approach speed categories and the associated weather minimums.

Instrument procedures based on GPS have become very common across the country. GPS is inexpensive, as it does not require a significant investment in ground-based systems by the airport or the FAA. All instrument approaches available at Lake Havasu City Municipal Airport also provide circling minimums which allows pilots the flexibility to land on the runway end more closely aligned with the prevailing wind conditions. This flexibility typically requires circling approaches to have higher visibility and cloud ceiling minimums than the straight-in approaches. The reason for this is to allow sufficient visibility and ground clearance to navigate visually from the approach to the desired runway end for landing. Therefore, any circling approach is considered a non-precision approach.

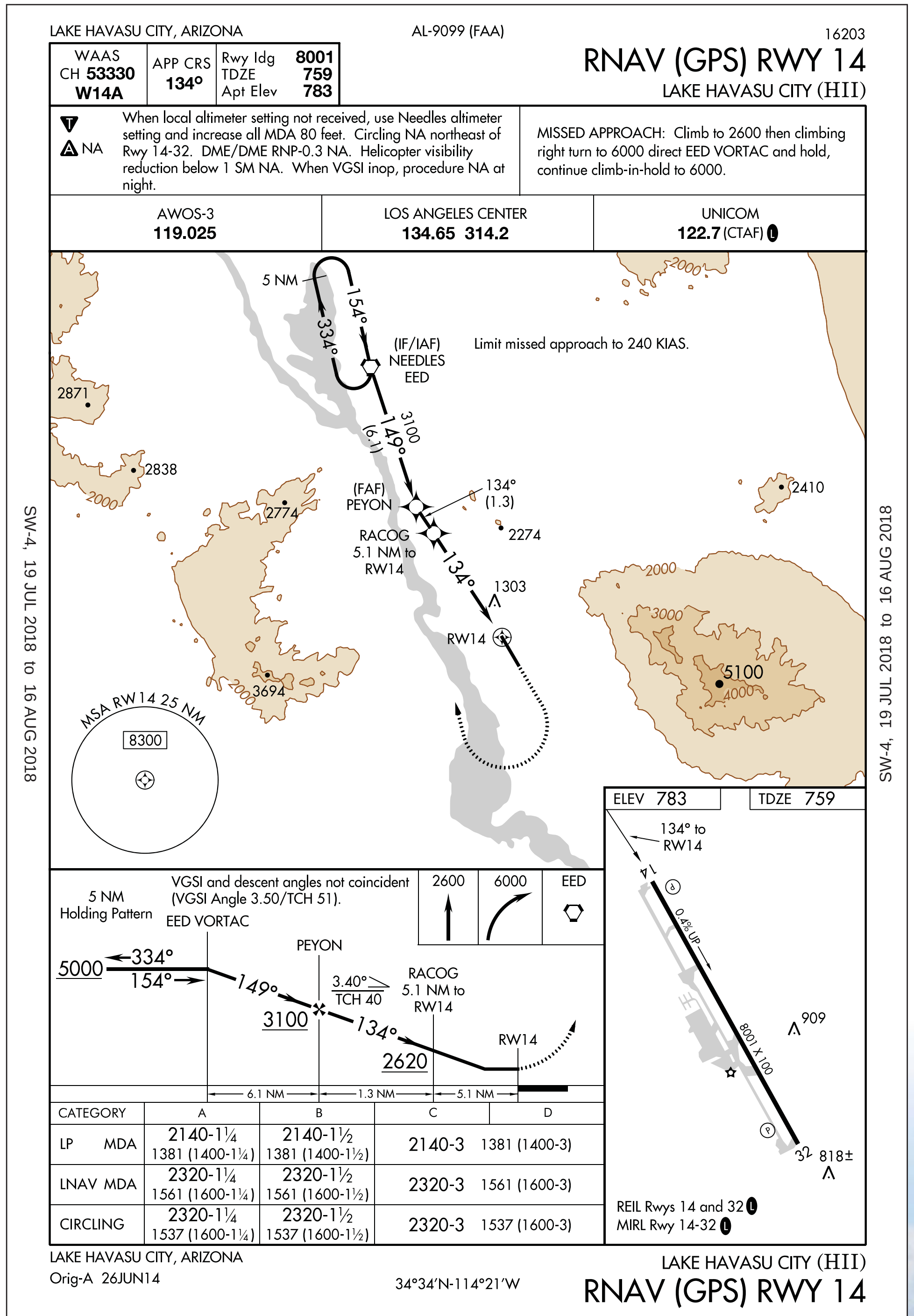
LOCAL OPERATING PROCEDURES

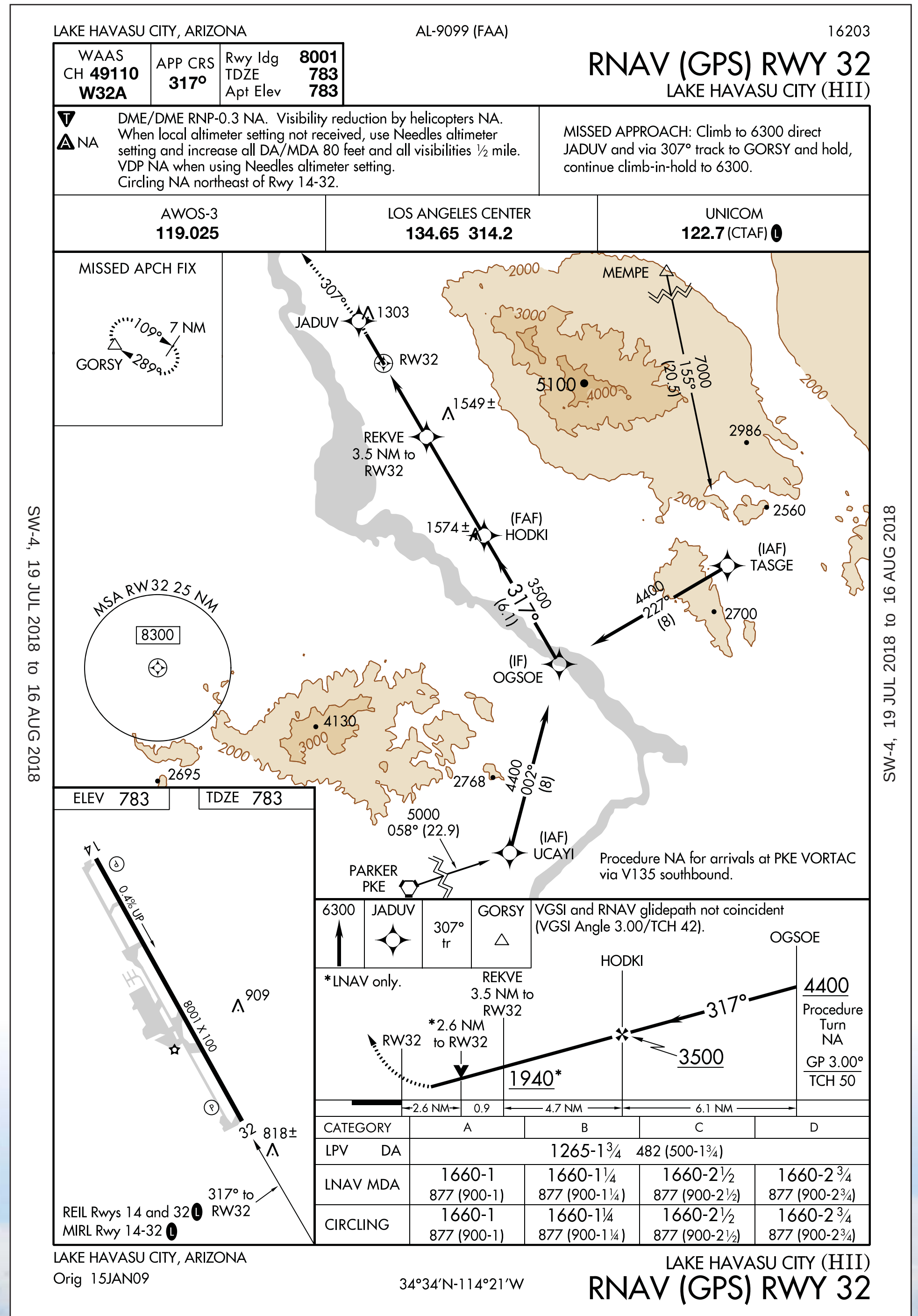
Lake Havasu City Municipal Airport is situated at 783 feet MSL. The traffic pattern at the airport is maintained to provide the safest and most efficient use of the airspace surrounding the airport. The airport utilizes a nonstandard right-hand traffic pattern for Runway 14 in order to keep a safe distance between aircraft and the Mohave Mountain Range directly to the east of the airport. A standard left-hand traffic pattern is used for Runway 32. The traffic pattern altitude for high performance aircraft, including jets, is 2,303 feet MSL. The traffic pattern altitude for smaller turbine and piston aircraft is 1,803 feet MSL. Pilots operating in and out of Lake Havasu City Municipal Airport are encouraged to follow noise abatement procedures published in the FAA Chart Supplement guide. The procedures are designed so that residential areas to the southwest of the airport can be avoided. The recommended operating procedures discourage the straight-in and straight-out departure of aircraft. Aircraft should enter the traffic pattern using a 45-degree angle entry to downwind.

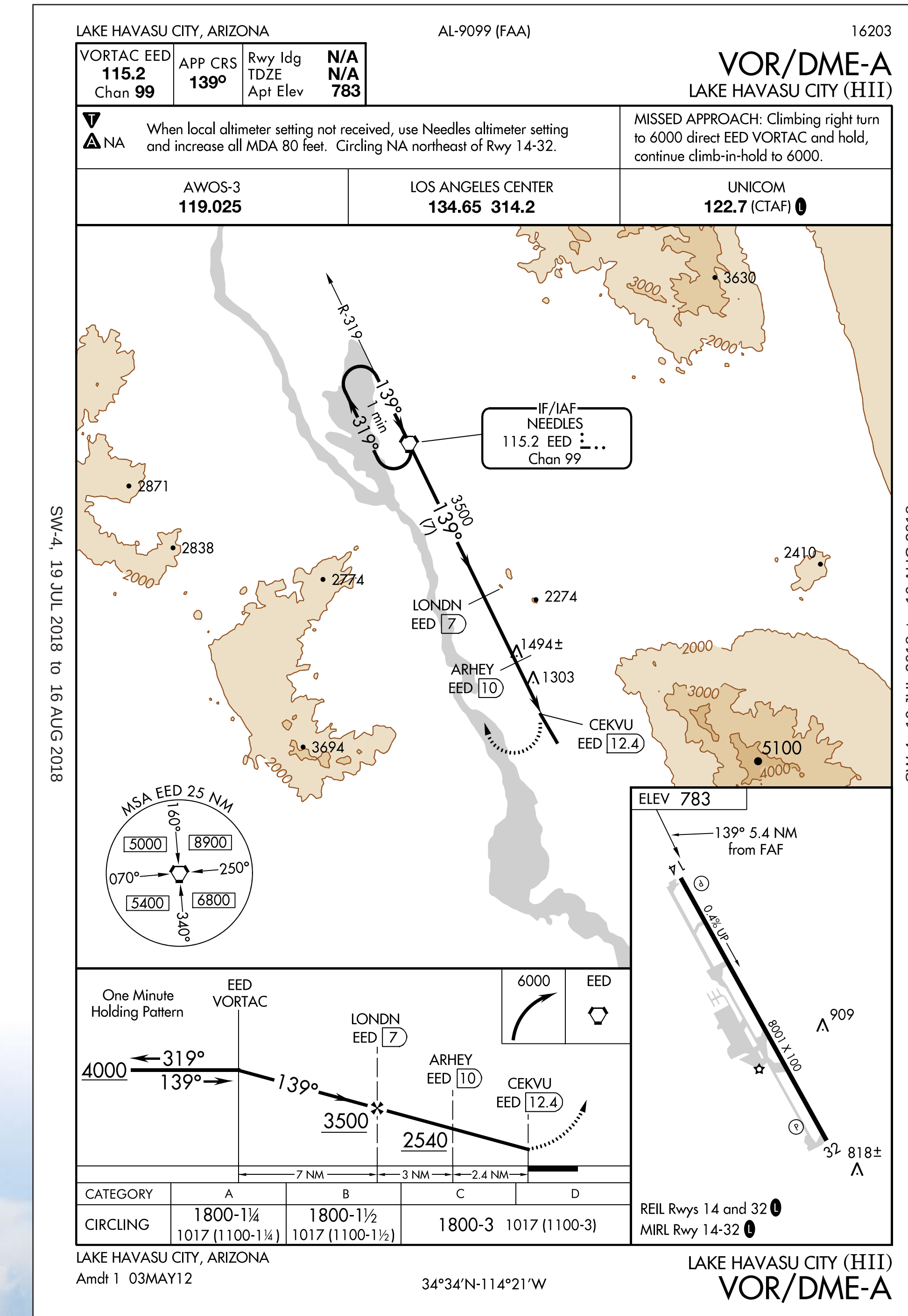
REGIONAL AIRPORTS

There are several public-use airports of various sizes, capacities, and functions within a 50 nautical-mile radius of Lake Havasu City Municipal Airport. It is important to consider the capabilities and limitations of these airports when planning for future changes and improvements at the airport. The airports within a 50 nautical-mile radius include: Chemehuevi Valley Airport (49X), Needles Airport (EED), Eagle Airpark (A09), Avi Suquilla Airport (P20), Sun Valley Airport (A20), Laughlin-Bullhead International Airport (IFP), and Kingman Airport (IGM). Information pertaining to each airport was collected from the most recent FAA Form 5010-1 *Airport Master Record* and identifies each airport's characteristics. **Exhibit 1J** provides information on the roles, facilities, services, and operational levels these airports experience. Analysis of public-use airports in the region indicates there are several facilities serving the needs of all types of aviation activity.

Airports such as Laughlin-Bullhead International Airport and Kingman Municipal Airport generally cater to larger aircraft operations including airline and corporate jet operations, but they also provide facilities and services that accommodate smaller general aviation aircraft. Except for Eagle Airpark and Chemehuevi Valley Airport, the other airports can also provide an array of services that cater to general aviation needs. However, the primary runway lengths at certain airports, such as Sun Valley Airport, Eagle Airpark, and Needles Airport, can limit larger aircraft from being able to fully operate at these facilities. Even with the existence of several aviation facilities nearby, Lake Havasu City Municipal Airport is positioned well to provide a full range of aviation services and capitalize on its proximity to one of Arizona's most popular recreational destinations.


LAKE HAVASU CITY, ARIZONA
AL-9099 (FAA)
16203
RNAV (GPS) RWY 14
LAKE HAVASU CITY (HII)
WAAS CH 53330 W14A
APP CRS 134°
Rwy ldg 8001
TDZE 759
Apt Elev 783
When local altimeter setting not received, use Needles altimeter setting and increase all MDA 80 feet. Circling NA northeast of Rwy 14-32. DME/DME RNP-0.3 NA. Helicopter visibility reduction below 1 SM NA. When VGSI inop, procedure NA at night.
MISSED APPROACH: Climb to 2600 then climbing right turn to 6000 direct EED VORTAC and hold, continue climb-in-hold to 6000.
AWOS-3 119.025
LOS ANGELES CENTER 134.65 314.2
UNICOM 122.7 (CTAF)
Limit missed approach to 240 KIAS.
(IF/IAF) NEEDLES EED
(FAF) PEYON
RACOG 5.1 NM to RW14
RW14
MSA RW14 25 NM
8300
ELEV 783
TDZE 759
5 NM Holding Pattern
VGSI and descent angles not coincident (VGSI Angle 3.50/TCH 51).
CATEGORY A B C D
LP MDA 2140-1¼ 1381 (1400-1¼) 2140-1½ 1381 (1400-1½) 2140-3 1381 (1400-3)
LNAV MDA 2320-1¼ 1561 (1600-1¼) 2320-1½ 1561 (1600-1½) 2320-3 1561 (1600-3)
CIRCLING 2320-1¼ 1537 (1600-1¼) 2320-1½ 1537 (1600-1½) 2320-3 1537 (1600-3)
REIL Rwys 14 and 32
MIRL Rwy 14-32
SW-4, 19 JUL 2018 to 16 AUG 2018
Orig-A 26JUN14
34°34'N-114°21'W


LAKE HAVASU CITY, ARIZONA
AL-9099 (FAA)
16203
RNAV (GPS) RWY 32
LAKE HAVASU CITY (HII)
WAAS CH 49110 W32A
APP CRS 317°
Rwy ldg 8001
TDZE 783
Apt Elev 783
DME/DME RNP-0.3 NA. Visibility reduction by helicopters NA. When local altimeter setting not received, use Needles altimeter setting and increase all DA/MDA 80 feet and all visibilities ½ mile. VDP NA when using Needles altimeter setting. Circling NA northeast of Rwy 14-32.
MISSED APPROACH: Climb to 6300 direct JADUV and via 307° track to GORSY and hold, continue climb-in-hold to 6300.
AWOS-3 119.025
LOS ANGELES CENTER 134.65 314.2
UNICOM 122.7 (CTAF)
MISSED APCH FIX
GORSY
JADUV
MEMPE
REKVE 3.5 NM to RW32
(FAF) HODKI
(IAF) TASGE
(IF) OGSOE
(IAF) UCAYI
PARKER PKE
Procedure NA for arrivals at PKE VORTAC via V135 southbound.
MSA RW32 25 NM
8300
ELEV 783
TDZE 783
VGSI and RNAV glidepath not coincident (VGSI Angle 3.00/TCH 42).
*LNAV only.
Procedure Turn NA
GP 3.00° TCH 50
CATEGORY A B C D
LPV DA 1265-1¾ 482 (500-1¾)
LNAV MDA 1660-1 877 (900-1) 1660-1¼ 877 (900-1¼) 1660-2½ 877 (900-2½) 1660-2¾ 877 (900-2¾)
CIRCLING 1660-1 877 (900-1) 1660-1¼ 877 (900-1¼) 1660-2½ 877 (900-2½) 1660-2¾ 877 (900-2¾)
REIL Rwys 14 and 32
MIRL Rwy 14-32
SW-4, 19 JUL 2018 to 16 AUG 2018
Orig 15JAN09
34°34'N-114°21'W


LAKE HAVASU CITY, ARIZONA
AL-9099 (FAA)
16203
VOR/DME-A
LAKE HAVASU CITY (HII)
VORTAC EED 115.2 Chan 99
APP CRS 139°
Rwy ldg N/A
TDZE N/A
Apt Elev 783
When local altimeter setting not received, use Needles altimeter setting and increase all MDA 80 feet. Circling NA northeast of Rwy 14-32.
MISSED APPROACH: Climbing right turn to 6000 direct EED VORTAC and hold, continue climb-in-hold to 6000.
AWOS-3 119.025
LOS ANGELES CENTER 134.65 314.2
UNICOM 122.7 (CTAF)
IF/IAF NEEDLES 115.2 EED Chan 99
LONDN EED 7
ARHEY EED 10
CEKVU EED 12.4
MSA EED 25 NM
ELEV 783
139° 5.4 NM from FAF
One Minute Holding Pattern
CATEGORY A B C D
CIRCLING 1800-1¼ 1017 (1100-1¼) 1800-1½ 1017 (1100-1½) 1800-3 1017 (1100-3)
REIL Rwys 14 and 32
MIRL Rwy 14-32
SW-4, 19 JUL 2018 to 16 AUG 2018
Amdt 1 03MAY12
34°34'N-114°21'W

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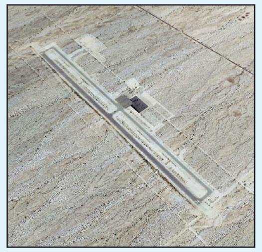
CHEMEHUEVI VALLEY AIRPORT (49X)

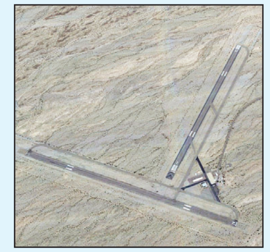


NPIAS Classification .... General Aviation
FAA Asset Study Classification ...... Basic
Location from HII .... 4 nm SW
Elevation (MSL) .... 638′
Weather Reporting AWOS-3
ATCT .... None
Annual Operations 4,000
Based Aircraft 4

Runway	16/34
Length (ft.)	5,000
Width (ft.)	75
Pavement Strength (pounds)	
SWL	12,000
DWL	N/A
DTW	N/A
DDTWL	N/A
Lighting	MIRL
Marking	Non-Precision
Approach Aids	N/A
Instrument Approach Procedures	N/A

Services Provided: 100LL and Jet A fuel, Maintenance, Hangars, Tiedowns, Air ambulance, Avionics, Charter, Instruction, Rental, Sales

NEEDLES AIRPORT (EED)



NPIAS Classification .... General Aviation
FAA Asset Study Classification .... Basic
Location from HII .... 18 nm NW
Elevation (MSL) .... 983′
Weather Reporting .... ASOS
ATCT .... None
Annual Operations 10,500
Based Aircraft 15

Runway	11/29	2/20
Length (ft.)	5,005	4,235
Width (ft.)	100	100
Pavement Strength (pounds)		
SWL	16,000	16,000
DWL	32,000	32,000
DTW	N/A	N/A
DDTWL	N/A	N/A
Lighting	MIRL	MIRL
Marking	Basic	Basic
Approach Aids	PAPI-2, REILs	PAPI-2
Instrument Approach Procedures	RNAV (GPS) Rwy 29, VOR-A	N/A

Services Provided: 100LL and Jet A fuel, Aircraft Parking, Hangar Leasing, Instruction, Courtesy Transportation

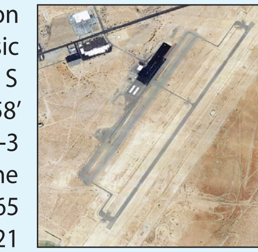
EAGLE AIRPARK (A09)

NPIAS Classification .... N/A
FAA Asset Study Classification ..... N/A
Location from HII .... 23 nm NW
Elevation (MSL) .... 485′
Weather Reporting .... N/A
ATCT .... None
Annual Operations 6,968
Based Aircraft 28

Runway	17/35
Length (ft.)	4,800
Width (ft.)	50
Pavement Strength (pounds)	
SWL	N/A
DWL	N/A
DTW	N/A
DDTWL	N/A
Lighting	N/A
Marking	Non-Standard
Approach Aids	N/A
Instrument Approach Procedures	N/A

Services Provided: Hangars, Tiedowns

AVI SUQUILLA AIRPORT (P20)



NPIAS Classification .... General Aviation
FAA Asset Study Classification ...... Basic
Location from HII .... 26 nm S
Elevation (MSL) .... 458′
Weather Reporting AWOS-3
ATCT .... None
Annual Operations 14,965
Based Aircraft 21

Runway	1/19
Length (ft.)	6,250
Width (ft.)	100
Pavement Strength (pounds)	
SWL	30,000
DWL	50,000
DTW	N/A
DDTWL	N/A
Lighting	N/A
Marking	Non-Precision
Approach Aids	PAPI-4
Instrument Approach Procedures	RNAV (GPS) Rwy 1, VOR/DME-A

Services Provided: 100LL and Jet A fuel, Maintenance, Hangars, Tiedowns

SUN VALLEY AIRPORT (A20)

NPIAS Classification .... N/A
FAA Asset Study Classification .... N/A
Location from HII .... 28 nm NE
Elevation (MSL) .... 725′
Weather Reporting .... N/A
ATCT .... N/A
Annual Operations 1,200
Based Aircraft 24

Runway	18/36
Length (ft.)	3,700
Width (ft.)	42
Pavement Strength (pounds)	
SWL	N/A
DWL	N/A
DTW	N/A
DDTWL	N/A
Lighting	LIRL
Marking	Non-Standard
Approach Aids	NTSD, VASI-2
Instrument Approach Procedures	N/A

Services Provided: 100LL fuel, Aircraft Parking, Hangars, Hangar Leasing/Sales, Passenger Terminal, Lounge, Rental Cars

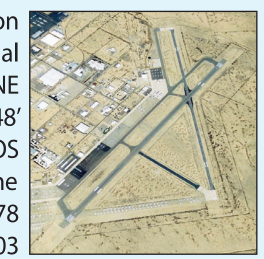
LAUGHLIN/BULLHEAD INTERNATIONAL AIRPORT (IFP)

NPIAS Classification ..... Non-Hub Primary
FAA Asset Study Classification .... N/A
Location from HII................ 37 nm N
Elevation (MSL) .... 701′
Weather Reporting AWOS-3
ATCT .... Yes
Annual Operations 10,220
Based Aircraft 22

Runway	16/34
Length (ft.)	8,500
Width (ft.)	150
Pavement Strength (pounds)	
SWL	75,000
DWL	200,000
DTW	400,000
DDTWL	N/A
Lighting	MIRL
Marking	Non-Precision
Approach Aids	PAPI-4, REILs
Instrument Approach Procedures	RNAV (GPS) Rwy 16 & 34 VOR Rwy 34

Services Provided: 100LL and Jet A fuel, Maintenance, Hangars, Tiedowns, Avionics, Charter

KINGMAN AIRPORT (IGM)



NPIAS Classification ..... General Aviation
FAA Asset Study Classification ... Regional
Location from HII.............. 46 nm NE
Elevation (MSL).................... 3,448′
Weather Reporting .... ASOS
ATCT.............................. None
Annual Operations 28,478
Based Aircraft 103

Runway	3/21	17/35
Length (ft.)	6,827	6,725
Width (ft.)	150	75
Pavement Strength (pounds)		
SWL	45,000	22,000
DWL	85,000	60,000
DTW	125,000	N/A
DDTWL	265,000	N/A
Lighting	MIRL	MIRL
Marking	Non-Precision	Basic
Approach Aids	PAPI-4, REILs	PAPI-2
Instrument Approach Procedures	RNAV (GPS) Rwy 3, RNAV (GPS) Y Rwy 21, RNAV (GPS) Z RWY 21 VOR/DME Rwy 21	N/A

Services Provided: 100LL and Jet A fuel, Tiedowns, Maintenance

KEY

ASOS | Automated Surface Observing System
ATCT | Air Traffic Control Tower
AWOS | Automated Weather Observing System
DME | Distance Measuring Equipment
DWL | Dual Wheel Loading
DTW | Double Tandem Wheel Loading
DDTW | Double Dual Tandem Wheel Loading
HIRL | High Intensity Runway Lights
FAA | Federal Aviation Administration
GPS | Global Positioning System
ILS | Instrument Landing System
LIRL | Low Intensity Runway Lights
MIRL | Medium Intensity Runway Lights
MSL | Mean Sea Level
N/A | Not Applicable
NM | Nautical Mile
NPIAS | National Plan of Integrated Airport Systems
NSTD | Non-Standard
PAPI | Precision Approach Path Indicator
REIL | Runway End Identification Light
RNAV | Area Navigation (GPS variant)
SWL | Single Wheel Loading
VASI | Visual Approach Slope Indicator
VOR | VHF Omnidirectional Range

Exhibit 1J
VICINITY AIRPORTS

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AREA LAND USE AND ZONING

Land use surrounding Lake Havasu City Municipal Airport can have a significant impact on airport operations and growth. The following will identify federal governance of airport land, existing land uses, and local zoning in the vicinity of the airport, as well as the future potential growth opportunities available to promote airport sustainability. By understanding land use issues surrounding the airport, more appropriate recommendations can be made for the future of the airport.

FEDERAL LAND USE 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. Additionally, Title 14 of the Code of Federal Regulations (CFR) Part 77 and Part 150 address land uses on and around public-use airports. The following is a summary of the federal laws and regulations related to land use compatibility and zoning surrounding airports.

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

One way that land use compatibility is controlled is through federal mandates, such as the *Airport and Airway Improvement Act of 1982,* which establishes grant assurances and allows the FAA to regulate airport land use indirectly. Airports that do not comply with grant assurances (obligations) set forth by the law are not eligible to receive federal grant funding. The objective of enforcing land use restrictions is to protect designated areas for the maintenance of operationally safe and obstruction-free airport activity. Airports rely heavily upon federal funding to stay operational and safe. Therefore, it is important that airports comply with FAA regulations and grant assurances. There are two FAA grant assurances that deal specifically with airport land use compatibility.

Grant Assurance 20 - Hazard Removal and Mitigation

Grant Assurance 20 states, "It 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."

Grant Assurance 21 - Compatible Land Use

Grant Assurance 21 states, "It will 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. In addition, if the project is for noise compatibility program implementation, it will not cause or permit any change in land use, within its jurisdiction, that will reduce its compatibility, with respect to the airport, of the noise compatibility program measures upon which federal funds have been expended."

Title 14 of the Code of Federal Regulations (CFR), Part 77 Objects Affecting Navigable Airspace

Part 77 defines a series of imaginary surfaces surrounding airports. The imaginary surfaces consist of the approach zone, conical zones, transitional zones, and horizontal zones. Objects such as trees, towers, buildings, or roads which penetrate any of these surfaces are considered by the FAA to be an obstruction to air navigation. Current Lake Havasu City ordinances adhere to and support the height restriction guidelines as set forth in 14 CFR, Part 77. Height restrictions can be accomplished through height and hazard zoning, avigation easements, or fee simple acquisition. **Exhibit 1K** depicts a model example of the application of the Part 77 criteria.

Title 14 of the Code of Federal Regulations (CFR), Part 150 Airport Noise Compatibility Planning

Part 150 prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs, including the process for evaluating and approving or disapproving those programs. This part also identifies those land uses which are normally compatible with various levels of exposure to noise by individuals. It provides technical assistance to airport operators, in conjunction with other local, state, and federal authorities, to prepare and execute appropriate noise compatibility planning and implementation programs.

Airport Land Use Compatibility Planning- FAA Advisory Circular (AC) 150/5060-6

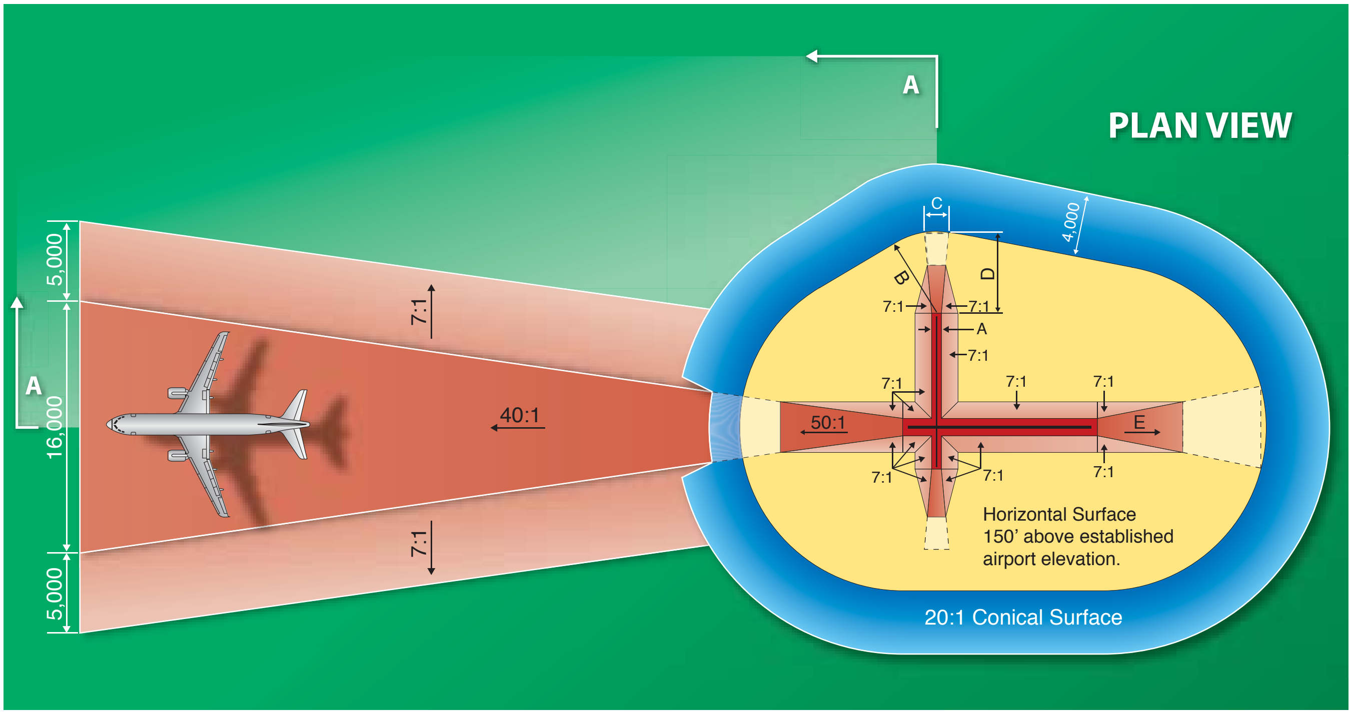
This document guides the development of a compatibility plan to ensure the environs surrounding an airport are not developed in a manner that could pose a risk to the airport's operations. This document specifically addresses land use and noise issues.

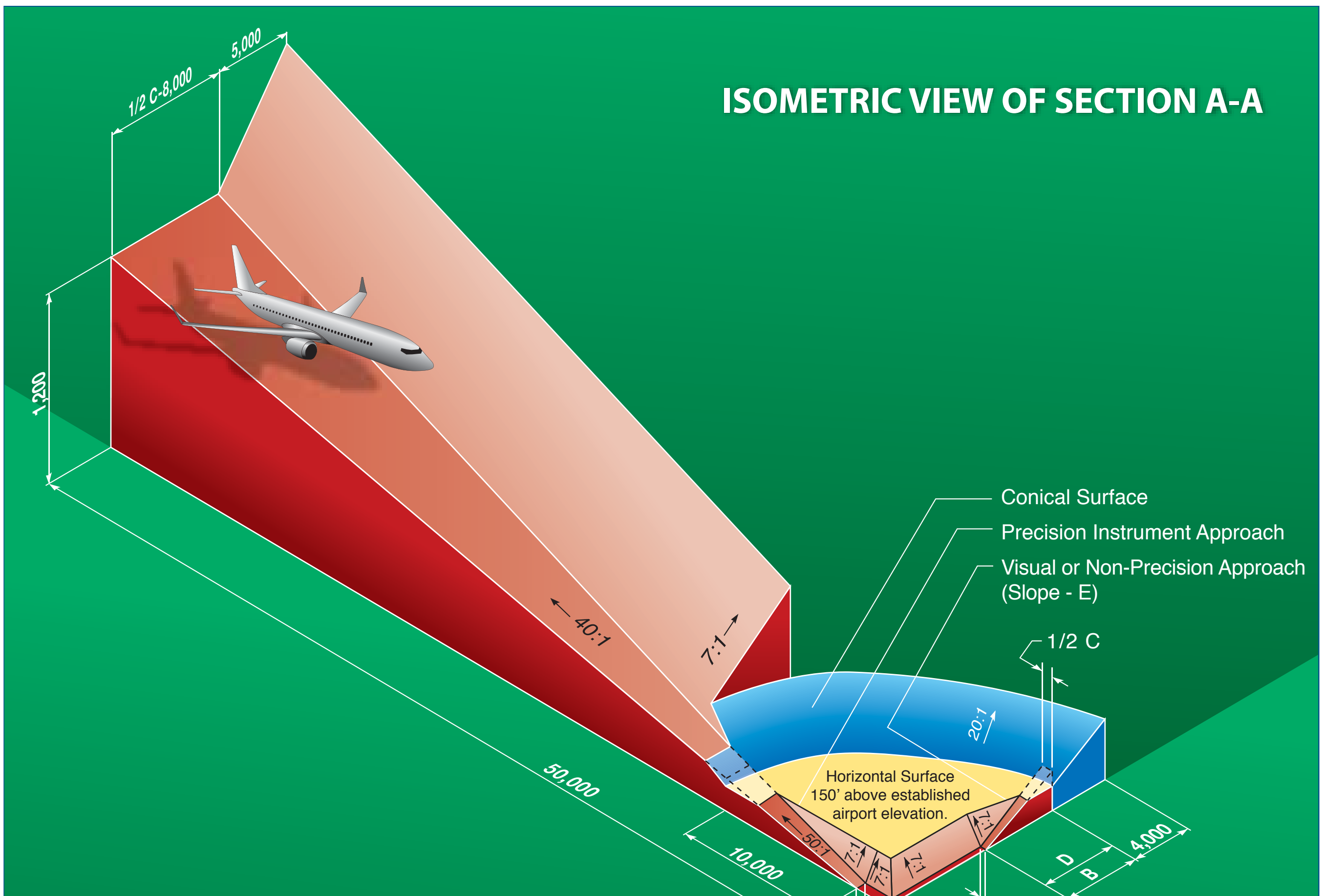
Airport Design- FAA Advisory Circular (AC) 150/5300-13A

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

EXISTING LAND USES

Lake Havasu City Municipal Airport is located approximately six miles north of Lake Havasu City center. Existing land uses immediately surrounding the airport include mainly vacant land to the north and east. These areas are part of the Mohave Mountain Range and include uninhabitable land due to steep terrain and other physical features. The majority of the developed property can be found west of the airport. A small RV camping area is located north of the airport on Bureau of Land Management (BLM) property, and an electrical sub-station can be found southeast of the airport. Approximately 3/4-mile





Source: 14 CFR Part 77, Section 77.25,
Civil Airport Imaginary Surfaces.

Exhibit 1K
EXAMPLE OF PART 77 CRITERIA

south of the airport is 40 acres of land utilized for an RV park, and directly south of that is a self-storage facility. Land west of State Highway 95 is currently being utilized for commercial retail sales. A large shopping center has been built which features several department stores, restaurants, specialty stores, and one car dealership. Farther to the west beyond the shopping center is a mobile home park and a small single-family residential subdivision. Another self-storage business is located south of the shopping complex. A large area of vacant land to the southwest is currently State Trust Land.

ZONING

The Lake Havasu City Development Code Title 14 of the Lake Havasu City Code of Ordinances establishes the Airport Overlay District. This district is intended to protect the public health, safety, and general welfare of the area surrounding the airport by minimizing exposure to hazards generated by airport operations of the airport, as well as to further development of compatible land uses around the airport. Existing zoning surrounding the airport calls for general commercial development to the west of the airport (west of State Highway 95). This zoning is considered compatible with airport activity. Land north and east of the airport has been identified as agriculture/preservation land (zoning classification of A1) due to the physical constraints associated with the Mohave Mountain Range. Areas to the southeast, south, and southwest are shown as employment centers that could support industrial and manufacturing activities. One parcel in the area is designated as P1 (public lands and facilities) due to the electrical substation located on that parcel. Finally, land to the west of Highway 95 is designated as C2/PD (general commercial/ planned development). **Exhibit 1L** identifies the city's zoning surrounding Lake Havasu City Municipal Airport.

SOCIOECONOMICS

Socioeconomic characteristics of an airport's surrounding area can provide valuable information to derive an understanding of the dynamics of growth near an airport. This information is crucial in determining aviation demand level requirements, as most aviation demand is directly related to the socioeconomic conditions of the surrounding region. Statistical analysis of population, employment, and income trends outline the economic strength of a region and can help determine the ability of the area to sustain a strong economy in the future. The forecast chapter of this master plan will be used to provide a better understanding of the roles that socioeconomic factors play, while the information in the following sections will serve as an introduction to socioeconomic trends in the study area.

POPULATION

Population is a key socioeconomic factor to consider when planning for future airport needs. Historical and forecast population trends provide an indication of the potential of the region to sustain growth in aviation activity. Population data for Lake Havasu City, Mohave County, and the state of Arizona are discussed to provide past and present population metrics of the region in which the airport serves. Since

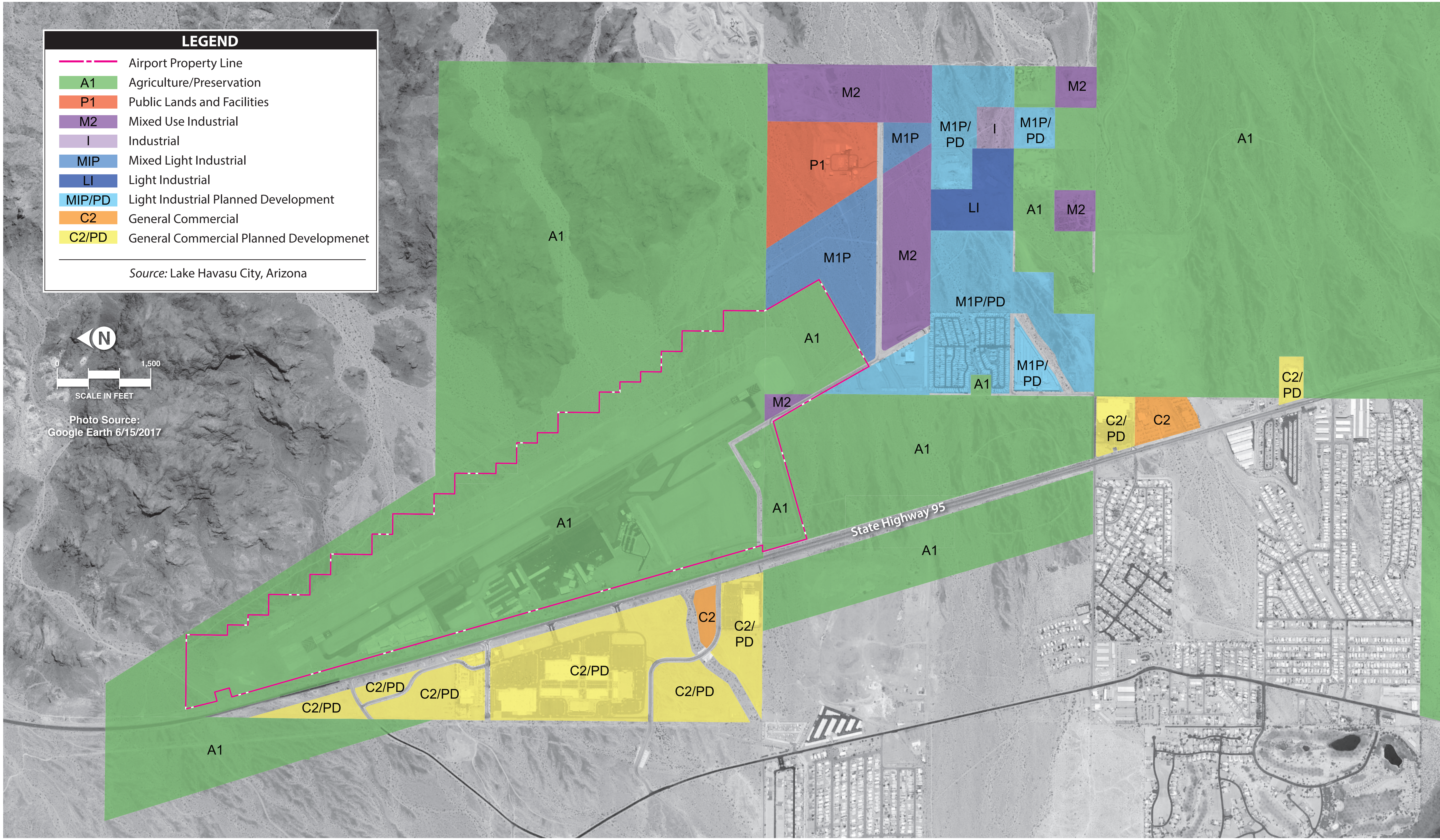


Exhibit 1L
EXISTING ZONING

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2005, Lake Havasu City has grown in population at a compound annual growth rate (CAGR) of 0.12 percent, which is a slower rate than both Mohave County (1.15 percent) and Arizona (1.38 percent). Lake Havasu City has grown at approximately one-half the growth rate of the United States, which has a CAGR of 0.79 percent. **Table 1H** presents historical population statistics.

TABLE 1H
Historical Population Statistics

	2005	2010	2015	2018	CAGR
Lake Havasu City	51,886	52,527	53,583	52,685	0.12%
Mohave County	184,743	200,186	205,716	214,359	1.15%
State of Arizona	5,924,476	6,401,569	6,758,251	7,076,199	1.38%
United States	295,516,553	309,326,085	320,742,673	327,167,434	0.79%

CAGR: Compound Annual Growth Rate
Source: Arizona Office of Economic Opportunity; Woods & Poole Complete Economic Demographic Data Source (2018)

EMPLOYMENT

Analysis of an area's employment base can provide valuable insight into the overall well-being of the region. Regional economic situations can have a tremendous effect on a community's economic health. Some indicators of a region's economic health include availability of jobs, variety of employment opportunities, and types of wages provided by local employers. Employment data for the region is calculated by analyzing the number of employees in the area. **Table 1J** gives historical employment data for Mohave County, the State of Arizona, and the United States since 2005. Total employment in Mohave County has grown at a CAGR of 0.04 percent since 2005, which is slower than the national and state growth rates over this time period. Between 2005 and 2018, Mohave County saw a net loss of jobs, which can be attributed to the recession the United States faced in 2008. Employment has since recovered to its pre-recession level. The State of Arizona has seen a growth rate significantly higher with an average of 1.41 percent. Lake Havasu City and Mohave County have been able to sustain an economy that provides a variety of employment options serving multiple industries. The city's close proximity to Lake Havasu makes it a hub for tourism and recreation, bolstering employment in the area. The community also provides retail shopping, entertainment, food service, medical, industrial manufacturing, education, government, and many more employment opportunities for its residents.

Understanding the types of employment opportunities will aid in identifying demand for aviation services in the area. Some major employers in Mohave County include Sterlite Corporation, Havasu Regional Medical Center, and Lake Havasu City. According to Lake Havasu City's Partnership for Economic Development, approximately 21,823 residents are included in the labor force, or about 40 percent of the total population. This is due to Lake Havasu City's status as a popular retirement destination, with a majority of residents no longer active in the labor force. Of those included in the work force, it is estimated that 20,946 are currently employed and 877 are unemployed, resulting in an unemployment rate of 4.02 percent.

TABLE 1J Historical Employment Statistics					
	2005	2010	2015	2018	CAGR
Mohave County	72,682	64,218	67,040	73,086	0.04%
State of Arizona	3,224,378	3,184,488	3,551,091	3,867,486	1.41%
United States	172,557,438	173,034,709	190,422,800	202,637,900	1.24%
CAGR: Compound Annual Growth Rate					
Source: Woods & Poole Complete Economic Demographic Data Source (2018)					

PER CAPITA PERSONAL INCOME

Table 1K presents per capita personal income (PCPI) for Mohave County, the State of Arizona, and the United States. PCPI is determined by dividing the total economic output by population. In order for PCPI to grow, income growth must outpace population growth significantly. Arizona's PCPI has increased 2.27 percent since 2005. Mohave County PCPI has outpaced Arizona with a growth rate of 2.6 percent, but the United States has been most productive with a 3.89 percent increase to PCPI.

TABLE 1K Historical Per Capita Personal Income (adjusted to 2018 dollars)					
	2005	2010	2015	2018	CAGR
Mohave County	$23,521	$25,626	$29,355	$32,820	2.60%
State of Arizona	$32,228	$33,558	$39,641	$43,132	2.27%
United States	$35,904	$40,277	$48,450	$52,920	3.89%
CAGR: Compound Annual Growth Rate					
Source: Woods & Poole Complete Economic and Demographic Data (2018)					

ENVIRONMENTAL INVENTORY

This environmental inventory identifies potential environmental sensitivities, based on the 14 environmental impact categories outlined in FAA's Order 1050.1F *Environmental Impacts: Policies and Procedures*, that should be considered when planning future improvements at the airport.

- Air Quality
- Biological Resources (including fish, wildlife, and plants)
- Climate
- Coastal Resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous Materials, Solid waste, and Pollution Prevention
- Historical, Architectural, Archeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Compatible Land Use

- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (including light emissions)
- Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

It was determined that the following resources are not present within the airport environs or cannot be inventoried because they are evaluated as part of project implementation:

- Resources Not Present
  - Coastal Resources (Coastal Barriers and Coastal Zones) – the airport is inland and not subject to any coastal restrictions.
  - Farmlands – No prime farmland was identified on airport property.
  - Wild and Scenic Rivers – There are no designated wild and scenic rivers within the vicinity of the airport. The closest designated river is the Amargosa River in California, approximately 131 miles northwest of the airport.

- Resources Not Inventoried
  - Natural resources and energy supply
  - Visual effect (including light emissions) – Lake Havasu City or surrounding environs are not designated as dark sky places.

AIR QUALITY

The concentration of various pollutants in the atmosphere describes the local air quality. The significance of a pollution concentration is determined by comparing it to the state and federal air quality standards. In 1971, the U.S. Environmental Protection Agency (EPA) established standards that specify the maximum permissible short-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for six criteria pollutants, which include: Ozone (O_3), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxide (NO_x), Particulate matter (PM_{10} and $PM_{2.5}$), and Lead (Pb).

Based on both federal air quality standards, a specific geographic area can be classified as either an "attainment," "maintenance," or "non-attainment" area for each pollutant. The threshold for non-attainment designation varies by pollutant. The airport is in Mohave County, Arizona, which is designated as an attainment area for all federal criteria pollutants except PM_{10}. Mohave County was previously a non-attainment area for this pollutant and was designated as a maintenance area in 2001.[1]

[1] https://www3.epa.gov/airquality/greenbook/anayo_az.html

BIOLOGICAL RESOURCES

Biotic resources include the various types of plants and animals that are present in an area. The term also applies to rivers, lakes, wetlands, forests, and other habitat types that support plants and animals.

The U.S. Fish and Wildlife Service (USFWS) is charged with overseeing the requirements contained within Section 7 of the *Endangered Species Act* (ESA). This Act was put into place to protect animal or plant species whose populations are threatened by human activities. Along with the FAA, the USFWS reviews projects to determine if a significant impact to these protected species will result with implementation of a proposed project. Significant impacts occur when the proposed action could jeopardize the continued existence of a protected species or would result in the destruction or adverse modification of federally designated critical habitat in the area.

According to the USFWS Information for Planning and Consultation (IPaC), there are seven federally listed threatened or endangered species which have the potential to occur in the vicinity of the airport. These species, along with habitat requirements, are noted in **Table 1L** below:

TABLE 1L
Federally Listed Species Potentially Occurring Near Lake Havasu City Municipal Airport
Mohave County, Arizona

Species Name	Scientific Name	Federal Status	Range / Habitat Requirements
Birds			
California least tern	*Sterna antillarum browni*	Endangered	Forms nesting colonies on barren to sparsely vegetated areas. Tends to nest in shallow depressions on open sandy beaches, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, or drainage systems.
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Habitat includes dense riparian habitats along streams, rivers, and other wetlands where cottonwood, willow, boxelder, saltcedar, Russian olive, buttonbush, and arrowweed are present. Nesting habitat is in thickets of trees and shrubs that are 13' to 23' tall, among dense, homogeneous foliage.
Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened	The Yellow-billed Cuckoo uses a variety of riparian habitats and appears to require large blocks of riparian habitat for breeding.
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Found at elevations below 4,000 feet in freshwater marshes, typically dominated by cattails, bulrushes, and sedges.
Reptiles			
Northern Mexican Garter Snake	*Thamnophis eques megalops*	Threatened	The Northern Mexican Garter Snake prefers to live at elevations of 130 to 8,497 ft and is considered a riparian obligate. This snake primarily lives in the following general habitat types: 1) source-area wetlands, 2) large river riparian woodlands and forests, and 3) streamside gallery forests.
Fishes			
Bonytail chub	*Gila elegans*	Endangered	Found in slow-water stream habitats at elevations below 4,000 feet.
Razorback sucker	*Xyrauchen texanus*	Endangered	Habitat includes backwaters, flooded bottomlands, pools, side channels, and other slower-moving habitats.

Source: U.S. Fish and Wildlife Service, Information for Planning and Conservation, https://ecos.fws.gov/ipac/; September 2018

Critical habitat for the bonytail chub (endangered fish) has been identified within the Colorado River, less than two miles west from the airport.

In addition to the ESA, the *Migratory Bird Treaty Act* (MBTA) is also applicable at the airport as much of the study area constitutes habitat for birds protected under this Act. The IPaC report lists ten bird species that may be present at the airport.

Birds protected under the MBTA may nest, winter, or migrate throughout the area, including those protected by the ESA. Under the requirements of the MBTA, all project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. Migratory birds with potential to occur in the study area are listed in **Table 1M** below.

TABLE 1M
Birds Protected Under the *Migratory Bird Treaty Act*
Mohave County, Arizona

Bald eagle	Lawrence's goldfinch
Black-chinned sparrow	Long-billed curlew
Clark's grebe	Marbled godwit
Costa's hummingbird	Rufous hummingbird
Gila woodpecker	Willet

Source: U.S. Fish and Wildlife Service, Information for Planning and Conservation, https://ecos.fws.gov/ipac/; 2018

The Biological Evaluation (BE) prepared by SWCA identified, through the USFWS IPaC, one bird of concern which has the probability of presence in the vicinity of the airport. This bird is the Clark's grebe (*Aechmophorus clarkii*), which has a year-round breeding season. The BE also identified other protected bird species on the field visit: the white-crowned sparrow (*Zonotrichia leucophrys*), loggerhead shrike (*Lanius ludovicianus*), rock wren (*Salpinctes obsoletus*), and chipping sparrow (*Spizella passerina*).

CLIMATE

The EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2016*, found that the transportation sector, which includes aviation, accounted for 28.5 percent of U.S. greenhouse gas (GHG) emissions in 2016. Of this, aviation contributed 168.0 million metric tons (MMT) of carbon dioxide equivalent (CO_2e), or nearly nine percent of all transportation emissions.[2, 3] Transportation sources include cars, trucks, ships, trains, and planes. Most of the GHG emissions from transportation are CO_2 emissions resulting from the combustion of petroleum-based products in internal combustion engines. Relatively insignificant amounts of methane (CH_4), hydrofluorocarbon (HFC), and nitrous oxide (N_2O) are emitted during fuel combustion.

[2] Aviation activity consists of emissions from jet fuel and aviation gasoline consumed by commercial aircraft, general aviation, and military aircraft.
[3] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016, Table 2-13 (available: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2016)

From 1990 to 2016, total transportation emissions increased. The upward trend is largely due to increased demand for travel; however, much of this travel was done in passenger cars and light-duty trucks. In addition to transportation-related emissions, **Figure 1** shows all GHG emissions sources in the U.S. in 2016.

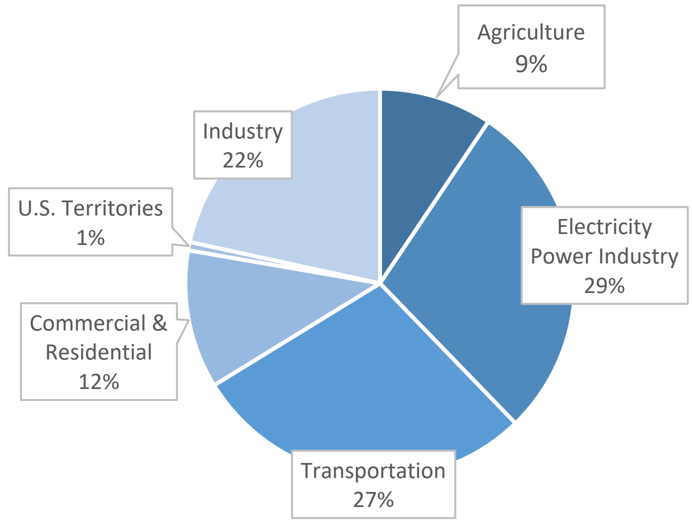


Figure 1: 2016 Sources of Greenhouse Gas Emissions in the U.S.
Source: U.S. EPA (2018)

Increasing concentrations of GHGs can affect global climate by trapping heat in the Earth's atmosphere. Scientific measurements have shown that Earth's climate is warming, with concurrent impacts, including warmer air temperatures, rising sea levels, increased storm activity, and greater intensity in precipitation events. This climate change is a global phenomenon that can also have local impacts (Intergovernmental Panel on Climate Change, 2014). GHGs, such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3), are both naturally occurring and anthropogenic (man-made).

Research has also shown a direct correlation between fuel combustion and GHG emissions. GHGs from anthropogenic sources include CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years.

Information regarding the climate in Lake Havasu City, including wind, temperature, and precipitation, are found earlier in this chapter.

DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Section 4(f) of the Department of Transportation (DOT) Act, which was recodified and renumbered as Section 303(c) of 49 USC, provides 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 parks, recreation areas, or waterfowl and wildlife refuges 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 nearby properties of each type that may be protected under Section 4(f) of the DOT Act:

- National Register of Historic Places
  - La Purisima Mission, 5.9 miles north-northwest
  - Old Trails Bridge, 11.1 miles northwest
- Recreation Area – Lake Mead National Recreation Area, 41.8 miles west
- Wilderness Areas
  - Havasu Wilderness, 1.0 miles west
  - Chemehuevi Mountain Wilderness, 3.9 miles west
- Wildlife Refuges
  - Havasu National Wildlife Refuge, 1.5 miles west-southwest
  - Bill Williams River National Wildlife Refuge, 23.1 miles southeast
- State Parks
  - Lake Havasu State Park, 5.9 miles south-southwest
  - Buckskin Mountain State Park, 24.4 miles south
- Regional Park – S.A.R.A. Park, 8.9 miles south
- Local Parks
  - Dick Samp Memorial Park, 2.4 miles south
  - Avalon Park, 2.9 miles south
  - Robyn Parrott Children's Park, 6.1 miles southeast
  - Indian Bend Park, 6.2 miles southeast
  - Yonder Park, 5.7 miles southeast
  - Realtor Park, 5.8 south-southeast
  - Jack Hardie Park, 6.2 miles south
  - Mesquite Park, 6.0 miles south
  - Wheeler Park, 5.8 miles south
  - Cypress Park, 6.4 miles south
  - Rotary Park, 6.2 miles south
  - London Bridge Beach, 6.2 miles south-southwest
  - Grand Island Park, 7.2 miles south-southwest

HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

Federal, state, and local laws regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. In addition, disrupting sites containing hazardous materials or contaminates may cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources. According to the EPA's *EJSCREEN*, there are no Superfund or brownfield sites within five miles of the airport.[4]

The Lake Havasu City Landfill, a solid waste landfill, is located less than two miles east-southeast of the airport.

[4] https://ejscreen.epa.gov/mapper/

HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL, 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.

The La Purisima Mission, located 5.9 miles north of the airport is the only property listed on the National Register of Historic Places within the vicinity of the airport.

The Chemehuevi Reservation is located within the vicinity west of the airport.

As part of the Master Plan, SWCA conducted an on-site, multi-day field archeological survey of airport property and observed five isolated occurrences (IOs) of historic-era sites consisting of one .50-calilber bullet cartridge case and four .50-caliber projectiles. It is recommended by SWCA these sites are ineligible for listing on the National Register of Historic Places (NRHP). Additionally, prior to fieldwork, SWCA consulted the AZSITE[5] state database to review previous conducted surveys and recorded sites within the vicinity of the airport. Records show that there have been 31 previous archaeological projects on and within one mile of airport property, which covered approximately 95 percent of airport property. None of these surveys identified cultural properties.

No other sites were identified within the vicinity of the airport.

LAND USE

Land uses around the airport are described earlier in the chapter and are displayed on **Exhibit 1L**.

NOISE AND COMPATIBLE LAND USE

Federal land use compatibility guidelines are established under 14 Code of Federal Regulations (CFR) Part 150 (Part 150), *Airport Noise Compatibility Planning*. According to 14 CFR Part 150, residential land uses and schools are noise-sensitive land uses that are not considered compatible with a 65 decibel (dB) Day-Night Average Sound Level (DNL). Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB DNL contour, are generally compatible when an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure. Special consideration also needs to be given to noise-sensitive areas within Section 4(f) properties where

[5] https://azsite3.asurite.ad.asu.edu/azsite/index.html

the land use compatibility guidelines in 14 CFR Part 150 do not account for the value, significance, and enjoyment of the area in question (FAA 2015). A Part 150 noise study has not been prepared for the airport.

Noise-sensitive land uses near the airport consist primarily of residential uses to the south and west. Other noise-sensitive land uses within the vicinity of the airport include:

- Schools
  - Nautilus Elementary, 2.8 miles south
  - Havasupai Elementary School, 3.9 miles south
  - Lake Havasu Charter School, 3.7 miles southwest
  - Lake Havasu High School, 4.7 miles south
  - Telesis Preparatory Academy, 5.0 miles south
- Religious Facilities
  - Havasu Bible Fellowship, 1.4 miles southwest
  - Church of Christ, 2.9 miles southwest
  - Lake Havasu Baptist Church, 2.8 miles south
  - Bethany Bible Church, 3.2 miles southwest
  - St. Peter the Aleut Orthodox Christian Church, 3.7 miles south
  - Lakeview Community Church, 4.4 miles southwest
  - Calvary Chapel Lake Havasu, 4.4 miles southwest
  - Living Word Family Church, 4.4 miles southwest
  - Mount Olive Lutheran Church, 4.4 miles south
  - Lake Havasu Church of the Nazarene, 4.7 miles south
- Hospitals / Nursing Homes
  - Havasu Regional Medical Center, 5.4 miles south
  - Sun Haven Assisted Living, 4.0 miles southeast

Lake Havasu City zoning ordinance establishes an airport overlay zone (AP-O district), applying to certain zones which include all land lying beneath the approach surface, transitional surfaces, horizontal surfaces, and conical surfaces for the airport. These zones are identified on a January 1986 Lake Havasu City Municipal Airport Approach Plan and Zoning Map and were incorporated into the zoning ordinance by reference. The AP-O district establishes height limitations for structures and landscaping within the overlay district, with maximum height being established by each distinct zone.

The AP-O zone also restricts uses to those that shall not be made of land or water within any zone established within any zone in a manner as to create electrical interference with navigational signals, or radio communications between the airport and aircraft, make it difficult for pilots to distinguish between airport lights and others, result in glare in the eyes of pilots using the airport, impair visibility in the vicinity of the airport, create bird strike hazards, or otherwise endanger or interfere with the landing, takeoff or maneuvering of aircraft intending to use the airport.[6]

[6] https://www.lhcaz.gov/docs/default-source/department-documents/2016-development-code.pdf?sfvrsn=fe31057c_12

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

General socioeconomic information, such as population and economic trends, are addressed earlier in the chapter. However, FAA Order 1050.1F specifically requires that a federal action causing disproportionate impacts to an environmental justice population (i.e., a low-income or minority population), be considered, as well as an evaluation of environmental health and safety risks to children. The EPA's *EJSCREEN* online tool was consulted regarding the presence of low income and minority populations within the airport environs. With an approximate population of 21,877 within five miles of the airport, 39 percent of the population is considered low-income and 19 percent is considered a minority population. Likewise, according to *EJSCREEN*, four percent of the population is under the age of five.

WATER RESOURCES

Lake Havasu City provides the stormwater infrastructure for the airport. The city prepared a Storm Water Pollution Prevention Plan (SWPPP), which identified two major objectives: 1) identify sources of pollution potentially affecting the quality of stormwater discharge and 2) ensure implementation measures minimize and control pollutants in stormwater discharges associated with activities conducted at the airport. In the State of Arizona, stormwater management is regulated on both the federal and state levels. Arizona Pollutant Discharge Elimination System (AZPDES) requirements apply to stormwater discharges associated with industrial activities at the airport which was reviewed by the FAA. Potential point sources for pollution identified in the SWPPP includes, but is not limited to, aircraft fueling and washing, runway maintenance, and landscape/green space maintenance. If any airport activities cause potential impact on local waters, they are properly addressed and, if necessary, the Lake Havasu City Fire Department is contacted. Water resources near the airport are depicted on **Exhibit 1M**.

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* (CWA). Wetlands are defined in Executive Order (EO) 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 USFWS, which manages the National Wetlands Inventory on behalf of all federal agencies, there are drainages identified as wetlands on the airport. It is important to note that these areas were identified as wetlands based on a review of aerial photography from 1981 and may no longer be present.

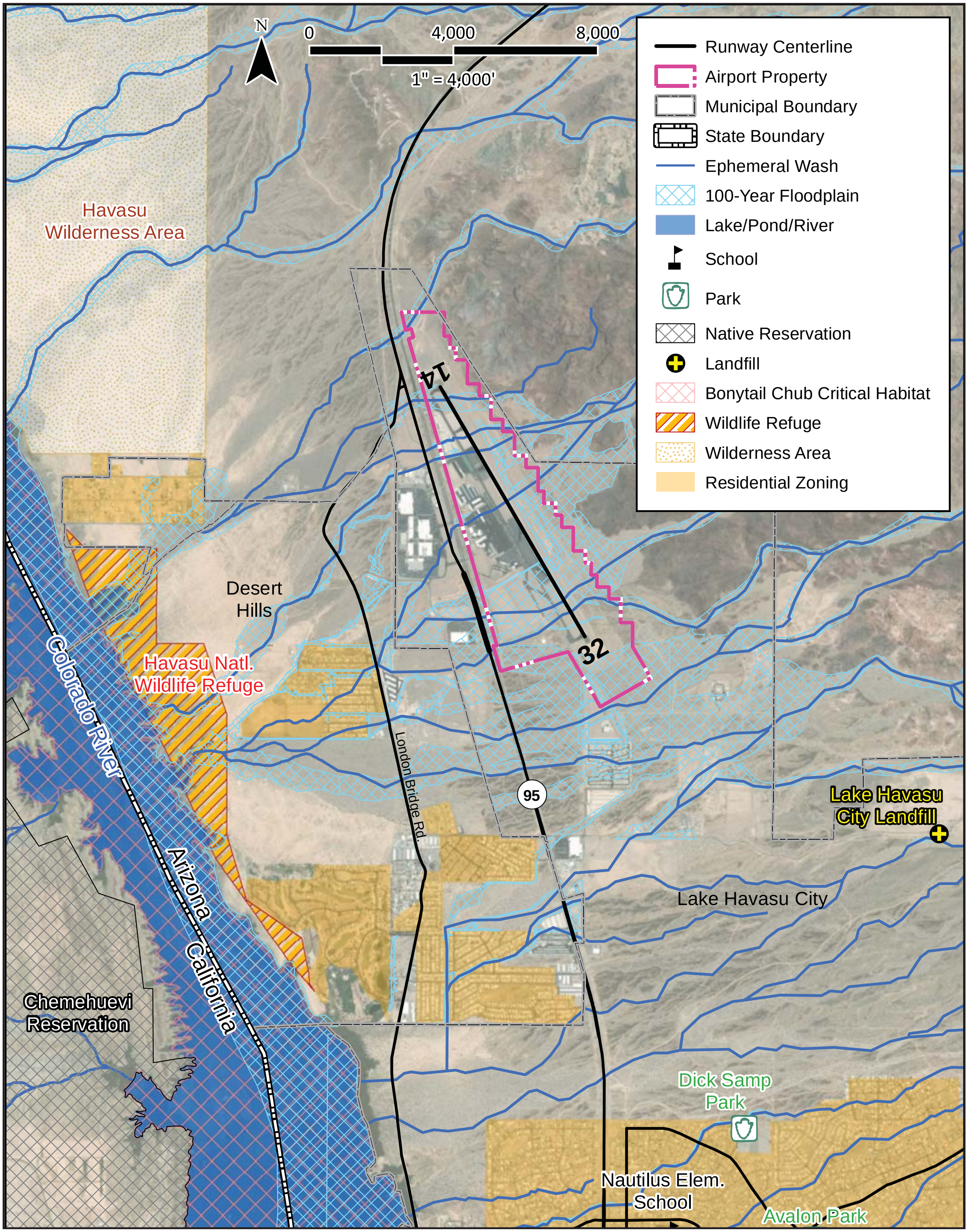


Exhibit 1M
ENVIRONMENTAL SENSITIVITIES

Additionally, based on information from the Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS), there are no hydric soils present on airport property.

Floodplains. EO 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 floodplains. Based on a review of Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 04015C5936H and 04015C5950H, both dated December 2, 2015, portions of airport property are within the AO floodplain. This area is designated as a Special Flood Hazard Area, which is subject to flooding by a 100-year flood event with an average depth of one to three feet.

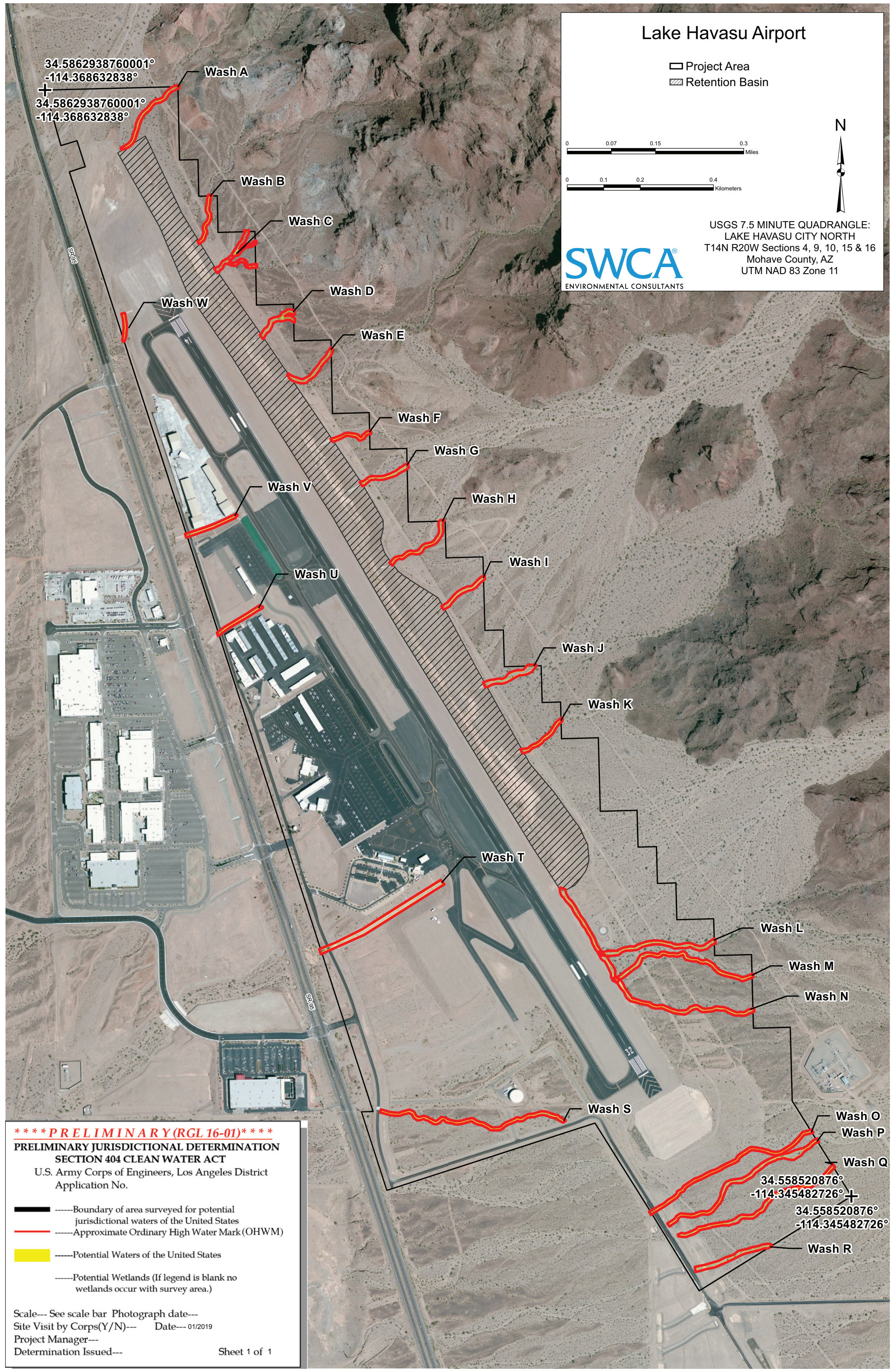
Surface Waters. The CWA provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc. Additionally, Congress has mandated (under the CWA) the National Pollutant Discharge Elimination System (NPDES). The Arizona Department of Environmental Quality has the authority to administer the NPDES program in the state, tribal lands excluded. The AZPDES permit mandates certain procedures required to prevent contamination of water bodies from stormwater runoff.

Examples of direct impacts to surface waters include any in-water work resulting from the expansion of an airport adjacent to surface waters, or the withdrawal of water from surface water feature for construction or operations. No impaired waters included in section 303(d) of the CWA are listed within the vicinity of the airport. A review of the National Hydrography Dataset, published by the United States Geological Survey, indicates there are drainage channels on airport property.

In October 2018, SWCA conducted a field study and prepared a Preliminary Jurisdictional Determination (PJD) technical memorandum for the airport to determine the extent of potentially jurisdictional waters of the U.S. (WOTUS) on airport property.[7] The PJD identified 22 ephemeral washes associated with stormwater discharge from the surrounding mountains. These washes are interconnected and have been channeled into culverts and detention ponds on the east side of the airport. The washes then flow under Runway 14-32, ultimately discharging into Lake Havasu and the Colorado River located approximately 1.5 miles to the west. These 22 ephemeral drainage features were determined to be potential WOTUS based on the presence of ordinary high-water marks (OHWMs) with an estimated area of 5.28 acres, identified in **Exhibit 1N**.

Wild and Scenic Rivers. The National Wild and Scenic Rivers Act was established to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the

[7] SWCA Environmental Consultants, Inc. Technical Memorandum Preliminary Jurisdictional Determination for the Lake Havasu City Municipal Airport Master Plan Updated Project in Lake Havasu City, Mohave County, Arizona (February 12, 2019).



SUMMARY OF POTENTIALLY JURISDICTIONAL WATERS OF THE U.S. FOR LAKE HAVASU AIRPORT

WASH IDENTIFIER	DRAINAGE LENGTH (TOTAL LINEAR FEET)	AVERAGE OHWM (FEET)	AREA (ACRES)
Wash A	774.72	9.0	0.16
Wash B	464.05	6.6	0.07
Wash C	862.73	9.6	0.19
Wash D	488.08	16.1	0.18
Wash E	479.81	15.4	0.17
Wash F	375.28	4.6	0.04
Wash G	438.26	12.9	0.13
Wash H	658.65	9.3	0.14
Wash I	451.95	12.5	0.13
Wash J	480.43	26.3	0.29
Wash K	461.33	7.6	0.08
Wash L	1,052.07	13.7	0.33
Wash M	1,405.55	9.0	0.29
Wash N	2,308.57	11.3	0.60
Wash O	1,691.84	5.4	0.21
Wash P	1,614.10	12.7	0.47
Wash Q	1,544.94	8.7	0.31
Wash R	679.52	17.3	0.27
Wash S	1,766.03	6.4	0.26
Wash T	830.87	39.8	0.76
Wash U	439.50	7.9	0.08
Wash V	463.05	8.5	0.09
Wash W	230.65	5.7	0.03
Total	**19,962**	**10.2 (Weighted Average)**	**5.28**

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enjoyment of present and future generations. The closest designated Wild and Scenic River is a portion of the Amargosa River in California, approximately 131 miles northwest of the airport.[8]

***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 airport is underlain by sandstone rock that retains only a minimal portion of the intergranular pore space that was present before the rock was consolidated, and the hydraulic conductivity is low to moderate. Because the hydraulic conductivity of sandstone is low to moderate, these types of aquifers tend to provide large amounts of water.[9] There is no sole source aquifer near the airport.

ENVIRONMENTAL INVENTORY SOURCES

A variety of resources were used during the inventory process. The following list is a compilation of these sources.

U.S. Environmental Protection Agency, Currently Designated Nonattainment Areas for All Criteria Pollutants:
https://www3.epa.gov/airquality/greenbook/anayo_az.html

U.S. Environmental Protection Agency, *EJSCREEN:*
http://www.epa.gov/ejscreen

FEMA Flood Map Service Center:
https://msc.fema.gov/portal/search?AddressQuery=lake%20havasu%20city%20municipal%20airport%2C%20lake%20havasu%20city%2C%20az#searchresultsanchor

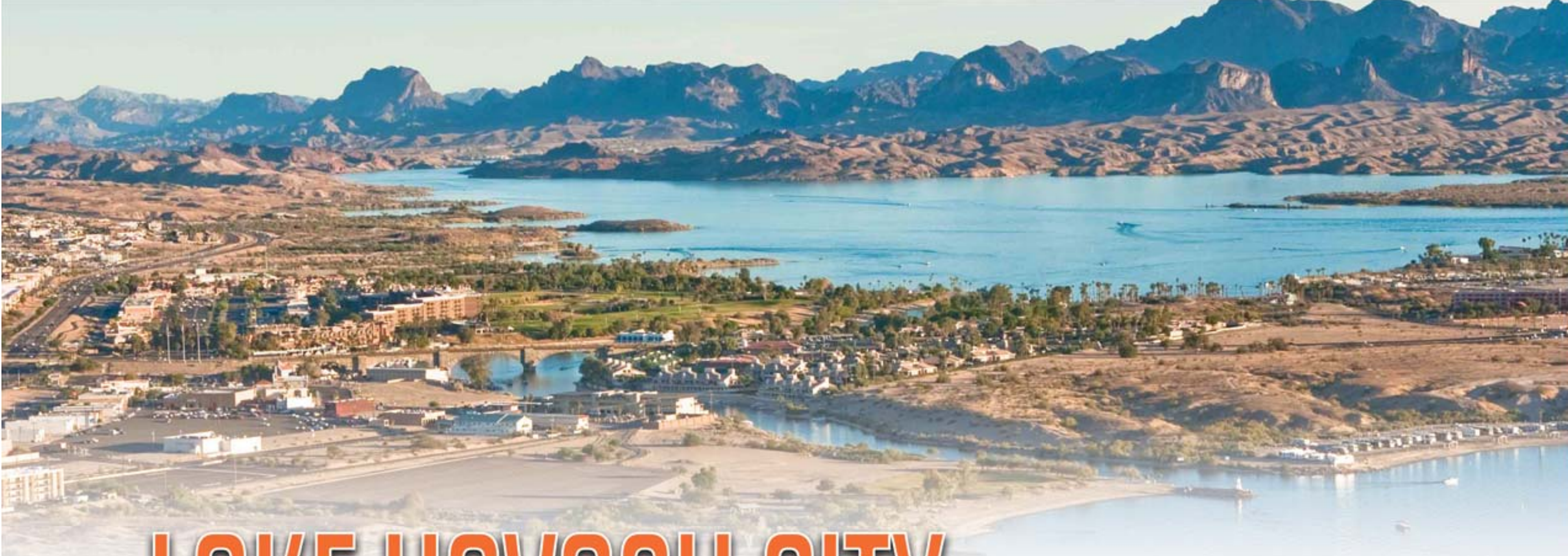
Natural Resources Conservation Service, Web Soil Survey:
http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

U.S. Fish and Wildlife Service Information, Planning and Consultation System:
https://ecos.fws.gov/ipac/

U.S. Fish and Wildlife Service National Wetlands Inventory:
http://www.fws.gov/wetlands/Data/Mapper.html

USGS National Map:
http://nationalmap.gov/

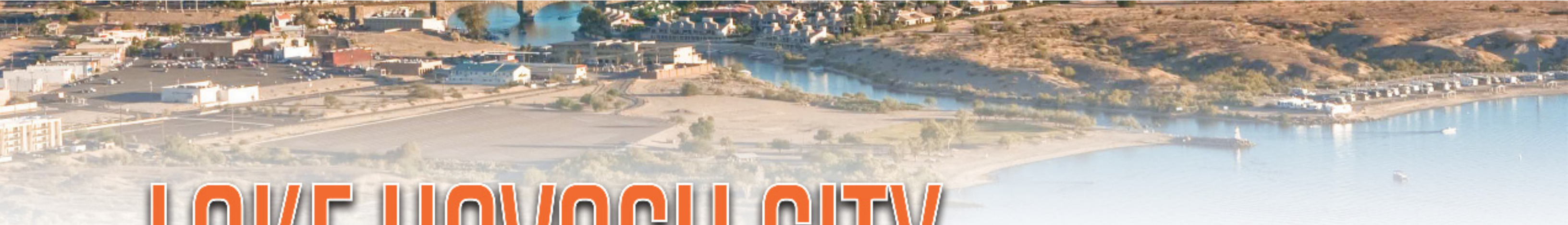
[8] https://rivers.gov/wsr-act.php
[9] https://water.usgs.gov/ogw/aquifer/101514-wall-map.pdf



LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

CHAPTER TWO

FORECASTS



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER TWO
FORECASTS

The forecast element of the Lake Havasu City Municipal Airport Master Plan begins with defining the potential demand at the airport over the specified planning period. The definition of demand that may reasonably be expected to occur during the useful life of an airport's key components (e.g., runways, taxiways, terminal buildings, storage hangars, etc.) is an important factor in facility planning. In airport master planning, this involves projecting potential aviation activity for at least a 20-year timeframe. Aviation demand forecasting for Lake Havasu City Municipal Airport will focus on demand indicators, such as based aircraft, based aircraft fleet mix, annual aircraft operations, operational peaking periods, and the critical design aircraft. In addition, potential commercial service demand indicators will be examined to evaluate the airport's opportunity to support commercial passenger services.

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

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

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

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

The forecasting process for an airport master plan consists of a series of basic steps that vary in complexity depending on 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 the aviation activities likely to impact facility needs. 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 judgement.

5. **Apply Forecasts 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 Forecasts 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 the

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.

The following forecast analysis for Lake Havasu City Municipal 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 forecasts developed for the airport must consider national, regional, and local aviation trends. The following section describes trends in aviation. This information is utilized both in statistical analysis and to aid the forecast preparer in making any manual adjustments to the forecasts as necessary.

Each year, the FAA updates and publishes a national aviation forecast. Included in this publication are forecasts for the large air carriers, regional/commuter air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budget and planning needs of the FAA and 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 2018-2038*, published in March 2018. 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.

Since its deregulation in 1978, the U.S. commercial air carrier industry has been characterized by boom-to-bust cycles. The volatility associated with these cycles was thought by many to be a structural feature of an industry that was capital intensive but cash poor. However, the great recession of 2007-09 marked a fundamental change in the operations and finances of U.S. airlines. Air carriers fine-tuned their business models to minimize losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, carriers initiated new services that customers were willing to purchase and started charging separately for services that were historically bundled in the price of a ticket. The industry experienced an unprecedented period of consolidation with three major mergers in five years. These changes, along with capacity discipline exhibited by carriers, have resulted in an eighth consecutive year of profitability for the industry in 2017. Looking ahead, there is optimism that the industry has been transformed from that of a boom-to-bust cycle to one of sustainable profits.

ECONOMIC ENVIRONMENT

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 1.9 percent annually. The uptick in passenger growth in 2016-2017 will continue into 2018 spurred on by favorable economic conditions in the U.S. and the world. The price of oil is projected to rise from around $48 per barrel in 2017 to $51 in 2018 and continue to rise, exceeding $100 by 2030 and approaching $119 by 2038.

U.S. economic performance in 2017 was estimated to have grown in real gross domestic product (GDP) to 17.0 trillion (inflation adjusted to 2009 dollars) and was forecast to grow at an average annual growth rate of 2.0 percent through 2038. Although the U.S. economy has managed to avoid a recession, a prolonged period of faster economic growth (e.g., > 3.0 percent) may not be forthcoming. Additional potential headwinds for the global economy include uncertainty surrounding "Brexit," recessions in Russia and Brazil, inconsistent performance in other emerging economies, a "hard landing" in China, and a lack of further stimulus in the advanced economies.

U.S. TRAVEL DEMAND

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. According to FAA, four distinct trends are shaping today's commercial air carrier industry: (1) easing capacity discipline; (2) steady growth of seats per aircraft; (3) increasing competitive pressure due to ultra-low-cost carrier expansion; and (4) continued reliance on ancillary revenues.

With the approval of the Alaska Airlines/Virgin America merger, the outlook for further consolidation via mergers and acquisitions appears to be limited. There are now six major mainline airlines: American, Delta, United, Southwest, Alaska/Virgin, and JetBlue, which accounted for more than 85 percent of the U.S. airline industry capacity and traffic. It is highly unlikely that the U.S. Government will approve any further mergers among these due to anti-trust regulations. In 2005, there were 12 major mainline airlines.

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), especially in domestic markets. Between 1978 and 2000, available seat miles (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 fiscal year (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. Since 2009, U.S. domestic ASMs have increased at an average rate of 2.1 percent per year, while revenue passenger miles (RPMs) have grown 2.8 percent per year.

In 2017, mainline carriers provided nine percent more capacity than they did in 2007, while carrying 11.8 percent more passengers. Capacity flown by the regional group has shrunk by 2.8 percent over the same period (with passengers carried down 5.1 percent).

The regional market has continued to shrink as the regionals compete for even fewer contracts with the remaining dominant carriers; this has meant slow growth in enplanements and yields. The regionals have less leverage with the mainline carriers than they have had in the past and are facing large pilot shortages and tighter regulations regarding pilot training. Labor costs are also increasing as they raise wages to combat the pilot shortage. Their capital costs have increased in the short-term as they continue to replace their 50-seat regional jets with more fuel-efficient 70-seat jets. This move to the larger aircraft will prove beneficial in the future, however, since their unit costs are lower.

Another continuing trend 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 unbundling 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 and internet access. Although U.S. passenger carriers posted record net profits in 2016, profits declined in 2017 on rising fuel, labor costs, and flat yields.

FAA COMMERCIAL AIR CARRIER FORECASTS

U.S. commercial air carriers' total number of domestic departures rose in 2016 for the first time since 2007, but then pulled back in 2017 and are about 18 percent below the 2007 level. ASMs, revenue passenger miles (RPMs), and enplanements all grew in each of the past six years; these trends underlie the expanding size of aircraft and higher load factors. In 2017, the domestic load factor came off a historic high reached the year before, but at 84.5 percent, remains near the peak for commercial air carriers. System capacity growth was up 2.9 percent in 2017, with U.S. carriers prioritizing domestic capacity over the international market. U.S. carrier domestic capacity growth will exceed their international capacity growth in 2018, but carriers will start expanding capacity in international markets faster than domestic markets beginning in 2019. This trend is projected to continue through 2038.

Supported by a growing U.S. and world economy, year-over-year RPM growth is forecast to be 2.4 percent on average over the period from 2018-2038. Over the same time, system capacity growth averages 2.3 percent per year and system enplanements are projected to increase an average of 1.9 percent a year, with mainline carriers growing at 2.0 percent a year – slightly higher than their regional counterparts (up 1.6 percent). By 2038, U.S. commercial air carriers are projected to fly 1.884 trillion ASMs and transport 1.284 billion enplaned passengers – a total of 1.596 trillion passenger miles. Planes will remain crowded, with load factors projected to grow to 84.7 percent in 2038 (up 1.2 points compared to the beginning of the forecast period in 2017).

Increases in passenger volume and traffic offset flat yields, along with higher ancillary revenues and relatively low fuel prices, resulted in U.S. carriers being solidly profitable in 2017. Over the long term, the FAA sees a competitive and profitable aviation industry characterized by increasing demand for air travel and airfares growing more slowly than inflation, reflective of a growing U.S. and global economy. **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 FORECAST

The number of aircraft in the U.S. commercial fleet is forecast to increase from 7,141 in 2017 to 8,290 in 2038 fueled by increased demand for air travel and air cargo. The number of jets in the fleet is forecast to add 45 new jets a year as carriers continue to remove older, less fuel-efficient narrow body aircraft. The narrow body fleet (including E-series aircraft at JetBlue and C-series at Delta) is projected to grow 27 aircraft a year as carriers replace the 757 fleet, current technology 737, and A320 family of aircraft with the next generation MAX and Neo families. The regional carrier fleet is forecast to decline by 120 aircraft by 2038 as carriers remove 50-seat regional jets and retire older, small turboprop and piston aircraft, while adding 70-90 seat regional jets, especially the E-2 family after 2020. By 2030, only a handful of 50-seat regional jets will remain in the fleet. By 2038, the number of jets in the regional carrier fleet totals 1,910, up from 1,644 in 2017. Turboprop/piston aircraft in the fleet is forecast to shrink by 79 percent by 2038. **Exhibit 2B** presents the FAA commercial aircraft fleet forecast through 2038.

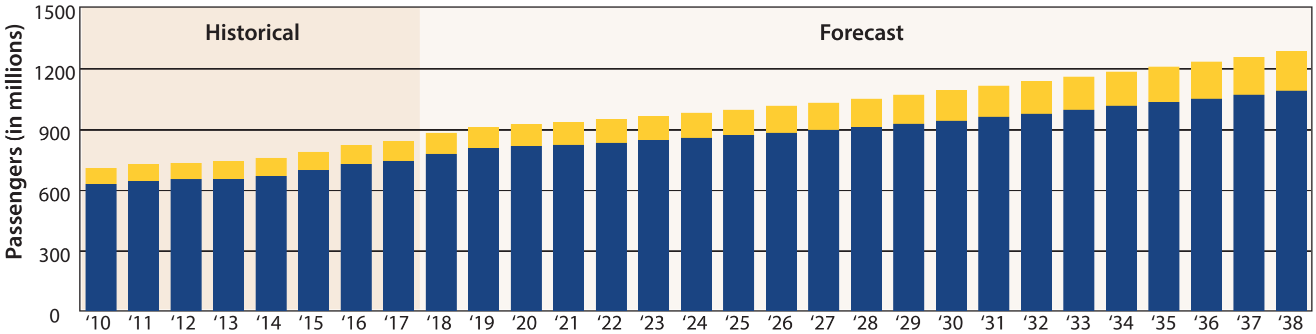
FAA GENERAL AVIATION FORECASTS

The FAA forecasts 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 FAA forecasts "active aircraft," not total aircraft. An active aircraft is one that is flown at least one hour during the year. From 2010 through 2013, the FAA undertook an effort 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, primarily in the piston category.

The long-term outlook for general aviation is favorable, led by gains in turbine aircraft activity. The active general aviation fleet is not forecast to grow significantly in the next 20 years, adding just 1,040 new aircraft to the fleet by 2038. 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 2017, the FAA estimated there were 146,670 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.8 percent from 2018-2038, resulting in 124,320 by 2038. This includes -1.0 percent annually for single engine pistons and -0.4 percent for multi-engine pistons.

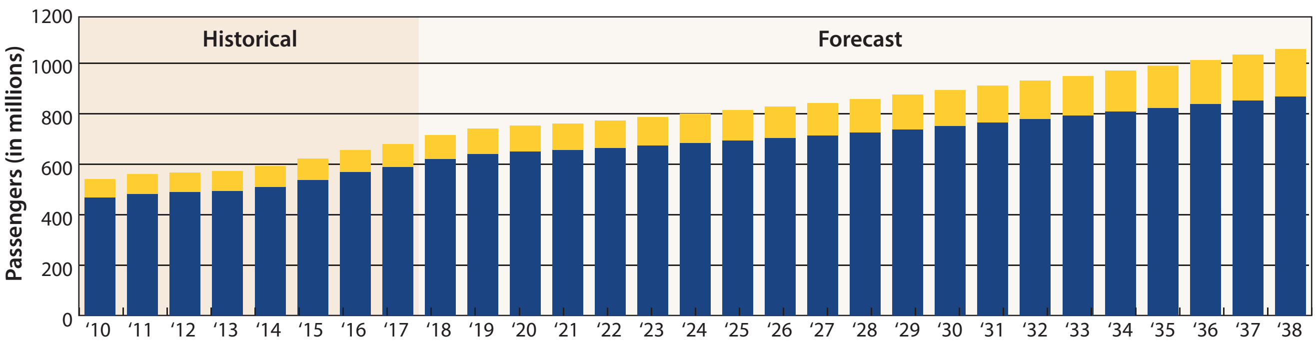
U.S. AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2017	2023	2028	2038	AAGR 2018-2038
Domestic Revenue Enplanements	743	844	909	1,090	1.7%
International Revenue Enplanements	97	119	140	194	3.3%
TOTAL	840	964	1,050	1,284	1.9%

Note: All figures measured in millions

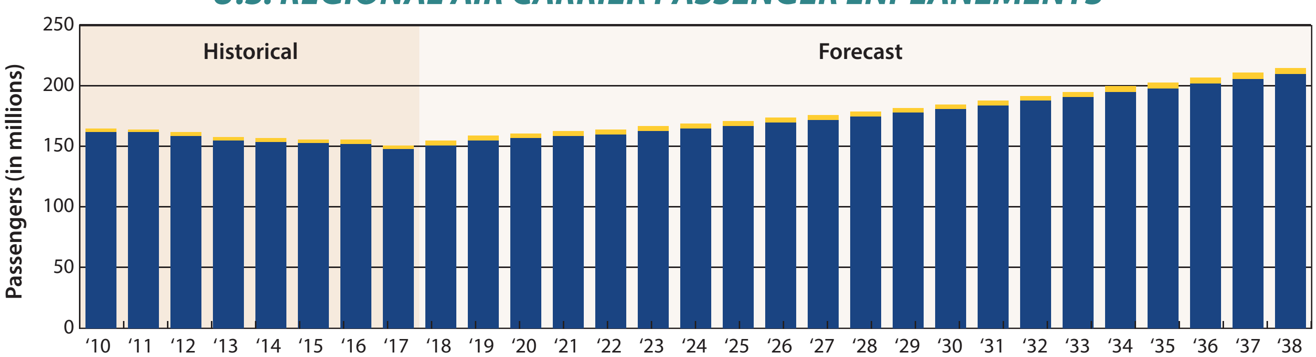
U.S. MAINLINE AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2017	2023	2028	2038	AAGR 2018-2038
Domestic Revenue Enplanements	595	682	734	880	1.7%
International Revenue Enplanements	93	115	136	189	3.3%
TOTAL	689	797	871	1,069	2.0%

Note: All figures measured in millions

U.S. REGIONAL AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2017	2023	2028	2038	AAGR 2018-2038
Domestic Revenue Enplanements	148	163	175	210	1.6%
International Revenue Enplanements	3	4	4	5	1.6%
TOTAL	152	166	179	215	1.6%

Note: All figures measured in millions. Totals may not equal due to rounding
Source: FAA Aerospace Forecast - Fiscal Years 2018-2038

Exhibit 2A
COMMERCIAL AIR CARRIER FORECASTS

Total turbine aircraft are forecast to grow at an annual growth rate of 2.0 percent through 2038. The FAA estimates there were 30,905 turbine-powered aircraft in the national fleet in 2017, and there will be 46,160 by 2038. This includes annual growth rates of 1.7 percent for turboprops, 2.2 percent for business jets, and 1.9 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 0.8 percent through 2038. The FAA estimates there were 27,865 experimental aircraft in 2017, and these are projected to grow to 33,105 by 2038. Sport aircraft are forecast to grow 3.6 percent annually through the long term, growing from 2,585 in 2017 to 5,440 by 2038. **Exhibit 2C** 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, 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 2038, total general aviation operations are forecast to grow 0.3 percent annually.

GENERAL AVIATION AIRCRAFT SHIPMENTS AND REVENUE

The 2008-2009 economic recession has 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. **Table 2A** presents currently available historical data related to general aviation aircraft shipments.

Worldwide shipments of general aviation airplanes increased in 2017 with a total of 2,324 units delivered around the globe, compared to 2,268 units in 2016. However, worldwide general aviation billings were lower than the previous year. In 2017, $20.2 billion in new general aviation aircraft were shipped, but year-end results were mixed across the market segments. North America is the largest market for general aviation aircraft. The Asian-Pacific region is the second largest market for piston-powered aircraft, Latin America is the second largest market for turboprops, and Europe is the second largest market for business jets.

Business Jets: Business jet deliveries grew from 667 units in 2016 to 676 units in 2017. The North American market accounted for 63.8 percent of business jet deliveries, which is a 1.8 percent increase in market share compared to 2016.

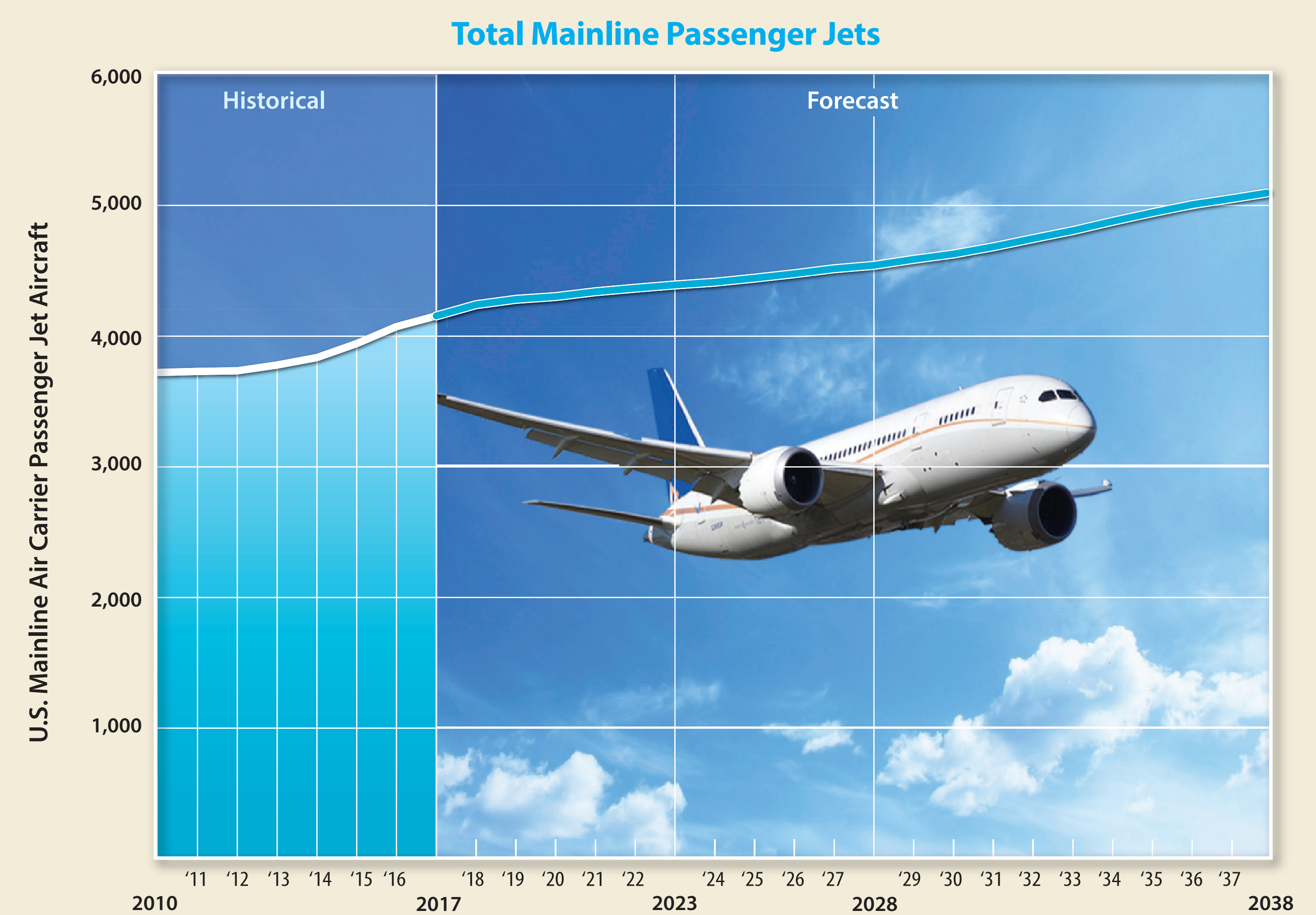
Turboprops: Turboprop shipments were down from 582 in 2016 to 563 in 2017. North America's market share of turboprop aircraft dropped by 3.6 percent in the last year, while the European, Asian-Pacific, and Latin American markets increased their market share.

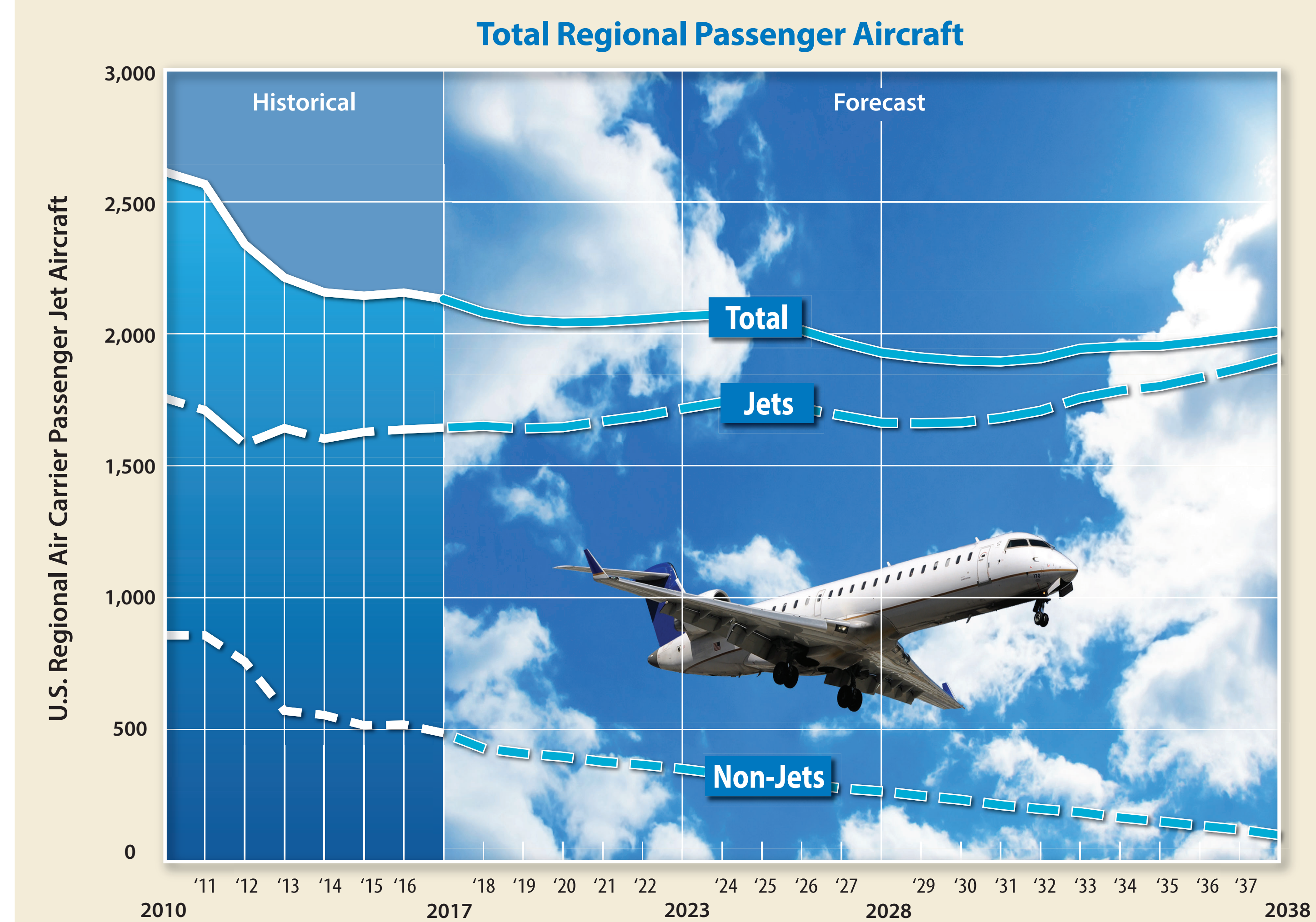
U.S. MAINLINE AIR CARRIER PASSENGER JET AIRCRAFT

	2017	2023	2028	2038	AAGR 2018-2038
Large Narrow Body					
2 Engine	3,539	3,710	3,844	4,190	0.7%
3-4 Engines	1	1	0	0	N/A
Large Wide Body					
2 Engine	517	601	619	833	2.3%
3-4 Wide Body Engines	0	0	0	0	N/A
Total Large Jets	4,057	4,312	4,463	5,023	1.0%
Total Regional Jets	98	80	79	78	-1.1%
Total Mainline Passenger Jets	4,155	4,392	4,542	5,101	0.9%

U.S. REGIONAL AIR CARRIERS PASSENGER AIRCRAFT

	2017	2023	2028	2038	AAGR 2018-2038
Less than 30 Seats					
Turboprop	396	278	200	49	-9.3%
31-40 Seats					
Turboprop	26	20	14	4	-8.8%
Over 40 Seats					
Turboprop	65	53	52	48	-0.7%
Jet	1,644	1,716	1,663	1,910	0.7%
Non-Jet Total	487	351	266	101	-7.0%
Jet Total	1,644	1,716	1,663	1,910	0.7%
Total Regional Passenger Aircraft	2,131	2,067	1,929	2,011	-0.2%





Source: FAA Aerospace Forecast - Fiscal Years 2018-2038

Exhibit 2B
NATIONAL US COMMERCIAL FLEET FORECASTS

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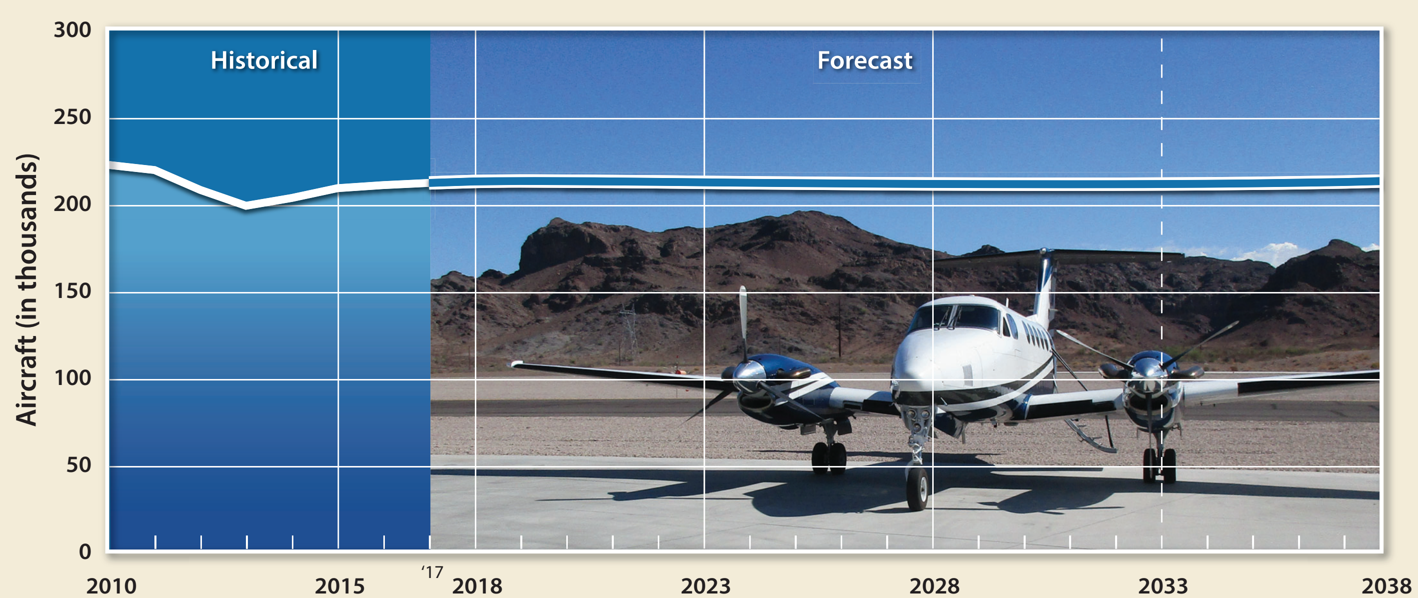
U.S. ACTIVE GENERAL AVIATION AIRCRAFT

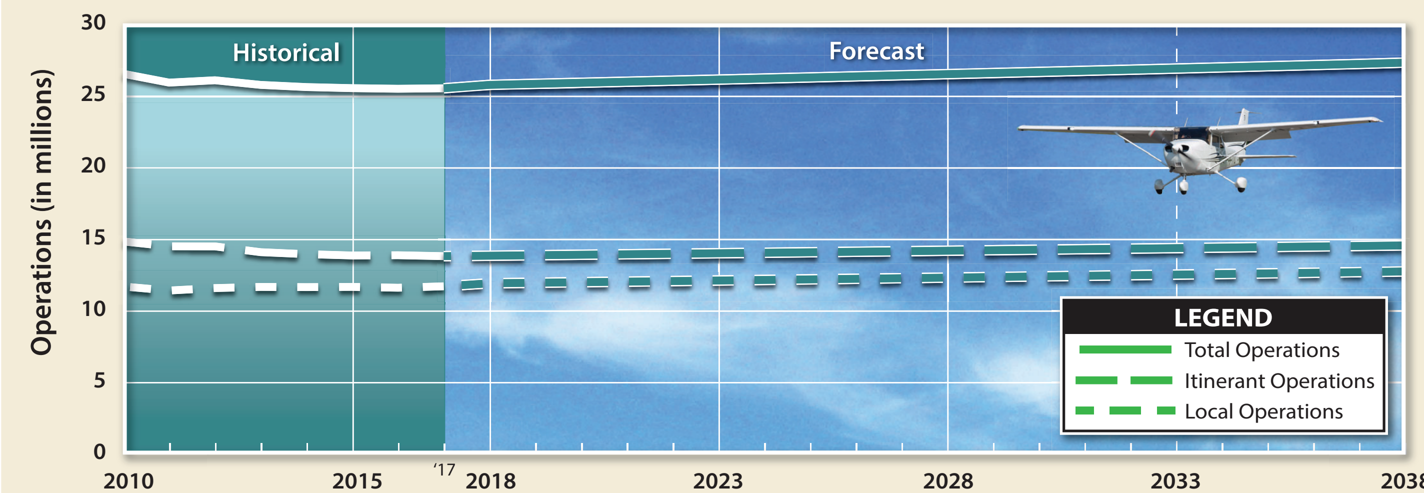
	2017E	2023	2028	2038	AAGR 2018-2038
Fixed Wing					
Piston					
Single Engine	130,330	125,330	118,740	107,800	-1.0%
Multi-Engine	12,935	12,720	12,465	11,845	-0.4%
Turbine					
Turboprop	9,430	9,025	9,870	12,855	1.7%
Turbojet	14,075	16,220	18,120	22,195	2.2%
Rotorcraft					
Piston	3,405	3,750	4,035	4,675	1.5%
Turbine	7,400	8,375	9,200	11,110	1.9%
Experimental					
	27,865	29,595	30,980	33,105	0.8%
Sport Aircraft					
	2,585	3,330	3,995	5,440	3.6%
Other					
	5,025	5,045	5,060	5,065	0.0%
Total Pistons	**146,670**	**141,800**	**135,240**	**124,320**	**-0.8%**
Total Turbines	**30,905**	**33,620**	**37,190**	**46,160**	**2.0%**
Total Fleet	**213,050**	**213,390**	**212,465**	**214,090**	**0.0%**



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 2018-2038*

U.S. GENERAL AVIATION OPERATIONS

	2017E	2023	2028	2038	AAGR 2018-2038
Itinerant					
	13,838,029	14,039,925	14,217,031	14,587,442	0.3%
Local					
	11,731,596	12,135,595	12,338,286	12,763,556	0.3%
Total GA Operations	**25,569,625**	**26,175,520**	**26,555,317**	**27,350,998**	**0.3%**



U.S. AIR TAXI

	2017E	2023	2028	2038	AAGR 2018-2038
Air Taxi/Commuter Operations					
Itinerant	7,179,301	5,442,448	5,671,740	6,287,749	-0.6%

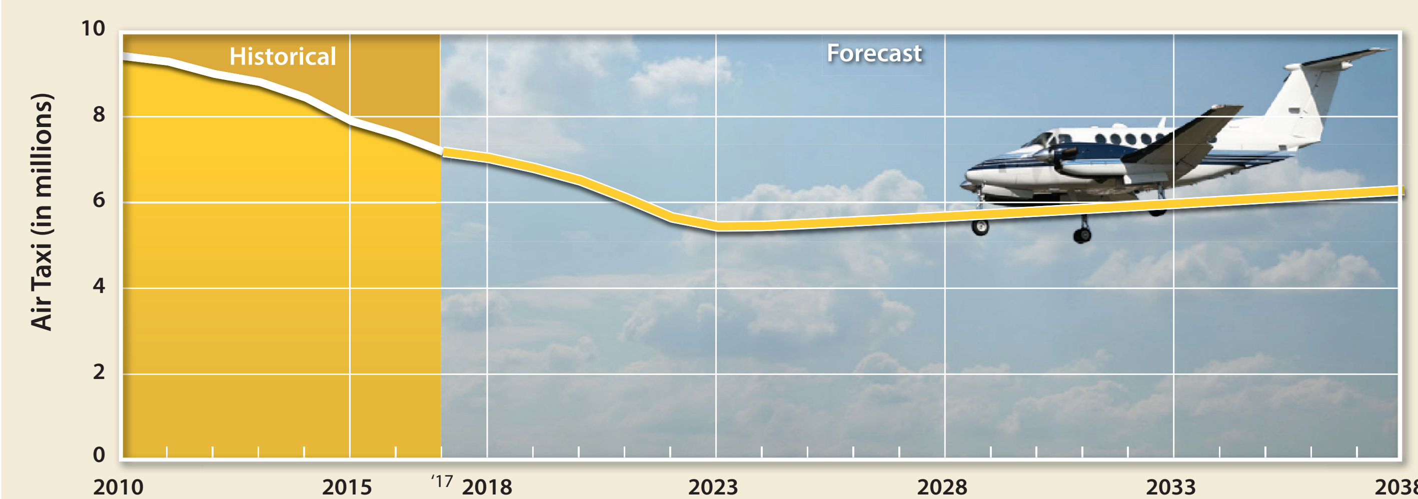


Exhibit 2C
NATIONAL GENERAL AVIATION/AIR TAXI FORECASTS

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Pistons: In 2017, piston airplane shipments grew to 1,085 units over last year's shipment of 1,019 units for a 6.5 percent increase. However, North America's market share of piston aircraft deliveries dropped from 69.6 percent in 2016 to 65.6 percent in 2017. The Asian-Pacific market saw the largest increase in market share at 3.2 percent growth.

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	24,129
2016	2,268	890	129	582	667	21,092
2017	2,324	936	149	563	676	20,197

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association, *2017 Annual Report*

RISKS TO THE FORECASTS

While the FAA is confident that its forecasts for aviation demand and activity can be achieved, this hinges on a number of factors, including the strength of the global economy, security (including the threat of international terrorism), and the level of oil prices. Higher oil prices could lead to further shifts in consumer spending away from aviation, dampening a recovery in air transport demand. In the long term, the FAA foresees a competitive and profitable industry characterized by increasing demand for air travel and airfares growing more slowly than inflation.

AIRPORT SERVICE AREA

The initial 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 Lake Havasu City Airport, the primary role is to accommodate 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 an 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.

The primary purpose of defining a service area is to identify the geographic area from which an airport will derive its aviation demand. As such, the service area generally represents where most based aircraft come from. It is not unusual for some based aircraft to be registered outside the region or even outside the state. Most pilots base their aircraft at an airport because of the convenience of the airport to their residence or their place of business; however, some aircraft owners have other priorities, such as runway length, specific services, hangar availability, airport congestion, etc., and may elect to base their aircraft at a more distant location.

Typically, the service area for regionalized airports can range from a minimum of 30 miles extending up to approximately 50 miles. The proximity and level of aviation services are largely defining factors when describing the general aviation service area. A description of airports within an approximately 50-nautical mile radius of Lake Havasu City Municipal Airport was discussed in Chapter One. Seven public use airports were included in this proximity to Lake Havasu City Municipal Airport.

Lake Havasu City Municipal Airport's location in Mohave County near Lake Havasu City and Lake Havasu itself makes it an important facility serving the needs of aviation in the county and region. Existing airport facilities, including an 8,001-foot runway, instrument approach capabilities, high quality aviation service providers, and abundant hangar space, situates Lake Havasu City Municipal Airport as a significant airport in the region.

When discussing the general aviation service area, another primary demand segment that needs to be addressed is an airport's ability to attract based aircraft. As long as reasonably priced hangars and aviation services are offered, most aircraft owners and operators will choose to base at an airport near their home or business. The corporate aviation component of the service area can extend farther, depending on the competing airports.

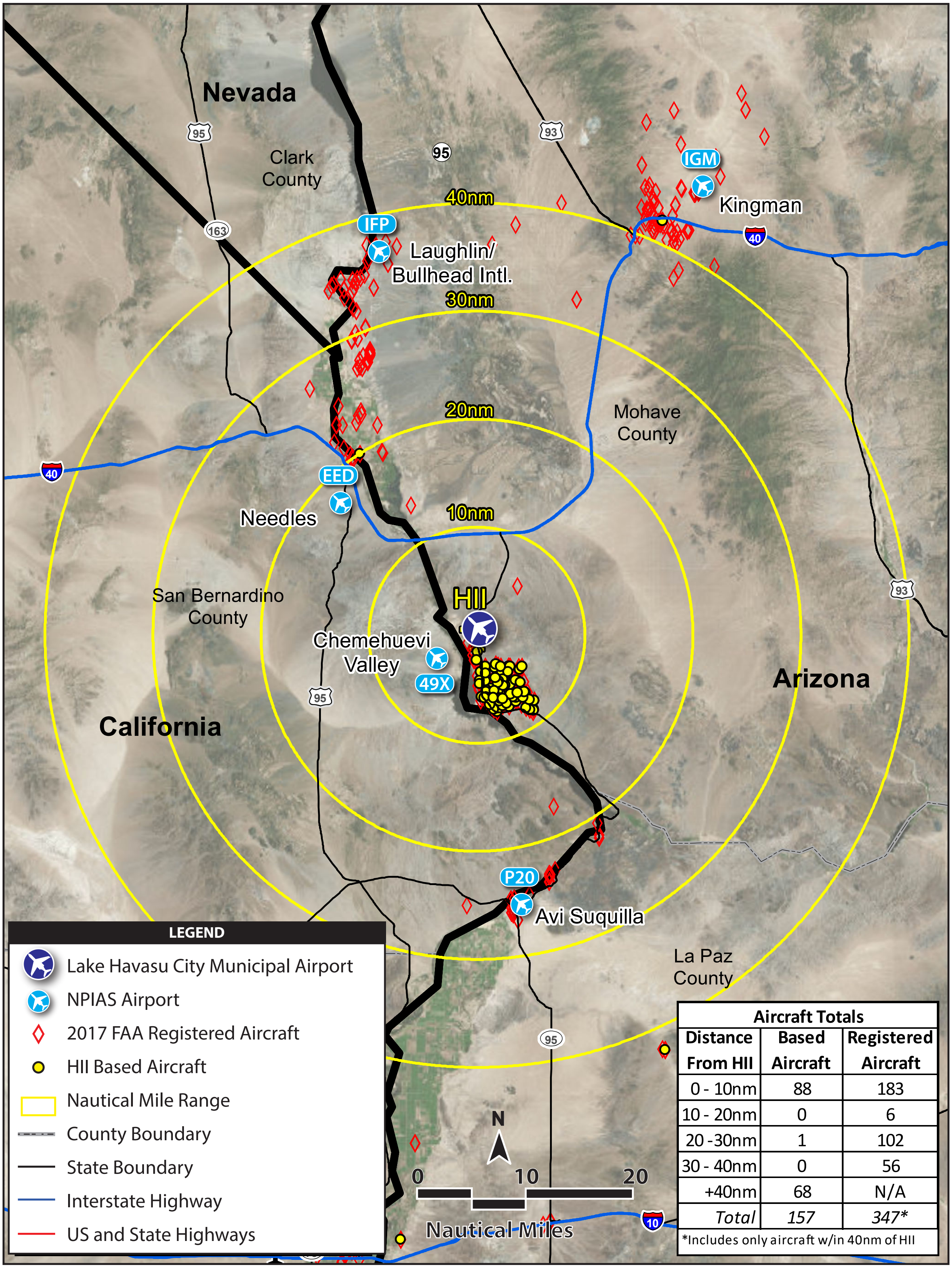
Exhibit 2D depicts the location of registered aircraft in the region in 2017. According to the FAA registered aircraft database, there were 347 registered aircraft within 40 nautical miles (nm) of the airport. As depicted, the majority of registered aircraft are concentrated in and around regional population centers, such as Lake Havasu City, Needles, Bullhead City, Kingman, and Parker. In addition, most are located close to an existing airport. While some of these airports may have more limited facilities and offer fewer services, they are much closer to the local aircraft owners and airport users. Proximity to an airport is typically the most important aviation demand factor for general aviation activity. Most general aviation operators will elect to operate at a closer airport unless facilities or services cannot be provided.

Exhibit 2D also presents the number of Lake Havasu City Municipal Airport based aircraft within the area. According to the FAA registered aircraft database, 88 based aircraft are located within 10 nm of the airport. An additional 68 based aircraft are registered to locations greater than 40 nm from the airport. It is not uncommon for an aircraft based in one location to be registered in another, especially for corporate aircraft which typically are registered by the controlling ownership entity, such as a bank. In areas such as Lake Havasu City where the transient population base fluctuates depending on the time of year, this is also a common occurrence. Aircraft owners who seasonally reside in Lake Havasu and base their aircraft at the airport during that time may have their aircraft registered to another address where they reside or conduct business during a different time of the year.

This data shows that a high percentage of Lake Havasu City Municipal Airport based aircraft owners reside or do business in close proximity to the airport. As such, for planning purposes, the primary service area for the airport will be Lake Havasu City, and more broadly defined as the southern portion of Mohave County and northern portion of La Paz County as the secondary service area. Airports serving the population centers in nearby cities such as Needles, Bullhead City, Kingman, and Parker will effectively limit the airport's service area to the north and south.

SOCIOECONOMIC TRENDS

The socioeconomic conditions for the 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 region and, in particular, the trends in aviation growth. Socioeconomic data for Lake Havasu City, Mohave County, and the State of Arizona is presented in **Table 2B**. Forecast data for population was obtained from the Arizona Office of Economic Opportunity, and the forecast data for employment and per capita personal income (PCPI) was obtained from the Woods & Poole Complete Economic and Demographic Data prepared in 2018.



Aircraft Totals

Distance From HII	Based Aircraft	Registered Aircraft
0 - 10nm	88	183
10 - 20nm	0	6
20 -30nm	1	102
30 - 40nm	0	56
+40nm	68	N/A
Total	*157*	*347**

*Includes only aircraft w/in 40nm of HII

Source: ESRI Basemap Imagery (2017), FAA Registered Aircraft Database, FAA Based Aircraft Listing

TABLE 2B
Socioeconomic Projections

	Historical			Projections			
	2005	2018	CAGR	2023	2028	2038	CAGR
Lake Havasu City							
Population	51,886	52,685	0.12%	54,143	55,386	57,799	0.46%
Mohave County							
Population	184,743	214,359	1.15%	229,793	244,639	274,790	1.25%
Employment	72,682	73,086	0.04%	79,334	85,009	94,911	1.32%
PCPI	$23,521	$32,820	2.60%	$41,151	$53,498	$90,360	5.19%
Arizona							
Population	5,924,476	7,076,199	1.38%	7,703,431	8,342,791	9,675,325	1.58%
Employment	3,224,378	3,867,486	1.41%	4,261,040	4,658,032	5,414,296	1.70%
PCPI	$32,228	$43,132	2.27%	$53,019	$67,864	$113,059	4.94%

CAGR- Compound Annual Growth Rate
PCPI- Per Capita Personal Income

Sources: Arizona Office of Economic Opportunity; Woods and Poole Complete Economic and Demographic Data (2018)

POPULATION

Total resident population for Lake Havasu City in 2018 is estimated at 52,685, which makes up approximately 26 percent of Mohave County's total population. Projections for population in Lake Havasu City estimate a 0.46 percent compound annual growth rate (CAGR) over the next 20 years, resulting in nearly 58,000 residents by 2038.

In 2018, population in Mohave County was estimated at 214,359 residents. The population for the county is forecast to increase to 274,790 by 2038, representing a 1.25 percent CAGR over the planning period. For comparative purposes, population for the State of Arizona has experienced a 1.38 percent CAGR since 2005, with a projected CAGR of 1.58 percent over the 20-year planning period.

EMPLOYMENT

Historical and forecast employment data for Mohave County and the State of Arizona are also presented. Between 2005 and 2018, Mohave County employment grew by an average of 0.04 percent annually. Through the next 20 years, the county's employment is forecast to grow at a quicker pace than has been experienced since 2005. Projections for the county call for a 1.32 percent CAGR in employment during the next 20 years. The state's employment is also forecast to increase at a higher rate when compared to the past 20 years.

PER CAPITA PERSONAL INCOME

The table also compares per capita personal income (PCPI), adjusted to 2018 dollars, for the county and state. Mohave County's PCPI for 2018 is $32,820, which represents a 2.60 percent CAGR since 2005. The State of Arizona saw a 2.27 percent increase over the same time period. Projections for Mohave

County estimate significant growth in PCPI over the next 20 years, increasing at a 5.19 percent CAGR. The same can be said for the State of Arizona, increasing at a 4.94 percent CAGR.

AVIATION FORECAST METHODOLOGY

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 judgement of the forecast analysis, 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.

By developing several projections for each aviation demand indicator, a reasonable planning envelope, or range of forecasts, will emerge. The selected forecast may be one of the individual projections based on the 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 and 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 way 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.

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.

Historical growth analysis is a simple forecasting method in which the historical annual growth rate is identified and then extended out to forecast years. This analysis method assumes factors that impacted growth in the past will continue into the future.

Correlation analysis provides a measure of the direct relationship between two separate sets of historic data. If there is a reasonable correlation between the data, further evaluation using regression analysis may be employed.
Regression analysis is a statistical technique that yields an r-squared (r^2) value which shows the level of the correlation between variables. If the r^2 value is greater than 0.95, it indicates a strong predictive reliability.

Beyond five years, the predictive reliability of the forecasts can diminish. Therefore, it is prudent for the airport to reassess the assumptions originally made, and revise the forecasts based on the current airport and industry conditions. Facility and financial planning usually require at least a 10-year review since it often takes several years to complete a major facility development program.

Another consideration is that 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 no mathematical way to estimate their impacts. It is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

Forecasts of aviation demand for Lake Havasu City Municipal Airport have been developed by utilizing statistical methods, available existing forecasts, and analyst expertise. The following section presents the aviation demand forecasts and includes activity in two broad categories: based aircraft and annual operations.

AVIATION FORECASTS

The following forecast analysis examines each of the aviation demand categories expected at Lake Havasu City Municipal Airport over the next 20 years. Each segment will be examined individually, and then collectively, to provide an understanding of the overall aviation activity at the airport through 2038.

The need for airport facilities at Lake Havasu City Municipal Airport can best be determined by accounting for forecasts of future aviation demand. Forecasts for airport activities include the following:

- Based Aircraft
- Based Aircraft Fleet Mix
- Annual Aircraft Operations
- Peaking Characteristics
- Annual Instrument Approaches

The following sections will examine historical trends with regard to these categories of activity and project future demand for these segments of aviation activity at the airport. These forecasts will become the basis for planning future facilities, both airside and landside, at the airport.

For a general aviation airport such as Lake Havasu City Municipal Airport, based aircraft, annual aircraft operations, and peak activity levels are the most important indicators of aviation demand that need to be forecast. Future facility requirements, such as hangars and apron area, are derived from the general aviation forecasts. In addition, analysis in this study will consider commercial passenger activity projections at the airport. As such, passenger enplanement forecasts have been developed to identify facility needs based upon the potential for on-demand service, or possibly the entry of regularly scheduled charter/mainline commercial service operator activities at the airport.

BASED AIRCRAFT FORECAST

The number of based aircraft is the most basic indicator of aviation demand. By first developing a forecast of based aircraft for Lake Havasu City Municipal Airport, other aviation activities and demand can be projected. Analysis presented earlier indicates that Lake Havasu City is the primary service area for general aviation demand. Aircraft ownership trends for the primary service area typically dictate the based aircraft trends for an airport.

Determining the number of based aircraft at an airport can be a challenging task. Aircraft storage can be somewhat transient in nature, meaning aircraft owners can and do move their aircraft. Some aircraft owners may store their aircraft at an airport for only part of the year. For many years, the FAA did not require based aircraft records; therefore, historical records are often incomplete or nonexistent.

The current based aircraft count at the airport was compiled using the FAA National Based Aircraft Inventory Program as reported by airport management. Based on Airport records, including specified aircraft registration numbers in 2018, there were 160 based aircraft at the airport. Historical based aircraft records prior to 2018 were not available; therefore, this data was obtained from the FAA TAF.

It should be noted that several regression and time-series analyses were considered. Because of the incomplete historical data associated with based aircraft and inconsistent trends in certain reporting forecasts, regression and time-series analyses did not result in reliable forecasts. As a result, these analytical methods were not considered further, and several market share and ratio projection forecasts have been developed.

Table 2C includes forecasts for based aircraft at Lake Havasu City Municipal Airport when examining the airport's share of registered aircraft in the United States. As shown, the airport captured .0748 percent of registered aircraft in the United States in 2018. The first forecast assumes a constant market share of 0.0748 percent. This yields no growth in based aircraft by 2038. The second projection assumes the airport's market share will increase throughout the planning period, similar to what has occurred over the past several years according to based aircraft data reported by airport management and the TAF. This projection would yield 214 aircraft by the year 2038, resulting in a CAGR of 1.47 percent.

Table 2D presents forecasts comparing the number of based aircraft at the airport with the Lake Havasu City and Mohave County populations. A constant ratio projection of based aircraft per 1,000 city and county residents results in based aircraft growing at the same rate as the estimated population. A constant ratio projection of 3.04 based aircraft per 1,000 city residents yields 176 based aircraft by 2038, representing a CAGR of 0.47 percent. A constant ratio projection of 0.75 based aircraft per 1,000 county residents results in 206 based aircraft by 2038, representing a CAGR of 1.27 percent. An increasing ratio projection assumes that the ratio of aircraft per 1,000 city and county residents will increase with the population over the 20-year planning period. It is important to note that an increasing ratio of based aircraft to city and county population has been experienced since 2010. The increasing ratio projection based on Lake Havasu City's population yields 202 based aircraft by 2038, resulting in a CAGR of 1.18 percent. The increasing ratio projection based on Mohave County population yields 239 based aircraft by 2038, representing a CAGR of 2.03 percent.

TABLE 2C Based Aircraft per Market Share of U.S. Active General Aviation Aircraft Lake Havasu City Municipal Airport			
Year	Airport Based Aircraft	U.S. Active General Aviation Aircraft	Market Share of Registered Aircraft
2010	128	223,370	0.0573%
2012	102	209,034	0.0488%
2014	104	204,408	0.0509%
2016	132	211,794	0.0623%
2018	160	213,905	0.0748%
Constant Market Share of Registered Aircraft (CAGR - 0.00%)			
2023	160	213,390	0.0748%
2028	159	212,465	0.0748%
2038	160	214,090	0.0748%
Increasing Market Share of Registered Aircraft (CAGR - 1.47%)			
2023	171	213,390	0.0800%
2028	186	212,465	0.0875%
2038	214	214,090	0.1000%
Sources: Airport Records; FAA Terminal Area Forecast (January 2019); FAA Aerospace Forecasts – Fiscal Years 2018-2038; Coffman Associates analysis			

TABLE 2D Based Aircraft per Lake Havasu City and Mohave County Population Lake Havasu City Municipal Airport					
Year	Based Aircraft	Lake Havasu City Population	Aircraft per 1,000 City Residents	Mohave County Population	Aircraft per 1,000 County Residents
2010	128	52,527	2.44	200,186	0.64
2012	102	52,720	1.93	203,072	0.50
2014	104	53,193	1.96	204,000	0.51
2016	132	52,098	2.53	208,265	0.63
2018	160	52,685	3.04	214,359	0.75
Constant Ratio Projection per 1,000 City Residents (CAGR - 0.47%)					
2023	165	54,143	3.04	229,793	0.72
2028	168	55,386	3.04	244,639	0.69
2038	176	57,799	3.04	274,790	0.64
Increasing Ratio Projection per 1,000 City Residents (CAGR - 1.18%)					
2023	172	54,143	3.20	229,793	0.75
2028	183	55,386	3.30	244,639	0.75
2038	202	57,799	3.50	274,790	0.74
Constant Ratio Projection per 1,000 County Residents (CAGR - 1.27%)					
2023	172	54,143	3.18	229,793	0.75
2028	183	55,386	3.31	244,639	0.75
2038	206	57,799	3.57	274,790	0.75
Increasing Ratio Projection per 1,000 County Residents (CAGR - 2.03%)					
2023	179	54,143	3.31	229,793	0.78
2028	198	55,386	3.58	244,639	0.81
2038	239	57,799	4.14	274,790	0.87
Source: Airport Records; FAA TAF (January 2019); Arizona Office of Economic Opportunity; Coffman Associates Analysis					

Existing forecasts for based aircraft at Lake Havasu City Municipal Airport were also reviewed to include projections from the FAA TAF published in January 2019 and the Lake Havasu City Municipal Airport Master Plan in 2009. The FAA TAF projection has based aircraft remaining constant at 128 throughout the planning period of this study. Given that this forecast is static and well below the actual number of existing based aircraft as reported by airport management, it will not be considered further in this study. The previous master plan completed in 2009 projected 295 based aircraft by 2017. Extrapolating this study's projected based aircraft growth rate when compared to the airport's current based aircraft count would yield approximately 280 based aircraft by 2038. This forecast is considered too aggressive given the current climate of the general aviation industry and historical based aircraft numbers experienced at the airport.

TABLE 2E
SASP Based Aircraft Projected Growth Rate (CAGR 1.24%)
Lake Havasu City Municipal Airport

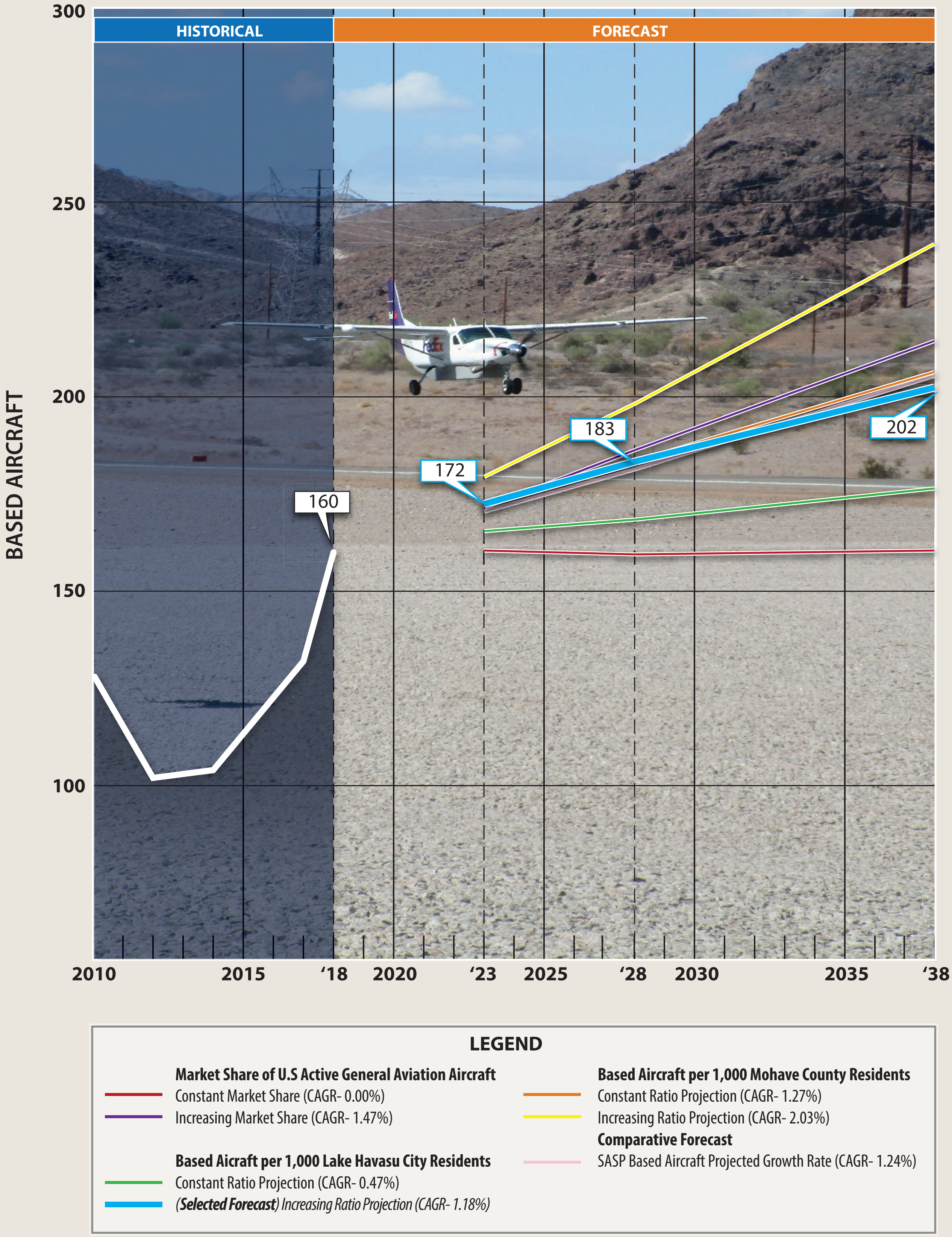
	2018	2023	2028	2038
Based Aircraft	160	170	181	205

The 2018 Arizona *State Aviation System Plan* (SASP) Update also provides based aircraft projections for airports in Arizona, including Lake Havasu City Municipal Airport. It should be noted that the SASP utilized the FAA TAF when determining its base year (2016) based aircraft number for the airport. As such, it accounted for 132 based aircraft. The 20-year forecast (2036) calls for 169 based aircraft. By applying the SASP projected growth rate (1.24 percent) to the verified/current based aircraft count at the airport, a forecast of 205 based aircraft emerges for 2038. **Table 2E** further breaks out the based aircraft forecast according to the SASP's projected growth rate.

A summary of based aircraft forecasts is presented in **Table 2F**. These forecasts represent a reasonable planning envelope. The selected based aircraft forecast considers applying the increasing ratio projection of Lake Havasu City residents. As such, it projects the airport experiencing an increase in the ratio of based aircraft to service area population through the planning period, as well as an increase in market share. These trends have been realized at the airport in the recent past. In the next five years, 172 based aircraft are projected. In 10 years, 183 based aircraft are projected and by 2038, 203 based aircraft are projected. This forecast results in a 1.18 percent CAGR through the 20-year planning period. **Exhibit 2E** presents a graphical depiction of historical, current, and projected based aircraft at Lake Havasu City Municipal Airport.

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 a reasonable development of airport facilities necessary to accommodate aviation demand. Competing airports will play a role in deciding demand, however, Lake Havasu City Municipal Airport is well suited to compete, as it is served by a runway capable of handling the majority of general aviation aircraft and has expansion capacity to meet future demand. These features make the airport a valuable asset to the general aviation community and will continue to serve Lake Havasu City.

Consideration must also be given to the current and future aviation conditions at the airport. Lake Havasu City Municipal Airport provides an array of aviation services and will continue to be favored by



Source: Airport Records: 2018 State Aviation System Plan; Coffman Associates analysis

EXHIBIT 2E
BASED AIRCRAFT FORECASTS

aviation operators due to its location and available facilities. It is important to note that new hangars have recently been constructed at the airport, further pointing to existing demand potential. Furthermore, Lake Havasu City has given every indication that it plans to continue support of the airport. Significant investments have been made to the facility and the airport should continue to meet the needs of aircraft in the regional aviation system.

TABLE 2F
Based Aircraft Forecasts Summary
Lake Havasu City Municipal Airport

Projections	2023	2028	2038
Market Share of U.S Active General Aviation Aircraft			
Constant Market Share (CAGR - 0.00%)	160	159	160
Increasing Market Share (CAGR – 1.47%)	171	186	214
Based Aircraft per 1,000 Lake Havasu City Residents			
Constant Ratio Projection (CAGR - 0.47%)	165	168	176
Increasing Ratio Projection (CAGR - 1.18%) - Selected	***172***	***183***	***202***
Based Aircraft per 1,000 Mohave County Residents			
Constant Ratio Projection (CAGR - 1.27%)	172	183	206
Increasing Ratio Projection (CAGR - 2.03%)	179	198	239
Comparative Forecast			
2018 State Aviation System Plan (CAGR - 1.24%)	170	181	205

Source: FAA Aerospace Forecast (2018-2038), SASP Update (2018), Based Aircraft-Airport Records, Coffman Associates Analysis

BASED AIRCRAFT FLEET MIX

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

Anticipating the aircraft fleet mix expected to utilize the facility is necessary to adequately plan for future facility requirement needs in order to best accommodate the types of operations expected to occur at the airport. The existing fleet mix of aircraft based at the airport is comprised of 124 single engine piston aircraft, 9 multi-engine piston aircraft, 5 turboprop aircraft, 7 jet aircraft, and 5 helicopters. There are also 10 ultralight aircraft on the field. These are classified as “other” for purposes of this forecast analysis.

The based aircraft fleet mix, as presented on **Table 2G**, was compared to the existing and forecast U.S. general aviation fleet mix trends as presented in *FAA Aerospace Forecasts- Fiscal Years 2018-2038*, as well as to trends occurring at the airport. The national trend in general aviation continues to be toward a greater percentage of larger, more sophisticated aircraft as part of the national fleet. While single engine piston powered aircraft will continue to account for the largest share of based aircraft at the airport, these aircraft are forecast to drop as a percentage of the fleet mix. Multi-engine piston powered aircraft are expected to decrease in number and decrease as a percentage of the national fleet mix over the course of the next 20 years. Consistent with national aviation trends, the number and percentage of turboprops and helicopters is expected to increase in the fleet mix and at most general aviation airports. Additionally, the airport can expect to accommodate more based jets over the next 20 years.

TABLE 2G
Based Aircraft Fleet Mix
Lake Havasu City Municipal Airport

	Existing		Forecast						
Aircraft Type	2018	Percent	2023	Percent	2028	Percent	2038	Percent	Net Change
Single Engine	124	77.5%	130	75.6%	136	74.3%	144	71.3%	+20
Multi-Engine	9	5.6%	8	4.7%	7	3.8%	6	3.0%	-3
Turboprop	5	3.1%	8	4.7%	10	5.5%	15	7.4%	+10
Jet	7	4.4%	9	5.2%	11	6.0%	16	7.9%	+9
Helicopter	5	3.1%	7	4.1%	9	4.9%	11	5.4%	+6
Other (ultralight)	10	6.3%	10	5.8%	10	5.5%	10	5.0%	0
Totals	**160**	**100.0%**	**172**	**100.0%**	**183**	**100.0%**	**202**	**100.0%**	+42

Source: Airport Records; Coffman Associates analysis

ANNUAL AIRCRAFT OPERATIONS FORECAST

Aircraft operations are classified as either local or itinerant. A local operation refers to any operation in which the aircraft does not intend to transition to another airport. Examples of these types of operations include mostly flight training or recreational flying such as simulated approaches, touch-and-go operations, or short flights to a practice area to perform flight maneuvers. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Typically, itinerant operations increase with business use, tourism, or other special aviation activities.

Airport operations can be further broken down into distinct categories. Airports such as Lake Havasu City Municipal Airport typically include operations consisting of general aviation, air taxi, and military. General aviation activities refer to operations conducted by private individuals or companies that are not associated with scheduled passenger services or non-scheduled transport services for hire. Air taxi operations are those that are certified in accordance with title 14 Code of Federal Regulations (CFR) Part 135 and are authorized to provide on-demand public transportation of persons and property by aircraft. Military operations are those conducted by military personnel and aircraft.

General Aviation Operations

Lake Havasu City Municipal Airport's operations consist mainly of general aviation operations. Due to the absence of an airport traffic control tower (ATCT), actual operation counts are not available. The FAA TAF provides estimated aircraft operations for the airport, which over the past several years has been a static projection of 45,000 annual operations. Of the 45,000 operations, approximately 42,950 are considered to be general aviation in nature. Due to the TAF's static estimate for annual operations, the master plan has utilized a FAA-approved statistical methodology for estimating general aviation operations using local variables to update the operations count.

This method, the *Model for Estimating General Aviation Operations at Non-Towered Airports*, was prepared for the FAA Statistics and Forecasts Branch in July 2001. This report develops and presents a regression model for estimating general aviation operations at non-towered airports. The model was derived using a combined data set for small towered and non-towered general aviation airports and incorporates a dummy variable to distinguish the two airport types. In addition, the report applies the model to estimate activity at 2,789 non-towered general aviation airports contained in the FAA TAF. The estimate of annual GA operations at Lake Havasu City Municipal Airport was computed using the two most applicable recommended equations (#15) and (#16) dealing with non-towered airports. Independent variables used in the equations include airport characteristics (i.e., number of based aircraft, number of flight schools), population totals, and geographic location. The equations yielded an annual general aviation operation estimate of 40,102 for equation #15 and 44,593 for equation #16 in 2018. As previously noted, the FAA TAF currently estimates 42,950 general aviation operations. As can be seen, the equation model estimates are very similar to the TAF. The model has verified that the FAA TAF estimates are reliable for future facility needs planning. As a result, a baseline estimate derived from the TAF of 42,950 general aviation operations will be utilized for the purposes of this master plan. Local and itinerant operations percentages were also derived from the FAA TAF estimates, which call for a 51/49 percent split between the two with itinerant operations being the slight majority of total general aviation operations.

Table 2H presents annual general aviation operations as a ratio per based aircraft at the airport. As shown in the table, the 2018 estimate of 42,950 annual general aviation operations equates to 268 operations per based aircraft. Two different forecasts were conducted for general aviation operations. First, a constant number of operations per based aircraft was used to project aircraft operations by applying 268 per based aircraft which yielded 54,100 operations by 2038. The second forecast increases the number of operations per based aircraft throughout the planning period. Operations per based aircraft typically range between 200-500 at general aviation airports. The higher operations per based aircraft are experienced at airports with higher numbers of local operations than itinerant operations. Increasing the operations per based aircraft ratio yields 62,600 general aviation operations by 2038.

Another forecast to determine potential general aviation operations that this study has employed is an extrapolation of the growth rate projected by the SASP Update (2018). A growth rate of 2.68 percent has been applied to the airport's actual and forecasted based aircraft to yield a forecast general aviation operations total of 72,900 by 2038.

It is also important to note that these methodologies do not consider air taxi, military, or other specialty aircraft operations at the airport. Separate forecasts related to these types of operations will be detailed in the following sections.

The FAA projects an increase in aircraft utilization and the number of general aviation hours flown nationally through the long-term planning period of this study. This trend, along with the projected growth in based aircraft and the fact that the airport serves a popular tourist destination and retirement community, support growth in annual general aviation operations during the planning period. The selected forecast results in 62,600 annual general aviation operations by 2038 and accounts for an increase in operations per based aircraft. This represents a CAGR of 1.90 percent. Local and itinerant operations splits are projected to remain with itinerant operations slightly outpacing local operations. **Exhibit 2F** presents the general aviation operations forecasts for both local and itinerant operations at Lake Havasu City Municipal Airport.

TABLE 2H
General Aviation Operations Forecasts
Lake Havasu City Municipal Airport

Year	Based Aircraft	Itinerant Operations	Local Operations	Total Annual Operations	Operations per Based Aircraft
2010	128	22,500	9,164	31,664	247
2012	102	22,500	9,164	31,664	310
2014	104	24,450	23,500	47,950	461
2016	132	21,950	21,000	42,950	325
2018	160	21,950	21,000	42,950	268
Constant Operations per Based Aircraft (CAGR - 1.16%)					
2023	172	23,500	22,600	46,100	268
2028	183	25,000	24,000	49,000	268
2038	202	27,600	26,500	54,100	268
Increasing Operations per Based Aircraft (CAGR - 1.90%) - Selected Forecast					
2023	172	***24,600***	***23,600***	***48,200***	280
2028	183	***27,500***	***26,500***	***54,000***	295
2038	202	***31,900***	***30,700***	***62,600***	310
SASP Preferred Operations Forecast (CAGR - 2.68%)					
2023	172	25,700	24,700	50,400	293
2028	183	29,500	28,400	57,900	316
2038	202	37,200	35,700	72,900	361

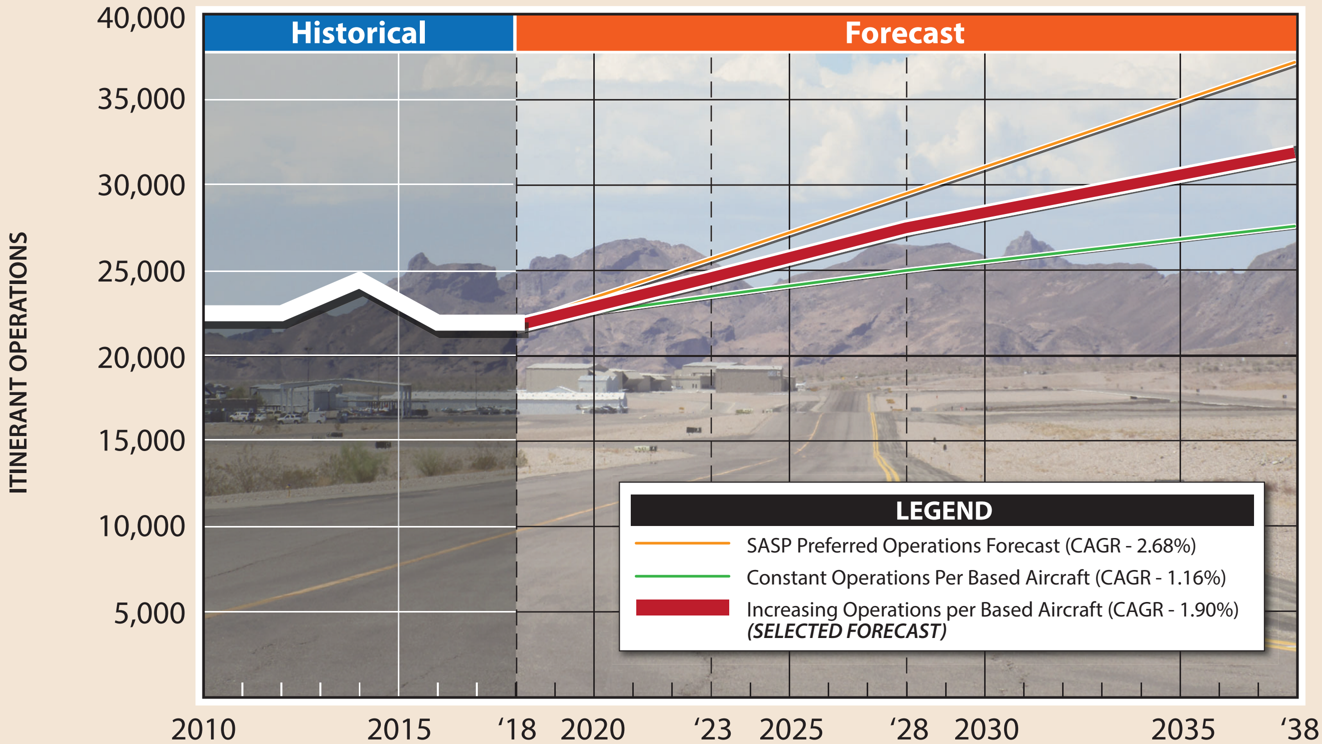
Source: 2018 State Aviation System Plan Update; FAA Terminal Area Forecast (January 2019); Airport Records

Air Taxi Operations

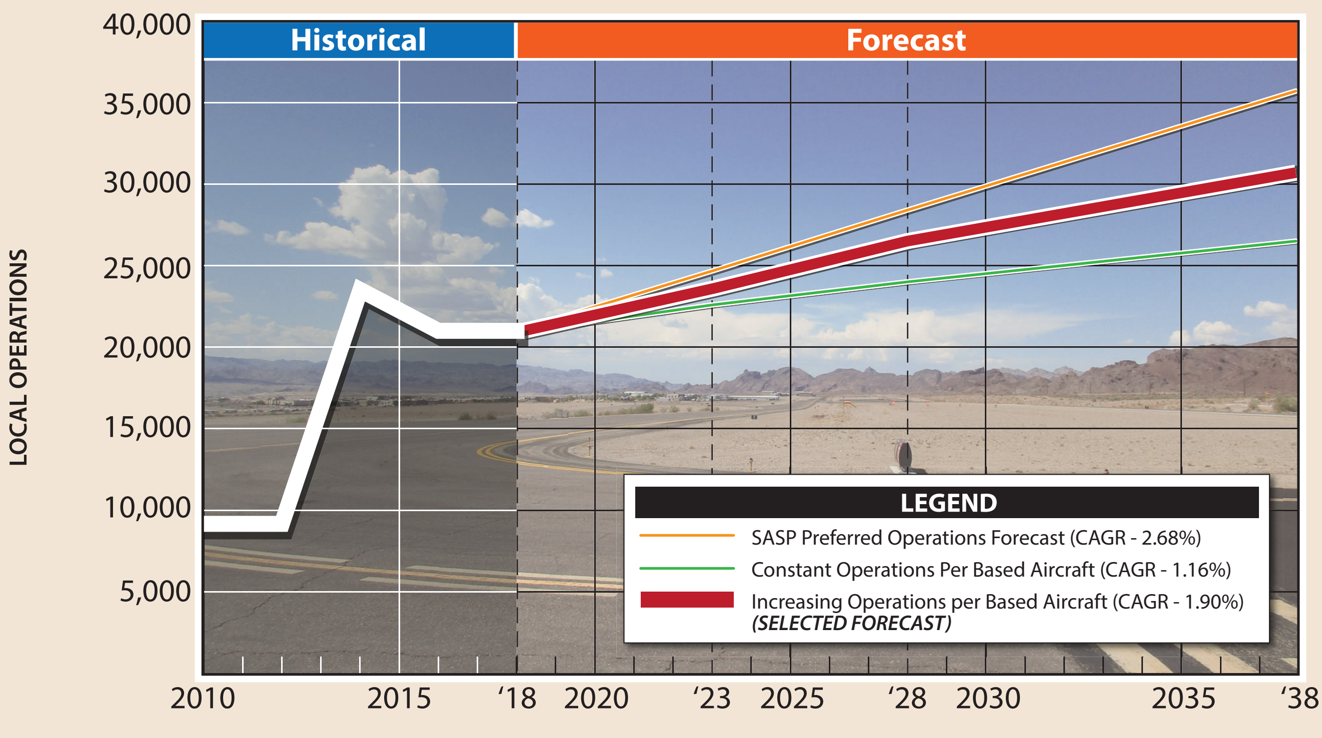
Air taxi are defined as operations with authority to provide “on-demand” transportation of persons or property by aircraft with fewer than 60 passenger seats. Air taxi includes a broad range of operations, including some smaller commercial service aircraft, some charter aircraft, air cargo aircraft, fractional ownership aircraft, and air ambulance services. The FAA TAF for 2018 estimates that there were 1,700 air taxi operations performed at Lake Havasu City Municipal Airport.

According to the current *FAA Aerospace Forecasts - Fiscal Years 2018-2038*, air taxi operations are projected to be stable, but experience a slight decrease of 0.06 percent over the course of the planning period. The primary reason for the projected decrease is the transition by commuter airlines to larger aircraft with more than 60 passenger seats, which will then be counted as air carrier operations as opposed to air taxi operations. While air taxi operations that are performed by commuter airlines are decreasing, air taxi by business and charter jets is expected to continue to grow. For the purposes of this study, air taxi operations category at Lake Havasu City Municipal Airport is forecast to increase at a 1.30 percent CAGR through 2038. Air taxi forecasts are presented in **Table 2J**. The forecast increase in

GENERAL AVIATION ITINERANT OPERATIONS FORECASTS



GENERAL AVIATION LOCAL OPERATIONS FORECASTS



Source: FAA Terminal Area Forecast: 2018 State Aviation System Plan; Coffman Associates analysis

EXHIBIT 2F
GENERAL AVIATION OPERATIONS FORECASTS

air taxi activity is prudent when considering the business and tourism activities in the region that often support air taxi operations at an airport.

TABLE 2J Air Taxi Operations Forecast Lake Havasu City Municipal Airport	
Year	**Other Air Taxi Operations**
2018	1,700
Forecast (CAGR= 1.30%)	
2023	1,800
2028	2,000
2038	2,200
Source: FAA TAF; Coffman Associates analysis	

Military Operations

Military activity accounts for the smallest portion of operational activity at the airport according to the FAA TAF. The TAF estimates 350 military operations per year at Lake Havasu City Municipal Airport. For planning purposes, a constant of 400 total itinerant operations annually will be utilized in forecasting. This is consistent with typical industry practices for projecting military operations given the unpredictable nature of military activity.

Total Operations Forecast

Table 2K presents a summary of the operations for all aircraft activity segments at Lake Havasu City Municipal Airport. The operational projections equate to a 1.87 percent CAGR. The selected total operations forecast for the airport is as follows: Year 2023 - 50,400 operations; Year 2028 - 56,400 operations; and Year 2038 - 65,200 operations**.**

TABLE 2K
Total Operations Forecast
Lake Havasu City Municipal Airport

	Itinerant Operations				Local Operations		
Year	**General Aviation**	**Air Taxi**	**Military**	**Total Itinerant**	**General Aviation**	**Total Local**	**Total Operations**
2018	21,950	1,700	350	24,000	21,000	21,000	**45,000**
Selected Total Operations Forecast (CAGR 1.87)							
2023	24,600	1,800	400	26,800	23,600	23,600	**50,400**
2028	27,500	2,000	400	29,900	26,500	26,500	**56,400**
2038	31,900	2,200	400	34,500	30,700	30,700	**65,200**
Source: Coffman Associates analysis							

Comparison to FAA TAF

The FAA will review the forecast presented in this master plan for consistency with the TAF. The local FAA Airports District Office (ADO) or Regional Airports Division are responsible for forecast approvals. When reviewing a sponsor's forecast, FAA must ensure that that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. Forecasts of based aircraft and annual aircraft operations are consistent with the TAF If they differ by less than 10 percent in the 5-year period and 15 percent in the 10-year forecast period. If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be utilized for FAA decision making. **Table 2L** presents the direct comparison of the master planning forecasts with the TAF published January 2019.

The FAA allows this differential because the TAF forecasts are not intended to replace forecasts developed locally (i.e., in this master plan). While the TAF can provide a point of reference or comparison, the purpose of the TAF is much broader in defining FAA national workload measures. As previously discussed, The FAA TAF simply maintains a static projection showing no growth for based aircraft or annual operations through the long-term planning period of this master plan.

TABLE 2L
Forecast Comparison to the FAA Terminal Area Forecast
Lake Havasu City Municipal Airport

Year	Airport Activity	FAA TAF	Percent Difference
BASED AIRCRAFT			
2018	160	128	22.2%
2023	172	128	29.3%
2028	183	128	35.4%
2038	202	128	44.8%
ANNUAL AIRCRAFT OPERATIONS			
2018	45,000	45,000	0.00%
2023	50,400	45,000	11.3%
2028	56,400	45,000	22.5%
2038	65,200	45,000	36.7%

Source: FAA TAF (2019); Coffman Associates analysis

For based aircraft, the FAA TAF misstates the 2018 base year figure. The TAF identifies a total of 128 based aircraft. In reality, there are 160 aircraft currently based at the airport. The presence of the actual based aircraft count has been verified by airport management through detailed recordkeeping. While the percent difference between the TAF and the master plan forecasts exceed the FAA tolerances for based aircraft, the reasons for the difference are evident. The TAF is simply not an accurate reflection of based aircraft at the airport, and it projects no growth in based aircraft through the next 20 years, while the master plan calls for modest growth.

For annual aircraft operations, the FAA-approved methodology (*Model for Estimating General Aviation Operations at Non-Towered Airports*) was utilized to estimate the number of existing general aviation operations. The resultant general aviation operations estimate was in close range to what the FAA TAF was projecting, therefore, the TAF estimate for operations was utilized as a baseline. A modest increase in general aviation activity through the planning period as well as accounting for air taxi and military operations results in a master plan forecast that differs from the TAF by 11.3 percent through the 5-year period and 22.5 percent in the 10-year period. Similar to based aircraft, the TAF calls for no growth in annual aircraft operations through the 20-year planning period.

PEAKING CHARACTERISTICS

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 in which peak aircraft operations occur.
- **Design Day**- The average day in the peak month. This indicator is calculated by dividing the peak month operations by the number of days in the month.

- **Busy Day**- The busy day of a typical week in the peak month.
- **Design Hour**- The peak hour with in the design day.

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

Without an ATCT, accurate operational information related to aircraft activity is not available to directly determine peak operational activity at the airport. Therefore, peak period forecasts have been determined according to trends experienced at similar airports and by examining operational counts completed at the airport in 2018.

Typically, the peak month of activity at an airport accounts for approximately 10 to 15 percent of the airport's annual operations. For planning purposes, peak month operations have been estimated at 13 percent of annual operations at Lake Havasu City Municipal Airport and typically occur during the winter and early spring months: when the city's seasonal residents return to enjoy the mild winter climate and spring break activities. The design day operations were calculated by dividing the peak month by 30. The design day is primarily used in airfield capacity calculations.

The busy day provides information for use in determining aircraft parking requirements. The busiest day of each week accounts for approximately 18 percent of weekly operations. To determine the typical busy day, the design day is multiplied by 1.25, which represents approximately 18 percent of the days in a week. Design hour operations were determined at 15 percent of the design day operations. The peaking characteristics are summarized in **Table 2M** for the short, intermediate, and long-term planning horizons.

TABLE 2M
Peak Operations Forecast
Lake Havasu City Municipal Airport

	2018	2023	2028	2038
Annual Operations	45,000	50,400	56,400	65,200
Peak Month	5,850	6,550	7,330	8,480
Design Day	200	220	240	280
Busy Day	250	280	300	350
Design Hour	30	33	36	42

Source: Coffman Associates analysis

ANNUAL INSTRUMENT APPROACHES

An instrument approach, as defined by the FAA, is "an approach to an airport with the intent to land an aircraft in accordance with an instrument flight rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude." To qualify as an instrument approach, an aircraft must land at an airport after following one of the published instrument approach procedures. Forecasts of annual instrument approaches (AIAs) provide guidance in determining an airport's requirements for navigational aid facilities. Practice or training approaches do not count as AIAs nor do instrument approaches that occur in visual conditions.

It is unusual for pilots to perform local operations when IFR conditions exist. AIAs may be expected to increase as transient operations by more sophisticated aircraft, (e.g., turboprop and business jets) increase through the planning period. For this reason, AIA projections consider a constant estimate of two percent of annual itinerant operations. The projections are presented in **Table 2N**.

TABLE 2N
Annual Instrument Approaches
Lake Havasu City Municipal Airport

Year	Annual Instrument Approaches	Itinerant Operations	Ratio
2018	480	24,000	2.00%
2023	536	26,800	2.00%
2028	598	29,900	2.00%
2038	690	34,500	2.00%

Source: Coffman Associates analysis

Exhibit 2G is a summary of the aviation forecasts previously detailed in this chapter. These forecasts for aviation activity, including based aircraft and annual aircraft operations, are key to determining future facility requirements.

POTENTIAL COMMERCIAL SERVICE ENPLANEMENTS AND OPERATIONS

Lake Havasu City Municipal Airport has historically been served by regularly scheduled commercial passenger services; however, there are currently no scheduled commercial airline activities offered at the airport. As part of this master plan, an analysis of passenger enplanements and commercial service operations is being reexamined to determine potential opportunities and facility needs should the airport experience future commercial service activities and enplanements.

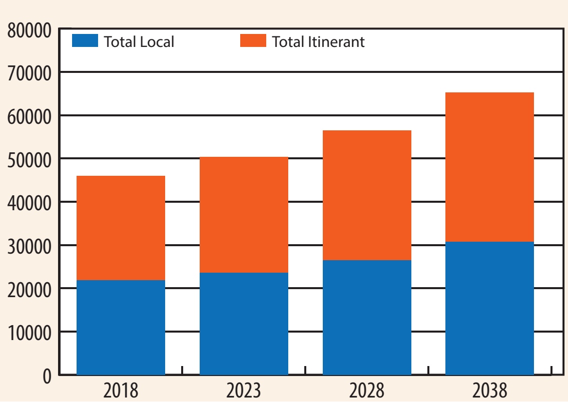
Passenger air service at Lake Havasu City Municipal Airport dates back to the late 1990s. Several commercial operators including Mesa Airlines, Arizona Express, Dynasty Air, and United Express operated at the airport from 1998 through 2007. The Beech 1900 was the primary commercial aircraft utilized and routes included McCarran International Airport in Las Vegas and Phoenix Sky Harbor International Airport. Mesa Airlines operating under Air Midwest ceased operations at the airport in May 2007. Since this time, there has not been scheduled commercial airline service offered at the airport.

Over the past several years, there have been significant changes in the commercial service industry serving airports. Financially, airlines are doing well at present, as their business practices have changed. Most carriers charged for checked luggage. Most also charge for defined “extras” or “perks” such as greater seat depth, expanded leg room, or window/aisle seats. These charges have generated significant profit centers for the airlines.

In 2007, the U.S. economy was just entering the most significant recession since the Great Depression. At present, economic conditions have improved with nominal growth rates annually since 2009. During the financial crisis of 2008-09, airlines slashed their flying capacities substantially in response to the sudden decline in demand for air travel. In the following years, even as the demand environment improved, network airlines did not add significant capacity. This was a practice commonly referred to as capacity discipline. The airlines have held back increasing capacity until more recently, which resulted in increased profitability but fewer network flights and fewer new market routes added.

	2018	2023	2028	2038
BASED AIRCRAFT				
Single Engine	124	130	136	144
Multi-Engine	9	8	7	6
Turboprop	5	8	10	15
Jet	7	9	11	16
Helicopter	5	7	9	11
Other	10	10	10	10
TOTAL BASED AIRCRAFT	**160**	**172**	**183**	**202**
ANNUAL OPERATIONS				
ITINERANT				
General Aviation	21,950	24,600	27,500	31,900
Air Taxi	1,700	1,800	2,000	2,200
Military	350	400	400	400
Total Itinerant	**24,000**	**26,800**	**29,900**	**34,500**
LOCAL				
General Aviation	21,000	23,600	26,500	30,700
Total Local	**21,000**	**23,600**	**26,500**	**30,700**
TOTAL OPERATIONS	**45,000**	**50,400**	**56,400**	**65,200**
PEAK OPERATIONS				
Peak Month	5,850	6,550	7,330	8,480
Design Day	200	220	240	280
Busy Day	250	280	300	350
Design Hour	30	33	36	42
ANNUAL INSTRUMENT APPROACHES	**480**	**536**	**598**	**690**

Total Operations



Based Aircraft Fleet Mix

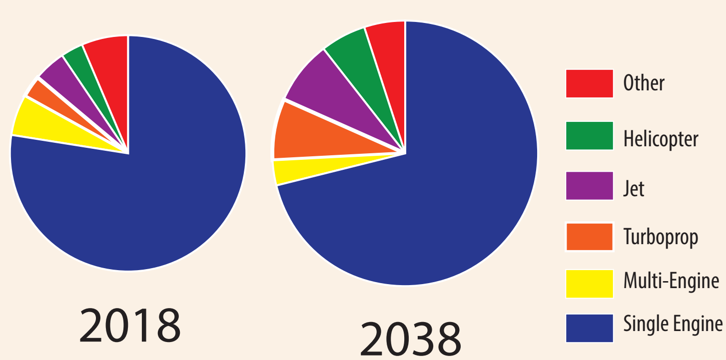


Exhibit 2G
FORECAST SUMMARY

At present, commercial service options at Lake Havasu City Municipal Airport are more limited than in 2007. Airlines have consolidated and are reluctant to add routes/new airports. The likelihood of any traditional mainline legacy carrier (American, Delta, and United) and/or Southwest Airlines moving into the airport is improbable. These airlines are strong anchors at Phoenix Sky Harbor International Airport and McCarran International Airport and historic trends would suggest that moving to an outlying, tertiary market is unlikely. These carriers tend to favor the trappings of a larger hub airport as they depend upon the ability to link their passengers via the "hub-and-spoke" system.

The opportunity to attract regularly scheduled commuter airline "feeder" service, as traditionally realized at Lake Havasu City Municipal Airport, is a possibility. This is similar to what is occurring at several small and non-hub airports in the region. For example, Flagstaff Airport, Yuma International Airport, and Page Municipal Airport are currently served by commuter airlines that provide direct service to Phoenix Sky Harbor International Airport, McCarran International Airport, and Dallas-Fort Worth International Airport. Historically, commuter airlines serving these markets utilized smaller turboprop aircraft. In recent years, the airlines have started using regional jets, making these markets and routes more appealing to passenger demand and economical/efficient for the airlines.

Another opportunity for commercial passenger service at the airport could involve non-traditional and/or low-cost passenger airlines. Non-traditional airlines (e.g. Allegiant Airlines) utilize an irregular schedule versus the daily departure schedule of the legacy carriers and Southwest Airlines. For example, Allegiant Airlines could serve a market departing Tuesday with a return on Saturday. Other low-cost options like Frontier, Spirit, Virgin America, etc., may offer daily departures but very limited schedule options. This type of service is often built around the origination and destination (O&D) model and could cater to the tourism market that serves Lake Havasu City and the surrounding region.

There are many non-traditional or low-cost carrier options but most are in relative infancy. New market entrants using non-traditional models including "clubs," "memberships," and the like are options as well. New entrants like Surf Air, Jet Suite X, and others could become potential carriers for the airport if they survive infancy.

It should be noted that these non-traditional or low-cost carriers tend to generate a demand of specific users, most commonly leisure travelers desiring low airfares. The users are willing to sacrifice things, such as schedule frequency and traditional perks associated with airline reward programs, in favor of low fares. Business travelers tend not to use these airlines as they are less reliable and offer fewer connections. Generally, local passenger demand for these airlines is limited when compared to a legacy carrier or Southwest Airlines.

Estimating the number of scheduled commercial service enplanements and operations is a function of the type of aircraft in use and the load factors. In the following sections, enplanement and commercial operations that may result from this and other potential commercial service operators will be presented. These forecasts are simply being conducted to offer long-term potential and will be considered separate from the planning forecasts presented earlier in this chapter. The primary purpose of this analysis is to provide Lake Havasu City and airport management with important facility planning information should commercial service be reestablished at the airport in the future.

Scheduled Commercial Service Enplanements

From 1998 through 2006, the airport averaged 8,500 annual enplanements. Due to a lack of consistent history of passenger service, it is challenging to develop a reasonable forecast of future passenger enplanements. Traditional trend-line and regression analyses do not generate a reasonable forecast as there is no recent history to examine. The method employed here is to examine comparable markets throughout the State of Arizona and surrounding region with similar-size city populations and other similar characteristics, such as proximity to a regional and larger hub airport and regional airport enplanement levels. The relationship between a service area's population and enplanements is called the travel propensity factor (TPF).

The TPF is predominantly impacted by the proximity of an airport to other regional airports with higher levels of service or "hub" airports. Regional airports with higher TPF ratios tend to be located farther from hub airports in relatively isolated areas. These airports generally have a service area that extends into adjacent, well-populated regions or have some type of air service advantage that attracts more of those passengers who might otherwise choose to drive to a more distant hub airport. Generally, the higher the TPF, the more likely air travelers are to utilize the local airport for commercial service.

Table 2P presents 10 comparable markets with similar characteristics to Lake Havasu City. Most markets are within a manageable driving distance to a larger hub airport. The table presents the 2010 enplanements at each of the communities at their local airport. A travel propensity factor is then determined by dividing the community population with the 2010 enplanements. The TPF is also calculated utilizing the 2017 community population and enplanement levels. The distance from each airport and the closest commercial service or hub airport is then considered.

In 2010, the average TPF of the airports serving the 10 selected cities was 0.530. By 2017, the average TPF had decreased slightly to 0.521, with three cities increasing their TPF and seven decreasing.

Table 2Q presents three different potential enplanement forecast approaches based upon the TPF comparison analysis. The high, low, and average TPFs from the comparison analysis are applied to the population forecast of Lake Havasu City to develop potential enplanement levels. The first projection applies the lowest 2015 TPF from the comparison markets (Ernest Love Field (Prescott – 0.138), which results in an enplanement projection of 7,976 by 2038. The second projection applies the average 2017 TPF of the comparison analysis (0.521), which results in an enplanement projection of 30,113 by 2038. The third projection applies the high TPF of the comparison analysis (Flagstaff Airport – 0.982), which results in an enplanement projection of 56,759 by 2038.

TABLE 2P
Travel Propensity Factor and Comparable Markets

Comparable Markets	2010 Population	2010 Enplanements	2010 TPF	2017 Population	2017 Enplanements	2017 TPF	Miles to Nearest Hub
Page Municipal Airport – Page, AZ	7,247	5,795	0.800	7,553	4,134	0.547	272 – Las Vegas
Yuma Int'l Airport– Yuma, AZ	93,064	82,163	0.883	95,502	79,564	0.833	172 – San Diego
Flagstaff Airport – Flagstaff, AZ	65,870	62,109	0.943	71,975	70,710	0.982	144 – Phoenix
Ernest Love Field – Prescott, AZ	39,843	7,836	0.197	42,731	5,888	0.138	100 – Phoenix
Show Low Regional Airport – Show Low, AZ	10,660	3,080	0.289	11,098	4,917	0.443	178 – Phoenix
Lea County Regional Airport - Hobbs, NM	34,122	334	0.010	37,764	16,216	0.429	97 – Midland
San Angelo Regional Airport – San Angelo, TX	93,200	56,021	0.601	100,119	59,206	0.591	110 – Midland
East Texas Regional Airport – Longview, TX	80,455	21,836	0.271	81,522	19,261	0.236	125 – Dallas
Lawton-Fort Sill Regional Airport – Lawton, OK	96,867	68,054	0.703	93,714	50,939	0.544	87 – Oklahoma City
Redding Municipal Airport – Redding, CA	89,861	54,420	0.606	91,794	42,361	0.461	161 – Sacramento
Average TPF			0.530			0.521	

TPF - Travel Propensity Factor

Sources: Population - U.S. Census Bureau; Enplanements - FAA Air Carrier Activity Information System and Bureau of Transportation Statistics

TABLE 2Q
Market Share and Travel Propensity Projections
Lake Havasu City Municipal Airport

Year	HII Enplanements	Lake Havasu City Population	Travel Propensity Factor	U.S. Domestic Enplanements	Market Share
Low Travel Propensity Factor					
2023	7,472	54,143	0.138	844,000,000	0.0009%
2028	7,643	55,386	0.138	909,000,000	0.0008%
2038	7,976	57,799	0.138	1,090,000,000	0.0007%
Average Travel Propensity Factor					
2023	28,209	54,143	0.521	844,000,000	0.0033%
2028	28,856	55,386	0.521	909,000,000	0.0032%
2038	30,113	57,799	0.521	1,090,000,000	0.0028%
High Travel Propensity Factor					
2023	53,168	54,143	0.982	844,000,000	0.0063%
2028	54,389	55,386	0.982	909,000,000	0.0060%
2038	56,759	57,799	0.982	1,090,000,000	0.0052%

Sources: Population - Arizona Office of Economic Opportunity; Enplanements - FAA Aerospace Forecasts - FY 2018 - 2038; Coffman Associates analysis

It should be noted that the projections presented in **Table 2Q** are for comparative purposes only and do not serve as a viable potential enplanement forecast for Lake Havasu City Municipal Airport. The airports offered in the comparison are regionalized with regularly scheduled airline operators linking to hub airports. These markets are not served primarily and/or only by non-traditional charter or member airline operators.

Potential Commercial Enplanement and Operations Forecast

Another methodology for forecasting potential enplanements and commercial operations is by considering potential flight schedules and aircraft fleets of the on-demand and scheduled airline operators. The potential enplanement and operations estimates are based on a potential flight schedule, as well as a limited set of factors; primarily population and distance to a hub airport. Factors that may positively affect enplanement levels include reliability of the airline, frequency of the schedule, convenience, advertising budget, as well as an unlimited number of community factors, such as industry, businesses, places of higher education, and recreational attractions.

The purpose here is to identify multiple scenarios of potential enplanement and operational figures that can be refined at a later date if necessary. One additional factor to consider is the willingness of a passenger to drive a longer distance to a hub airport.

Table 2R presents three different potential enplanement and operations scenarios. The first scenario is strictly based upon the flight schedule of a commercial air taxi operator, such as Surf Air. This scenario uses the 8-seat Pilatus PC-12 at an estimated 80 percent boarding load factor (BLF). The operator would conduct a total of 12 flights per week. Under this scenario, the airport could experience an estimated annual enplanement level of 3,744 and an annual commercial operations level of 1,248.

The second scenario assumes modest growth with an air taxi operator at 18 flights per week with the Pilatus PC-12, along with the potential for an additional commuter airline operator conducting five flights per week with an ERJ 145. Both operators would function at an 80 percent BLF. Under this scenario, potential annual enplanements total 16,016, while overall estimated commercial operations total 2,392.

Finally, the third scenario assumes more significant growth in scheduled air service at Lake Havasu City Municipal Airport to include an air taxi operator and commuter airline, along with the addition of other air taxi/charter operators, and small air carriers, such as Allegiant Airlines. With all the operators functioning at 80 percent BLF, this scenario produces the potential for 35,672 enplanements and 3,640 commercial operations on an annual basis.

TABLE 2R
Enplanements and Operations Based on a Potential Flight Schedule

Aircraft Type	ARC	Seats	BLF %	Occupied Seats	Departure Frequency	Total Enplanements	Total Operations
SCENARIO 1							
Pilatus PC-12	A-II	8	80%	6	12x Weekly	3,744	1,248
Beech 1900	B-II	19	80%	15	-	-	-
Embraer ERJ-145	C-II	50	80%	40	-	-	-
Airbus A319	C-III	138	80%	110	-	-	-
TOTALS						**3,744**	**1,248**
SCENARIO 2							
Pilatus PC-12	A-II	8	80%	6	18x Weekly	5,616	1,872
Beech 1900	B-II	19	80%	15	-	-	-
Embraer ERJ-145	C-II	50	80%	40	5x Weekly	10,400	520
Airbus A319	C-III	138	80%	110	-	-	-
TOTALS						**16,016**	**2,392**
SCENARIO 3							
Pilatus PC-12	A-II	8	80%	6	21x Weekly	6,552	2,184
Beech 1900	B-II	19	80%	15	4x Weekly	3,120	416
Embraer ERJ-145	C-II	50	80%	40	7x Weekly	14,560	728
Airbus A319	C-III	138	80%	110	2x Weekly	11,440	208
TOTALS						**35,672**	**3,640**

Source: Coffman Associates analysis

Potential Commercial Service Enplanements Summary

The analysis in this section presents various enplanement scenarios for Lake Havasu City Municipal Airport. Due to the lack of historical context for commercial service activity, it is difficult to predict which of these scenarios is more likely to occur and, in fact, there is no guarantee that the airport will be able to develop and maintain consistent commercial service activity at all. For this reason, the enplanement projections are separated from the overall annual aircraft operations and based aircraft forecasts that will be submitted to the FAA for review and approval. The purpose of preparing enplanement projections is to provide Lake Havasu City with the ability to plan for facilities and services to accommodate commercial activities should they develop in the future.

The enplanement projection scenarios resulted in a wide range of possibilities for the airport; from approximately 3,700 enplanements up to approximately 57,000 enplanements annually. In all likelihood, enplanement potential for the airport is somewhere in between these high and low figures. Therefore, for the purposes of this study, an enplanement level of 35,000 and an annual operational level of 3,700 will be carried forward as the selected scenario when considering terminal building and support facility requirements. Again, this enplanement scenario is not intended to serve as a forecast of activity but will be used to establish potential facility needs should commercial enplanements become a reality at Lake Havasu City Municipal Airport in the future.

Peaking Characteristics Based Upon Potential Enplanements and Operations

Table 2S outlines the peaking characteristics for the potential enplanement scenario of 35,000 annual enplanements. In general, airport capacity and facility needs related to specific activity types will typically consider the levels of activity during a peak or design period. Determination of peaking characteristics related to commercial activity is important for the planning and design of the passenger terminal building as well as associated facilities and services. The analysis is commonly utilized as a basis for determining the appropriate size of the terminal building and the functional areas therein. Terminal building elements could include hold rooms, security checkpoints, concessions, restrooms, baggage claim area, etc. The peaking characteristics could also relate to aircraft gates and apron space.

TABLE 2S
Potential Commercial Service Peaking Characteristics
Lake Havasu City Municipal Airport

Peak Potential Enplanements	
Annual Enplanements	35,000
Peak Month	2,917
Design Day	185
Design Hour	138
Peak Potential Commercial Service Operations	
Annual Operations	3,700
Peak Month	308
Design Day	10
Design Hour	1

Source: Coffman Associates analysis

Given the lack of historical commercial enplanement and operational data, the peak month projections for commercial activity were calculated simply by dividing the potential annual enplanements by 12. The peak potential enplanements for the design day are based upon the potential flight schedule described in Scenario 3 in the previous section, resulting in an enplanement design day 185. The potential enplanement design hour is based upon the seating capacity of the largest aircraft included in the scenario, which is the Airbus A319 aircraft with 138 passenger seats.

As previously mentioned, the peak potential monthly commercial operations were derived by dividing the potential annual operations under each scenario by 12. In the same fashion, the operational levels of the potential design were calculated simply by dividing the design month under each scenario by 31. This calculation provides a potential design day total of 10 operations. Finally, peak potential design hour operations are based upon the potential flight schedule and frequency of operations in this scenario.

AIR CARGO

Air cargo in the Lake Havasu City 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 multi-engine Beechcraft 99, and Empire Airlines serves as the cargo operator for Federal Express (FedEx) and flies a single engine Cessna 208 Caravan. Cargo in the area can also be transported by ground to Phoenix and Las Vegas and handled by designated air cargo carriers. Due to the airport's proximity to Phoenix Sky Harbor International Airport and McCarran International Airport (Las Vegas), 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.

AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION

The FAA has established several aircraft classifications systems that group aircraft types based on their performance (approach speed in landing gear configuration) and 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 in use or are expected to be in 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 2H.**

Aircraft Approach Category (AAC): A grouping of aircraft based on a reference landing speed referred to as (VREF) if specified, or if VREF is not specified, 1.3 times the stall speed (VSO) at the aircraft's maximum certified landing weight may be substituted. VREF, VSO, and the maximum certificated landing weight are established for each aircraft by the certification authority of the country of registry.

The ACC refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards will be. The ACC, categorized by letters A through E, is the aircraft approach category and relates to aircraft approach speed. The ACC mostly 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 runway/taxiway separation standards.

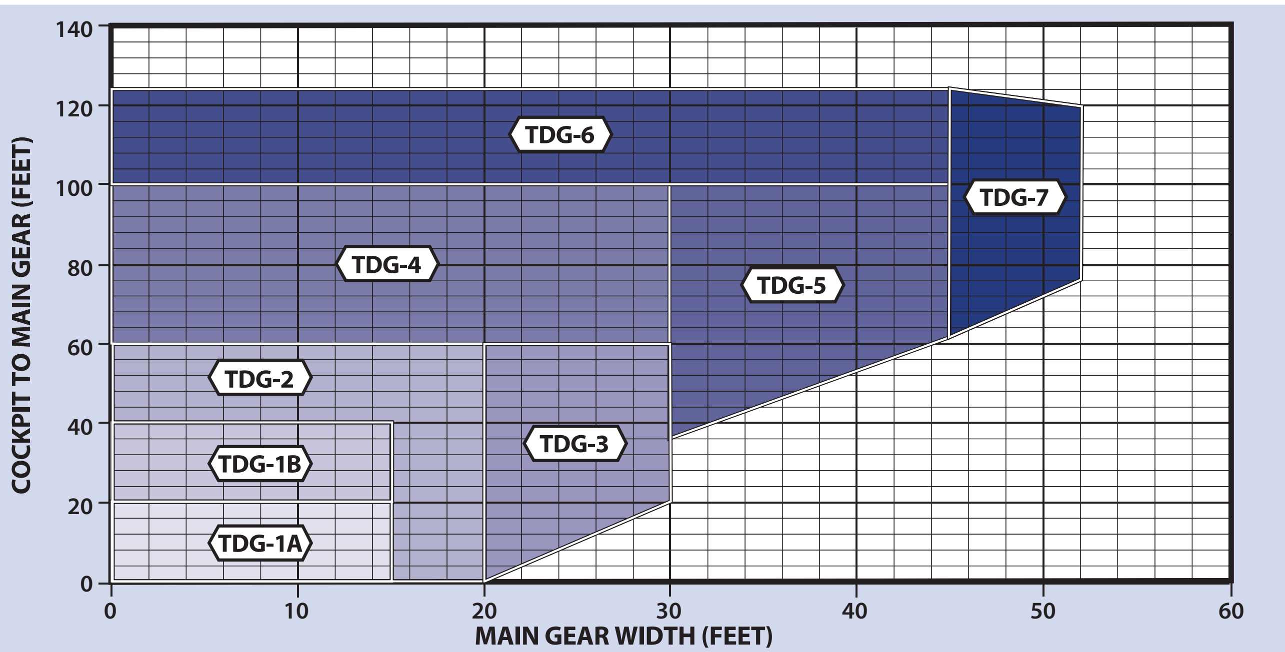
Airplane Design Group (ADG): The ADG, categorized by a roman numeral I through VI, is a classification of aircraft which relates to aircraft wingspan or tail height (physical characteristic). When the aircraft

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	79-<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	Not lower than 1-mile
4,000	Lower than 1-mile but not lower than ¾-mile
2,400	Lower than ¾-mile but not lower than ½-mile
1,600	Lower than ½-mile but not lower than ¼-mile
1,200	Lower than ¼-mile

TAXIWAY DESIGN GROUP (TDG)



KEY

RVR: Runway Visual Range

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

Exhibit 2H
CLASSIFICATION PARAMETERS

wingspan and tail height fall into different categories, the higher group is used. ADG influences design standards for taxiway safety area (TSA), taxiway/taxilane object free area (TOFA), apron wingtip clearance, and various separation distances.

Taxiway Design Group (TDG): A classification of aircraft 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. Other taxiway elements, such as the taxiway safety area (TSA), taxiway object free area (TOFA), taxiway separation to parallel taxiway or fixed or movable objects, and taxiway 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 2J summarizes the classification of the most common aircraft in the national fleet today. It should be noted that helicopters are not assigned an AAC or ADG given their unique operating characteristics. As such, they are not considered when determining an airport's critical design aircraft.

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 airport facilities are to be designed and built.

Runway Design Code (RDC): A code signifying the design standards to which the runway is to be designed and 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 component, 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.

Airport Reference Code (ARC): An airport designation that signifies the airport's highest RDC, minus the 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 utilize the airport safely. The current ALP for Lake Havasu City Municipal Airport, which will be updated as part of this master plan, identifies an existing and ultimate ARC of C-III.

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 A90/100
- 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
- **Global Express**, Global 5000
- Fairchild F-27
- ATR 72

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

Exhibit 2J
AIRCRAFT REFERENCE CODES

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 ACC, ADG, and the RVR. The APRC describes the current operational capabilities of the runway under certain 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 a 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 take off 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 of 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 utilizing or are expected to utilize the 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 the 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 airport design on an aircraft that uses the airport infrequently.

The design aircraft is defined as the most demanding aircraft type, or 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 the 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 CRITICAL DESIGN AIRCRAFT

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 Lake Havasu City Municipal Airport and was utilized in this analysis.

Since turboprop and jet aircraft are larger and faster, they will typically have a greater impact on airport design standards than smaller aircraft. The following analysis will focus on itinerant activity by these larger aircraft categories.

Exhibit 2K presents the TFMSC turboprop and jet aircraft activity at the airport for the last 10 years. As can be seen, the airport experiences activity by a full range of turboprops and business jets, including some of the largest in the national fleet.

Over the course of the sample period, the greatest number of operations in any single design family combined was 10,058 in B-I, followed closely by 9,398 operations in B-II. These operations accounted for over 80 percent of the logged turboprop and jet aircraft activity. Representative turboprop and jet aircraft included in the B-I and B-II categories include several models of the King Air and Cessna Citation.

Overall, the most demanding aircraft to utilize the airport in terms of AAC were business jets including the Lear 35/36 and the Gulfstream 200, 450, and 500/600 series. These aircraft fall within AAC D. Also included in this AAC are military jets such as the F/A-18 Hornet. The most demanding business jets, in terms of ADG to operate at the airport, were the Gulfstream 500/600 series, Bombardier Global Express and Global 5000, and Falcon 7X/8X series, which fall in ADG III. These aircraft have operated at the Airport on a limited basis in the past; however, it is important to note that one Gulfstream 650 (D-III category) is currently based at Lake Havasu City Municipal Airport. More significant are the number of AAC C aircraft operations being experienced at the airport. Since 2015, the airport has averaged approximately 300 annual operations by aircraft in AAC C.

Lake Havasu City Municipal Airport has exhibited a long-term trend of significant turboprop and jet aircraft activity. The aircraft utilize the airport on a regular basis and constitute a substantial number of operations. The aviation demand forecasts indicate the potential for continued growth in jet and turboprop activity at the airport. This includes a forecast increase in based turboprop and business jet aircraft through the 20-year planning horizon. The type and size of these aircraft (especially jets) using the airport regularly can impact the design standards to be applied to the airport system. Therefore, it is important to understand what type of aircraft may use the airport in the future. Factors such as population and employment growth in the airport's service area, proximity to and level of service at other airports, and development at the airport can influence future activity.

RUNWAY DESIGN CODE

Each runway at an airport is assigned an RDC. The RDC relates to specific FAA design standards that should be planned in relation to each runway, regardless of whether the airport currently meets the appropriate design standards (to be discussed in Chapter Three).

Runway 14-32

Runway 14-32 measures 8,001 feet in length by 150 feet in width and has instrument approach capabilities providing visibility minimums as low as one-mile on Runway 32. The currently approved ALP (2010) for the airport defines Runway 14-32 as an existing and ultimate ARC C-III. It is important to note that this C-III designation was included per direction from the FAA at the time of the last master plan and was based on an earlier ALP approved in 2003. It did not reflect 500 operations by the critical design aircraft, which at the time fell within ARC B-II. (Note: The updated AC would classify Runway 14-32 as existing and ultimate RDC C-III.)

According to the TFMSC data detailed earlier, operations by aircraft in AAC B and ADG II make up the most demand RDC that has exceeded the 500 annual operations threshold. Therefore, **this Master Plan will utilize an existing RDC of B-II-5000 for Runway 14-32**. Future planning should consider the increased use of larger business jets at the airport, in addition to the potential emergence of commercial service aircraft. As detailed earlier, operations by aircraft in AAC C have been on the increase, averaging nearly 300 annual operations over the past few years. Furthermore, the airport could achieve visibility minimums down to ¾-mile associated with advancements in global positioning system (GPS) technology. As a result, **the future RDC for Runway 14-32 should at least be analyzed for C-II-4000.**

It is important to also take into account the currently approved ALP that specifies a C-III design category on the runway system. This, coupled with the fact that a Gulfstream 650 (D-III category) jet aircraft is currently based at the airport, should also **lend consideration to analyzing a future RDC of C/D-III-4000 on Runway 14-32.**

AIRPORT DESIGN SUMMARY

Table 2T summarizes the design aircraft components to be applied at the airport. The ultimate RVR (visibility) component for Runway 14-32 may change based on analysis and recommendations regarding potential instrument approach capability. The APRC and DPRC are also depicted for the runway system.

Table 2T
Design Aircraft Parameters
Lake Havasu City Municipal Airport

Runway Design Parameters	Runway Design Code (RDC)	Approach Reference Code (APRC)	Departure Reference Code (DPRC)
Existing			
Runway 14-32	B-II-5000	B/III/5000	B/III
340' runway/taxiway separation		D/II/5000	D/II
Ultimate			
Runway 14-32	C-II-4000*	B/III/4000	B/III
340' runway/taxiway separation		D/II/4000	D/II
Note: *This master plan will also analyze RDC C/D-III-4000 on Runway 14-32.			
Source: FAA AC 150/5300-13A, Change 1, *Airport Design*			

ARC	Aircraft Model	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
A-I	Eclipse 400/500	22	20	14	24	16	20	24	18	6	32
	Kodiak Quest	0	0	0	0	0	0	0	0	0	2
	Lancair 4	18	14	0	0	0	0	0	0	0	0
	Lancair Evolution/Legacy	2	0	0	0	0	0	4	2	2	120
	Pilatus PC-7	4	2	0	0	0	0	2	0	0	0
	Piper Malibu/Meridian	106	164	208	306	292	146	102	122	144	292
	Socata TBM 7/850/900	12	20	24	36	156	214	76	16	30	34
	TOTAL	164	220	246	366	464	380	208	158	182	480
A-II	Cessna Caravan	556	720	652	626	626	616	658	630	646	664
	De Havilland Twin Otter	10	6	8	2	0	0	0	2	2	4
	Pilatus PC-12	208	322	224	158	130	128	116	66	102	80
	Pilatus PC-6	0	0	0	0	0	0	0	0	0	2
	TOTAL	774	1,048	884	786	756	744	774	698	750	750
B-I	Aero Commander 680	0	0	2	0	2	0	0	0	0	2
	Beech 99 Airliner	2	0	0	0	0	0	0	0	0	2
	Beechjet 400	36	36	32	26	16	20	20	54	22	12
	Cessna 425 Corsair	144	108	188	184	168	168	186	170	178	92
	Citation CJ1	218	266	364	304	286	368	412	482	540	320
	Citation I/SP	96	74	78	100	42	26	26	72	16	18
	Citation M2	0	0	0	0	0	0	0	0	16	52
	Citation Mustang	16	14	30	14	22	18	154	226	180	242
	Falcon 10	10	6	2	2	4	2	0	0	12	18
	Hawker 1000	0	0	0	0	4	0	0	0	0	0
	Honda Jet	0	0	0	0	0	0	2	0	0	6
	King Air 90/100	118	542	328	122	144	126	150	166	150	180
	L-39 Albatross	0	4	0	0	0	2	0	2	2	2
	Mitsubishi MU-2	2	12	4	2	4	2	12	2	2	8
	Phenom 100	6	12	20	52	24	34	54	44	54	26
	Piaggio Avanti	0	6	8	0	2	0	0	2	4	6
	Piper Cheyenne	12	22	14	18	10	16	32	30	26	44
	Premier 1	40	4	12	16	6	10	8	16	40	20
	T-6 Texan	0	0	2	6	0	0	2	72	50	58
	TOTAL	700	1,106	1,084	846	734	792	1,058	1,338	1,292	1,108
B-II	Aero Commander 690	4	4	10	10	8	8	2	8	0	2
	Beech 1900	0	2	2	0	2	0	4	2	4	2
	Cessna Conquest	460	194	60	46	18	30	36	26	94	46
	Challenger 300	0	0	8	4	16	10	18	10	26	14
	Citation CJ2/CJ3/CJ4	40	54	38	62	92	144	206	164	170	180
	Citation II/SP/Latitude	164	152	122	122	98	116	154	128	112	176
	Citation V/Sovereign	88	120	172	102	84	98	58	96	56	124
	Citation Longitude	0	0	0	0	0	0	0	0	0	2
	Citation X	6	4	8	2	6	2	8	8	18	4
	Citation XLS	18	18	10	22	18	50	50	16	28	36
	Dornier 328	0	0	4	0	2	2	2	4	0	0
	Embraer EMB-110/120	4	2	0	0	0	2	4	6	0	0
	Falcon 20/50	6	14	2	2	4	8	16	16	32	22
	Falcon 2000	0	0	0	8	0	0	0	0	10	4
	Falcon 900	2	4	2	0	4	4	4	0	2	0
	Hawker 4000	0	0	0	0	0	2	0	0	0	0
	King Air 200/300/350	200	354	250	258	256	382	300	246	340	384
	King Air F90	8	10	10	26	16	18	18	16	22	6
	Phenom 300	0	0	0	0	10	20	14	6	14	16
	Saab 340	0	2	6	6	0	0	0	0	0	14
	Shorts 330/360	0	0	0	0	0	0	0	4	2	2
	Swearingen Merlin	82	106	112	96	102	98	80	96	92	82
	TOTAL	1,082	1,040	816	766	736	994	974	852	1,022	1,116
B-III	Bombardier Global 5000	0	0	0	0	0	0	0	0	0	2
	Bombardier Global Express	0	0	0	0	0	0	2	2	0	0
	C-2 Greyhound	0	0	0	0	4	2	2	2	0	2
	De Havilland Dash 8 Series	2	2	4	0	0	0	0	0	0	0
	Falcon 7X/8X	0	2	0	0	0	0	0	0	0	0
	Grumman E-2 Hawkeye	0	0	0	0	2	2	4	14	6	0
	TOTAL	2	4	4	0	6	4	8	18	6	4
C-I	BAe HS 125 Series	0	0	30	4	0	0	0	0	0	2
	Learjet 20 Series	8	38	12	0	2	10	16	0	0	0
	Learjet 31	10	12	8	6	4	4	18	4	4	8
	Learjet 40 Series	38	24	18	10	20	12	6	4	4	14
	Learjet 50 Series	2	2	0	2	0	0	6	4	0	2
	Learjet 60 Series	12	4	4	8	4	6	10	4	4	8
	T-45 Goshawk	0	2	0	0	0	0	0	0	0	0
	Westwind II	10	4	4	4	8	10	8	16	22	6
	TOTAL	80	86	76	34	38	42	64	32	34	40

Note: ARC- Airport Reference Code

Source: Traffic Flow Management System Counts

ARC	Aircraft Model	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
C-II	Beech Starship	0	0	0	2	0	0	0	2	0	0
	Bombardier CRJ 100/200/700	4	2	0	0	0	0	0	0	2	0
	Challenger 600/604	10	18	16	16	22	32	36	22	14	8
	Citation III/VI	12	8	0	12	8	4	130	172	174	68
	Embraer 500/450 Legacy	0	0	0	0	0	0	0	0	2	0
	Embraer ERJ-135/140/145	0	2	0	0	2	0	2	4	2	6
	Gulfstream 100/150	0	0	2	0	4	0	4	0	0	0
	Gulfstream G100	36	26	20	10	10	4	0	2	4	10
	Gulfstream G-III	2	32	34	0	6	4	8	10	6	8
	Hawker 800	16	14	18	26	36	30	30	20	14	22
	Learjet 70 Series	0	0	0	0	0	6	4	8	10	10
	TOTAL	80	102	90	66	88	80	214	240	228	132
C-III	Airbus A319/320/321	0	2	0	0	0	0	0	0	0	0
	Boeing 737 (200 thru 700 series)	4	0	0	0	0	2	0	0	0	0
	P-3 Orion	0	0	2	0	0	0	0	0	10	4
	TOTAL	4	2	2	0	0	2	0	0	10	4
C-IV	Boeing 707	2	0	0	0	0	0	0	0	0	0
	Boeing C-17	0	0	0	0	0	0	0	0	0	2
	C-130 Hercules	0	2	2	6	6	8	4	26	32	20
	TOTAL	2	2	2	6	6	8	4	26	32	22
D-I	F/A-18 Hornet	2	4	2	0	0	0	4	0	10	10
	Learjet 35/36	16	70	56	24	40	34	30	34	30	14
	TOTAL	18	74	58	24	40	34	34	34	40	24
D-II	Gulfstream 200	10	4	10	12	0	8	6	0	2	74
	Gulfstream 450	30	26	82	28	16	28	28	22	24	12
	Gulfstream G-IV	2	0	2	0	0	0	0	0	2	0
	TOTAL	42	30	94	40	16	36	34	22	28	86
D-III	Boeing 737 800/900	0	0	0	2	0	0	0	0	0	0
	Gulfstream 500/600	4	8	4	6	2	8	10	68	42	26
	TOTAL	4	8	4	8	2	8	10	68	42	26
E-I	F-16 Falcon/Viper	4	0	2	2	0	0	0	0	0	6
	TOTAL	4	0	2	2	0	0	0	0	0	6

TURBOPROP AND JET ARC CODE SUMMARY

ARC CODE	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
A-I	164	220	246	366	464	380	208	158	182	480
A-II	774	1,048	884	786	756	744	774	698	750	750
B-I	700	1,106	1,084	846	734	792	1,058	1,338	1,292	1,108
B-II	1,082	1,040	816	766	736	994	974	852	1,022	1,116
B-III	2	4	4	0	6	4	8	18	6	4
C-I	80	86	76	34	38	42	64	32	34	40
C-II	80	102	90	66	88	80	214	240	228	132
C-III	4	2	2	0	0	2	0	0	10	4
C-IV	2	2	2	6	6	8	4	26	32	22
D-I	18	74	58	24	40	34	34	34	40	24
D-II	42	30	94	40	16	36	34	22	28	86
D-III	4	8	4	8	2	8	10	68	42	26
E-I	4	0	2	2	0	0	0	0	0	6
Total	2,956	3,722	3,362	2,944	2,886	3,124	3,382	3,486	3,666	3,798

TURBOPROP AND AIRCRAFT APPROACH CATEGORY SUMMARY

AAC	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
A	938	1,268	1,130	1,152	1,220	1,124	982	856	932	1,230
B	1,784	2,150	1,904	1,612	1,476	1,790	2,040	2,208	2,320	2,228
C	166	192	170	106	132	132	282	298	304	198
D	64	112	156	72	58	78	78	124	110	136
E	4	0	2	2	0	0	0	0	0	6
Total	2,956	3,722	3,362	2,944	2,886	3,124	3,382	3,486	3,666	3,798

TURBOPROP AND AIRPLANE DESIGN GROUP SUMMARY

ADG	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
I	966	1,486	1,466	1,272	1,276	1,248	1,364	1,562	1,548	1,658
II	1,978	2,220	1,884	1,658	1,596	1,854	1,996	1,812	2,028	2,084
III	10	14	10	8	8	14	18	86	58	34
IV	2	2	2	6	6	8	4	26	32	22
Total	2,956	3,722	3,362	2,944	2,886	3,124	3,382	3,486	3,666	3,798

Exhibit 2K
HISTORICAL TURBOPROP AND JET OPERATIONS

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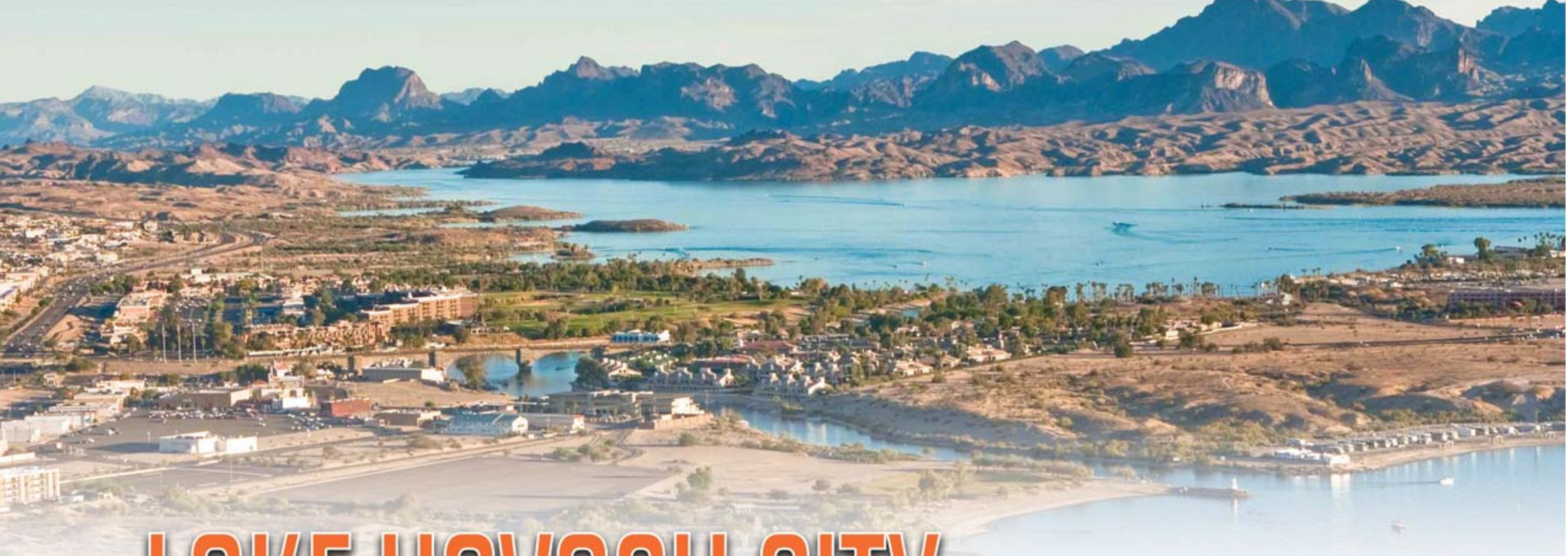
SUMMARY

Lake Havasu City Municipal Airport is a significant aviation facility that serves a vital function for the regional area. This chapter has outlined the various activity levels that might reasonably be anticipated over the next 20 years at the airport. The primary forecasts of aviation activity, including based aircraft and operations, is key to determining future facility requirements. There are currently 160 based aircraft at the airport, and this number is forecast to grow to 202 aircraft by 2038. It is estimated that the airport experienced 45,000 operations in 2018. The total number of operations is forecast to grow to approximately 65,200 by 2038.

The fleet mix operations, or type and frequency of aircraft use, is important in determining facility requirements and environmental impacts. While single engine piston-powered aircraft are expected to continue to represent the majority of based aircraft, the long-term forecast considers that most of the growth in based aircraft will be seen in turboprop and jet aircraft. In addition, potential scheduled commercial service activities (enplanements and operations) have been analyzed for further input into identifying future facility needs.

The next step in the master plan process is to use the forecasts to determine development needs for the airport through 2038. Chapter Three will address airside elements, such as safety areas, runways, taxiways, lighting, and navigational aids, as well as landside requirements, including hangars, aircraft aprons, and support services. As a general observation, Lake Havasu City Municipal Airport is positioned for growth into the future. The remaining portions of the master plan will lay out how that growth can be accommodated in an orderly, efficient, and cost-effective manner.

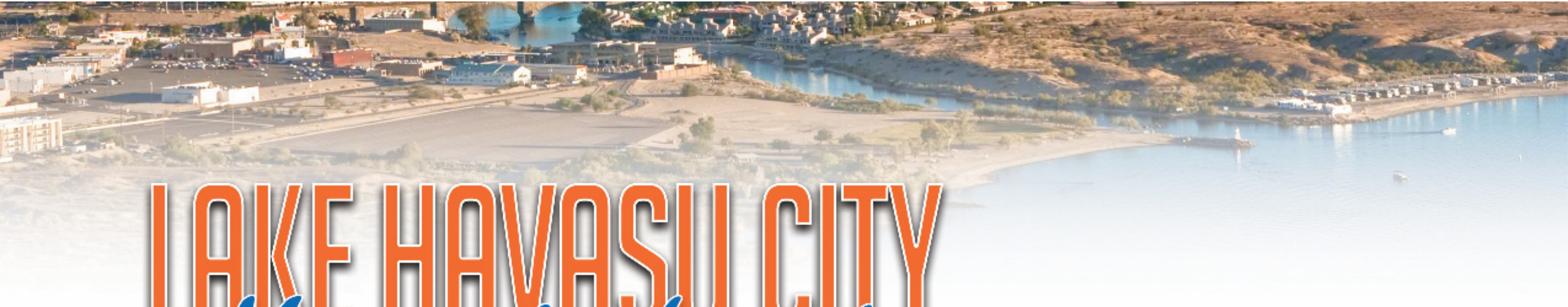


LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

CHAPTER THREE

FACILITY REQUIREMENTS



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER THREE

FACILITY REQUIREMENTS

Proper airport planning requires the translation of forecast aviation demand into the specific types and quantities of facilities that can adequately serve the identified demand. This chapter will analyze the existing capacities of Lake Havasu City Municipal Airport facilities. The existing capacities will then be compared to the forecast activity levels prepared in Chapter Two to determine the adequacy of existing facilities, as well as to identify if deficiencies currently exist or may be expected to materialize in the future. The chapter will present the following elements:

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

As indicated 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. These 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. These components include:

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

The objective of this effort is to identify, in general terms, the adequacy of existing airport facilities, outline what new facilities may be needed, and when these may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated to determine the most practical, cost-effective, and efficient means for implementation.

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

- Advisory Circular (AC) 150/5300-13A, *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B (and Draft 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)*

PLANNING HORIZONS

In Chapter Two, an updated set of aviation demand forecasts for Lake Havasu City Municipal Airport was established. The activity forecasts include based aircraft, fleet mix, annual operations, peaking characteristics, and annual instrument approaches (AIAs). With this information, specific components of the airside and landside systems can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, safe, efficient, and orderly development of an airport should rely more upon actual demand at the airport than 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 has been established of Lake Havasu City Municipal Airport that takes into consideration the reasonable range of aviation demand projections. The planning horizons for the master plan are short term (years 1-5), intermediate term (years 6-10), and long term (years 11-20).

It is important to consider that the actual activity at any given time at the airport may be higher or lower than the projected activity levels. By planning accordingly to activity milestones, the resulting plan can accommodate unexpected shifts or changes in the airport's aviation demand by allowing airport management the flexibility to make decisions and develop facilities according to need generated by actual demand levels, not based solely on dates in time. The demand-based schedule provides flexibility in development, as schedules can either be slowed or expedited according to actual demand at any given time over the planning period. The resultant plan provides airport management with a financially responsible and needs-based program. **Table 3A** presents the short-, intermediate-, and long-term planning horizon milestones for each aircraft activity level forecasted in Chapter Two.

TABLE 3A
Planning Horizon Activity Summary
Lake Havasu City Municipal Airport

	Base Year (2018)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (10-20 years)
BASED AIRCRAFT				
Single Engine	124	130	136	144
Multi Engine	9	8	7	6
Turboprop	5	8	10	15
Jet	7	9	11	16
Helicopter	5	7	9	11
Other	10	10	10	10
Total Based Aircraft	**160**	**172**	**183**	**202**
ANNUAL AIRCRAFT OPERATIONS				
Itinerant	24,000	26,800	29,900	34,500
Local	21,000	23,600	26,500	30,700
Total Operations	**45,000**	**50,400**	**56,400**	**65,200**
PEAKING CHARACTERISTICS				
Peak Month	5,850	6,550	7,330	8,480
Design Day	200	220	240	280
Busy Day	250	280	300	350
Design Hour	30	33	36	42
ANNUAL INSTRUMENT APPROACHES				
Annual Estimate	480	536	598	690

Source: Coffman Associates analysis

In addition to the general aviation activity forecasts presented above, forecasts for potential commercial enplanements and operations were also detailed earlier in this study. Many assumptions were made to derive a potential demand level for future commercial service activities. Based upon this analysis, it is determined that these types of aviation service segments would likely not materialize until at least the long-term planning period of this study, if at all. Nonetheless, it is important to recognize the potential facility needs that would be required to accommodate commercial air carrier passenger service at the airport. Facility needs will be based on the following long-term commercial activity projections:

- Annual Passenger Enplanement Potential – 35,000
- Annual Commercial Aircraft Operations Potential – 3,700

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 Advisory Circular (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 Lake Havasu City Municipal Airport and include airfield layout, weather conditions, aircraft fleet mix, and operations.

- **Runway Configuration** – The existing airfield configuration consists of one runway. Runway 14-32 measures 8,001 feet long by 150 feet wide. It is supported by a full-length parallel taxiway on the west side of the runway.

- **Runway Use** – Runway use in capacity conditions will be controlled by wind and/or airspace conditions. For Lake Havasu City Municipal 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.

- **Exit Taxiways** – Exit taxiways have a significant impact on airfield capacity because the number and location of exits directly determines the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within a prescribed range of the runway landing threshold. Based upon aircraft fleet mix, only taxiways between 2,000 and 4,000 feet from the landing threshold count in the exit rating. The exits must be at least 750 feet apart to count as separate exit taxiways. Under these criteria, the exit taxiway rating is one for Runway 14 and two for Runway 32.

- **Weather Conditions** – Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather, when flight visibility is best. Capacity is diminished 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 time period, thus reducing overall airfield capacity.

    - According to meteorological data collected from the nearby Needles Airport automated weather observation system (AWOS), visual meteorological conditions (VMC) exist

AIRFIELD LAYOUT

Runway Configuration

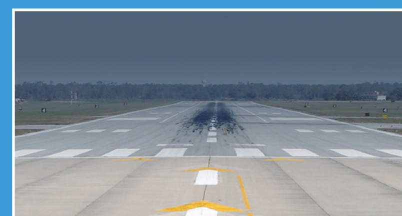
Runway Use

Number of Exits

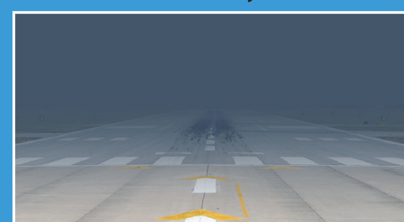
WEATHER CONDITIONS

VMC- Visual Meteorological Conditions

IMC- Instrument Meteorological Conditions



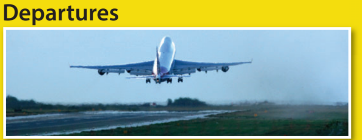
PVC- Poor Visibility Conditions



OPERATIONS

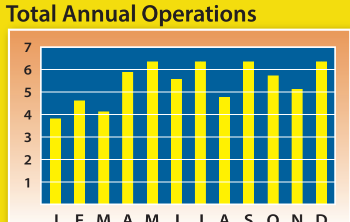
Arrivals

Departures



Touch-and-Go Operations

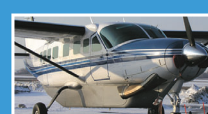
Total Annual Operations



AIRCRAFT MIX

Class A & B Aircraft


Single Engine


Small Turboprop


Twin Piston

Class C Aircraft


Business Jet


Regional Jet


Commuter


Commercial Jet

Class D Aircraft


Wide Body Jets

approximately 99.5 percent of the time. VMC exists when cloud ceilings are greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) exist when cloud ceilings are between 500 and 1,000 feet AGL and visibility is between one and three statute miles. Poor visibility conditions (PVC) apply when cloud ceilings are below 500 feet AGL and visibility is below one mile. According to the weather observations, IMC and PVC combined prevailed less than one percent of the time. **Table 3B** summarizes the weather conditions experienced over a 10-year period in the area.

TABLE 3B
Weather Conditions
Lake Havasu City Municipal Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1,000' AGL	> 3 statute miles	99.60%
IMC	≥ 500' AGL to < 1,000' AGL	1-3 statute miles	0.23%
PVC	< 500' AGL	< 1 statute mile	0.17%

VMC- Visual Meteorological Conditions
IMC- Instrument Meteorological Conditions
PVC- Poor Visibility Conditions
AGL- Above Ground Level
Note: Weather observations obtained from Needles Airport.
Source: NOAA - National Climate Data Center, Airport Observations

- **Aircraft Mix** – The aircraft mix for the capacity analysis is defined in terms of four aircraft classifications. 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, but do include some air taxi, air cargo, and commuter aircraft. The majority of aircraft operations at Lake Havasu City Municipal 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 which utilize the airport on a regular basis. Class D aircraft consist of aircraft weighing more than 300,000 pounds. The airport does not experience operations by Class D aircraft.

- **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 Lake Havasu Municipal 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 takeoff occurs within a shorter time period than individual operations. Touch-and-go operations at Lake Havasu City Municipal Airport account for approximately 50 percent of total annual operations. A similar percentage is expected in the future.

- **Peak Period Operations** – Average daily operations and average peak hour operations during the peak month are utilized for the airfield capacity analysis. 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 existing and ultimate airfield ASV is estimated at 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 operation will increase exponentially. The current operational level for the airport represents approximately 23 percent of the airfield's ASV. By the long-term planning period, total annual operations are expected to represent approximately 33 percent of the airfield's ASV.

FAA Order 5090.3B, *Field Formation 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 ASV. This is an approximate level to begin the detailed planning of the 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 as part of this master plan.

AIRSIDE FACILITY REQUIREMENTS

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 FAA has established various dimensional design standards related to the airfield to ensure the safe operations of aircraft. The FAA design standards impact the design of each of the airfield components to be analyzed. The following airside components are analyzed for compliance to the FAA design standards in detail.

- Runway Orientation
- 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 orientated 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 14-32 at Lake Havasu City Municipal 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 computed based on not exceeding 10.5 knots (12 mph) for Runway Design Code (RDC) A-1 and B-1; 13 knots (15 mph) for RDC A-II and B-II; 16 knots (18 mph) for RDC A-III, B-III, C-I through C-III, and D-I through D-III; and 20 knots for RDC A-IV through D-VI.

As previously detailed, weather data specific to the airport was not available. As such, weather information was obtained from Needles Airport, located 17 nautical miles northwest of Lake Havasu City Municipal Airport. The data has been collected continuously over a 10-year period starting January 1, 2008 through December 31, 2017. A total of 83,439 weather observations were made during this time, including observations for wind direction and speed.

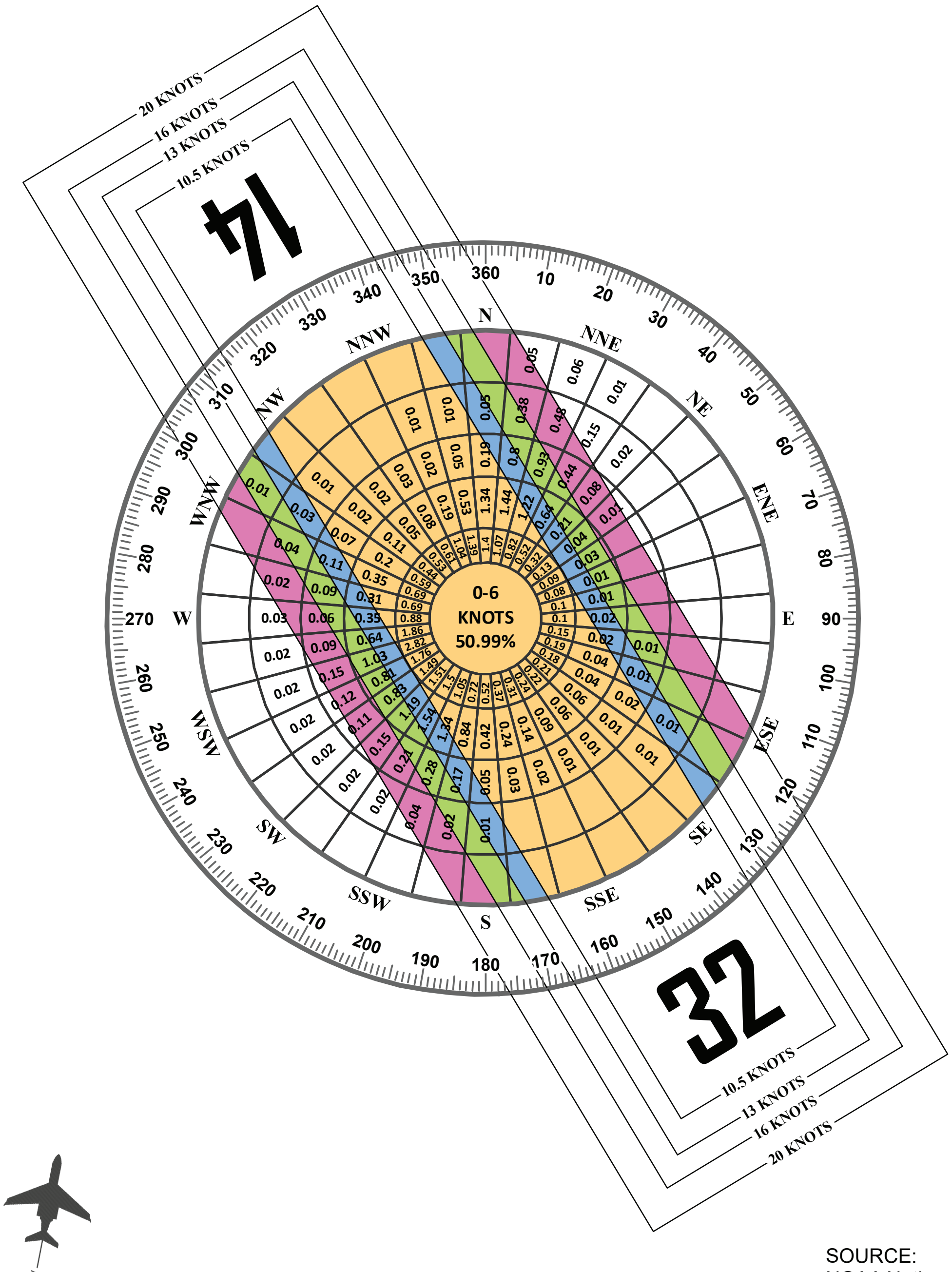
Exhibit 3B presents the all-weather wind rose for Lake Havasu City Municipal Airport. A wind rose is a graphic tool used to give a succinct view of how wind speed and direction are historically distributed at a specific location. The table at the top of the wind rose indicates the percent of the wind coverage for the runway and specific wind intensity. In all-weather conditions based on wind data observed at Needles Airport, Runway 14-32 provides 86.17 percent wind coverage for 10.5 knots, 91.96 percent coverage at 13 knots, 97.20 percent at 16 knots, and 99.31 percent at 20 knots.

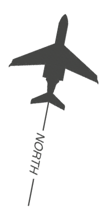
Based upon this wind data, Runway 14-32 falls short of the crosswind components for 10.5 knots and 13 knots. As such, analysis indicates that a crosswind runway could be planned in order to meet RDC B-II standards associated with 13 knots. The previous master plan identified similar findings, as it also utilized wind data from Needles Airport at the time. It is important to note that due to geographical differences, the data obtained from Needles Airport could be different from what is experienced at Lake Havasu City Municipal Airport. Without more applicable information, a site-specific determination for actual wind conditions and their relationship to the existing runway orientation cannot be made.

As stated in the previous master plan, topographical features, surrounding terrain, and existing development on and adjacent to Lake Havasu City Municipal Airport further limit the feasibility of a crosswind runway. As a result, no additional runway orientations will be evaluated as part of this master plan.

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 14-32	86.17%	91.96%	97.20%	99.31%





Magnetic Declination
11° 06' 00" East (Aug 2018)
Annual Rate of Change
00° 05' 00" West (Aug 2018)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Needles Airport
Needles, California

OBSERVATIONS:
83,439 All Weather Observations
Jan. 1, 2008 - Dec, 31 2017

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstruction 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).

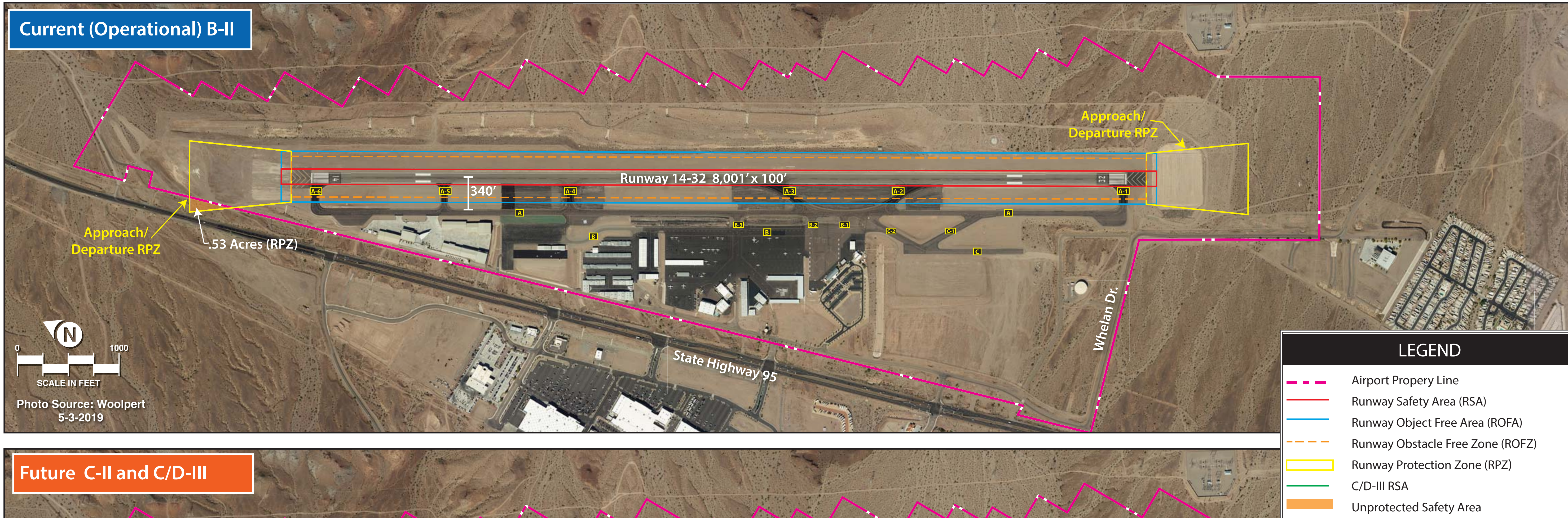
The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. The RPZ should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within an RPZ) or having sufficient land use control measures in place which ensures the RPZ remains free of incompatible development. The various airport safety areas are 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. In addition, separation standards that apply to the airfield system also account for the type of aircraft and approach capabilities of the runway environment. **Table 3C** presents the FAA design standards as they apply to Runway 14-32 at Lake Havasu City Municipal Airport per the detailed analysis conducted at the end of Chapter Two.

As discussed in Chapter Two, operations by aircraft in Aircraft Approach Category (AAC) B and Aircraft Design Group (ADG) II have exceeded the 500 annual operations thresholds on Runway 14-32. As a result, from an operational perspective, the runway is classified in RDC B-II. The future airfield design should be planned to at least C-II based on projected activity by larger business jets. Furthermore, the current airport layout plan (ALP) for Lake Havasu City Municipal Airport identifies Runway 14-32 as a C-III runway per direction provided by the FAA at the time of the previous master plan and ALP approval process. In addition, a Gulfstream 650 (D-III category) jet aircraft is currently based at the airport. As such, the design standards for both C-II and C/D-III will be examined in the following analysis.

Runway Safety Area

The RSA is defined in FAA AC 150/5300-13A, Change 1, *Airport Design*, as a "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." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical 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.



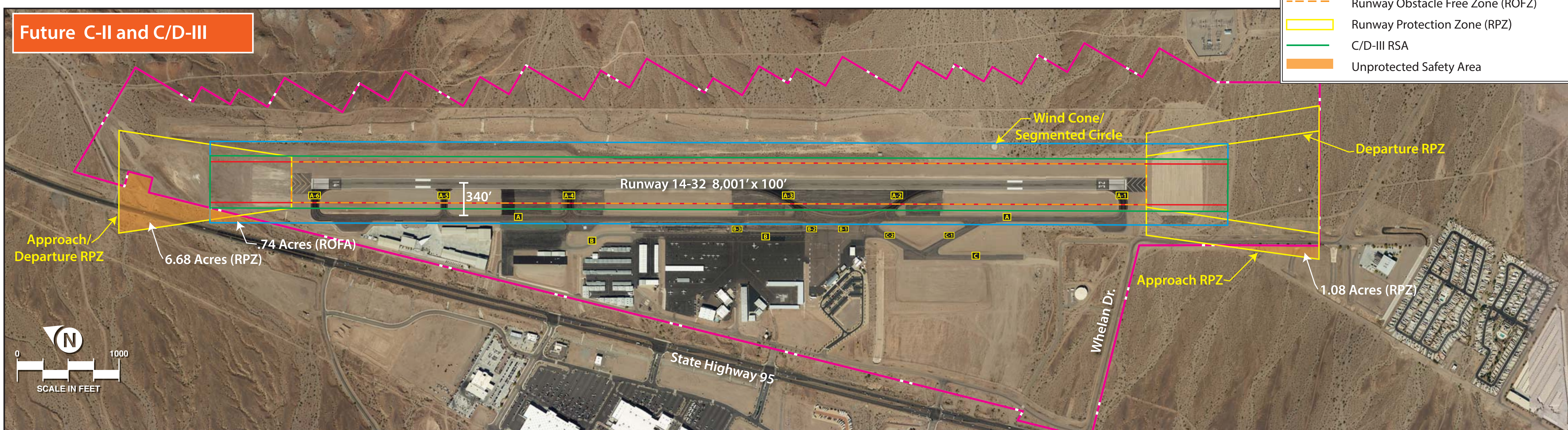


Exhibit 3C
RUNWAY DESIGN STANDARDS

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TABLE 3C
Runway Design Standards
Lake Havasu City Municipal Airport

	Runway 14-32		
	Current (Opera-tional)	**Future**	**Currently Approved ALP**
Runway Design Code	B-II-5000	C-II-4000	C/D-III-4000
Visibility Minimums	≥ 1 mile (both ends)	≥ 1 mile Rwy 14 ≥ ¾ mile Rwy 32	≥ 1 mile Rwy 14 ≥ ¾ mile Rwy 32
Runway Design			
Runway Width[1]	100	100	150[1]
Blast Pad Length/Width	150 x 95	150 x 120	200 x 200[2]
Runway Protection			
Runway Safety Area			
Width	150	400	500
Length Beyond Departure End	300	1,000	1,000
Length Prior to Threshold	300	600	600
Runway Object Free Area			
Width	500	800	800
Length Beyond Departure End	300	1,000	1,000
Length Prior to Threshold	300	600	600
Runway Obstacle Free Zone			
Width	400	400	400
Length Beyond Runway End	200	200	200
Approach Runway Protection Zone			
Inner Width	500	500	1,000
Outer Width	700	1,010	1,510
Length	1,000	1,700	1,700
Departure Runway Protection Zone			
Inner Width	500	500	500
Outer Width	700	1,010	1,010
Length	1,000	1,700	1,700
Runway Separation			
Runway Centerline to:			
Holding Position	200	250	258[3]
Parallel Taxiway	240	300	400
Aircraft Parking Apron	250	400	500

[1] For airplanes with maximum certificated takeoff weight of 150,000 pounds or less, the standard runway width is 100 feet.
[2] For airplanes with maximum certificated takeoff weight of 150,000 pounds or less, the standard blast pad width is 140 feet.
[3] This distance is increased one foot for each 100 feet above sea level.
Note: All dimensions in feet unless otherwise noted.

Source: Airport Layout Plan from *Lake Havasu City Municipal Airport Master Plan* (2010); FAA AC 150/5300-13A, Airport Design

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 AC 150/5300-13, Change 1, *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 B-II design, the FAA calls for the RSA to be 150 feet wide and extend 300 feet beyond the runway ends. It appears Runway 14-32 conforms to RSA standards for B-II design.

The RSA for ultimate RDC C-II design expands and is 400 feet wide, extending 1,000 feet beyond each runway end. For RDC C/D-III, the RSA width is 500 feet and also 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/D-III standards. A preliminary examination of the RSA for Runway 14-32 under these conditions does identify some vegetation that may penetrate the RSA along the east side of the runway system. A more detailed evaluation of potential RSA obstructions associated with vegetation and terrain (grade) will be made when survey data is obtained as part of this master plan. **Exhibit 3C** further depicts the RSAs associated with various RDCs outlined above.

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 B-II design, the FAA calls for the ROFA to be 500 feet wide, extending 300 feet beyond each runway end. Runway 14-32 currently meets this standard according to preliminary analysis.

The ROFA for RDCs C-II and C/D-III requires more demanding dimensional standards, encompassing an area of 800 feet wide and 1,000 feet beyond each runway end in order to meet design criteria for the future critical aircraft. Like the RSA, only 600 feet is needed prior to the landing threshold.

Exhibit 3C depicts the ROFAs associated with existing and ultimate airfield design standards. In the southeast area of the airport, the future ROFA is obstructed by vegetation as well as the wind cone and segmented circle situated approximately 325 feet east of the runway centerline. On the northwest side of the airport, approximately 0.74-acre of the future ROFA extends beyond airport property and is obstructed by portions of the airport's perimeter fencing and encroaches upon the right-of-way for State Highway 95 that traverses the west side of the airport. It is preferred that the airport control the entirety of its ROFA through fee simple property acquisition. The existing and future ROFAs will be further evaluated for vegetation, terrain (grade), and other factors upon receiving survey data during this study process.

Runway Object Free Zone

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

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). These standards apply to both existing and ultimate conditions associated with Runway 14-32. The ROFZ standards appear to be met under both scenarios, and further evaluation will be made upon receiving survey data of the airfield environment. **Exhibit 3C** further details the ROFZ dimensions associated with existing and future design.

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 according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13A, 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
- 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 sponsors 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; and
  - 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 (ACC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the ACC 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, only a small portion (0.53-acre) of the approach/departure RPZs serving Runway 14 extends beyond 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. The approach/departure RPZs associated with Runway 32 are fully contained on airport property.

Ultimate planning on Runway 14-32 should incorporate larger RPZs. **Exhibit 3C** details the approach/departure RPZ serving Runway 14 with not lower than one-mile visibility minimums. The RPZ extends farther north and encompasses approximately 6.68 acres of land outside existing airport property. Furthermore, the RPZ encompasses a portion of State Highway 95. On the south side of Runway 14-32, the approach RPZ associated with a potential not lower than ¾-mile visibility minimum approach encompasses approximately 1.08 acres of land outside airport property and includes a portion of Whelan Drive. 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 effect on RPZ dimensions will also be considered.

Runway/Taxiway Separation

The design standard for the required separation between runway and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimums. The separation standards for RDC B-II with not lower than one-mile visibility minimums is 240 feet. The runway-to-parallel taxiway separation standard for RDC C-II with not lower than ¾-mile visibility minimums is 300 feet. For RDC C/D-III standards, the separation standard is 400 feet.

Parallel Taxiway A is currently 340 feet from the runway; therefore, the current location of the parallel taxiway exceeds current separation standards for RDC B-II design and ultimate separation standards associated with RDC C-II design. RDC C/D-III standards fall short of the 400-foot separation requirement. The existing terrain and landside infrastructure in place on the west side of Runway 14-32 would make the relocation of parallel Taxiway A farther west a costly endeavor in meeting RDC C/D-III standards.

Hold Line Separation

Hold lines are markings on taxiways leading to runways. When instructed, pilots are to stop short of the hold line. For Runway 14-32, hold lines are marked 250 feet from the runway centerline. This exceeds the standard for RDC B-II associated with not lower than one-mile visibility minimums, which is 200 feet. For RDC C-II design, hold lines should be placed 250 feet from the runway centerline. The hold line separation standard for ultimate RDC C-II design is met.

According to FAA AC 150/5300-13A, Change 1, *Airport Design*, the hold line location may need to be increased based on an airport's elevation and the RDC of the runway. For RDC C/D-III, the holding position marking line should be increased one foot for every 100 feet above sea level. With Lake Havasu City Municipal Airport's elevation at 783 feet above mean sea level (MSL), the hold lines for Runway 14-32 should be increased to be 258 feet from the runway centerline in order to meet RDC C/D-III standards.

Aircraft Parking Apron Separation

For Runway 14-32, aircraft parking areas should be at least 250 feet from the runway centerline for RDC B-II. For RDC C-II, parking aprons would need to be at least 400 feet from the runway centerline associated with not lower than ¾-mile approach visibility minimums. The aircraft parking aprons situated adjacent to the west side of parallel Taxiway A meet these RDC standards. It should be noted that in order to meet RDC C/D-III standards for aircraft parking apron separation, 500 feet of separation from the runway centerline is needed. Various aircraft parking areas west of the runway environment would penetrate this 500-foot requirement.

RUNWAYS

The adequacy of the existing runway system at Lake Havasu City Municipal Airport has been analyzed from several 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 of 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 the airport is based on five primary factors:

- Mean maximum temperature of 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)

The mean maximum daily temperature of the hottest month for Lake Havasu City Municipal Airport is 109.2 degrees Fahrenheit (F), which occurs in July. The airport elevation is 783 feet. For aircraft in approach categories A and B, the maximum allowable runway gradient is 2 percent. For aircraft in approach categories C and D, the maximum allowable longitudinal runway gradient is 1.5 percent. The gradient of Runway 14-32 is 0.4 percent, which conforms to FAA design standards for all aircraft approach categories.

Airplanes operate on a wide variety of available runway lengths. Many factors will govern the sustainability of 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 sustainability of the runway length. Policies, such as area zoning and height and hazard restricting, can protect an airport's runway length. Airport ownership (fee simple easement) of land leading to the runway ends reduces the possibility of natural growth or man-made obstructions. Planning of runways should include an evaluation of aircraft types expected to use the airport now and in the future. Future planning should be realistic and supported by the FAA-approved forecasts and should be based on the critical design aircraft (or family of aircraft).

General Aviation Aircraft

The majority of operations at Lake Havasu City Municipal 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 4,200 feet is recommended. For small aircraft with 10 or more passenger seats, 4,700 feet of runway length is recommended.

The airport is also utilized by aircraft weighing more than 12,500 pounds, including small- to medium-sized 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 3D** 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 3D
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW (lbs.)	75-100 percent of the national fleet	MTOW (lbs.)	Greater than 60,000 pounds	MTOW (lbs.)
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	Gulfstream 650	99,600
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 3E 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 5,600 feet is recommended. This length is derived from a raw length of 5,200 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 7,700 feet is recommended.

TABLE 3E
Runway Length Requirements
Lake Havasu City Municipal Airport

Airport Elevation	783 feet above mean sea level
Average High Monthly Temp.	109.2 degrees F (July)
Runway Gradient	33.9 feet

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length with Gradient Adjustment (+340')	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
100% of small airplanes	4,200’	N/A	N/A	4,200’
100% of small airplanes (10+ seats)	4,700’	N/A	N/A	4,400’
75% of fleet at 60% useful load	5,200’	5,540’	5,500'	5,600’
100% of fleet at 60% useful load	7,300’	7,640’	5,500’	7,700’
75% of fleet at 90% useful load	8,400’	8,740’	7,000’	8,800’
100% of fleet at 90% useful load	11,000’	11,340’	7,000'	11,400’

*Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet condition
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at an 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 11,400 feet is recommended.

Another method to determine runway length requirements for jet aircraft at Lake Havasu City Municipal 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 109.2 degrees F at a field elevation of 783 feet MSL. **Exhibit 3D** provides a detailed runway length analysis for several of the most common business jets in the national fleet. This data was obtained from Ultranav software, which computes operational parameters for specific aircraft based on flight manual data. The analysis includes the maximum takeoff weight (MTOW) allowable and the percent useful load from 60 percent to 100 percent. This analysis shows that the runway length of 8,001 feet is capable of accommodating many of these business jet aircraft when operating at or below 80 percent useful load. Larger business jets, to include certain models of the Gulfstream, Global, and Hawker, would be weight-restricted when using Runway 14-32, especially during the summer months when the airport experiences hot temperatures. Due to these hot temperatures, several aircraft would be climb-limited at higher useful load percentages when factoring in the high-density altitudes that correspond with the summer months.

Exhibit 3D 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 own aircraft under direction of pilots specifically assigned to said aircraft. The landing length analysis shows an average landing length of 5,400 feet for aircraft operating under CFR Part 91k during wet runway conditions and an average of 7,200 feet for aircraft operating under Part 135 during wet runway conditions. Certain aircraft, such as the Gulfstream IV, as well as certain Cessna Citation aircraft models, require over 9,000 feet of runway length for landing when operating at maximum landing weight under Part 135 during wet runway conditions.

As previously noted, the FAA will typically only support runway length planning to the 60 percent useful load factor unless it can be demonstrated that business jets are frequently operating fully loaded (90 percent). Most business aircraft are capable of taking off on the runway at Lake Havasu City Municipal Airport at or above 80 percent useful load. For landing situations, the analysis showed that the existing runway length can accommodate the majority of business jets; however, certain jets would need more than 8,000 feet during wet conditions. It is important to note that wet runway conditions are rare at the airport.

Commercial/Air Charter Aircraft

Runway length needs for commercial service aircraft must factor the local operating 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.

An analysis in Chapter Two considered the potential for commercial activity at Lake Havasu City Municipal Airport in the future. **Table 3F** presents the runway length needs for various commercial jet aircraft utilizing the maximum ambient temperature conditions available in each aircraft's operating manual. For many of these aircraft, the maximum temperature available for planning calculations is approximately 90 degrees F. As previously detailed, the most demanding temperature at Lake Havasu City Municipal Airport is 109.2 degrees F in the month of July. As such, many of the runway length needs for these aircraft would likely increase based on the mean maximum temperature of 109.2 degrees F. The operating manuals for the Boeing Business Jets 1 and 2 provide a maximum temperature condition of 102 degrees F, thus falling more in line with the mean maximum temperature for the airport.

This analysis shows that many of these aircraft are capable of operating at 60 percent, 70 percent, and 80 percent useful loads on the current runway length based on an ambient temperature of 90 degrees F. Moving up to 90 percent and 100 percent useful loads, many aircraft would be weight-restricted and require additional runway length to operate at MTOW. It should be noted that due to the age and efficiency of certain aircraft, such as the MD-80 series and ERJ-135, many airline operators are phasing these aircraft out of their fleet mix and replacing them with newer and more efficient aircraft, such as the A319 and CRJ-700.

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at Lake Havasu City Municipal Airport. The airport should strive to accommodate commercial service aircraft and business jets to the greatest extent possible as demand would dictate.

Runway 14-32 is currently 8,001 feet long and can accommodate a large majority of business jets on the market under moderate loading conditions, especially with shorter trip lengths and during cool to warm temperatures. It is the hot days and longer trip lengths that can limit business jets operating at Lake Havasu City Municipal Airport. The potential introduction of commercial passenger service in the future would likely be capable of utilizing the existing runway length, depending on the type of aircraft and trip length. Short trip lengths, such as Las Vegas or Phoenix, utilizing newer aircraft in today's fleet mix should be capable of operating on the existing runway length.

Justification for any runway extension to meet the needs of business or commercial jets would require regular use on the order of 500 annual itinerant operations. This is the minimum threshold required to obtain FAA grant funding assistance. Previous planning studies conducted for the airport, as well as the existing ALP, indicate the existing runway length is sufficient for operational activity at the airport. Based on the analysis above and the current fleet mix of aircraft that utilize the airport on a regular basis, it is recommended that the existing runway length of 8,001 feet be maintained through the planning period of this study.

Aircraft Name	MTOW (lbs.)	Payload (lbs)	Takeoff Lengths Required: 60 % Useful Load Takeoff Weight (lbs)	60 % Useful Load Takeoff Field Length (ft.)	70% Useful Load Takeoff Weight (lbs)	70% Useful Load Takeoff Field Length (ft.)	80 % Useful Load Takeoff Weight (lbs)	80 % Useful Load Takeoff Field Length (ft.)	90 % Useful Load Takeoff Weight (lbs)	90 % Useful Load Takeoff Field Length (ft.)	100 % Useful Load Takeoff Weight (lbs)	100 % Useful Load Takeoff Field Length (ft.)
Beechjet 400A	16,300	5,315	14,174	4,577	14,706	4,916	15,237	5,318	15,769	5,795	16,300	O/L
Citation II (550)	13,300	5,100	11,260	3,945	11,770	4,379	12,280	4,842	12,790	5,333	13,300	5,851
Citation 560 XL	20,000	7,300	17,080	4,368	17,810	4,797	18,540	5,282	19,270	O/L	20,000	O/L
Citation X	35,700	13,236	30,406	5,622	31,729	6,161	33,053	6,787	34,376	O/L	35,700	O/L
Citation III	21,500	9,689	17,624	5,524	18,593	O/L	19,562	O/L	20,531	O/L	21,500	O/L
Citation Mustang	8,645	3,085	7,411	3,903	7,720	4,501	8,028	5,183	8,337	6,438	8,645	O/L
Citation Sovereign	30,300	12,150	25,440	3,622	26,655	3,866	27,870	4,183	29,085	4,527	30,300	4,950
Citation (525A) CJ2	12,375	4,575	10,545	3,893	11,003	4,224	11,460	4,547	11,918	4,938	12,375	O/L
Challenger 300	38,850	15,000	32,850	5,373	34,350	5,890	35,850	6,429	37,350	6,980	38,850	7,674
Challenger 601	45,100	18,850	37,560	5,760	39,445	6,440	41,330	7,240	43,215	8,180	45,100	9,230
Falcon 7X	70,000	33,400	56,640	5,093	59,980	5,697	63,320	6,361	66,660	7,141	70,000	7,940
Falcon 2000	35,800	13,050	30,580	5,772	31,885	6,534	33,190	7,087	34,495	7,869	35,800	9,368
Falcon 50 EX	41,000	18,000	33,800	5,234	35,600	5,809	37,400	6,414	39,200	O/L	41,000	O/L
Gulfstream 200	35,450	15,250	29,350	6,397	30,875	7,220	32,400	8,138	33,925	O/L	35,450	O/L
Gulfstream V	90,500	42,100	73,660	4,942	77,870	5,737	82,080	6,690	86,290	7,777	90,500	9,040
Gulfstream 100	24,650	10,015	20,644	5,760	21,646	6,394	22,647	7,062	23,649	7,727	24,650	O/L
Gulfstream 150	26,100	11,000	21,700	5,673	22,800	6,003	23,900	O/L	25,000	O/L	26,100	O/L
Gulfstream 300	72,000	29,139	60,344	4,897	63,258	5,202	66,172	5,797	69,086	6,373	72,000	7,004
Gulfstream 350	70,900	28,000	59,700	4,828	62,500	5,277	65,300	5,769	68,100	6,297	70,900	6,868
Gulfstream 450	74,600	31,400	62,040	5,199	65,180	5,748	68,320	6,341	71,460	6,983	74,600	7,705
Gulfstream 550	91,000	42,300	74,080	5,354	78,310	6,109	82,540	6,977	86,770	7,954	91,000	9,017
Gulfstream IIB	69,700	31,550	57,080	4,986	60,235	5,504	63,390	6,041	66,545	O/L	69,700	O/L
Gulfstream III	69,700	31,900	56,940	4,963	60,130	5,487	63,320	6,029	66,510	O/L	69,700	O/L
Gulfstream IV	74,600	30,700	62,320	5,063	65,390	5,650	68,460	O/L	71,530	O/L	74,600	O/L
Global 5000	92,500	41,660	75,836	4,976	80,002	5,542	84,168	6,137	88,334	6,759	92,500	O/L
Global Express	98,000	46,800	79,280	5,442	83,960	6,107	88,640	6,806	93,320	O/L	98,000	O/L
Global XRS	98,000	46,800	79,280	5,442	83,960	6,107	88,640	6,805	93,320	O/L	98,000	O/L
Hawker 800XP	28,000	11,750	23,300	5,203	24,475	O/L	25,650	O/L	26,825	O/L	28,000	O/L
Hawker 900 XP	28,000	11,500	23,400	4,817	24,550	5,303	25,700	5,837	26,850	O/L	28,000	O/L
Hawker 1000	31,000	13,000	25,800	6,280	27,100	O/L	28,400	O/L	29,700	O/L	31,000	O/L
Hawker 4000	39,500	15,800	33,180	4,940	34,760	5,381	36,340	5,930	37,920	6,631	39,500	7,399
Lear 31A	17,000	5,786	14,686	4,843	15,264	5,328	15,843	5,924	16,421	6,134	17,000	O/L
Lear 35A	19,600	8,800	16,080	7,087	16,960	O/L	17,840	O/L	18,720	O/L	19,600	O/L
Lear 45	21,500	7,500	18,500	5,912	19,250	6,677	20,000	7,753	20,750	8,884	21,500	O/L
Lear 60	23,500	8,728	20,009	6,369	20,882	6,918	21,754	7,612	22,627	8,496	23,500	9,606
Premier 1A	12,500	3,900	10,940	5,339	11,330	6,032	11,720	6,664	12,110	7,331	12,500	O/L
Westwind I	22,850	9,850	18,910	O/L	19,895	O/L	20,880	O/L	21,865	O/L	22,850	O/L
Westwind II	23,500	10,250	19,400	6,182	20,425	O/L	21,450	O/L	22,475	O/L	23,500	O/L

Runway length calculation assumptions: 783 MSL field elevation; 109.2° F ambient temperature; 0.42% runway gradient
Red values exceed existing runway length

Aircraft Name	MLW (lbs)	Landing Lengths Required: CFR Part 25 Dry (ft)	CFR Part 25 Wet (ft)	CFR Part 135 Dry (.6) (ft)	CFR Part 135 Wet (.6) (ft)	CFR Part 91K Dry (.8) (ft)	CFR Part 91K Wet (.8) (ft)
Beechjet 400A	15,700	3,885	5,806	6,475	9,677	4,856	7,258
Citation II (550)	12,700	2,570	3,727	4,283	6,212	3,213	4,659
Citation 560 XL	18,700	3,697	5,849	6,162	9,748	4,621	7,311
Citation X	31,800	4,255	6,096	7,092	10,160	5,319	7,620
Citation III	19,000	4,301	6,287	7,168	10,478	5,376	7,859
Citation Mustang	8,000	2,716	3,824	4,527	6,373	3,395	4,780
Citation Sovereign	27,100	3,140	4,059	5,233	6,765	3,925	5,074
Citation (525A) CJ2	11,500	3,461	4,982	5,768	8,303	4,326	6,228
Challenger 300	33,750	2,645	5,070	4,408	8,450	3,306	6,338
Challenger 601	36,000	3,382	4,059	5,637	6,765	4,228	5,074
Falcon 7X	62,400	2,970	3,415	4,950	5,692	3,713	4,269
Falcon 2000	33,000	3,174	3,651	5,290	6,085	3,968	4,564
Falcon 50 EX	35,715	2,974	3,420	4,957	5,700	3,718	4,275
Gulfstream 200	30,000	3,761	4,326	6,268	7,210	4,701	5,408
Gulfstream V	75,300	2,834	3,259	4,723	5,432	3,543	4,074
Gulfstream 100	20,700	3,377	6,267	5,628	10,445	4,221	7,834
Gulfstream 150	21,700	3,330	4,847	5,550	8,078	4,163	6,059
Gulfstream 300	66,000	3,220	3,703	5,367	6,172	4,025	4,629
Gulfstream 350	66,000	3,312	3,809	5,520	6,348	4,140	4,761
Gulfstream 450	66,000	3,312	5,986	5,520	9,977	4,140	7,483
Gulfstream 550	75,300	2,817	5,387	4,695	8,978	3,521	6,734
Gulfstream IIB	58,500	3,209	3,691	5,348	6,152	4,011	4,614
Gulfstream III	58,500	3,209	3,691	5,348	6,152	4,011	4,614
Gulfstream IV	66,000	3,674	4,225	6,123	7,042	4,593	5,281
Global 5000	78,600	2,708	3,114	4,513	5,190	3,385	3,893
Global Express	78,600	2,708	3,114	4,513	5,190	3,385	3,893
Global XRS	78,600	2,708	3,114	4,513	5,190	3,385	3,893
Hawker 800XP	23,350	2,698	4,295	4,497	7,158	3,373	5,369
Hawker 900 XP	23,350	2,698	4,151	4,497	6,918	3,373	5,189
Hawker 1000	25,000	2,942	4,028	4,903	6,713	3,678	5,035
Hawker 4000	33,500	3,444	3,960	5,740	6,600	4,305	4,950
Lear 31A	16,000	3,139	4,395	5,232	7,325	3,924	5,494
Lear 35A	15,300	3,366	4,712	5,610	7,853	4,208	5,890
Lear 45	19,200	2,959	3,829	4,932	6,382	3,699	4,786
Lear 60	19,500	3,759	5,136	6,265	8,560	4,699	6,420
Premier 1A	11,600	3,535	4,583	5,892	7,638	4,419	5,729
Westwind I	19,000	2,520	2,890	4,200	4,817	3,150	3,613
Westwind II	19,000	2,440	2,810	4,067	4,683	3,050	3,513

MLW - Maximum Landing Weight
MTOW - Maximum Takeoff Weight
O/L - Climb Limited - Out of Limits

Exhibit 3D
BUSINESS JET RUNWAY LENGTH REQUIREMENTS

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TABLE 3F
Runway Length Requirements for Select Commercial Aircraft
Lake Havasu City Municipal Airport

Aircraft	Temp.	Aircraft Weights (lbs.)			Takeoff Wt. with % Payload (lbs.)					Runway Length (ft.) Needed at % Payload				
		MTOW	BOW/ OEW	Payload	60%	70%	80%	90%	100%	60%	70%	80%	90%	100%
Airbus A319	ISA +15c (90 f)	145,505	87,801	57,704	122,423	128,194	133,964	139,735	145,505	4,100	4,600	4,900	5,200	6,000
Airbus A320	ISA +15c (90 f)	157,630	91,150	66,480	131,038	137,686	144,334	150,982	157,630	5,000	5,500	6,200	6,900	7,500
Boeing Business Jet 1	ISA +25c (102 f)	171,000	92,345	78,655	139,538	147,404	155,269	163,135	171,000	5,400	5,900	6,800	7,800	9,200
Boeing Business Jet 2	ISA +25c (102 f)	174,200	96,727	77,473	143,211	150,958	158,705	166,453	174,200	6,200	6,800	7,600	8,800	11,100
Boeing 737-300	ISA +15c (90 f)	135,000	72,540	62,460	110,016	116,262	122,508	128,754	135,000	4,900	5,400	6,200	7,400	9,800
Boeing 737-700	ISA +15c (90 f)	154,500	83,000	71,500	125,900	133,050	140,200	147,350	154,500	5,000	5,800	6,800	8,500	10,100
Boeing 737-800	ISA +15c (90 f)	174,200	91,300	82,900	141,040	149,330	157,620	165,910	174,200	5,300	6,000	6,500	7,100	8,200
Boeing 737-900	ISA +15c (90 f)	174,200	94,580	79,620	142,352	150,314	158,276	166,238	174,200	6,300	7,100	7,400	8,400	11,200
Embraer ERJ-135	ISA +15c (90 f)	44,092	25,355	18,737	36,597	38,471	40,345	42,218	44,092	4,600	5,100	5,500	6,000	6,800
Embraer EMB-145	ISA +15c (90 f)	45,415	26,399	19,016	3,7809	39,710	41,612	43,513	45,415	4,100	4,400	4,800	5,200	7,000
Bombardier CRJ-200	ISA +8c (84 f)	53,000	30,900	22,100	44,160	46,370	48,580	50,790	53,000	4,500	5,000	5,400	6,200	6,800
Bombardier CRJ-700	ISA +15c (90 f)	75,000	44,245	30,755	62,698	65,774	68,849	71,925	75,000	4,400	4,700	5,200	5,500	6,400
McDonnell Douglas MD-81	ISA +15c (90 f)	140,000	77,888	62,112	115,155	121,366	127,578	133,789	140,000	4,800	5,800	6,300	7,000	8,600

All MTOWs and BOWs/OEWs from aircraft operating manuals
Payload calculated from difference of MTOW and BOW/OEW
Zero slope runway, no-wind conditions assumed for all aircraft
MTOW - Maximum Takeoff Weight; BOW - Basic Operating Weight; OEW - Operating Empty Weight
Source: Aircraft Operating Manuals

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 14-32, RDC B-II design criteria stipulate a runway width of 75 feet. The current runway exceeds the standard as it is 100 feet wide. Runway design standards for future RDC C-II require the runway to be 100 feet wide. As such, the current runway width meets this ultimate standard. Furthermore, RDC C/D-III design criteria stipulate a runway width of 100 feet unless the critical aircraft has a maximum takeoff weight (MTOW) greater than 150,000 pounds. For ADG III aircraft with MTOWs greater than 150,000 pounds, the standard runway width is 150 feet. As such, the existing width of 100 feet on Runway 14-32 should be maintained in order to meet future RDC standards.

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 14-32 at 100,000 pounds single wheel loading (SWL). This strength rating refers to the configuration of the aircraft landing gear. SWL refers to landing gear that only has a single wheel on each side of the fuselage on the aircraft's main 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 the aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. It is the airport sponsor's responsibility, however, to properly maintain the runway and protect the useful life of the runway, typically for 20 years.

According to the FAA-published Chart Supplement, also known as the Airport/Facility Directory (AFD), "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 Chart Supplement 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 operate at the airport and most that are forecast to utilize the airport in the future. As such, future planning should maintain the existing pavement strength on Runway 14-32, with ultimate consideration given to an increase if the airport sees significant growth in large business jet or commercial aircraft operations.

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 Lake Havasu City Municipal Airport, each end of Runway 14-32 is provided with a blast pad. The blast pad associated with Runway 14 is 200 feet long by 200 feet wide, and the blast pad associated with Runway 32 is 200 feet long by 140 feet wide. The blast pad dimensions on both runway ends exceed the design standards for RDCs B-II and C-II, and at least meet the design standards for RDC C/D-III. As such, they should be maintained through the long-term planning period.

TAXIWAYS

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the ADG of the critical design aircraft. As determined previously, the applicable ADG for Runway 14-32 is currently ADG II. Ultimate planning should conform to at least ADG II for the runway. Furthermore, ADG III should be evaluated based on the currently approved ALP. **Table 3G** presents the various taxiway design standards related to ADGs II and III.

TABLE 3G
Taxiway Dimensions and Standards
Lake Havasu City Municipal 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*

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 14-32 should be TDG 2. As such, the taxiways on the airfield should be at least 35 feet wide. Ultimate planning also accounts for TDG 3. Taxiway design associated with TDG 3 calls for a 50-foot width.

The current taxiway system is composed of varying taxiway widths. Parallel Taxiway A serving Runway 14-32 is 50 feet wide. Entrance/exit Taxiways A1 through A6 range in width from 50 feet to 65 feet. Taxiways A1, A4, and A6 are 65 feet wide, and the remaining entrance/exit taxiways are 50 feet wide. Other taxiway infrastructure associated with Taxiways B and C networks range in width from 35 feet up to 75 feet.

All taxiway widths on the airfield should be maintained unless financial constraints dictate. As such, the width could 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.

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 Lake Havasu City Municipal 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 Lake Havasu City Municipal Airport meets the recommended design and geometry standards set forth by the FAA. There are certain non-standard conditions that include:

- Taxiway A3 provides for direct access from the main aircraft parking apron to Runway 14-32.
- Taxiway A4 provides for direct access from an aircraft run-up apron (compass rose) and the north ramp apron to Runway 14-32.

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. Lake Havasu City Municipal Airport employs the following navigational aids.

Instrument Approach Aids

Instrument approaches are categorized as either precision approaches or non-precision approaches. Precision instrument approaches 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 instrument landing system (ILS); however, with advances in global positioning system (GPS) technology, it is now used to provide both vertical and lateral navigation for pilots.

Lake Havasu City Municipal Airport has straight-in instrument approach capabilities to each end of Runway 14-32. These include area navigation (RNAV) GPS approaches serving Runways 14 and 32, and a very high frequency omnidirectional range (VOR) with distance measuring equipment (DME) approach. The RNAV GPS approach to Runway 14 provides for 1.25-mile visibility and 1,400-foot cloud ceilings. The RNAV GPS approach serving Runway 32 allows for visibility minimums as low as one mile and 500-foot cloud ceilings. It should be noted that the RNAV GPS to Runway 32 offers vertical guidance for properly equipped aircraft. As such, this approach allows for lower approach minimums. The VOR/DME approach is a circling approach only, allowing for minimums to either end of the runway environment. Analysis in the next chapter will consider improvements necessary for enhancing instrument approach capabilities to the runway system at Lake Havasu City Municipal Airport.

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, both ends of Runway 14-32 are served by a four-box precision approach path indicator (PAPI-4). These approach aids should be maintained through the planning period.

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 the 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 more sophisticated approach lighting systems. There are currently REIL systems on each end of Runway 14-32. These systems should be maintained through the long-term planning period.

Weather Reporting Aids

Lake Havasu City Municipal Airport has four wind cones and a segmented circle. The wind cones provide information to pilots regarding wind speed and direction. Typically, one wind cone is centralized on the airfield system and often co-located within a segmented circle, which is the case at Lake Havasu City Municipal Airport. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. The segmented circle/lighted wind cone at the airport is located in the southeast area of the airfield, approximately 400 feet east of Runway 14-32.

The airport is equipped with an Automated Weather Observation System III (AWOS-III), which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur in real time. This information is then transmitted via a designated radio frequency at regular intervals. Aircraft in the vicinity of the airport can receive the weather information via 119.025 MHz. This system should be maintained through the planning period. Furthermore, it is recommended that weather information obtained through the AWOS be transmitted to the National Oceanic Atmospheric Administration (NOAA) in order to better collect historical weather data, such as wind conditions.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

There are several lighting and pavement marking aids serving pilots using the airport. These aids assist pilots in locating an airport and runway at night or in poor visibility conditions. They also serve aircraft navigating the airport environment on the ground when transitioning to/from aircraft parking areas to the runway.

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. To pilots approaching the airport, the beacon appears as a flashing light which is alternating between white and green. The rotating beacon at Lake Havasu City Municipal Airport is located in the southeast area of the airfield, approximately 800 feet northeast of the Runway 32 threshold.

Runway and Taxiway Lighting

Runway lighting provides the pilot with positive identification of the runway and its alignment. Runway 14-32 is served by medium intensity runway lighting (MIRL). Runway lighting on this runway should be maintained through the planning period.

Medium intensity taxiway lighting (MITL) has been installed on Taxiway A, as well as the entrance and exit taxiways connected to the runway. This system is vital for safe and efficient ground movements and should be maintained through the planning period. In addition, Taxiway B and its connector taxiways, as well as Taxiways C1 and C2, are equipped with MITL. Taxiway C is equipped with elevated edge reflectors. Future planning should also consider MITL on future taxiways that directly support the runway system at the airport. At a minimum, planning should also consider edge reflectors on more remote taxiways and taxilanes serving landside development areas.

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 14-32 is served by non-precision markings. This aids in accommodating the RNAV GPS approaches to the runway and provides enhanced identification for both ends of the runway. All runway markings should be maintained through the long-term planning horizon.

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, runway exits, and runway distance remaining. All these signs should be maintained throughout the planning period.

A summary of the airside facilities at Lake Havasu City Municipal Airport are 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 Lake Havasu City Municipal Airport, this includes components for general aviation and potential commercial service needs such as:

- General Aviation Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Potential Commercial Passenger Terminal Complex
- Airport Support Facilities

Landside facility requirements are outlined in **Exhibit 3F**.

GENERAL AVIATION TERMINAL FACILITIES

The general aviation terminal facilities at an 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, pilot's lounge, flight planning, concessions, management, storage, and many other various needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by fixed base operators (FBOs) and other specialty operators for these functions and services. At Lake Havasu City Municipal Airport, general aviation terminal services are primarily provided by Desert Skies Executive Air Terminal and Havasu Air Center, the two FBOs on the airfield. It is important to note that the airport terminal building was not included as part of these calculations because it was originally designed as a commercial service passenger terminal. Since there are currently no commercial passenger services offered at the airport, the terminal is currently being used primarily to support airport administrative office space and rental car services. Most general aviation terminal activities utilize space provided by the FBOs. This does not preclude the terminal building from being able to accommodate basic general aviation functions. The existing terminal building encompasses approximately 5,700 square feet.

The methodology used in estimating general aviation terminal facility needs was based on 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 2.2 in the short term, increasing to 2.8 in the long term, was also applied to terminal facility needs to better determine the number of passengers associated with each itinerant aircraft operation. This increasing multiplier indicates an expected increase in business operations through the long term. Business operations typically support larger turboprop and jet aircraft, which can accommodate an increasing passenger load factor. Such is the case at Lake Havasu City Municipal Airport, as the facility is expected to experience an increase in business and recreational operations through the long-term planning period.

	AVAILABLE	SHORT TERM	LONG TERM
RUNWAYS		**Runway 14-32**	
	RDC B-II-5000	Evaluate RDC C-II-4000 and C/D-III-4000	RDC C-II-4000 or C/D-III-4000
	8,001' x 100'	Maintain	Maintain
	100,000 lbs. SWL	Maintain	Potential increase based on aircraft fleet mix
	Portion of Runway 14 Approach RPZ extends beyond existing Airport property line	Evaluate RSA, ROFA, ROFZ, and RPZ to appropriate safety design standards; consider acquisition of all properties encompassed by safety areas	Maintain
TAXIWAYS			
	All Taxiways 35'-75' wide	All Taxiways associated with Runway 14-32 at least 35' wide	Evaluate Taxiway width to potential RDC C/D-III design
	Runway/Parallel Taxiway Separation - 340'	Maintain	Evaluate Runway/Parallel Taxiway separation at 400'
	Two Hold Aprons serving Runway 14-32	Maintain	Maintain
	Non-standard conditions associated with Taxiways A3 and A4	Examine Taxiway system for safety, efficiency, and proper geometry	Examine Taxiway system for safety, efficiency, and proper geometry
NAVIGATIONAL AND APPROACH AIDS			
	RNAV (GPS) Approach - Runway 14-32	Evaluate improved Approach visibility minimums on Runway 32	Maintain
	VOR/DME-A Approach- Runway 14-32	Maintain	Maintain
	AWOS-III	Maintain	Maintain
	3 Lighted Windcones	Maintain	Maintain
	Segmented Circle	Maintain	Maintain
	PAPI-4 - Runway 14-32	Maintain	Maintain
	REILs - Runway 14-32	Maintain	Maintain
LIGHTING, MARKING, AND SIGNAGE			
	Rotating Beacon	Maintain	Maintain
	MIRL	Maintain (Consider LED technology)	Maintain
	MITL - On Parallel Entrance/Exits Taxiways and Connector Taxiways	Transition Elevated Edge Reflectors to MITL (Consider LED technology)	Maintain
	Non-Precision Markings	Maintain	Maintain
	Hold Lines - 250' from Runway Centerline	Maintain	Evaluate hold line separation to potential RDC C/D-III design
	Lighted Airfield Signs	Maintain (Consider LED technology)	Maintain

ABBREVIATIONS

RDC - Runway Design Code
SWL - Single Wheel Loading
RSA- Runway Safety Area
ROFA- Runway Object Free Area
ROFZ- Runway Object Free Zone
RPZ- Runway Protection Zone
GPS - Global Positioning System
LED - Light Emitting Diode
VOR- Very-high Frequency Omni-Directional Range
DME- Distance Measuring Equipment
RNAV - Area Navigation
AWOS - Automated Weather Observation System
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
REILs - Runway End Identification Lights
PAPI - Precision Approach Path Indicator

Exhibit 3E
AIRSIDE FACILITY REQUIREMENTS

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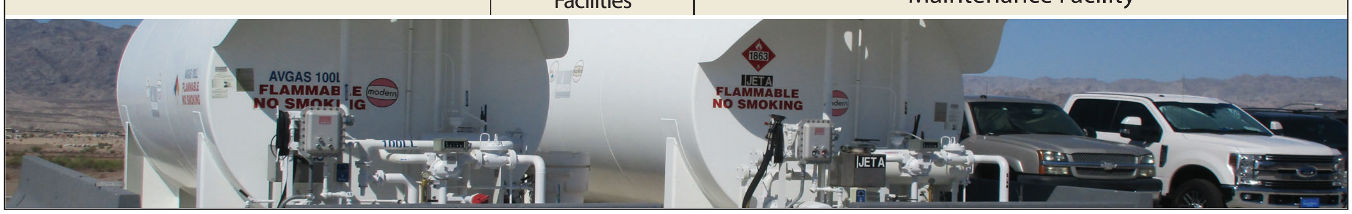
	AVAILABLE	SHORT-TERM NEED	INTERMEDIATE TERM NEED	LONG-TERM NEED
GENERAL AVIATION TERMINAL SERVICES				
General Aviation Services Facility Area (s.f.)	8,300[1]	4,600	5,600	7,600
Vehicle Parking Spaces	167[2]	123	137	162

	AVAILABLE	SHORT-TERM NEED	INTERMEDIATE TERM NEED	LONG-TERM NEED
AIRCRAFT STORAGE HANGAR RQUIREMENTS				
Total Based Aircraft	160	172	183	202
Aircraft to be Hangared	147	158	168	187
Port-a-Port/ Linear Box Hangar/ Shade Port (s.f.)	199,500	204,000	208,500	216,900
Executive Box Hangar (s.f.)	129,000	136,500	141,500	154,000
Conventional Hangar (s.f.)	48,200	61,200	74,200	102,200
Total Hangar Area (s.f.)	**376,700**	**421,500**	**465,000**	**537,300**

	AVAILABLE	SHORT-TERM NEED	INTERMEDIATE TERM NEED	LONG-TERM NEED
AIRCRAFT PARKING APRON REQUIREMENTS				
Based Aircraft Parking	-	34	35	36
Transient General Aviation/ Air Taxi Parking	-	29	32	37
Jet Aircraft Parking	-	9	10	11
Total Apron Area (s.y.)	**128,000**	**59,200**	**64,000**	**71,300**

	AVAILABLE	SHORT-TERM NEED	INTERMEDIATE TERM NEED	LONG-TERM NEED
SUPPORT FACILITIES				
Fuel Storage- Avgas (100LL)	24,750 gallons	Based on Fixed Base Operator Demand		
Fuel Storage- Jet A	27,000 gallons	Based on Fixed Base Operator Demand		
	Perimeter Fencing/Gates	Maintain	Maintain	Maintain
	Airport Maintenance Facilities	Evaluate Potential Development of Designated Maintenance Facility		



[1] Includes approximate space currently offered by FBOs

[2] Approximate number of total marked vehicle parking spaces at the airport not including the terminal building.

Exhibit 3F
LANDSIDE FACILITY REQUIREMENTS

Table 3H outlines the space requirements for general aviation terminal services at Lake Havasu City Municipal Airport through the long-term planning period. As shown in the table, up to 7,600 square feet of space could be needed in the long term for general aviation passengers. The amount of space currently offered by the FBO is approximately 8,300 square feet. These spaces include designated areas for a passenger waiting lobby, flight planning, pilot lounge, restroom facilities, and other amenities.

Other specialty aviation operators on the airfield also provide space for pilots and passengers. It can be assumed that adequate services and space is provided to accommodate their customers.

General aviation vehicular parking demands have also been determined for Lake Havasu City Municipal 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.

TABLE 3H
General Aviation Terminal Area Facilities
Lake Havasu City Municipal Airport

	Currently Available	Short Term Need	Intermediate Term	Long Term Need
General Aviation Services Facility Area (s.f.)	8,300[1]	4,600	5,600	7,600
Design Hour Passengers	30	37	45	61
Passenger Multiplier	2.0	2.2	2.4	2.8
Vehicle Parking Spaces	167[2]	123	137	162

[1]Includes approximate terminal space offered by FBOs.
[2]Approximate number of total marked vehicle parking spaces at the airport not including the terminal building.
Source: Coffman Associates analysis

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 123 spaces in the short term, increasing to approximately 162 spaces in the long-term planning horizon. It is estimated that there are 167 marked vehicle parking spaces at Lake Havasu City Municipal Airport currently serving various airport activities, including the FBOs and other general aviation functions. Future consideration in the master plan will be given to providing vehicle parking to support additional general aviation development potential.

Additionally, the airport terminal building parking area provides 192 vehicle parking spaces for airport staff, visitors, rental cars, and employees of service providers located in the terminal building. The terminal parking area is not included in this analysis.

AIRCRAFT HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preference. The trend in general aviation aircraft is toward more sophisticated (and consequently, more expensive) aircraft; therefore, many aircraft owners prefer enclosed hangar space as opposed to outside tiedowns.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the 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 most aircraft owners prefer enclosed aircraft storage, a number of based aircraft will still use outdoor tiedown spaces, usually due to lack of available hangar space, high hangar rental rates, or operational needs. Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. At Lake Havasu City Municipal Airport, approximately 92 percent of based aircraft utilize hangar space. The remaining eight percent are stored outside on aircraft parking aprons.

As discussed in Chapter One, hangar types vary greatly in size and function. Port-a-Port hangars, shade port hangars, and linear box hangars are popular with aircraft owners that need to store one private aircraft. These hangars often provide individual spaces within a larger structure or in standalone portable buildings. There is an estimated 199,500 square feet of storage space at the airport comprised of Port-a-Port hangars, shade port hangars, and linear box hangars. For determining future aircraft storage needs, a planning standard of 1,200 square feet per aircraft is utilized for these types of hangars.

Executive box hangars are open space facilities with no interior supporting structure. These hangars can vary in size between 1,500 and 2,500 square feet, with some approaching 10,000 square feet. They are typically able to house multi-engine, turboprop, and jet aircraft, as well as helicopters. Executive box hangar space at Lake Havasu City Municipal Airport is estimated at 129,000 square feet. For future planning, a standard of between 1,200 and 5,000 square feet per aircraft is utilized for executive box hangars.

Conventional hangars are the large open space facilities with no supporting interior structure. These hangars provide for bulk aircraft storage and are often utilized by airport businesses, such as an FBO or an aircraft maintenance operator. Conventional hangars are generally larger than executive box hangars and can range in size from 10,000 square feet to more than 20,000 square feet. Often, a portion of a conventional hangar is utilized for non-aircraft storage needs, such as maintenance or office space. There are four conventional hangars at Lake Havasu City Municipal Airport totaling approximately 48,200 square feet of storage space. For future planning needs, 1,500 square feet per single engine aircraft is utilized for conventional hangars. For multi-engine, turboprop, and helicopters, 2,500 square feet is utilized. For jet aircraft, a planning standard of 5,000 square feet per aircraft is used. 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 125 square feet per based aircraft. In total, there is currently approximately 377,000 square feet of hangar, maintenance, and office space provided on the airport.

Future hangar requirements for the airport are summarized in **Table 3J**. While some based aircraft will continue to utilize aircraft parking apron space as opposed to enclosed hangar space, the overall percentage of aircraft seeking hangar space is projected to increase during the long-term planning period.

The analysis shows that future hangar requirements indicate that there is a potential need for over 537,000 square feet of hangar storage space through the long-term planning period. This includes a mixture of hangar area, with the largest needs projected in the executive box hangar and conventional hangar categories. 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.

TABLE 3J
Aircraft Hangar Requirements
Lake Havasu City Municipal Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Total Based Aircraft	160	172	183	202
Aircraft to be Hangared	147	158	168	187
Hangar Area Requirements				
Port-a-Port Hangar/Shade Port/Linear Box Hangar Area (s.f.)	199,500	204,000	208,500	216,900
Executive Box Hangar Area (s.f.)	129,000	136,500	141,500	154,000
Conventional Hangar Area (s.f.)	48,200	61,200	74,200	102,200
Maintenance Area (s.f.)	--	19,800	40,800	64,200
Total Hangar Area (s.f)	**376,700***	**421,500**	**465,000**	**537,300**

Note: *Includes total hangar and maintenance area currently at the airport
Source: Coffman Associates analysis

It should be noted that hangar requirements are general in nature and based upon the aviation demand forecasts. The actual need for hangar space will further depend on the actual usage within the 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. FAA Advisory Circular 150/5300-13A, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy day operations. The number of itinerant parking spaces required was determined to be approximately 15 percent of the busy day itinerant operations for general aviation operations. A planning standard of 800 square yards per aircraft was applied to determine future transient apron requirements for single and multi-engine piston aircraft. For business jets, which oftentimes are much larger, a planning standard of 1,600 square yards per aircraft position was used. In addition, Lake Havasu City Municipal Airport has aircraft that use outside aircraft tiedowns for storage. It is assumed that these aircraft require less space than transient aircraft; therefore, planning a planning standard of 650 square yards per aircraft was applied. For local tiedown needs, an additional 20 spaces are identified for maintenance activities. Apron parking requirements are presented in **Table 3K**. Transient apron parking needs are divided into business jet needs and smaller single and multi-engine aircraft needs.

Currently, existing aircraft parking aprons at the airport total approximately 128,000 square yards of space and provide 202 marked aircraft parking positions. This includes city tiedowns and tiedowns associated with FBOs and other specialty aviation operators. As shown in the table, the apron area currently available is adequate and will remain adequate through the long-term planning period.

TABLE 3K
Aircraft Parking Apron Requirements
Lake Havasu City Municipal Airport

	Available	Short Term Need	Intermediate Term Need	Long Term Need
Based Aircraft Parking		34	35	36
Transient General Aviation / Air Taxi Parking		29	32	37
Jet Aircraft Parking		9	10	11
Total Apron Area (s.y.)	**128,000**	**59,200**	**64,000**	**71,300**

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. Helicopter operations should be segregated to the extent practicable to increase safety and efficiency of aircraft parking aprons. Two designated helicopter parking spaces can be found on the terminal apron. Another helicopter parking location can be found at the north end of the Havasu Air Center parking apron. Long-term facility planning will consider additional dedicated helicopter activity areas at the airport.

POTENTIAL COMMERCIAL PASSENGER TERMINAL COMPLEX

Components of the passenger terminal area complex include the terminal building, gate positions, aircraft apron area, vehicle parking, and surface access roads. Based upon the potential commercial enplanements and operations analysis conducted in Chapter Two, this section identifies potential passenger terminal facilities required to meet a scenario of 35,000 enplanements. The premise of this scenario is that, at some point in the future, Lake Havasu City Municipal Airport could attract one or more scheduled commercial airline operators. It is important to note that this passenger terminal complex requirements analysis is based entirely on theoretical enplanement and operations levels. The purpose of this section is simply to provide Lake Havasu City with an idea of what types and sizes of facilities would be needed should commercial service demand reach this level at the airport.

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*. Also sourced was *Airport Passenger Terminal Planning and Design, Report 25,* published by the Airport Cooperative Research Program (ACRP). **Table 3L** summarizes the future capacity requirements for the terminal building.

Passenger terminal building requirements were developed for the following functional areas:

- Airline Ticketing and Operations
- Security Screening
- Departure Facilities
- Baggage Claim
- Terminal Services – Rental Cars
- and Concessions
- Public Use Areas – Restrooms and
- Lobby Areas
- Administration/Support
- Internal Facilities – Circulation,
- Mechanical, and HVAC

TABLE 3L
Potential Terminal Building Requirements
Lake Havasu City Municipal Airport

	Potential Need
Terminal Building Requirements	
Ticketing/Check-In	
No. of Agent Positions	5
Counter Frontage (lf)	30
Ticket Lobby Queue (sf)	330
Ticket Office (sf)	1,230
Outbound Baggage (sf)	1,440
Subtotal Ticketing/Check-in	3,000
Airline Operations (sf)	
Counter Area	330
Airline Ops/Makeup	1,230
Subtotal Airline Operations	1,560
Security Screening	
Security Checkpoints	1
Checkpoint Station Area (sf)	360
Security Queue Area (sf)	440
Security Office Space (sf)	700
Subtotal Security Checkpoint (sf)	1,500
Departure Facilities	
Peak Occupants	138
Holdroom Area (sf)	4,050
Baggage Claim	
Claim Display (lf)	80
In-Bound Baggage	960
Claim Display Floor Area (sf)	400
Claim Lobby Area (sf)	1,680
Total Bag Claim Area (sf)	2,080
Rental Car Counters	
Counter Frontage (lf)	14
Counter Office Area (sf)	210
Counter Queue Area (sf)	110
Total Rental Car Area (sf)	320
Concessions (sf)	
Food and Beverage	420
Gift Shops	300
Total Concessions	720
Public Waiting Lobby/Circulation (sf)	
Total Public Waiting Lobby/Circulation	4,210
Restrooms (sf)	
Total Restroom Area	660
Subtotal Functional Space	**19,060**
Internal Facilities	
HVAC/Mechanical/Stairwells (sf)	2,310
Gross Terminal Building Space (sf)	**21,370**

lf: linear feet
sf: square feet
Source: Coffman Associates analysis

Ticketing and Check-In

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 security checkpoint and gate area. Airline ticket counter frontage, counter area, counter queuing area, ticketing lobby, and airline office and operations area requirements for the potential enplanement level have been calculated.

Under a scenario of 35,000 annual enplanements, a maximum of five ticket agent positions would be needed, requiring approximately 30 feet of linear ticket counter space. A ticket counter of this size would necessitate an estimated 330 square feet of queue area. All total, approximately 3,000 square feet of ticketing/check-in area would be needed.

Airline Operations

The airline operations area encompasses all space necessary for the processing of passengers and baggage. This includes the area behind the ticket counter, offices, and baggage make-up and storage areas. In total, the airline operations area would need to encompass approximately 1,560 square feet of 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.

The security checkpoint area can be functionally divided into three components: checkpoints, checkpoint area, and queue area. The appropriate size for the checkpoint area, where actual passenger screening takes place, is estimated by providing 360 square feet per checkpoint station. It is anticipated that one station will be needed.

The security checkpoint queue is the area that accommodates passengers as they wait in line to be screened. The queue line is calculated by providing 16 square feet per design hour enplaning passenger. Ultimate planning forecasts 440 square feet to be needed for the security line queue.

Space in the terminal building should also be provided for TSA personnel. This office space should be located away from the security screening functions. Potential planning considers 700 square feet of TSA office space per available security checkpoint. In the future, at least 700 square feet of office space could be provided for TSA office functions. Altogether, it is estimated that 1,500 square feet could be needed for security and security checkpoints under the given potential enplanement level.

Departure Gates and Holdrooms

The need for jetways is dependent upon the airline schedule and type of aircraft serving an airport. Under this enplanement scenario, within one hour, it is estimated that one aircraft may need access to a gate.

The secure holdroom is the waiting area for passengers who have completed the screening process and are waiting to board the aircraft. Holdroom space is calculated at 15 square feet per peak hour enplaned passenger plus 350 square feet per gate. For the commercial service analysis at Lake Havasu City Municipal Airport, the potential peak hour is 138 passengers; therefore, a holdroom of approximately 4,050 square feet is needed.

Baggage Claim

The passenger arrival process consists primarily of those facilities and functions that reunite the arriving passengers with their checked baggage. Passenger baggage claim facilities are estimated at 60 percent of peak hour deplaning passengers. The potential claim display need is 80 linear feet of baggage claim carousel.

The inbound baggage unloading area is designed to allow ground support equipment to pull into a covered sally-port where baggage is offloaded onto the baggage claim carousel. Potential inbound baggage unloading area needs are estimated at 12 square feet per linear foot of baggage carousel frontage need. This results in an estimated need of 960 square feet.

Baggage claim floor area is calculated at five square feet per linear foot of claim display (carousel length). Based upon the 35,000 annual enplanement level, it is estimated that 400 square feet would be needed at peak periods.

The baggage claim lobby is determined by taking into consideration the number of deplaning passengers during the peak hour and the estimated number of visitors greeting arriving passengers. This planning scenario estimates a total area of approximately 2,080 square feet to be needed for the baggage claim area.

Terminal Services

Similar to airline ticketing, rental car counter facilities include office, counter area, and queue areas. Rental car facilities could provide approximately 14 linear feet of counter space, 210 square feet of office space, and 110 square feet for queuing area. Combined, rental car facilities would consist of an estimated 320 square feet.

In addition, many terminal buildings will provide food, beverage, and gift shop concessions in the unsecured and/or secured areas of the terminal building. Calculations for concessions are based primarily on annual enplanements. Under the estimated 35,000 annual enplanement scenario, total concessions area could include approximately 720 square feet.

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 the secure departure areas, so a public lobby is important. Public waiting and greeting lobby areas are based upon design hour passengers. For planning purposes, 35 square feet is allotted for 80 percent of the total design hour passengers. Based upon these planning techniques, approximately 4,210 square feet could be needed for public areas.

Restrooms

Restrooms should be planned for both the public areas and the secure areas of the terminal building. Potential public restroom space is a function of total peak hour passengers and visitors at the airport. The public restroom facilities should be planned at an estimated 660 square feet.

Internal Facilities

Internal facilities include mechanical/HVAC functions and stairwells. Potential needs for circulation are estimated at 11 percent of the total programmed terminal building space. Any additions to the terminal building should also take into consideration the needs of the internal facilities.

Commercial Airline Terminal Building Requirements Summary

Altogether, under a 35,000 annual enplanement scenario, gross terminal building space requirements total an estimated 21,370 square feet. It should be noted that terminal building space requirements are purely scenario-based and are for advisory purposes only. As previously noted, the existing terminal building provides for approximately 5,700 square feet of space. Future planning will consider enhancements to passenger terminal functions at the airport.

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. Thus, prudent planning should be exercised when planning the location and roadway access to a potential future terminal building. Alternative analysis in the next chapter will further analyze this roadway access improvement based upon potential terminal locations.

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 9/11, most airports police the curb front much more strictly for security reasons. This alone has reduced the curb front capacity problems at most airports.

Potential enplaning curb length needs are estimated at 90 percent of peak hour enplanements, while potential deplaning curb needs are estimated at 105 percent of peak hour enplanements. **Table 3M** presents the terminal curb requirements as they would apply to the potential 35,000 annual enplanement scenario.

TABLE 3M
Airline Terminal Vehicle Requirements
Lake Havasu City Municipal Airport

Terminal Curb	
Enplane Curb (ft)	70
Deplane Curb (ft)	150
Total Curb (ft)	220
Auto Parking	
Total Public Parking	200
Employee	10
Rental Car	35
Total All Parking	**245**

Vehicle parking in the airline passenger terminal area of an airport includes those spaces utilized by passengers, visitors, and employees of the airline terminal facilities. Parking spaces are classified as public, employee, and rental car.

Calculations of vehicle parking needs take into consideration estimates of the mode of transportation to and from the airport, peak hour enplanements, and annual enplanements. For Lake Havasu City Municipal Airport, it is estimated that 80 percent of passengers would arrive/depart by private automobile, 15 percent would utilize rental car services, and 5 percent would utilize a taxi service. Employee parking space requirements are estimated at five percent of total private automobile space requirements. Potential terminal parking requirements are shown in **Table 3M**. Currently, there are 192 parking spaces offered in the passenger terminal area. Future planning should consider approximately 250 spaces to best accommodate potential commercial service activities detailed earlier in this study.

AIRPORT SUPPORT FACILITIES

Various other landside facilities that play a supporting role in overall airport operations have also been identified. These support facilities include:

- Aviation Fuel Storage
- Aircraft Rescue and Firefighting (ARFF)
- Perimeter Fencing and Gates
- Maintenance Facilities

Aviation Fuel Storage

There are two fuel farms located on the airport that currently store fuel for aviation use. Both fuel farms are owned, operated, and maintained by the FBOs.

D2 Aero Aviation Services owns one 10,000-gallon capacity 100LL storage tank and one 10,000-gallon Jet A storage tank. Both tanks are above ground. The fuel farm is currently leased to Desert Skies Executive Air Terminal. Self-service capabilities are available from the Avgas fuel tank. Desert Skies also offers full-service fueling capabilities via trucks to deliver fuel to aircraft.

Havasu Air Center owns the other fuel farm, which includes two above-ground storage tanks. A 12,000-gallon 100LL storage tank and a 12,000-gallon capacity Jet A storage tank are available. Havasu Air Center offers only full-service fueling capabilities.

As presented in **Table 3N**, there is 51,750 gallons of fuel storage capacity on airport property utilized for the re-sale of fuel for commercial aviation activities. Approximately 52 percent of the storage capacity is dedicated to Jet A fuel.

TABLE 3N
On-Airport Fuel Storage Capacity
Lake Havasu City Municipal Airport

	Tank Storage Capacity (Gallons)	Truck Storage Capacity (Gallons)	Total Storage Capacity (Gallons)
Avgas (100LL)	22,000	2,750	24,750
Jet A	22,000	5,000	27,000

Source: Airport Records

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 aircraft demand experienced by the FBOs 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.

Title 14 CFR Part 139 Certification of Airports

Based upon the potential commercial passenger service scenario presented previously in this study, Lake Havasu City Municipal Airport may be required to become a Title 14 CFR Part 139 certificated airport. This is a designation the airport held several years ago when it experienced scheduled commercial passenger service. The regulation (which implemented provisions of the *Airport and Airway Development Act of 1970*, as amended 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.

The Title 14 CFR part 139 requirements applicable to Lake Havasu City Municipal Airport under this potential scenario relate to the type of aircraft serving the airport. To define the airport's class, it is important to understand the distinction between the definition of large and small air carrier aircraft.

- A large air carrier aircraft is designed for 31 passenger seats or more.
- A small air carrier aircraft is designed for 10 to 30 passenger seats.

It should be noted that Title 14 CFR Part 139 requirements do not apply to airports served by scheduled air carrier aircraft with nine seats or less and/or unscheduled air carrier aircraft with 30 seats or less.

Title 14 CFR part 139 defines four airport classifications as follows:

- **Class I** – an airport certificated to serve scheduled operations of large air carrier aircraft that also can serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft. A Class I airport may serve any class of air carrier operations.
- **Class II** – 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** – 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** - an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

Airports that meet the requirements for Part 139 certifications are issued an Airport Operating Certificate (AOC). AOCs serve to ensure safety in air transportation. To obtain a certificate, an airport must agree to operational and safety standards and provide for certain safety services and facilities. These requirements vary depending on the size of the airport and the types of flights available. The regulation, however, does allow FAA to issue certain exemptions to airports that serve few passengers yearly and for which some requirements might create financial hardship.

According to Title 14 CFR Part 139, the following steps would need to be taken in order for Lake Havasu City Municipal Airport to receive an AOC:

1. Prepare and submit an Airport Certification Manual (ACM) to the FAA.
2. Prepare ground vehicle operating rules and regulations.
3. Prepare a ground vehicle training program.
4. Prepare a training program for airport personnel involved with Part 139 implementation.
5. Ensure that FBOs comply with the fuel training requirements.
6. Develop a recordkeeping system for the following:
    a. Personnel training (24 months)
    b. Emergency personnel training (24 months)
    c. Airport tenant fueling inspection (12 months)
    d. Airport tenant fueling agent training (12 months)
    e. Self-inspection (6 months)
    f. Movement areas and safety areas training (24 months)
    g. Accident and incident (12 months)
    h. Airport condition (6 months)
7. Prepare and submit an Airport Emergency Plan to the FAA.
8. Acquire an aircraft rescue and firefighting (ARFF) vehicle and comply with ARFF training and operational requirements.

The ACM is a required document that 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 updated annually. 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. Each section independently addresses who (primary/secondary), what, how, and when criteria as it relates to each element.

The administrative section of the ACM covers such elements as the organizational chart, operational responsibilities, maps, descriptions, weather sensors, access, and cargo. The procedural elements cover such items as paved and unpaved areas, safety areas, lighting and marking, communications and navigational aids, ARFF, handling of hazardous material, utility protection, public protection, self-inspection program, ground vehicle control, obstruction removal, wildlife management, and construction supervision.

Aircraft Rescue and Fire Fighting

Part 139 airports are required to provide ARFF services during air carrier operations. Each certificated airport maintains equipment and personnel based on an ARFF index established according to the length of aircraft and scheduled daily flight frequency. In terms of flight frequency, an airport's ARFF index is determined by the longest aircraft conducting at least five or more daily departures. In terms of aircraft length, there are five indices, A through E, with A applicable to the smallest aircraft and E the largest.

Previously, ARFF equipment and staffing met ARFF Index B; however, the airport currently does not maintain an active ARFF status. It is important to note that ARFF capabilities are not currently a requirement for the airport. **Table 3P** presents the vehicle requirements and capacities for each index level. The potential enplanement scenario that was utilized to establish terminal building needs includes aircraft in Index B, to include the Embraer ERJ-145 and Airbus A319. If operations by these aircraft regularly utilize the airport in the future as part of scheduled commercial service activity, Lake Havasu City Municipal Airport would be required to meet associated ARFF index levels.

TABLE 3P
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

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 legal boundary of the outermost limits of the 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 the aircraft operations areas on the airport.
- Creates a psychological deterrent.
- Demonstrates a corporate concern for facilities.
- Limits inadvertent access to the aircraft operations area by wildlife.

Lake Havasu City Municipal Airport operations areas are completely enclosed by an eight-foot chain-link fence topped by three-strand barbed-wire. The fence does not always follow the airport property line due to the physical terrain of the area and the layout of the airport property. There are five controlled access gates available for use at the airport.

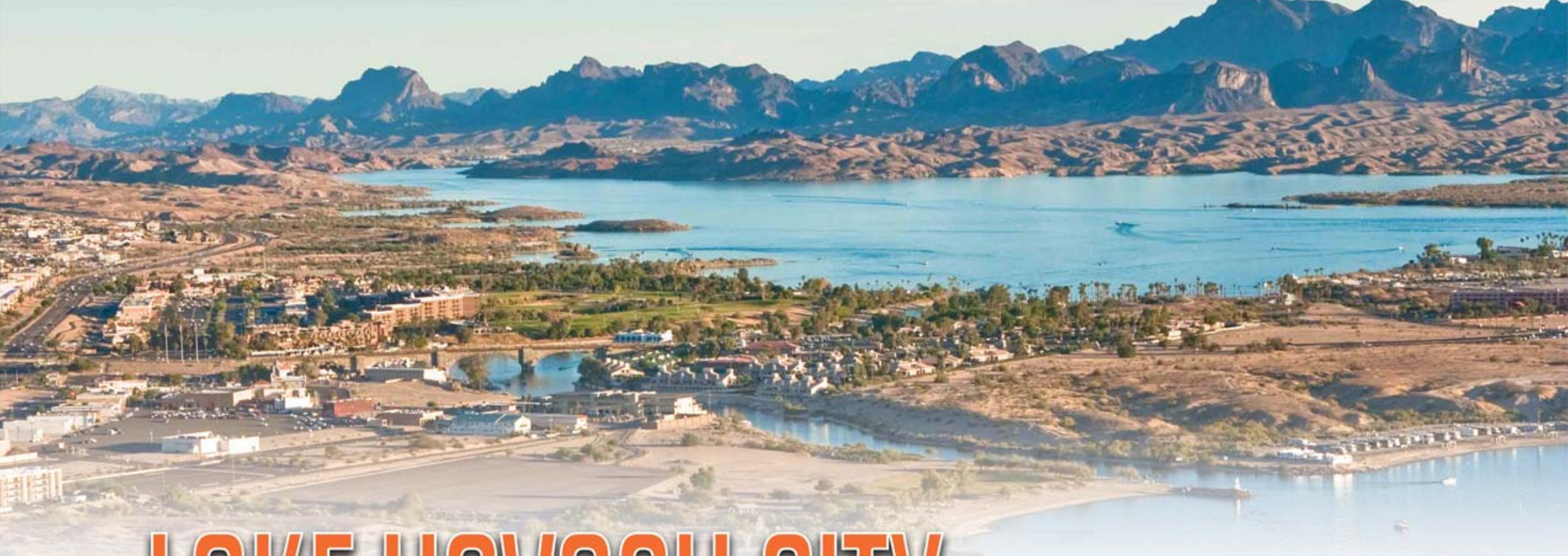
Maintenance Facilities

Airport maintenance activities are currently staged from an existing hangar and other outside locations for equipment storage. Future planning should give consideration to constructing a dedicated maintenance facility for the storage of maintenance equipment and to provide work areas for airport maintenance employees.

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at Lake Havasu City Municipal 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 5-year timeframe, the intermediate term is approximately 10 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 for Lake Havasu City Municipal Airport.



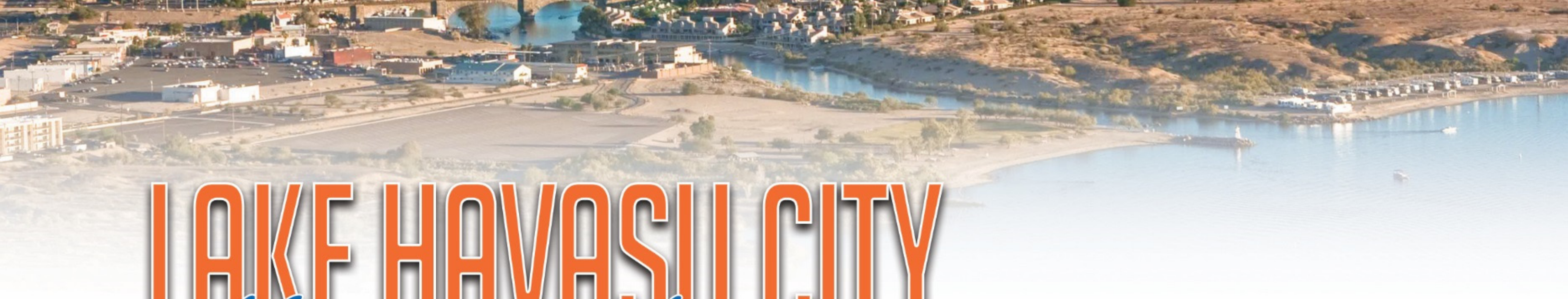
LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER FOUR

AIRPORT ALTERNATIVES



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER FOUR
AIRPORT ALTERNATIVES

In the previous chapter, airport facilities required to satisfy 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 Lake Havasu City Municipal 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 Lake Havasu City, airport users, and citizens of the community, who have a vested interest in the development and operation of Lake Havasu City Municipal 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 Lake Havasu City Municipal 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 alternatives 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.

The alternatives presented in this chapter have been formulated as potential means to meet the overall program objectives for the airport in a balanced manner. Through coordination with Lake Havasu City, the Planning Advisory Committee (PAC), and the public, an alternative (or combination thereof) will be refined and modified as necessary into a recommended development concept. Therefore, the alternatives presented in this chapter can be considered a beginning point in the evolution of a recommended concept for the future of Lake Havasu City Municipal Airport.

NON-DEVELOPMENT ALTERNATIVES

Prior to presenting development alternatives for Lake Havasu City Municipal 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.

Lake Havasu City Municipal Airport plays a critical role in the economic development of Lake Havasu City 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, 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 – Aeronautics Group (ADOT), 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, and installation of supporting infrastructure that is already available, and could result in significant environmental impacts. Furthermore, Lake Havasu City, FAA, and ADOT 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 can accommodate projected future demand in its current location. As a result, the transfer of aviation services is not a viable option for Lake Havasu City Municipal 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 terminal area 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, Lake Havasu City 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. The following development objectives have been defined for this planning effort:

- Conform to FAA and ADOT 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 as outlined in Chapters Two and Three.
- 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.

REVIEW OF PREVIOUS AIRPORT PLANS

The previous master plan for Lake Havasu City Municipal Airport was completed in 2009. As part of this planning effort, the Airport Layout Plan (ALP) was also updated and approved by the FAA in 2010.

The ALP is shown on **Exhibit 4A**. This drawing provides information on existing and ultimate conditions at Lake Havasu City Municipal Airport during the time of the previous master plan, including:

- Airport data related to airport category, Airport Reference Code (ARC), elevation, wind conditions, temperature, and navigational aids located at the 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.

The ALP graphically depicts airside and landside recommendations based upon previous airport planning that includes:

- Meeting ultimate ARC C-III design standards for Runway 14-32.
- 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 general aviation development.
- Relocation of the terminal area to include a new commercial passenger terminal building and associated vehicle parking.

It should be noted that the previous master plan analyzed an ultimate ARC of C/D-II for airside facilities at the airport ; however, per direction from the FAA at that time, the ALP identifies the airport and associated runway system as an existing and ultimate ARC C-III. This was based on previous planning dating back to the 2003 ALP prepared for the airport and did not reflect 500 annual operations by the critical design aircraft at the time. The assumptions made and conclusions drawn from previous planning efforts will be independently evaluated in this master plan. Some elements from the previous master plan may continue to be viable and could be included in this planning effort. Other elements may no longer be viable based on updates to FAA design standards (FAA published new design standards in September 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 at the airport.

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 allow the airport to market itself to developers and businesses so 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

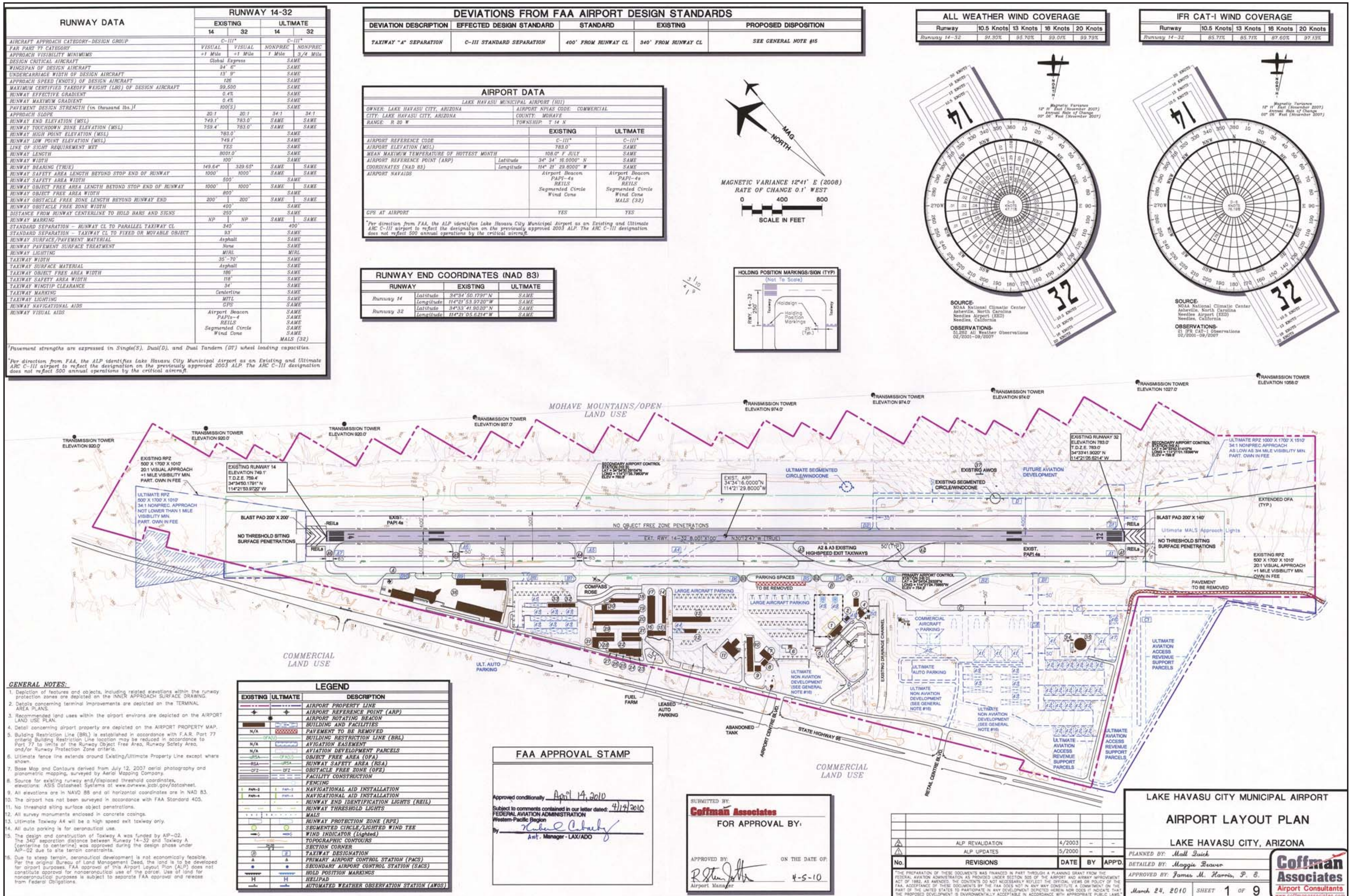


Exhibit 4A
AIRPORT LAYOUT PLAN

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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 Lake Havasu City Municipal Airport. Obviously, this is a simple plan based on previous planning, 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 to satisfy its intended goals and needs. The land use plan depicted on **Exhibit 4B** is based on the airport property as it exists today and includes five broad development categories:

- Airfield Operations
- Airport Terminal Facilities
- General Aviation
- Aviation-Related Revenue Support
- Non-Aviation Revenue Support

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 Runway 14-32, 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.

Airport Terminal Facilities include land areas necessary to accommodate the transition of passengers between air and ground. At Lake Havasu City Municipal Airport, this includes the existing airport terminal facility area and associated aircraft parking apron location, as well as additional land area to the south previously designated for a potential commercial terminal building and aircraft parking apron location. These areas also provide vehicle parking to support terminal area activities. It is important to note that Lake Havasu City Municipal Airport does not currently provide scheduled commercial passenger service.

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). General aviation uses will generate a moderate activity level on both the airside and landside, including based aircraft and itinerant aircraft traffic. Typical facilities range from T-hangars to larger conventional hangars. General aviation users are best suited for flight line access and are more common than those that only have one primary hangar facility. 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. A significant amount of existing landside development at the airport is reserved for general aviation use.

The **Aviation-Related Revenue Support** land use category includes those areas that should be reserved for development requiring access to the airfield operations area, such as aircraft hangars and/or aviation related businesses. Generally, these areas include all land immediately adjacent to the runway and taxiway system. There are two areas on **Exhibit 4B** that are being planned as aviation-related revenue support areas: a large parcel in the southwest portion of airport property and a smaller area referred to as the north ramp apron which is located north of the main aircraft parking apron area.

Non-Aviation Related Revenue Support 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. One area shown as Non-Aviation Revenue Support is found northwest of the existing terminal building, and a second area is designated adjacent to the southwest side of the terminal area. Both areas are provided immediate vehicle access from Whelan Drive. In addition, due to physical land constraints, it would be difficult to provide aircraft access to these parcels.

The previous chapter identified numerous considerations for improved or expanded facilities, including airfield geometry enhancements, terminal facility needs, and new hangar facilities. The space needed to accommodate the projected aviation demand in this study is not anticipated to exceed the undeveloped/vacant property currently available for development. With existing property that is accessible to/from the airfield system, Lake Havasu City Municipal Airport is positioned to market itself to potential developers and, in doing so, accommodate future aviation demand segments while also improving airport revenues. Portions of airport property that are not easily accessible to the airfield system will continue to be evaluated for non-aviation related development such as industrial parks or business centers that can also enhance airport revenue potential.

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.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas must be examined individually and then coordinated as a whole to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors must be evaluated to determine if the investment in Lake Havasu City Municipal Airport will meet the needs of the surrounding area, both during and beyond the planning period of this study.

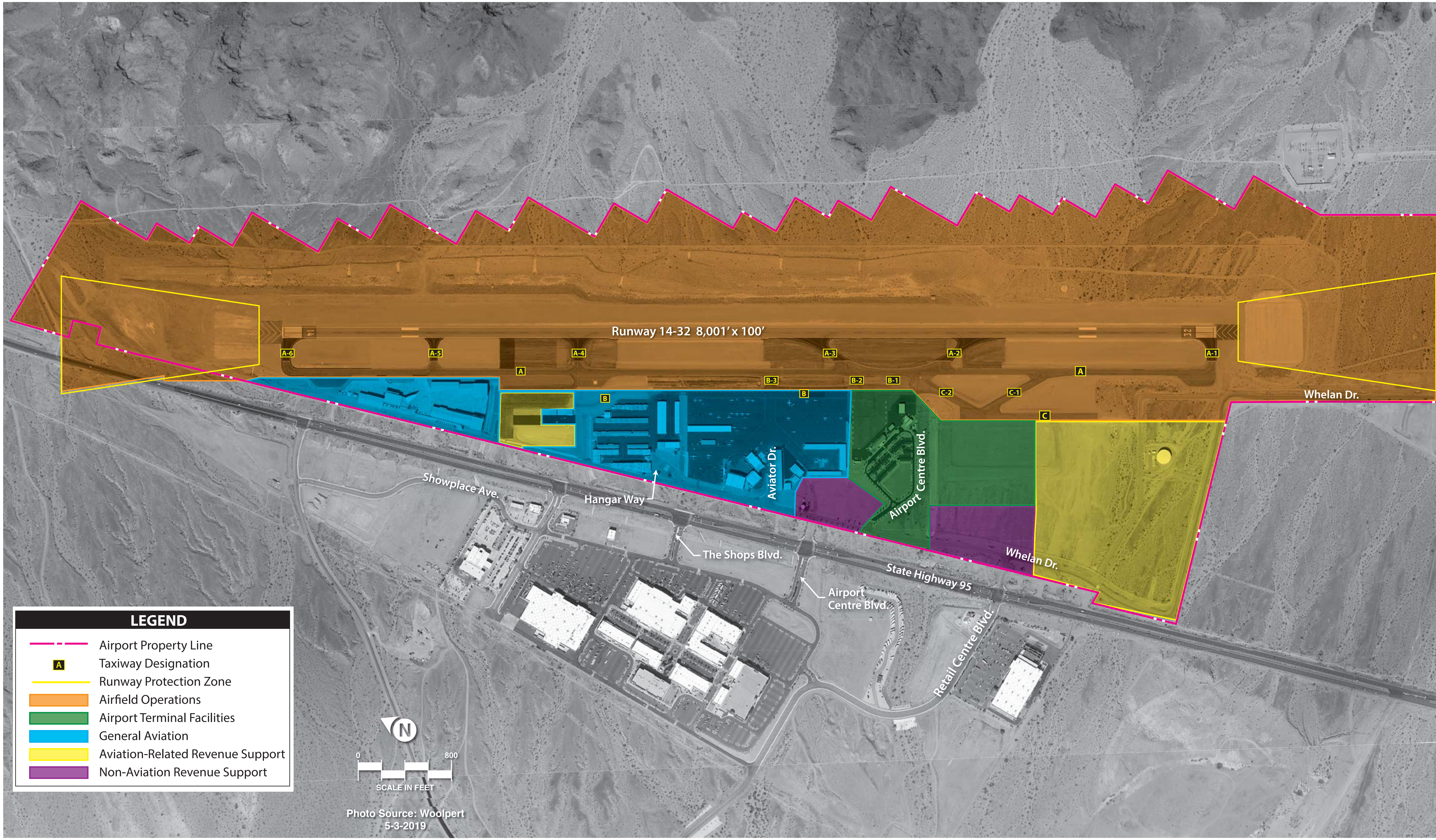

Exhibit 4B
FUTURE AIRPORT LAND USE

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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, Lake Havasu City, 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 Lake Havasu City Municipal 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.

The selection of the current and future critical aircraft must be realistic in nature and supported by current data and realistic projections. A detailed analysis was conducted in Chapter Two that identified the types and number of turboprop and jet operations that have historically occurred at Lake Havasu City Municipal Airport based upon the FAA's Traffic Flow Management System Counts (TFMSC).

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, operationally, the RDC for Runway 14-32 at Lake Havasu City Municipal Airport is currently B-II-5000. As previously discussed, the currently approved ALP designates the runway as a C-III. Future projections associated with this master plan indicate that the ultimate RDC at Lake Havasu City Airport should be planned for D-III-4000 design standards. The airfield should

AIRSIDE CONSIDERATIONS

- Evaluate Runway 14-32 in meeting ultimate Runway Design Code (RDC) D-III design standards
- Analyze runway/taxiway separation for RDC D-III standards
- Analyze improved instrument approach capabilities on Runway 32
- Analyze elimination of direct access points from aircraft parking aprons to Runway 14-32
- Examine airfield geometry associated with acute-angled Taxiways A2 and A3
- Identify potential property acquisition for ultimate expansion of runway protection zones (RPZ)
- Analyze impact of displacing Runway 14 landing threshold to accommodate runway safety areas
- Consider relocation of segmented circle/lighted wind cone
- Implement enhanced lighting in the form of medium intensity taxiway lighting (MITL) on all taxiways
- Consider ultimate light emitting diode (LED) lighting on the runway and taxiway system
- Consider addition of 20-foot runway shoulders
- Analyze bypass holding bay expansion

LANDSIDE CONSIDERATIONS

- Analyze development alternatives for north ramp apron area
- Identify space for additional hangar development to meet projected demand
- Identify locations for a permanent airport maintenance facility
- Consider alternatives for development in the southwestern portion of airport property
- Identify locations for non-aviation development and revenue support
- Identify property southwest of existing airport property for land acquisition
- Identify areas suitable for cargo operations
- Identify locations for an aircraft wash rack
- Identify areas suitable for airport terminal facility expansion and/or relocation to accomodate future aviation demand segments

Exhibit 4C
ALTERNATIVE CONSIDERATIONS

continue to be planned for the most demanding general aviation business jet aircraft on the market today. Runway 14-32 provides adequate runway length to support these aircraft operations, and the airport is equipped with landside infrastructure to support activities by these aircraft. As a result, this alternatives analysis will evaluate facility development that could meet ultimate RDC standards for D-III on Runway 14-32. It is important to note the FAA has approved the forecasts prepared as part of this master plan (see Appendix B). As a result, the alternatives analysis to follow will evaluate facility development to meet ultimate RDC standards for D-III-4000.

Furthermore, the alternatives will analyze the impact of the airport achieving visibility minimums down to ¾-mile associated with the instrument approach procedure serving Runway 32. Lower visibility minimums on Runway 32 would be advantageous to support the full array of aircraft operations at the airport, to include planning for potential scheduled commercial service activities. Lower visibility minimums will not be analyzed for approach to Runway 14 due to safety area and approach constraints north of the runway environment. **Table 4A** summarizes the existing and planned RDC for Runway 14-32 based on the forecasts recently approved by the FAA.

TABLE 4A
Runway Design Code
Lake Havasu City Municipal Airport

Runway	Operational Runway Design Code*	Ultimate Runway Design Code*
14-32	B-II-5000	D-III-4000

*Based on the FAA-approved forecasts in a letter dated July 22, 2019.

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.

Runway Safety Area

According to AC 150/5300-13A, Change 1, in order to meet ultimate RDC D-III design standards associated with Runway 14-32, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway end. Only 600 feet of RSA is needed prior to the landing threshold on each runway end under RDC D-III standards. A preliminary examination of the ultimate RSA for Runway 14-32 does appear to meet the ultimate design standards. **Exhibit 4D** depicts the RSAs associated with RDC D-III.

Runway Object Free Area

For ultimate D-III design, the FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end. Only 600 feet of ROFA is needed prior to the landing threshold. Runway 14-32 does not meet ultimate ROFA standards due to the current location of the segmented circle and associated wind cone located approximately 300 feet to the east of the runway centerline. The airport should consider relocating the segmented circle and wind cone to a location outside of the ROFA, as depicted on **Exhibit 4D**. On the northwest side of the airport, approximately 0.74 acre of the proposed RDC D-III ROFA extends beyond airport property and is obstructed by portions of the airport's perimeter fence. The airport should attempt to remove the portion of perimeter fencing within the ROFA or acquire the land in order to control the entirety of the ROFA. This could include fee simple acquisition or obtaining an easement on the property. Given its location adjacent to State Highway 95, it may not be possible to acquire outright given the highway right-of-way.

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). 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 each end of Runway 14-32.

This master plan will analyze approach minimums down to ¾-mile on Runway 32. When reducing visibility requirements, the design standards associated with the corresponding approach RPZ would be significantly larger. The RPZ would be expanded beyond the airport's property line and encompass an area of approximately 1.08 acres, as presented on **Exhibit 4D**. The RPZ expansion would also cross a portion of Whelan Drive.

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 guidance provided in AC 150/5300-13A, Change 1, and *Interim Guidance on Land Uses within a Runway Protection Zone* (September 27, 2012).

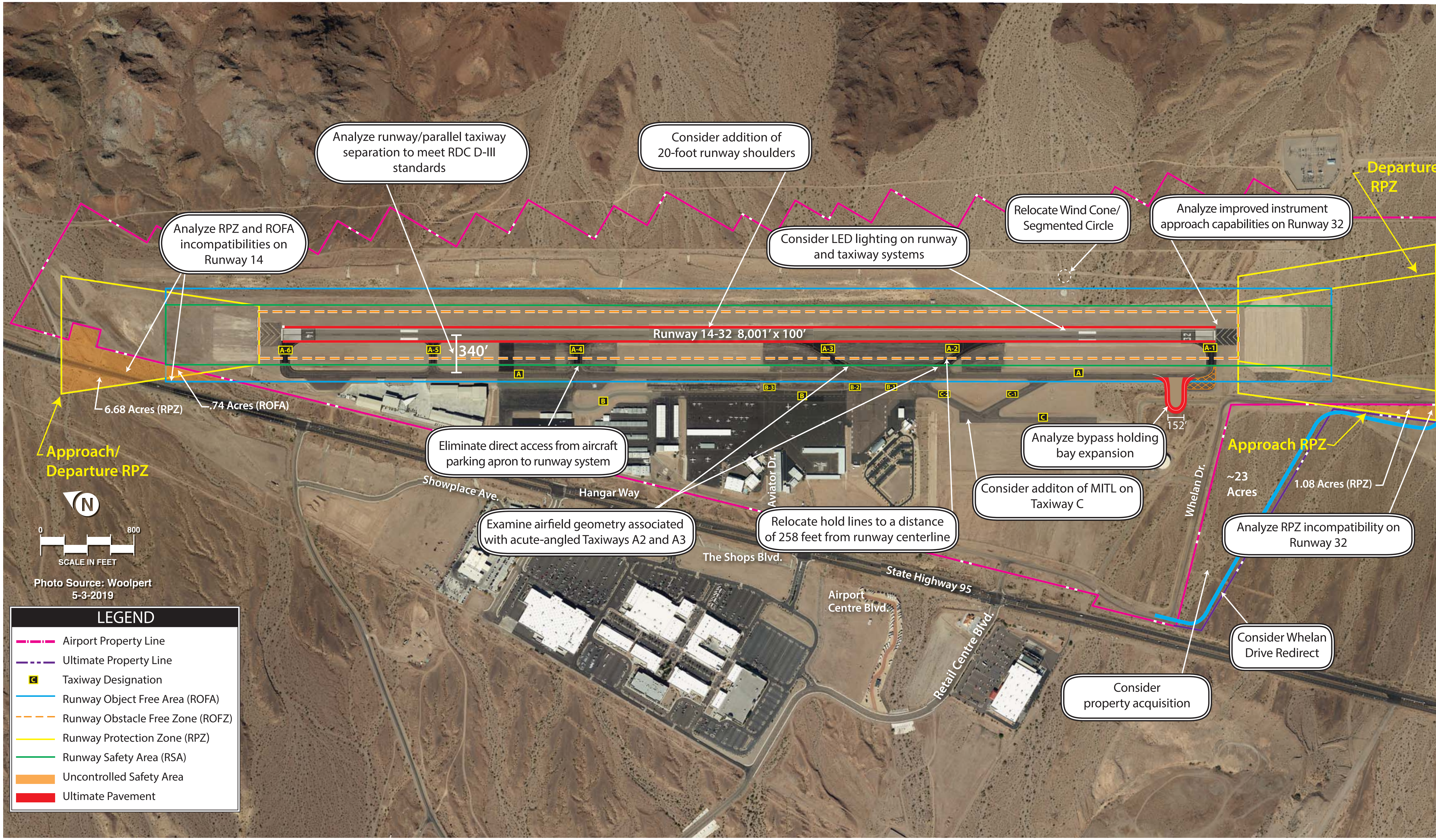

Exhibit 4D
AIRSIDE ALTERNATIVE CONSIDERATIONS

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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. 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 14-32 at Lake Havasu City Municipal Airport encompass vacant land; however, State Highway 95 traverses the ultimate approach and departure RPZs beyond the north end of the runway. The ultimate approach RPZ proposed on the south side of Runway 14-32 would include a portion of Whelan Drive as previously mentioned. These potential RPZ incompatibilities are depicted on **Exhibit 4D**.

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, the placement of State Highway 95 and/or Whelan Drive could be considered acceptable due to their existence prior to updated RPZ standards that were published in 2012, and given the fact that the currently approved ALP considers RPZ dimensions that are similar to those associated with ultimate RDC D-III standards as outlined above. Alternatives discussed later in this chapter will evaluate the impacts of mitigating RPZ incompatibilities as well analyzing RPZs when considering instrument approach improvements associated with the runway system.

AIRPORT CONTROL OF SAFETY AREAS

Exhibit 4D depicts the safety areas associated with planning for an ultimate RDC of D-III-4000 on Runway 14-32. As shown, portions of the planned approach and departure RPZs and ROFA associated with Runway 14-32 extend beyond the airport property line. On the north end of the runway, approximately 6.68 acres of land included within the RPZ and 0.74 acre of land included within the ROFA are off airport property. On the south end of the runway, approximately 1.08 acres of the proposed approach RPZ are located off airport property. Ideally, the airport should seek to obtain positive control of these safety areas through fee simple property acquisition or by acquiring an easement to ensure there is no incompatible development within these areas.

Controlling the property north of the airport will be difficult due to the location of State Highway 95. The RPZs on the north end cannot be fully contained and controlled by the airport or Lake Havasu City unless the highway is rerouted outside of the RPZs, and it would be a large undertaking to relocate portions of the highway. If positive control of the ROFA and the RPZs cannot be obtained, the FAA could require that the runway environment be reconfigured to accommodate the safety areas. Alternatives to follow will further detail adherence to future safety areas associated with the runway environment.

RUNWAY LENGTH, WIDTH, AND STRENGTH

Analysis in Chapter Three indicated that the current length of Runway 14-32 (8,001 feet) can accommodate a large majority of the business jets on the market under moderate loading conditions as well as the potential commercial service regional jets that have been analyzed. As such, this master plan recommends that the existing runway length of 8,001 feet be maintained through the long-term planning period of the study.

Runway 14-32 is currently 100 feet wide. In order to meet RDC D-III standards, the FAA calls for a 150-foot wide runway; however, a runway width of 100 feet is adequate for D-III aircraft weighing 150,000 pounds or less. The airport rarely accommodates aircraft over 150,000 pounds. As such, the width of Runway 14-32 should continue to be maintained at 100 feet wide through the long-term planning period.

The pavement strength for Runway 14-32 is reported at 100,000 pounds single wheel loading (SWL). Published runway strengths for dual wheel loading (DWL), dual single wheel loading (2SWL), and dual tandem wheel loading (DTWL) are not currently reported. 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 heavier loads over time. Future consideration should be given to providing a pavement strength of 150,000 pounds DWL. This strength rating will better accommodate regular operations by larger business jets that currently operate at the airport and the potential for commercial service aircraft if that demand segment were to be re-introduced to the airport.

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.

According to the FAA 5010 Airport Master Record, Runway 14-32 has not been assigned a PCN value. Consideration should be given to determining a PCN value in order to better understand the runway's weight bearing capabilities.

RUNWAY BLAST PADS

A runway blast pad is a surface adjacent to the end of the runway designed to reduce erosion created by aircraft jet blast and/or propeller wash. Runway 14-32 is outfitted with blast pads on both ends of the runway. Runway 14 features a blast pad measuring 200 feet wide by 200 feet long, and Runway 32's blast pad is 140 feet wide by 200 feet long. The blast pad dimensions on both runway ends meet design standards for RDC D-III. As such, they should be maintained through the long-term planning period.

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 14-32 currently features seven-foot runway shoulders. Recommended shoulder width for runways designed to accommodate ADG II aircraft is 10 feet; however, this is not a requirement. Paved shoulders are required for runways accommodating ADG IV and are highly recommended for runways accommodating ADG III aircraft. The FAA's recommended design for runway shoulders associated with ADG III aircraft with a maximum take-off weight of 150,000 pounds or less is 20 feet. As such, consideration should be given to the addition of 20-foot paved shoulders at Lake Havasu City Municipal Airport, 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 14-32 is equipped with a four-box precision approach path indicator (PAPI-4).

Runway 14-32 also features runway end identification lights (REILs) which are recommended for all runway ends not planned for a more sophisticated approach lighting system.

Analysis in Chapter Three recommended the segmented circle and associated wind cone on the east side of the airfield be relocated. As part of the airside analysis, a new location for these is proposed east of their current location in order to remain clear of the ultimate ROFA. The segmented circle could be constructed at ground level so as not to interfere with any potential expansions of the safety areas associated with the runway system.

HOLD LINE MARKINGS

The current hold line markings on taxiways associated with Runway 14-32 are located 250 feet from the runway centerline. The standard for hold lines associated with ultimate RDC D-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 258 feet from the runway centerline to meet ultimate design standards.

HOLDING BAYS

The FAA has provided updated guidance on the configuration of holding bays. This guidance recommends that holding bays be designed to allow aircraft to bypass one another to taxi to the runway. Under this concept, each parking area on the holding bay is independent, with the ability for aircraft to bypass others both on entrance and exit. This design would warrant a much deeper holding bay than what is provided currently. Additionally, due to the airport property line constraints on the northwest portion of Taxiway A, this design configuration is not recommended. However, a bypass holding bay could be constructed at the south end of Taxiway A. **Exhibit 4D** depicts the addition of a bypass holding bay.

AIRFIELD LIGHTING

During the course of the planning period, medium intensity runway lighting (MIRL) should continue to be provided to Runway 14-32, and medium intensity taxiway lighting (MITL) should be provided on all existing and proposed taxiways serving the runway system. This includes Taxiway C, which currently is not served by MITL. At a minimum, edge reflectors should be maintained on Taxiway C 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 project associated with various pavements on the runway and taxiway system. LED lighting has many advantages, including lower energy consumption and longer lifetimes.

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 Lake Havasu City Municipal 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.

Lake Havasu City Municipal Airport is served by a taxiway system which includes a full-length parallel taxiway and six entrance/exit taxiways serving Runway 14-32. 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:

- Taxiway A3 allows direct access to the runway system from an aircraft parking apron.
- Taxiway A4 allows direct access from an aircraft run-up apron (compass rose) and the north ramp apron to Runway 14-32
- Taxiways A2 and A3 are acute-angled taxiways. Acute-angled taxiways can be confusing to pilots and provide reduced visibility; thus, they are considered a safety concern at smaller airports where no capacity issues are present.

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 Lake Havasu City Municipal Airport, Taxiways A3 and A4 extend east of the aircraft parking apron and offer a direct pavement connection to Runway 14-32. The FAA has found that requiring a turn prior to entering a runway can minimize runway incursion events. 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 are not a viable option at Lake Havasu City Municipal due to the current taxiway configuration. As such, further analysis presented in this chapter will address direct access points and evaluate taxiway geometry improvements.

Right-Angle Intersections

All taxiways connecting Runway 14-32 and the parallel taxiway system currently provide right-angle intersections with the exception of Taxiways A2 and A3. Right-angle intersections are the standard runway/taxiway intersection, unless there is a need for a high-speed taxiway exit to accommodate airfield capacity demand. Right-angle taxiways provide the best visual perspective for a pilot to observe an aircraft in both directions. Future planning should consider aligning these taxiways at a right angle to Runway 14-32. The alternatives to follow will consider the potential relocation of the taxiways in order to provide right angle intersections, which would enhance airfield geometry and safety.

RUNWAY/TAXIWAY/AIRCRAFT PARKING APRON SEPARATION

Separation distances between a runway and various areas on the airfield are primarily a function of the critical design aircraft and instrument approaches that are provided. Parallel Taxiway A, located on the west side of Runway 14-32, currently has a separation of 340 feet from the runway (centerline to centerline). The runway-to-taxiway separation standard for ultimate RDC D-III is 400 feet. As such, under ultimate RDC D-III conditions, the separation standard is not currently met. Alternatives discussed later in this chapter will further evaluate the effects of improving separation between Runway 14-32 and parallel Taxiway A as well as associated aircraft parking areas.

It is important to note that according to the currently approved ALP (see **Exhibit 4A**), General Note #15 states, "The design and construction of Taxiway A was funded by AIP-02. The 340' separation distance between Runway 14-32 and Taxiway A (centerline to centerline) was approved during the design phase under AIP-02 due to site terrain constraints." This is important to consider during the alternatives phase of this study, as physical land constraints west of the runway/parallel taxiway environment still exist, making it difficult to relocate the parallel taxiway.

Separation standards also apply to Runway 14-32 and various aircraft parking areas on the airfield. For RDC D-III, aircraft parking areas should be located at least 500 feet from the runway centerline. The main aircraft parking apron currently provides approximately 565 feet of separation from the runway centerline. The north ramp apron parking area is approximately 455 feet west of the runway centerline. The aircraft parking apron associated with Havasu Air Center begins approximately 430 feet west of the runway.

AIRSIDE ALTERNATIVES

The following section describes alternatives as they relate to airside considerations previously discussed. The first set of alternatives evaluates the potential need to improve the overall separation between Runway 14-32 and parallel Taxiway A to meet ultimate RDC D-III standards and the impacts on existing facilities. The second set of airside alternatives analyze proposed runway safety area improvement scenarios on the north side of Runway 14-32 to accommodate the ROFA and the RPZ associated with RDC D-III design. A third set of alternatives evaluates the impacts of improved instrument approach capabilities at the airport. The final set of airside alternatives evaluates improvements to airfield taxiway geometry.

RUNWAY/PARALLEL TAXIWAY SEPARATION ANALYSIS

For Lake Havasu City Municipal Airport, one of the most significant improvements needed to meet ultimate RDC D-III-4000 design standards would involve providing 400 feet of separation between Taxiway A and Runway 14-32 (centerline to centerline). Currently, Runway 14-32 and parallel Taxiway A are separated by 340 feet. The following describes three options for addressing the runway/parallel taxiway separation issue at Lake Havasu City Municipal Airport. Also considered are proper separation needed between parallel Taxiway A and existing landside facilities.

As previously discussed, the FAA has historically approved a C-III design recognizing the 340-foot separation noted on the currently approved ALP. As such, this issue has been previously analyzed and the ultimate disposition could keep the runway-to-parallel taxiway separation at its current dimension in the event the airport transitions to RDC D-III. The purpose of this analysis is to further evaluate the impacts in order to help determine appropriate planning for the future airfield environment.

Runway/Parallel Taxiway Separation – Alternative 1

Alternative 1, depicted on the top half of **Exhibit 4E**, proposes that parallel Taxiway A be relocated 60 feet the west to provide 400 feet of separation from the runway centerline in order to meet RDC D-III standards. In addition to the runway/parallel taxiway separation standards, the FAA also specifies separation distances between a taxiway and fixed or movable objects, known as the taxiway object free area (TOFA). These distances apply at Lake Havasu City Municipal Airport in areas where infrastructure development such as aircraft parking aprons and hangars extend in proximity to the taxiway system. For aircraft in ADG III, FAA standards specify that the TOFA is 186 feet wide, 93 feet either side of the taxiway centerline.

A detailed examination of the impacts to existing landside facilities has been evaluated to meet ultimate RDC D-III standards for runway/parallel taxiway separation. Shifting Taxiway A 60 feet west of its current location would be difficult given TOFA requirements and the impacts on current airport infrastructure located on the west side of the airfield. The infrastructure affected by the relocation of parallel Taxiway A to meet RDC D-III design standards includes the following:

- Approximately 3,400 square yards of pavement and 12 marked tiedowns associated with the north ramp apron.
- The separation between relocated Taxiway A and existing Taxiway B would be reduced and not meet proper taxiway-to-taxiway separation criteria.
- Approximately 3,900 square yards of apron space associated with Havasu Air Center would be impacted.
- Infrastructure associated with Havasu Air Center including six aircraft tiedowns, one helicopter parking pad, and three executive box hangars would penetrate the relocated Taxiway A TOFA.

As previously detailed, Lake Havasu City Municipal Airport is a highly functional facility and contains an array of landside development on the airfield. Relocating parallel Taxiway A would result in major impacts to the landside development, which currently support the operation and activity of the airport and surrounding region.

Runway/Parallel Taxiway Separation – Alternative 2

Exhibit 4E also presents Alternative 2, which proposes the relocation of Runway 14-32 60 feet to the east of its current location to provide the separation required between parallel Taxiway A and the runway in order to meet ultimate RDC D-III standards.

Under this alternative, the relocation of Runway 14-32 60 feet to the east would necessitate significant clearing and grading of terrain to accommodate runway safety areas related to D-III standards, which could prove extremely costly. Furthermore, the cost of replacing runway pavement and associated airfield lighting and signage would be significant. Additionally, the Mohave Mountain Range is situated directly east of the runway and currently dictates the airport's traffic patterns. If the runway were relocated to be closer to the mountain range, aircraft operations could be affected. Another consideration related to relocation of the runway are impacts to environmental infrastructure. Airfield drainage infrastructure is currently installed east of Runway 14-32 and would be affected if the runway were relocated. This type of infrastructure would need to be reconstructed or at least maintained to ensure proper airfield drainage.

Runway/Parallel Taxiway Separation Summary

In order to provide increased separation between Runway 14-32 and parallel Taxiway A, significant improvements are necessary that would be very costly and could substantially impact landside development.

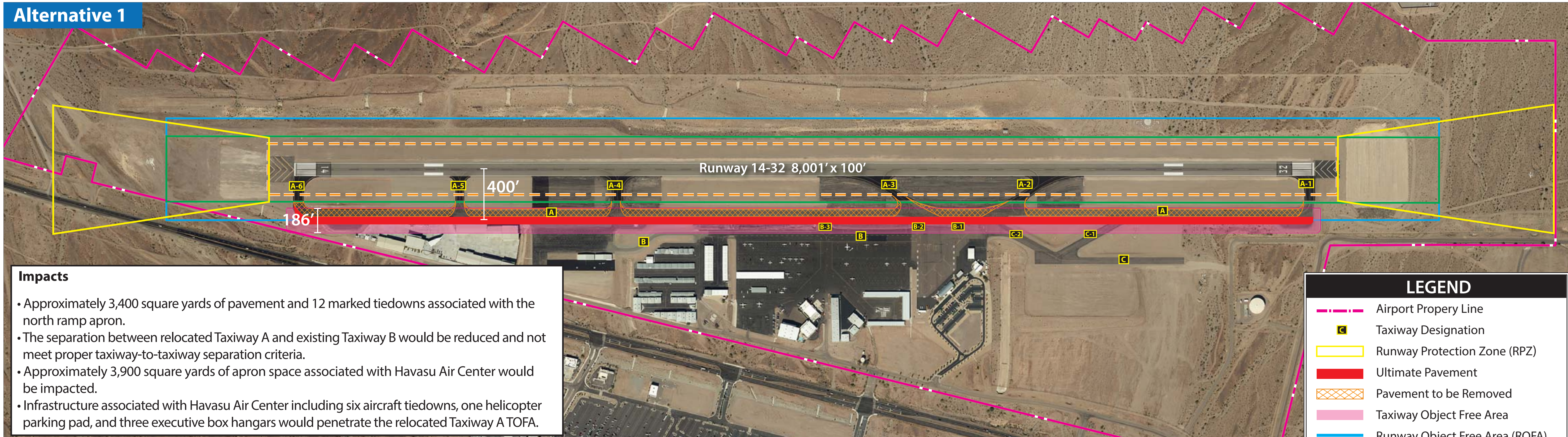
Alternative 1 proposes relocating parallel Taxiway A 60 feet to the west to obtain 400 feet of separation to meet RDC D-III design. The impacts to relocating Taxiway A on the west side of Runway 14-32 to meet RDC D-III would be significant in terms of affecting apron space as well as aircraft storage hangar space, which is in high demand at the airport. Other obstacles that must be considered are the significant variations of grade and the terrain associated with the airport's location.

Alternative 2 considers the 60-foot relocation of Runway 14-32 to meet D-III design standards, but the impacts in doing so would likely be even more significant and costly. This alternative would necessitate a complete runway design and construction requiring significant clearing and grading. The proximity of the Mohave Mountain Range to the runway environment affects aircraft traffic patterns. Environmental considerations relating to airport drainage infrastructure must be relocated to remain clear of the ROFA.

While it is desirable to plan and design the standards for the critical aircraft set forth by the FAA, it is not always practicable to do so. An airport that does not meet the FAA design standards guidelines for a particular classification of aircraft is not necessarily unsafe for operations by those aircraft. Under federal law, the FAA has the exclusive authority to regulate the airport for aviation safety. Unless an airfield is determined as inherently unsafe by the FAA in accordance with the current Code of Federal Regulations (CFR), the final decision to land and/or depart from an airfield is up to the aircraft operator, who must also abide by the CFRs regarding the aircraft and its operation.

It is also important to consider the no-development alternative when dealing with the runway/parallel taxiway separation analysis if the airport transitions to RDC D-III standards in the future. Under this alternative, parallel Taxiway A and Runway 14-32 would remain in their current location. The future disposition of the runway/parallel taxiway separation at Lake Havasu City Municipal Airport will need further coordination with the FAA prior to any implementation measures. When certain standards and

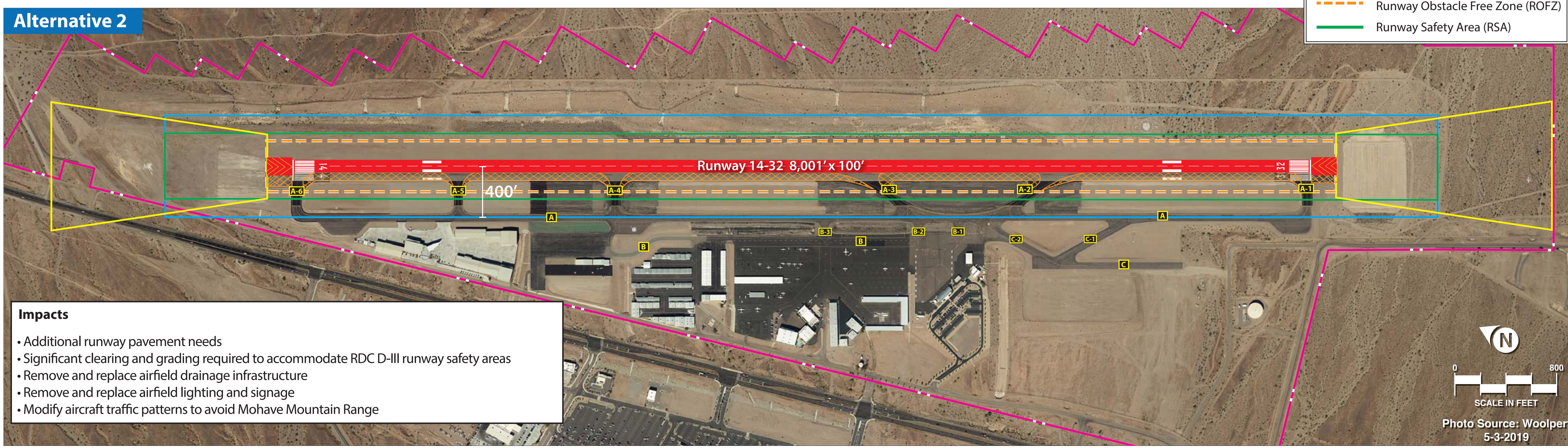
Alternative 1



Impacts

- Approximately 3,400 square yards of pavement and 12 marked tiedowns associated with the north ramp apron.
- The separation between relocated Taxiway A and existing Taxiway B would be reduced and not meet proper taxiway-to-taxiway separation criteria.
- Approximately 3,900 square yards of apron space associated with Havasu Air Center would be impacted.
- Infrastructure associated with Havasu Air Center including six aircraft tiedowns, one helicopter parking pad, and three executive box hangars would penetrate the relocated Taxiway A TOFA.

Alternative 2



Impacts

- Additional runway pavement needs
- Significant clearing and grading required to accommodate RDC D-III runway safety areas
- Remove and replace airfield drainage infrastructure
- Remove and replace airfield lighting and signage
- Modify aircraft traffic patterns to avoid Mohave Mountain Range

Exhibit 4E
RUNWAY/TAXIWAY SEPARATION ALTERNATIVES

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separations, such as those previously discussed, do not meet FAA criteria or there is a belief that implementing these standards may not be economically practicable or feasible, a request for a Modification to Standard should be looked at as an option.

Modification to Design Standards

According to AC 150/5300-13A, Change 1, *Airport Design*, a Modification to Standard is "any approved nonconformance to FAA standards, other than the dimensional standards for Runway Safety Areas (RSAs), applicable to an airport design, construction, or equipment procurement project that is necessary to accommodate an unusual local condition for a specific project on a case-by-case basis while maintaining an acceptable level of safety."

FAA Order 5300.1F, *Modifications to Agency Airport Design, Construction, and Equipment Standards*, further defines a Modification to Standard as "any change to FAA standards, other than dimensional standards for runway safety areas, applicable to an airport design, construction, or equipment procurement project that results in lower costs, greater efficiency, or is necessary to accommodate an unusual local condition on a specific project, when adopted on a case-by-case basis."

An airport sponsor's request for a Modification to Standard is submitted to the appropriate FAA Airports Regional or District Office and contains the following information:

1. A list of standards affected and the basis for the request.
2. A description of the proposed modifications.
3. A discussion of viable alternatives for accommodating the unusual conditions.
4. Assurance that modifications to materials, construction, or equipment standards will provide a product that will meet FAA standards for acceptance and that the finished product will perform for its intended design life, based on historical data; or, modifications to airport design standards will provide an acceptable level of safety, and modification is necessary to conform to local laws and regulations (if applicable).

Coordination with affected FAA Lines of Business must be accomplished before a Modification to Standard is approved. At a minimum, this typically includes coordination with the Flight Standards, Air Traffic, and Airway Facilities and requires concurrence by the division managers or their designated representatives. An approved Modification to Standard is typically required for any non-standard item that is reflected on a new or revised ALP at the time of the plan's approval. Normally, the Modification to Standard should be coordinated with the "draft" ALP drawing set that reflects and lists the status of all Modifications to Standards at the airport.

It is important to note that this master plan is not suggesting the airport seek the approval of Modification to Standards for certain design and safety standards as previously outlined. Rather, it is evaluating the airfield based on current and future operational demand and can serve as an aid in determining whether it is feasible and practicable to meet ultimate RDC D-III requirements as set forth by the FAA.

As previously discussed, Runway 14-32 is recognized as a RDC C-III runway on the currently approved ALP. Based on operational demand evaluated during this master plan, Runway 14-32 should adhere to current RDC B-II standards. FAA guidance states that the airport's RDC should be reflective of operational demand regardless of whether or not the sponsor plans to reconfigure the airport to meet design standards. Because the airport sponsor has responsibilities for airport safety, it will continue to coordinate with the FAA to determine the appropriate design standards to be applied to the airfield system. If geometric changes are not feasible, then potential risk mitigation strategies should be examined for implementation, including Modification to Standards or adjusted operational procedures.

RUNWAY 14-32 SAFETY AREA ANALYSIS

As previously discussed, this master plan is tasked with evaluating safety area improvements beyond the north end of the runway in order to meet ultimate RDC D-III standards. In order to improve RPZ and ROFA impacts beyond the north end of Runway 14-32, a displaced threshold and subsequent declared distances are analyzed. A displaced threshold is a threshold located at a point on the runway other than the designated physical beginning of the runway pavement. Displacement of a threshold reduces the length of runway available for landings. The portion of runway behind a displaced threshold is available for takeoffs in either direction and landings from the opposite direction. From a physical standpoint, any runway displacement alternative needs to also include the associated impacts on the taxiway system, navigational aids, and lighting systems. A runway threshold displacement also needs to consider the associated safety areas and RPZs.

With the proposed changes to runway length, the use of declared distances is proposed. Declared distances are used by pilots in order to measure usable runway length. Declared distances are the effective runway length the airport operator declares available for takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements. The four declared distances are defined as the following:

Takeoff run available (TORA) - The length of the runway declared available and suitable to accelerate from brake release to lift-off, plus safety factors.

Takeoff distance available (TODA) - The TORA plus the length of any remaining runway or clearway beyond the far end of the TORA available to accelerate from brake release past lift-off, to start of takeoff climb, plus safety factors.

Accelerate-stop distance available (ASDA) - The length of the runway plus stopway declared available and suitable to accelerate from brake release to take-off decision speed, and then decelerate to a stop, plus safety factors.

Landing distance available (LDA) - The distance from the threshold to complete the approach, touchdown, and decelerate to a stop, plus safety factors.

The TORA and TODA apply to takeoff, the ASDA applies to a rejected takeoff, and LDA applies to landing. Declared distances may be used to obtain additional RSA and/or ROFA prior to a runway's threshold and/or beyond the stop end of the runway, to mitigate unacceptable incompatible land uses in the RPZ, to meet runway approach and/or departure surface clearance requirements, or to mitigate environmental impacts. Declared distances may also be used as an incremental improvement technique when it is not practical to fully meet these requirements. Declared distances may only be used for these purposes when it is impracticable to meet the airport design standards or to mitigate environmental impacts by other means, and the use of declared distances is practicable.

The TORA and TODA are often equal to the actual runway length. The TORA may be reduced in order to resolve incompatible land uses in the departure RPZ and/or to mitigate environmental effects. The TORA can never be longer than the TODA. The TODA may be limited from extending to the runway end in order to mitigate penetrations to the 40:1 instrument departure surface (when applicable). The TODA may also extend beyond the runway end through the use of a published clearway. A clearway is a defined area beyond the end of a runway that is cleared and suitable for use in lieu of runway to satisfy takeoff distance requirements. There is no clearway designated beyond either end of Runway 14-32.

The ASDA and the LDA are the primary considerations in determining the runway length available for use by aircraft, as these calculations must consider providing the full RSA and ROFA to standard in operational calculations. The ASDA and LDA can be figured as the usable portions of the runway length, less the distance required to maintain adequate safety areas beyond the ends of the runway or prior to the landing threshold. By regulation, a full 1,000 feet of RSA and ROFA must be available at the far end of a departure operation in the ASDA calculation. For LDA calculations, 600 feet of RSA and ROFA is required prior to the landing threshold, and 1,000 feet of RSA and ROFA is required beyond the far end of the landing operation.

Runway Safety Area Improvements – Alternative 1

Alternative 1, depicted on the top half of **Exhibit 4F**, considers a 1,200-foot displaced threshold on Runway 14. Under this scenario, the approach and departure RPZs would shift farther south and encompass 0.66 acre of land outside airport property. The proposed RSA, ROFZ, and ROFA would be under airport control and be clear of any incompatibilities.

As a result of the 1,200-foot threshold displacement on the north end of the runway, the approach and departure RPZs are removed from State Highway 95. Public roadways, such as State Highway 95, are considered incompatible land uses within an RPZ, which is the primary concern being addressed in this alternative analysis. Declared distances have been calculated based on the proposed threshold displacement. The landing distance available (LDA) would be reduced by 1,200 feet, resulting in 6,801 feet of available runway for aircraft landing on Runway 14. The TORA, TODA, and ASDA would remain at 8,001 feet.

For Runway 32, the TODA is calculated at 8,001 feet. The ASDA and LDA are calculated at 7,407 feet in order to meet the 1,000-foot RSA and ROFA requirement beyond the end of the runway. Finally, the TORA is calculated to 6,801 feet to account for maintaining the RPZs clear of State Highway 95.

This alternative would mitigate the safety area incompatibilities associated with the Runway 14 ROFA as well as the incompatibilities that exist inside the approach and departure RPZs under the ultimate D-III design. Displacing the runway threshold would have negative impacts, however, namely reducing the amount of distance available for aircraft landing on Runway 14. In addition, the runway threshold lighting and PAPI-4 system serving Runway 14 would need to be relocated in order to accommodate the displaced threshold. Further operational impacts would be associated with Runway 32, in the form of a reduction in runway length associated with the TORA, ASDA, and LDA.

Runway Safety Area Improvements – Alternative 2

Alternative 2 depicted on the bottom half of **Exhibit 4F** focuses primarily on mitigating incompatibilities within the ultimate ROFA associated with an RDC D-III design. Approximately 406 feet beyond the existing runway threshold, the ultimate ROFA penetrates the airport perimeter fence and encompasses approximately 0.74 acres off airport property. In order for the airport to maintain control of the ROFA, a 194-foot displaced threshold is proposed. In doing so, this would allow for 600 feet of ROFA prior to the Runway 14 landing threshold and meet ultimate D-III standards. Like the previous alternative, this threshold displacement will have an effect on useable runway length and would affect aircraft utilizing the runway. This alternative does not address any incompatibilities related to the approach or departure RPZs. Relocation of the runway threshold lighting and PAPI-4s would also be required under this alternative.

The Runway 14 LDA would be reduced by 194 feet, resulting in 7,807 feet of available runway for landing aircraft. The TORA, TODA, and ASDA would remain at 8,001 feet.

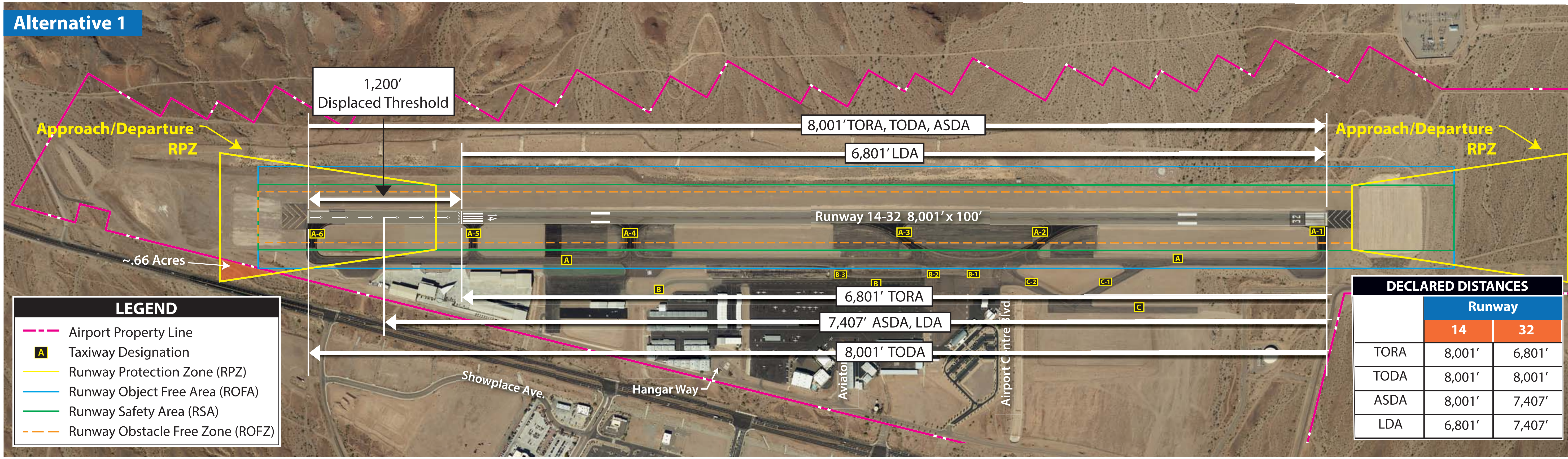
For Runway 32, the TORA and TODA are calculated at 8,001 feet. The ASDA and LDA are calculated at 7,407 feet to account for the required 1,000 feet of RSA and ROFA beyond the runway end.

Runway Safety Area Improvement Summary

The previous runway threshold displacement alternative considers methods by which to attempt to meet FAA airport safety design criteria for RDC D-III to the extent practicable. **Table 4B** further outlines the runway lengths declared available with the displaced runway threshold scenarios.

As with previous alternatives analyses, the no-development alternative can also be considered as it relates to a potential displaced threshold at Lake Havasu City Municipal Airport. Under this scenario, the existing runway length would be maintained. Airport staff should continue to monitor aircraft activity in order to make sure the facility is meeting the needs of aviation demand both now and in the future.

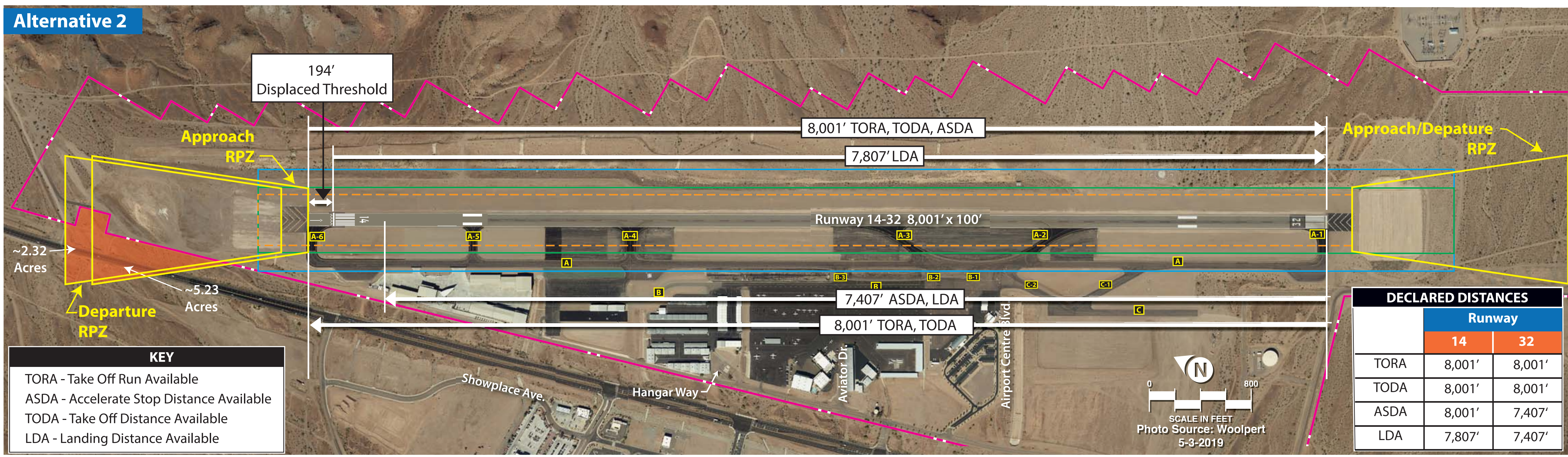
Alternative 1



DECLARED DISTANCES

	Runway 14	Runway 32
TORA	8,001'	6,801'
TODA	8,001'	8,001'
ASDA	8,001'	7,407'
LDA	6,801'	7,407'

Alternative 2



DECLARED DISTANCES

	Runway 14	Runway 32
TORA	8,001'	8,001'
TODA	8,001'	8,001'
ASDA	8,001'	7,407'
LDA	7,807'	7,407'

Exhibit 4F
RUNWAY 14 SAFETY AREA ALTERNATIVES

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It is important to note that if the FAA directs the airport to address safety area issues as previously discussed in this chapter, doing so could potentially decrease the utilization of Runway 14-32.

TABLE 4B
Proposed Runway Declared Distances (in feet)
Lake Havasu City Municipal Airport

	Runway	
Alternative 1	**14**	**32**
Takeoff Run Available (TORA)	8,001	6,801
Takeoff Distance Available (TODA)	8,001	8,001
Accelerate-Stop Distance Available (ASDA)	8,001	7,407
Landing Distance Available (LDA)	6,801	7,407
Alternative 2	**14**	**32**
Takeoff Run Available (TORA)	8,001	8,001
Takeoff Distance Available (TODA)	8,001	8,001
Accelerate-Stop Distance Available (ASDA)	8,001	7,407
Landing Distance Available (LDA)	7,807	7,407

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.

Lake Havasu City Municipal Airport has straight-in instrument approach capabilities to each end of Runway 14-32. These include area navigation (RNAV) GPS approaches serving Runways 14 and 32 and a very high frequency omnidirectional range (VOR) with distance measuring equipment (DME) approach. The RNAV GPS approach to Runway 14 provides for 1.25-mile visibility and 1,400-foot cloud ceilings. The RNAV GPS approach serving Runway 32 allows for visibility minimums as low as one mile and 500-foot cloud ceilings. It should be noted that the RNAV GPS to Runway 32 offers vertical guidance for properly equipped aircraft. As such, this approach allows for lower approach minimums. The VOR/DME approach is a circling approach only, allowing for 1.25-mile approach visibility minimums to either end of Runway 14-32.

Improved approach capabilities are not being analyzed for approaches to Runway 14 due to the limited available space suitable for expansion of safety areas and current incompatibilities associated with the RPZs north of the runway. In addition, the terrain farther north of the airport could impede upon approach surfaces associated with instrument approach enhancements.

The following analysis considers improved visibility minimums on Runway 32 at Lake Havasu City Municipal Airport to provide an understanding of the impacts associated with lowering approach minimums.

The dimensions of the RPZ will change in size if there are improvements to the instrument approach capabilities. **Table 4C** presents the dimensions of the RPZs based upon the current approach visibility minimums as well as those being proposed. **Exhibit 4G** illustrates two alternatives for instrument approach procedures on Runway 32.

TABLE 4C
Runway Protection Zones
Lake Havasu City Municipal Airport

	Instrument Approach Capabilities			
Runway Design Code	**Operational B-II**		**Ultimate D-III**	
Visibility Minimum	1-Mile	3/4-Mile	1-Mile	3/4-Mile
Approach Runway Protection Zone				
Inner Width (ft.)	500	1,000	500	1,000
Outer Width (ft.)	700	1,510	1,010	1,510
Length (ft.)	1,000	1,700	1,700	1,700
Departure Runway Protection Zone				
Inner Width (ft.)	500	500	500	500
Outer Width (ft.)	700	700	1,010	1,010
Length (ft.)	1,000	1,000	1,700	1,700

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

Runway 32 Straight-In Approach – Alternative 1

Alternative 1 depicts the approach RPZ for a **not lower than 1-mile** minimum approach associated with the RNAV (GPS) Runway 32 approach under ultimate RDC D-III RPZ standards. The RPZ would encompass vacant land currently owned by the airport. This alternative introduces no incompatibilities into the RPZ.

Runway 32 Straight-In Approach – Alternative 2

In Alternative 2, the approach RPZ would expand due to approach visibility minimums decreasing to **not lower than 3/4-mile** associated with ultimate RDC D-III standards. The proposed RPZ serving Runway 32 would extend farther south and encompass 1.08 acres of land outside existing airport property. The larger RPZ also extends over Whelan Drive to the southwest. The FAA recommends that airports control all property located within the RPZ using either fee simple property acquisition or an avigation easement to ensure that there is little to no development and/or congestion within it. As previously discussed, roadways are considered incompatible land use within an RPZ. As such, the airport should seek to acquire the property included in the expanded RPZ. It is also recommended that Whelan Drive be relocated outside of the expanded RPZ.

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

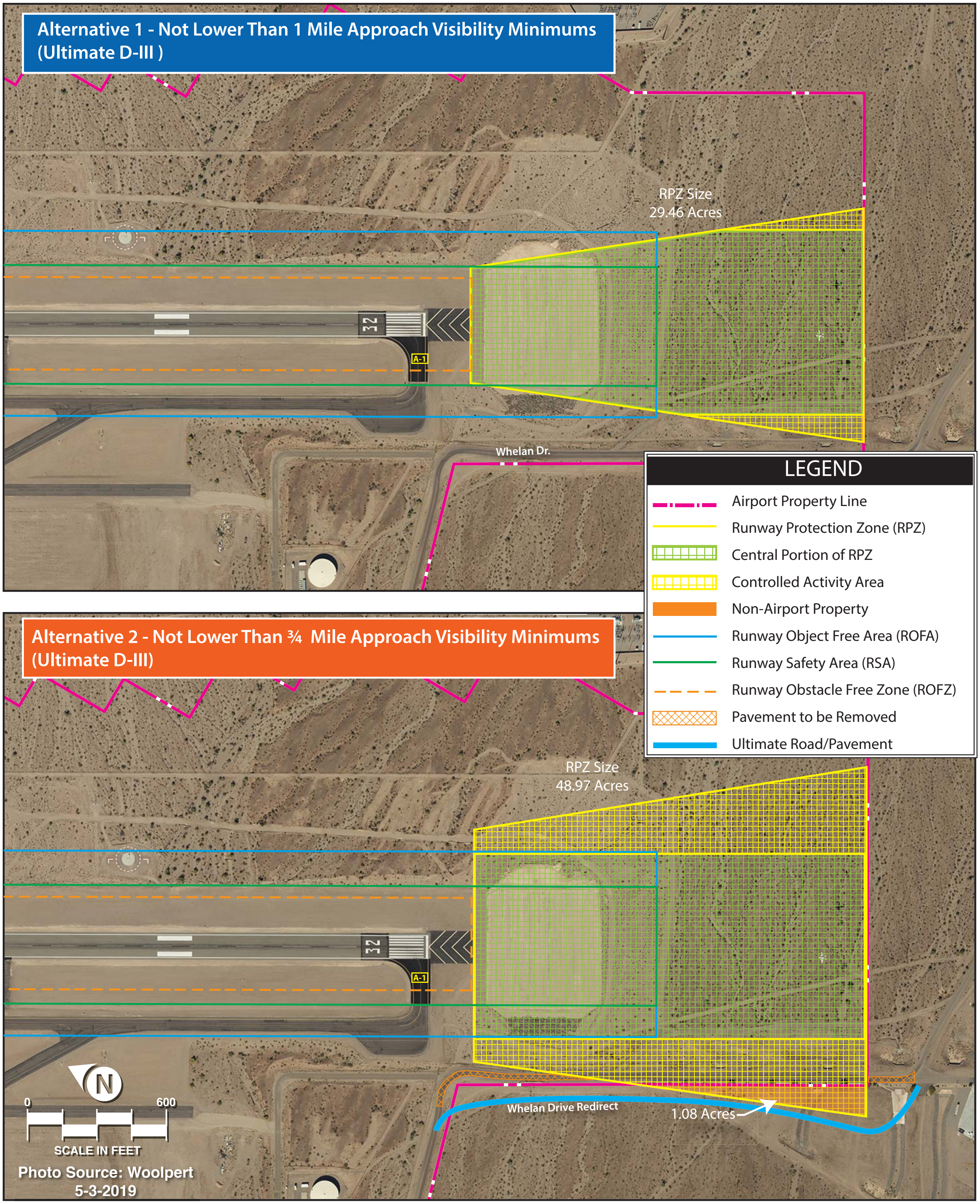

Exhibit 4G
RUNWAY 32 STRAIGHT IN APPROACH

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. 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 is not grandfathered, Lake Havasu City should work to realign a portion of the roadway to remain clear of the RPZ.

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 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 14-32. 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 4D**.

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 32, the option of lowering visibility minimums to not lower than ¾-mile would not require the installation of an approach lighting system, such as a medium intensity approach lighting system (MALS), as depicted on the currently approved ALP.

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.

TABLE 4D
Standards for Instrument Approach Procedures

Criteria	Visibility Minimums	
	¾-mile to < 1 Mile	Not Lower Than 1 Mile
HATh	≥ 250 feet	≥ 250 feet
TERPS GQS	Clear	Clear
PA final approach surfaces	Not Required	Not Required
POFZ (PA & APV only)	Not Required	Not Required
TERPS Chapter 3, Section 3	20:1 Clear	20:1 Clear
ALP	Required	Required
Minimum Runway Length	3,200 feet	3,200 feet
Runway Markings	Non-precision	Non-precision
Holding Position Signs & Markings	Non-precision	Non-precision
Runway Edge Lights	HIRL/MIRL	LIRL/MIRL
Parallel Taxiway	Required	Recommended
Approach Lights	Recommended	Recommended
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	20:1 Clear
Survey Required	VGS (PA & APV)/NVGS	NVGS

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*

AIRFIELD GEOMETRY IMPROVEMENT ANALYSIS

As previously detailed, there are existing non-standard taxiway conditions that should be addressed which do not conform to geometry standards recommended by the FAA. These include certain taxiways providing direct access from aircraft parking aprons to the runway environment and taxiways that do not provide a right-angle connection to the runway. The following analysis considers enhancements to airfield geometry standards.

Taxiway Exit Analysis

An analysis of the taxiway exits serving Runway 14-32 was conducted to further evaluate taxiway geometry and to examine potential opportunities to improve circulation. **Exhibit 4H** presents an analysis of the proposed exit taxiways serving Runway 14-32. 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 single engine, small twin-engine, large, and heavy aircraft fleet that can utilize the exits under both wet and dry conditions.

Exhibit 4H depicts the relocation of Taxiways A3 and A4 in order to prevent direct access from the parking apron to the runways. It is important to maintain an adequate distance between Taxiways A3 and A4. The distance proposed is approximately 1,500 feet. Taxiway A2 and A3 are also acute-angle or "high speed" taxiways that should be removed and replaced with standard right-angle connector taxiways. Acute-angle taxiways are not necessary at Lake Havasu City Municipal Airport for meeting existing and future capacity needs. Furthermore, acute-angled taxiways do not provide the best visibility to pilots and can lead to confusion and/or collisions. The taxiways should be replaced with standard right-angle connector taxiways in order to continue to provide sufficient opportunities for aircraft to exit the runway system.

The following runway utilization percentages presented are based upon the proposed taxiway exit locations. For arrivals on Runway 14 under dry runway conditions, 100 percent of small single engine aircraft and 20 percent of small twin-engine aircraft will be able to exit the runway at Taxiway A4, and this percentage increases moving farther south. At the proposed location of Taxiway A3, it is estimated that 100 percent of small single engine and twin-engine aircraft can exit the runway system. For large aircraft, Taxiway A3 can accommodate 20 percent of operations, increasing to 94 percent at Taxiway A2. Heavy aircraft will likely need to exit at Taxiway A2 or roll out to the end of the runway and exit at Taxiway A1. Under wet conditions, the utilization percentages are lower for small single engine and twin-engine aircraft. As such, Taxiway A3 would be able to accommodate 100 percent of small single engine aircraft and 93 percent of small twin-engine aircraft. Large and heavy aircraft are more likely to utilize Taxiways A2 or roll out to the end of the runway under wet runway conditions.

For arrivals on Runway 32, approximately 66 percent of small single engine aircraft could exit the runway at Taxiway A2, and 100 percent could exit at Taxiway A3 under dry conditions. Approximately 86 percent of small twin-engine aircraft would likely utilize Taxiway A3 under these same conditions. For wet conditions, 45 percent of single engine aircraft can expect to exit the runway system beginning with Taxiway A2, and 99 percent will be able to exit at Taxiway A3. Large and heavy aircraft would typically exit at Taxiways A4 and A5 or roll out to the end of the runway during dry or wet conditions.

AIRSIDE ALTERNATIVES 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, Lake Havasu City, and the general

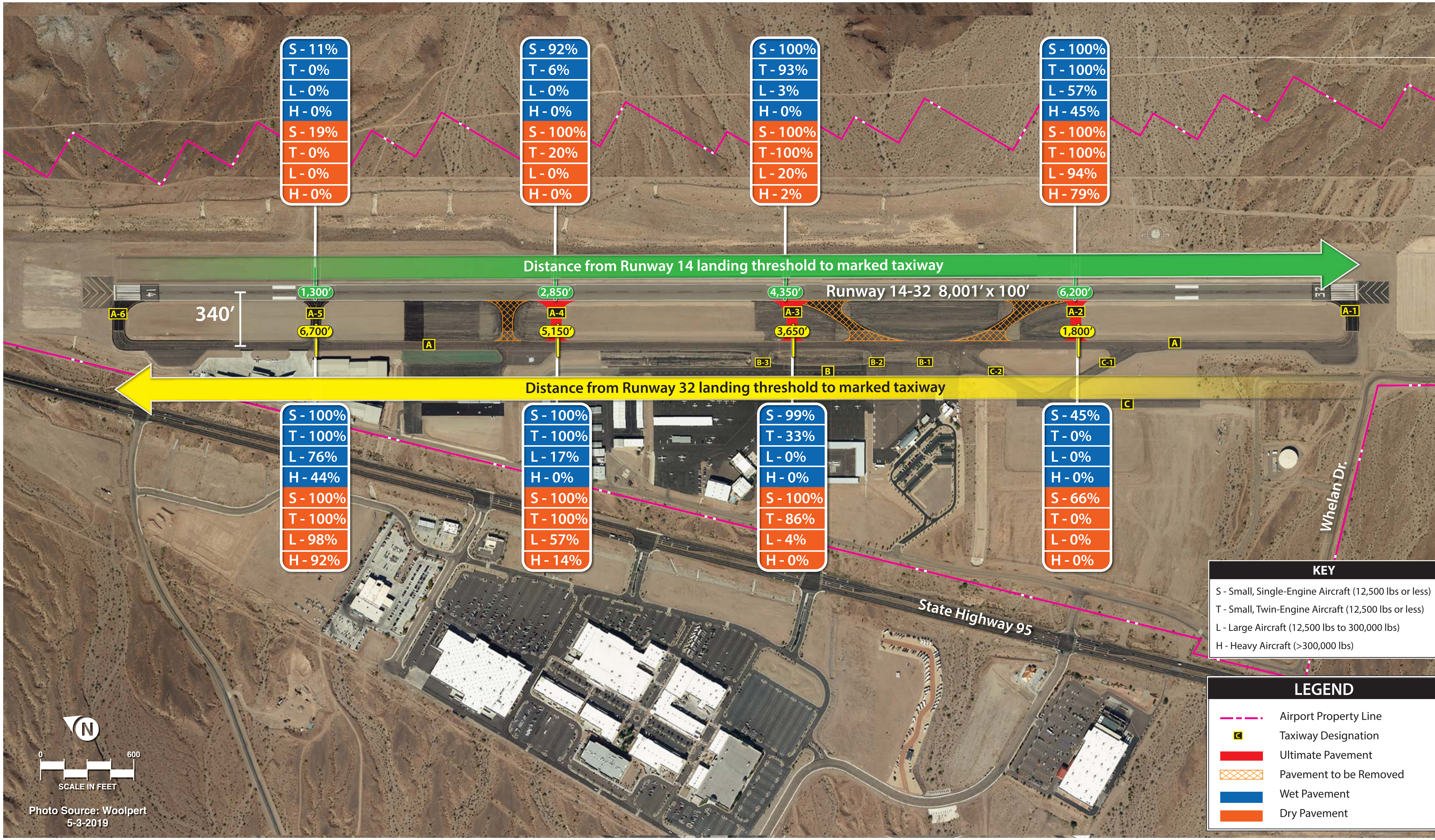

Exhibit 4H
AIRFIELD GEOMETRY IMPROVEMENT ANALYSIS

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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 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. Land use planning considerations, summarized previously on **Exhibit 4B**, 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 layout and availability of land available at Lake Havasu City Municipal 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.

AVIATION ACTIVITY LEVELS

The aviation development areas should be divided into high, medium, and low activity levels at an airport. The high activity area should be planned and developed to provide aviation services on the airport. An example of the high activity area is the terminal building and adjoining aircraft parking apron, which provides tiedown locations and circulation for aircraft. In addition, hangars used for FBOs, flight departments, or storing many 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 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. 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 the airport. As previously mentioned, the airport serves as a very important link to the entire region. 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.

In order 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.

HANGAR DEVELOPMENT

Analysis in Chapter Three indicated that the airport should plan for the construction of additional aircraft hangars over the next 20 years as demand dictates. 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 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 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 an airport. Limited utility services are needed for these areas.

Other types of hangar development can include executive/box hangars for accommodating either one larger aircraft or multiple smaller aircraft. These types of hangars can be 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 4E** summarizes the aircraft hangar types and corresponding size and aviation uses that are typically associated with each facility.

Currently, there is approximately 376,700 square feet of hangar space provided on the airport, made up of a combination of hangar types. Future planning indicates a potential need for approximately 537,300 square feet of hanger space through the long-term planning period. With a potential need for 160,600 square feet of additional hangar space, a wide range of hangar types could provide the space needed. According to forecasts in Chapter Two, the largest demand for hangars will be in the conventional and executive hangar categories.

TABLE 4E
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/Box	Clear span hangars less than 10,000 square feet	SASOs, flight departments, and private aircraft storage resulting in medium-to-high activity uses
T-Hangar/Linear Box/Shade Hangar	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

POTENTIAL COMMERCIAL TERMINAL EXPANSION/RELOCATION ANALYSIS

In the event that Lake Havasu City Municipal Airport regains commercial passenger service at the levels projected in Chapter Two, additional commercial terminal building space may be needed. As outlined in Chapter Three, the existing terminal measures approximately 5,700 square feet, and the terminal area recommended to adequately serve the projected number of passengers is calculated to be 21,370 square feet. Areas that may need expansion include baggage claim, ticketing/check-in, security screening, departure hold room facilities, concessions, restrooms, and general circulation spaces. The landside alternatives to follow present several options ranging from expanding the existing terminal to the construction of a new terminal building to meet potential demand.

When considering a new terminal facility, it is important to remember that the terminal is often the first impression air travelers have of the area. A functional and attractive terminal facility can be needed to secure and build air travelers' favorable opinion of the surrounding area, particularly business leaders who may be investing in communities adjacent to an airport.

Terminal Siting Considerations

FAA Advisory Circular (AC) 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*, identifies a number of basic considerations that affect the location of a terminal building. The primary considerations include the following:

1. **Runway Configuration:** The terminal site should be located to minimize aircraft taxiing distances and active runway crossings.

2. **Airfield Access:** The terminal site should consider the layout of terminal aprons and access taxilanes or taxiways and apply recommended airfield design standards to reduce the probability of runway incursions.

3. **FAA Geometric Design Standards and Airspace:** The terminal location needs to assure adequate distance from present and future aircraft operational areas and remain clear of imaginary airspace surfaces.

4. **Access to Highway Network:** The terminal should be located to provide the most direct/shortest routing to the access transportation system.

5. **Expansion Potential:** The long-term viability of the terminal is dependent upon the ability of the site to accommodate expansion of the terminal beyond forecast requirements.

6. **Existing and Planned Facilities:** The terminal site should consider the existing and planned locations of other airport facilities and equipment so as to not interfere with line-of-sight or other operational restrictions associated with these facilities.

7. **Terrain:** Topographical conditions should be considered in the selection of a terminal site.

The landside alternatives consider locations for a commercial passenger terminal complex that could meet the airport's functionality needs. The commercial passenger terminal complex should only be further analyzed in the event that enhanced scheduled airline/air charter service would take place at Lake Havasu City Municipal Airport in the future; however, prudent planning will consider potential locations that could best accommodate such functions in the future. Consideration in the alternatives analysis is given to a terminal location that best meets the criteria listed above while considering existing airport infrastructure investment and future development potential, while also being able to best segregate general aviation and potential commercial service activities.

HELICOPTER OPERATIONS AREAS

Lake Havasu City Municipal Airport serves military and civilian helicopter operations regularly. As such, the landside alternatives will present several locations currently available to serve as additional helicopter operations areas. These areas are suitable rotor wing locations as they are separated from fixed wing aircraft movement areas.

AIRPORT MAINTENANCE FACILITY

Airport maintenance activities are currently staged from an existing hangar and other outside locations for equipment storage. The following landside alternatives give several potential locations for a dedicated maintenance facility for the storage of maintenance equipment and to provide work areas for airport maintenance employees.

AIRCRAFT WASH RACK

An aircraft wash rack is being proposed as an addition to the airfield infrastructure. The addition of an aircraft wash rack can serve to attract based aircraft and can be used to keep airport maintenance equipment clean and maintained.

AIR CARGO

Lake Havasu City Municipal Airport currently provides air cargo services to the community. A current staging area associated with air cargo activity is situated on the west side of the main aircraft parking apron. The landside alternatives to follow identify other potential locations for future air cargo staging in the event the west portion of the main aircraft parking apron area is re-purposed for other aviation activities. A dedicated air cargo area would be beneficial to the airport by separating general aviation traffic from commercial air cargo operations.

BUILDING RESTRICTION LINE

The building restriction line (BRL) identifies suitable building area locations on the airport. The BRL encompasses the RPZs, the ROFA, navigational aid critical areas, areas required for terminal instrument procedures, and other areas necessary for meeting airport line-of-sight criteria.

Two primary factors contribute to the determination of the BRL: type of runway (utility or other-than-utility) and the capability of the instrument approaches. Runway 14-32 is considered an "other-than-utility" runway, which is intended to be used by aircraft in the "other than utility category" or "large aircraft" category with a gross weight greater than 12,500 pounds.

The BRL is the product of Title 14 CFR Part 77 transitional surface clearance requirements. These requirements stipulate that no object be located in the primary surface, defined as being no closer than 250 feet from a non-precision instrument runway centerline and not closer than 500 feet to a runway served by a precision instrument approach. For Lake Havasu City Municipal Airport, the primary surface is 1,000 feet wide (500 feet on either side of the runway centerline). From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizontal feet.

The location of the BRL is dependent upon the selected allowable structure height. Traditionally, the BRL is set at a point where the transitional surface is 20 feet or 35 feet above runway elevation.

REVENUE SUPPORT LAND USES

As part of this master plan, consideration is being given to portions of airport property to be utilized for non-aviation purposes. As can be seen from the analysis of facility needs conducted so far, significant portions of airport property are needed to help satisfy existing and projected aviation demand. Prudent planning, however, will evaluate various land uses that could be developed for non-aviation purposes that would be compatible with aviation-related activity in order to further support and enhance the airport's self-sufficiency.

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 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, Lake Havasu City, being the 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.

Land Use Change

A land use change permits land to be leased for non-aeronautical purposes. A land use change 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. If land is needed for aeronautical purposes, a land use change is not justified. 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 and may not be used for a non-airport purpose. The proceeds 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.

Land use planning is a very common practice for communities across the country. The primary purpose of 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.

LAND ACQUISITIONS

FAA AC 150/5100-17, *Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects* provides procedural guidance to airport sponsors. The AC provides detailed information and guidance on regulatory requirements that pertain to each phase of a land acquisition process. Additionally, all federally funded land acquisitions must comply with the *Uniform Relocation Assistance and Real Property Acquisition Act of 1970* (Uniform Act). The Uniform Act is the Federal law that provides minimum real property acquisition policies and requires the uniform and equitable treatment of persons displaced as a result of a federally assisted project. One of the following alternatives analyzes potential land acquisition to accommodate safety areas and expand property for future development adjacent to the southwest side of the airport. It is important to note that this proposed land acquisition is depicted on the currently approved ALP.

LANDSIDE ALTERNATIVES

The following section describes a series of landside alternatives as they relate to considerations detailed above. Aviation activity at Lake Havasu City Municipal Airport is well established on the west side of the airfield. These areas can continue to accommodate the forecast demand for aviation activity through the long-term planning period of this master plan and are the most readily available for development given existing roadway access and utility infrastructure.

LANDSIDE ALTERNATIVES ANALYSIS

The intent of this analysis is to present three landside alternatives, all of which involve development potential on the west side of Runway 14-32. Due to terrain constraints, this is where most of the airport's developable property can be found. The alternatives are straightforward development plans aimed at meeting the needs of aviation and additional 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 Lake Havasu City Municipal Airport in the strategic planning of available properties. Many times, airport operators change their plan to meet the needs of specific users. The goal in analyzing landside development alternatives is to focus future development so that airport property can be maximized. The landside element of the recommended master plan concept, to be presented in the next chapter, may be one of these alternatives or, more likely, a combination of elements from each of them. Input from the planning advisory committee and the public is integral to determining the landside vision for the airport.

Landside Alternative 1

Landside Alternative 1 is depicted on **Exhibit 4J**. Landside development is composed of future development opportunity to the west of the runway. As presented, the primary development items proposed for Alternative 1 include:

- Maintain the terminal building in existing location and consider expanding it to provide approximately 21,000 square feet of space. This space could accommodate an array of aviation support functions to include the potential for commercial passenger service.
- Maintain commercial cargo operations area in existing location.
- Three conventional hangars added to vacant land adjacent to the north ramp apron that would be served by an area for vehicle parking.
- A dedicated airport maintenance facility immediately west of the cargo area.
- Shade/T-Hangar complex added to the north side of the main aircraft tiedown apron.
- Two helicopter hard stands on main aircraft tiedown apron.
- Nine conventional hangars west of Taxiway C in an area that has been graded for future aviation related development.
- Eight linear box or T-Hangar complexes extending west of Taxiway C.
- New taxiway extending west of Taxiway A providing airside access to the southwest development area.
- Aircraft wash rack located south of Taxiway C.
- Eight large clear span conventional hangars and twelve executive hangars in southwest development area.

This alternative proposes maintaining potential commercial passenger service operations in the existing airport terminal building and expanding the building to meet the demand. The existing vehicle access roads and parking areas provided are sufficient to accommodate projected enplanement levels through the long-term planning period.

Alternative 1 also considers long-term general aviation development. It is important to separate aircraft by activity levels to reduce congestion. High, medium, and low activity areas are separated by specific apron areas. The primary functionality of the southwest side development would be high activity areas providing parking aprons serving large, clear span conventional hangars which could house aviation related business and/or large aircraft operator needs. Medium activity areas consisting of executive hangars and low activity T-hangar/linear box hangar facilities are separated from the high activity areas. A dedicated maintenance building is proposed directly east of the air cargo area to provide storage and workspace for airport maintenance employees. Marked helicopter hard stands are added to the southeast side of the main aircraft parking apron to separate helicopter operations from any commercial service activity near the terminal building. Several areas shown as potential non-aviation revenue support are available adjacent to Whelan Drive. All total, these non-aviation support areas constitute approximately 19 acres.

Landside Alternative 2

The second landside alternative is presented on **Exhibit 4K**. Unlike Alternative 1, this alternative proposes the acquisition of approximately 23 acres of land adjacent to the southwest side of the airport. As previously detailed, this property acquisition is called for on the currently approved ALP and Lake Havasu City has historically considered this area for future airport development. Another difference between this alternative and the first is the proposed relocation of the commercial service terminal building. As depicted, the following facilities are proposed in Alternative 2:

- Construct a new terminal building that could accommodate future commercial passenger service and an associated commercial aircraft parking apron.
- Maintain the existing terminal facility to support other aviation-related functions such as airport administration, general aviation, and support needs.
- Five linear box hangars/T-hangars included on the north ramp apron.
- Shade hangar/T-hangar complex added to north side of main aircraft tiedown apron.
- Two linear box/T-hangar complexes west of the existing shade hangars on the main aircraft tiedown apron.
- Additional vehicle parking in a vacant area adjacent to the intersection of Aviator Drive and Whelan Drive.
- Ten large, clear span conventional hangars extending west of Taxiway C in the southwest development area.
- 16 smaller conventional hangars immediately south of the larger conventional hangars described above with access extending west of Taxiway C.
- 10 executive box hangars and three linear box/T-hangar complexes farther southwest in a low-activity area of the airport.
- A dedicated cargo area extending south of Taxiway C. In order to accommodate this development, the airport would need to acquire the 23 acres of land previously noted.
- Support facilities that include an aircraft wash rack and maintenance building with access provided by extending Taxiway C farther south.
- Approximately 15 acres dedicated for future aviation reserve in the proposed land acquisition area.

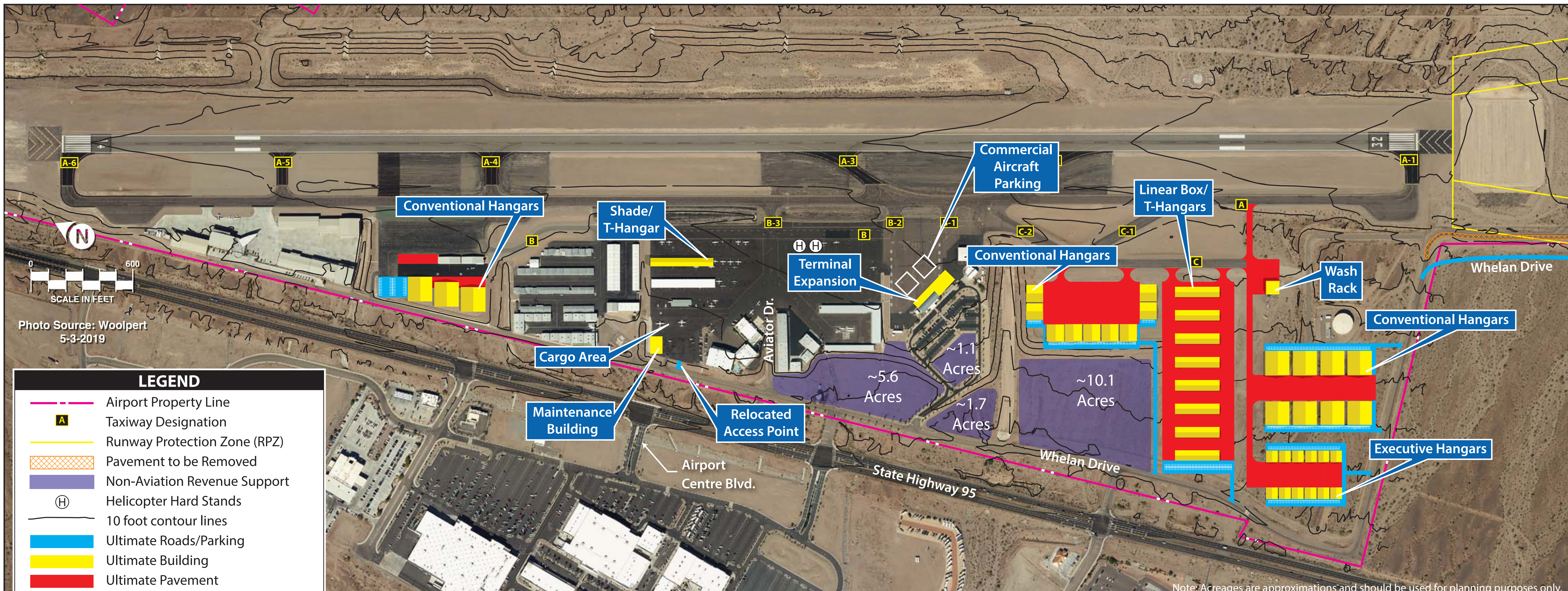

Exhibit 4J
LANDSIDE ALTERNATIVE 1

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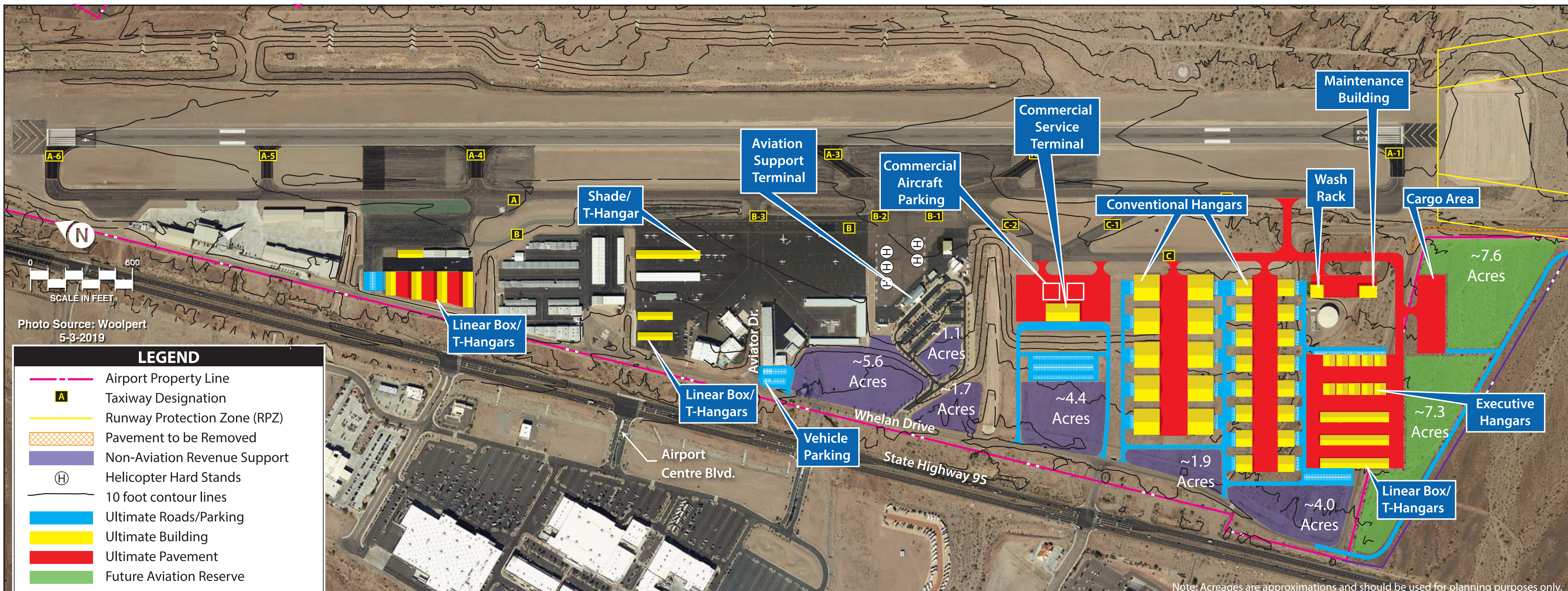
Maintenance Building
Commercial Service Terminal
Aviation Support Terminal
Commercial Aircraft Parking
Wash Rack
Cargo Area
Shade/ T-Hangar
Conventional Hangars
A-6
A-5
A-4
A-3
A-1
A
B
B-3
B-2
B-1
C-2
C-1
C
N
0
600
SCALE IN FEET
Photo Source: Woolpert 5-3-2019
Linear Box/ T-Hangars
~7.6 Acres
~1.1 Acres
~5.6 Acres
~1.7 Acres
~4.4 Acres
Aviator Dr.
Linear Box/ T-Hangars
Executive Hangars
~7.3 Acres
Whelan Drive
Vehicle Parking
Airport Centre Blvd.
State Highway 95
~1.9 Acres
~4.0 Acres
Linear Box/ T-Hangars
LEGEND
Airport Property Line
Taxiway Designation
Runway Protection Zone (RPZ)
Pavement to be Removed
Non-Aviation Revenue Support
Helicopter Hard Stands
10 foot contour lines
Ultimate Roads/Parking
Ultimate Building
Ultimate Pavement
Future Aviation Reserve
Note: Acreages are approximations and should be used for planning purposes only.

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Alternative 2 proposes the addition of linear box hangars/T-hangars as well as additional vehicle parking adjacent to the north ramp apron. On the main aircraft tiedown apron, this alternative proposes additional shade hangars/T-hangars. Linear box/T-hangers are shown in the area that is currently used for cargo operations and long-term vehicle parking. A new dedicated cargo area is proposed south of Taxiway C.

As in Alternative 1, careful consideration is given to high, medium and low activity areas when considering landside hangar development. Ten large conventional hangars and 16 smaller conventional hangars are proposed west of Taxiway C and each is provided with individual vehicle access and parking areas. Single aircraft storage is provided by 10 executive hangars and three linear box/T-hangars. A dedicated airport maintenance building and an aircraft wash rack are proposed adjacent to the existing water tower west of Taxiway C. Additional vehicle parking is proposed at the corner of Whelan Drive and Aviation Drive to expand parking near the airport restaurant and provide more long-term parking outside of the aircraft movement area. As in Alternative 1, there are several areas designated as non-aviation related revenue support. All total, approximately 20 acres of land is proposed for non-aviation development potential under Alternative 2.

Landside Alternative 3

Finally, Landside Alternative 3 is presented on **Exhibit 4L.** This alternative provides more private single aircraft storage than the previous alternatives. This alternative also utilizes the existing terminal building and provides a commercial terminal expansion (if needed) to meet potential commercial service demands. The primary development items proposed for Alternative 3 include:

- Terminal building and commercial aircraft parking to remain in existing location and include a commercial service expansion to provide 21,000 square feet of terminal space.
- Seven linear box hangars/T-hangars constructed west of the north ramp apron.
- Shade hangar expansion to connect to existing shade hangar on main aircraft tiedown apron.
- One large conventional hangar near the existing cargo area.
- Additional shade hangar/T-hangar constructed on the south side of the main aircraft tiedown apron.
- Five large conventional hangars west of Taxiway C with road access and parking.
- Dedicated airport maintenance building and aircraft wash rack west of Taxiway C.
- Six smaller conventional hangars with access provided by extending a taxiway west of Taxiway C.
- 37 executive box hangars farther west adjacent to Whelan Drive.
- 12 linear box hangar complexes in the southwest area of existing airport property.
- Three helicopter hard stands east of Taxiway C.
- A dedicated air cargo area that could be served by extending Taxiway C farther south.

Alternative 3 provides several large conventional hangars to cater to businesses and/or general aviation jet operations, but also assumes major growth in single small aircraft storage related to general aviation based aircraft. This alternative provides ample aircraft storage and uses airport property efficiently to do so. Also, additional road access and vehicle parking is proposed in this alternative. The air cargo area is again relocated from its current location to a dedicated apron to allow for additional hangar development. Similar to the previous landside alternatives, Alternative 3 dedicates portions of airport property for non-aviation uses. This includes approximately 18 acres within five separate parcels with immediate access to Whelan Drive.

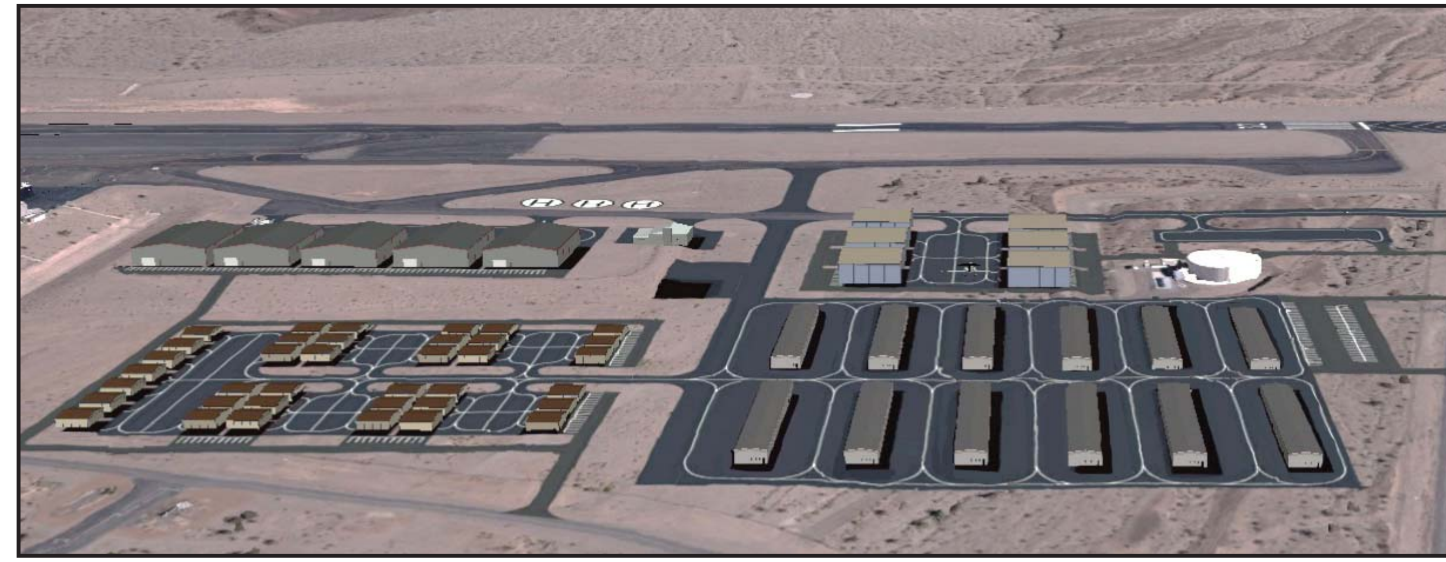
Landside Alternatives Summary

The landside alternatives previously detailed look to accommodate an array of aviation activities that either currently occur or could be expected to occur at Lake Havasu City Municipal Airport in the future. As with many of the alternatives detailed in this chapter, airport staff should continually monitor the demand that is occurring on the airfield and in the region to help determine the potential need for enhanced landside facilities, both aviation and non-aviation related. Each of the development options considers a long-term vision that would, in some cases, extend beyond the 20-year scope of this master plan. Nonetheless, it is beneficial to provide a long-term vision for the airport for future generations.

ALTERNATIVES 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 the alternative development options in order to maximize the opportunities of Lake Havasu City Municipal 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, Lake Havasu City, and interested local citizens, a recommended development concept for Lake Havasu City Municipal Airport to include a detailed capital improvement program and environmental overview will be presented in the next phase of this study.



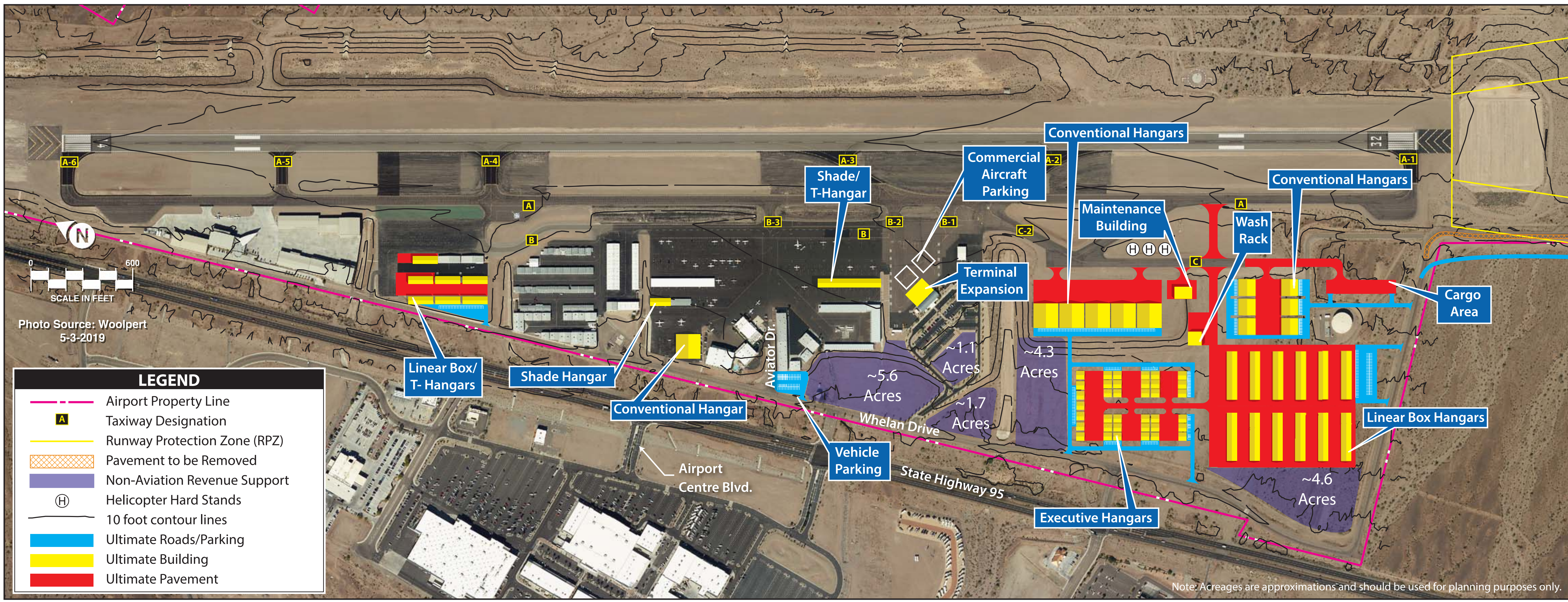


Exhibit 4L
LANDSIDE ALTERNATIVE 3

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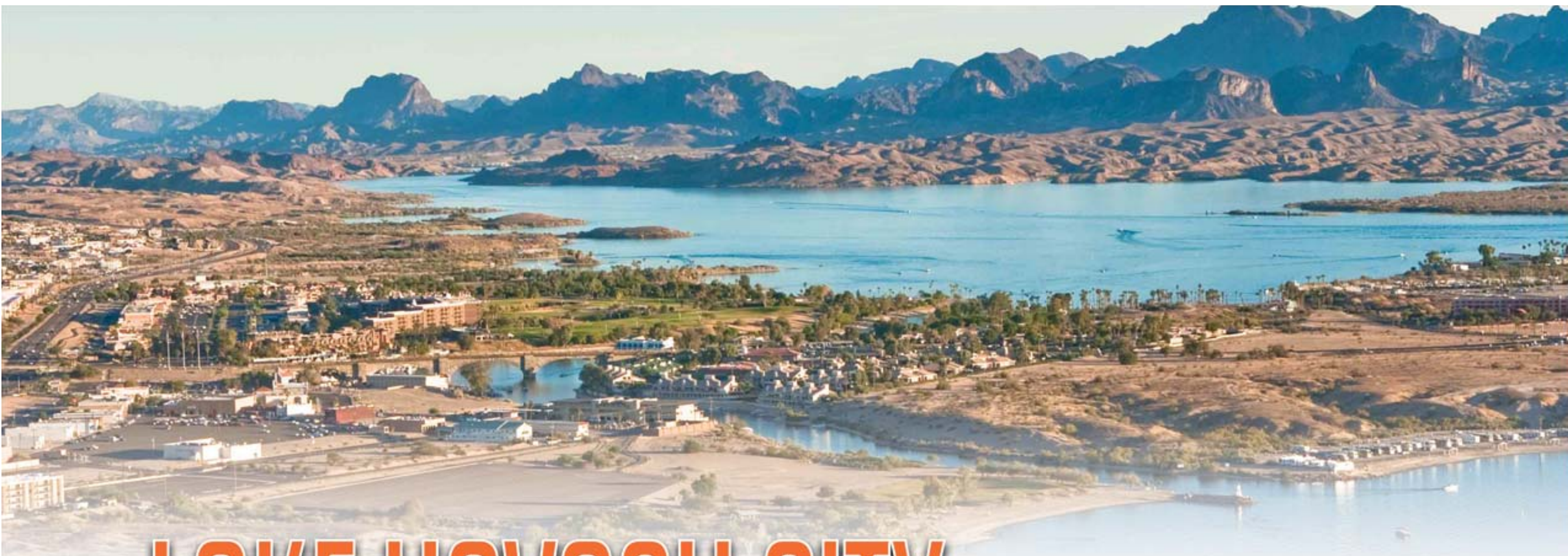
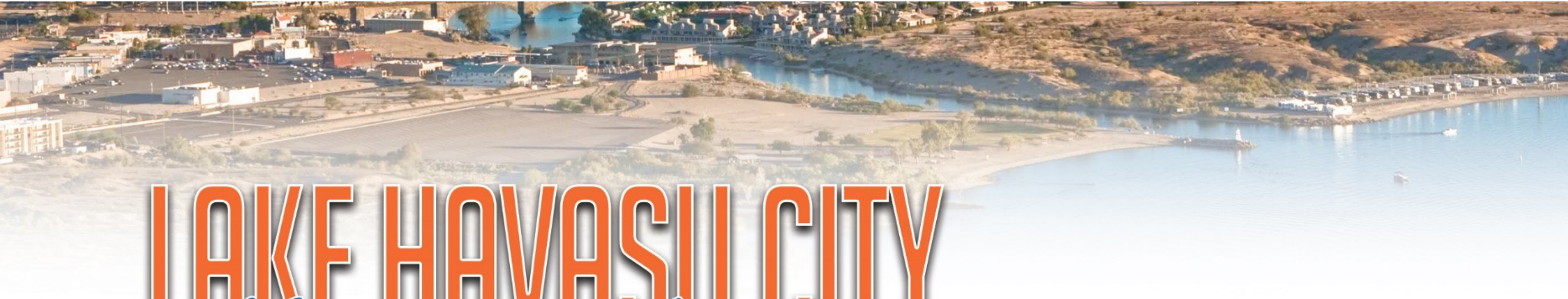


LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

CHAPTER FIVE

MASTER PLAN CONCEPT



LAKE HAVASU CITY Municipal Airport
AIRPORT MASTER PLAN

CHAPTER FIVE
MASTER PLAN CONCEPT

The process for the preparation of the master plan has included technical efforts in the previous chapters intended to establish the role of Lake Havasu City Municipal Airport, forecast potential aviation demand, establish airside and landside facility needs, and evaluate alternatives 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), a group comprised of stakeholders 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 scenarios for enhanced safety and development 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, as are recommended recycling, reuse, and waste reduction methods for the airport to consider.

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 development, 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 airport.

MASTER PLAN CONCEPT

Lake Havasu City Municipal Airport is a vital aviation asset, as evidenced by the role that the Federal Aviation Administration (FAA) assigns it. The airport is classified by the FAA as a "regional" general aviation facility and included in the *National Plan of Integrated Airport Systems* (NPIAS). As such, it serves as an important air transportation facility by connecting adjacent communities to regional and national markets. Regional airports have high levels of activity, ranging from small single engine aircraft to multi-engine jet aircraft operations. As previously detailed, Lake Havasu City Municipal Airport experiences a broad range of aviation operations and services and is currently home to 160 based aircraft. At the state level, the Arizona Department of Transportation – Aeronautics Group (ADOT) classifies Lake Havasu City Municipal Airport as a General Aviation – Community Airport.

The recommended master plan concept, as shown on **Exhibit 5A**, presents a long-term configuration for the airport, which preserves and enhances the role of the airport, while meeting FAA design and safety standards to the extent practicable. 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 facility needs beyond the 20-year planning period of this study. The recommended concept provides the ability to meet the needs of the various airport operators, including general aviation, air cargo, and other specialized aviation activities, such as potential commercial airline and air tour operations. The goal of this plan is to ensure the airport can continue to serve, and even improve, in its role of serving Lake Havasu City and surrounding region. A phased capital program to achieve the recommended master plan concept is presented in Chapter Six.

While the master plan concept makes recommendations for the future of Lake Havasu City Municipal Airport, it is important to continue to obtain local perspective and input on important development goals and objectives as the study process moves toward completion. The following sections describe the master plan concept in detail. When assessing future development potential, the plan has separated the airport into airside and landside functional areas.

AIRSIDE DEVELOPMENT CONCEPT

The airside development plan generally considers those improvements related to the runway and taxiway system and often requires the greatest commitment of land area to meet the necessary physical features and associated safety areas required to support flight operations. Lake Havasu Municipal Airport functions as a single-runway airfield, with Runway 14-32 measuring 8,001 feet by 100 feet. The airport currently serves approximately 45,000 aircraft operations per year. Operational activity is anticipated to grow through the 20-year planning horizon of this master plan, and the airport is projected to

Exhibit 5A
RECOMMENDED DESIGN CONCEPT

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continue to serve the full range of aircraft operations, including general aviation, air taxi, and military. The major airside issues addressed in the master plan concept include the following:

- Adhere to ultimate Runway Design Code (RDC) D-III standards on Runway 14-32;
- Improve safety area deficiencies related to ultimate RDC D-III that exist on Runway 14-32; in particular, the runway object free area (ROFA) north of the runway system;
- Pursue a Modification to Design Standards to allow for 340 feet of separation between Runway 14-32 and parallel Taxiway A (centerline to centerline);
- Eliminate direct access taxiways and acute-angled taxiway intersections in order to improve airfield geometry;
- Construct a holding bay adjacent to the south end of Taxiway A;
- Per FAA standards, relocate hold line markings on all taxiways associated with Runway 14-32 at 258 feet from the runway centerline;
- Acquire land beyond the south side of Runway 14-32 for approach/departure protection and positive control of safety areas;
- Provide enhanced instrument approach capabilities serving Runway 32;
- Upgrade airfield lighting with light emitting diode (LED) technology;
- Relocate the co-located windcone and segmented circle east of Runway 14-32 outside the ultimate ROFA; and
- Extend Taxiway C south for future aviation development.

RUNWAY DIMENSIONAL STANDARDS

The FAA has established design criteria to define the physical dimensions of runways and taxiways, as well as the imaginary surfaces surrounding them, to enhance the safe operation of aircraft at airports. These design standards also define the separation criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on the airport's critical design aircraft. The critical aircraft is the most demanding aircraft, or family of aircraft, which currently, or are projected to, conduct 500 or more operations (takeoffs and landings) per year at the 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). Analysis at the end of Chapter Two concluded that the current RDC for Runway 14-32 is B-II. Future planning considers an ultimate RDC of D-III for Runway 14-32.

Table 5A provides a summary of the RDC for Runway 14-32 based on 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 14-32, the RVR value of 4,000 indicates approach visibility minimums not lower than ¾-mile. As detailed in previous chapters, planning considers ultimate enhanced approach visibility minimums down to ¾-mile on Runway 32. Additional discussion related to instrument approach capabilities is undertaken later in this chapter.

TABLE 5A
Ultimate Runway Design Code
Lake Havasu City Municipal Airport

Runway	Planned Runway Design Code*
14-32	D-III-4000

* The ultimate ARC for Lake Havasu City Municipal Airport is D-III based upon the RDC designation for Runway 14-32.

RUNWAY SAFETY ENHANCEMENTS

The ultimate RDC D-III expands the runway object free area (ROFA) significantly from the current RDC B-II design parameters which, in turn, introduces incompatibilities north of the runway system. Approximately 0.74 acre of the ultimate ROFA extends beyond the existing airport property line. The property contained within the ROFA should be acquired outright by the airport; however, given the proximity of the ROFA to State Highway 95, an easement could be pursued to prevent any future incompatible land uses. The ultimate ROFA is also obstructed by sections of the airport's perimeter fencing. The fencing must also be relocated to satisfy the ultimate ROFA requirements.

Additionally, the current location of the airport's primary windcone/segmented circle introduces another incompatibility inside the ultimate RDC D-III ROFA. The master plan concept proposes the relocation of the windcone/segmented circle east of its current location to remain clear of the ultimate ROFA.

APPROACH/DEPARTURE PROTECTION AND INSTRUMENT APPROACHES

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. As depicted on **Exhibit 5A**, portions of the ultimate approach RPZ associated with Runway 14 extend beyond airport property and encompass approximately 6.68 acres of land, primarily associated with State Highway 95. Relocating the highway and acquiring the uncontrolled RPZ through fee simple property acquisition would be the preferred option to mitigate the ultimate RPZ incompatibility; however, it would be a costly endeavor to relocate the highway.

As detailed in Chapter Four, since RPZ guidance addresses new or modified RPZs, existing incompatibilities may be grandfathered under certain conditions. The placement of State Highway 95 could be considered acceptable due to its existence prior to updated RPZ standards that were published in 2012, and given the fact that the currently approved Airport Layout Plan (ALP) depicts RPZ dimensions that are the same as those associated with the ultimate RDC D-III RPZ standards. Similarly, on the south side of the runway, a proposed ¾-mile instrument approach planned for Runway 32 enlarges the approach RPZ serving this runway and, in doing so, encompasses a portion of Whelan Drive. The master plan concept considers the relocation of a portion of Whelan Drive outside the ultimate RPZ and acquiring 1.08 acres of land to gain full control of the RPZ.

Airport officials and Lake Havasu City 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.

AIRFIELD GEOMETRY ENHANCEMENTS

A safety project involving improvements to airfield geometry at Lake Havasu City Municipal Airport is recommended that involves removing the acute-angled taxiways (Taxiways A2 and A3), which are not necessary for capacity and 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 elimination of the existing Taxiways A2 and A3 between parallel Taxiway A and Runway 14-32 and replaces/relocates them with one connector taxiway aligned at a 90-degree connection to the runway.

Farther north along the runway, Taxiways A4 and A5 are shown to be eliminated and replaced by a single 90-degree connector taxiway (designated Taxiway A3). As a result of these taxiway geometry enhancements, safety is increased by elimination of the acute-angled taxiways and the direct access from various apron areas to Runway 14-32, while providing an adequate number of entrance/exit taxiways and reducing the total number of taxiway connectors that must be maintained. It should be noted that the changes to the connector taxiway system detailed above are to be included in an upcoming rehabilitation project associated with Taxiway A.

HOLDING BAY

The implementation of a taxiway holding bay is included on the master plan concept. Chapter Four outlined updated guidance that the FAA has adopted since the previous master plan with regards to the configuration of holding areas associated with runway ends. As detailed on **Exhibit 5A**, a holding bay that meets FAA-recommended guidance is planned at the south end of Taxiway A near the Runway 32 threshold. The holding bay would provide the ability for aircraft to perform engine run-up procedures, while allowing aircraft to bypass each other, if necessary.

It should be noted that there is no change proposed to the existing hold apron on the north end of Taxiway A that serves Runway 14. It was determined that the required depth of the holding bays in this area would interfere with the location of State Highway 95 and other landside development. As such, the existing hold apron serving the north end of Runway 14-32 is being carried forward in the master plan concept.

HOLD LINE MARKINGS

In order to meet ultimate RDC D-III standards, hold line markings on taxiways associated with Runway 14-32 should be relocated from 250 feet to 258 feet from the runway centerline to account for the airport's elevation above mean sea level. The distance is increased by one foot for every 100 feet above mean sea level (MSL). Lake Havasu City Municipal Airport is situated at 783 feet MSL.

TAXIWAY C EXTENSION

The extension of Taxiway C to the south is intended to provide access to additional landside development areas adjacent to the southwest of Runway 14-32. As shown on **Exhibit 5A**, this taxiway extension would allow for aviation development in the form of a dedicated cargo apron, additional aircraft storage hangars, and/or a host of other aviation-related businesses or services as demand would dictate. It is important to note that the proposed extension of Taxiway C does extend beyond the airport's current property line. Therefore, the airport would need to acquire property adjacent to the southwest side of the airport to allow for the extension as planned. Further details regarding landside development and property acquisition associated with the extension of Taxiway C are detailed later in this chapter.

AIRFIELD LIGHTING

As detailed in Chapter Four, future planning will consider replacing the existing incandescent airfield lighting and signage with light emitting diode (LED) technology. This would help to lower energy consumption by providing a more efficient and longer lasting airfield electrical system. It is important to note that an Energy Audit Report being conducted for the airport as part of this study process (see Appendix C), also recommends the implementation of LED technology on the airfield system.

In addition, medium intensity taxiway lighting (MITL) should be considered for all existing and proposed taxiways. If MITL is not installed, elevated edge reflectors should be utilized.

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 benefit the economic well-being of the regional area. The primary goal of landside facility planning is to provide adequate 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 Lake Havasu City Municipal Airport.

There are numerous facility layout concepts that could be considered. Several potential layouts were presented in the previous chapter that could support hangar development and placement of aviation support facilities. The master plan concept provides an approach to the layout of proposed landside facilities which attempts to maximize potential aviation development space on the airfield. Focus is given to designate areas for future executive and conventional hangar development as the airport is experiencing greater levels of demand for aviation activities associated with these types of facilities; however, hangar development associated with smaller general aviation aircraft storage (T-hangars and linear box hangars) is also proposed. The major landside issues addressed in the master plan concept include the following:

- Expansion of the existing terminal facility to accommodate potential future commercial passenger service as demand dictates;
- Create additional apron west of Taxiway C to encourage private development of conventional hangars for large aircraft storage;
- Extend Taxiway C and construct additional access taxilanes in the southwest quadrant of the airport to allow aircraft access to future aviation-related development areas;
- Identify areas suitable for additional aircraft storage hangars around existing infrastructure;
- Designate aviation development that can accommodate a range of general aviation infrastructure and activities in currently vacant parcels on the airport;
- Acquire land and extend utility infrastructure for future landside development areas;
- Develop additional vehicle parking areas;
- Create a designated air cargo operations apron;
- Construct a dedicated airport maintenance facility and aircraft wash rack; and
- Designate potential non-aviation development areas on airport property to further enhance airport revenues.

It is important to note, while airfield elements, such as safety areas, must meet design standards associated with the applicable RDC, landside elements can be designed to accommodate specific categories of aircraft. For example, an airside taxiway must meet taxiway object free area (TOFA) for all aircraft types using the taxiway, while the taxilane to a T-hangar area only needs to meet width standards for smaller single and multi-engine piston aircraft expected to utilize the taxilane.

AVIATION DEVELOPMENT POTENTIAL

The master plan concept depicts future landside development potential on vacant land in the southwest area of the airport, as well as on and adjacent to existing apron areas north of the terminal building. As illustrated on **Exhibit 5A**, several areas are highlighted for future aviation development, as demand would dictate, that could accommodate aircraft storage hangars, additional aircraft parking apron space, and other specialty aviation support services. As previously detailed, proposed hangar development takes the form of many hangar types that can accommodate the full array of general aviation activities, ranging from private aircraft storage to large-scale aircraft service operations.

Chapter Three outlined over 160,000 square feet of additional hangar space that could be needed through the long-term planning period based upon the aviation demand forecasts. The proposed hangar development set aside in the master plan concept exceeds the amount of space needed for hangar development; therefore, the layout presented can represent a vision for the airport that extends beyond the scope of this study.

As previously detailed, the recommended landside development plan only serves as a guide for the airport which will aid Lake Havasu City in the strategic planning of airport property moving forward. These proposed development areas can be reconfigured as necessary to meet future demand and development needs.

Aircraft Hangar Development

The recommended master plan concept depicted on **Exhibit 5A** proposes the location of certain hangar types by following the philosophy of separation of activity levels as discussed in Chapter Four. The plan depicts hangar development items that include the following:

- Construction of a T-hangar/shade hangar complex and the extension of an existing shade hangar on the main aircraft parking apron for private aircraft storage
- Development of additional apron space west of Taxiway C to allow for the development of nine 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).
- The construction of a taxiway/taxilane system west of Taxiway C would provide access to additional aviation development potential.
- Southwest of Taxiway C, 37 executive box hangars and 10 T-hangar/linear box hangar complexes are depicted for private aircraft storage and would serve primarily low activity levels.
- Extension of Taxiway C to the south would also provide space for an additional high activity apron on which six large clear-span conventional hangars are depicted.

It is important to note that these plans exceed the 20-year projected needs and represent the ultimate build-out of the airport. The layout provided exceeds the amount of hangar space needed throughout the long-term planning period based upon the aviation demand forecast. Therefore, the hangar layout presented can represent a vision for the airport that extends beyond the scope of this study. As such, this layout can be utilized as justification to reserve dedicated areas for development of certain hangar types in the future.

Additionally, there are three areas designated as future aviation reserve/support. These areas are accessible or can be made accessible to the airside facilities and, as such, should remain dedicated aviation use property. One parcel consisting of 5.6 acres is located adjacent to Whelan Drive in the southwest development area and another 3.3-acre parcel is adjacent to the north ramp apron. Finally, a 1.2-acre parcel is located west of the private aircraft storage area and it is currently where the inactive fuel farm exists. The City plans to remove the fuel farm to allow for future aviation-related development in that area.

POTENTIAL COMMERCIAL PASSENGER TERMINAL FACILITY EXPANSION

Lake Havasu City Municipal Airport has a terminal building that measures approximately 5,700 square feet and was originally designed for commercial passenger service. Because scheduled passenger service is not currently available at the airport, the terminal building now serves airport administrative offices, rental car activities, and provides space for a pilot lounge for airport users. Should commercial passenger service at the airport be restored, analysis in Chapter Three indicated that the terminal may require expansion to meet the needs of commercial passenger operations. For planning purposes, an enplanement forecast was developed to plan for the return of commercial passenger service. The analysis called for up to 21,000 square feet of terminal infrastructure needed in order to accommodate 35,000 passenger enplanements per year. As such, a terminal expansion would be necessary to provide areas for ticketing, security, baggage claim, and secure passenger hold rooms to accommodate these commercial passenger needs. As a result, a terminal expansion has been depicted on the master plan concept and would only be needed in the event the airport is to experience commercial passenger service activities.

Exhibit 5A also depicts an area west of the airport terminal vehicle parking area that is vacant and currently being used as an overflow parking area. This area is reserved for future terminal vehicle parking in the event that commercial passenger service returns to Lake Havasu City Municipal Airport.

GENERAL AVIATION PARKING

The master plan concept provides additional vehicle parking for general aviation users adjacent to the intersection of Aviator Drive and Whelan Drive. The 2,000-square-yard gravel area is currently being utilized as overflow parking for various activities on the airport.

AIRPORT MAINTENANCE FACILITY

The plan calls for the construction of a dedicated airport maintenance facility to be constructed adjacent to the west side of Taxiway C in the southwest development area. The building is granted direct access to the airfield and the facility would be used to accommodate the storage of airport vehicles, equipment, and supplies that are currently being stored either outdoors or in various storage facilities on the airfield.

AIRCRAFT WASH RACK

An aircraft wash rack is also depicted west of Taxiway C. An aircraft wash rack would ensure that the harmful chemicals that are often contained in cleaning products are disposed of properly and Lake Havasu City Municipal Airport remains in compliance with federal and state environmental requirements.

AIR CARGO SUPPORT APRON

Air cargo operations are an important component of the airport's activity. As such, a dedicated air cargo support apron is provided to separate these types of operations involving turboprop aircraft from general aviation activities. Air cargo operations are currently being conducted on the main aircraft parking apron, which could create a safety hazard to general aviation pilots, passengers, aircraft, or vehicles also utilizing the ramp apron. The relocation of the cargo area will be dependent upon the extension of Taxiway C and would be provided vehicle access via Whelan Drive.

HELICOPTER HARD STANDS

Helicopter operations are frequent at Lake Havasu City Municipal Airport. Currently, helicopters are operating on the main aircraft parking apron along with fixed wing aircraft. Ideally, segregation of these types of activities could be provided to enhance overall airfield safety and efficiency. As such, three dedicated helicopter hard stands are planned adjacent to Taxiway C. The airport also serves military helicopters, which typically utilize the marked helicopter parking areas on the terminal apron.

LAND ACQUISITION

Several land acquisition parcels are depicted on the recommended master plan concept. As previously discussed, a 0.74-acre parcel and 1.08-acre parcel associated with meeting ultimate RDC D-III design standards on the airfield system are highlighted for acquisition.

As previously outlined in Chapter Two, Lake Havasu City Municipal Airport is well-positioned to experience growth in aviation demand. The aviation demand forecasts project the airport to realize increases in based aircraft and annual aircraft operations and continue to support the full array of general aviation activities. In order to allow the airport to realize these future demands, Lake Havasu City should consider the acquisition of land to increase the footprint of airport and provide space for landside development in the future. **Exhibit 5A** calls for the acquisition of approximately 24.7 acres of land adjacent to the southwest side of the airport. Extending Taxiway C farther south would provide access to this property. In addition, Whelan Drive would need to be relocated to allow proper aircraft access to this parcel of land.

NON-AVIATION RELATED REVENUE SUPPORT

Exhibit 5A also details portions of property on the airport that can potentially be utilized for non-aviation development. The proposed non-aviation land use areas consider access to existing roadway infrastructure and account for land that is not readily granted access to the airfield system for aviation use. The areas highlighted on the west side of the airport consist of three individual parcels totaling approximately 11.2 acres. It is important that any future non-aviation development is compatible with airport activities. This could entail commercial, industrial, and business park activities that would support existing land uses in proximity to the airport, such as what is occurring south and west of the airport.

It should be noted that this study does not provide any clearance for any potential non-aviation parcels. Lake Havasu City must obtain specific approval from the FAA for such uses of airport property. A detailed description of the steps that must be taken to allow non-aviation uses on airport property were outlined in Chapter Four.

ENVIRONMENTAL OVERVIEW

An analysis of potential environmental impacts associated with proposed airport projects is an essential consideration in the master plan process. The primary purpose of this discussion is to review the proposed master plan concept and associated capital program at the airport to determine whether the projects identified in the master plan could, individually or collectively, significantly impact existing environmental resources. The information contained in this section was obtained from previous studies, official internet websites, and analysis by the consultant.

Construction of any and all improvements depicted on the ALP will require compliance with the *National Environmental Policy Act* (NEPA) *of 1969*, as amended. This includes privately funded projects and those projects receiving federal funding. For projects not categorically excluded under FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). In instances where significant environmental impacts are expected, as determined by the FAA, an Environmental Impact Statement (EIS) may be required. While this portion of the master plan is not designed to satisfy the NEPA requirements, it provides a preliminary review of environmental issues that may need to be considered in more detail within the environmental review processes. It is important to note that the FAA is ultimately responsible for determining the level of environmental documentation required for airport actions.

The environmental inventory included in Chapter One provides baseline information about the airport environs. This section provides an overview of the potential impacts on existing resources that could result from the implementation of the planned improvements outlined in the master plan.

POTENTIAL ENVIRONMENTAL CONCERNS

Table 5B summarizes potential environmental concerns associated with the implementation of the recommended master plan development concept for Lake Havasu City Municipal Airport. Analysis under NEPA includes direct, indirect, and cumulative impacts. Direct impacts are caused by the action and occur at the same time and place (see 40 Code of Federal Regulations [CFR] § 1508.8[a]). Examples of direct impacts include:

- Construction of a facility or runway in a wetland which results in the loss of a portion of the wetland; or
- Noise generated by the proposed action or alternative(s) which adversely affects noise-sensitive land uses.

Indirect impacts are caused by an action, although are later in time or farther removed in distance and are reasonably foreseeable (see 40 CFR § 1508.8[b]). Indirect impacts may include growth-inducing impacts and other effects related to induced changes in the pattern of land use, population density or growth rate, and related impacts on air and water and other natural systems, including ecosystems (see 40 CFR § 1508.8[b]).

Cumulative impacts are those that take into consideration the environmental impact of past, present, and future actions. Cumulative impacts will vary based on the project type, geographic location, potential to impact resources, and other factors, such as the current condition of potentially affected impact categories.

TABLE 5B
Summary of Potential Environmental Concerns
Lake Havasu City Municipal Airport

Environmental Impact Category	FAA Order 1050.1F 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.**	**Potential Impact.** The projected increase in operations over the 20-year planning horizon of the master plan would result in additional emissions. Mohave County currently meets federal criteria pollutant standards, except PM_{10}. The county was previously a moderate nonattainment area for PM_{10} and was designated as a maintenance area in 2001. An air quality analysis during the NEPA process to determine if PM_{10} emissions exceed the *de minimis* thresholds established by the NAAQS may be required. For all other construction emissions, a qualitative or quantitative emissions inventory under NEPA may be required, depending on the type of environmental review needed for development projects outlined in the master plan and on the associated ALP.
Biological Resources	**Threshold: The U.S. Fish and Wildlife Service (USFWS) 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:* **Potential Impact.** According to the USFWS Information for Planning and Consulting (IPaC) system, there are seven endangered or threatened species identified with the potential to occur within the vicinity of the airport: ▪ California least tern (endangered, bird) ▪ Southwestern willow flycatcher (endangered, bird) ▪ Yellow-billed cuckoo (threatened, bird) ▪ Yuma clapper rail (endangered, bird) ▪ Northern Mexican garter snake (threatened, reptile) ▪ Bonytail chub (endangered, fish) ▪ Razorback sucker (endangered, fish) It is possible any of the avian species listed above or the northern Mexican garter snake could be present at the airport and impacts to these species should be assessed prior to proposed actions and may require consultation with the USFWS. It is unlikely any aquatic species will be present at the airport; however, indirect impacts from construction or increased runoff from the airport due to additional impervious surfaces from project implementation may need to be assessed. *For designated critical habitat:* **Potential Impact.** There are no areas of critical habitat within the areas proposed for development in the master plan.

		However, critical habitat was identified for the bonytail chub within the Colorado River. Ephemeral washes located on airport property ultimately drain to the Colorado River. Implementing projects proposed in the master plan concept could affect the ephemeral washes, and, thereby, potentially impact the river's critical habitat. Since proposed development could potentially affect habitat, impacts must be assessed prior to land disturbances for proposed airport projects and may require consultation with the USFWS. *For non-listed species:* **Potential Impact.** Non-listed species of concern include those protected by the *Migratory Bird Treaty Act*. There are presently 14 non-listed species of concern that could be impacted by activities at the airport. Habitat to support breeding for these species may be near the site; therefore, the potential for impacts to migratory birds should be evaluated on a project-specific basis. In December 2018, SWCA Environmental Consultants, Inc. (SWCA) conducted a field survey of the airport and identified the possible presence of the Clark's grebe, due to the bird's year-round breeding season. Pre-construction nesting surveys may be required prior to the implementation of projects outlined in the master plan.
Coastal Resources	FAA has not established a significant threshold for Coastal Resources. Factors to consider are if an action would have the potential to: ▪ Be inconsistent with the relevant state coastal zone management plan(s); ▪ Impact a coastal barrier resources system unit; ▪ Pose an impact on coral reef ecosystems; ▪ Cause an unacceptable risk to human safety or property; or ▪ Cause adverse impacts on the coastal environment that cannot be satisfactorily mitigated.	**No Impact.** The airport is not located within a designated Coastal Zone.
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.	**Potential Impact.** An increase in greenhouse gas (GHG) emissions could occur over the 20-year planning horizon of the master plan. Prior to implementation, a project-specific analysis may be required per the FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, based on the parameters of the individual projects.
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**	**No Impact.** The Havasu Wilderness Area and the Havasu National Wildlife Refuge are located less than two miles west of the airport and are considered Section 4(f) resources. Proposed improvements would not result in a physical use of these

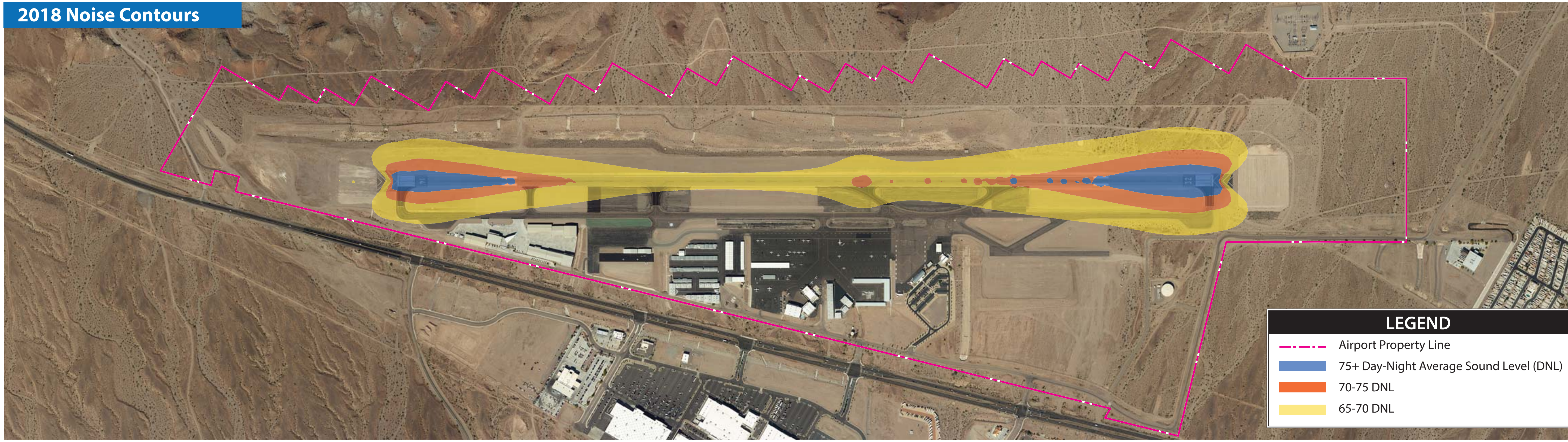
	Section 4(f) resource. Resources that are protected by Section 4(f) are publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; and publicly or privately owned land from an historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.	resources. It is unlikely airport activities would result in the constructive use of Section 4(f) resources, as these resources are one mile or more from the airport and not expected to result in substantial impairment. During the preparation of NEPA documentation, the FAA would be responsible for consulting all appropriate federal, state, and local officials having jurisdiction over the affected Section 4(f) resource to determine whether impacts will substantially impair the resource. If necessary, the Section 4(f) compliance process can involve the preparation of a Section 4(f) statement, which evaluates other feasible alternatives.
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).) FPPA applies when airport activities meet the following conditions: ▪ Federal funds are involved; ▪ The action involves the potential for the irreversible conversion of important farmlands to non-agricultural uses. Important farmlands include pastureland, cropland, and forest considered to be prime, unique, or statewide or locally important land; or ▪ None of the exemptions to FPPA apply. These exemptions include: o When land is not considered "farmland" under FPPA, such as land already developed or already irreversibly converted. These instances include when land is designated as an urban area by the U.S. Census Bureau or the existing footprint includes rights-of-way. o When land is already committed to urban development. o When land is committed to water storage. o The construction of non-farm structures necessary to support farming operations. o The construction/land development for national defense purposes.	**No Impact.** Soils at the airport are not classified as farmland by the NRCS.

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 consider 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.	**Potential Impact.** The airport has a fuel farm and provides aircraft maintenance activities that could involve fossil fuels or other types of hazardous materials or wastes; these operations are regulated and monitored by the appropriate regulatory agencies, such as the U.S. EPA, the Arizona Department of Environmental Quality (ADEQ), and Mohave County. The recommended development concept does not anticipate land uses that would produce an appreciable difference in quantity or type of hazardous waste. However, should this type of land use be proposed, further NEPA review and/or permitting would be required. According to the U.S. EPA *EJSCREEN*, there are no known hazardous materials or waste contamination sites currently on airport property. Since land acquisition for the RPZs is proposed in the master plan, an Environmental Due Diligence Audit (EDDA) is required as part of the procurement process. Per Order 1050.19B, *Environmental Due Diligence Audits in the Conduct of FAA Real Property Transactions*, the airport is responsible in executing a Phase I EDDA prior to the acquisition of real property.
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).	**Potential Impact.** The airport is located within the vicinity of the Chemehuevi Reservation. However, as noted in Chapter One, a multi-day field archaeological survey was conducted by SWCA in December 2018 for the entire 590 acres the airport owns. During that survey, SWCA did not identify artifacts on airport property that would be eligible for listing on the National Register of Historic Places (NRHP), including cultural artifacts that could be significant to the neighboring Chemehuevi Reservation. However, if any buried and/or previously unidentified cultural materials are encountered during the undertaking of any action proposed on the master plan, it is required that work cease immediately in that location and the Airport Sponsor is to notify the FAA and Arizona State Historic Preservation Office (SHPO) immediately to determine the appropriate course of action. If any findings are of Native American significance, coordination is undertaken by FAA as part of government-to-government consultation with federally recognized tribes, per Executive Order (E.O.) 13175, *Consultation and Coordination with Indian Tribal Governments*.

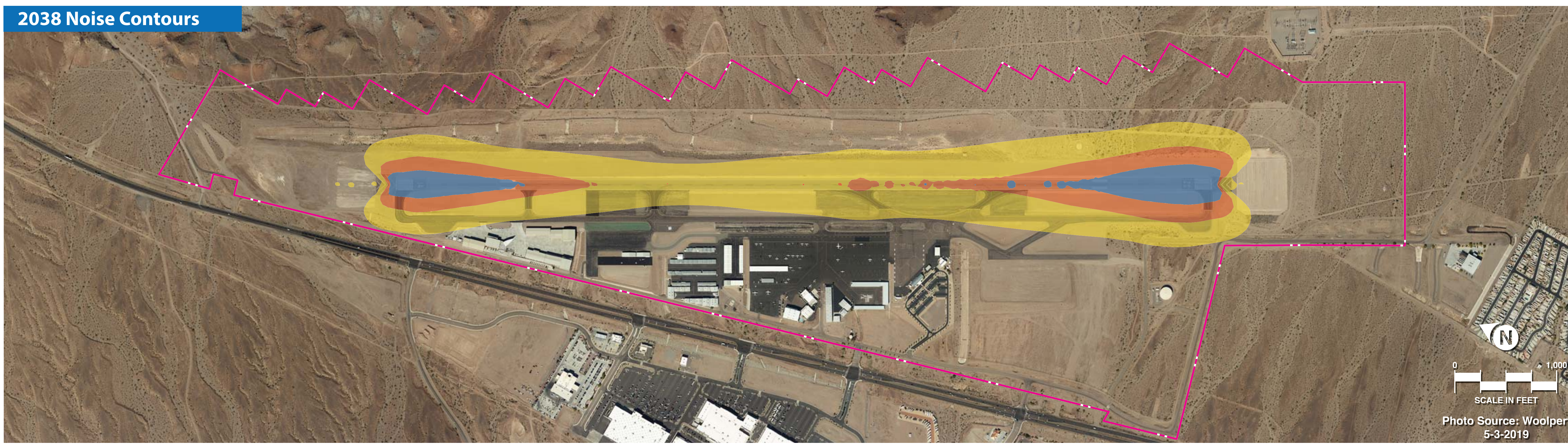
Land Use	FAA has not established a significance threshold for Land Use. There are also no specific independent factors to consider. The determination that significant impacts exist is normally dependent on the significance of other impacts.	**Potential Impact.** The proposed development concept plan includes land or easement acquisition to accommodate currently uncontrolled safety areas both north and south of Runway 14-32. South of Runway 14-32, approximately 1.08 acres is currently identified as an uncontrolled safety area and proposed for acquisition. North of the airport, there is an approximate 6.68 acres of uncontrolled safety area, which includes State Highway 95. The master plan concept recommends the relocation of State Highway 95, and coordination with the Arizona Department of Transportation, Mohave County, and Lake Havasu City may be required. The master plan also recommends the acquisition of approximately 24.7 acres south of the airport and east of State Highway 95 for future aviation reserve use. Currently, this area is undeveloped.
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 significance of noise impacts on noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in Title 14 CFR Part 150 are not relevant to the value, significance, and enjoyment of the area in question.	**No Impact. Exhibit 5B** highlights both the 2018 and 2038 noise contours for Lake Havasu City Municipal Airport. As depicted in the top panel on the exhibit, existing conditions for the DNL 65 dB noise exposure level remains on airport property and close to the runway. As shown in the 2038 condition (bottom panel of **Exhibit 5B**), the DNL 65 dB noise exposure contour expands around the runway as a result of anticipated growth; however, the DNL 65 dB contour remains on airport property. It is important to note that operational growth, unless tied to a specific project, will not result in noise impacts under FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. Impacts to noise-sensitive land uses are only identified through NEPA documentation for specific projects or through the voluntary Part 150 process.
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;	**Potential Impact.** The proposed development on airport property could potentially encourage economic growth for the region. Results include new construction jobs, new jobs for the airport and other commercial uses, new housing, and increases to the local tax base. While the master plan proposes the acquisition of approximately 24.7 acres south of the airport for future aviation reserve use, no residential or business uses are located within this acquisition area.

	▪ 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.	New non-aviation revenue support proposed on the master plan could change the level of service to roads leading to and within the airport along State Highway 95. The long-term changes to the level of service are determined by the type of use proposed, and it may be necessary to perform a traffic study to ensure service is either not substantially impacted or mitigation measures are addressed. In the short-term during construction, there would be temporary disruptions to surface traffic patterns.
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 a way that FAA determines is unique to the environmental justice population and significant to that population.	**Potential Impact.** Both low-income and minority populations have been identified in the vicinity of the airport. E.O. 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 the 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. Environmental justice impacts may be avoided or minimized through early and consistent communication with the public and allowing ample time for public consideration. If disproportionately high or adverse impacts are noted, mitigation and enhancement measures and offsetting benefits can be taken into consideration.
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.	**Potential Impact.** The airport is bounded by undeveloped land and State Highway 95, which is a divided highway and could act as a man-made barrier from existing residential land uses west of the highway. No residential land uses are adjacent to the airport. The closest school to the airport is over one mile south of the airport boundary. However, just south of the airport is a recreational vehicle (RV) park, located within an industrially zoned district. The RV park caters to both short- and long-term RV parking rentals, which can include families with children. Therefore, best management practices (BMPs) should be implemented to decrease environmental health risks to children. Construction sites can be considered an attractive nuisance and can be appealing to children as a place to play. During the construction of the projects outlined in the master plan, appropriate measures should be taken to prevent access by unauthorized persons and children to restricted project areas.

2018 Noise Contours



2038 Noise Contours



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<table>
<tr><th colspan="3">Visual Effects</th></tr>
<tr><td>Light Emissions</td><td>The FAA has not established a significant 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 resource.</td><td>No Impact. New lighting associated with the recommended master plan development concept would remain on the airfield and other developed portions of the airport. Proposed lighting would most likely be associated with new development, such as wall pack lighting on new hangars and edge lighting for relocated taxiways. It is unlikely that surrounding uses would be impacted by new lighting, as environs immediately around the airport are undeveloped, with the closest residential uses west of State Highway 95.</td></tr>
<tr><td>Visual Resources/ Visual Character</td><td>FAA has not established a significance threshold for Visual Resources or Character. However, a factor to consider is the extent an action would have on 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
▪ Block or obstruct the views of the visual resources, including whether these resources would still be viewable from other locations.</td><td>Potential Impact. The development proposed in the recommended concept plan could change the overall visual character of the airport with additional roads and structures planned on-site. New development could change the character of the area, contrasting with the visual character from the nearby mountains.

Potential effects could be minimized by preserving as much natural vegetation as possible and integrating development into existing natural surroundings.</td></tr>
<tr><th colspan="3">Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)</th></tr>
<tr><td>Wetlands</td><td>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.</td><td>Potential Impact. Drainages/ephemeral washes have been identified as wetlands on airport property, although this information is based on aerial photography interpretation from 1981. Field surveys and wetland delineations may be required to determine the presence or absence of wetlands in project areas. Project areas at the southern extent of the airport could impact these ephemeral washes.

Disturbance to wetlands may require a Section 404 permit under the Clean Water Act, which regulates the discharge of dredged or fill material into waters of the United States, including wetlands.</td></tr>
</table>

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.***	**Potential Impact.** The 100-year floodplain has been identified on a significant portion of airport property adjacent to and on the airport crossing Runway 14-32 at both the northern and southern extent of the property. Proposed landside projects identified on the master plan concept, such as new hangars, apron, wash rack, non-aviation revenue land use, and the acquisition of 24.7 acres will occur within the floodplain. If airport activities occur in a special flood hazard area, coordination with the Mohave County Floodplain Administrator is required to determine if permits are needed.
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: ▪ 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 impact when obtaining a permit or authorization.	**Potential Impact.** The airport is located within the Lower Colorado River basin watershed. Most likely, runoff from the airport will flow in a westerly manner towards the Colorado River through drainages/ephemeral washes located on airport property. Stormwater pollutants are a source of potential adverse effects to endangered species living in the Colorado River and the Havasu National Wildlife Refuge. Lake Havasu City manages airport stormwater discharges with an Arizona Pollutant Discharge Elimination System (AZPDES) issued and regulated by the ADEQ. Improvements to the airport will require a revised permit to be issued addressing operational and structural source controls, treatment with best management practices (BMPs), and sediment and erosion control. An AZPDES General Construction permit would be required for all projects involving ground disturbance over one acre. FAA's Advisory Circular (AC) 150/5370-10G, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control*, should also be implemented during construction projects at the airport.

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.** 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.	**No Impact.** Proposed projects would not substantially change the amount of water used by the airport. Additionally, the airport property does not serve as a significant source of groundwater recharge and is not located near a sole source aquifer.
Wild and Scenic Rivers	FAA has not established a significance threshold for Wild and Scenic Rivers. Factors to consider are when an action would have an adverse impact on the values for which a river was designated (or considered for designation) through: ▪ Destroying or altering a river's free-flowing nature; ▪ A direct and adverse effect on the values for which a river was designated (or under study for designation); ▪ Introducing a visual, audible, or other type of intrusion that is out of character with the river or would alter outstanding features of the river's setting; ▪ Causing the river's water quality to deteriorate; ▪ Allowing the transfer or sale of property interests without restrictions needed to protect the river or the river corridor; or ▪ Any of the above impacts preventing a river on the Nationwide Rivers Inventory (NRI) or a Section 5(d) river that is not included in the NRI from being included in the Wild and Scenic River System or causing a downgrade in its classification (e.g., from wild to recreational).	**No Impact.** The nearest designated Wild and Scenic river segment, the Amargosa River, is over 100 miles from the airport. It is unlikely that proposed projects on the master plan concept will have adverse effects on the river's outstandingly remarkable values (i.e., scenery, recreation, geology, fish, wildlife, and history).
Source: Coffman Associates analysis		

AIRPORT RECYCLING, REUSE, and WASTE REDUCTION

The *FAA Modernization and Reform Act of 2012* (FMRA), which amended Title 49, United States Code (USC), included several changes to the Airport Improvement Program (AIP). Two of these changes are related to recycling, reuse, and waste reduction at airports.

- Section 132(b) of FMRA expanded the definition of airport planning to include "developing a plan for recycling and minimizing the generation of airport solid waste, consistent with applicable state and local recycling laws, including the cost of a waste audit."
- Section 133 of FMRA added a provision requiring airports that have prepared or plan to prepare a master plan, and that receive AIP funding for an eligible project, to ensure that the new or updated master plan addresses issues relating to solid waste recycling at the airport, including:

    - The feasibility of solid waste recycling at the airport;
    - Minimizing the generation of solid waste at the airport;
    - Operation and maintenance requirements;
    - A review of waste management contracts; and
    - The potential for cost savings or the generation of revenue.

Typically, an airport sponsor has purview over waste handling services in facilities it owns and operates, such as the terminal building, ARFF station, and maintenance facilities. Tenants of airport-owned buildings/hangars or tenants that own their own facilities are typically responsible for coordinating their own waste handling services. While the focus of this plan is on airport-operated facilities, the airport should work to incorporate facility-wide strategies that create consistency in waste disposal mechanisms. This would ultimately result in the reduction of materials sent to the landfill.

Understanding the waste stream for Lake Havasu City Municipal Airport requires an understanding of the types of waste typically generated at airports. Generally, airport waste can be divided into eight categories:[1]

- **Municipal Solid Waste** (MSW) – more commonly known as trash or garbage – consists of everyday items that are used and then discarded, like product packaging.
- **Construction and Demolition Waste (**C&D) is considered non-hazardous trash resulting from land clearing, excavation, demolition, renovation or repair of structures, roads and utilities, including concrete, wood, metals, drywall, carpet, plastic, pipe, cardboard, and salvaged building components. C&D is also generally labeled as MSW.
- **Green Waste** is yard waste consisting of tree, shrub, and grass clippings, leaves, weeds, small branches, seeds, and pods.
- **Food Waste** includes unconsumed food products or waste generated and discarded during food preparation. MSW is also considered.

[1] *Recycling, Reuse and Waste Reduction at Airports*, FAA (April 24, 2013)

- **Deplaned Waste** is waste removed from passenger aircraft. Deplaned waste includes bottles, cans, newspapers, mixed paper (napkins or paper towels), plastic cups, service ware, food waste, and food-soiled paper/packaging. Deplaned waste can represent as much as 20 percent of an airport's total MSW stream.
- **Lavatory Waste** is a special waste that is emptied through a hose and pumped into a lavatory service vehicle. The waste is then transported to a triturator[2] facility for pretreatment prior to discharge in the sanitary sewage system. Due to the chemicals in lavatory waste, it can present environmental and human health risks if mishandled. Caution must be taken to ensure lavatory waste is not released to the public sanitary sewerage system prior to pretreatment.
- **Spill Cleanup and Remediation Wastes** are also special wastes and are generated during cleanup of spills and/or the remediation of contamination from several types of sites on an airport.
- **Hazardous Wastes** are governed by the *Resource Conservation and Recovery Act* (RCRA), as well as the regulations in 40 Code of Federal Regulations (CFR) Subtitle C, Parts 260 to 270. The United States (U.S.) Environmental Protection Agency (EPA) developed less stringent regulations for certain hazardous waste, known as universal waste, described in 40 CFR Part 237 – *Standards for Universal Waste Management*.

As seen on **Exhibit 5C**, there are seven potential areas of the airport contributing to the waste stream, including terminal, airfield, restaurant, aircraft maintenance hangars, aircraft, offices, and airport construction projects. To create a comprehensive waste reduction and recycling plan for Lake Havasu City Airport, all potential inputs must be considered.

EXISTING SERVICES

Currently, airport administration and the maintenance lead oversee waste management for Lake Havasu Municipal Airport. Solid waste services are provided by Republic Services. MSW dumpsters are located adjacent to the fire station, Gate 1, the central ramp, and airfield restrooms. Additionally, a roll-off container is available for large waste and tailings, located southwest of Taxiway C. No information is available regarding the weight of MSW hauled or the cost of service, and dumpsters are emptied once a week on Thursdays. However, the dumpster for Hangar 24 Brewery and Grill restaurant is emptied twice a week.

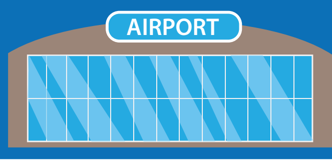
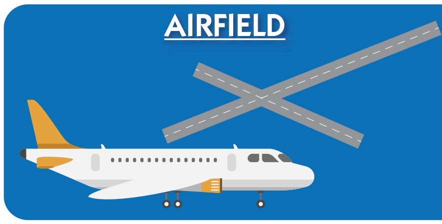
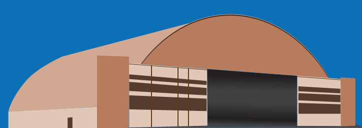
At this time, there is no formal recycling program at Lake Havasu City Municipal Airport. Airport tenants are responsible for setting up individual recycling services if they choose.

SOLID WASTE MANAGEMENT SYSTEM

Waste management services at Lake Havasu City Municipal Airport are currently managed independently by various tenants in what is known as a *decentralized* waste management system. To maximize waste management and recycling efforts, the airport should actively engage tenants by

[2] A triturator facility turns lavatory waste into fine particulates for further processing.

AIRPORT WASTE STREAMS AT LAKE HAVASU CITY MUNICIPAL AIRPORT

AIRPORT AREA	POTENTIAL INPUTS	POTENTIAL OUTPUTS
TERMINAL 	Passengers Employees	Food Waste, Paper Plastic, Aluminum Cans Trash, Green Waste Deplaned Waste
AIRFIELD 	Aircraft Operations	Runway Rubber Green Waste
HANGARS 	Goods Movements	Plastic Wood Vehicle Waste (Tires & Fluids)
AIRCRAFT 	Aircraft Ground Support Equipment (GSE)	Vehicle Waste Plastic Wastewater Hazmat
AIRPORT CONSTRUCTION 	Construction Re-Construction Demolition	Reused Concrete Reused Asphalt Vehicle Waste Soils, Building Materials Wood, General Waste
ADMINISTRATIVE OFFICES 	Employees	Food Waste Paper, Plastic Aluminum Cans Trash, Cardboard
RESTAURANT 	Passengers Employees	Food Waste Paper, Plastic Aluminum Cans, Grease & Oil, Cardboard, Green Waste

Source: Recycling, Reuse, and Waste Reduction at Airports, FAA (April 24, 2013) transitioning to a *centralized* waste management system. **Exhibit 5D** summarizes the differences between these two styles.

The centralized system is advantageous in that it has fewer participants involved in the overall management of the solid waste and recycling efforts. This management style allows greater control by the airport over the type, placement, and maintenance of compactors and dumpsters; saves space; and eliminates the need for each tenant to have their own separate containers. Centralized waste management systems provide greater opportunity for participation from airport tenants who may not be incentivized to recycle on their own. A centralized strategy can be inefficient for some airports as it requires more effort and oversight on the part of airport management. Ultimately, a centralized waste management system will streamline waste and recycling collection, maximizing the opportunity to reduce waste generation and increase the diversion of recyclables.

RECYCLING GOALS

Some steps can be taken to initiate a recycling program since the airport currently does not participate in one. First and foremost, it is important to get the buy-in from tenants to ensure the effort is a success. Such activities can include:

- Make recycling a part of everyday business. Airport administration can provide training, education, and support to personnel, tenants, and others who conduct business at the airport. In-person meetings with airport tenants should be held to create a mutual understanding of the airport's solid waste and recycling goals and how tenants play a vital role in the airport's overall success.
- Establish consistent internal procedures to ensure there are no unacceptable items contaminating recycling containers or recyclables thrown in the trash. Clearly marked signage of what can and cannot be accepted placed near the solid waste and recycling containers is a significant act of a consistent, effective recycling system. Items accepted for recycling are depicted in **Exhibit 5E**.

A second step in initiating a recycling program is to conduct a waste audit, which is the most comprehensive and intensive way to assess the airport's waste stream composition and capture of recyclables, as well as to identify further opportunities for waste reduction. This will ensure that waste and recycling containers are right-sized for the existing operation, as well as having a collection schedule that picks up only when the containers are full.

Finally, the implementation of an effective program requires accurate data of current local waste and recycling cost rates. Since waste collection and recycling services are exclusively provided by Republic Service in Lake Havasu City, the airport could track recycling cost rates and waste quantities to identify the most beneficial service available. Quantitative data can be measured from available information provided by the airport and the Republic Services, such as:

COMPONENTS OF AN AIRPORT WASTE MANAGEMENT SYSTEM

DECENTRALIZED

Airport Tenants

- Tenants & Restaurant
- ↓
- Janitorial Service
- ↓
- Waste and Recycling Receptacles
- Waste/ Recycling Removal Contracts

Airport Management

- Airport Management Offices | Public Terminal
- ↓ ↓
- Janitorial Service
- ↓
- Waste and Recycling Receptacles
- Waste/Recycling Removal Contracts

CENTRALIZED

Airport Management

- Tenants & Restaurant | Airport Management Offices | Public Terminal
- ↓ ↓ ↓
- Janitorial Service | Janitorial Service
- ↓ ↓
- Shared Waste and Recycling Receptacles
- Single waste removal and recycling contract with the airport management. The cost is either factored into the airport lease fees, or billed separately, like a utility.

Source: Natural Resources Defense Council, Trash Landings: How Airlines and Airports Can Clean Up Their Recycling Programs, December 2006.

Recycle Right

talogs direct mail coupons STATIONERY notebooks
hredded paper phone books paperback books
COLA BOTTLES detergent bottles yogurt containers
ION VIALS picnic cups milk jugs GLASS *wine bottles*

ALLOWABLE RECYCLABLES

PAPER

- Newspaper
- Phone books
- Envelopes
- Junk mail
- Brochures
- Magazines

ALUMINUM/METAL RECYLCING

- Aluminum beverage cans
- Food cans
- Scrap metal

CARDBOARD RECYCLING

- Ream wrappers
- File folders
- Poster board
- Frozen food boxes
- Cardboard boxes
- Milk Cartons

PLASTIC RECYCLING

- Water bottles
- Take-out containers
- Soda bottles

GLASS RECYCLING

Varies by location

- Beverage containers
- Glass food jars

OTHER ITEMS

ITEMS REQUIRING SPECIAL HANDLING

These items should never be mixed with regular recycling. Disposal requires special handling.

- Incandescent light bulbs
- Fluorescent tubes
- Computers & Electronics
- Needles or syringes
- Hazardous waste
- Toxic material containers
- Paint
- Yard waste (Green Waste)

NON-RECYCLABLE ITEMS

- Aerosol cans
- Aluminum foil
- Batteries
- Clothing
- Food waste
- Napkins
- Mirrors
- Ceramic
- Plastic bags
- Shredded paper
- Stickers/Address labels
- Tissue
- Styrofoam
- Paper towels
- Glass windows
- Pyrex

Source: Republic Services (2019)

Examination of Records

- Waste hauling and disposal records
- Supply and equipment invoices
- Other waste management costs (commodity rebates, container costs, etc.)

Facility Walk-Through

- Qualitative waste information
- Understanding waste pickup and hauling practices

Waste Audit

- Collection and analysis of the types of waste produced

While the airport may or may not incorporate a recycling program, other sustainable opportunities are available to reduce MSW. **Table 5C** outlines objectives that could help reduce waste generation at the airport. To increase the effectiveness of tracking progress at the airport, a baseline state of all suggested metrics should be established to provide a comparison over time.

TABLE 5C
Waste Management and Recycling Goals
Lake Havasu City Municipal Airport

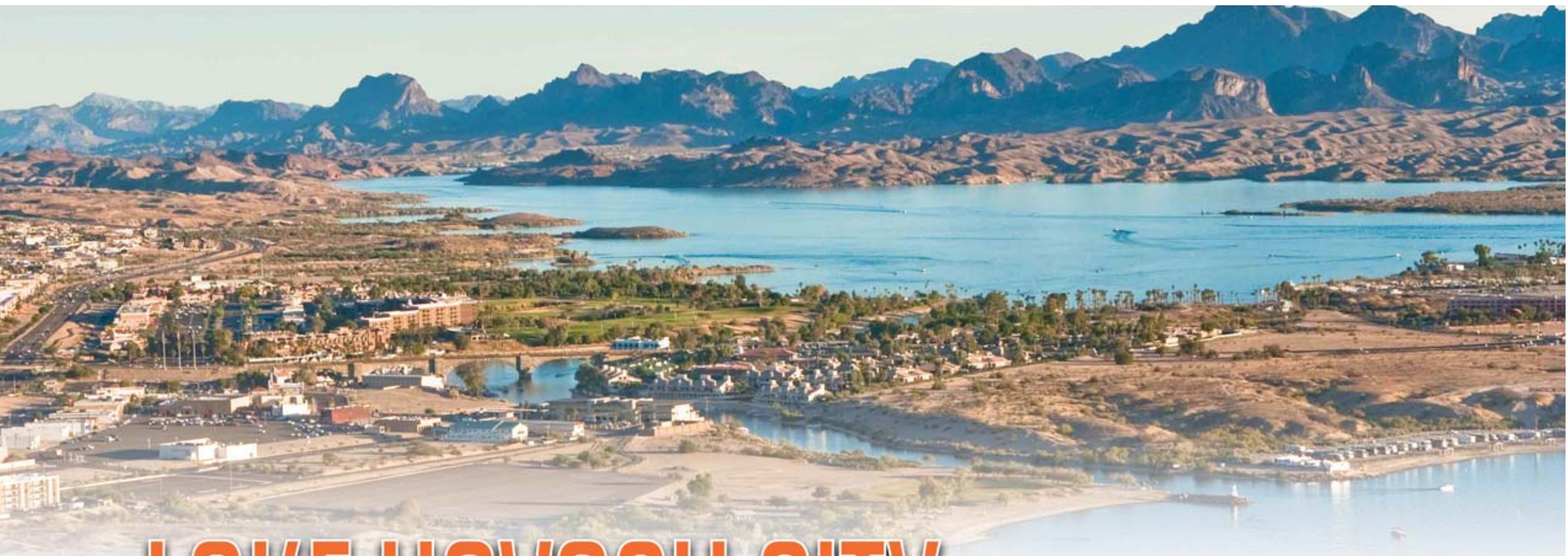
Goals	Objectives
Reduce the amount of solid waste generated	Switch to online bill pay to eliminate monthly paper bills
	Conduct a waste audit to identify the most common types of waste
	Eliminate the purchase of items that are not recyclable (i.e., Styrofoam, plastic bags)
	Make electronic files, not paper files, when possible
	Set copiers and printers to print on both sides of paper by default
	Reduce the amount of "junk mail" received
Reuse of materials or equipment	Offer reusable dishes to employees
	Reuse of cardboard boxes
	Reuse of construction materials
Increase the amount of material recycled	Improve waste tracking and data management
	Incorporate recycling requirements and/or recommendations into tenant lease agreements
	Expand recycling marketing and promotion efforts throughout public areas
	Require contractors to implement strategies to reduce, reuse, and recycle construction and demolition waste

Source: Coffman Associates

MASTER PLAN CONCEPT SUMMARY

This chapter has been prepared to help Lake Havasu City plan for the future growth and development of Lake Havasu City Municipal Airport by describing the master plan concept and detailing the environmental conditions that must be taken into consideration when implementing the development plan. The master plan concept represents an airfield facility that fulfills the needs of the community, while conforming to safety and design standards to the extent practicable. It also provides a landside development concept that can be developed over time as demand dictates. Further refinements can be made pending comments from the PAC, Lake Havasu City, and the general public.

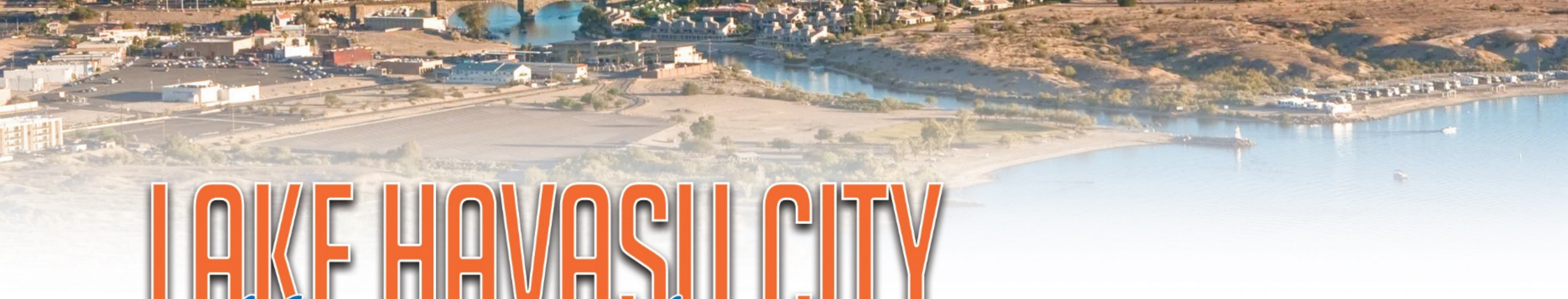
Flexibility is important when planning future development at an airport, as activity may not occur as predicted. The master plan concept provides airport stakeholders with a guide to help maintain the long-term viability of the airport. The next chapter of the master plan will consider strategies for funding the recommended improvements and provide a reasonable schedule for improvement projects based upon airport safety priorities and operational demand over the course of the 20-year planning period.



LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

CHAPTER SIX
CAPITAL PROGRAM



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

CHAPTER SIX
CAPITAL PROGRAM

The analyses completed in previous chapters evaluated development needs at Lake Havasu City Municipal 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 two sections. First, the airport's CIP and associated cost estimates are presented in narrative and graphic form. The CIP has been developed following Federal Aviation Administration (FAA) guidelines for master plans and primarily identifies those projects that are likely eligible for FAA and Arizona Department of Transportation – Aeronautics Group (ADOT) grant funding. Second, capital improvement funding sources on the federal, state, and local levels are identified and discussed.

AIRPORT CAPITAL IMPROVEMENT PROGRAM

With the recommended master plan concept and specific needs and improvements for the airport having been established, the next step is to determine a realistic schedule for project implementation as well as the associated costs for the plan. The capital program considers the interrelationships among the projects in order to determine an appropriate sequence of projects, while remaining within reasonable fiscal constraints. The CIP, programmed by planning horizons, has been developed to cover the short- (years 1-5), intermediate- (years 6-10), and long-term (years 11-20) planning horizons. By utilizing planning horizons instead of specific years, Lake Havasu City will have greater flexibility to adjust capital needs as demand dictates. **Table 6A** summarizes the key aviation demand milestones projected at Lake Havasu City Municipal Airport for each of the three planning horizons.

TABLE 6A
Planning Horizon Activity Levels
Lake Havasu City Municipal Airport

	Base Year	Short Term	Intermediate Term	Long Term
BASED AIRCRAFT				
Single Engine Piston	124	130	136	144
Multi Engine Piston	9	8	7	6
Turboprop	5	8	10	15
Jet	7	9	11	16
Helicopter	5	7	9	11
Other	10	10	10	10
TOTAL BASED AIRCRAFT	**160**	**172**	**183**	**202**
ANNUAL OPERATIONS				
Itinerant				
General Aviation	21,950	24,600	27,500	31,900
Air Taxi	1,700	1,800	2,000	2,200
Military	350	400	400	400
Total Itinerant	**24,000**	**26,800**	**29,900**	**34,500**
Local				
General Aviation	21,000	23,600	26,500	30,700
Total Local	**21,000**	**23,600**	**26,500**	**30,700**
TOTAL OPERATIONS	**45,000**	**50,400**	**56,400**	**65,200**

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, many of which have been previously defined by airport management. 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 these demand indicators. For example, the plan includes construction of new taxilanes that could serve landside development to support aircraft activity. Based aircraft will be a primary indicator for these projects. If based aircraft growth occurs as projected, additional hangars should be constructed to meet the demand, in which case taxilane access to these hangars could be necessary. If growth slows or does not occur as forecast, some projects may be delayed. As a result, capital expenditures are planned to be made on an as-needed basis, leading to more 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 most 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 (2019) 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 Lake Havasu City Municipal 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 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 the airport. The remaining amount (8.94 percent) would be equally shared (4.47 percent) between ADOT and Lake

Havasu City. 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, many of the 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. 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. In this case, ADOT would provide 90 percent of the total project cost and the remaining amount (10 percent) would be the responsibility of the airport sponsor.

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. Nevertheless, 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. 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 Lake Havasu City Municipal 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 Lake Havasu City Municipal 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

Term	Fiscal Year	Project Number and Description*		Project Cost	FAA Share	ADOT Share	AIRPORT/ LOCAL Share
Short Term Projects	2020	1	Design - Taxiway A Reconstruction Project (including removal and replacement of existing connector Taxiways A2,A3, and A4)	$406,000	$369,704	$18,148	$18,148
		2	Design and Construct - Remove Inactive Fuel Farm	$180,000	$0	$0	$180,000
		3	Design and Construct - Remove and Replace Soil Cement on North Ramp Apron (28,000 SY)	$500,000	$0	$450,000	$50,000
			2020 Total	*$1,086,000*	*$369,704*	*$468,148*	*$248,148*
	2021	4	Construct -Taxiway A Reconstruction Project (including removal and replacement of existing connector Taxiways A2, A3, and A4)	$3,700,000	$3,369,220	$165,390	$165,390
		5	Design - Runway 14-32 Strengthening and Overlay (8,000' x 100')	$250,000	$227,650	$11,175	$11,175
		6	Design and Construct - Removal of Existing Hydrants and Replace with Flush Mounted Hydrants (6 Hydrants Adjacent to Taxiway B)	$450,000	$0	$405,000	$45,000
			2021 Total	*$4,400,000*	*$3,596,870*	*$581,565*	*$221,565*
	2022	7	Design and Construct - Replacement of PAPI-4 on Runway 32 and REILS on each end of Runway 14-32 and Implement LED Technology on all Airfield Lighting and Signage.	$715,000	$651,079	$31,961	$31,961
			2022 Total	*$715,000*	*$651,079*	*$31,961*	*$31,961*
	2023	8	Construct - Runway 14-32 Strengthening and Overlay (8,000' x 100')	$6,500,000	$5,918,900	$290,550	$290,550
		9	Design and Construct - Replacement of Airfield Signage (Runway Distance Remaining Markers)	$120,000	$0	$108,000	$12,000
			2023 Total	*$6,620,000*	*$5,918,900*	*$398,550*	*$302,550*
	2024	10	Design and Construct - Airfield Hazard Markings in Aircraft Operations Areas	$143,000	$130,216	$6,392	$6,392
		11	Design - Main Aircraft Parking Apron Reconstruction (approximately 105,000 SY)	$350,000	$0	$315,000	$35,000
		12	Construct - Shade Hangar Extension and Add Shade Hangar or T-Hangar Complex to Main Aircraft Parking Apron**	$1,450,000	$0	$0	$1,450,000
			2024 Total	*$1,943,000*	*$130,216*	*$321,392*	*$1,491,392*
	2025	13	Design and Construct - Terminal Apron Pavement Reconstruction (approximately 32,000 SY)	$2,500,000	$2,276,500	$111,750	$111,750
		14	Construct - Main Aircraft Parking Apron Reconstruction - Phase 1 (approximately 50,000 SY)	$2,100,000	$0	$1,890,000	$210,000
			2025 Total	*$4,600,000*	*$2,276,500*	*$2,001,750*	*$321,750*
			SHORT TERM PROGRAM TOTAL	**$19,364,000**	**$12,943,268**	**$3,803,366**	**$2,617,366**
Intermediate Term Projects	6-10 years	1	Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Intermediate Term Program***	$150,000	$136,590	$6,705	$6,705
		2	Construct Main Aircraft Parking Apron Reconstruction - Phase 2 (approximately 55,000 SY)	$2,310,000	$2,103,486	$103,257	$103,257
		3	Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 1	$904,000	$710,682	$40,409	$152,909
		4	Construct Holding Bay Adjacent to South End of Taxiway A	$780,000	$710,268	$34,866	$34,866
		5	Construct Helicopter Hardstands East of Taxiway C	$589,000	$536,343	$26,328	$26,328
		6	Construct Aircraft Parking Apron Adjacent to Taxiway C for Future Aviation Development	$1,733,000	$1,578,070	$77,465	$77,465
		7	Construct Dedicated Airport Maintenance Building	$544,000	$0	$0	$544,000
		8	Construct General Aviation Vehicle Parking Area at Intersection of Aviator Drive and Whelan Drive	$83,000	$75,580	$3,710	$3,710

Term	Fiscal Year	Project Number and Description*		Project Cost	FAA Share	ADOT Share	AIRPORT/ LOCAL Share
Intermediate Term Projects	6-10 years	9	Construct Connector Taxiway Between Taxiway A and Taxiway C (325' x 50')	$369,000	$336,011	$16,494	$16,494
		10	Construct Taxiway Network Extending West of Taxiway C to Serve Future Aviation Development (1250' x 35') and (1,400' x 35')	$1,222,000	$1,112,753	$54,623	$54,623
		11	Construct Extension of Taxiway C - Phase 1 (600' x 50') and taxiway extending west from Taxiway C for Future Aviation Development	$554,000	$504,472	$24,764	$24,764
		12	Construct Air Cargo Support Apron and Vehicle Access Road	$462,000	$420,697	$20,651	$20,651
		13	Construct Terminal Expansion (as necessary for commercial passenger service)	$2,262,000	$2,059,777	$101,111	$101,111
		14	Construct Aircraft Wash Rack and Associated Apron Area	$363,000	$330,548	$16,226	$16,226
		15	Relocate Hold Line Markings to 258' to Meet RDC D-III Design Standards	$25,000	$22,765	$1,118	$1,118
		16	Relocate Segmented Circle and Co-located Windcone East of the Ultimate ROFA	$50,000	$45,530	$2,235	$2,235
		17	Acquire Property Interest within Ultimate RDC D-III ROFA (0.74 acres) and RPZ (6.68 acres) North of Runway 14-32 and Relocate Perimeter Fencing	$601,000	$547,271	$26,865	$26,865
		18	General Airfield Pavement Maintenance	$500,000	$455,300	$22,350	$22,350
			INTERMEDIATE TERM PROGRAM TOTAL	**$13,501,000**	**$11,686,144**	**$579,178**	**$1,235,678**
Long Term Projects	11-20 years	1	Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Long Term Program***	$1,000,000	$910,600	$44,700	$44,700
		2	Construct Terminal Vehicle Parking Area Expansion (as necessary for commercial passenger service)	$261,000	$237,667	$11,667	$11,667
		3	Acquire Property Interest (1.08 acres) for Runway 32 Enhanced Approach Protection	$92,500	$84,231	$4,135	$4,135
		4	Redirect Whelan Drive for Approach Protection and Airfield Safety	$496,000	$451,658	$22,171	$22,171
		5	Potential Relocation Highway 95 to Accommodate Ultimate RPZ and ROFA Associated with RDC D-III Design Standards for Runway 14-32 (further coordination with FAA and ADOT)	$3,770,000	$3,432,962	$168,519	$168,519
		6	Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 2	$515,000	$356,459	$23,021	$135,521
		7	Acquire Property Interest (24.7 acres) Southwest of the Airport for Future Airport Development	$2,368,000	$2,156,301	$105,850	$105,850
		8	Redirect Whelan Drive for Future Landside Development Potential	$391,000	$356,045	$17,478	$17,478
		9	Construct Extension of Taxiway C - Phase 2 (850' x 50')	$867,000	$789,490	$38,755	$38,755
		10	General Airfield Pavement Maintenance	$1,000,000	$910,600	$44,700	$44,700
			LONG TERM PROGRAM TOTAL	**$10,760,500**	**$9,686,011**	**$480,994**	**$593,495**
			CAPITAL IMPROVEMENT PROGRAM TOTAL	**$43,625,500**	**$34,315,424**	**$4,863,538**	**$4,446,539**

*Project implementation is dependent on federal and state grant funding and availability. The CIP is based on FAA fiscal year programming.
**Hangar development is eligible for Non- Primary Entitlement (NPE) funds and would require the airport sponsor to set aside up to four years funding at 150,000 per year. For purposes of this study, it is assumed that NPE funds will be utilized for other airport projects.
***Actual costs would be determined on a per project basis throughout the course of the planning period.

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. These allocations are subject to change.

KEY

FAA	Federal Aviation Administration	**REIL**	Runway End Identification Light
ADOT	Arizona Department of Transportation	**MITL**	Medium Intensity Taxiway Lighting
CatEx	Categorical Exclusion	**LED**	Light Emitting Diode
EA	Environmental Assessment	**RDC**	Runway Design Code
ROFA	Runway Object Free Area	**PAPI**	Precision Approach Path Indicator
RPZ	Runway Protection Zone		

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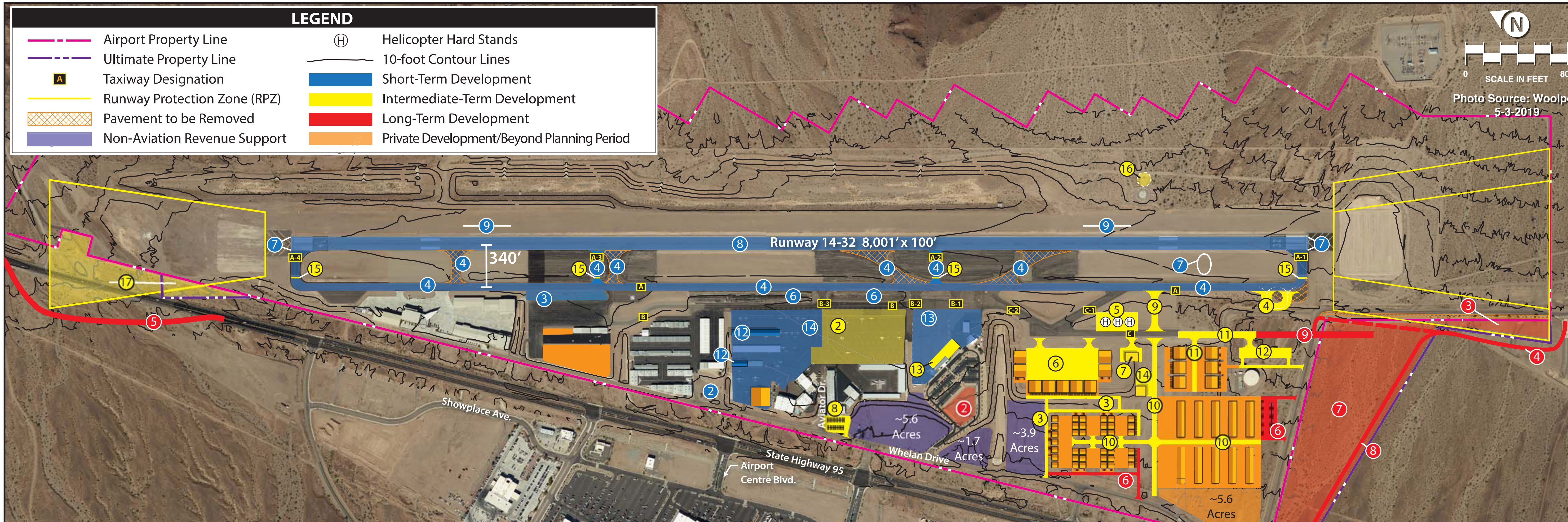

Short-Term Projects (1-5 years)

2020 (Current Year)

1. Design Taxiway A Reconstruction Project (including removal and replacement of existing connector Taxiways A2,A3, and A4) - Not Pictured
2. Removal of Inactive Fuel Farm
3. Remove and Replace Soil Cement on North Ramp Apron (28,000 SY)

2021

4. Construct Taxiway A Reconstruction Project (including removal and replacement of existing connector Taxiways A2, A3, and A4)
5. Design Runway 14-32 Strengthening and Overlay (8,000' x 100') - Not Pictured
6. Design and Construct Removal of Existing Hydrants and Replace with Flush Mounted Hydrants (6 Hydrants Adjacent to Taxiway B)

2022

7. Design and Construct Replacement of PAPI-4 on Runway 32 and REILS on each end of Runway 14-32 and Implement LED Technology on all Airfield Lighting and Signage

2023

8. Construct Runway 14-32 Strengthening and Overlay (8,000' x 100')
9. Design and Construct Replacement of Airfield Signage (Runway Distance Remaining Markers)

2024

10. Design and Construct Airfield Hazard Markings in Aircraft Operations Areas - Not Pictured
11. Design Main Aircraft Parking Apron Reconstruction (approximately 105,000 SY) - Not Pictured
12. Construct Shade Hangar Extension and Add Shade Hangar or T-Hangar Complex to Main Aircraft Parking Apron

2025

13. Design and Construct Terminal Apron Pavement Reconstruction (approximately 32,000 SY)
14. Construct Main Aircraft Parking Apron Reconstruction - Phase 1 (approximately 50,000 SY)

Intermediate-Term Projects (6-10 years)

1. Environmental Documentation (CatEx or EA) for Airside and Landside Improvements in Intermediate-Term Program - Not Pictured
2. Construct Main Aircraft Parking Apron Reconstruction - Phase 2 (approximately 55,000 SY)
3. Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 1
4. Construct Holding Bay Adjacent to South End of Taxiway A
5. Construct Helicopter Hardstands East of Taxiway C
6. Construct Aircraft Parking Apron Adjacent to Taxiway C for Future Aviation Development
7. Construct Dedicated Airport Maintenance Building
8. Construct General Aviation Vehicle Parking Area at Intersection of Aviator Drive and Whelan Drive
9. Construct Connector Taxiway Between Taxiway A and Taxiway C (325' x 50')
10. Construct Taxiway Network Extending West of Taxiway C to Serve Future Aviation Development
11. Construct Extension of Taxiway C - Phase 1 (600' x 50') and taxiway extending west from Taxiway C for Future Aviation Development
12. Construct Air Cargo Support Apron and Vehicle Access Road
13. Construct Terminal Expansion (as necessary for commercial passenger service)
14. Construct Aircraft Wash Rack and Associated Apron Area
15. Relocate Hold Line Markings to 258' to Meet RDC D-III Design Standards
16. Relocate Segmented Circle and Co-located Windcone East of the Ultimate ROFA
17. Acquire Property Interest within Ultimate RDC D-III ROFA (0.74 acres) and RPZ (6.68 acres) North of Runway 14-32 and Relocate Perimeter Fencing
18. General Airfield Pavement Maintenance - Not Pictured

Long-Term Projects (11-20 years)

1. Environmental Documentation (CatEx or EA) for Airside and Landside Improvements in Long-Term Program - Not Pictured
2. Construct Terminal Vehicle Parking Area Expansion (as necessary for commercial passenger service)
3. Acquire Property Interest (1.08 acres) for Runway 32 Enhanced Approach Protection
4. Redirect Whelan Drive for Approach Protection and Airfield Safety
5. Potential Relocation Highway 95 to Accommodate Ultimate RPZ and ROFA Associated with RDC D-III Design Standards for Runway 14-32 (Further Coordination with FAA and ADOT)
6. Construct Vehicle Access and Utility Infrastructure to Southwest Development Area -Phase 2
7. Acquire Property Interest (24.7 acres) Southwest of the Airport for Future Airport Development
8. Redirect Whelan Drive for Future Landside Development Potential
9. Construct Extension of Taxiway C - Phase 2 (850' x 50')
10. General Airfield Pavement Maintenance - Not Pictured

Exhibit 6B
CIP DEVELOPMENT STAGING

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enhancing terminal facilities. The short-term program considers 14 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: Design - Taxiway A Reconstruction Project

Description: This project includes engineering, design, and environmental documentation associated with the reconstruction of full-length parallel Taxiway A. This project also calls for the design of airfield geometry improvements. The design includes removal and replacement of existing Taxiways A2, A3, and A4 and replacement with fewer connector taxiways.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 2: Design and Construct - Remove Inactive Fuel Farm

Description: This project consists of the removal of the decommissioned fuel farm west of the private aircraft storage apron to allow for redevelopment of the area.
Funding Breakdown: FAA - 0 percent / ADOT - 0 percent / Airport-Local - 100 percent

Project # 3: Design and Construct - Remove and Replace Soil Cement Adjacent to North Ramp Apron

Description: The rehabilitation of soil cement adjacent to the north ramp apron consists of the removal and replacement of existing soil cement. This project is intended for soil stabilization and foreign object debris (FOD) reduction between Taxiway A and the north ramp apron.
Funding Breakdown: FAA - 0 percent / ADOT - 90 percent / Airport-Local - 10 percent

Project # 4: Construct - Taxiway A Reconstruction Project

Description: The reconstruction of Taxiway A, including removal and replacement of existing connector Taxiways A2, A3, and A4, and replace with fewer connector taxiways to better meet FAA geometry standards.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 5: Design - Runway 14-32 Strengthening and Overlay

Description: This project includes engineering, design, and environmental documentation associated with the strengthening and overlay of Runway 14-32 (8,001' x 100').
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 6: Design and Construct - Removal of Existing Hydrants and Replace with Flush-Mounted Hydrants (6 Hydrants Adjacent to Taxiway B)
Description: This project includes the engineering, design, environmental documentation, and construction of six flush-mounted hydrants adjacent to Taxiway B for airfield safety.
Funding Breakdown: FAA - 0 percent / ADOT - 90 percent / Airport-Local - 10 percent

Project # 7: Design and Construct - Replacement of PAPI-4 on Runway 32 and REILS on each end of Runway 14-32 and Implement LED Technology on all Airfield Lighting and Signage
Description: This project will replace precision approach path indicator (PAPI-4) and runway end identifier lights (REILs) and will retrofit all runway and taxiway lighting and signage with new fixtures to implement light emitting diode (LED) technology.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 8: Construct - Runway 14-32 Strengthening and Overlay
Description: This project rehabilitates and strengthens the runway to continue to support demand for the full array of aircraft that utilize the airport.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 9: Design and Construct - Replacement of Airfield Signage (Runway Distance Remaining Markers)
Description: The runway distance to-go markers are severely faded and beyond the useable service life and are programmed for replacement. Although eligible for FAA grant funding assistance, this project is currently programmed for state funding assistance only.
Funding Breakdown: FAA - 0 percent / ADOT - 90 percent / Airport-Local - 10 percent

Project # 10: Design and Construct - Airfield Hazard Markings in Aircraft Operations Areas
Description: This project is for design and construction of airfield hazard markings in aircraft operations areas (AOA). Paved shoulder areas must be marked in accordance with FAA safety standards.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 11: Design - Main Aircraft Parking Apron Reconstruction
Description: This project includes engineering, design, and environmental documentation associated with the reconstruction of the main aircraft parking apron. The apron pavement condition index (PCI) number is 46 (approximately 105,000 square yards). Although eligible for FAA grant funding assistance, this project is currently programmed for state funding assistance only.
Funding Breakdown: FAA - 0 percent / ADOT - 90 percent / Airport-Local - 10 percent

Project # 12: Construct - Shade Hangar Extension and Add Shade Hangar or T-Hangar Complex to Main Aircraft Parking Apron
Description: This project includes engineering, design, and environmental documentation associated with the construction of hangar complexes on the main aircraft parking apron. Although eligible for FAA grant funding assistance, this project is currently programmed for 100 percent local funding.
Funding Breakdown: FAA - 0 percent / ADOT - 0 percent / Airport-Local - 100 percent

Project # 13: Design and Construct - Terminal Apron Pavement Reconstruction

Description: This project focuses on design and reconstruction of the aircraft parking apron associated with the airport terminal area. Rehabilitation of the terminal apron is appropriate as the reported PCI of the apron is 47 (approximately 32,000 square yards).
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 14: Construct - Main Aircraft Parking Apron Reconstruction – Phase 1

Description: This is a reconstruction of approximately 50,000 square yards of the main aircraft parking apron. This portion of the project is phase 1 of 2. 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 $19.36 million as detailed on **Exhibit 6A**. Of this total, approximately $16.75 million is eligible for federal and state funding assistance. The remaining $2.62 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 6 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 18 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 Main Aircraft Parking Apron Reconstruction - Phase 2

Description: Reconstruction/rehabilitation of approximately 55,000 square yards of the main aircraft parking apron reconstruction project. This portion of the project is phase 2 of 2.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 3: Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 1

Description: This project provides utility infrastructure and vehicle access to the southwest development area for future aviation development potential. Utility infrastructure is not AIP-eligible; therefore, that portion of the project funding must be sourced locally. All other project funding is divided between federal/state/local as follows.

Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 4: Construct Holding Bay Adjacent to South End of Taxiway A

Description: For airfield safety, a redesigned holding bay is programmed at the south end of Taxiway A. The construction of this holding bay would provide the ability of aircraft to perform engine run-up procedures, while allowing aircraft to bypass each other, if necessary. This holding bay configuration adheres to FAA design for hold areas on an airfield.

Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 5: Construct Helicopter Hardstands East of Taxiway C

Description: This project programs the design and construction of three dedicated helicopter hardstands adjacent to Taxiway C. Segregation of fixed wing and helicopter operations provides enhanced overall airfield safety and efficiency.

Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 6: Construct Aircraft Parking Apron Adjacent to Taxiway C for Future Aviation Development

Description: This project creates additional aircraft parking apron west of Taxiway C for future aviation development of conventional hangars for large aircraft storage.

Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 7: Construct Airport Maintenance Building

Description: This project provides a dedicated airport maintenance facility adjacent to the west side of Taxiway C. This facility would be used to accommodate the storage of airport vehicles, equipment, and supplies.

Funding Breakdown: FAA - 0 percent / ADOT - 0 percent / Airport-Local - 100 percent

Project # 8: Construct General Aviation Vehicle Parking Area at Intersection of Aviator Drive and Whelan Drive

Description: This project provides vehicle parking for general aviation users adjacent to the intersection of Aviator Drive and Whelan Drive. The parking area will be approximately 2,000 square-yards.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 9: Construct Connector Taxiway Between Taxiway A and Taxiway C

Description: Constructing a 90-degree taxiway connector would allow large aircraft to transition between Taxiway A, Taxiway C, and the southwest development area more easily by eliminating the need to back-taxi using Taxiway C.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 10: Construct Taxiway Network Extending West of Taxiway C to Serve Future Aviation Development

Description: This project provides airfield access to the southwest development area to allow for future aviation development. Two intersecting taxiways are programmed: one east/west taxiway **(**1250' x 35') and one north/south taxiway (1,400' x 35').
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 11: Construct Extension of Taxiway C - Phase 1 (600' x 50') and taxiway extending west from Taxiway C for Future Aviation Development

Description: The extension of Taxiway C provides additional airfield access to airport property to allow for future development. An additional taxiway extending west from Taxiway C could be used for hangar development areas.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 12: Construct Air Cargo Support Apron and Vehicle Access Road

Description: The construction of a dedicated air cargo operations apron is programmed to separate air cargo activity from general aviation activity on the main aircraft parking apron.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 13: Construct Terminal Expansion

Description: A terminal building expansion to 21,000 square feet to accommodate scheduled commercial service operations of approximately 35,000 enplanements per year. This project is programmed “as necessary” for commercial passenger service.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 14: Construct Aircraft Wash Rack and Associated Apron Area
Description: An aircraft wash rack and its associated apron is programmed west of Taxiway C. The aircraft wash rack provides a safe disposal area for aircraft cleaning products.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 15: Relocate Hold Line Markings to 258' to Meet RDC D-III Design Standards
Description: Relocate the hold lines on all taxiways associated with Runway 14-32 to 258 feet in order to meet ultimate RDC D-III design standards.
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport-Local – 4.47 percent.

Project # 16: Relocate Segmented Circle and Co-located Windcone East of the Ultimate ROFA
Description: In an effort to enhance airfield safety, a relocated segmented circle is programmed approximately 150 feet east of the existing segmented circle/windcone to remain clear of the ultimate runway object free area (ROFA) surrounding Runway 14-32.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 17: Acquire Property Interest within Ultimate RDC D-III ROFA (0.74-acre) and RPZ (6.68 acres) North of Runway 14-32 and Relocate Perimeter Fencing
Description: This project calls for the purchase of land on the north side of Runway 14-32 that will allow the airport to own all safety areas and have easements over a large majority of the approach and departure runway protection zones (RPZs), which is highly recommended by the FAA. This project also relocates perimeter fencing to accommodate the ultimate ROFA.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 18: 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 $13.50 million as presented on **Exhibit 6A**. Of this total, approximately $12.27 million could be eligible for federal/state funding, and the local share is projected at $1.24 million.

LONG-TERM PROGRAM

The long-term planning horizon considers 10 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 Lake Havasu City should assess the need and timing for these projects based on actual demand and growth at Lake Havasu City Municipal 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: Construct Terminal Vehicle Parking Area Expansion

Description: This project expands terminal parking to include what is currently a grave areal west of the paved terminal parking area. This area is currently utilized as overflow parking. This project is programmed “as necessary” for commercial passenger service.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 3: Acquire Property Interest (1.08 acres) for Runway 32 Enhanced Approach Protection

Description: This land acquisition is programmed for approach protection and airfield safety associated with enhanced instrument approach capabilities on Runway 32.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 4: Redirect Whelan Drive for Approach Protection and Airfield Safety

Description: This project is also dependent on enhanced approach procedures on Runway 32. Whelan Drive would need to be relocated outside the ultimate RPZ for Runway 32.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 5: Potential Relocation of Highway 95 to Accommodate Ultimate RPZ and ROFA Associated with RDC D-III Design Standards for Runway 14-32 (further coordination with FAA and ADOT)

Description: The project for the relocation of Highway 95 would be an option for addressing incompatibilities that the highway presents to the RPZ. Redirecting the highway would require further coordination with FAA and ADOT.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 6: Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 2

Description: This project provides additional utility infrastructure and vehicle access to the southwest development area for future aviation development potential. Utility infrastructure is not AIP eligible; therefore, that portion of the project funding must be sourced locally. All other project funding is divided between federal/state/local as follows.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 7: Acquire Property Interest (24.7 acres) Southwest of the Airport for Future Airport Development

Description: This project calls for the acquisition of approximately 24.7 acres of land adjacent to the southwest side of the airport for future airport development.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 8: Redirect Whelan Drive for Future Landside Development Potential
Description: The redirection of Whelan Drive provides vehicle access for landside development southwest of the airport on the 24.7-acre parcel described in Project # 7.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 9: Construct Extension of Taxiway C - Phase 2 (850' x 50')
Description: Provided the CIP projects # 7 and # 8 are realized in the future, aviation access will need to be provided via Taxiway C. This project achieves that access by extending Taxiway C approximately 850'.
Funding Breakdown: FAA - 91.06 percent / ADOT - 4.47 percent / Airport-Local - 4.47 percent

Project # 10: 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 $10.76 million. Of the total long-term program projects detailed on **Exhibit 6A**, approximately $10.17 million is eligible for federal/state funding assistance. The airport's matching share is projected at $593,495 thousand.

CAPITAL IMPROVEMENT PROGRAM SUMMARY

The list of projects needed to accomplish the vision for Lake Havasu City Municipal 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 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 $43.63 million in airport development needs. Of this total, approximately $39.18 million could be eligible for federal/state funding assistance. The local funding estimate for the proposed CIP is approximately $4.45 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. Nevertheless, the CIP can serve as a road map of airport improvements to help guide Lake Havasu City, the FAA, and ADOT.

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
Lake Havasu City Municipal Airport

PROJECT DESCRIPTION		
SHORT-TERM PROGRAM (1-5 years)		**Initial NEPA Action**
1	Remove and Replace Soil Cement on North Ramp Apron (28,000 SY)	CatEx
2	Construct Taxiway A Reconstruction Project (including removal and replacement of existing connector Taxiways A2, A3, and A4)	CatEx
3	Design and Construct Removal of Existing Hydrants and Replace with Flush-Mounted Hydrants (6 Hydrants Adjacent to Taxiway B)	CatEx
4	Design and Construct Replacement of PAPI-4 on Runway 32 and REILS on each end of Runway 14-32	CatEx
5	Construct Runway 14-32 Strengthening and Overlay (8,000' x 100')	CatEx
6	Design and Construct Replacement of Airfield Signage (Runway Distance Remaining Markers)	CatEx
7	Design and Construct Airfield Hazard Markings in Aircraft Operations Areas	CatEx
8	Construct Shade Hangar Extension and Add Shade Hangar or T-Hangar Complex to Main Aircraft Parking Apron	CatEx
9	Design and Construct Terminal Apron Pavement Reconstruction (approximately 32,000 SY)	CatEx
10	Construct Main Aircraft Parking Apron Reconstruction - Phase 1 (approximately 50,000 SY)	CatEx
INTERMEDIATE-TERM PROGRAM (6-10)		
1	Construct Main Aircraft Parking Apron Reconstruction - Phase 2 (approximately 55,000 SY)	CatEx
2	Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 1	CatEx
3	Construct Holding Bay Adjacent to South End of Taxiway A	CatEx
4	Construct Helicopter Hardstands East of Taxiway C	CatEx

TABLE 6B (Continued)		
5	Construct Aircraft Parking Apron Adjacent to Taxiway C for Future Aviation Development	CatEx
6	Construct Dedicated Airport Maintenance Building	CatEx
7	Construct General Aviation Vehicle Parking Area at Intersection of Aviator Drive and Whelan Drive	CatEx
8	Construct Connector Taxiway Between Taxiway A and Taxiway C (325' x 50')	CatEx
9	Construct Taxiway Network Extending West of Taxiway C to Serve Future Aviation Development (1250' x 35') and (1,400' x 35')	CatEx
10	Construct Extension of Taxiway C - Phase 1 (600' x 50') and Taxiway Extending West from Taxiway C for Future Aviation Development	CatEx
11	Construct Air Cargo Support Apron and Vehicle Access Road	CatEx
12	Construct Terminal Expansion (as necessary for commercial passenger service)	CatEx
13	Construct Aircraft Wash Rack and Associated Apron Area	CatEx
14	Relocate Hold Line Markings to 258' to Meet RDC D-III Design Standards	CatEx
15	Relocate Segmented Circle and Co-located Windcone East of the Ultimate ROFA	CatEx
16	Acquire Property Interest (0.74-acre) within Ultimate RDC D-III ROFA North of Runway 14-32 and Relocate Perimeter Fencing	CatEx
LONG-TERM PROGRAM (11-20)		
1	Acquire Property Interest (1.08 acres) for Runway 32 Enhanced Approach Protection	CatEx
2	Redirect Whelan Drive for Approach Protection and Airfield Safety	CatEx
3	Potential Relocation Highway 95 to Accommodate Ultimate RPZ and ROFA Associated with RDC D-III Design Standards for Runway 14-32 (Further Coordination with FAA and ADOT)	EA
4	Construct Vehicle Access and Utility Infrastructure to Southwest Development Area - Phase 2	CatEx
5	Acquire Property Interest (24.7 acres) Southwest of the Airport for Future Airport Development	EA
6	Redirect Whelan Drive for Future Landside Development Potential	EA
7	Construct Extension of Taxiway C - Phase 2 (850' x 50')	EA

KEY
CatEx- Categorical Exclusion
EA- Environmental Assessment

CAPITAL IMPROVEMENT FUNDING SOURCES

There are generally four sources of funds used to finance airport development, which include:

- Airport cash flow
- Revenue and general obligation bonds
- Federal/state/local grants
- 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 the smaller commercial service and general aviation airports often requiring subsidies from local governments to fund operating expenses and finance modest improvements.

Financing capital improvements at Lake Havasu City Municipal Airport will not rely solely on the financial resources of Lake Havasu City. Capital improvement funding is available through various grant-in-aid programs on both the federal and state levels. Historically, the airport has received federal and state grants. While more funds could be available some years, the CIP was developed with project phasing in order to remain realistic and within the range of anticipated grant assistance. 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. Legislation affecting federal funding, the *FAA Modernization and Reform Act of 2012*, was enacted on February 17, 2012. The law authorized the FAA's AIP at $3.35 billion for fiscal years 2012 through 2015. The law was then extended through a series of continuing resolutions. In 2016, Congress passed legislation (H.R. 636, *FAA Extension, Safety, and Security Act of 2016*) amending the law to expire on September 30, 2017. Subsequently, Congress passed a bill (H.R. 3823, *Disaster Tax Relief and Airport and Airway Extension Act of 2017*) authorizing appropriations to the FAA through March 31, 2018, and the *Consolidated Appropriations Act, 2018* extended FAA's funding and authority through September 30, 2018. In October 2018, Congress passed legislation entitled, *FAA Reauthorization Act of 2018*, which will fund the FAA's AIP at $3.35 billion annually until 2023. This bill reauthorizes the FAA for five years, at a cost of $97 billion, and represents the longest funding authorization period for the FAA since 1982.

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.

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 Lake Havasu City Municipal 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 in the following sections.

Table 6C presents the approximate distribution of the AIP funds as described in FAA Order 5100.38D, Change 1, *Airport Improvement Program Handbook*, issued February 26, 2019. The Lake Havasu City Municipal Airport is eligible to apply for grants which may be funded through state apportionments, the small airport fund, discretionary funds, and/or set-aside categories.

TABLE 6C
Federal AIP Funding Distribution

Funding Category	Percent of Total	Funds*
Apportionment/Entitlement		
Passenger Entitlements	27.01%	$904,840,000
Cargo Entitlements	3.50%	$117,250,000
Alaska Supplemental	0.67%	$22,450,000
Nonprimary Entitlements	12.01%	$402,340,000
State Apportionment	7.99%	$267,670,000
Carryover	22.85%	$765,480,000
Small Airport Fund		
Small Hubs	2.33%	$78,060,000
Nonhubs	4.67%	$156,450,000
Nonprimary (GA and Reliever)	9.33%	$312,560,000
Discretionary		
Capacity/Safety/Security/Noise	4.36%	$146,060,000
Pure Discretionary	1.45%	$48,580,000
Set Asides		
Noise and Environmental	3.37%	$112,900,000
Military Airports Program	0.39%	$13,070,000
Reliever	0.06%	$2,010,000
Totals	100.00%	$3,350,000,000

* FAA *Modernization and Reform Act of 2018*
AIP: Airport Improvement Program
Source: FAA Order 5100.38D, Change 1, 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: 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 tribal lands. For states that qualify, such as Arizona, the federal share is increased depending on the airport classification. As a general aviation airport, the federal share of eligible capital improvement projects for Lake Havasu City Municipal 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.

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. If the threshold is met, the airport receives $1 million annually in entitlement funds. Other entitlement funds are distributed to cargo service airports, states and insular areas (state apportionment), and Alaska airports.

General aviation airports included in the *National Plan of Integrated Airport Systems* (NPIAS) can receive up to $150,000 each year in non-primary entitlement (NPE) funds. These funds can be carried over and combined for up to four years, thereby allowing for completion of a more expensive project. It should be noted that Lake Havasu City Municipal Airport is eligible and does receive NPE funds.

The FAA also provides a state apportionment based on a federal formula that takes into account area and population. The FAA then distributes these funds for projects at various airports throughout the state.

Small Airport Fund

If a large- or medium-hub commercial service airport chooses to institute a PFC, 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, non-hub commercial service airports, reliever, and general aviation airports. As a general aviation airport, Lake Havasu City Municipal 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 of 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.

FAA Facilities and Equipment (F&E) Program

The Airway Facilities Division of the FAA administers the Facilities and Equipment (F&E) Program. This program provides funding for the installation and maintenance of various navigational aids and equipment of the national airspace system. Under the F&E program, funding is provided for FAA airport traffic control towers (ATCTs), enroute navigational aids, on-airport navigational aids, and approach lighting systems.

While F&E still installs and maintains some navigational aids, on-airport facilities at general aviation airports have not been a priority. Therefore, airports often request funding assistance for navigational aids through AIP and then maintain the equipment on their own[1].

STATE FUNDING PROGRAMS

ADOT – 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. Lake Havasu City Municipal 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 – 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 APPP consists of visual inspections of all airport pavements. Evaluations are made of the types and severities observed and entered into a computer program database. 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

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[1] Guidance on the eligibility of a project for federal AIP grant funding can be found in FAA Order 5100.38D, *Airport Improvement Program Handbook*.

participating system airports. ADOT – Aeronautics Group ensures that the APMS database is kept current, in compliance with FAA requirements.

Every year, ADOT, 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 sponsor may sign an Inter-Government Agreement (IGA) with ADOT-MPD – Aeronautics Group to participate in the APPP. Lake Havasu City Municipal Airport is eligible to participate in this program.

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

An 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 and 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. Nevertheless, 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, an 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 Lake Havasu City Municipal Airport could potentially be made available for non-aviation development. Although, 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. For example, Lake Havasu City Municipal Airport has historically hosted an airport open house that attracts spectators from around the region. 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.

FUNDING AIRPORT OPERATIONS

Lake Havasu City Municipal Airport is operated by Lake Havasu City. Various rates and charges from general aviation and non-aviation revenue sources currently help fund the airport. General aviation revenues are generated specifically by aviation and aircraft operations, while non-aviation revenues are produced by land leases and/or building leases by on-airport businesses that are not aviation-related. There are restrictions on the use of revenues collected on airports. 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 to additions or improvements to airport facilities.

EXPENSES

Generalized operating expenses for the airport include salaries and benefits, supplies, services, and equipment. Salaries and benefits are the largest expense category, which includes personnel costs associated with all those individuals who help maintain the airport. Supply items (office supplies, building supplies, vehicle supplies, utilities, etc.) and service fees (building maintenance, security, custodial, communications, etc.) also account for major expense items within the operating budget.

REVENUES

The operation of the airport generates revenues, which are secured by federal grant assurances, to be utilized only on the airport. While these revenues generated are significant, they are oftentimes not enough to fund both airport operating expenditures and capital improvement requirements. Most general aviation airports in this country do not generate enough revenues to cover operating expenses, which has historically been the case at Lake Havasu City Municipal Airport. Nearly all need some level of community tax or bonding support to fund capital expenditures.

AIRPORT RATES AND CHARGES

The FAA places several stipulations on rates and charges establishment and collection; however, two primary considerations need to be addressed. First, the rates and charges must be fair, equally applied, and resemble fair market value. Second, the rates and charges collected must be returned to and used only by and/or for the airport. In other words, the revenues generated by airport operations cannot be diverted to the general use of Lake Havasu City. The FAA requires funds to be used at airports as these funds are many times needed to either support the day-to-day operational costs or offset capital improvement costs.

Given its location to other airports, the rates and charges structure at Lake Havasu Municipal Airport needs to be somewhat competitive with other airports in the region. If the costs are too high, some users may choose other airports. On the other hand, if rates and charges are set too low, some facilities will not be capable of being amortized, thus requiring a subsidy from the city. The following provides several activities that could enhance revenue production for an airport, some of which are currently being practiced at Lake Havasu City Municipal Airport.

Aircraft Parking/Tiedowns

Aircraft parking fees, also referred to as tiedown fees, are typically assessed to those aircraft utilizing a portion of an aircraft parking area that is owned by the airport. These fees are most generally assessed on a daily or monthly basis, depending upon the specific activity of a particular aircraft.

Aircraft parking fees can be established in several different ways. Typically, airports assess aircraft parking fees in accordance with an established schedule in which an aircraft within a designated weight and/or size pays a similar fee (i.e., small aircraft, single engine aircraft). Aircraft parking fees may also be charged according to a "cents per 1,000 pounds" basis in which larger aircraft with increased weights would obviously pay more for utilizing the aircraft parking apron. There are also instances in which aircraft parking fees are not assessed on an airport.

An airport sponsor may also include in a lease agreement with an aviation-related commercial operator at the airport to collect aircraft parking fees on portions of an aircraft parking apron in which the airport does not own or is leasing to a commercial operator, such as an FBO. As a result, the airport could directly collect parking fees from an aircraft utilizing this space or allow the commercial operator to collect the parking fee, in which the agreement may allow the commercial operator to retain a portion of the parking fee as an administrative or service fee.

Aircraft parking fees can be assessed on a daily or monthly basis. Daily aircraft parking fees are typically assessed to transient aircraft utilizing the airport on a short-term basis, while monthly fees are charged to aircraft that utilize a particular parking area for the permanent storage of their aircraft. Monthly aircraft parking fees are often assessed at airports that contain a waiting list for aircraft hangar storage space. It is also common practice at many airports to waive a daily aircraft parking fee in the event the aircraft purchases fuel prior to departing the airport.

Previous rates and charges analysis conducted by the consultant outside this study have indicated that daily aircraft parking fees can vary from $3 to $20 depending on the type of aircraft, and monthly aircraft parking fees can range between $50 and $200 per month depending on the type and size of the aircraft. According to the *Lake Havasu City Master Fee Schedule*, the airport charges $59 per month for an uncovered tiedown space, which is within the industry standard.

Aircraft Storage Hangars

There are several types of aircraft storage hangars that can accommodate aircraft on an airport. In order to establish hangar fees, an airport typically factors in such qualities as hangar size, location, and utilities. Aircraft hangar fees are most often charged on a monthly basis.

Common aircraft storage hangars are typically categorized as shade hangars, T-hangars, and conventional hangars. Shade hangars consist of tiedown spaces with a protective roof covering. T-hangars provide for separate, single-aircraft storage areas. Conventional hangars provide a larger enclosed space that can accommodate larger multi-engine piston or turbine aircraft and/or multiple aircraft storage. Conventional hangars can also be utilized by aviation-related commercial operators for their business activities on an airport.

Location can also play a role in determining hangar rates. Aircraft storage hangars with direct access to improved taxiways/taxilanes and adjacent to aviation services being offered at an airport can oftentimes be more expensive to rent. In addition, the type of utility infrastructure being offered to the hangar can also help determine storage fees. Smaller aircraft storage hangars, such as a T-hangar or small box hangar, can either be granted access through a manual sliding door or electric door. It is common for hangars that provide electric doors to have higher rental fees as the cost associated with constructing these hangars would exceed the cost associated with simpler structures.

At some airports, hangar facilities are constructed by the airport sponsor, while at other airports, hangars are built by private entities. In some cases, airports have both public and private hangar facilities available. Hangars can be expensive to construct and offer minimal return on investment in the short term. In order to amortize the cost of constructing hangars, lease rates should be developed at a minimum to recover development and finance costs.

T-hangars often range from $100 to $450 per month depending on several factors previously listed. Larger conventional-style hangars can be leased per aircraft space or for the entire hangar. Monthly rates similar to those for individual T-hangar units often apply to leased aircraft space in a conventional hangar.

Ground Rental

Ground rentals can be applied to aviation and non-aviation development on an airport. Also known as a land lease, a ground lease can be structured to meet the particular needs of an airport operator in terms of location, terrain features, amount of land needed, and type of facility infrastructure included.

One of the single most valuable assets available to an airport is the leasable land with access to the runway/taxiway system. For aviation-related businesses, it is critical that they be located on an airport. Airport property is available for long-term lease but, in most cases, it cannot be sold. At the expiration of the lease, and any extensions, the improvements on the leased land typically revert back to the airport sponsor. In order for this arrangement to make financial sense to the private developer or financer, most ground leases are at least 20 years in length and include extension opportunities. Those who lease land on an airport are typically interested in constructing a hangar for their own private use, for sub-lease, or for operation of an airport business. Therefore, the long-term lease arrangement is important in order to obtain capital funding for the construction of a hangar or other type of facility. It should also be noted that ground leases should include the opportunity to periodically review the lease and adjust the rate according to the CPI. Typical lease agreements range from 20 to 30 years with options for extensions.

Ground leases are typically established on a yearly fee schedule based upon the amount of square feet leased. The amount charged can vary greatly depending on the level of improvements to the land. For example, undeveloped land with readily accessible utilities and taxiway access can generate more revenue than unimproved property. Previous surveys at other airports across the country conducted by the consultant have determined ground lease rates to range from $0.08 per square foot per year to approximately $1.00 per square foot per year. In some instances, lease rates were well over $1.00 per square foot per year.

According to the airport's master fee schedule, current FBO land lease rates are $0.29 cents per square foot for FBO sites and for improved land, per year. In the future, the airport could consider increasing land lease rates per square foot per year to better recognize the regional market trends.

Some airports will have other leasable space available. For example, airports with a terminal building may have office or counter space available for aviation and non-aviation related businesses. Some example businesses could include commercial airlines, aircraft sales, flight instruction, aircraft insurance, and a restaurant.

As previously mentioned, under certain circumstances, an airport sponsor may utilize portions of the airport for non-aviation purposes, such as commercial and/or industrial development if certain areas are not needed to satisfy aviation demand or are not accessible to aviation activity. Prior to an airport pursuing a ground lease with a commercial operator for non-aviation purposes, the sponsor must formally request from the FAA a release from certain land parcels that may not be needed for aviation-related uses.

Fuel Sales and Flowage

Fuel sales are typically managed at an airport in one of two ways: the airport sponsor acts as the fuel distributor or fueling operations are sub-contracted to an FBO. If the airport sponsor acts as the fuel distributor, then the airport would receive revenues equal to the difference between wholesale and retail prices. Of course, there are added expenses, such as employing people to fuel the aircraft.

When these services are undertaken by an FBO, the airport sponsor typically receives a fuel flowage fee per gallon of fuel. By way of agreement with the airport sponsor, FBOs would be required to pay a fuel flowage fee for each gallon of fuel sold or received into inventory. In the case of self-fueling entities, a fuel flowage fee could apply for each gallon of fuel dispensed. Fuel flowage fees are typically paid on a "cents per gallon" basis. In some instances, fuel flowage fees will be established based upon the type of aviation activity. For example, commercial airline service operators may be assessed a higher fuel flowage fee than general aviation aircraft or no fuel flowage fee at all if being assessed a landing fee (to be discussed in the next section). Fuel flowage fees can also be distinguished by type of fuel (100LL or Jet A).

The owner of the fuel farm can also be the airport sponsor or an FBO operator. If the airport sponsor owns the fuel farm and the FBO operator undertakes the fueling activities, then a separate fuel storage fee can be charged, or a higher fuel flowage fee may be assessed. Fuel flowage fees oftentimes range from $0.03 cents per gallon to $0.20 cents per gallon.

The airport's current fuel flowage fee is $0.09 cents per gallon, according to the airport's master fee schedule. The airport could consider incrementally increasing its fuel flowage fee over coming years to better its revenue potential and overall financial outlook. It is also recommended that the rate be based on fuel delivered to the vendor, with those records provided by the vendor.

Landing Fees

Landing fees typically only apply to larger aircraft, such as those over 60,000 pounds, for example, and only those involved in commercial airline or air taxi operations. Landing fees are not common on general aviation airports and are generally discouraged due to collection difficulty. Moreover, landing fees are somewhat discouraging to aircraft operators, who will many times elect to utilize a nearby airport that does not collect a landing fee.

When landing fees are assessed, they are most commonly based upon aircraft weight and a "cents per 1,000 pounds" approach. In addition, some airport sponsors may use a flat fee approach wherein aircraft within a specified weight range are charged the same fee.

Landing fees may be collected directly by the airport sponsor or an airport may have an agreement with a commercial operator to collect landing fees. Similar to what was discussed with aircraft parking fees, under this scenario, the agreement may allow the commercial operator, such as an FBO, to retain a portion of the landing fee as an administrative or service fee.

According to the *Lake Havasu City Master Fee Schedule*, landing fees are collected at $1.00 per 1,000 pounds of gross landing weight (for aircraft over 12,500 pounds) for private, corporate, commercial, and air cargo operations.

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 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 Lake Havasu City Municipal Airport to best serve the air transportation needs of the region, while achieving economic self-sufficiency.

The CIP and the phasing program presented will change over time. An effort has been made to identify and prioritize all major capital projects that would require FAA and ADOT grant funding. Nevertheless, the airport and FAA review the five-year CIP on an annual basis.

The value of this study is keeping the issues and objectives at the forefront of the minds of managers and decision-makers. In addition to adjustments in aviation demand, decisions on 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. Updates can be done by airport management, thereby improving the plan's effectiveness. Nevertheless, airports are typically encouraged to update their master plans every 7 to 10 years, or sooner if significant changes occur in the interim.

In summary, the planning process requires Lake Havasu City to consistently monitor the progress of the airport. The information obtained from continually monitoring activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.

LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

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 specific aviation subject.

AIR CARRIER: An operator which: (1) performs at least five round trips per week between two or more points and publishes flight schedules which specify the times, days of the week, and places between which such flights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for flight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing configuration at their maximum certificated 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 specified 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 existing 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 fulfillment 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 airfield 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 defining 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 flight 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 flight 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 certificated 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 specific trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the en route phase of flight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central flow 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 categorization 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 flight 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 final 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 defined 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 specified portion of the airfield 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 flight 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 flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

B

BASE LEG: A flight 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 specific 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 eliminating 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 identifies 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 specified 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.

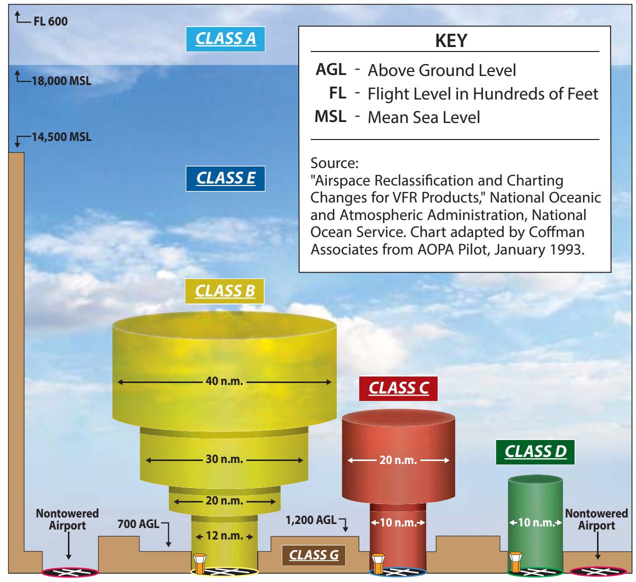
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

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 specified 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 flying 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 identified 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 defined 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 operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights in accordance with the airspace classification. 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 flight 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 configuration 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 traffic 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 five 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 configured 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 classified 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 configured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.
- **CLASS G**: Generally, that airspace not classified 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 flight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.

CROSSWIND LEG: A flight 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.

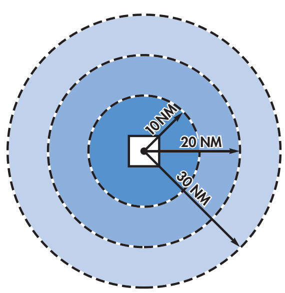
- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.
- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the acceleration and deceleration of an aircraft aborting a 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 specified 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 flight 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 specified form of development or activity, as well as any other legal rights in the property that may be specified 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 significantly 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 executive 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 flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A defined area over which the final 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 final 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 significant 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, flight training, repair, and maintenance.

FLIGHT LEVEL: A measure of altitude used by aircraft flying above 18,000 feet. Flight levels are indicated by three digits representing the pressure altitude in hundreds of feet. An airplane flying at flight level 360 is flying at a pressure altitude of 36,000 feet. This is expressed as FL 360.

FLIGHT SERVICE STATION: An operations facility in the national flight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-flight and in-flight 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 certificate 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 classification 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 aircraft turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific 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 flight 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 flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight 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 specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specified 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 certified 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 flights 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 fixed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classification 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 classification 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 flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight 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 certificates 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 finding 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 flight 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 aircraft 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 final approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specified 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 final 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 defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific 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 flight 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 flight 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 flights over determined tracks within prescribed accuracy tolerances without the need to overfly ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A defined 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 flashing lights installed on the extended centerline of the runway usually in conjunction with an approach lighting system.

RUNWAY DESIGN CODE: A code signifiying the design standards to which the runway is to be built.

RUNWAY END IDENTIFICATION LIGHTING (REIL): Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification 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 defined 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 five feet above the runway centerline to any point five 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 identifies and defines 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 transition 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 certified takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of defined dimensions identified by a surface area wherein activities must be confined 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 classifications 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 defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA**: Designated airspace within which the flight of aircraft is prohibited.
- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the flight 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 flight 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 final 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 defined path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY DESIGN GROUP: A classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

TAXIWAY SAFETY AREA (TSA): A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published flight 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.

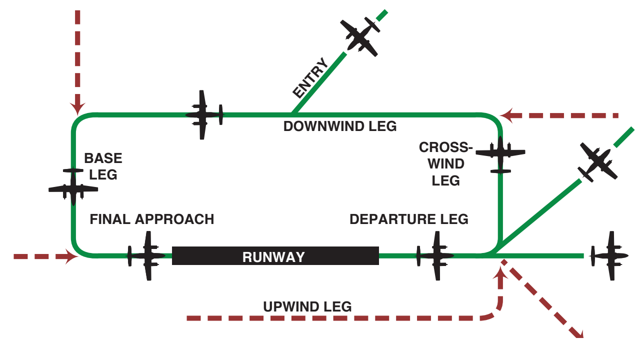
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The first 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 flow that is prescribed for aircraft 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 final 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.

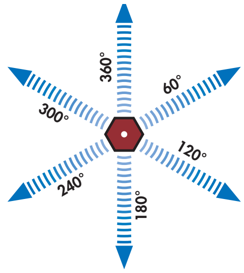
UPWIND LEG: A flight path parallel to the landing runway in the direction of landing. See "traffic pattern."

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 identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A navigation 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 defined by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR flight 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 flight 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 flight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific 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 flight.

Abbreviations

AC: advisory circular

ADF: automatic direction finder

ADG: airplane design group

AFSS: automated flight 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 flashers (CAT I configuration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircraft rescue and fire fighting

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: fixed base operator

FY: fiscal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument flight 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 committee

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 identification 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: simplified 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

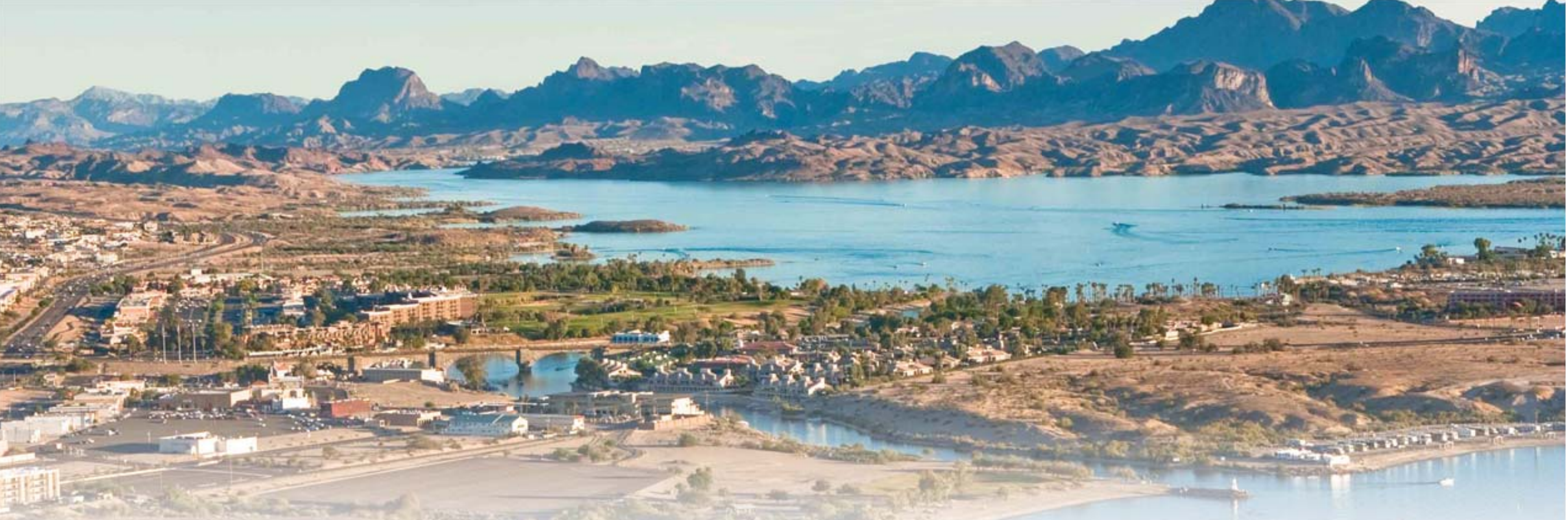
VASI: visual approach slope indicator

VFR: visual flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated



LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

APPENDIX B

FAA FORECAST APPROVAL LETTER




U.S. Department
of Transportation
Federal Aviation Administration

Western-Pacific Region
Office of Airports
Phoenix Airports District Office

3800 N Central Ave
Suite 1025
Phoenix, AZ 85012

July 22, 2019

Damon Anderson
Airport Supervisor
Lake Havasu Municipal Airport
5600 N. Highway 95 #1
Lake Havasu City, AZ 86404

Dear Mr. Anderson:

Lake Havasu Municipal Airport (HII), Lake Havasu City, Arizona
Aviation Activity Forecast Approval

The Federal Aviation Administration (FAA) has reviewed the aviation forecast for the airport master plan dated Juky 16, 2019. The FAA approves this forecast and the use of B-II as the existing critical design aircraft, and D-III as the future critical design aircraft for airport planning purposes, including Airport Layout Plan (ALP) development.

In summary, the FAA TAF and the Lake Havasu Municipal Airport forecast update regarding total operations exceeds the 10 percent and 15 percent allowance for 5 and 10 year planning horizons. The airport forecast update appropriately explains these tolerances due to the most current conditions at the airport and the available data when the forecasts were developed which include an estimated 1.87% compound annual growth rate, the increase in the actual based aircraft (160 based planes vs. TAF's estimated 128 planes), increased operations, and future airport development. While the 5 and 10 year forecasts do exceed benchmarks established in the FAA's Guidance on Review & Approval of Local Aviation Forecasts published in 2008, approval of this forecast doesn't need to be sent to FAA Headquarters for review because the future growth has been adequately justified.

The forecast was developed using current data, appropriate methodologies, and therefore is approved for planning purposes at Lake Havasu Municipal Airport. It is important to note that the approval of this forecast doesn't guarantee funding for large scale capital improvements as future projects will need to be justified by current activity levels 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
Phoenix ADO,
Community Planner

Cc: FAA Grant File
Jeffery Herb, Project Manager - City of Lake Havasu
Matt Quick, Associate - Coffman Associates

LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

APPENDIX C

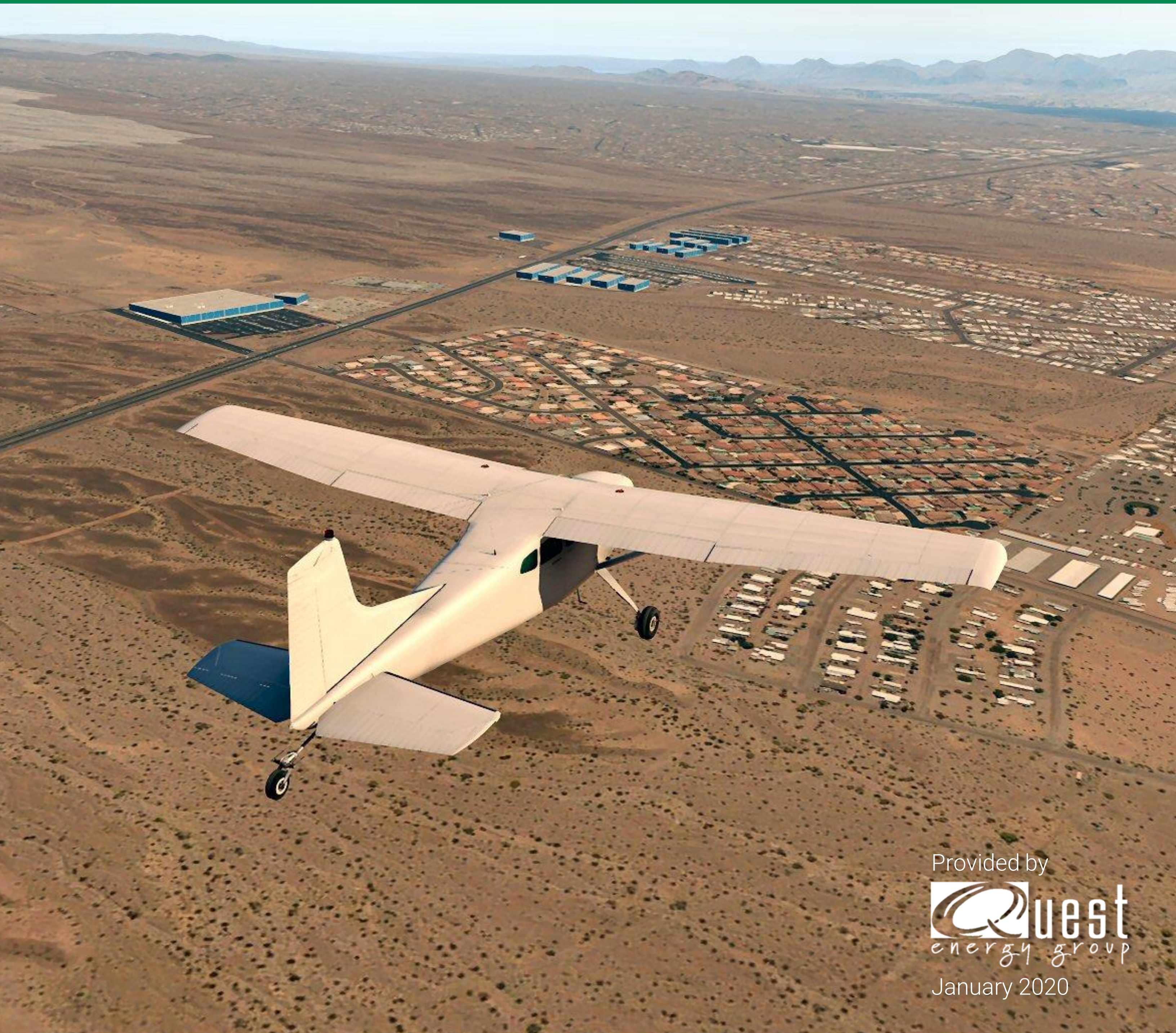
ENERGY AUDIT REPORT




Lake Havasu City Municipal Airport

Lake Havasu City, Arizona

ASHRAE Level II Energy Audit Report



Provided by

Quest energy group

January 2020

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Executive Summary

As part of the updated Master Plan's Sustainability Section for Lake Havasu City Municipal Airport, Quest Energy Group performed a comprehensive energy audit of selected buildings at the airport to assist in identifying and prioritizing potential energy and water conservation measures (ECMs).

This audit meets or exceeds the Level II requirements established by ASHRAE, which requires a historical analysis of all building utility consumption, efficiency improvement recommendations, and a detailed financial analysis recommendation. Above and beyond the requirements for an ASHRAE Level II Audit, Quest Energy Group developed a full scale energy simulation model using eQUEST software with IPMVP compliant baseline calibration in order to validate energy savings estimates.

Key Audit Findings

The Lake Havasu City Municipal Airport spent over $38,000 on electricity from May 2018 to April 2019. The results of the audit yielded the following findings listed below and summarized in the following table and figure. Additionally, individual energy and water conservation opportunities are detailed within each individual building report following this Executive Summary.

- Installing LED interior and exterior lighting fixtures results in overall energy reduction of almost **19%** with a simple payback close to **5 years**.
- Small control upgrades to HVAC equipment in the Main Terminal, Maintenance Office, and Transformer room would provide immediate savings, up to **2%** of the total electricity usage.
- Upgrading to heat pump technology in the Main Terminal, Maintenance Office, and Transformer room relying on electric heating would provide substantial energy savings. It recommended that this occurs when HVAC equipment is due for replacement.
- LED upgrades to the airport landing lighting fixtures requires a significantly high first cost and results in an unfavorable economic return. Powering the landing lights through a solar PV system provides a more economically favorable return while offsetting 100% of lighting energy usage.
- Solar PV systems are good option in this climate and there are a variety of applications that would provide significant, long term cost savings.

ECM	Measure Description	Estimated Initial Costs	Utility Cost Savings	Potential UES Incentives	Simple Payback
ECM1	LED Lighting Upgrades	$22,120	$2,947	$2,473	6.7
ECM2	LED Exterior Lighting Upgrades	$19,802	$4,289	$4,226	3.6
ECM3	HVAC Controls Upgrades	$0	$779	$0	Immediate
ECM4	HVAC Equipment Upgrades	$55,400	$2,076	$1,288	26.1
ECM5	Landing Lights LED Replacement	$290,000	$3,281	$2,981	87.5
ECM6	Individual Solar PV Projects	$213,510	$22,753	$0	9.4

Figure 1 – Annual Financial Results Summary Table for Aggregated Measures (All Meters)

ECM	Measure Description	Electricity Usage (kWh/year)	Electricity Cost ($/year)	Percent Savings (%)
B0	Baseline Utility Usage	302,802	$38,977	0.0%
ECM1	LED Lighting Upgrades	275,983	$36,030	7.6%
ECM2	LED Exterior Lighting Upgrades	233,718	$31,741	18.6%
ECM3	HVAC Controls Upgrades	226,587	$30,962	20.6%
ECM4	HVAC Equipment Upgrades	207,258	$28,886	25.9%
ECM5	Landing Lights LED Replacement	177,427	$25,605	34.3%
ECM6	Individual Solar PV Projects	100,974	$16,224	58.4%

Figure 2 – Annual Results Breakdown for Aggregated Measures (All Meters)

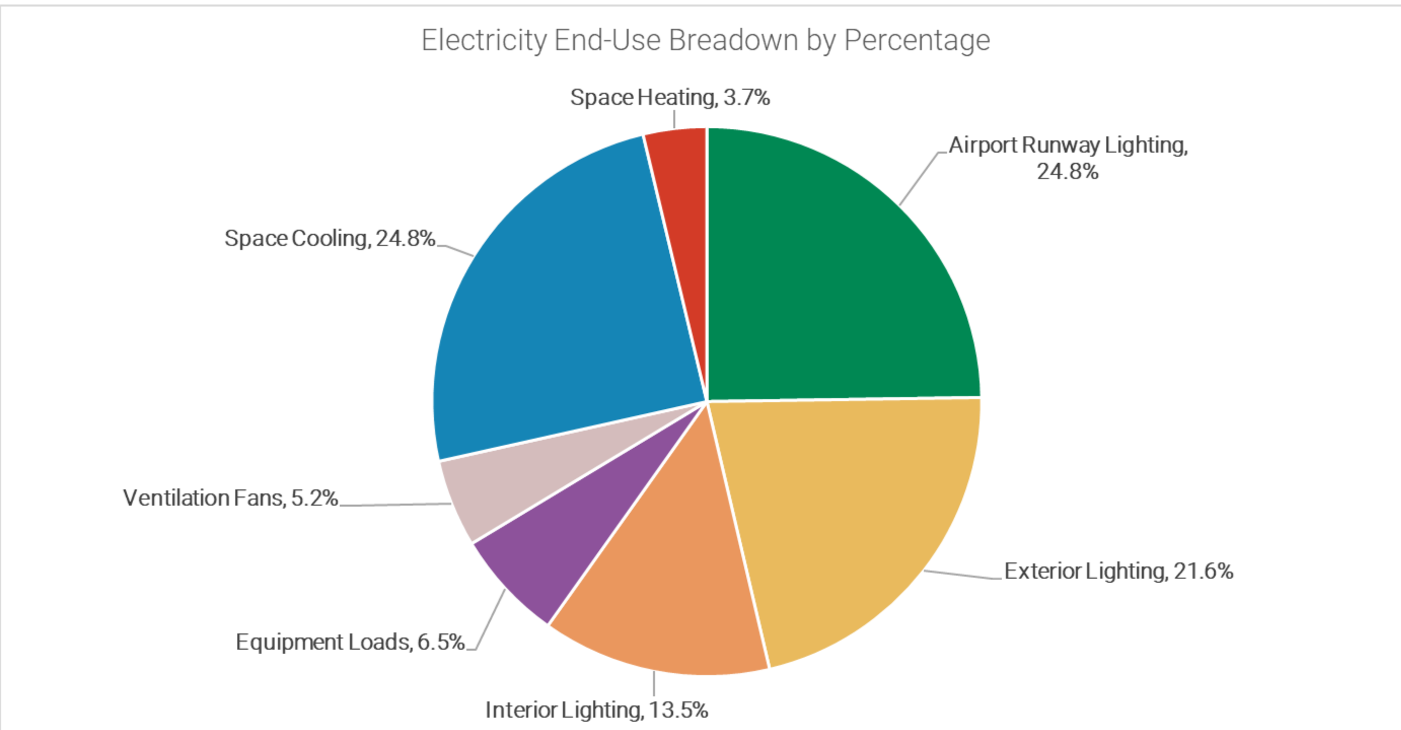


Figure 3: Baseline Energy Breakdown by End-Use

Solar PV Discussion

The climate at Lake Havasu City Municipal Airport provides an ideal location for solar energy production from a solar photovoltaic system. Additionally, UniSource Energy Services offers net metering which credits the users for any unused, generated electricity from the PV system that is sent back to the electrical grid. This means that a battery storage system does not need to be installed with the solar PV panels.

Each section of the report evaluates the opportunity and economics of installing a solar PV system at the individual meter. Another path worth discussing is the potential to install a large scale PV system that would potentially offset 100% of the electrical energy usage by the 12 meters discussed in this report. The following barriers would likely be encountered with such an endeavor:

- Federal Aviation Administration (FAA) regulations for glare and other flight impact issues.
- Taxpayer/ public approval of funding
- Utility connectivity issues and/or production arrangements
- Other airport operational constraints

In similar circumstances, other businesses have elected to form a power-purchase agreement (PPA) with a third-party developer. This would theoretically enable the airport to lease the land to a developer (solar services provider), who would build, own, and maintain the solar equipment. The solar services provider could then sell the produced energy back to the airport at a set rate. The advantage of this approach is that the solar services provider could take advantage of any tax credits not available to ADOT, thus lowering the net cost of the project, while potentially avoiding or mitigating some of the barriers mentioned above.

There is sufficient area to generate 100% of the airport's energy needs, plus much more, potentially. Based on the utility analysis, the municipal airport uses about **302,802 kWh per year** of electrical energy. A fixed tilt, ground mount PV system would produce approximately 1,650 kWh/kW of installed capacity per year. Therefore, to offset the total energy consumption for the municipal airport, a **190 kW** solar PV array would need to be installed. The following map highlights the potential location and actual size of the 190 kW ground mount solar PV array.

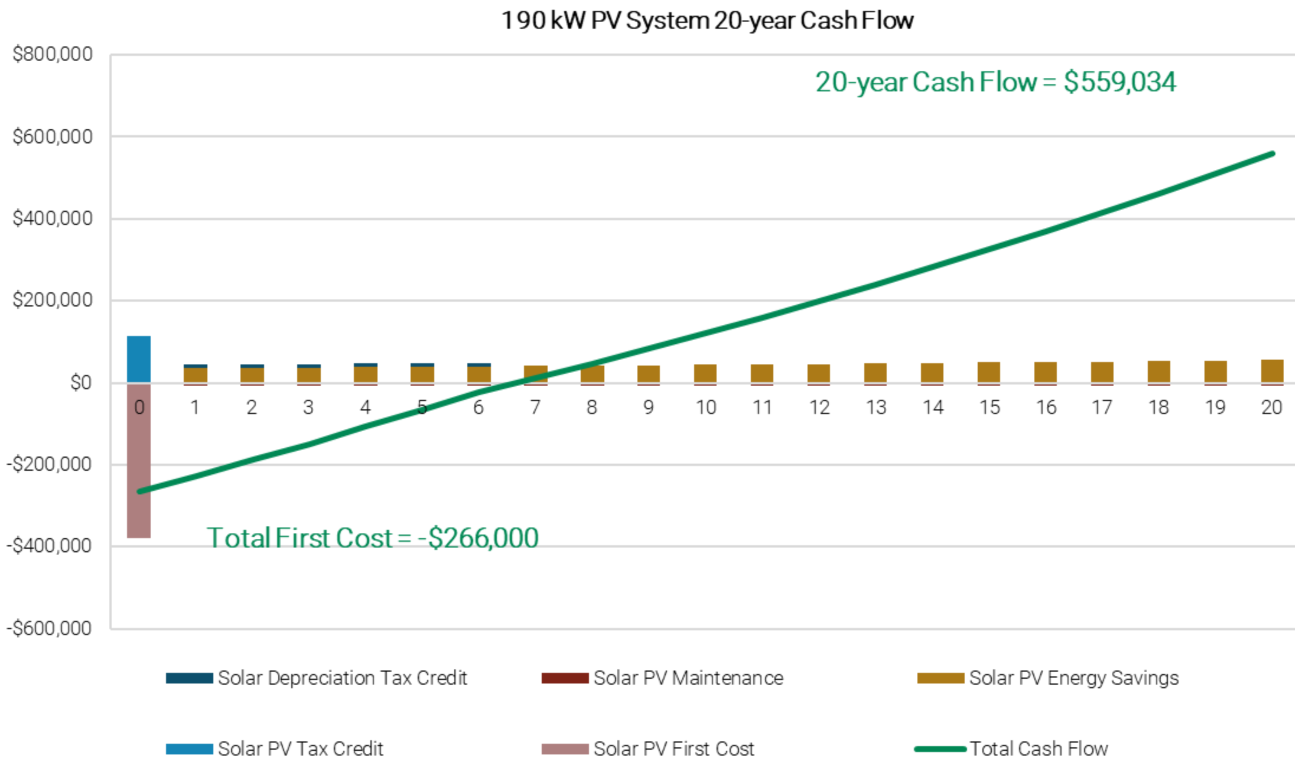
Figure 4: Potential Location for 190 kW Solar PV Array

The following table shows the financial inputs for the 190 kW ground mount solar PV system. Based on the table below, the solar PV system annual cost savings would be about **$35,728 per year.** The first cost of the solar PV system is expected to be about **$2.00** /Watt, or **$380,000**, before the 30% Federal Tax Credit.

Solar PV Cost Inputs/Outputs		
Solar PV First Cost	$2.00	/Watt
Federal Tax Incentive	30%	-
Equipment Lifetime	20	years
Solar Utility Rate	$0.11	$/kWh
Energy Escalation Rate	3.0%	-
Solar Depreciation Term	6	years
Solar PV Y1 Cost Savings	$35,728	/year
Solar PV Annual Maintenan	$6,000	-

The following table summarizes the financial results, and the following graph shows the 20 year cash flow for the solar PV system, incorporating first cost, federal tax credit, solar depreciation, and cost savings. Installing a 190 kW PV system would result in a 20 year cash flow of **$559,034** with a **20 year NPV of $239,071** and an **IRR of 13.8%.** Additionally, the main terminal would become a net-zero energy building.

Financial Results		
20-year NPV	$239,071	-
Straight Line Payback	6.68	years
Year-1 ROI	10.9%	-
IRR	13.8%	-


190 kW PV System 20-year Cash Flow
20-year Cash Flow = $559,034
Total First Cost = -$266,000
$800,000
$600,000
$400,000
$200,000
$0
-$200,000
-$400,000
-$600,000
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Solar Depreciation Tax Credit
Solar PV Maintenance
Solar PV Energy Savings
Solar PV Tax Credit
Solar PV First Cost
Total Cash Flow

Methodology

The primary focus of the site audit performed was to survey the existing envelope, lighting, domestic hot water (DHW) and HVAC equipment in the buildings and provide a summary of condition, age and life of the units, and overall performance level. This audit is composed of a site visit conducted by Michael Ising on August 15th, 2019 as well as several phone conversations with site personnel.

Based on the information collected from the site audit, a detailed energy simulation model was developed using eQUEST (DOE2.2) software to analyze the baseline energy usage for the Main Terminal at the airport. The collected information was also used to develop engineering grade spreadsheets of the remaining buildings and energy consuming equipment in scope: Public and Private Hangars, Maintenance Building, Landing Lights, and Exterior Lighting. The methodology and assumptions in the energy modeling process are detailed below. A graphical depiction of the model is shown in each building report.

- A detailed energy model of the Terminal building was constructed based on drawings provided by airport personnel and field observations during the audit. Site inspections included verifying wall and roof constructions, glass types, lighting equipment, HVAC, DHW, and other major energy using equipment.
- Equipment operation schedules were based on operational, occupancy, and usage data and supplemented through interviews with the operations and maintenance staff and field observations.
- Lighting fixtures and schedules were input into the models based on field data and electrical drawings.
- HVAC and DHW equipment were added to the model according to drawings and field observations, and each zone was assigned to the appropriate HVAC system. Equipment efficiencies were based on nameplate data and/or mechanical plans. Operation schedules and controls were input according to maintenance staff interviews.

Project Information

Project Name & Location

Lake Havasu City Municipal Airport
Lake Havasu City, AZ 86404

Airport Contact

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Utility Meters and Map

The project is comprised of 12 electrical utility meters. Each utility meter is listed below along with a description and a map that highlights the areas each meter serves.

Meter No.	Area of Service
1	Fuel Farm, Monitoring System
2	Maintenance Building, Exterior Lighting in Terminal Parking Lot
3	Public Hangars #53-60
4	FBO Site #1
5	Wellsite
6	Hangars #41-52
7	Airport Runway and Taxing Lighting, Transformer Room
8	Private Hangars
9	Construction Area, North Runway Exterior Lighting
10	Airport Entrance Signage
11	Hangars #74-79
12	Main Terminal Building

Figure 5: Summary of Utility Meters

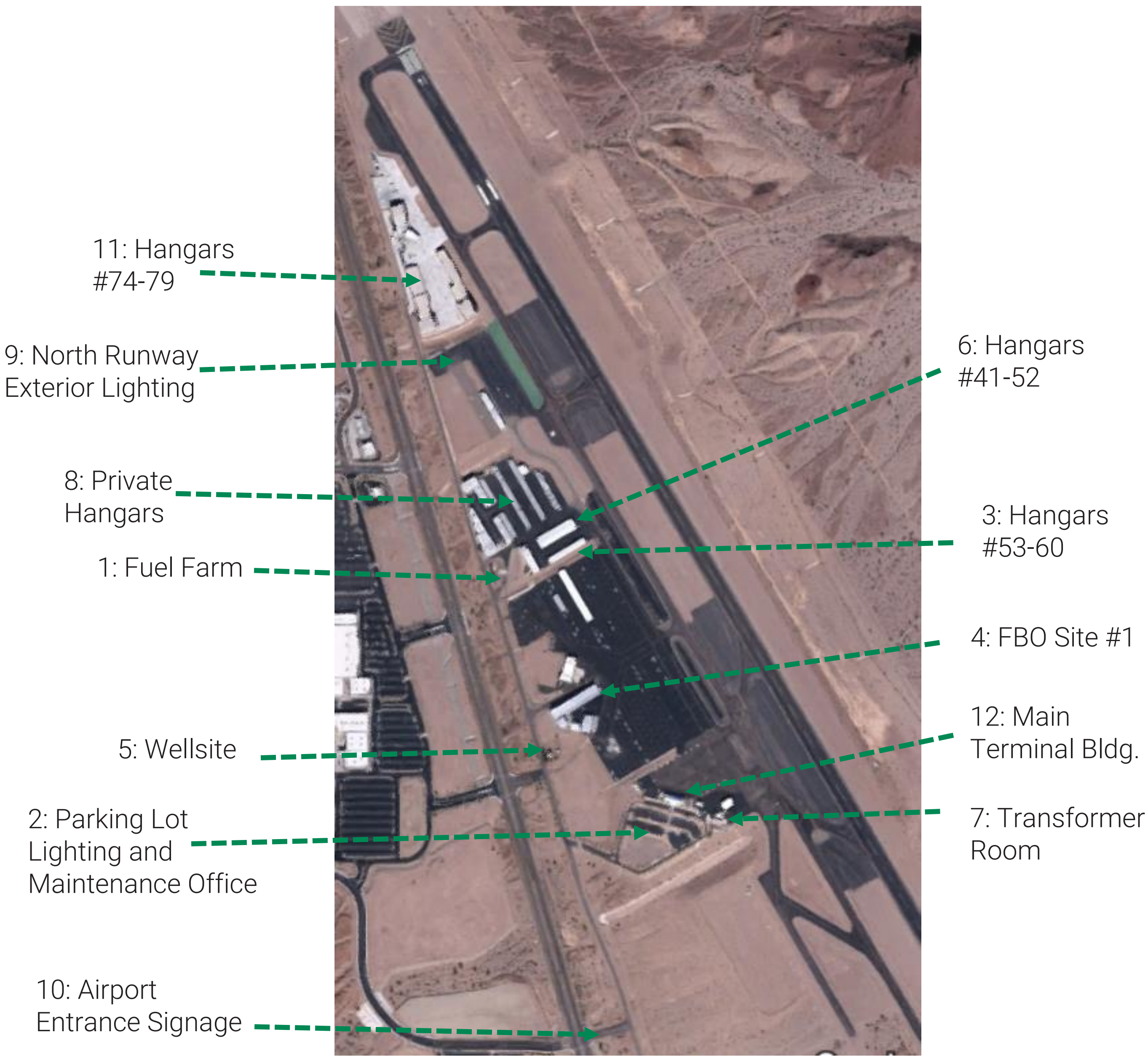


Figure 6: Map of Lake Havasu City Municipal Airport

Baseline Utility Summary

Electricity bills from May 2018 to April 2019 were collected and analyzed for all utility meters in the scope. A summary of all utility meter annual electricity cost is provided below.

As shown below, the municipal airport spends about **$38,977 per year** on electricity at a unit cost of about **$0.13 per kWh.** The utility meters that account for the majority of electricity usage are the landing lights (#7), Main Terminal (#12), and the Terminal Parking Lot Lighting (#2).

Utility Meter	Electricity Usage kWh/year	Unit Cost $/kWh	Total Cost $/year	% of Total Usage
Landing Lights #7	105,473	$0.11	$11,696	34.8%
Terminal #12	74,120	$0.11	$8,093	24.5%
RMP&PRK #2	60,169	$0.16	$9,431	19.9%
Hangars-Private #8	24,161	$0.12	$3,012	8.0%
Hangars 53-60 #3	12,519	$0.13	$1,630	4.1%
Const #9	8,367	$0.14	$1,178	2.8%
Hangars #74-79 #11	7,444	$0.15	$1,081	2.5%
Hangars #41-52 #6	5,335	$0.17	$895	1.8%
Ent Sign #10	2,381	$0.23	$553	0.8%
Fuel Farm #1	1,463	$0.32	$463	0.5%
Wellsite #5	1,200	$0.50	$601	0.4%
FBO Site #1 #4	170	$2.03	$345	0.1%
Total	**302,802**	**$0.13**	**$38,977**	

Figure 7: Electricity Usage and Cost by Utility Meter

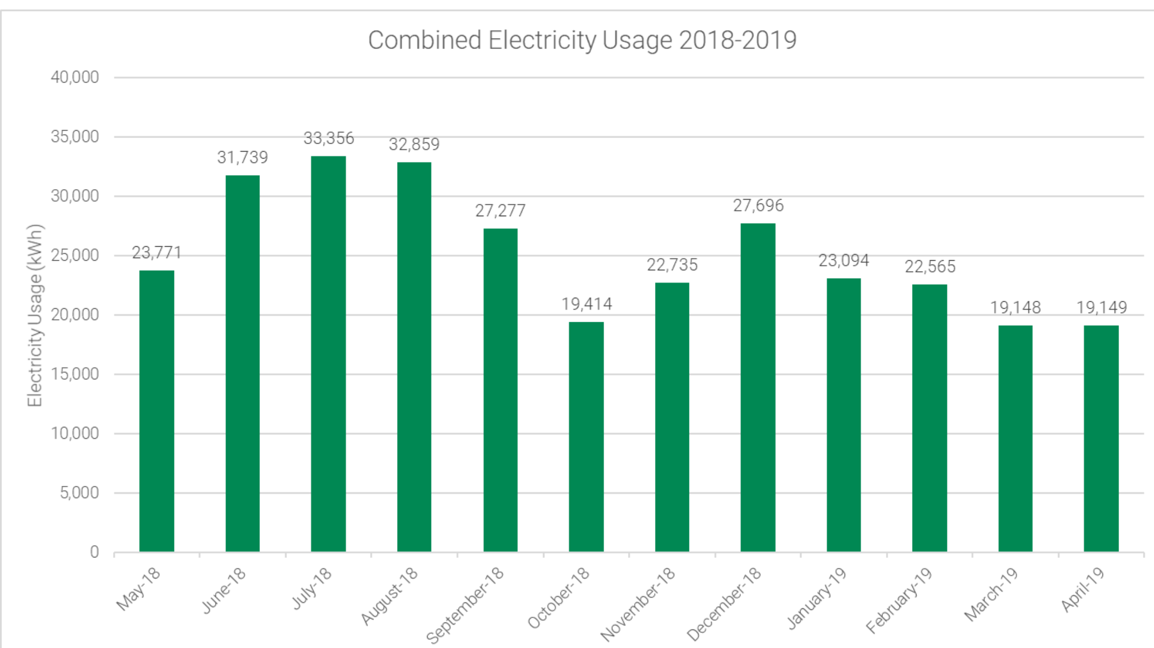


Figure 8 – Total Electricity Usage from May 2018 to April 2019

Baseline Model Calibration

Calibration Process

After a detailed baseline model is constructed for each utility meter, it is important to adjust and validate the accuracy of the model results by comparing it with the real-life building behavior. This process, known as calibration, is outlined in the paragraph and figure below.

Calibration of an energy model is initiated by running the model simulation using the actual weather data from the site over a one-year performance period. The simulated energy and power outputs are then compared to the historical utility data for the same period, and the model inputs are refined to make the simulated behavior match the actual data as closely as possible. Model input adjustments are typically made based on sub-metered data, trend data, and operational details provided by the building staff. This iterative process is repeated until the accuracy of the model is within reasonable tolerances (+/- 5% MBE as recommended by IPMVP).

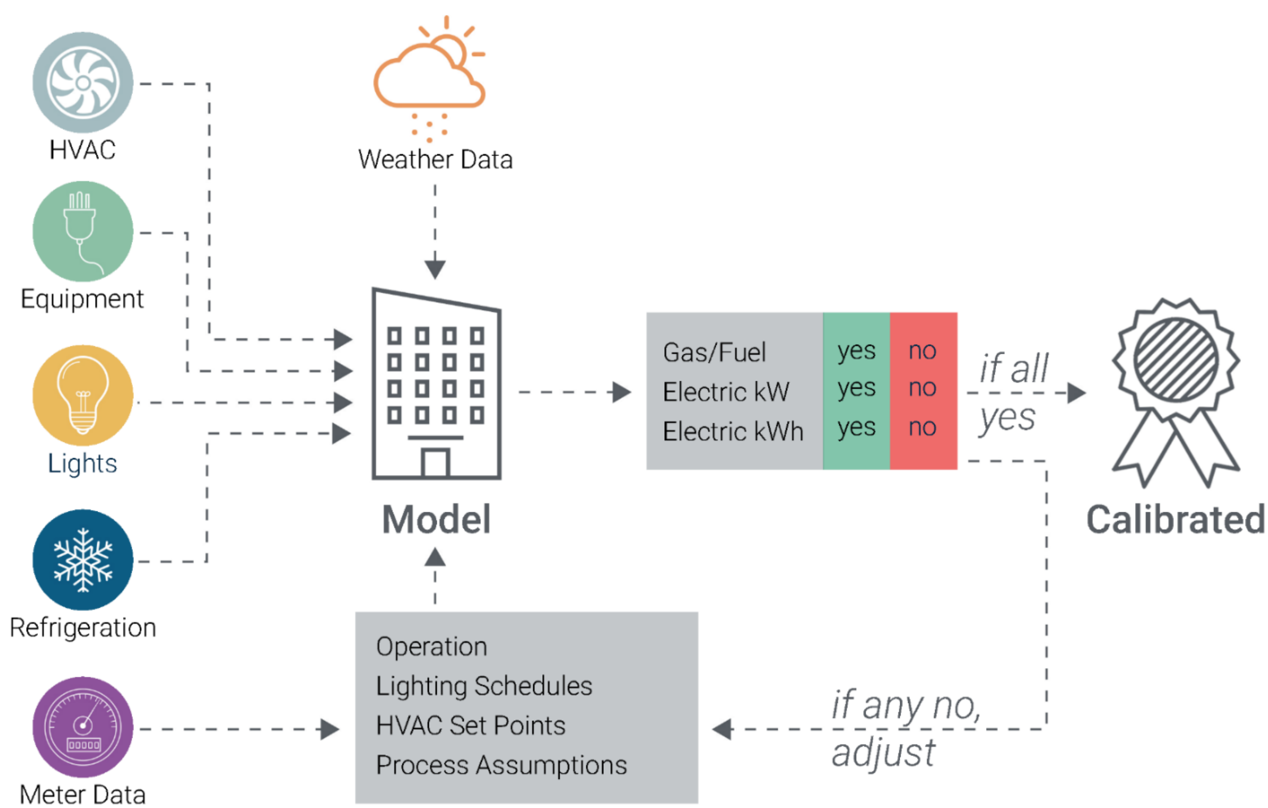
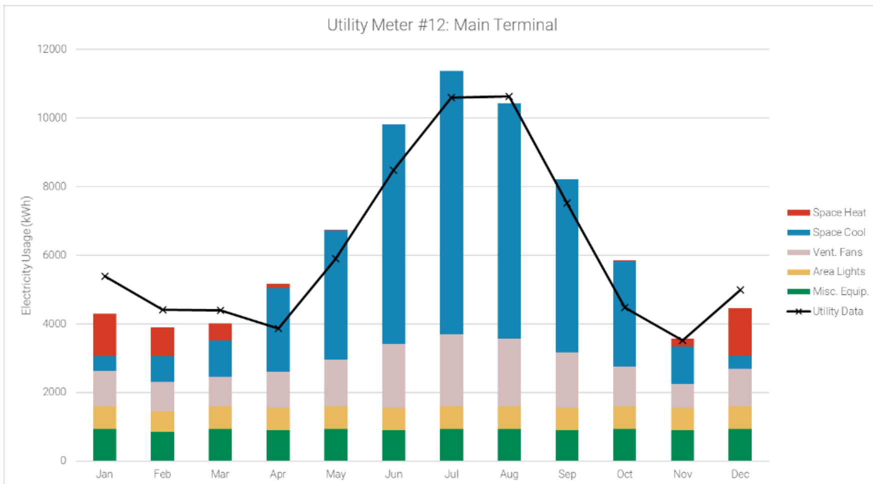


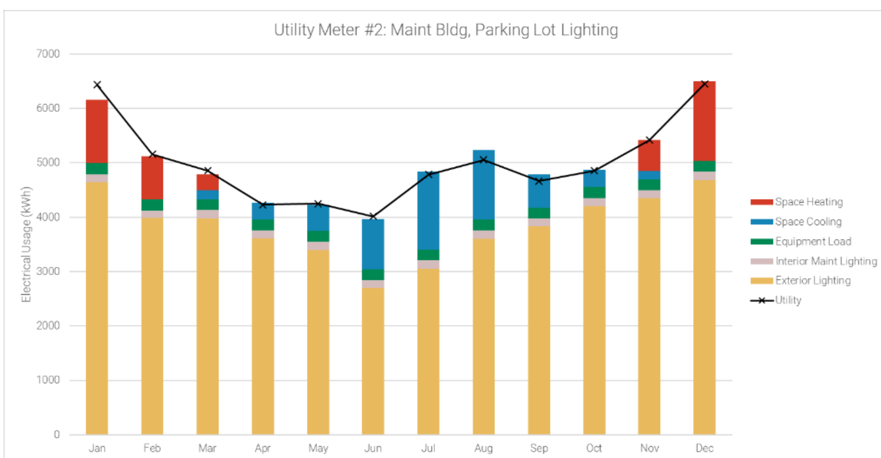
Figure 9 – Calibration Process Flowchart

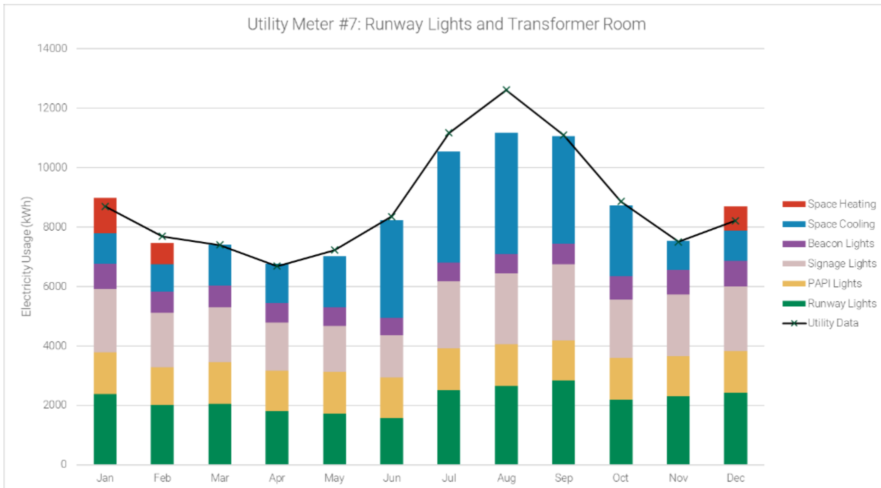
Baseline Energy Use Analysis & Calibration

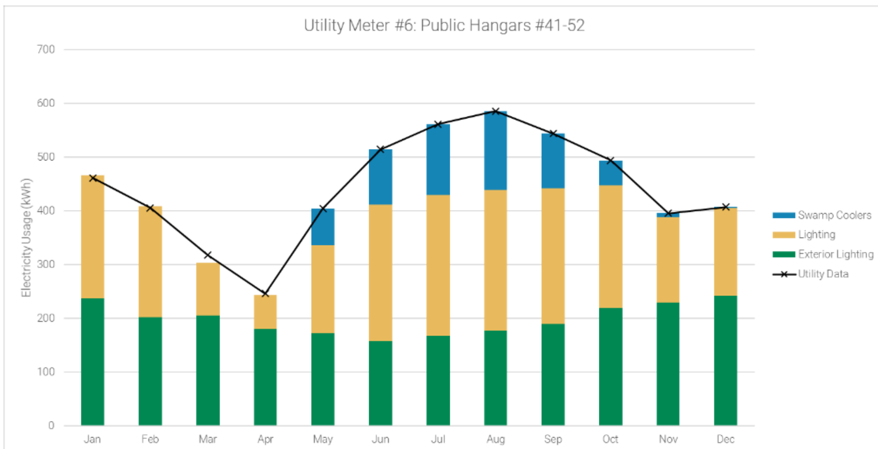
The building modeled and calibrated through eQUEST was the Main Terminal. All other buildings/utility metered were calibrated utilizing engineering grade excel sheets. The figures below illustrate the simulated eQUEST and excel generated electrical energy usage predicted throughout the one-year period (May 2018 – April 2019) as compared to the actual historical utility data. The black line represents actual building/utility data provided by each electrical meter. Most models were calibrated to within IPMVP guidelines for calibration (MBE <±5%, Cv(RSME) <15%).

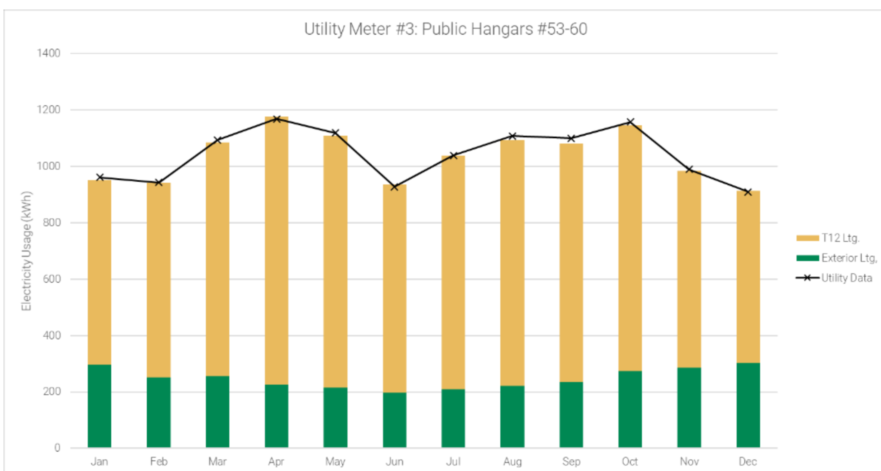
The FBO Site #4, Fuel Farm, and Wellsite utility meters were not calibrated given there is only process load equipment attached to those meters, and thus, there are not energy efficiency recommendations associated with those meters.

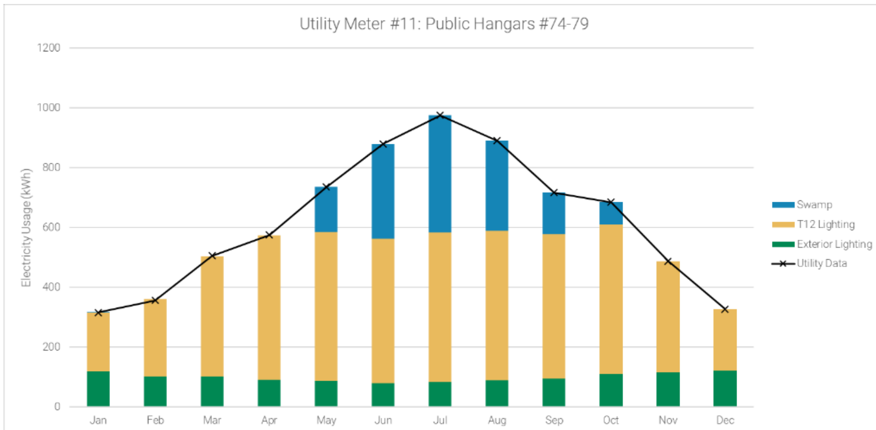


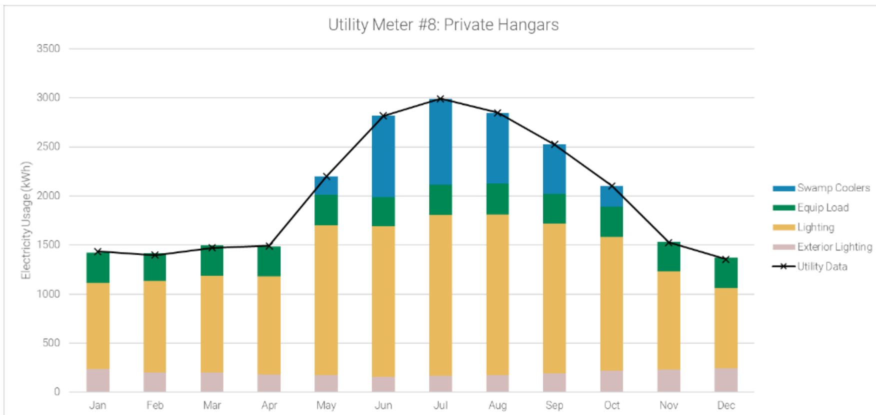


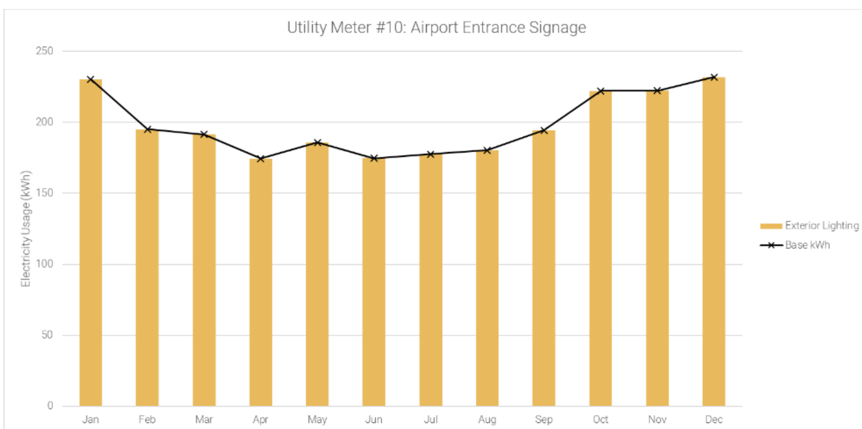

Utility Meter #7: Runway Lights and Transformer Room
Electricity Usage (kWh)
0
2000
4000
6000
8000
10000
12000
14000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Space Heating
Space Cooling
Beacon Lights
Signage Lights
PAPI Lights
Runway Lights
Utility Data


Utility Meter #6: Public Hangars #41-52
Electricity Usage (kWh)
0
100
200
300
400
500
600
700
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Swamp Coolers
Lighting
Exterior Lighting
Utility Data


Utility Meter #3: Public Hangars #53-60
Electricity Usage (kWh)
0
200
400
600
800
1000
1200
1400
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
T12 Ltg.
Exterior Ltg.
Utility Data







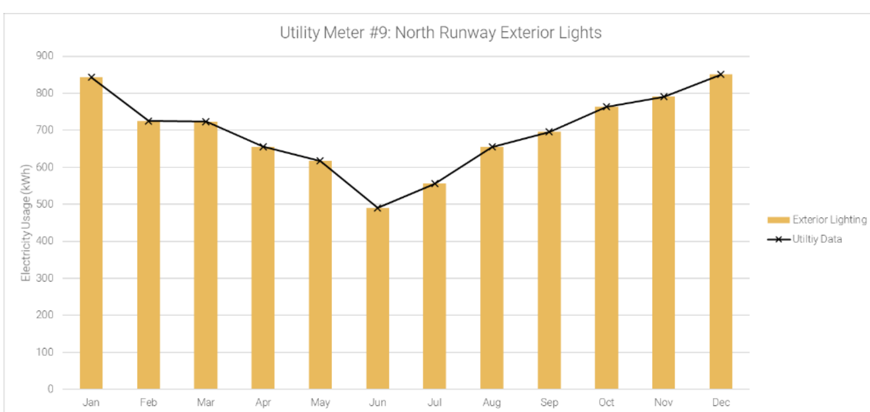


Figure 10 – Baseline Electricity Usage Calibration by Utility Meter

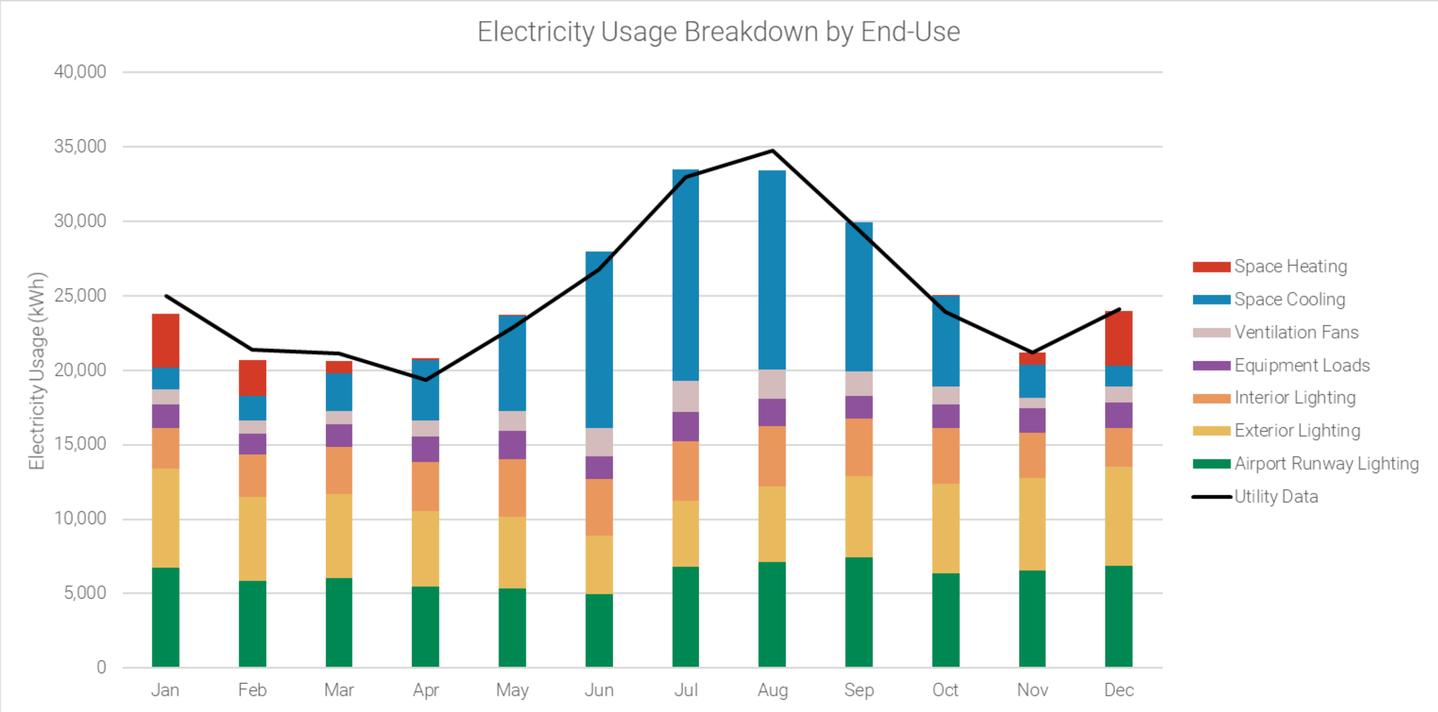
Baseline Energy Use and Calibration Analysis

Where possible, the meters and buildings were analyzed separately to minimize uncertainty. The following comments highlight some of the key takeaways from the baseline analysis:

- Electrical energy usage for the Main Terminal is dominated by space cooling and space heating. The terminal has a large increase in electrical energy usage during summer months and a slight increase in electrical space heating during the winter months.
- Exterior lighting (utility meters #9, #10, and #2) have distinct profiles. Exterior lighting energy usage increases during the winter months when nights are longer and decreases during the summer months when nights are shorter. This verifies that the photocells controlling the exterior lighting are functioning as designed.
- The maintenance building, shown in Utility Meter #2, has a very high heating load during the wintertime and cooling load during the summer, possibly indicating there are no temperature setbacks for the building.
- The majority of energy usage for the public and private hangars is due to the current T12, 8ft. fluorescent fixtures. During the hot, summer months, there is a noticeable increase in electrical energy usage due to the operation of the swamp coolers.
- The landing lights and transformer room account for over 1/3 of the total energy usage for the airport. The transformer room, specifically, has a high cooling load during the summer months.
- As noticed in Figure 6 above, the FBO Site #1, Wellsite, Entrance Signage, and Fuel Farm have pretty high unit costs, between $0.17-$2.00/kWh. This is mainly due to the low energy usage on each meter and the inclusion of customer charges and other fixed charges on the utility bill. There may be opportunity to consolidate meters and reduce costs by only paying one customer charge/fixed charges.

The following graphs combines all the calibrated utility meters' energy usage into one and breaks down the electrical energy by end-use. The following are key takeaways when looking at the airport energy usage as a whole:

- Landing lights, exterior lights, and interior lights comprise almost 60% of the total energy usage across all 12 meters.
- Electrical energy for space cooling accounts for about 25% of the total energy usage, of which the majority is space cooling in the Main Terminal.
- The remainder of the energy use consists of plug loads, ventilation fans, and space heating.



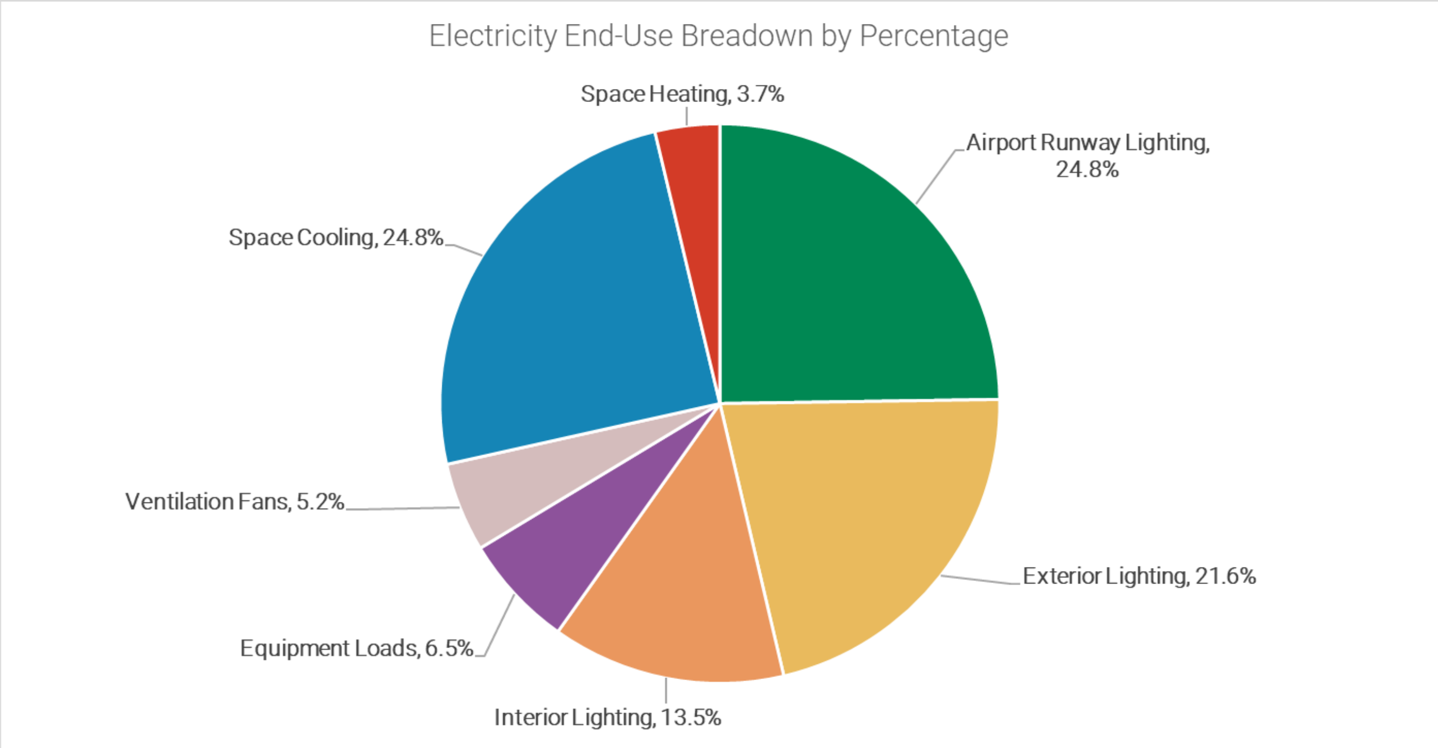


Figure 11 – Baseline Energy Breakdown by End-Use

Utility Meter Reports

Main Terminal

Landing Lights

Public and Private Hangars

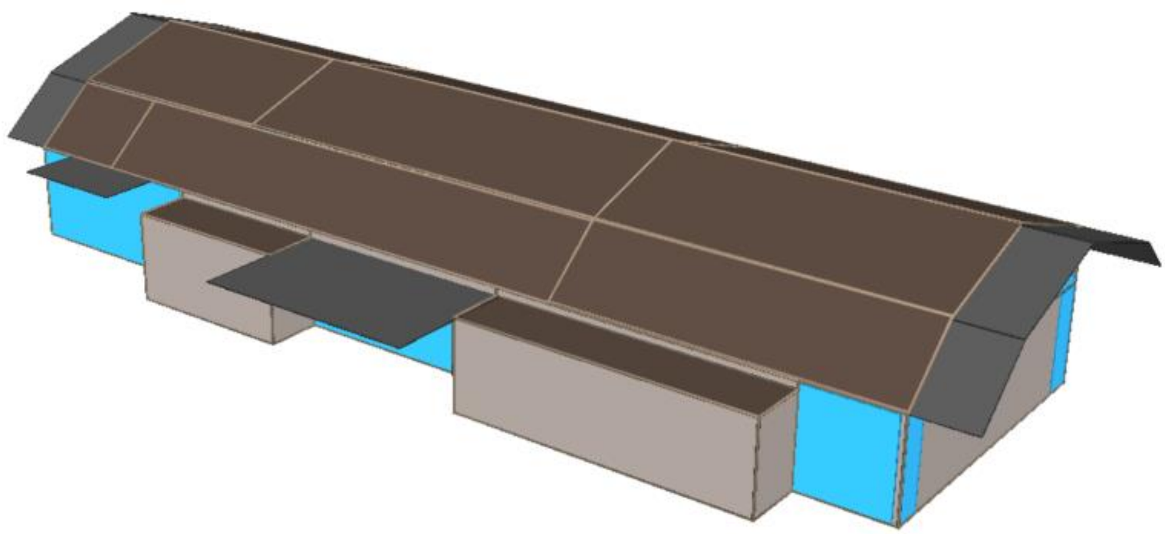
Entrance Sign

Additional Utility Meters

Meter 12: Main Terminal

Building Description

The main terminal is comprised of office, rental car area, and the main terminal areas. The total square footage of the building is about 8,000 SF. A 3D eQUEST rendering of the building is shown in the figure below.



Operational Schedules

The main terminal is divided between the office area, rental car, and main terminal area. The office area is expected to be occupied from 7:30 AM to 5:00 PM Monday through Sunday. The rental car area and main terminal is expected to be occupied from 5:00 AM to 10 PM every day of the week.

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit. Estimated energy/water savings, implementation cost, and simple payback are calculated for each conservation measure.

T01: Replace T5 and T8 Fluorescent Lamps with LEDs

Existing Condition

The main terminal utilizes a mixture of 2-lamp 4ft. T5/T8 fluorescent fixtures throughout. Each fixture has the opportunity to be upgraded to LED lamps/fixtures that draw significantly less power while also providing similar/better lighting levels.

Figure 1: Fluorescent Lighting Fixtures in the Employee Offices

Recommended Action

Replace all T5/T8 fluorescent lamps with LED lamps. Use a 12W GE LED12ET8/g/4/840 linear LED lamp or similar to replace linear T5/T8 fluorescent lamps. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing all T5/T8 fluorescent lamps with LED lamps would result in electrical savings of about 3,583 kWh per year. Total cost savings would be about $391 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $150 in incentive rebates. It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $995, and the simple payback would be 2.54 years, including the incentive.

T02: Install Heating and Cooling Temperature Setbacks

Existing Condition


Figure 2: Thermostat in Main Terminal Area

Based on site observations, the heating and cooling setpoints in the main terminal area are 72 °F and 78 °F, respectively. It is understood that the cooling setback temperature is 82 °F; however, there is no setback temperature for heating in the main terminal area. For the office spaces, the current heating and cooling setpoints are 72 °F and 76 °F, respectively. Based on the thermostat setting, there are no temperature setbacks in the office areas.

Recommended Action

It is recommended that the maintenance staff implement and program the existing thermostats to include a temperature setback schedule for both heating and cooling for the office and main terminal areas.

Onsite personnel indicated that the office areas are occupied from 7:30 AM to 5:00 PM Monday through Sunday. Thus, it is recommended that the staff program the thermostats to be 82 °F for cooling and 60 °F for heating from 6 PM to 6:30 AM everyday of the week.

For the main terminal area, the expected occupancy is currently from 5 AM to 10 PM every day of the week. It is recommended that the staff program the thermostats to be 60 °F from 10 PM to 5:30 AM.

Energy and Cost Savings

Programming the thermostats to include heating and cooling unoccupied setpoints would result in electrical savings of about **4,907 kWh per year.** Total cost savings would be about **$535 per year**. There is expected to be no implementation cost since no new equipment is required, and programming the thermostats requires about 30 minutes.

T03: Reduce Space Heating Temperature Setpoint to 70 °F

Existing Condition

The current heating temperature setpoint in the main terminal area and office area is 72 °F.

Recommended Action

It is recommended that the heating temperature setpoint in the main terminal area and office areas be reduced to 70 °F.

Energy and Cost Savings

Reducing the heating setpoint temperature to 70 °F would result in electrical savings of about 1,227 kWh per year. Total cost savings would be about $134 per year. There is expected to be no implementation cost since no new equipment is required, and programming the thermostats requires about 15 minutes.

Figure 3: Thermostat in the Office Areas

T04: Install High Efficiency Heat Pump Units at End of Life

Existing Condition

The main terminal currently utilizes three, 7.5 ton Trane heat pump units to provide space cooling and space heating for the main terminal areas. Based on manufacturing data, the cooling and heating efficiency of the heat pump units is nearly 10.1 EER and 3.0 COP, respectively. The office areas utilize a 4 ton Trane heat pump unit. Based on manufacturing data, the cooling and heating efficiency of the 4 ton unit is about 13 SEER and 3.0 COP, respectively. All units can be upgraded to high efficiency heat pump units to reduce cooling, heating, and fan energy usage.

Figure 4: 7.5 Ton Trane Heat Pump Unit

Recommended Action

It is recommended that the 7.5 ton Trane units be replaced with the Daikin DZ11TA090/DAT0904 heat pump unit or similar at end of life. The Daikin units would provide an increased cooling efficiency of 11 EER and heating efficiency of 3.29 COP. Additionally, the new units would provide two speed ECM fan operation to minimize fan energy usage.

It is recommended that the 4 ton Trane unit be replaced with a 4 ton Trane unit be replaced with the Armstrong BCE4M60S/4SHP20LX heat pump unit or similar at end of life. The Armstrong unit would provide an increased cooling efficiency of 19 SEER and heating efficiency of 3.82 COP. Additionally, the new unit would provide variable speed ECM fan operation to minimize fan energy usage. The recommended heat pump unit specifications can be found in the Appendix.

Energy and Cost Savings

Replacing the current split heat pump systems with high efficiency heat pump units would result in electrical savings of about 7,121 kWh per year. Total cost savings would be about $776 per year.

Based on UniSource Energy Services incentives, this recommendation would qualify for about $712 in rebates.

Based on manufacturing data and RSMeans costs, a new 7.5 ton unit is expected to cost around $7,500 with another $4,000 in installation costs. A new 4 ton unit is expected to cost around $4,500 with another $2,000 in installation costs. Thus, the total implementation cost would be about $40,288, and the simple payback would be over 10 years.

Given that the payback for this recommendation is over 10 years, it is recommended that switching out HVAC equipment be completed at the end of life of the current equipment. Additionally, this recommendation should be weighed against recommendation T07: High Efficiency Packaged VAV System at End of Life.

T05: Install High Efficiency Split AC Units in Restrooms at End of Life

Existing Condition

The men's and women's restroom currently utilize Carrier XPower split AC units. Based on the site visit, the carrier unit was about 5-7 years old. Based on manufacturing data, the cooling efficiency of the unit is about 15 SEER and the heating efficiency is about 3.5 COP. These units can be upgraded to a similar high efficiency Mitsubishi unit that has been installed in the Rental Car area.

Figure 5: Carrier XPower Split AC Unit in the Men's Restroom

Recommended Action

It is recommended that the split AC units in the restroom be replaced with the Mitsubishi MSZ-GL18NA/MUZ-GL18NA or similar split AC unit at end of life. The Mitsubishi unit has a cooling efficiency of about 20.5 SEER and a heating efficiency of about 3.77 COP.

Energy and Cost Savings

Replacing the current split AC units with high efficiency units would result in electrical savings of about 562 kWh per year. Total cost savings would be about $61 per year.

Based on UniSource Energy Services incentives, this recommendation would qualify for about $56 in rebates.

Based on manufacturing data and RSMeans costs, a new split AC unit is expected to cost around $3,200 with another $500 in installation costs. Thus, the total implementation cost would be about $7,344, and the simple payback would be over 10 years.

Given that the payback for this recommendation is over 10 years, it is recommended that switching out HVAC equipment be completed at the end of life of the current equipment.

T06: Install High Efficiency Packaged VAV System at End of Life

Existing Condition

The main terminal currently utilizes three, 7.5 ton Trane heat pump units to provide space cooling and space heating for the main terminal areas. Based on manufacturing data, the cooling and heating efficiency of the heat pump units is nearly 10.1 EER and 3.0 COP, respectively. The office areas utilize a 4 ton Trane heat pump unit. Based on manufacturing data, the cooling and heating efficiency of the 4 ton unit is about 13 SEER and 3.0 COP, respectively. The current system is a constant volume system. There is opportunity to install a packaged VAV system to minimize fan power at part load conditions.

Figure 6: 7.5 Ton Trane Heat Pump Unit

Recommended Action

It is recommended that the airport consider switching out the constant volume packaged HVAC system with a variable volume packaged VAV system. Installing a VAV system would optimize airflow and cooling energy at part load conditions as well as provide optimal thermal comfort for employees and travelers. Additionally, only one HVAC unit would need to be install versus the four that currently provide conditioning.

Energy and Cost Savings

Replacing the current split AC units with a high efficiency packaged VAV system would result in electrical savings of about **9,912 kWh per year.** Total cost savings would be about **$1,080 per year**.

Based on UniSource Energy Services incentives, this recommendation would qualify for about **$991** in rebates.

Based on manufacturing data and RSMeans costs, a new 25 ton, packaged VAV unit is expected to cost around $21,000 with another $6,000 in installation costs. Additionally, installing VAV boxes would cost another $5,000 and reconfiguring the ductwork would cost another $7,500. Thus, the total implementation cost would be about **$38,509**, and the simple payback would be **over 10 years**.

Given that the payback for this recommendation is over 10 years, it is recommended that switching out HVAC equipment be completed at the end of life of the current equipment. Additionally, this recommendation should be weighed against recommendation T05: High Efficiency Heat Pump Units at End of Life.

Analysis Results

Economic Results Summary

The following table details the eQUEST outputs, energy savings, and cost savings for each ECM option evaluated. Key findings from the energy analysis include:

- Installing LED lighting can reduce electrical energy costs by 4.6%
- Installing proper temperature controls and setpoints can reduce energy costs by about 8% with zero implementation cost.
- Replacing HVAC equipment should only be considered at the end of life for the specific equipment. At the end of life for the split heat pump units, both high efficiency split heat pump units and high efficiency packaged VAV system (highlighted in green) provide significant reduction (9%-12%) in electrical energy costs.

Lake Havasu City Municipal Airport Terminal										
				HVAC				Totals		
#	Run	Ambient Lighting (kWh)	Misc Equip (kWh)	Heating Electric (kWh)	Cooling Electric (kWh)	Vent Fans (kWh)	Total HVAC (kWh)	Total Electric (kWh)	Total Cost $/year	Percent Cost Savings
B0	Calibrated Model	7,757	11,015	4,384	38,968	15,686	59,038	77,840	$8,485	0.0%
T01	Replace T5/T8 Fluorescent Lamps with LEDs	4,639	11,015	4,605	38,342	15,627	58,574	74,257	$8,094	4.6%
T02	Install Heating and Cooling Temperature Setbacks	4,639	11,015	3,013	36,935	13,719	53,667	69,350	$7,559	10.9%
T03	Reduce Space Heating Temperature Setpoint to 70 °F	4,639	11,015	2,425	36,761	13,257	52,443	68,123	$7,425	12.5%
T04	Install High Efficiency HP Units at End of Life	4,639	11,015	2,299	32,268	10,754	45,321	61,002	$6,649	21.6%
T05	Install High Efficiency Split AC Units in Restrooms	4,639	11,015	2,266	31,739	10,754	44,759	60,440	$6,588	22.4%
T06	Install High Efficiency PVAV System at End of Life	4,639	11,015	4,648	30,340	7,524	42,512	58,211	$6,345	25.2%
	Savings relative to Previous Measure									
T01	Replace T5/T8 Fluorescent Lamps with LEDs	3,118	-	(221)	626	59	464	3,583	$391	4.6%
T02	Install Heating and Cooling Temperature Setbacks	-	-	1,592	1,407	1,908	4,907	4,907	$535	6.3%
T03	Reduce Space Heating Temperature Setpoint to 70 °F	-	-	588	174	462	1,224	1,227	$134	1.6%
T04	Install High Efficiency HP Units at End of Life	-	-	126	4,493	2,503	7,122	7,121	$776	9.1%
T05	Install High Efficiency Split AC Units in Restrooms	-	-	33	529	-	562	562	$61	0.7%
T06	Install High Efficiency PVAV System at End of Life	-	-	(2,223)	6,421	5,733	9,931	9,912	$1,080	12.7%
	Total Savings									
	Total Savings	3,118	-	2,118	7,229	4,932	14,279	17,400	$1,897	22.4%
	Percent of Baseline	40.2%	0.0%	48.3%	18.6%	31.4%	24.2%	22.4%	22.4%	22.4%

Figure 7: Energy and Cost Summary for Each ECM

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	UES Incentive	Simple Payback
T01	Replace T5/T8 Fluorescent Lamps with LEDs	$1,145	$391	$150	2.5
T02	Install Heating and Cooling Temperature Setbacks	$0	$535	$0	Immediate
T03	Reduce Space Heating Temperature Setpoint to 70 °F	$0	$134	$0	Immediate
T04	Install High Efficiency HP Units at End of Life	$41,000	$776	$712	51.9
T05	Install High Efficiency Split AC Units in Restrooms	$7,400	$61	$56	119.9
T06	Install High Efficiency PVAV System at End of Life	$39,500	$1,080	$991	35.6

Figure 8 – Economic Results Summary

Solar PV Analysis

The climate at Lake Havasu City Municipal Airport provides an ideal location for solar energy production from a solar photovoltaic system. Additionally, UniSource Energy Services offers net metering which credits the users for any unused, generated electricity from the PV system that is sent back to the electrical grid. This means that a battery storage system does not need to be installed with the solar PV panels.

At the Main Terminal, there is plenty of space and parking lots to potentially install a solar PV system. The following analysis details a solar PV that would offset all electricity usage for Meter #12: Main Terminal and turn the Main Terminal into a net-zero energy building.

Based on the utility analysis, the main terminal annual electricity usage is about 74,120 kWh per year. A fixed, tilt, ground mount PV system would produce approximately 1650 kWh/kW of installed capacity per year. Therefore, to offset the total energy consumption for the Main Terminal, a 45 kW solar PV array would need to be installed. The following map highlights the potential location and size of the 45 kW ground mount solar PV array.

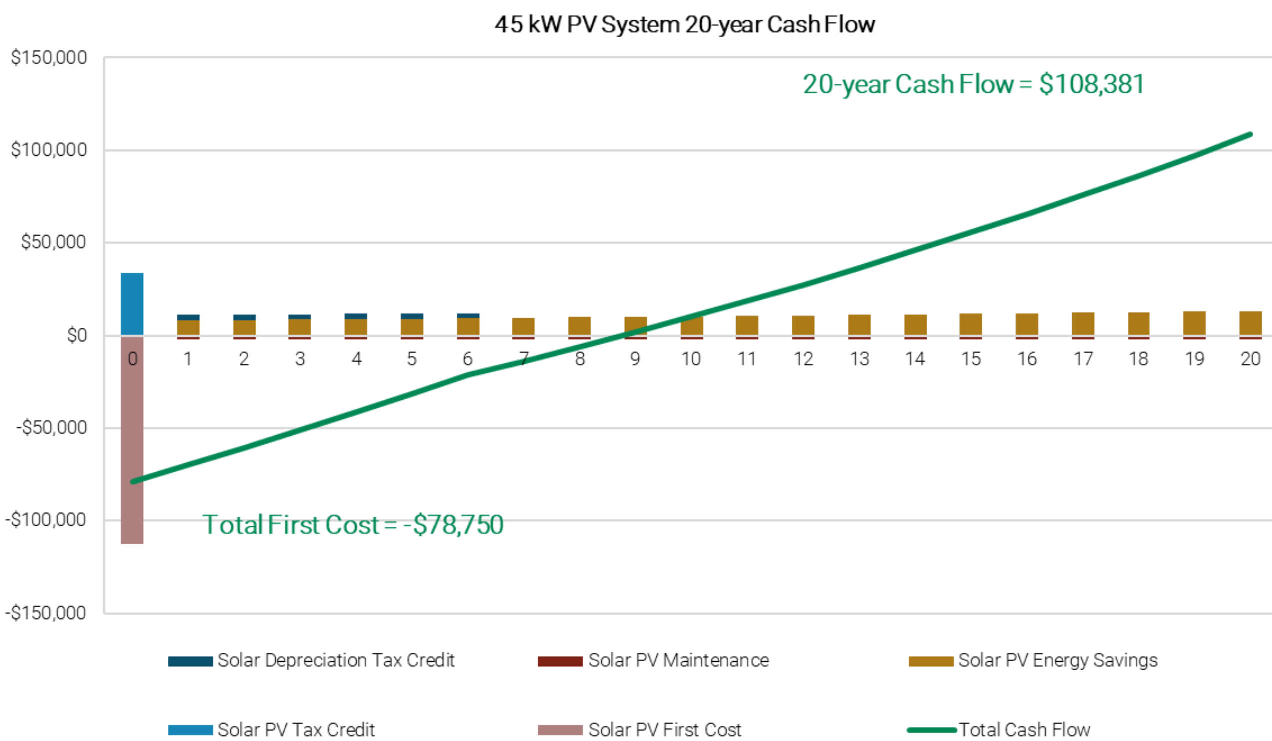
Figure 9: Site of Potential Ground Mount Solar PV Array

The following table shows the financial inputs for the 45 kW ground mount solar PV system. Based on the table below, the solar PV system annual cost savings would be about **$8,462 per year.** The first cost of the solar PV system is expected to about **$2.50** /Watt, or **$112,500**, before the 30% Federal Tax Credit.

Solar PV Cost Inputs/Outputs		
Solar PV First Cost	$2.50	/Watt
Federal Tax Incentive	30%	-
Equipment Lifetime	20	years
Solar Utility Rate	$0.11	$/kWh
Energy Escalation Rate	3.0%	-
Solar Depreciation Term	6	years
Solar PV Y1 Cost Savings	$8,462	/year
Solar PV Annual Maintenance	$2,000	-

The following table summarizes the financial results, and the following graph shows the 20 year cash flow for the solar PV system, incorporating first cost, federal tax credit, solar depreciation, and cost savings. Installing a 45 kW PV system would result in a 20 year cash flow of **$108,381** with a **20 year NPV of $36,455** and an **IRR of 9.9%.** Additionally, the main terminal would become a net-zero energy building.

Financial Results		
20-year NPV	$36,455	-
Straight Line Payback	8.76	years
Year-1 ROI	7.9%	-
IRR	9.9%	-



Meter #7: Landing Lights

Equipment Description

The main two areas of equipment that are served by Meter #7 are all of the landing lights and the air conditioned transformer room located adjacent to the main terminal. The four types of landing lights at the airport are as follows: beacon, runway, signage, and precision approach path indicator (PAPI) lights. The transformer room mainly consists of the transformers serving the landing lights and a packaged AC unit to condition the room.

Operational Schedules

Beacon Light Schedule

- Dusk to Dawn

Runway and Signage Light Schedule

- Activated by incoming pilots, lighting intensity varies on pilot's preference

PAPI Lights Schedule

- 24/7 operation

Transformer Room Schedule

- HVAC unit cycles on/off to maintain cooling setpoint of 79 °F

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for the runway lighting. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

L01: Replace 3-ton AC Unit with High Efficient Heat Pump Unit

Figure 1: 3-ton Marvair AC Unit

Existing Condition

The transformer room is currently conditioned by a 3 ton Marvair AC unit with a full load efficiency of about 9 EER. The unit also utilizes electric resistance heating with a rated capacity of 5 kW. The AC unit maintains a cooling setpoint temperature of 79 °F during the summer. The heating setpoint temperature was not known at the time of the site visit.

Recommended Action

It is recommended that the existing AC unit be replaced with a newer 3-ton Marvair heat pump unit that has a full load cooling efficiency of about 11.2 EER and heating efficiency of about 3 COP. Additionally, the new unit would be equipped with economizer control to provide free cooling to the space when outdoor air conditions are favorable. Given that there is a large internal heating load, installing an economizer would provide a significant energy reduction opportunity.

Energy and Cost Savings

Replacing the existing Marvair AC unit with a newer Marvair heat pump unit would result in electricity savings of about 7,801 kWh per year and cost savings of about $858 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $260 in incentive rebates. Based on manufacturing data and RSMeans data, the expected cost for each guidance sign would be about $3,500. If so, the total implementation cost would be about $3,240. The simple payback would be over 3.8 years.

L02: Replace Runway Fixtures with LED Fixtures

Existing Condition

Based on site observation, there are about 400 runway fixtures that line the landing strip and taxing paths. Currently, each fixture utilizes a 30W halogen lamp to illuminate the runway and paths. There is opportunity to replace the 30W halogen fixtures with LED fixtures that draw significantly less power while also provide the same/better lighting levels.

Figure 2: Runway Replacement Lamp

Recommended Action

It is recommended that the 30W halogen fixtures be replaced with the Navigate Series 861-L 20W LED fixtures, or similar. Based on FAA regulations, the whole fixture would need to be replaced, not just the lamp. Additionally, staff personnel should consider if the voltage between the new LED fixtures and old incandescent fixtures would change. If so, it is possible the transformers would need to be replaced as well.

Energy and Cost Savings

Replacing the incandescent runway fixtures with LED fixtures would result in electricity savings of about 8,808 kWh per year and cost savings of about $969 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $880 in incentive rebates. Based on conversations with facility personnel and manufacturing data, the expected cost for each fixture would be about $200. If so, the total implementation cost would be about $79,120. The simple payback would be over 10 years.

L03: Replace PAPI Fixtures with LED Fixtures

Existing Condition

Based on site observation and conversation with facility personnel, there are about 18 PAPI lamps that draw 105W each. The PAPI lamps are required to operate 24/7 to guide pilots during their descent into the airport. There is opportunity to replace the 105W lamps with LED fixtures that draw significantly less power while also provide the same/better lighting levels.

Figure 3: 105W PAPI Lamp

Recommended Action

It is recommended that 105W PAPI fixtures be replaced with the Carmanah 55W PAPI fixtures or similar. Based on FAA regulations, the whole fixture would need to be replaced, not just the lamp. Additionally, staff personnel should consider if the voltage between the new LED fixtures and old incandescent fixtures would change. If so, it is possible the transformers would need to be replaced as well.

Energy and Cost Savings

Replacing the incandescent PAPI fixtures with LED fixtures would result in electricity savings of about 7,884 kWh per year and cost savings of about $867 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $788 in incentive rebates. Based on conversations with facility personnel and manufacturing data, the expected cost for each PAPI fixture would be about $10,000. If so, the total implementation cost would be about $49,212. The simple payback would be over 10 years.

L04: Replace Signage Lights with LED Fixtures

Existing Condition
Based on conversations with facility personnel, there area about 75 airfield guidance signs, each with three 45W fluorescent lamps. The signs are operated by the pilots during their descent into the airport. There is opportunity to replace the current guidance signs with more efficient LED signs.

Recommended Action
It is recommended that the current airfield guidance signs be replaced with new LED guidance signs, AGSF-L signs or similar. Based on FAA regulations, the whole fixture would need to be replaced, not just the lamps. Additionally, staff personnel should consider if the voltage between the new LED fixtures and old incandescent fixtures would change. If so, it is possible the transformers would need to be replaced as well.

Energy and Cost Savings
Replacing the existing signs with new LED signs would result in electricity savings of about 7,927 kWh per year and cost savings of about $872 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $792 in incentive rebates. Based on conversations with facility personnel and manufacturing data, the expected cost for each guidance sign would be about $2,000. If so, the total implementation cost would be about $149,208. The simple payback would be over 10 years.

L05: Replace Beacon Light with LED Fixture

Existing Condition

The current beacon light draws about 2000W and is controlled by a photocell to operate from dusk till dawn. Similar to the other landing lights, there is opportunity to replace the beacon fixture with a more efficient LED fixture.

Recommended Action

Replace the 2000W beacon fixture with a 795W RBMI Rotating Beacon light, or similar. Based on FAA regulations, the whole fixture would need to be replaced, not just the lamps. Additionally, staff personnel should consider if the voltage between the new LED fixtures and old incandescent fixtures would change. If so, it is possible the transformers would need to be replaced as well.

Energy and Cost Savings

Replacing the existing beacon fixture with a new, higher efficient light would result in electricity savings of about 5,211 kWh per year and cost savings of about $573 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $521 in incentive rebates. Based on conversations with facility personnel and manufacturing data, the expected cost for each guidance sign would be about $10,000. If so, the total implementation cost would be about $9,479. The simple payback would be over 10 years.

Analysis Results

Economic Results Summary

Energy results for each of the ECMs described above are shown in the table below. Overall, installing LED lighting for the landing lights and a high efficient heat pump unit for the transformer room could reduce costs for Meter #7 by about **36%**.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	105,472	$11,602	0%	$0	0%
L01	Replace AC Unit with Heat Pump Unit	97,671	$10,744	7%	$858	7%
L02	Replace Runway Fixtures with LED Fixtures	88,863	$9,775	16%	$969	8%
L03	Replace PAPI Fixtures with LED Fixtures	80,979	$8,908	23%	$867	7%
L04	Replace Signage Lights with LED Fixtures	73,052	$8,036	31%	$872	8%
L05	Replace Beacon Light with LED Fixtures	67,841	$7,462	36%	$573	5%

Figure 4: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data. Overall, replacing landing lights is not economically favorable and should only be considered when fixtures have to be replaced.

ECM	Measure Description	First Cost	Utility Cost Savings	UES Incentive	Simple Payback (years)
L01	Replace AC Unit with Heat Pump Unit	$3,500	$858	$260	3.8
L02	Replace Runway Fixtures with LED Fixtures	$80,000	$969	$880	81.7
L03	Replace PAPI Fixtures with LED Fixtures	$50,000	$867	$788	56.8
L04	Replace Signage Lights with LED Fixtures	$150,000	$872	$792	171.1
L05	Replace Beacon Light with LED Fixtures	$10,000	$573	$521	16.5

Figure 5 – Economic Results Summary

Solar PV Analysis

The climate at Lake Havasu City Municipal Airport provides an ideal location for solar energy production from a solar photovoltaic system. There is plenty of space and parking lots to potentially install a solar PV system next to the transformer room. The following analysis details a solar PV that would offset all electricity usage for Meter #7: Landing Lights.

Based on the utility analysis, annual electricity usage for Meter #7 is about 105,473 kWh per year. A fixed, tilt, ground mount PV system would produce approximately 1650 kWh/kW of installed capacity per year. Therefore, to offset the total energy consumption for the landing lights, a 64 kW solar PV array would need to be installed. The following map highlights the potential location and size of the 65 kW ground mount solar PV array.

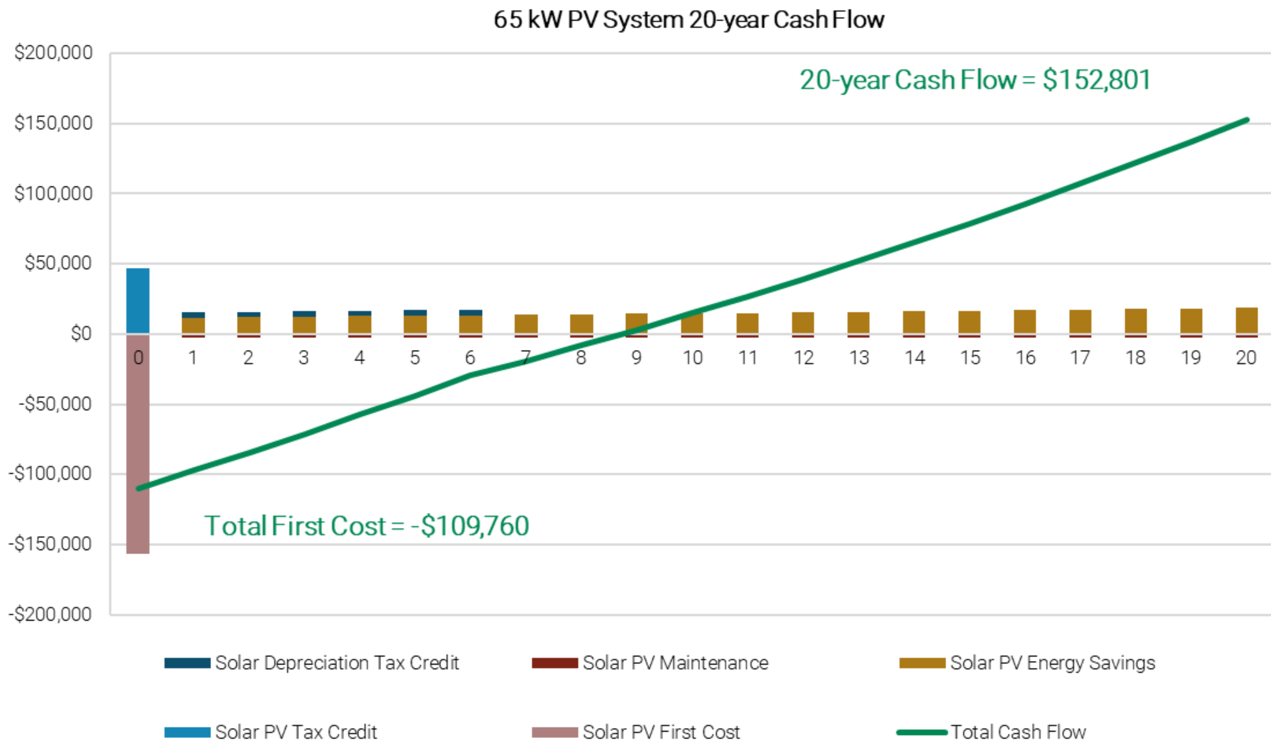
Figure 6: Site of Potential Ground Mount Solar PV Array

The following table shows the financial inputs for the 65 kW ground mount solar PV system. Based on the table below, the solar PV system annual cost savings would be about **$12,035 per year.** The first cost of the solar PV system is expected to about **$2.45** /Watt, or **$156,800**, before the 30% Federal Tax Credit.

Solar PV Cost Inputs/Outputs		
Solar PV First Cost	$2.45	/Watt
Federal Tax Incentive	30%	-
Equipment Lifetime	20	years
Solar Utility Rate	$0.11	$/kWh
Energy Escalation Rate	3.0%	-
Solar Depreciation Term	6	years
Solar PV Y1 Cost Savings	$12,035	/year
Solar PV Annual Maintenan	$3,000	-

The following table summarizes the financial results, and the following graph shows the 20 year cash flow for the solar PV system, incorporating first cost, federal tax credit, solar depreciation, and cost savings. Installing a 65 kW PV system would result in a 20 year cash flow of **$152,801** with a **20 year NPV of $51,751** and an **IRR of 10%.** Additionally, the solar PV system would offset all electricity usage for Meter #7.

Financial Results		
20-year NPV	$51,751	-
Straight Line Payback	8.72	years
Year-1 ROI	8.0%	-
IRR	10.0%	-



Meters 3,6,8,11: Public and Private Hangars

Equipment Description

There are about 40 private and 26 public hangars that are divided between Meters #3, 6, 8, and 11. All hangars utilize T12 fluorescent linear fixtures. Additionally, the hangars utilize a mixture of CFL, halogen, and incandescent exterior fixtures. Based on site observations and the utility analysis, only the public hangars #53-60 are not equipped with dedicated swamp coolers.

Operational Schedules

Public and Private Hangars

- . There is no set schedule of operation, as the schedule is highly dependent on the occupants.

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for interior and exterior lighting. Estimated energy/water savings, implementation cost, and simple payback are calculated for each conservation measure.

H01: Replace All 2-Lamp, 8ft. T12 Fixtures with LED Fixtures

Existing Condition

The public hangars #41-60 utilize 4, 2-lamp 8-foot T12 fluorescent fixtures each. The hangars #74-79 and private hangars each utilize 2, 2-lamp 8-foot T12 fluorescent fixtures. Each T12 fixture outputs about 220W. Each fixture has the opportunity to be upgraded to LED fixtures that draw significantly less power while also providing same/better lighting levels.

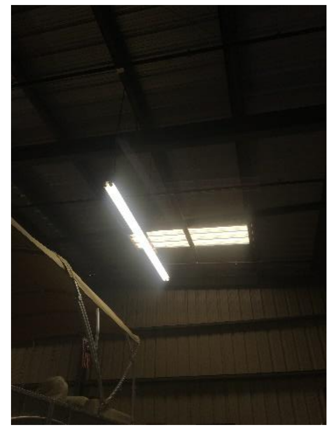


Figure 1: 2-lamp T8 8 ft. Fluorescent Fixture

Recommended Action

It is recommended that each T12 fixture in the hangars be replaced with a Series SKD 8ft. 80W LED fixture or similar. It is also recommended that the whole fixture be replaced instead of just replacing the lamps. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as fluorescent fixtures at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing all T12 8ft. fixtures in the hangars with LED fixtures would result in electrical energy savings of about 22,231 kWh per year and cost savings of about $2,445 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $2,223 in incentive rebates. It is assumed that each fixture would take about one hour to replace the fixture at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended fixtures, the implementation cost would be about $18,277, and the simple payback would be 7.47 years, including the incentive.

H02: Replace All Exterior Lighting with LED Fixtures

Existing Condition

Based on the site visit, Hangars #41-52, #53-60, and #74-79 utilize a total of eleven exterior 150W halide fixtures that are controlled by a photocell. The private hangars utilize a mixture of halogen and compact fluorescent fixtures. Each exterior fixture has the opportunity to be upgraded to LED fixtures that draw significantly less power while also providing the same/better lighting levels.

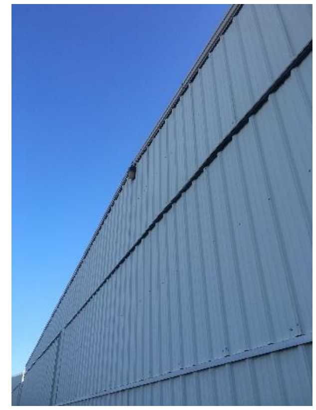


Figure 2: Exterior Halide Fixture

Recommended Action

It is recommended that each exterior 150W halide fixture be replaced with a 50W LED Flat Corn Light or similar. Each compact fluorescent fixture should be replaced with a 10W A19 screw in LED. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as fluorescent fixtures at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing all exterior fixtures serving the hangars with LED fixtures would result in electrical energy savings of about 6,573 kWh per year and cost savings of about $723 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $657 in incentive rebates. It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended fixtures, the implementation cost would be about $1,045, and the simple payback would be 1.44 years, including the incentive.

Analysis Results

Economic Results Summary

Energy results for each ECM described above are shown in the table below. Overall, replacing all lighting fixtures with high efficient LEDs could reduce total energy consumption for the Hangars by 48%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	49,459	$6,618	0%	$0	0%
H01	Replace All 2-Lamp, 8ft. T12 Fixtures w/ LEDs	27,228	$4,173	37%	$2,445	37%
H02	Replace All Exterior Lighting w/ LEDs	20,655	$3,450	48%	$723	11%

Figure 3: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	UES Incentive	Simple Payback (years)
H01	Replace All 2-Lamp, 8ft. T12 Fixtures w/ LEDs	$20,500	$2,445	$2,223	7.5
H02	Replace All Exterior Lighting w/ LEDs	$1,702	$723	$657	1.4

Figure 4 – Economic Results Summary

Meter 10: Entrance Sign

Equipment Description

Four, 175W halogen lighting fixtures illuminate the main entrance sign to the airport. The lighting fixtures are controlled by a photocell to turn the lights on from dusk to dawn.

Operational Schedules

Entrance Sign Lights

The entrance sign lights operate from dusk till dawn every day.

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for exterior lighting. Estimated energy/water savings, implementation cost, and simple payback are calculated for each conservation measure.

E01: Replace 175W Halogen Fixture with 50W LED Fixture

Existing Condition

Four, 175W halogen lighting fixtures illuminate the main entrance sign to the airport. The lighting fixtures are controlled by a photocell to turn the lights on from dusk to dawn. Each fixture has the opportunity to be upgraded to LED fixtures that draw significantly less power while also providing same/better lighting levels.

Figure 1: 175W Halogen Fixture

Recommended Action

It is recommended that each 175W halogen fixture be replaced with a 50W Mini LED Flood Light Fixture, or similar. It is also recommended that the whole fixture be replaced instead of just replacing the lamps. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as fluorescent fixtures at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing the four, 175W halogen fixtures with LED fixtures would result in electrical energy savings of about 1,701 kWh per year and cost savings of about $187 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $170 in incentive rebates. It is assumed that each fixture would take about one hour to replace the fixture at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended fixtures, the implementation cost would be about $330, and the simple payback would be 1.76 years, including the incentive.

Solar PV Analysis

Figure 2: Solar Powered Exterior Flood Light Example

The climate at Lake Havasu City Municipal Airport provides an ideal location for solar energy production from a solar photovoltaic system. For the entrance lighting fixtures, there are specific technologies that utilize solar PV panels to power exterior lighting fixtures. One example of many is the 50W LED Lighting Solutions solar flood light shown in the appendix. The flood light has an integrated lithium battery to store the generated energy from the PV panel during the day. At full charge, the flood light is able to operate all night. Thus installing four of the 50W solar powered flood lights would eliminate the need for a utility meter at the entrance sign and result in electrical energy savings of 2,381 kWh per year. Cost savings would be $553 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $238 in incentive rebates. It is assumed that each fixture would take about 1.5 hours to replace the fixture at a labor rate of $25 per hour (which assumes internal staff). Based on manufacturing costs, each 50W solar powered flood light would cost about $400. Utilizing this information and cost data for the recommended fixtures, the implementation cost would be about $1,570, and the simple payback would be 2.84 years, including the incentive.

Additional Meters #2 and #9

Equipment Description

Meter #2 consists of the maintenance building and the exterior parking lot pole lights for the terminal and streets leading to the terminal. The maintenance building utilizes 2-lamp T8 4 ft. fluorescent lighting fixtures and a Bard wall mounted AC unit with electric heat. There are about 33, 400W metal halide exterior pole lights that illuminate the parking lot and roads between the buildings and hangars.

Meter #9 only consists of 6, 400W metal halide exterior pole lights to illuminate the north side of the airport roads.

Operational Schedules

Maintenance Offices

Based on conversations with facility personnel, the maintenance office is occupied every day from about 5AM to 1:30 PM during the summer months and 6:30 AM to 3:00 PM during the winter months.

Exterior Pole Lights

The exterior pole lights are controlled with a photosensor to operate from dusk till dawn.

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for maintenance office and exterior lighting. Estimated energy/water savings, implementation cost, and simple payback are calculated for each conservation measure.

A01: Replace 400W Exterior Pole Fixtures with 150W LED Fixtures

Existing Condition

Currently, the airport utilizes about 36, 400W exterior pole lamps to illuminate the parking lot and roads between buildings. The fixtures are controlled by photocells to turn on at dusk and turn off at dawn. The 400W pole lamps draw a significant amount of power, and there is opportunity to replace the current fixtures with 150W LED fixtures.

Figure 1: Two, 400W Exterior Pole Fixtures

Recommended Action

It is recommended that all exterior pole fixtures be replaced with the NextGen II 150W LED fixture or similar. It is assumed that the existing pole structure is in good shape and the LED fixture could be fastened to the existing pole.

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing the exterior pole fixtures with high efficiency LED fixtures would result in electricity savings of about **33,991 kWh per year** and cost savings of about **$3,379** per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to **$3,399** in incentive rebates. It is assumed that each fixture would require an electrical contractor to work a full week to replace the fixtures at a labor rate of $125 per hour. Total labor cost would be about $5,000. Based on manufacturing data and RSMeans data, the expected cost for each LED fixture would be about **$350**. If so, the total implementation cost would be about **$14,201**. The simple payback would be over **4.2 years**.

A02: Replace T8 Fluorescent Lamps with LEDs in the Maintenance Office

Existing Condition

The maintenance office utilizes nine, 2-lamp T8 4 ft. fluorescent fixtures. Each fixture has the opportunity to be upgraded to LED lamps/fixtures that draw significantly less power while also providing same/better lighting levels.

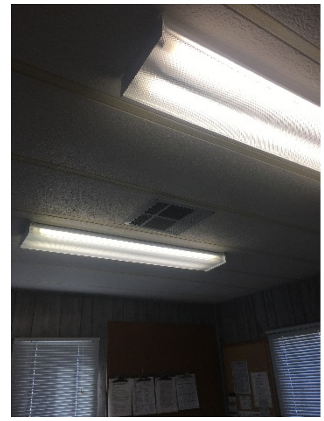


Figure 2: T8 Lighting Fixtures in the Maintenance Offices

Recommended Action

Replace all T8 fluorescent lamps with LED lamps. Use a 12W GE LED12ET8/g/4/840 linear LED lamp or similar to replace linear T8 fluorescent lamps. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing T8 fluorescent lamps with LED lamps would result in electrical savings of about 1,005 kWh per year. Total cost savings would be about $111 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $100 in incentive rebates. It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $375, and the simple payback would be 3.4 years, including the incentive.

A03: Install Heating and Cooling Temperature Setbacks in Maintenance Office

Existing Condition

Based on site observations, the heating and cooling setpoints in the maintenance office area are 68 °F and 72 °F, respectively. It is understood that there is no setback temperature for heating or cooling when the maintenance office is unoccupied.

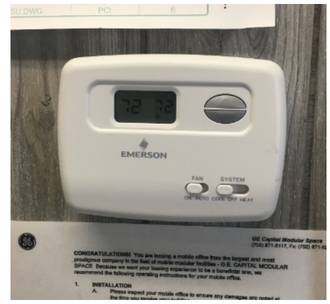


Figure 3: Thermostat in Maintenance Office

Recommended Action

It is recommended that the maintenance staff implement and program the existing thermostat to include a temperature setback schedule for both heating and cooling for the office and main terminal areas.

Based on conversations with facility personnel, the maintenance office is occupied every day from about 5AM to 1:30 PM during the summer months and 6:30 AM to 3:00 PM during the winter months. Thus, it is recommended that the staff program the thermostats to be 80 °F for cooling and 60 °F for heating from 2:30 PM to 4: AM during the summer and 4:00 PM to 5:30 AM PM during the week. It was unclear during the site visit if the current thermostat has a scheduling capability. If not, a new Emerson thermostat, or similar, would need to be purchased.

Energy and Cost Savings

Programming the thermostats to include heating and cooling unoccupied setpoints would result in electrical savings of about 996 kWh per year. Total cost savings would be about $110 per year. Assuming the current thermostat contains a scheduling function, there is no implementation. The simple payback is immediate.

A04: Replace 3-ton AC Unit with High Efficient Heat Pump Unit

Existing Condition

The maintenance office is currently conditioned by a 3-ton Bard AC unit with a full load efficiency of about 9.2 EER. The unit also utilizes electric resistance heating with a rated capacity of 7.5 kW. The AC unit maintains a cooling setpoint temperature of 72 °F during the summer and a heating setpoint of 68 °F during the winter.

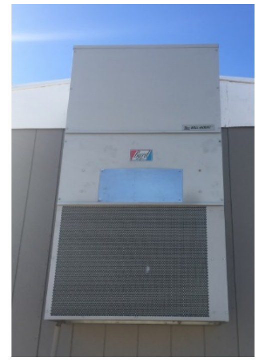


Figure 4: 3-ton Bard AC Unit

Recommended Action

It is recommended that the existing AC unit be replaced with a newer 3-ton Marvair heat pump unit that has a full load cooling efficiency of about 11.2 EER and heating efficiency of about 3 COP. Additionally, the new unit would be equipped with economizer control to provide free cooling to the space when outdoor air conditions are favorable.

Energy and Cost Savings

Replacing the existing Bard AC unit with a newer Marvair heat pump unit would result in electricity savings of about 3,465 kWh per year and cost savings of about $381 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $260 in incentive rebates. Based on manufacturing data and RSMeans data, the expected cost for the new heat pump would be about $3,500. If so, the total implementation cost would be about $3,240. The simple payback would be over 8.5 years.

Analysis Results

Economic Results Summary

Energy results for each of the ECMs described above are shown in the table below. Installing LED exterior lighting can reduce costs for Meters #2 and #9 by about **35%**. Additionally, installing LED interior lighting and optimizes HVAC systems and controls can reduce costs by another **6%**. Overall, electrical energy costs could be reduced by up to 41% for Meters #2 and #9.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline	68,536	$10,609	0%	$0	0%
E01	Replace 400W Pole Fixtures with LED Fixtures	34,545	$6,870	35%	$3,739	35%
E02	Replace T8 Lamps with LED Lamps	33,540	$6,759	36%	$111	1%
E03	Install Tempature Setbacks	32,543	$6,650	37%	$110	1%
E04	Replace 3-ton AC Unit with Heat Pump Unit	29,078	$6,269	41%	$381	4%

Figure 5: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	UES Incentive	Simple Payback (years)
A01	Replace 400W Pole Fixtures with LED Fixtures	$17,600	$3,379	$3,399	4.2
A02	Replace T8 Lamps with LED Lamps	$475	$111	$100	3.4
A03	Install Tempature Setbacks	$0	$110	$0	Immediate
A04	Replace 3-ton AC Unit with Heat Pump Unit	$3,500	$381	$260	8.5

Figure 6 – Economic Results Summary

Solar PV Analysis

Maintenance Office

The climate at Lake Havasu City Municipal Airport provides an ideal location for solar energy production from a solar photovoltaic system. Additionally, UniSource Energy Services offers net metering which credits the users for any unused, generated electricity from the PV system that is sent back to the electrical grid. This means that a battery storage system does not need to be installed with the solar PV panels.

Near the Maintenance Office, there is plenty of ground area and/or roof area to potentially install a solar PV system. The following analysis details a solar PV that would offset all electricity usage for the Maintenance Office, resulting in a net-zero energy building.

Based on the utility analysis and baseline calibration, the maintenance office annual electricity usage is about 18,338 kWh per year. A fixed, tilt, ground mount PV system or roof mounted PV system would produce approximately 1650 kWh/kW of installed capacity per year. Therefore, to offset the total energy consumption for the Maintenance Office, a 45 kW solar PV array would need to be installed. The following map highlights the potential location and size of the 45 kW ground mount solar PV array.

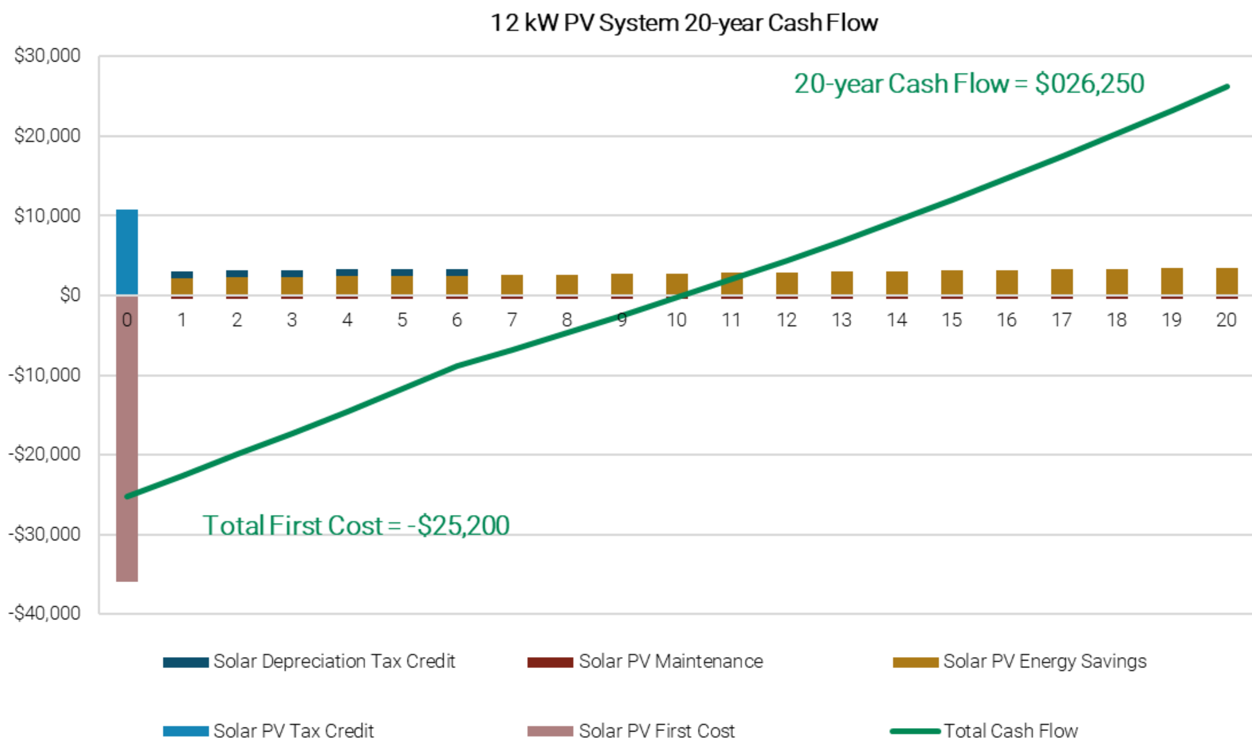
Figure 7: Site of Potential Ground Mount Solar PV Array

As noticed, very little room (about 900 ft^2) is needed for the 12-kW PV system. The following table shows the financial inputs for the 12 kW ground mount solar PV system. Based on the table below, the solar PV system annual cost savings would be about **$2,256 per year.** The first cost of the solar PV system is expected to about **$3.00** /Watt, or **$36,000**, before the 30% Federal Tax Credit.

Solar PV Cost Inputs/Outputs		
Solar PV First Cost	$3.00	/Watt
Federal Tax Incentive	30%	-
Equipment Lifetime	20	years
Solar Utility Rate	$0.11	$/kWh
Energy Escalation Rate	3.0%	-
Solar Depreciation Term	6	years
Solar PV Y1 Cost Savings	$2,256	/year
Solar PV Annual Maintenan	$3,000	-

The following table summarizes the financial results, and the following graph shows the 20 year cash flow for the solar PV system, incorporating first cost, federal tax credit, solar depreciation, and cost savings. Installing a 12 kW PV system would result in a 20 year cash flow of **$26,250** with a **20 year NPV of $6,683** and an **IRR of 7.9%.** Additionally, the maintenance office would become a net-zero energy building.

Financial Results		
20-year NPV	$6,683	-
Straight Line Payback	10.11	years
Year-1 ROI	6.8%	-
IRR	7.9%	-



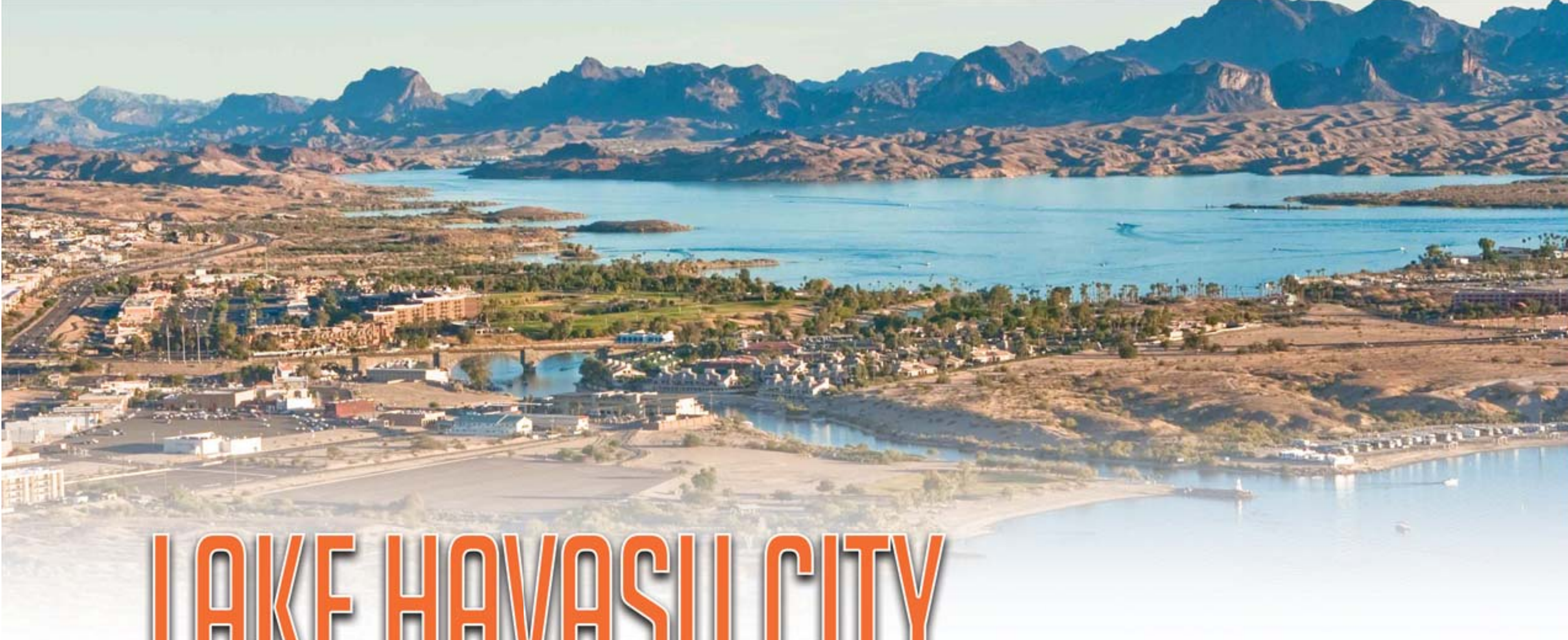
Solar Powered Exterior Pole Lighting Fixtures

Figure 8: Solar Powered Exterior Pole Lighting Example

For the exterior pole lighting fixtures, there are specific technologies that utilize solar PV panels to power the exterior lighting fixtures. One example is the Greenshine Supera Solar Pole Lighting System that is specifically designed to illuminate streets and parking lots. Each pole system incorporates an 80W LED lamp, 110W-160W solar PV panel, and the proper pole structure to support the weight. At full charge, the pole fixture is able to operate all night. Thus, installing the 36 solar pole lighting systems would eliminate all electrical energy usage for exterior pole lights and result in electrical energy savings of 54,386 kWh per year. Cost savings would be $6,240 per year.

Based on UniSource Energy Services incentives, this recommendation could receive up to $5,438 in incentive rebates. It is estimated it would take an electrical contractor half a day to install each fixture at a hourly rate of $125 per hour. Total labor cost would be about $18,000. Based on manufacturing data and RSMeans data, the expected cost for each solar powered pole lighting fixture would be about $3,000. If so, the total implementation cost would be about $126,000. The simple payback would be about over 10 years.

Given that the payback is greater than 10 years, it is recommended to simply switch out all exterior pole lights with LED fixtures (per recommendation A01).



LAKE HAVASU CITY
Municipal Airport
AIRPORT MASTER PLAN

APPENDIX D
ECONOMIC BENEFIT ANALYSIS

Appendix D
ECONOMIC BENEFIT ANALYSIS

This section presents an analysis of economic benefits created by Lake Havasu City Municipal Airport (HII). The airport is owned and operated by Lake Havasu City. The airport encompasses 646 acres and is about six miles north of the central district of Lake Havasu City, directly east of Arizona State Highway 95. There are currently 163 based aircraft on the airport, including 7 jets and 5 turboprop aircraft. The airport has one runway 8,001 feet in length and is capable of serving most business jets, although the airport does not have a tower. The airport features a modern terminal built in 1991 and private firms have developed high quality FBO services that attract aircraft from across the West. In addition, the Lake Havasu City area offers extensive resort-like vacation, entertainment, and recreation amenities.

General aviation aircraft owners based at Lake Havasu City Municipal Airport enjoy the benefits of on-demand flight schedules to destinations within the state or any of the nearly 5,000 general aviation airports that provide access to large and small communities across the country. Business aircraft arriving at the airport bring travel parties supporting the local economy, such as corporate representatives meeting with local firms or specialized medical personnel. Many general aviation visitors come as tourists, vacationers, and resort property owners who enjoy world-class scenery and the unique recreational opportunities within the Lake Havasu area.

Lake Havasu City Municipal Airport creates significant benefits that extend beyond the aviation community to impact economic growth and development, as well as improve the quality of life for residents of Lake Havasu City and Mohave County. The availability of an airport with sufficient infrastructure to support corporate jets 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, including various branches of the U. S. military. Medical transport, aerial mapping, and air cargo shipments are all essential functions provided at the airport every day of the year.

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, analysts have emphasized economic benefits that can be quantified:

- **Employment** is the number of jobs supported by economic activity created by the presence of Lake Havasu City Municipal 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, D.C., 1992, and has been closely followed in recent years by public and private sector aviation analysts. Consistent with the FAA methodology, this study views Lake Havasu City Municipal Airport as a source of measurable benefits that impact the residents of Lake Havasu City and Mohave County. 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 a 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 by 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. Many owners of vacation properties in the Lake Havasu area depend on general aviation and the airport to allow them to visit their second homes and participate as part of the Lake Havasu City community.

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. Spending by the pilot provides revenue to the Fixed Base Operator, 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 secondary transactions known as multiplier or "ripple effects," 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 further detail below.

- **Total economic benefits** are the combined sum of direct and secondary benefits created both on and off the airport.

- **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. 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 the number of visitors and their outlays for goods and services. These initial direct benefit figures are the "inputs" to an input-output model to estimate secondary benefits.

- **Secondary benefits** 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.

There are two types of 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 inter-industry or "supply chain" relationships within the 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 input-output model used for this study was the IMPLAN model, based on data and coefficients for the Mohave County economy from the U.S. Bureau of Economic Analysis and the Arizona Office of Economic Opportunity. The IMPLAN 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 2019 and figures are expressed in 2019 dollars.

SUMMARY OF FINDINGS

The total economic benefits of Lake Havasu Municipal Airport, incorporating direct benefits and all multiplier or secondary benefits, included 248 jobs with payroll of $11.7 million and output of $34.1 million. The direct benefits of on-airport and air visitor activity related to the airport consisted of economic output of $22.0 million, employment for 154 workers, and payroll of $7.6 million in 2019. The secondary benefits, incorporating both indirect and induced benefits, added employment of 94 workers, payroll of $4.1 million, and additional output for the region of $12.1 million. The direct, secondary, and total economic benefits created by on-airport, commercial service and general aviation activity are set out in **Table D1**.

TABLE D1
Summary of Economic Benefits
Lake Havasu City Municipal Airport

SOURCE	EMPLOYMENT	PAYROLL	OUTPUT
Direct Economic Benefits			
On-Airport Benefits: Activity by Aviation Firms, Government Agencies, Capital Improvement Projects	89	$5,863,000	$17,462,000
Air Visitor Benefits: Activity by General Aviation Travelers	65	$1,775,000	$4,525,000
Direct Benefits	***154***	***$7,638,000***	***$21,987,000***
Secondary Economic Benefits			
Indirect Benefits: Activity by Suppliers & Vendors	31	$1,258,000	$4,171,000
Induced Benefits: Activity by Employees as Consumers	63	$2,813,000	$7,963,000
Secondary Benefits	***94***	***$4,071,000***	***$12,134,000***
Total Economic Benefits			
Total Benefits	**248**	**$11,709,000**	**$34,121,000**

Source: On-airport employment obtained through on-site interviews and records maintained by Lake Havasu City Municipal Airport administrative staff. Payroll based on Mohave County wage data from U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages. Output estimates computed from the IMPLAN input-output model, with coefficients for Mohave County. Air visitor spending estimates based on data from Trip Advisor, Arizona Office of Tourism, and U.S. Government Services Agency. Secondary benefits (indirect and induced) were computed from the IMPLAN model. All Values in 2019 dollars.

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. Private employment accounted for eighty-five percent of all jobs on the airport in 2019.

There were 13 on-airport employers, with 89 workers in combined aviation, construction firms, and government units. Payroll for on-airport workers was $5.9 million. The direct output created by on-airport tenants, public agencies, and capital improvement project spending was $17.5 million.

SUMMARY: AIR VISITOR DIRECT BENEFITS

An estimated 11,227 itinerant general aviation aircraft arrived at Lake Havasu Municipal Airport in 2019. Of these, 2,195 remained overnight and the remaining 9,032 stayed for one day or, in some cases, a brief portion of a day. An estimated 3,544 arriving itinerant aircraft were at the airport for only a short time (often less than one hour), while 5,488 other travel parties conducted business or visited recreation sites in the area during their one-day stay. The direct spending on lodging, food and drink, retail, and recreation and entertainment off the airport by overnight and one-day general aviation visitors was $4.5 million in the Lake Havasu City hospitality industry, creating 65 private sector jobs with payroll to workers of $1.8 million.

SUMMARY: SECONDARY BENEFITS

The production of goods and services on the airport and for air visitors requires intermediate inputs from suppliers across the supply chain, creating secondary benefits in the form of additional output, employment, and payroll in the regional economy. As the initial direct benefits of Lake Havasu City Airport recirculated, secondary benefits as estimated by the IMPLAN model added output of $12.1 million and 94 additional jobs with payroll of $4.1 million. Every 10 direct on-airport or hospitality jobs supported six additional secondary jobs in other sectors, and every $1 million dollars of direct output created an additional $550,000 of secondary output in the general economy.

Of the 94 secondary jobs due to the presence of the airport, 31 were 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 systems, and communication. Indirect benefits from the IMPLAN input-output model included additional output in the regional economy of $4.2 million and payroll to workers of $1.2 million.

In addition, on-airport and visitor industry direct employees, and the secondary employees of suppliers created induced benefits as they spent their payroll in their home communities. As estimated in the IMPLAN model, there were 63 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 $8.0 million of output to the area economy.

The indirect and induced benefits reported are only those calculated from the IMPLAN input-output model that apply to Mohave County, although firms also made purchases outside the county. For example, when the auto rental firm at the airport purchases a new vehicle through a Mohave county dealership, the dealer's sales margin adds to local output, but the initial output and jobs involved in the production of the auto are not included in Mohave County benefits.

SUMMARY: TOTAL ECONOMIC BENEFITS

The total benefits are the sum of the direct and secondary benefits. Including direct benefits from on-airport economic activity and air visitor spending plus all secondary (multiplier) benefits, Lake Havasu City Municipal Airport created total economic benefits in 2019 as shown in **Figure B**.

248	$11.7 mil.	$34.1 mil.
EMPLOYMENT	PAYROLL	OUTPUT

Figure B. Lake Havasu City Municipal Airport Total Economic Benefits

The total economic benefits represent the economic contribution of the airport to the Lake Havasu City economy during 2019. The summation of direct and multiplier benefits measures the total economic benefits or total contribution to the economy of 248 jobs, with payroll of $11.7 million and output (sales or revenues) of $34.1 million. Focusing on the output figure, Lake Havasu Municipal Airport can be described as creating a total economic benefit of $34.1 million for Mohave County.

The airport is an employment center with 89 jobs directly on the airport, producing output (sales or revenues) of $17.5 million. The airport serves visitors or second-home property owners that arrive by general aviation private or charter aircraft. Spending by those visitors supports 65 jobs in the hospitality industry and creates output of $4.5 million. Purchases from suppliers along the supply chain (indirect benefits) and spending by employees as consumers (induced benefits) involves a multiplier effect resulting in 94 additional jobs and $12.1 million more output. These components combine to measure the total economic benefits of Lake Havasu City Municipal Airport.

A DAY AT LAKE HAVASU CITY MUNICIPAL AIRPORT

Airports are available to serve the flying public and support the economy every day of the year. The Lake Havasu City Municipal Airport is a "24/7" source of revenues, employment, and income for the regional economy. During an average day in 2019, Lake Havasu City Municipal Airport generated $93,500 of total economic benefits (including direct plus secondary benefits) and supported 248 area workers bringing home daily income of $32,000 for spending in their home communities (**Table D2**).

TABLE D2
Economic Benefits for an Average Day
Lake Havasu City Municipal Airport

Activity	Average Day
All Aircraft Operations	118 Daily Aircraft Operations
On-Airport Employment	89 Workers on the Airport
On-Airport Payrolls	$16,000 Paid to Airport Workers
General Aviation Air Visitors	90 Air Visitors in the Area Daily*
Air Visitor Spending	$12,400 Daily Visitor Spending
Total Employment	248 Total Area Jobs Supported
Total Payrolls	$32,000 Paid to Area Workers
Total Economic Benefits	$93,500 Daily Economic Benefits

*Includes overnight visitors as well as those who remain for only part of a day

On an average day at the airport, there were 118 operations by aircraft involved in local or itinerant activity, including touch-and-go operations, pilot training flights, corporate travel on business jets, or general aviation flights bringing passengers visiting the area for personal or business travel. On an average day, 90 air visitors were in the area spending for lodging, food and drink, retail goods and services, recreation, and ground transportation. Visitor spending injected $12,400 per day into the regional economy.

ON-AIRPORT ECONOMIC BENEFITS

Economic benefits on the airport flow from the employment, payroll, and output created by the 13 private firms and public agencies located on the airport, as well as capital improvement projects undertaken by private contractors that come onto the airport.

Figures for employment, payroll, and output reported in this study were obtained through surveys and interviews with managers conducted in 2019. Survey participants were informed that the individual employer results were confidential and only aggregate totals would appear in the written report.

The Lake Havasu City Municipal Airport Administration provided substantial data and collaboration in support of this study. Airport staff shared tenant records, facilitated on-site interviews with business owners and managers, and provided helpful insight and knowledge regarding airport operations.

During 2019, the 13 employers on the airport reported 89 employees **(Table D3)**. This tally includes two government agencies with 13 employees and 11 private firms with 70 employees, along with 6 worker-years employment for construction workers on site. Government units include Lake Havasu City Municipal Airport staff and Lake Havasu City Fire Station #6. Eighty-five percent of on-airport jobs are in the private sector.

TABLE D3
On-Airport Economic Benefits
Lake Havasu City Municipal Airport

SOURCE	EMPLOYMENT	PAYROLL	OUTPUT
Direct Economic Benefits			
Private Aviation Employers (11 Firms)	70	$4,181,000	$14,167,000
Government Employers (2 Agencies)	13	$1,472,000	$2,810,000
Capital Improvement Projects (5 Year Average Value)	6	$210,000	$485,000
Direct Benefits	***89***	***$5,863,000***	***$17,462,000***
Secondary Economic Benefits			
Indirect Benefits: *Activity by Suppliers & Vendors*	22	$981,000	$3,029,000
Induced Benefits: *Activity by Workers as Consumers*	48	$2,124,000	$6,051,000
Secondary Benefits	***70***	***$3,105,000***	***$9,080,000***
Total Economic Benefits			
Total Benefits	**159**	**$8,968,000**	**$26,542,000**

Source: On-airport employment obtained through on-site interviews and records maintained by Lake Havasu City Municipal administrative staff. Payroll figures based on employer interviews and Mohave County wage data from U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages. Output estimates computed from the IMPLAN input-output model, with coefficients for Mohave County. Values in 2019 dollars.

The 13 tenants on the airport provide a range of services in support of aviation activity, as shown in **Figure C**. Full service fueling is available for general aviation aircraft, and in addition, the airport attracts transient military and flight school aircraft due to ease of access and quality of services. Airport firms offer many aviation services, such as flight training, charters, and photography. Aircraft storage is available and new hangars have recently been constructed. Maintenance availability ranges from painting to highly technical avionics, repair, and upgrades. The private sector aviation firms on the airport reported employment of 70 workers with compensation of $4.2 million and output (revenues) of $14.2 million. There were 13 government workers on the airport, with payroll of $1.5 million and budgets of $2.8 million.

LAKE HAVASU CITY MUNICIPAL AIRPORT

Aviation Services
(13 Firms & Agencies)

- FBO Services & Fueling
- Flight Training
- Avionics & ADS-B Systems
- Maintenance & Inspections
- Aircraft Painting
- Helicopter Service
- Repair & Upgrades
- Sales & Rental
- Aircraft Parts
- Photography
- Charter Flights &Tours
- Hangar Rental
- Pilot Supplies
- Fire Department
- Airport Administration

Figure C. Airport Services

The average wage of workers on the airport during 2019 was $65,875. According to the U. S. Bureau of Economic Analysis, the average wage for Mohave County was $49,772 (2018). The on-airport average wage exceeded the county wage by approximately one third.

CAPITAL IMPROVEMENT PROJECTS

Capital improvement projects are also included as a source of airport economic benefits, as 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 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.

TABLE D4
Annual Capital Improvement Projects
Lake Havasu City Municipal Airport

Year	Expenditures
2014	$1,278,000
2015	$502,000
2016	$40,000
2017	$500,000
2018	$104,000
Five Year Average	*$485,000*

Source: Lake Havasu City Municipal Airport records of capital improvement spending from federal, state, and local sources.

For this study, figures on capital improvements were obtained from Lake Havasu City Municipal Airport records and averaged over the five-year period from 2014 through 2018. The average annual outlay was $485,000 **(Table D4)**. This value was used to obtain the employment estimate of 6 workers and payroll of $210,000 as representative annual figures for capital improvement activity at the airport.

DIRECT, SECONDARY, AND TOTAL ON-AIRPORT BENEFITS

The capital improvement projects undertaken on the airport by private contract firms were incorporated into the computation of direct benefits of on-airport activity to provide a final sum of 89 jobs on the airport, with payroll of $5.9 million and output of $17.5 million.

Secondary benefits as estimated by the IMPLAN model added employment of 70 more jobs and additional output of $9.1 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 across the area economy.

Of the 70 secondary jobs created by airport operations, 22 were indirect jobs in supplier industries to on-airport activity, such as finance and insurance, business services, providers of parts, supplies and materials, transportation and warehousing, and information and communication systems. There were 48 additional jobs induced by airport and supplier employee household spending across a broad spectrum of consumer industries, including healthcare, 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 159 jobs supported, with payroll of $9.0 million, and output of $26.5 million contributed to the area economy.

Comparison of total on-airport benefit figures with the initial direct benefits gives insight into the multiplier values for each component. For example, the 89 direct on-airport jobs support total employment of 159, a multiplier of 1.8. The economic interpretation is that every 10 on-airport jobs support an average of eight additional jobs in the general economy.

The output multiplier is the ratio of total output ($26.5 million) to direct on-airport output ($17.5 million), or 1.5. Every million dollars of direct output on the airport results in $500,000 more of additional output as the initial direct spending recirculates in the regional economy.

GENERAL AVIATION VISITOR ECONOMIC BENEFITS

Visitors travel on general aviation aircraft to Lake Havasu City Municipal Airport for business, as tourists, to vacation at second homes, to enjoy water-based recreational activity, or for any number of other various personal or professional reasons. 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 Lake Havasu City Municipal 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, general aviation flyers face fewer restrictions on transportability of baggage, have more efficient security checks, and enjoy flexibility of arrival and departure schedules.

Lake Havasu City Municipal Airport does not have a tower, so operations must be estimated from various sources, as explained in Chapter 2 of the *Lake Havasu City Municipal Airport Master Plan*. Extrapolating from the 2018 itinerant operations baseline of 21,950, an estimate was developed of 22,453 itinerant general aviation (GA) operations at Lake Havasu City Municipal Airport for 2019 (**Table D5**). Arrivals account for one half of operations, yielding an estimate of 11,227 itinerant arrivals. An itinerant arrival is defined as a flight that has originated at an airport other than Lake Havasu City Municipal. This definition includes returning based aircraft and arriving non-based aircraft; some remain only briefly on the airport, while others remain for most of a day and some remain overnight.

TABLE D5
General Aviation Itinerant Aircraft
Lake Havasu City Municipal Airport

Category	2019
Itinerant GA Operations	22,453
Itinerant GA Arrivals	11,227
Limited Stay Aircraft	3,544
Visiting GA Aircraft	7,682
One Day Stay Aircraft	5,488
Overnight Stay Aircraft	2,195
Property Owners	*1,756*
All Other Overnight	*439*

Source: Derived from the FlightAware Flight Tracker System, 2019

To determine the characteristics of transient arrivals, the FlightAware Flight Tracker database for Lake Havasu City Municipal Airport was used. This source includes arrival and departure times for aircraft identified by N numbers, on a 24-hour basis. Based aircraft arrivals were identified by matching arriving N numbers with known N numbers of Lake Havasu City Municipal based aircraft. Through this process, 3,544 limited stay itinerant arrivals were estimated (approximately one third of arrivals). Through registration records, many limited stay aircraft were associated with flight training at other airports, fuel stops, or some other short-term purpose. For this study, these limited stay aircraft were not included in the air visitor spending calculations. (Note that fuel spending is already measured as part of FBO output and on-airport restaurant spending is included in output of the on-site restaurant.)

An estimated 5,488 itinerant aircraft remained in the area for one day, long enough to visit businesses or recreation sites off the airport and spend in the local economy. There were 2,195 overnight itinerant aircraft. According to FBO managers, an estimated 80 percent of overnight visiting aircraft are owned by property owners, some of whom stay in the area as long as two weeks or longer at a time.

GENERAL AVIATION VISITOR SPENDING

Overall, visitor spending depends on the number of visitors, their length of stay, and the types of expenditures made. The number of visitors for an arriving general aviation aircraft was based on transient aircraft characteristics for similar sized airports in Texas and Kansas. These studies found an average count across general aviation aircraft flights of 2.7 persons, a figure that is widely used in airport economic benefit studies. For 5,488 one-day visiting aircraft, there were 14,818 visitor days in 2019.

From the FlightAware data base, there was wide variation in the length of stay for overnight aircraft, ranging from one-night to an entire month in several instances. To obtain a conservative estimate of the benefits of overnight visitors, an average length of stay of 3.0 nights was used. Multiplying length of stay by 2,195 overnight aircraft and then by an average 2.7 party size, the result is 17,780 visitor days by general aviation visitors that remained overnight. The sum of visitor days from one-day and overnight visitors was 32,598 visitor days in 2019, or an average of 90 general aviation visitors in the Lake Havasu City area each day in 2019.

Visitor spending estimates were based on several basic assumptions. One assumption was that day visitor travel parties would have the same daily expenditures as overnight parties for such categories as food or retail but would have no expenditures for lodging. Similarly, 80 percent of overnight travel parties owned second home property and would also have no lodging expenses. Otherwise, all parties would have similar expenses for each category.

Estimates for visitor spending per travel party per day are set out in **Table D6**.

Lodging expenses ($165 per party, per day) were obtained from the Travel Advisor website, based on rates at the 10 largest Lake Havasu City hotel properties averaged between June and February. Auto rental rates were obtained in the same way, based on actual quotes ($71) from rental agencies.

TABLE D6
General Aviation Visitor Spending per Travel Party per Day
Lake Havasu City Municipal Airport

Category	Overnight GA Visitors	One Day GA Visitors
Lodging	$165	
Food & Drink	$132	$132
Retail Goods & Services	$48	$48
Recreation & Entertainment	$106	$106
Ground Transportation	$71	$71
Spending per Day	***$522***	***$357***
Direct Visitor Spending	**$2,567,000**	***$1,958,000***
Direct Visitor Benefits **$4,525,000**		

Source: Air visitor spending estimates based on data from Trip Advisor, Arizona Office of Tourism, and U.S. Government Services Agency.

Food and drink expenses were based on per diem restaurant food rates in Mohave County, as compiled by the U. S. General Services Agency and used by traveling federal employees and other organizations. The rate used was $49 per person, or $132 for party size of 2.7 persons. Retail spending on goods and services ($48) and recreation and entertainment ($106) were derived from the Mohave County section of the *Arizona Travel Impacts* (2018) study of the Arizona Office of Tourism.

Spending per overnight travel party per day was $522 and for one-day travel parties was $357. Multiplication of spending per party results in estimates of annual overnight visitor spending of $2.6 million and annual one-day visitor spending of $1.9 million, for a direct economic benefit of $4.5 million in 2019.

DIRECT, SECONDARY, AND TOTAL AIR VISITOR BENEFITS

Annual direct, secondary, and total air visitor benefits are shown in **Table D7**. Output (visitor expenditures) benefits are shown for overnight, one-day, and combined general aviation visitors. The largest spending category by aviation visitors was food and drink, with outlays of $1.6 million. The level of food service employment associated with this spending level was 25 jobs and payroll of $601,000. The second greatest spending category was entertainment and recreation fees and outlays, with combined expenses of $1.3 million, creating 23 jobs with payroll of $605,000. Direct visitor benefits include spending of $4.5 million, 65 jobs supported, and payroll of $1.8 million.

TABLE D7
Economic Benefits from Air Visitors
Lake Havasu City Municipal Airport

Category	Overnight GA Visitors	One Day GA Visitor	Output (All Expenditures)	Worker Payroll	Employment
Direct Economic Benefits					
Lodging	$217,000		$217,000	$67,000	2
Food/Drink	$869,000	$724,000	$1,594,000	$601,000	25
Retail Sales	$315,000	$262,000	$577,000	$298,000	12
Entertainment	$698,000	$582,000	$1,280,000	$605,000	23
Ground Transport	$468,000	$389,000	$857,000	$204,000	4
Direct Benefits	***$2,567,000***	***$1,958,000***	***$4,525,000***	***$1,775,000***	***65***
Secondary Economic Benefits					
Indirect Benefits	$644,000	$498,000	$1,142,000	$277,000	9
Induced Benefits	$1,080,000	$833,000	$1,912,000	$689,000	15
Secondary Benefits	***$1,724,000***	***$1,331,000***	***$3,054,000***	***$967,000***	***24***
Total Economic Benefits					
Total Benefits	**$4,291,000**	**$3,288,000**	**$7,579,000**	**$2,741,000**	**89**

Source: Air visitor spending estimates based on data from Trip Advisor, Arizona Office of Tourism, and U.S. Government Services Agency. Secondary benefits (indirect and induced) computed from the IMPLAN model. All Values in 2019 dollars. Figures may not compute exactly due to rounding.

Each one million dollars of direct spending by air visitors created 14 jobs in the hospitality industry. This figure is obtained from 65 jobs/$4.5 million. By visitor spending category, the employment benefits from spending on entertainment and recreation are greatest, with 18 jobs created per one million dollars of outlays.

The indirect benefits created by purchase of intermediate goods and services from Mohave County suppliers to the hospitality industry were output of $1.1 million and nine additional jobs across the regional economy. The induced spending by workers as consumers created benefits of $1.9 million revenues and 15 jobs. Both the indirect and induced spending recirculated within the area 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 $3.0 million of revenues, 24 jobs, and $967,000 of payroll.

The total economic benefits from air visitor spending were $7.6 million in output and 89 jobs supported throughout the economy, with payroll income to workers of $2.7 million. The output multiplier for GA visitor spending was $7.6/$4.5 = 1.67, indicating that each one million dollars of direct air visitor spending recycled in the economy to create total final output of $1.67 million (or $670,000 of secondary spending benefits per million dollars of direct spending). The employment multiplier (comparing total employment of 89 with direct employment of 65) was 1.37. Every 10 direct jobs related to air visitor spending created an additional 3.7 jobs in the overall economy.

FUTURE ECONOMIC BENEFITS

Lake Havasu Municipal Airport has many advantages expected to support continued growth in aviation activity and economic benefits in the years ahead. The airport features high quality technical services for corporate jets and has a runway of 8,001 feet in length that provides easy access from neighboring California as well as other Western states. Hangar space is available, including new facilities recently completed. Forecasts developed in the *Lake Havasu City Municipal Airport Master Plan* (Chapter 2) project an increase in based aircraft from 163 in 2019 to 172 in 2023 and to 202 by 2038, when there will be more than 30 turboprop or jet aircraft based at the airport. Total operations will rise from 45,000 in 2018 to 50,400 by 2023, an increase of 12 percent. Further increases in aviation activity are projected to bring operations to 56,400 by 2028 and 65,200 by 2038. As based aircraft increase and operations rise, on-airport employment and output will grow larger and the number of visitors arriving to the Lake Havasu City area will increase.

Table D9 shows a baseline summary of current economic benefits associated with the presence of Lake Havasu City Municipal Airport for the year 2019, when operations increase by 2.3 percent from the 2018 level to 46,035. **Tables D10 through D12** illustrate the future benefits of the airport based on projections for the years 2023, 2028, and 2038. The methodology for estimating future economic benefits is a linear extrapolation of current baseline values of the direct on-airport and visitor benefits applying growth rates for aviation activity as measured by overall operations as developed in Chapter 2 of the *Lake Havasu City Municipal Airport Master Plan*. All figures are expressed in 2019 dollars.

On-airport revenues, employment, and payrolls increase by the forecast growth rate of combined annual operations: 9.5 percent between 2019 and 2023, 11.9 percent between 2023 and 2028, and 15.6 percent from 2028 to 2038. General aviation visitor spending, payroll, and employment are assumed to increase at the same pace as operations and on-airport activity. 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 D9
Baseline Economic Benefits: 2019
Lake Havasu City Municipal Airport

Source	Employment	Payroll	Output
On-Airport	89	$5,863,000	$17,462,000
Air Visitors	65	$1,775,000	$4,525,000
Direct Benefits	**154**	**$7,638,000**	**$21,987,000**
Secondary Benefits	**94**	**$4,071,000**	**$12,134,000**
Total Benefits	**248**	**$11,709,000**	**$34,121,000**

Source: Calculations based on 46,035 operation in 2019.

Lake Havasu City Municipal Airport operations are forecast to rise to 50,400 by 2023. Between 2023 and 2028, annual operations increase by 6,000 rising to 56,400 in 2028. There are 65,200 annual operations forecast in 2038.

Airport direct benefits from on-airport activity are projected to rise from $17.5 million output and 89 on-site jobs in 2019 to $19.1 million output and 97 jobs in 2023 (**Table D10**). The rise in operations to 50,400 in 2023 increases air visitor spending to $5.0 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 2023, total benefits include employment of 272, with payroll of $12.8 million and output of $37.4 million.

TABLE D10
Projected Economic Benefits: 2023
Lake Havasu City Municipal Airport

Source	Employment	Payroll	Output
On-Airport	97	$6,419,000	$19,118,000
Air Visitors	72	$1,943,000	$4,954,000
Direct Benefits	**169**	**$8,362,000**	**$24,072,000**
Secondary Benefits	**103**	**$4,457,000**	**$13,284,000**
Total Benefits	**272**	**$12,819,000**	**$37,356,000**

Source: Calculations based on 50,400 operations in 2023; all figures are in $2019

For the year 2028, on-airport output is projected to be $21.4 million with 108 on-site jobs. Output from air visitor spending is projected to rise to $5.5 million, creating 81 hospitality sector jobs. By 2028, total benefits increase to 304 jobs in the region with payroll of $14.3 million and output of $41.8 million **(Table D11).**

TABLE D11
Projected Economic Benefits: 2028
Lake Havasu City Municipal Airport

Source	Employment	Payroll	Output
On-Airport	108	$7,182,000	$21,393,000
Air Visitors	81	$2,175,000	$5,543,000
Direct Benefits	**189**	**$9,357,000**	**$26,936,000**
Secondary Benefits	**115**	**$4,987,000**	**$14,865,000**
Total Benefits	**304**	**$14,344,000**	**$41,801,000**

Source: Calculations based on 56,400 operations in 2028; all figures are in $2019

By 2038, aviation demand levels rise to 65,200 annual operations. Based aircraft at Lake Havasu City Municipal Airport are projected to increase by more than 25 percent from 2018, to 202. At this level of activity, on-airport employment increases to 125 workers, with payroll of $8.3 million and output of $24.7 million **(Table D12)**. Visitor spending is projected to rise to $6.4 million, creating 93 jobs.

In the year 2038, Lake Havasu City Municipal Airport becomes a $48.3 million-dollar economic asset. Total output of $48.3 million represents an increase more than 40 percent above the 2019 baseline total output of $34.1 million. For 2038, total regional employment due to the presence of the airport increases to 351 workers with payroll of $16.6 million.

TABLE D12
Projected Economic Benefits: 2038
Lake Havasu City Municipal Airport

Source	Employment	Payroll	Output
On-Airport	125	$8,303,000	$24,730,000
Air Visitors	93	$2,514,000	$6,408,000
Direct Benefits	**218**	**$10,817,000**	**$31,138,000**
Secondary Benefits	**133**	**$5,765,000**	**$17,184,000**
Total Benefits	**351**	**$16,582,000**	**$48,322,000**

Source: Calculations based on 65,200 operations in 2038; all figures are in $2019

GOVERNMENT REVENUE BENEFITS

Because of the output, jobs, and income created by the presence of Lake Havasu City Municipal 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 D13**. The table shows the revenues for each tax category derived from the IMPLAN model. The model uses current average tax rates for Mohave 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 **Table D13** shows tax revenues associated with the 2019 baseline level of total output of $34.1 million. The total economic benefits include direct and secondary benefits from on-airport activity and air visitor spending. The 248 total workers supported by airport activity receive payrolls of $11.7 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 $1.5 million in 2019. The second largest federal tax category is the personal income tax paid by workers and proprietors of $708,000. The federal corporate profits tax is $71,000. Overall, federal tax revenues estimated due to economic activity associated with Lake Havasu City Municipal Airport are calculated to be $2.6 million for 2019. State and local tax revenues, shown in the lower portion of the table, sum to $2.3 million for 2019. The largest state and local components are sales taxes of $1.1 million. Property taxes for homeowners and businesses are estimated to be $901,000. Combined federal, state, and local government tax revenues created by the presence of Lake Havasu City Municipal Airport are $4.9 million at the 2019 level of airport activity and visitor spending.

TABLE D13
Government Revenue Benefits
Lake Havasu City Municipal Airport

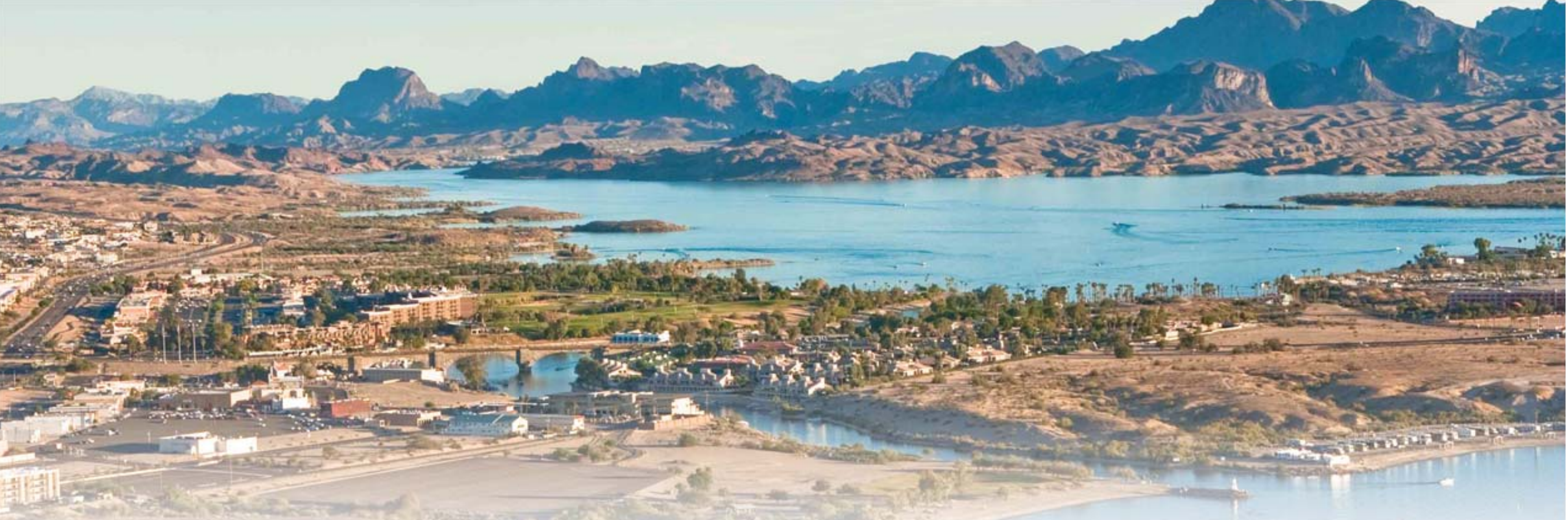
Source	2019	2023	2028	2038
Federal Taxes				
Corporate Profits Tax	$71,000	$79,000	$89,000	$103,000
Personal Income Tax	$708,000	$793,000	$888,000	$1,026,000
Social Security Tax	$1,501,000	$1,681,000	$1,881,000	$2,175,000
All Other Federal Taxes	$286,000	$320,000	$358,000	$414,000
Total Federal Taxes	**$2,566,000**	**$2,873,000**	**$3,216,000**	**$3,718,000**
State and Local Taxes				
Corporate Profits Tax	$14,000	$16,000	$18,000	$21,000
Property Tax	$901,000	$1,009,000	$1,130,000	$1,306,000
Sales Tax	$1,134,000	$1,270,000	$1,421,000	$1,642,000
Personal Income Tax	$125,000	$140,000	$157,000	$181,000
All Other State & Local	$146,265	$158,019	$176,830	$204,421
Total State & Local Taxes	**$2,320,000**	**$2,593,019**	**$2,902,830**	**$3,354,000**
Total Federal, State and Local Taxes				
Total Taxes	**$4,886,000**	**$5,466,019**	**$6,118,830**	**$7,072,000**

Source: Calculations from the IMPLAN input-output model based on tax rates for Mohave County and Arizona and current federal rates. All figures are in 2019 dollars.

Projected tax revenues rise as future airport activity increases. In the year 2023, total economic benefits created by the presence of Lake Havasu City Municipal Airport are projected to be $37.3 million, with 272 jobs supported in the region and worker compensation of $12.8 million. At the federal level, the rise in employment and income will be accompanied by an increase in business and employee social security contributions paid to $1.7 million. Federal personal income taxes will rise to $793,000. All figures assume constant 2019 tax rates and are expressed in 2019 dollars. In 2023, state and local government revenues will be $2.6 million, and combined total annual state and federal tax collections will be $5.5 million.

Total economic benefits due to the presence of the airport are projected to increase to $41.8 million for the year 2028. Jobs supported will rise to 304, and worker and proprietor income will be $14.3 million. Total state and federal tax collections will be $6.1 million, consisting of federal taxes of $3.2 million and state and local taxes of $2.9 million.

Within the long-term 2038 horizon, total economic benefits from activity at Lake Havasu City Municipal Airport are projected to reach $48.3 million, with 351 jobs supported and payroll of $16.6 million. Annual federal tax collections in 2038 are estimated to be $3.7 million, with social security contributions of $2.2 million and personal income taxes paid of $1.0 million (assuming rates under current law). At the state and local levels, annual sales tax collections increase to $1.6 million and property tax collections rise to $1.3 million. Combined state and federal tax collections will be $7.1 million, an increase of 45 percent over the 2019 base year revenues, with all figures expressed in 2019 dollars.



LAKE HAVASU CITY Municipal Airport

AIRPORT MASTER PLAN

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 Lake Havasu City Municipal 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 (ADOT) – 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) 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.

2) 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.

3) 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.

4) 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.

5) 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 Lake Havasu City Municipal 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 17, 2020.

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 17, 2020

Lake Havasu Airport
Damon Anderson
Airport Supervisor
5600 N. Hwy 95 #1
Lake Havasu City, AZ 86404

Dear Mr. Anderson:

The Lake Havasu Airport (HII), Airport Layout Plan (ALP), prepared by Coffman Associates, and bearing your signature, is approved. A signed copy of the FAA approved ALP is enclosed.

An aeronautical study (no. 2020-AWP-3096-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 ALP 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

AIRPORT MASTER PLAN

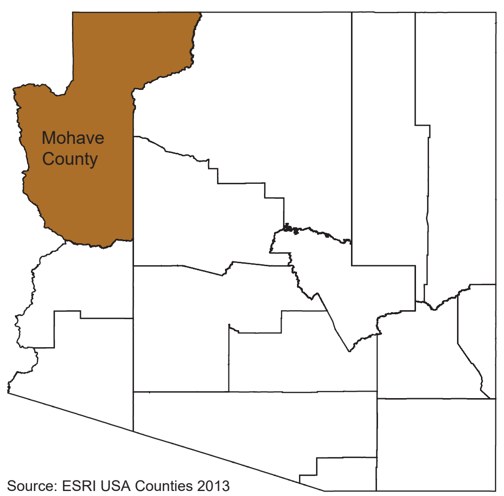
for the

LAKE HAVASU CITY MUNICIPAL AIRPORT

Lake Havasu City, Arizona

Prepared for
Lake Havasu City , Arizona

COUNTY MAP



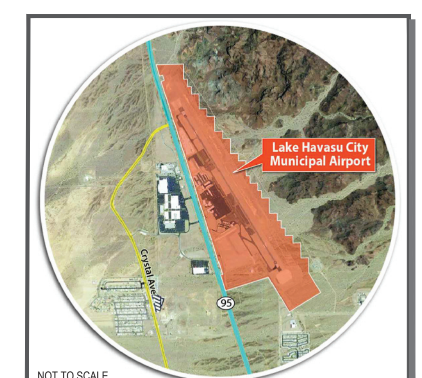
Source: ESRI USA Counties 2013

LOCATION MAP

DRAWING INDEX

1. TITLE SHEET
2. AIRPORT DATA SHEET
3. AIRPORT LAYOUT PLAN DRAWING
4. AIRPORT AIRSPACE DRAWING
5. APPROACH PROFILE DRAWING FOR RUNWAY 14-32
6. INNER PORTION OF THE APPROACH SURFACE DRAWING FOR RUNWAY 14-32
7. DEPARTURE SURFACE DRAWING FOR RUNWAY 14-32
8. NORTH TERMINAL AREA DRAWING
9. CENTER TERMINAL AREA DRAWING
10. SOUTH TERMINAL AREA DRAWING
11. AIRPORT LAND USE DRAWING
12. EXHIBIT "A" AIRPORT PROPERTY INVENTORY MAP

VICINITY MAP



FOR APPROVAL BY:

Lake Havasu City, Arizona

APPROVED BY: Damon Anderson, Airport Supervisor — ON THE DATE OF: 7/22/20

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
4	AIRPORT BEACON AS-BUILT (C&S)	3/2014	RJB	LRM
3	MASTER PLAN UPDATE	4/2010	CA	-
2	ALP REVALIDATION	4/2003	--	--
1	ALP UPDATES	5/2000	--	--

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LAKE HAVASU CITY MUNICIPAL AIRPORT

TITLE SHEET

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020 — SHEET 1 OF 12

Coffman Associates — Airport Consultants — www.coffmanassociates.com

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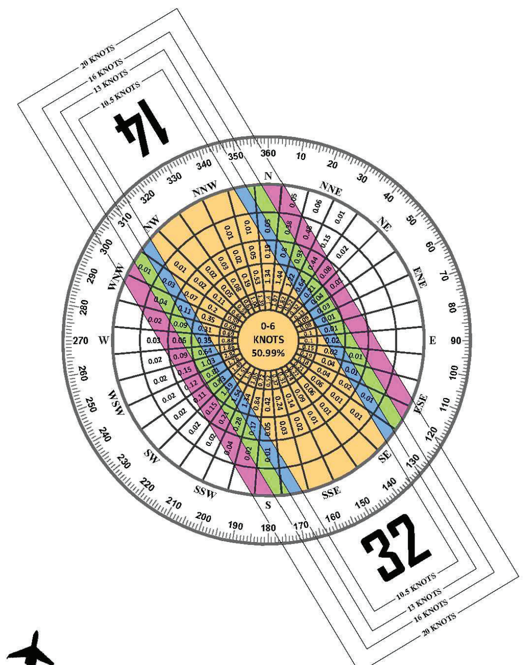
ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 14-32	86.17%	91.96%	97.20%	99.31%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Needles Airport
Needles, California

OBSERVATIONS:
83,439 All Weather Observations
Jan. 1, 2008 - Dec, 31 2017

AIRPORT DATA

CITY:LAKE HAVASU CITY	COUNTY: MOHAVE	OWNER: LAKE HAVASU CITY
LAKE HAVASU CITY MUNICIPAL AIRPORT (HII)	**EXISITNG**	**ULTIMATE**
AIRPORT REFERENCE CODE (ARC)	B-II	D-III
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH	109.2° JULY	
AIRPORT ELEVATION (NAVD 88)	782.8'	SAME
AIRPORT NAVIGATIONAL AIDS	AIRPORT BEACON	SAME
	PAPI-4s	SAME
	REILs	SAME
	GPS	SAME
	VOR/DME,GPS	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES (NAD 83)	Latitude N34° 34' 16.046" N	SAME
	Longitude W114° 21' 29.797" W	SAME
MISCELLANEOUS FACILITIES	SEGMENTED CIRCLE	SAME
	LIGHTED WIND CONE	SAME
	AWOS III	SAME
DESIGN CRITICAL AIRCRAFT	CITATION II	GULFSTREAM 650
WINGSPAN OF DESIGN AIRCRAFT (FEET)	52.17'	99.58'
APPROACH SPEED OF DESIGN AIRCRAFT (KNOTS)	112	145
UNDERCARRIAGE WIDTH OF DESIGN AIRCRAFT (FEET)	13.33'	16'
MAGNETIC DECLINATION (DEGREES)	10° 59' E	SAME
MAGNETIC DECLINATION DATE & SOURCE	5/6/2020/NOAA	SAME
NPIAS CODE	REGIONAL	SAME
STATE SYSTEM PLAN ROLE	GA-COMMUNITY	SAME

MODIFICATIONS TO STANDARDS APPROVAL TABLE

APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
NONE	NONE	NONE	NONE

ULTIMATE MODIFICATIONS TO STANDARDS APPROVAL TABLE

APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
		RUNWAY CENTERLINE TO PARALLEL TAXIWAY CENTERLINE SEPARATION 400'	RUNWAY CENTERLINE TO PARALLEL TAXIWAY CENTERLINE SEPARATION 340'

RUNWAY DECLARED DISTANCES

RUNWAY DECLARED DISTANCES	EXISTING	ULTIMATE
	14-32	14-32
TAKE OFF RUN AVAILABLE (TORA)	8,001'-8,001'	SAME
TAKEOFF DISTANCE AVAILABLE (TODA)	8,001'-8,001'	SAME
ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)	8,001'-8,001'	SAME
LANDING DISTANCE AVAILABLE (LDA)	8,001'-8,001'	SAME

RUNWAY DATA TABLE

RUNWAY DATA TABLE		RUNWAY 14-32			
		EXISITING		**ULTIMATE**	
RUNWAY IDENTIFICATION		14	32	14	32
RUNWAY DESIGN CODE (RDC)		B-II-5000		D-III-4000	
APPROACH REFERENCE CODE (APRC)		B/III/5000 D/II/5000		B/III/4000 D/II/4000	
DEPARTURE REFERENCE CODE (DPRC)		B/III D/II		SAME	
RUNWAY SURFACE MATERIAL		ASPHALT		SAME	
RUNWAY PAVEMENT STRENGTH WHEEL (IN THOUSAND LBS.)[1]		100(S)		SAME	
RUNWAY PAVEMENT STRENGTH PCN		11/F/D/Y/T		SAME	
RUNWAY PAVEMENT SURFACE TREATMENT		NONE		SAME	
RUNWAY EFFECTIVE GRADIENT		0.40%		SAME	
RUNWAY WIND COVERAGE	10.5 knots	86.17%		SAME	
	13 knots	91.96%		SAME	
	16 knots	97.20%		SAME	
RUNWAY DIMENSIONS (LENGTH X WIDTH)		8,001' x 100'		SAME	
RUNWAY DISPLACED THRESHOLD ELEVATION (NAVD88)		NONE	NONE	SAME	SAME
RUNWAY SAFETY AREA DIMENSION DESIGN STANDARD (WIDTH x LENGTH BEYOND END)		150' X 300'	150' X 300'	500' X 1,000'	500' X 1,000'
RUNWAY SAFETY AREA DIMENSION ACTUAL (WIDTH x LENGTH BEYOND END)		150' X 300'	150' X 300'	500' X 1,000'	500' X 1,000'
RUNWAY END COORDINATES	LAT	34°34'50.183N	34°33'41.907N	SAME	SAME
	LONG	114°21'53.975W	114°21'05.623W	SAME	SAME
DISPLACED THRESHOLD COORDINATES	LAT	NA	NA	SAME	SAME
	LONG	NA	NA	SAME	SAME
RUNWAY LIGHTING TYPE		MIRL		SAME	
APPROACH RUNWAY PROTECTION ZONE DIMENSIONS		500' X 700' X 1,000'	500' X 700' X 1,000'	500' X 1,700' X 1,010'	1,000' X 1,700' X 1,510'
DEPARTURE RUNWAY PROTECTION ZONE DIMENSIONS		500' X 700' X 1,000'	500' X 700' X 1,000'	SAME	SAME
RUNWAY MARKING TYPE		NON-PREC	NON-PREC	SAME	SAME
14 CFR PART 77 APPROACH SLOPE		34:1	34:1	SAME	SAME
14 CFR PART 77 APPROACH TYPE		NON-PREC	NON-PREC	SAME	SAME
VISIBILITY MINIMUMS		≥1 MILE	≥1MILE	≥1 MILE	>3/4 MILE
TYPE OF AERONAUTICAL SURVEY REQUIRED FOR APPROACH		NON-VERTICALLY GUIDED		SAME	
DEPARTURE SURFACE (YES/NO)		YES		SAME	
RUNWAY OBJECT FREE AREA DIMENSION DESIGN STANDARD (WIDTH x LENGTH BEYOND END)		500' X 300'	500' X 300'	800' X 1,000'	800' X 1,000'
RUNWAY OBJECT FREE AREA DIMENSION ACTUAL (WIDTH x LENGTH BEYOND END)		500' X 300'	500' X 300'	800' X 1,000'	800' X 1,000'
RUNWAY OBSTACLE FREE ZONE DIMENSION DESIGN STANDARD (WIDTH x LENGTH BEYOND END)		400' X 200'	400' X 200'	400' X 200'	400' X 200'
RUNWAY OBSTACLE FREE ZONE DIMENSION ACTUAL (WIDTH x LENGTH BEYOND END)		400' X 200'	400' X 200'	400' X 200'	400' X 200'
OBSTACLE CLEARANCE SURFACE (OCS)		20:1	20:1	20:1	20:1
RUNWAY VISUAL AND INSTRUMENT NAVAIDS		PAPI-4	PAPI-4	SAME	SAME
		REILS	REILS	SAME	SAME
		VOR/DME,GPS	VOR/DME,GPS	SAME	SAME
		LIGHTED WIND CONES	LIGHTED WIND CONES	SAME	SAME
		ROTATING BEACON	ROTATING BEACON	SAME	SAME
TOUCHDOWN ZONE ELEVATION (TDZE)		759.1'	782.8'	SAME	SAME
VERTICAL DATUM		NAVD		SAME	
HORIZONTAL DATUM		NAD83		SAME	

NOTES:
1. (S)-SINGLE WHEEL.

TAXIWAY DATA TABLE

Taxiway Designation	Taxiway Width	TDG	Taxiway Existing/Ultimate Safety Area Dimension	Taxiway Existing/Ultimate Object Free Area Dimension	Taxiway Existing/Ultimate CL to Fixed or Moveable Object	Taxiway Existing /Ultimate Separation	Taxiway Lighting	Notes
A	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
A1	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
A2	50'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	TO BE REMOVED
A3	50'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	TO BE REMOVED
A4	65'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	TO BE REMOVED
A5	50'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	TO BE REMOVED
B	50'	2	79'	131'	65.5'	105'	MITL/REFLECTORS	
B1	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
B2	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
B3	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
C	50'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
C1	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
C2	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
C3	60'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	
A	35'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE
A1	41.1'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE
A2	47.6'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE
A3	47.6'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE
A4	41.1'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE
C	50'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE
C3	47.6'	2	79'/118'	131'/186'	65.5'/93'	105'/152'	MITL/REFLECTORS	ULTIMATE

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
4	AIRPORT BEACON AS-BUILT (C&S)	3/2014	RJB	LRM
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LAKE HAVASU CITY MUNICIPAL AIRPORT

AIRPORT DATA SHEET

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

Coffman Associates
Airport Consultants
www.coffmanassociates.com

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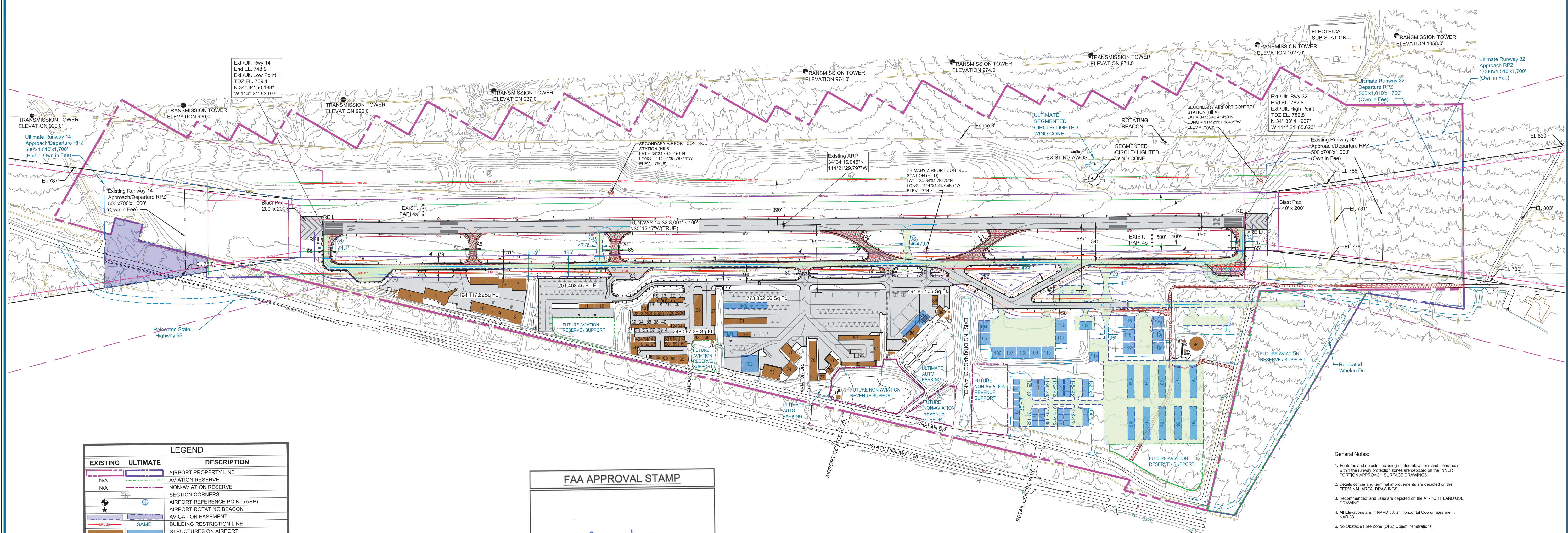
EXISTING AIRPORT FACILITIES			EXISTING AIRPORT FACILITIES			EXISTING AIRPORT FACILITIES			EXISTING AIRPORT FACILITIES			EXISTING AIRPORT FACILITIES		
NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)
1	FUEL FARM	NA	20	PORT-A-PORT HANGAR	749.70'	39	PORT-A-PORT HANGAR	749.02'	58	EXECUTIVE BOX HANGAR	758.78'	77	EXECUTIVE BOX HANGAR	757.17'
2	STORAGE SHED	749.70'	21	PORT-A-PORT HANGAR	749.70'	40	PORT-A-PORT HANGAR	749.03'	59	EXECUTIVE BOX HANGAR	759.82'	78	EXECUTIVE BOX HANGAR	756.26'
3	LINEAR BOX HANGARS	789.78'	22	EXECUTIVE BOX HANGAR	749.08'	41	PORT-A-PORT HANGAR	749.11'	60	EXECUTIVE BOX HANGAR	759.55'	79	EXECUTIVE BOX HANGAR	759.75'
4	CONVENTIONAL HANGAR	789.78'	23	EXECUTIVE BOX HANGAR	749.47'	42	EXECUTIVE BOX HANGAR	749.12'	61	EXECUTIVE BOX HANGAR	755.69'	80	T-HANGARS	761.84'
5	LINEAR BOX HANGAR	785.27'	24	EXECUTIVE BOX HANGAR	749.85'	43	EXECUTIVE BOX HANGAR	749.03'	62	EXECUTIVE BOX HANGAR	758.78'	81	EXECUTIVE BOX HANGARS	761.84'
6	LINEAR BOX HANGAR	785.27'	25	EXECUTIVE BOX HANGAR	750.14'	44	EXECUTIVE BOX HANGAR	749.12'	63	EXECUTIVE BOX HANGAR	759.55'	82	SHADE PORTS	748.09'
7	CONVENTIONAL HANGAR	785.27'	26	EXECUTIVE BOX HANGAR	750.62'	45	CIVIL AIR PATROL OFFICE	746.71'	64	EXECUTIVE BOX HANGAR	762.64'	83	STORAGE SHED	752.76'
8	CONVENTIONAL HANGAR	785.96'	27	EXECUTIVE BOX HANGAR	750.43'	46	EXECUTIVE BOX HANGAR	748.16'	65	EXECUTIVE BOX HANGAR	758.78'	84	AIRPORT MAINT. OFFICE	758.08'
9	LINEAR BOX HANGAR	785.96'	28	EXECUTIVE BOX HANGAR	750.53'	47	EXECUTIVE BOX HANGAR	748.58'	66	LINEAR BOX HANGAR	754.07'	85	UTILITY VAULT SHADE	759.56'
10	LINEAR BOX HANGAR	785.96'	29	EXECUTIVE BOX HANGAR	750.62'	48	EXECUTIVE BOX HANGAR	748.58'	67	LINEAR BOX HANGAR	751.19'	86	TERMINAL BUILDING	771.49'
11	LINEAR BOX HANGAR	769.89'	30	EXECUTIVE BOX HANGAR	750.63'	49	EXECUTIVE BOX HANGAR	748.90'	68	EXECUTIVE BOX HANGAR	758.16'	87	OPERATIONS SHADE	762.87'
12	LINEAR BOX HANGAR	770.81'	31	STORAGE/OFFICE	741.33'	50	EXECUTIVE BOX HANGAR	749.12'	69	EXECUTIVE BOX HANGAR	755.62'	88	ARFF SHADE PORT	774.14'
13	EXECUTIVE BOX HANGAR	758.15'	32	PORT-A-PORT HANGAR	745.62'	51	EXECUTIVE BOX HANGAR	749.25'	70	STORAGE SHED	744.84'	89	ARFF	769.94'
14	PORT-A-PORT HANGAR	747.27'	33	PORT-A-PORT HANGAR	746.14'	52	EXECUTIVE BOX HANGAR	749.12'	71	SHADE PORT	749.80'	90	UTILITY VAULT SHADE	757.79'
15	PORT-A-PORT HANGAR	747.12'	34	PORT-A-PORT HANGAR	745.97'	53	EXECUTIVE BOX HANGAR	749.25'	72	SHADE PORT	742.52'	91	WATER TANK (Abandoned)	NA
16	PORT-A-PORT HANGAR	747.12'	35	PORT-A-PORT HANGAR	746.08'	54	EXECUTIVE BOX HANGAR	759.05'	73	CONVENTIONAL HANGAR	772.35'	92	PUMP HOUSE	745.02'
17	PORT-A-PORT HANGAR	753.80'	36	PORT-A-PORT HANGAR	748.41'	55	EXECUTIVE BOX HANGAR	758.63'	74	EXECUTIVE BOX HANGAR	769.46'	93	UTILITY VAULT	745.00'
18	PORT-A-PORT HANGAR	749.70'	37	PORT-A-PORT HANGAR	748.59'	56	EXECUTIVE BOX HANGAR	758.42'	75	EXECUTIVE BOX HANGAR	753.68'	94	WATER TANK	764.00'
19	PORT-A-PORT HANGAR	749.70'	38	PORT-A-PORT HANGAR	748.76'	57	EXECUTIVE BOX HANGAR	758.52'	76	LINEAR BOX HANGAR	764.91'	95	FUEL FARM	744.00'

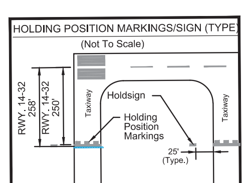
ULTIMATE AIRPORT FACILITIES			ULTIMATE AIRPORT FACILITIES			ULTIMATE AIRPORT FACILITIES			ULTIMATE AIRPORT FACILITIES		
NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)	NO.	DESCRIPTION	ELEV. (MSL)
100	SHADE/T-HANGAR	±749.00'	119	CONVENTIONAL HANGAR	±765.00'	138	EXECUTIVE BOX HANGAR	±760.00'	157	LINEAR BOX/T-HANGAR	±755.00'
101	SHADE HANGAR	±742.00'	120	CONVENTIONAL HANGAR	±765.00'	139	EXECUTIVE BOX HANGAR	±760.00'	158	LINEAR BOX/T-HANGAR	±755.00'
102	CONVENTIONAL HANGAR	±760.00'	121	EXECUTIVE BOX HANGAR	±760.00'	140	EXECUTIVE BOX HANGAR	±760.00'	159	LINEAR BOX/T-HANGAR	±755.00'
103	TERMINAL EXPANSION	±772.00'	122	EXECUTIVE BOX HANGAR	±760.00'	141	EXECUTIVE BOX HANGAR	±760.00'	160	LINEAR BOX/T-HANGAR	±755.00'
104	CONVENTIONAL HANGAR	±760.00'	123	EXECUTIVE BOX HANGAR	±760.00'	142	EXECUTIVE BOX HANGAR	±760.00'	161	LINEAR BOX/T-HANGAR	±755.00'
105	CONVENTIONAL HANGAR	±760.00'	124	EXECUTIVE BOX HANGAR	±760.00'	143	EXECUTIVE BOX HANGAR	±760.00'	162	LINEAR BOX/T-HANGAR	±755.00'
106	CONVENTIONAL HANGAR	±760.00'	125	EXECUTIVE BOX HANGAR	±760.00'	144	EXECUTIVE BOX HANGAR	±760.00'	163	LINEAR BOX/T-HANGAR	±755.00'
107	CONVENTIONAL HANGAR	±760.00'	126	EXECUTIVE BOX HANGAR	±760.00'	145	EXECUTIVE BOX HANGAR	±760.00'	164	LINEAR BOX/T-HANGAR	±755.00'
108	CONVENTIONAL HANGAR	±760.00'	127	EXECUTIVE BOX HANGAR	±760.00'	146	EXECUTIVE BOX HANGAR	±760.00'	165	LINEAR BOX/T-HANGAR	±755.00'
109	CONVENTIONAL HANGAR	±760.00'	128	EXECUTIVE BOX HANGAR	±760.00'	147	EXECUTIVE BOX HANGAR	±760.00'	166	LINEAR BOX/T-HANGAR	±755.00'
110	CONVENTIONAL HANGAR	±760.00'	129	EXECUTIVE BOX HANGAR	±760.00'	148	EXECUTIVE BOX HANGAR	±760.00'	167	LINEAR BOX/T-HANGAR	±755.00'
111	CONVENTIONAL HANGAR	±760.00'	130	EXECUTIVE BOX HANGAR	±760.00'	149	EXECUTIVE BOX HANGAR	±760.00'			
112	CONVENTIONAL HANGAR	±760.00'	131	EXECUTIVE BOX HANGAR	±760.00'	150	EXECUTIVE BOX HANGAR	±760.00'			
113	MAINTENANCE BUILDING	±760.00'	132	EXECUTIVE BOX HANGAR	±760.00'	151	EXECUTIVE BOX HANGAR	±760.00'			
114	WASH RACK	NA	133	EXECUTIVE BOX HANGAR	±760.00'	152	EXECUTIVE BOX HANGAR	±760.00'			
115	CONVENTIONAL HANGAR	±765.00'	134	EXECUTIVE BOX HANGAR	±760.00'	153	EXECUTIVE BOX HANGAR	±760.00'			
116	CONVENTIONAL HANGAR	±765.00'	135	EXECUTIVE BOX HANGAR	±760.00'	154	EXECUTIVE BOX HANGAR	±760.00'			
117	CONVENTIONAL HANGAR	±765.00'	136	EXECUTIVE BOX HANGAR	±760.00'	155	EXECUTIVE BOX HANGAR	±760.00'			
118	CONVENTIONAL HANGAR	±765.00'	137	EXECUTIVE BOX HANGAR	±760.00'	156	EXECUTIVE BOX HANGAR	±760.00'			

MAG NORTH

MAGNETIC DECLINATION 10°59' E (2020)
RATE OF CHANGE 0.6' WEST

0 400 800
SCALE IN FEET





LEGEND		
EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
N/A		NON-AVIATION RESERVE
		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
ESMT	ESMT(U)	AVIGATION EASEMENT
BRL-20'	SAME	BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE
		RUNWAY TAXIWAY APRON PAVEMENT
		SHOULDER PAVEMENT
		FENCE LINE
		HOLD MARKING
		ROADS AND PARKING PAVEMENT
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
	SAME	RUNWAY END IDENTIFIER LIGHTS
3660	3660	TOPOGRAPHIC CONTOURS
		COMPASS ROSE

FAA APPROVAL STAMP

Approved conditionally August 17, 2020
Subject to comments contained in our letter dated: 8-17-2020
FEDERAL AVIATION ADMINISTRATION
Western-Pacific Region
By
Manager / Assistant Manager – Phoenix ADO

FOR APPROVAL BY:

Lake Havasu City, Arizona

APPROVED BY: ON THE DATE OF: 7/22/20
Damon Anderson
Airport Supervisor

General Notes:

1. Features and objects, including related elevations and clearances, within the runway protection zones are depicted on the INNER PORTION APPROACH SURFACE DRAWINGS.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA DRAWINGS.
3. Recommended land uses are depicted on the AIRPORT LAND USE DRAWING.
4. All Elevations are in NAVD 88, all Horizontal Coordinates are in NAD 83.
6. No Obstacle Free Zone (OFZ) Object Penetrations.
7. The Exiting Airplane Design Group (ADG) and Taxiway Design Group (TDG) standards associated with the taxiway system are not depicted to allow for clear representation of the ALP Drawing. All existing taxiway standards are met. The ultimate ADG and TDG standards associated with the taxiway system are depicted on the ALP Drawing.

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
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3	MASTER PLAN UPDATE	4/2010	CA	-
2	ALP REVALIDATION	4/2003	--	--
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LAKE HAVASU CITY MUNICIPAL AIRPORT

AIRPORT LAYOUT PLAN DRAWING

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

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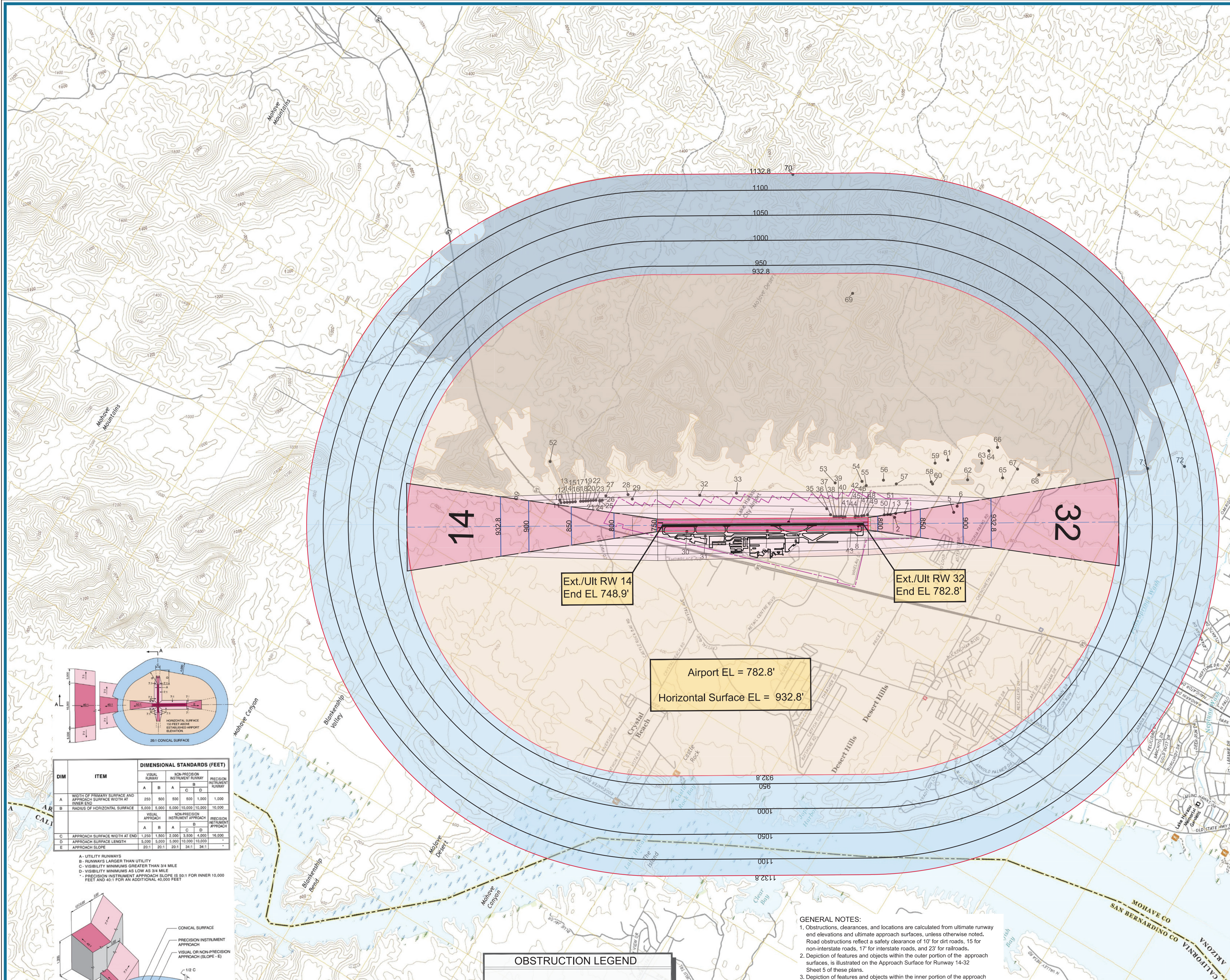

OBSTRUCTION TABLE

Obj. No.	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Object Penetration	Proposed Object Disposition
1	Bush	810.21' MSL	Rwy 32 Approach	1.29'	Trim or Remove
2	Bush	817.02' MSL	Rwy 32 Approach	3.20'	Trim or Remove
3	Tree	820.42' MSL	Rwy 32 Approach	5.28'	Trim or Remove
4	Tree	827.20' MSL	Rwy 32 Approach	1.19'	Trim or Remove
5	Pole	888.33' MSL	Rwy 32 Approach	5.29'	Add Obstruction Lighing
6	Pole	897.65' MSL	Rwy 32 Approach	10.45'	Add Obstruction Lighing
7	Airfield Sign	761.73' MSL	Primary Surface	1.51'	Fixed By Function
8	Airfield Sign	781.72' MSL	Primary Surface	0.23'	Fixed by Function
9	Road Group	955.37' MSL	Transitional	0.57'	To Be Determined
10	Pole	903.58' MSL	Transitional	10.93'	Add Obstruction Lighing
11	OL on Power Transmission Tower	974.97' MSL	Transitional	97.75'	Lighted
12	Power Transmission Line	888.54' MSL	Transitional	11.84'	Add Obstruction Lighing
13	Power Transmission Line	884.60' MSL	Transitional	7.83'	Add Obstruction Lighing
14	Power Transmission Line	882.17' MSL	Transitional	5.85'	Add Obstruction Lighing
15	Power Transmission Line	879.36' MSL	Transitional	2.52'	Add Obstruction Lighing
16	Power Transmission Line	878.36' MSL	Transitional	1.41'	Add Obstruction Lighing
17	Power Transmission Line	878.79' MSL	Transitional	1.27'	Add Obstruction Lighing
18	Power Transmission Line	878.01' MSL	Transitional	0.34'	Add Obstruction Lighing
19	Power Transmission Line	878.53' MSL	Transitional	0.74'	Add Obstruction Lighing
20	Power Transmission Line	879.62' MSL	Transitional	1.65'	Add Obstruction Lighing
21	Power Transmission Line	881.95' MSL	Transitional	3.84'	Add Obstruction Lighing
22	Power Transmission Line	883.03' MSL	Transitional	4.77'	Add Obstruction Lighing
23	Power Transmission Line	887.34' MSL	Transitional	8.94'	Add Obstruction Lighing
24	Power Transmission Line	903.00' MSL	Transitional	27.11'	Add Obstruction Lighing
25	Power Transmission Line	904.19' MSL	Transitional	31.22'	Add Obstruction Lighing
26	Power Transmission Line	882.78' MSL	Transitional	6.88'	Add Obstruction Lighing
27	Pole	923.93' MSL	Transitional	24.47'	Add Obstruction Lighing
28	Utility Pole	910.80' MSL	Transitional	12.07'	Add Obstruction Lighing
29	Power Transmission Line	888.04' MSL	Transitional	16.18'	Add Obstruction Lighing
30	OL on Windsock	757.38' MSL	Transitional	3.63'	Lighted/Fixed by Function
31	Building	785.17' MSL	Transitional	0.23'	Fixed by Function
32	Power Transmission Pylon	907.15' MSL	Transitional	17.37'	Add Obstruction Lighting
33	Power Transmission Pylon	918.81' MSL	Transitional	15.05'	Add Obstruction Lighting
34	OL on Windsock	761.46' MSL	Transitional	1.22'	Lighted/Fixed by Function
35	OL on A.W.O.S.	823.71' MSL	Transitional	0.19'	Lighted/Fixed by Function
36	OL on Windsock	802.39' MSL	Transitional	11.67'	Lighted/Fixed by Function
37	Tree	788.25' MSL	Transitional	8.43'	Trim or Remove
38	Bush	794.79" MSL	Transitional	13.9'	Trim or Remove
39	Tree	782.11' MSL	Transitional	1.45'	Trim or Remove
40	Tree	792.09' MSL	Transitional	8.67'	Trim or Remove
41	Tree	780.86' MSL	Transitional	0.83'	Trim or Remove
42	Tree	792.31' MSL	Transitional	10.5'	Trim or Remove
43	OL on Windsock	781.57' MSL	Transitional	1.43'	Lighted/Fixed By Function
44	Tree	784.15' MSL	Transitional	0.77'	Trim or Remove
45	Bush	801.76' MSL	Transitional	11.69'	Trim or Remove
46	Bush	790.70' MSL	Transitional	3.20'	Trim or Remove
47	Tree	804.25' MSL	Transitional	12.34'	Trim or Remove
48	Tree	800.43' MSL	Transitional	5.92'	Trim or Remove
49	Bush	802.41' MSL	Transitional	3.93'	Trim or Remove
50	Bush	804.70' MSL	Transitional	1.06'	Trim or Remove
51	Tree	809.13' MSL	Transitional	3.87'	Trim or Remove
52	Utility Group	995.18' MSL	Horizontal	62.29'	Add Obstruction Lighting
53	Utility Pole	933.53' MSL	Horizontal	0.64'	Add Obstruction Lighting
54	Pole	944.32' MSL	Horizontal	11.43'	Add Obstruction Lighting
55	Power Transmission Pylon	933.08' MSL	Horizontal	0.19'	Add Obstruction Lighting
56	Utility Pole	941.07' MSL	Horizontal	8.18'	Add Obstruction Lighting
57	Power Transmission Pylon	966.24' MSL	Horizontal	33.35'	Add Obstruction Lighting
58	Power Transmission Pylon	975.29" MSL	Horizontal	42.40'	Add Obstruction Lighting
59	Tower	963.15' MSL	Horizontal	30.57'	Add Obstruction Lighting
60	Pole	934.15' MSL	Horizontal	1.26'	Add Obstruction Lighting
61	Utility Pole	939.24' MSL	Horizontal	6.35'	Add Obstruction Lighting
62	Utility Group	979.00' MSL	Horizontal	46.86'	Add Obstruction Lighting
63	Utility Group	962.99' MSL	Horizontal	30.10'	Add Obstruction Lighting
64	Utility Pole	984.40' MSL	Horizontal	51.51'	Add Obstruction Lighting
65	Utility Pole	989.77' MSL	Horizontal	56.88'	Add Obstruction Lighting
66	Utility Pole	1007.92' MSL	Horizontal	75.04'	Add Obstruction Lighting
67	Utility Pole	939.94' MSL	Horizontal	7.05'	Add Obstruction Lighting
68	Utility Group	1029.31' MSL	Horizontal	96.42'	Add Obstruction Lighting
69	Terrain Group	1538.15' MSL	Horizontal	605.26'	To Remain
70	Terrain Group	1672.08' MSL	Conical	541.22'	To Remain
71	Utility Group	1102.45' MSL	Conical	95.77'	Add Obstruction Lighting
72	Utility Pole	1097.47' MSL	Conical	17.40'	Add Obstruction Lighting

OBSTRUCTION LEGEND

1 ● OBSTRUCTION HIGH POINT

●1 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 Approach Surface for Runway 14-32 Sheet 5 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 14-32 Sheet 6 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
6. Surveys used for obstruction data are a combination of Woolpert 18B survey dated May 4, 2019.
7. Obstruction Data for groups represent the tallest object (Natural or Man Made) in the group.

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
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LAKE HAVASU CITY MUNICIPAL AIRPORT

AIRPORT AIRSPACE DRAWING

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020 | SHEET 4 OF 12

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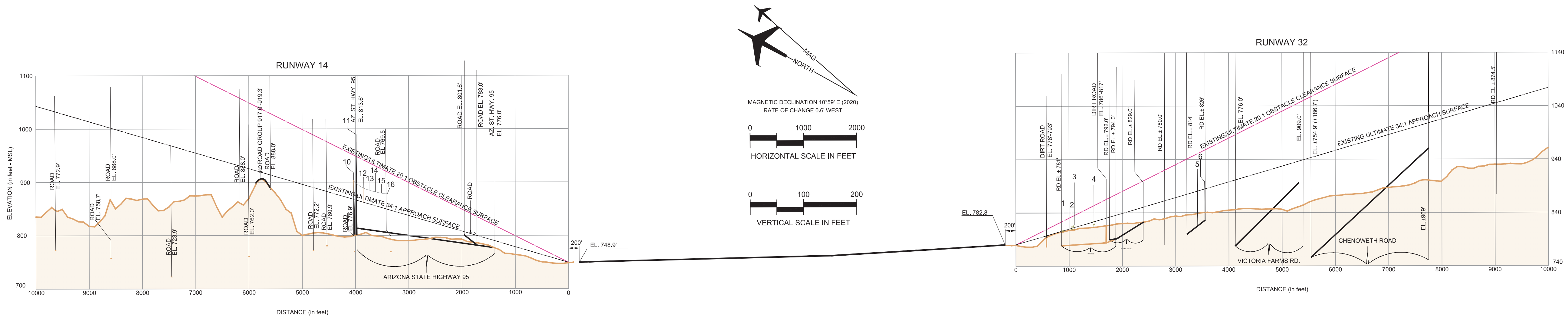
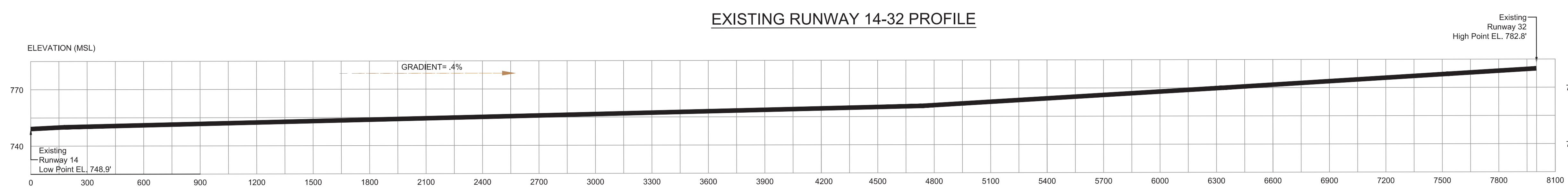


OBSTRUCTION TABLE					
Obj. No.	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Object Penetration	Proposed Object Disposition
9	Dirt Road Group	921.37' MSL	Rwy 14 Approach	1.80'	To Be Determined
10	Pole	903.58' MSL	Rwy 14 Approach	35.70'	Add Obstruction Lighting
11	OL on Power Transmission Tower	974.97' MSL	Rwy 14 Approach	109.10'	Lighted
12	Power Transmission Line	888.54" MSL	Rwy 14 Approach	26.30'	Add Obstruction Lighting
13	Power Transmission Line	884.60' MSL	Rwy 14 Approach	25.90'	Add Obstruction Lighting
14	Power Transmission Line	882.17' MSL	Rwy 14 Approach	26.20	Add Obstruction Lighting
15	Power Transmission Line	879.36' MSL	Rwy 14 Approach	27.10'	Add Obstruction Lighting
16	Power Transmission Line	878.36' MSL	Rwy 14 Approach	29.40'	Add Obstruction Lighting

Note: OL = Obstruction Lighting

OBSTRUCTION TABLE					
Obj. No.	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Object Penetration	Proposed Object Disposition
1	Bush	810.21' MSL	Rwy 32 Approach	1.29'	Trim or Remove
2	Bush	817.02' MSL	Rwy 32 Approach	3.20'	Trim or Remove
3	Tree	820.42' MSL	Rwy 32 Approach	5.28'	Trim or Remove
4	Tree	827.20' MSL	Rwy 32 Approach	1.19'	Trim or Remove
5	Pole	888.33' MSL	Rwy 32 Approach	5.29'	Add Obstruction Lighting
6	Pole	897.65' MSL	Rwy 32 Approach	10.45'	Add Obstruction Lighting

EXISTING RUNWAY 14-32 PROFILE



GENERAL NOTES:

1. GROUND SURVEY DATED MAY 4, 2019 BY WOOLPERT.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OBSTRUCTIONS IDENTIFIED BY COFFMAN ASSOCIATES FROM WOOLPERT OF GROUND SURVEY. DATED MAY 4, 2019
4. ALL ELEVATIONS IN MSL FEET.
5. 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.

NO.	REVISIONS	DATE	BY	APP'D.
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LAKE HAVASU CITY MUNICIPAL AIRPORT

APPROACH PROFILE DRAWING FOR RUNWAY 14-32

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020 SHEET 5 OF 12

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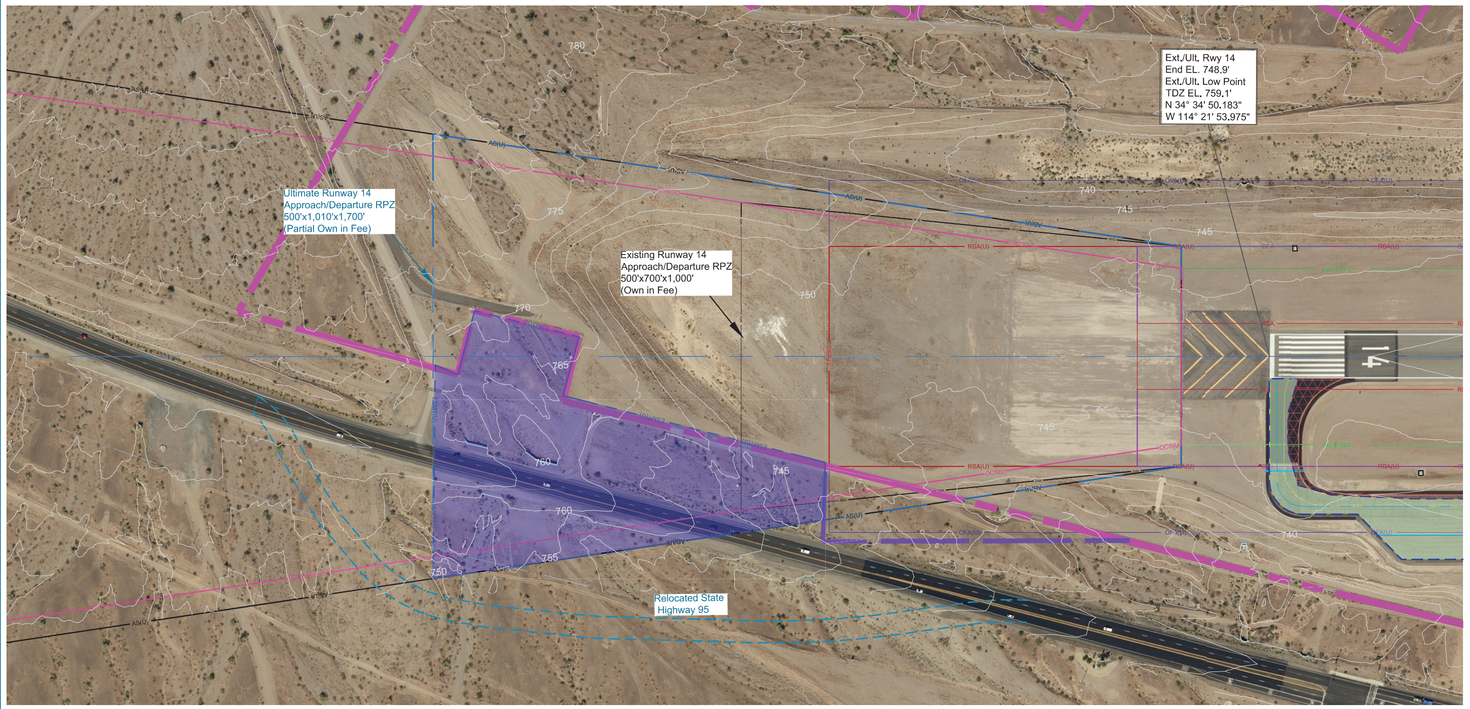
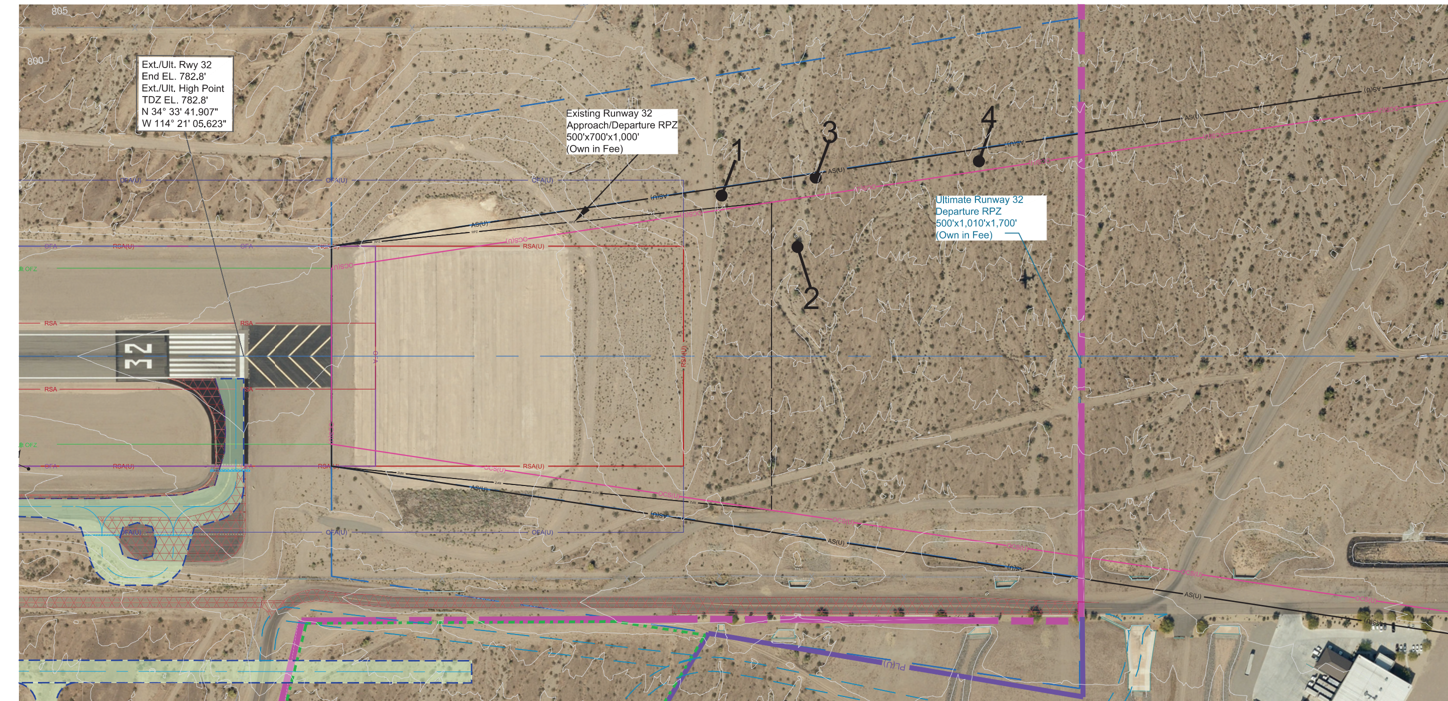
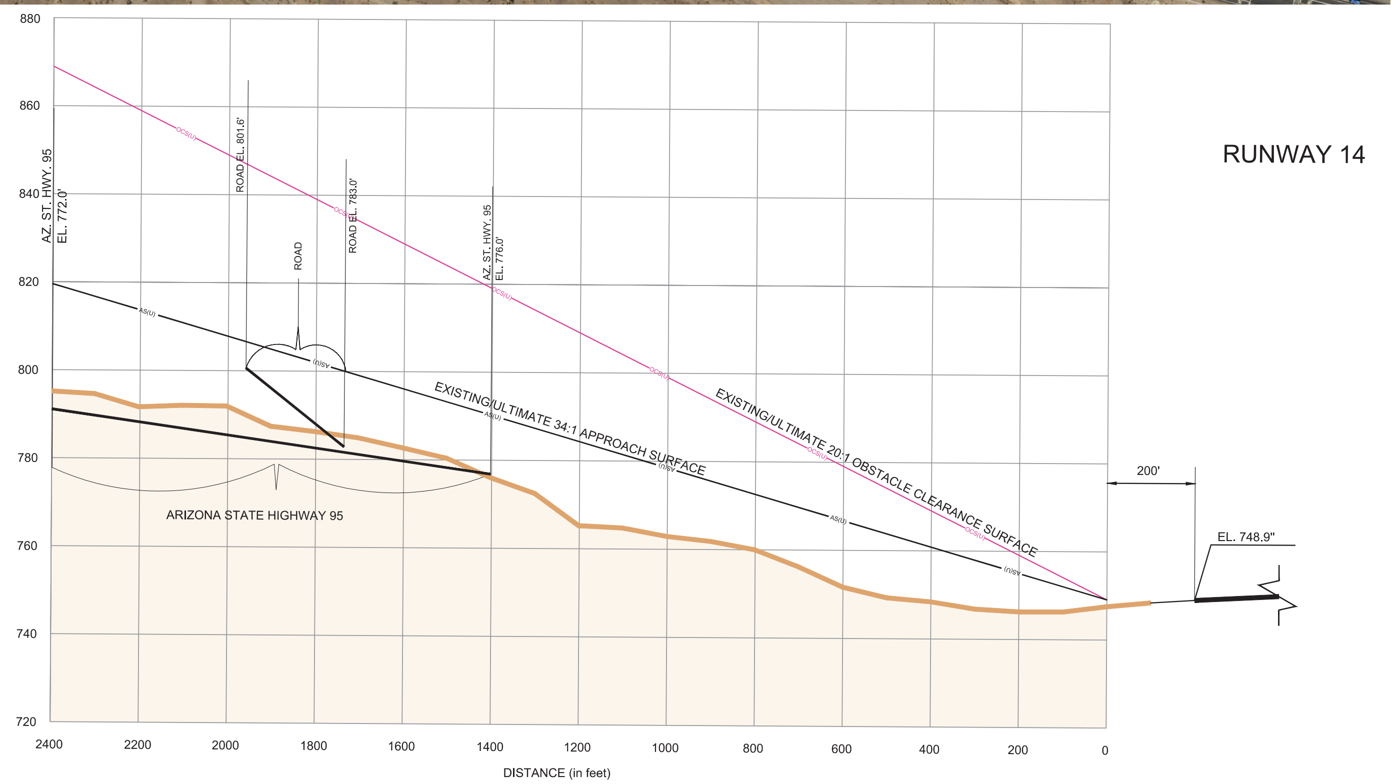
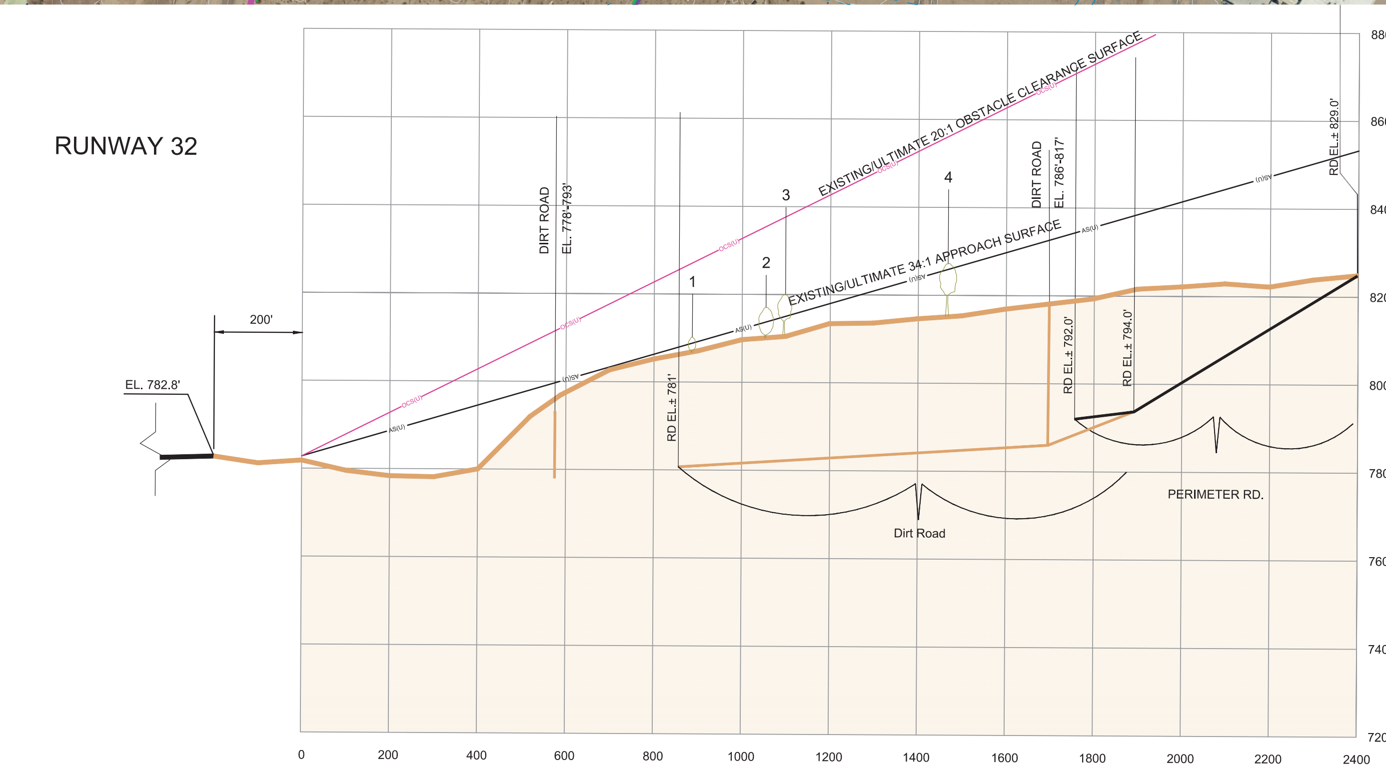






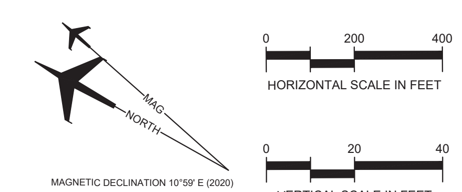


OBSTRUCTION TABLE

Obj. No.	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Object Penetration	Proposed Object Disposition
	NONE				

OBSTRUCTION TABLE

Obj. No.	Object Description	Top Object Elevation	Obstructed Part 77 Surface	Object Penetration	Proposed Object Disposition
1	Bush	810.21' MSL	Rwy 32 Approach	1.29'	Trim or Remove
2	Bush	817.02' MSL	Rwy 32 Approach	3.20'	Trim or Remove
3	Tree	820.42' MSL	Rwy 32 Approach	5.28'	Trim or Remove
4	Tree	827.20' MSL	Rwy 32 Approach	1.19'	Trim or Remove



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LAKE HAVASU CITY MUNICIPAL AIRPORT

INNER PORTION OF THE APPROACH SURFACE DRAWING FOR RUNWAY 14-32

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020 | SHEET 6 OF 12

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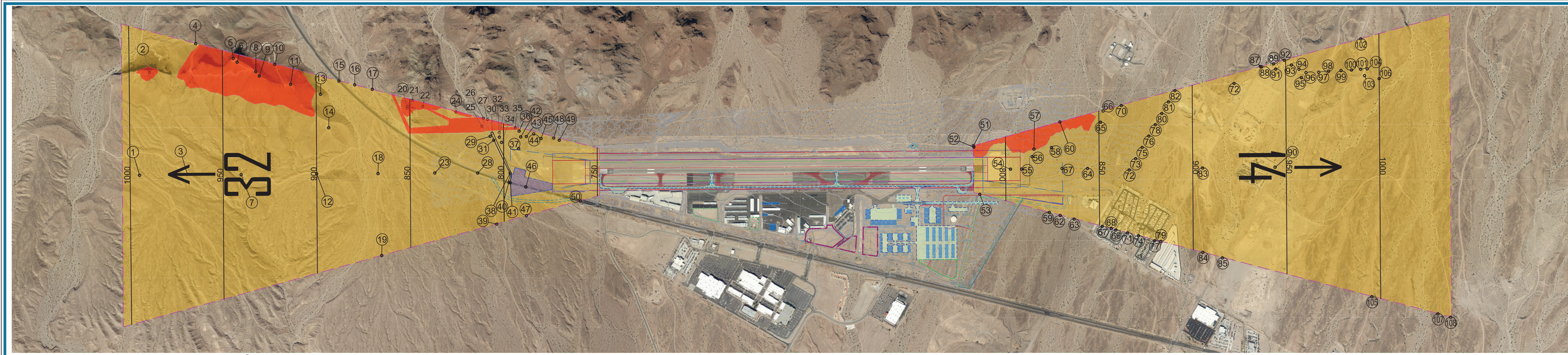

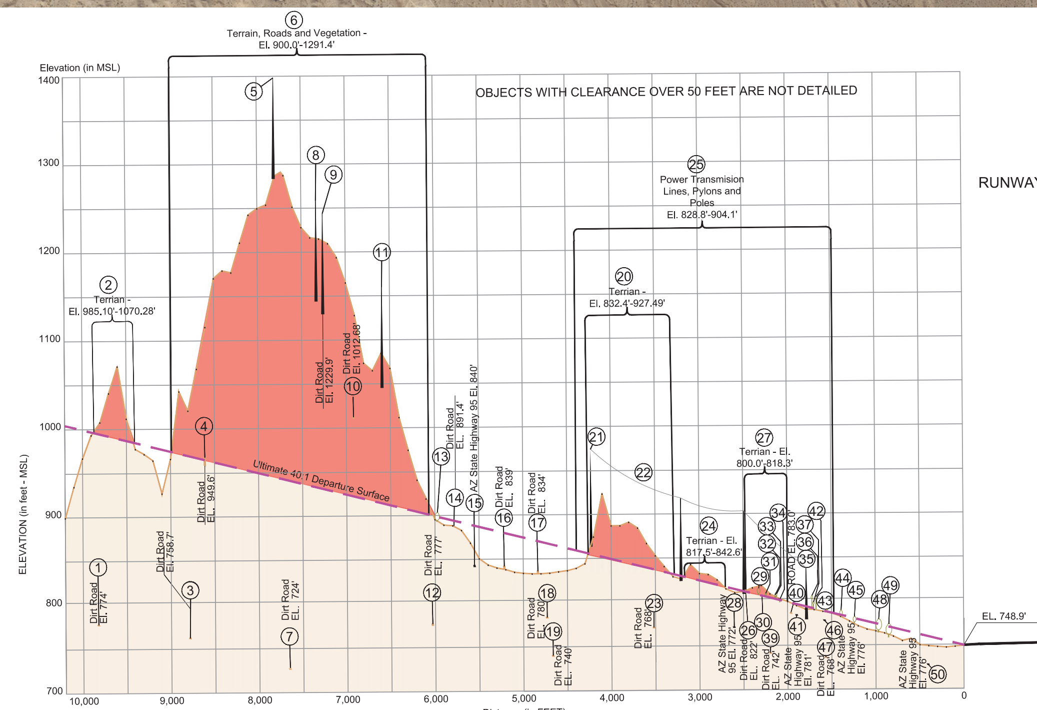

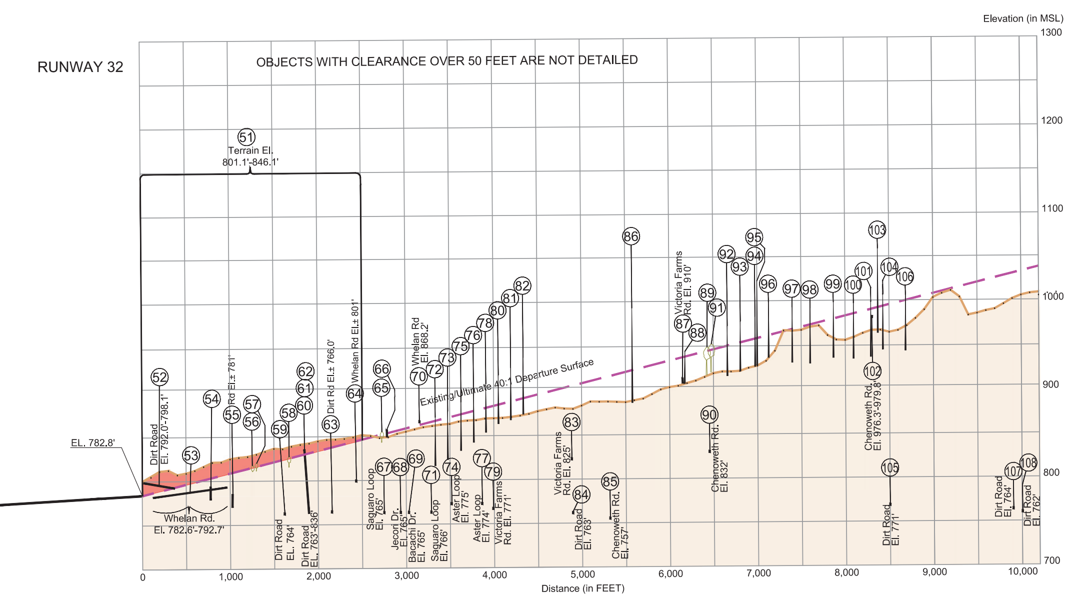

Runway 32 Departure Obstruction Table				
Obj. No.	Object Description	Top Object Elevation	Object Penetration	Proposed Request Aeronautical Study
2	Terrain Group	1070.28' MSL	80.97'	Request Aeronautical Study
4	Dirt Road	949.60' MSL	0.28'	Request Aeronautical Study
5	Power Transmission Pylon	1355.02' MSL	410.72'	Request Aeronautical Study
6	Terrain Group	1291.40' MSL	349.06'	Request Aeronautical Study
8	Power Transmission Pylon	1258.34' MSL	326.00'	Request Aeronautical Study
9	Power Transmission Pylon	1244.61' MSL	314.18'	Request Aeronautical Study
10	Dirt Road	1012.68' MSL	105.65'	Request Aeronautical Study
11	Power Transmission Line	1158.93' MSL	245.17'	Request Aeronautical Study
13	Bush	903.11' MSL	5.17'	To be Lowered or Removed
14	Dirt Road	891.40" MSL	12.53'	Request Aeronautical Study
20	Terrain Group	927.29' MSL	75.81'	Request Aeronautical Study
21	Utility Pole	974.29' MSL	125.52'	Request Aeronautical Study
22	Power Transmission Line	922.52' MSL	79.28'	Request Aeronautical Study
24	Terrain Group	836.59' MSL	11.10'	Request Aeronautical Study
25	Power Transmission Line Group	904.19' MSL	92.56'	Request Aeronautical Study
26	Dirt Road	822.11' MSL	27.30'	Request Aeronautical Study
27	Terrain Group	815.64' MSL	6.82'	Request Aeronautical Study
29	Tree	815.11' MSL	7.83'	To be Lowered or Removed
30	Dirt Road	811.78' MSL	20.50'	Request Aeronautical Study
31	Tree	809.70' MSL	4.31'	To be Lowered or Removed
32	Bush	804.81' MSL	5.35'	To be Lowered or Removed
33	Tree	809.54' MSL	7.19'	To be Lowered or Removed
34	Tree	803.32' MSL	2.10'	To be Lowered or Removed
35	Utility Pole	835.56' MSL	41.76'	Request Aeronautical Study
36	Tree	803.56' MSL	11.82'	To be Lowered or Removed
37	Tree	793.44' MSL	1.30'	To be Lowered or Removed
38	Dirt Road	783.66' MSL	1.90'	Request Aeronautical Study
40	Dirt Road	783.02' MSL	0.60'	Request Aeronautical Study
41	AZ State Highway 95	781.00' MSL	2.57'	Request Aeronautical Study
42	Tree	802.80' MSL	10.45'	To be Lowered or Removed
43	Bush	788.20' MSL	0.20'	To be Lowered or Removed
44	Bush	787.10' MSL	3.26'	To be Lowered or Removed
45	Bush	781.50' MSL	1.44'	To be Lowered or Removed
46	AZ State Highway 95	776.80' MSL	3.36'	Request Aeronautical Study
48	Tree	776.23' MSL	2.93'	To be Lowered or Removed
49	Tree	770.90' MSL	0.60'	To be Lowered or Removed

OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINTIY OF OBJECTS.

OBSTRUCTION IDENTIFIER

Runway 14 Departure Obstruction Table				
Obj. No.	Object Description	Top Object Elevation	Object Penetration	Proposed Request Aeronautical Study
51	Terrain Group	801.14' MSL	18.14'	Request Aeronautical Study
52	Dirt Road	798.90' MSL	15.65'	Request Aeronautical Study
53	Whelan Road Group	792.70' MSL	11.36'	Request Aeronautical Study
56	Bush	814.02' MSL	2.69'	To be Lowered or Removed
57	Tree	820.42' MSL	4.97'	To be Lowered or Removed
58	Tree	827.20' MSL	2.51'	To be Lowered or Removed
60	Dirt Road	836.50' MSL	7.31'	Request Aeronautical Study
65	Tree	855.53' MSL	4.51'	To be Lowered or Removed
66	Dirt Road	857.88' MSL	20.40'	To be Lowered or Removed
70	Whelan Road	868.23' MSL	21.39'	Request Aeronautical Study
72	Utility Pole	870.90' MSL	4.82'	Request Aeronautical Study
73	Utility Pole	878.06' MSL	8.44'	Request Aeronautical Study
75	Utility Pole	888.33' MSL	15.16'	Request Aeronautical Study
76	Utility Pole	897.65' MSL	20.95'	Request Aeronautical Study
78	Utility Pole	904.40' MSL	24.17'	Request Aeronautical Study
80	Utility Pole	914.29' MSL	30.51'	Request Aeronautical Study
81	Utility Pole	922.90' MSL	35.65'	Request Aeronautical Study
82	Utility Pole	934.11' MSL	43.24'	To be Lowered or Removed
86	Power Transmission Pylon	989.78' MSL	67.40'	Request Aeronautical Study
88	Utility Pole	939.90' MSL	2.65'	To be Lowered or Removed
89	Tree	944.80' MSL	1.17'	To be Lowered or Removed
91	Tree	951.30' MSL	6.52'	To be Lowered or Removed
92	Power Transmission Line	968.22' MSL	18.90'	To be Lowered or Removed
93	Utility Pole	973.80' MSL	20.68'	Request Aeronautical Study
94	Utility Pole	973.80' MSL	21.71'	To be Lowered or Removed
95	Power Transmission Pylon	1029.30' MSL	70.81'	To be Lowered or Removed
96	Utility Pole	988.29' MSL	27.16'	Request Aeronautical Study
97	Utility Pole	989.59' MSL	21.43'	Request Aeronautical Study
98	Utility Pole	988.59' MSL	15.56'	Request Aeronautical Study
99	Utility Pole	994.97' MSL	15.34'	To be Lowered or Removed
100	Utility Pole	993.60' MSL	8.22'	To be Lowered or Removed
101	Utility Pole	1001.10' MSL	10.99'	To be Lowered or Removed
102	Chenoweth Road	979.80' MSL	4.46'	To be Lowered or Removed
103	Power Transmission Pylon	1059.34' MSL	67.04'	Request Aeronautical Study
104	Utility Pole	1006.96' MSL	13.22'	To be Lowered or Removed
106	Utility Pole	1006.17' MSL	6.07'	To be Lowered or Removed

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. Survey used for obstruction data are from Woolpert 18B survey dated May 4 2019.
3. Obstruction Data for groups represent the tallest object (Natural or Man Made) within the group.

MAG. NORTH

MAGNETIC DECLINATION 11°04' E (2019)
RATE OF CHANGE 0.5' WEST

0 1000 2000
HORIZONTAL SCALE IN FEET

0 100 200
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
4	AIRPORT BEACON AS-BUILT (C&S)	3/2014	RJB	LRM
3	MASTER PLAN UPDATE	4/2010	CA	-
2	ALP REVALIDATION	4/2003	--	--
1	ALP UPDATES	5/2000	--	--

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LAKE HAVASU CITY MUNICIPAL AIRPORT

DEPARTURE SURFACE DRAWING FOR RUNWAY 14-32

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

Coffman Associates
Airport Consultants
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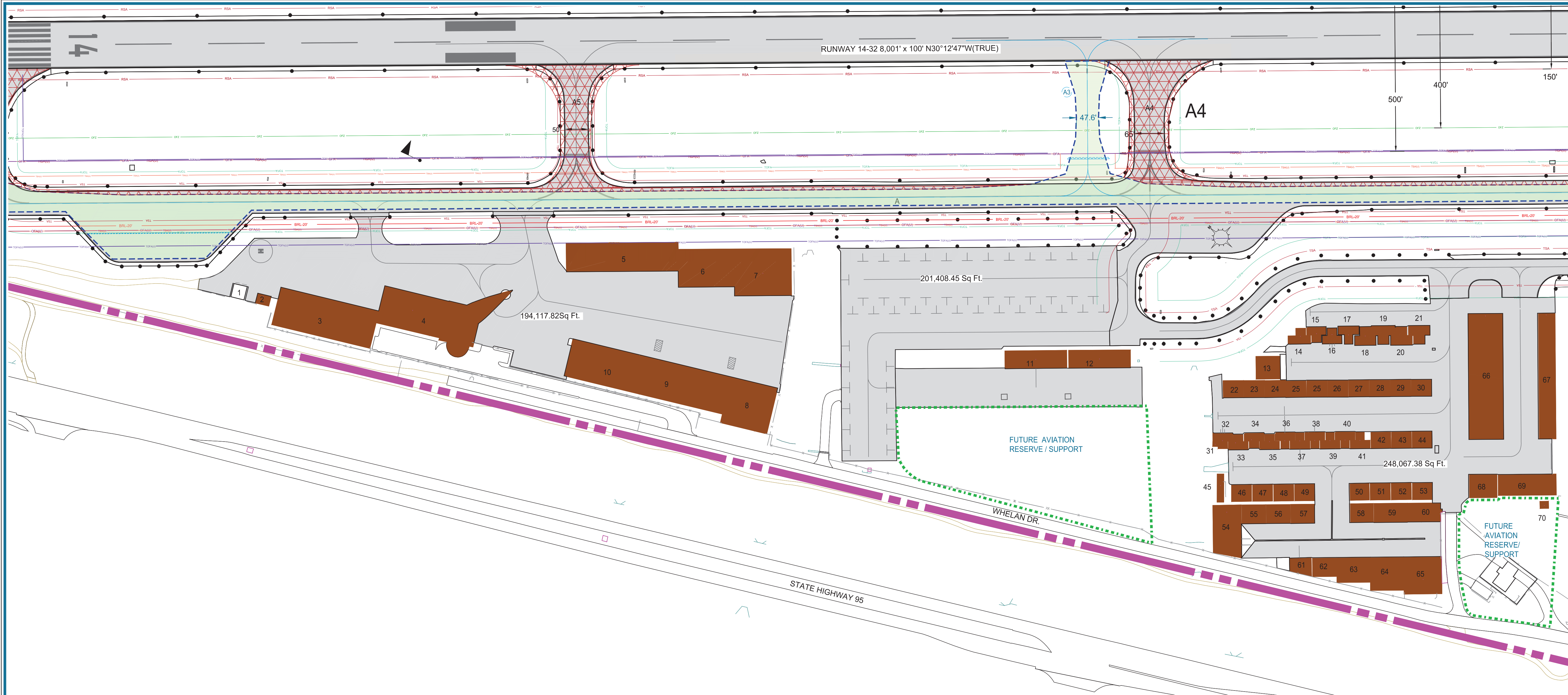

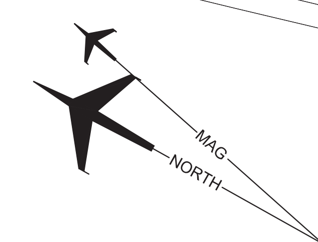

MAGNETIC DECLINATION 10°59' E (2020)
RATE OF CHANGE 0.6' WEST

0 100 200
SCALE IN FEET

EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	FUEL FARM	NA
2	STORAGE SHED	749.70'
3	LINEAR BOX HANGARS	789.78'
4	CONVENTIONAL HANGAR	789.78'
5	LINEAR BOX HANGAR	785.27'
6	LINEAR BOX HANGAR	785.27'
7	CONVENTIONAL HANGAR	785.27'
8	CONVENTIONAL HANGAR	785.96'
9	LINEAR BOX HANGAR	785.96'
10	LINEAR BOX HANGAR	785.96'
11	LINEAR BOX HANGAR	769.89'
12	LINEAR BOX HANGAR	770.81'
13	EXECUTIVE BOX HANGAR	758.15'
14	PORT-A-PORT HANGAR	747.27'
15	PORT-A-PORT HANGAR	747.12'
16	PORT-A-PORT HANGAR	747.12'
17	PORT-A-PORT HANGAR	753.80'
18	PORT-A-PORT HANGAR	749.70'
19	PORT-A-PORT HANGAR	749.70'
20	PORT-A-PORT HANGAR	749.70'
21	PORT-A-PORT HANGAR	749.70'
22	EXECUTIVE BOX HANGAR	749.08'
23	EXECUTIVE BOX HANGAR	749.47'
24	EXECUTIVE BOX HANGAR	749.85'
25	EXECUTIVE BOX HANGAR	750.14'
26	EXECUTIVE BOX HANGAR	750.62'
27	EXECUTIVE BOX HANGAR	750.43'
28	EXECUTIVE BOX HANGAR	750.53'
29	EXECUTIVE BOX HANGAR	750.62'
30	EXECUTIVE BOX HANGAR	750.63'
31	STORAGE/OFFICE	741.33'
32	PORT-A-PORT HANGAR	745.62'
33	PORT-A-PORT HANGAR	746.14'
34	PORT-A-PORT HANGAR	745.97'
35	PORT-A-PORT HANGAR	746.08'
36	PORT-A-PORT HANGAR	748.41'
37	PORT-A-PORT HANGAR	748.59'
38	PORT-A-PORT HANGAR	748.76'
39	PORT-A-PORT HANGAR	749.02'
40	PORT-A-PORT HANGAR	749.03'
41	PORT-A-PORT HANGAR	749.11'
42	EXECUTIVE BOX HANGAR	749.12'
43	EXECUTIVE BOX HANGAR	749.03'
44	EXECUTIVE BOX HANGAR	749.12'
45	CIVIL AIR PATROL OFFICE	746.71'
46	EXECUTIVE BOX HANGAR	748.16'
47	EXECUTIVE BOX HANGAR	748.58'
48	EXECUTIVE BOX HANGAR	748.58'
49	EXECUTIVE BOX HANGAR	748.90'
50	EXECUTIVE BOX HANGAR	749.12'
51	EXECUTIVE BOX HANGAR	749.25'
52	EXECUTIVE BOX HANGAR	749.12'
53	EXECUTIVE BOX HANGAR	749.25'
54	EXECUTIVE BOX HANGAR	759.05'
55	EXECUTIVE BOX HANGAR	758.63'
56	EXECUTIVE BOX HANGAR	758.42'
57	EXECUTIVE BOX HANGAR	758.52'
58	EXECUTIVE BOX HANGAR	758.78'
59	EXECUTIVE BOX HANGAR	759.82'
60	EXECUTIVE BOX HANGAR	759.55'
61	EXECUTIVE BOX HANGAR	755.69'
62	EXECUTIVE BOX HANGAR	758.78'
63	EXECUTIVE BOX HANGAR	759.55'
64	EXECUTIVE BOX HANGAR	762.64'
65	EXECUTIVE BOX HANGAR	758.78'
66	LINEAR BOX HANGAR	754.07'
67	LINEAR BOX HANGAR	751.19'
68	EXECUTIVE BOX HANGAR	758.16'
69	EXECUTIVE BOX HANGAR	755.62'
70	STORAGE SHED	744.84'

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
N/A		NON-AVIATION RESERVE
32 33 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
ESMT	ESMT(U)	AVIGATION EASEMENT
BRL-20'	SAME	BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE
		RUNWAY TAXIWAY APRON PAVEMENT
		SHOULDER PAVEMENT
x		FENCE LINE
		HOLD MARKING
		ROADS AND PARKING PAVEMENT
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
	SAME	RUNWAY END IDENTIFIER LIGHTS
3660	3660	TOPOGRAPHIC CONTOURS
		COMPASS ROSE

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
4	AIRPORT BEACON AS-BUILT (C&S)	3/2014	RJB	LRM
3	MASTER PLAN UPDATE	4/2010	CA	-
2	ALP REVALIDATION	4/2003	--	--
1	ALP UPDATES	5/2000	--	--

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LAKE HAVASU CITY MUNICIPAL AIRPORT

NORTH TERMINAL AREA DRAWING

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

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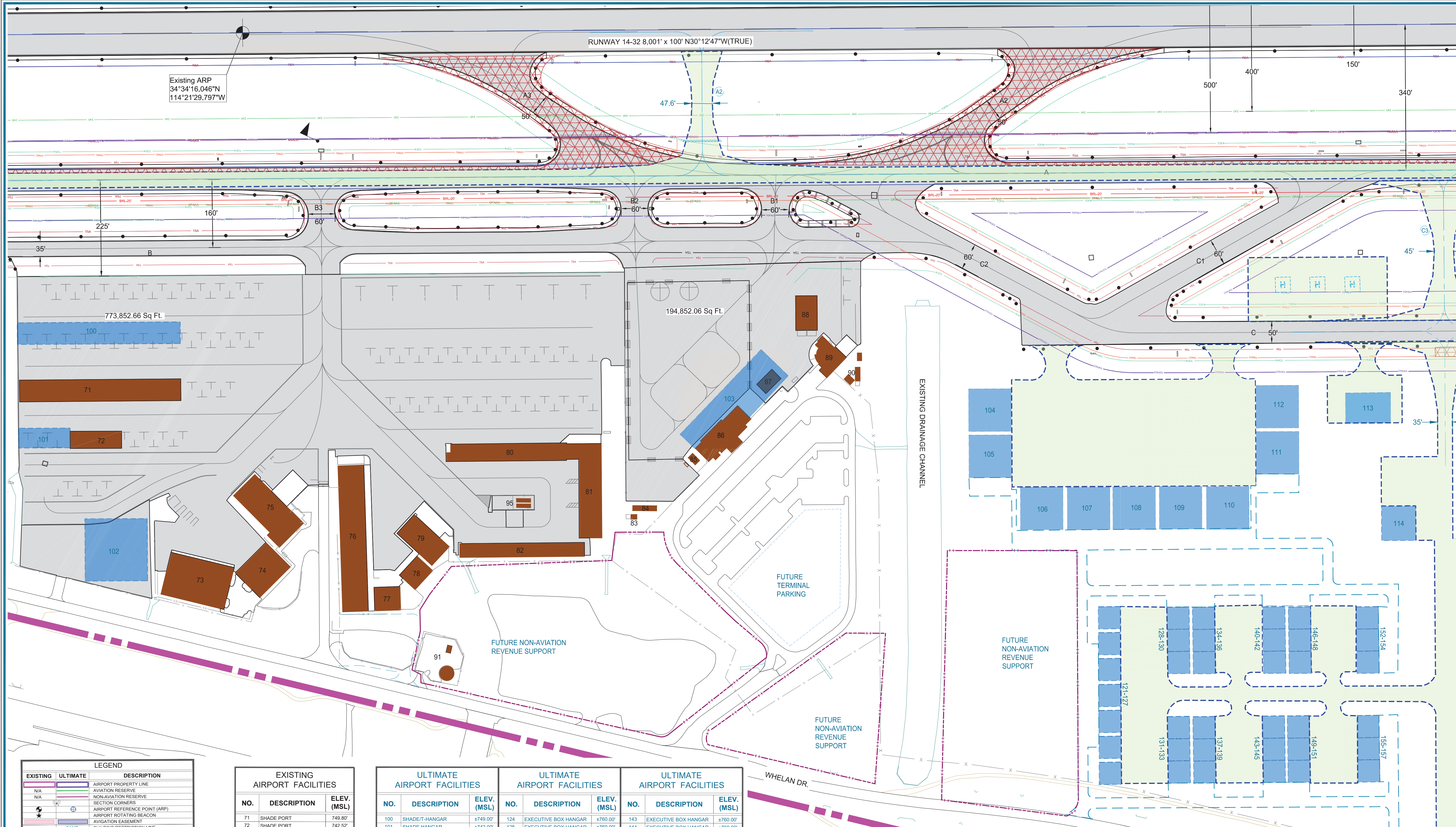

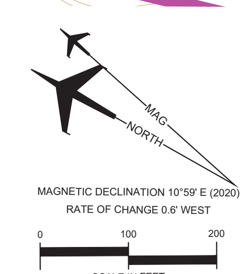

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
N/A		NON-AVIATION RESERVE
32 33 / 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
BRL-20'	SAME	BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE
		RUNWAY TAXIWAY APRON PAVEMENT
		SHOULDER PAVEMENT
		FENCE LINE
		HOLD MARKING
		ROADS AND PARKING PAVEMENT
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
	SAME	RUNWAY END IDENTIFIER LIGHTS
3660	3660	TOPOGRAPHIC CONTOURS
		COMPASS ROSE

EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
71	SHADE PORT	749.80'
72	SHADE PORT	742.52'
73	CONVENTIONAL HANGAR	772.35'
74	EXECUTIVE BOX HANGAR	769.46'
75	EXECUTIVE BOX HANGAR	753.68'
76	LINEAR BOX HANGAR	764.91'
77	EXECUTIVE BOX HANGAR	757.17'
78	EXECUTIVE BOX HANGAR	756.26'
79	EXECUTIVE BOX HANGAR	759.75'
80	T-HANGARS	761.84'
81	EXECUTIVE BOX HANGARS	761.84'
82	SHADE PORTS	748.09'
83	STORAGE SHED	752.76'
84	AIRPORT MAINT. OFFICE	758.08'
85	UTILITY VAULT SHADE	759.56'
86	TERMINAL BUILDING	771.49'
87	OPERATIONS SHADE	762.87'
88	ARFF SHADE PORT	774.14'
89	ARFF	769.94'
90	UTILITY VAULT SHADE	757.79'

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
100	SHADE/T-HANGAR	±749.00'
101	SHADE HANGAR	±742.00'
102	CONVENTIONAL HANGAR	±760.00'
103	TERMINAL EXPANSION	±772.00'
104	CONVENTIONAL HANGAR	±760.00'
105	CONVENTIONAL HANGAR	±760.00'
106	CONVENTIONAL HANGAR	±760.00'
107	CONVENTIONAL HANGAR	±760.00'
108	CONVENTIONAL HANGAR	±760.00'
109	CONVENTIONAL HANGAR	±760.00'
110	CONVENTIONAL HANGAR	±760.00'
111	CONVENTIONAL HANGAR	±760.00'
112	CONVENTIONAL HANGAR	±760.00'
113	MAINTENANCE BUILDING	±760.00'
114	WASH RACK	NA
121	EXECUTIVE BOX HANGAR	±760.00'
122	EXECUTIVE BOX HANGAR	±760.00'
123	EXECUTIVE BOX HANGAR	±760.00'

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
124	EXECUTIVE BOX HANGAR	±760.00'
125	EXECUTIVE BOX HANGAR	±760.00'
126	EXECUTIVE BOX HANGAR	±760.00'
127	EXECUTIVE BOX HANGAR	±760.00'
128	EXECUTIVE BOX HANGAR	±760.00'
129	EXECUTIVE BOX HANGAR	±760.00'
130	EXECUTIVE BOX HANGAR	±760.00'
131	EXECUTIVE BOX HANGAR	±760.00'
132	EXECUTIVE BOX HANGAR	±760.00'
133	EXECUTIVE BOX HANGAR	±760.00'
134	EXECUTIVE BOX HANGAR	±760.00'
135	EXECUTIVE BOX HANGAR	±760.00'
136	EXECUTIVE BOX HANGAR	±760.00'
137	EXECUTIVE BOX HANGAR	±760.00'
138	EXECUTIVE BOX HANGAR	±760.00'
139	EXECUTIVE BOX HANGAR	±760.00'
140	EXECUTIVE BOX HANGAR	±760.00'
141	EXECUTIVE BOX HANGAR	±760.00'
142	EXECUTIVE BOX HANGAR	±760.00'

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
143	EXECUTIVE BOX HANGAR	±760.00'
144	EXECUTIVE BOX HANGAR	±760.00'
145	EXECUTIVE BOX HANGAR	±760.00'
146	EXECUTIVE BOX HANGAR	±760.00'
147	EXECUTIVE BOX HANGAR	±760.00'
148	EXECUTIVE BOX HANGAR	±760.00'
149	EXECUTIVE BOX HANGAR	±760.00'
150	EXECUTIVE BOX HANGAR	±760.00'
151	EXECUTIVE BOX HANGAR	±760.00'
152	EXECUTIVE BOX HANGAR	±760.00'
153	EXECUTIVE BOX HANGAR	±760.00'
154	EXECUTIVE BOX HANGAR	±760.00'
155	EXECUTIVE BOX HANGAR	±760.00'
156	EXECUTIVE BOX HANGAR	±760.00'
157	LINEAR BOX/T-HANGAR	±755.00'

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
4	AIRPORT BEACON AS-BUILT (C&S)	3/2014	RJB	LRM
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LAKE HAVASU CITY MUNICIPAL AIRPORT

CENTER TERMINAL AREA DRAWING

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

Coffman Associates Airport Consultants www.coffmanassociates.com

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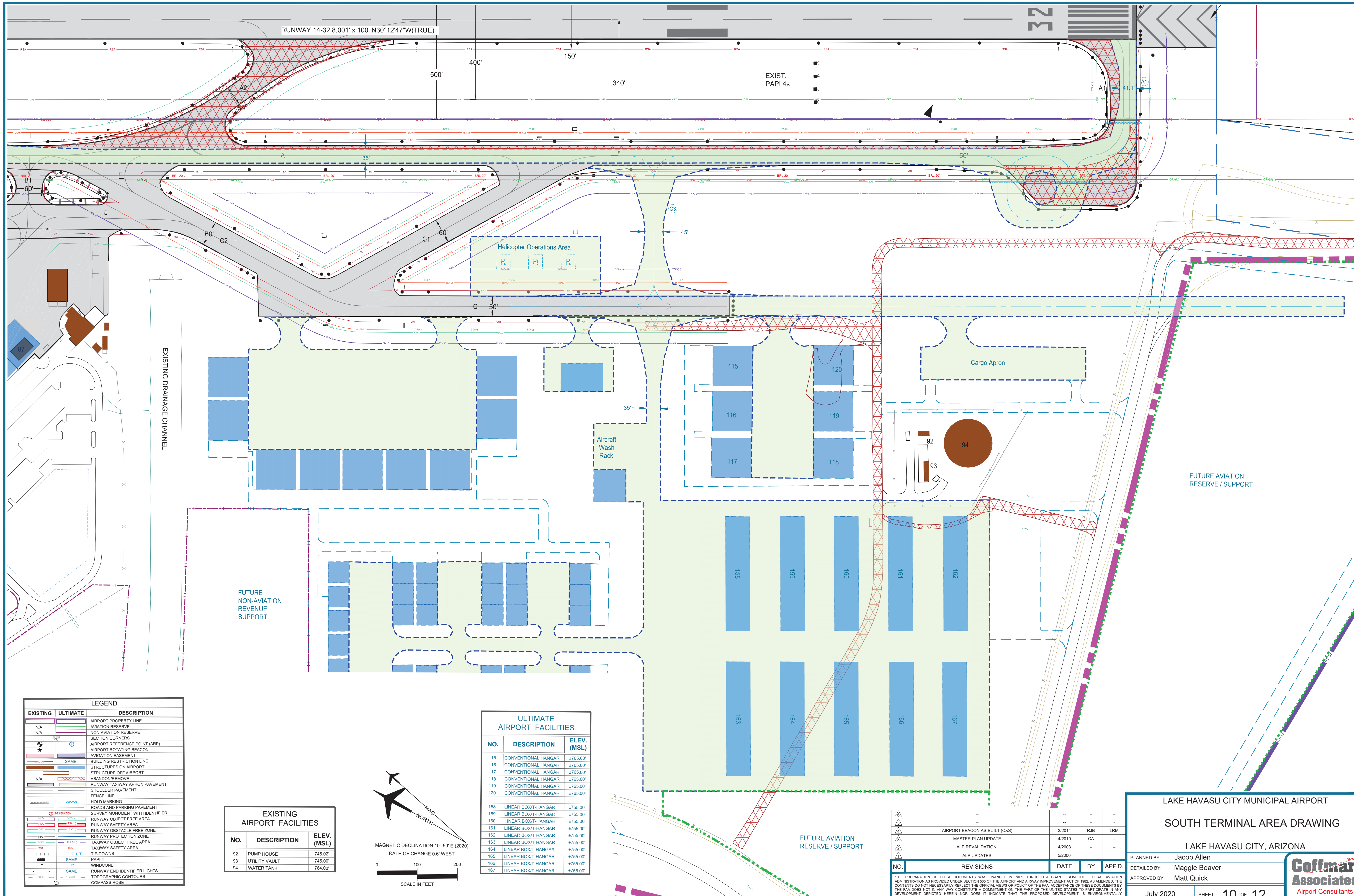

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
N/A		NON-AVIATION RESERVE
32 33 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
BRL-20'	SAME	BUILDING RESTRICTION LINE
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE
		RUNWAY TAXIWAY APRON PAVEMENT
		SHOULDER PAVEMENT
		FENCE LINE
		HOLD MARKING
		ROADS AND PARKING PAVEMENT
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	RUNWAY OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	RUNWAY OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
	SAME	RUNWAY END IDENTIFIER LIGHTS
3660	3660	TOPOGRAPHIC CONTOURS
		COMPASS ROSE

EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
92	PUMP HOUSE	745.02'
93	UTILITY VAULT	745.00'
94	WATER TANK	764.00'

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
115	CONVENTIONAL HANGAR	±765.00'
116	CONVENTIONAL HANGAR	±765.00'
117	CONVENTIONAL HANGAR	±765.00'
118	CONVENTIONAL HANGAR	±765.00'
119	CONVENTIONAL HANGAR	±765.00'
120	CONVENTIONAL HANGAR	±765.00'
158	LINEAR BOX/T-HANGAR	±755.00'
159	LINEAR BOX/T-HANGAR	±755.00'
160	LINEAR BOX/T-HANGAR	±755.00'
161	LINEAR BOX/T-HANGAR	±755.00'
162	LINEAR BOX/T-HANGAR	±755.00'
163	LINEAR BOX/T-HANGAR	±755.00'
164	LINEAR BOX/T-HANGAR	±755.00'
165	LINEAR BOX/T-HANGAR	±755.00'
166	LINEAR BOX/T-HANGAR	±755.00'
167	LINEAR BOX/T-HANGAR	±755.00'

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
5	--	--	--	-
4	AIRPORT BEACON AS-BUILT (C&S)	3/2014	RJB	LRM
3	MASTER PLAN UPDATE	4/2010	CA	-
2	ALP REVALIDATION	4/2003	--	--
1	ALP UPDATES	5/2000	--	--

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LAKE HAVASU CITY MUNICIPAL AIRPORT

SOUTH TERMINAL AREA DRAWING

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

Coffman Associates
Airport Consultants
www.coffmanassociates.com

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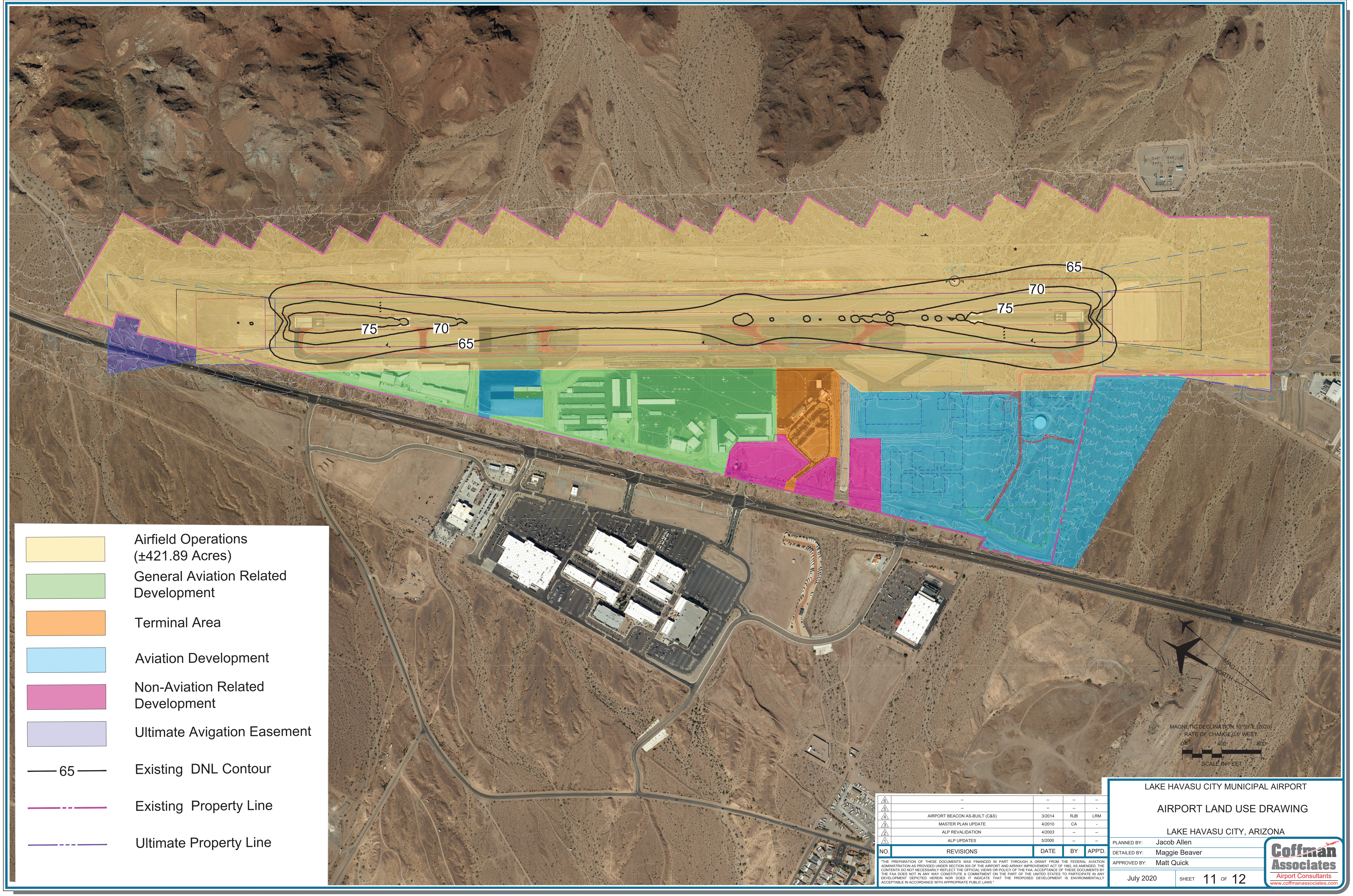

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LAKE HAVASU CITY MUNICIPAL AIRPORT

AIRPORT LAND USE DRAWING

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

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EXISTING PROPERTY DATA									
Parcel ID	Grantor	Interest Type	Acreage	ARC Acreage	Instrument	Book/Page	FAA Grant #	Easement	Date
1	U.S. Government, BLM	Fee Simple	555.05±	515.00	Patent	Book 1596, Page 723/733	N/A	N/A	9/5/1989
2	Poli - Gold	Fee Simple	5.78±	5.83	Condemnation	Book 3319, Page 728	#3-04-0071-02	N/A	6/10/1999
3	Poli - Gold	Fee Simple	20.21±	20.25	Condemnation	Book 3319, Page 728	#3-04-0071-02	N/A	6/10/1999
4	State of Arizona	Fee Simple	48.51±	48.60	NA	Book 768, Page 444	#3-04-0071-02	N/A	12/17/1981

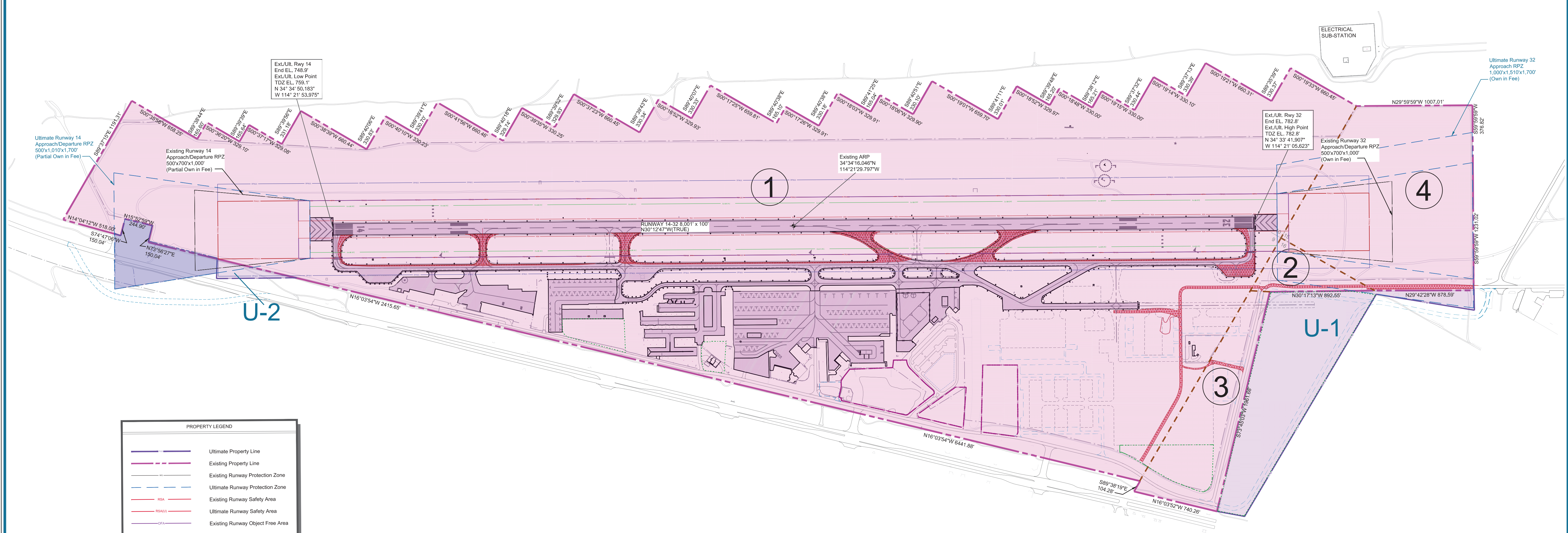
ULTIMATE AIRPORT PROPERTY		
ID	ACREAGE	PURPOSE
U-1	±28.28	To be acquired for Ultimate RPZ protection/future aviation development
U-2	±1.43	To be acquired for Ultimate ROFA/RPZ protection

Key:
Runway Protection Zone (RPZ)
Runway Object Free Area (ROFA)

MAG NORTH

MAGNETIC DECLINATION 10°59' E (2020)
RATE OF CHANGE 0.6' WEST

0 400 800
SCALE IN FEET



PROPERTY LEGEND

- Ultimate Property Line
- Existing Property Line
- Existing Runway Protection Zone
- Ultimate Runway Protection Zone
- Existing Runway Safety Area
- Ultimate Runway Safety Area
- Existing Runway Object Free Area
- Ultimate Runway Object Free Area
- Ultimate Airport Property
- Existing Airport Property
- Parcel Boundary
- Ultimate Airport Easement
- Ultimate Easement Boundary

FOR APPROVAL BY:

Lake Havasu City, Arizona

APPROVED BY: Damon Anderson, Airport Supervisor

ON THE DATE OF: 7/22/20

NO.	REVISIONS	DATE	BY	APP'D.
6	--	--	--	--
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LAKE HAVASU CITY MUNICIPAL AIRPORT

EXHIBIT "A" AIRPORT PROPERTY INVENTORY MAP

LAKE HAVASU CITY, ARIZONA

PLANNED BY: Jacob Allen
DETAILED BY: Maggie Beaver
APPROVED BY: Matt Quick

July 2020

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