Airport Master Plan

CHANDLER
MUNICIPAL AIRPORT
CHD

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Community of Innovation

AIRPORT MASTER PLAN

CHANDLER MUNICIPAL AIRPORT
Chandler, Arizona

Prepared for:

The City of Chandler

Prepared by:

Coffman Associates
Airport Consultants

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TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION AND SUMMARY

CHAPTER ONE – INVENTORY

CHAPTER ONE – INVENTORY (continued)

CHAPTER TWO – FORECASTS

CHAPTER TWO – FORECASTS (continued)

CHAPTER THREE – FACILITY REQUIREMENTS

CHAPTER FOUR – AIRPORT ALTERNATIVES

CHAPTER FIVE – RECOMMENDED MASTER PLAN CONCEPT

CHAPTER SIX – CAPITAL FINANCIAL PLAN

EXHIBITS

EXHIBITS (continued)

Facility Requirements

Airport Alternatives

Recommended Master Plan Concept

Capital Financial Plan

APPENDICES

INTRODUCTION AND SUMMARY

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INTRODUCTION AND SUMMARY

WHAT IS A MASTER PLAN?

The Federal Aviation Administration (FAA) recommends that airports update their long-term planning documents every seven to 10 years, or as necessary to address local changes at the airport. The last master plan update for Chandler Municipal Airport (CHD) was completed in 2007. The City of Chandler (City), the sponsor of the airport, received a grant from the FAA to update the Airport Master Plan.

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

CHANDLER MUNICIPAL AIRPORT CHD

The Airport Master Plan follows a systematic approach outlined by the FAA to identify airport needs in advance of the actual need for improvements. This is done to ensure that the City can coordinate environmental reviews, project approvals, design, financing, and construction to minimize the negative effects of maintaining and operating inadequate or insufficient facilities. An important outcome of the Master Plan process is a recommended development plan, which reserves sufficient areas for future facility needs. Such planning will protect development areas and ensure they will be readily available when required to meet future needs. The intended outcome of this study is a detailed on-airport land use concept which outlines specific uses for all areas of airport property, including strategies for revenue enhancement.

The preparation of this Master Plan is evidence that the City recognizes the importance of the airport to the surrounding region and the associated challenges inherent in providing for its unique operating and improvement needs. The cost of maintaining an airport is an investment which yields impressive benefits to the local community. With a sound and realistic Master Plan, the airport can maintain its role as an important link to the regional, state, and national air transportation systems. Moreover, the plan will aid in supporting decisions for directing limited and valuable City resources for future airport development. Ultimately, the continued investments in the airport will allow the City to reap the economic benefits generated by historical investments.

Some common questions regarding what a master plan is / is not are answered in the graphic below.

What an Airport Master Plan is:

- A comprehensive, long-range study of the airport and all air and landside components that describes plans to meet FAA safety standards and future aviation demand.
- Required by the FAA to be conducted every 7-10 years to ensure plans are up-to-date and reflect current conditions and FAA regulations. The last Master Plan was completed in 2007.
- Funded by the FAA through the Airport Improvement Program (AIP), which provides 91.06% of the total project costs. The remaining 8.94% is funded by ADOT – Aeronautics Group and the City of Chandler.
- A local document that will ultimately be presented for approval from the City of Chandler. The FAA approves only two elements of the Master Plan, the Aviation Demand Forecasts and the Airport Layout Plan (ALP) drawing set.
- An opportunity for airport stakeholders and the general public to engage with airport staff on issues related to the airport and its current and future operations, and environmental and socioeconomic impacts. Three (3) public information workshops will be conducted throughout the Master Plan process to facilitate this public outreach effort.

What an Airport Master Plan is not:

- A guarantee that the airport will proceed with any planned projects. Master Plans are guides that help airport staff plan for future airport development; however, the need/demand for certain projects may not ever materialize.
- A guarantee that the City of Chandler, ADOT, or the FAA will fund any planned projects. Project funding is considered on a project-by-project basis requiring appropriate need and demand. Certain projects may require the completion of a benefit-cost analysis.
- Environmental clearance for any planned projects. The Master Plan includes an environmental overview that identifies potential environmental sensitivities per the National Environmental Policy Act of 1969 (NEPA); however, most planned projects will require a separate NEPA study (Environmental Impact Statement/Environmental Assessment/Categorical Exclusion) prior to construction.

WHO IS PREPARING THE MASTER PLAN?

The City has contracted with the airport planning firm Coffman Associates, Inc. to undertake the Airport Master Plan. Coffman Associates is an airport consulting firm that specializes in master planning and environmental studies. Coffman Associates will lead the planning team, with support from the following firms:

- Dibble Engineering | Engineering support primarily to offer insights into development alternatives and estimates of probable costs;
- MakPro Services | Community outreach and involvement support;
- Quest Energy | Evaluating the airport in terms of its energy use and efficiency;
- SWCA | Conducting field surveys in support of the environmental elements of the plan; and,
- Woolpert | Aerial photography, ground survey, and Geographic Information System (GIS) products to meet FAA 5300-18B requirements for Airports GIS data submittal.

The Airport Master Plan Update has been prepared in accordance with FAA requirements, including Advisory Circular (AC) 150/5300-13A, *Airport Design* (as amended), and AC 150/5070-6C, *Airport Master Plans* (as amended). The plan will be closely coordinated with other planning studies relevant to the area and with aviation plans developed by the FAA and ADOT – Aeronautics Group. The plan will also be coordinated with the City of Chandler, as well as other local and regional agencies as appropriate.

GOALS AND OBJECTIVES

The primary goal of this Master Plan is to develop and maintain a financially feasible, long-term development program, which will satisfy aviation demand of the region; be compatible with community development, other transportation modes, and the environment; and enhance employment and revenue for the local area. Accomplishing this goal requires an evaluation of the existing airport to decide what actions should be taken to maintain a safe, adequate, and reliable facility.

Specific objectives of the study include the following:

- Document the issues that proposed development will address.
- Justify the 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 capital improvement program.
- Propose an achievable financial plan to support the implementation schedule.
- 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.

- Document policies and future aeronautical demand to support municipal or local deliberations on spending, debt, land use controls, and other policies necessary to preserve the integrity of the airport and its surroundings.

- 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.

- To enhance/expand general aviation services to accommodate tenants/users, thus increasing the socioeconomic benefits to the community.

BASELINE ASSUMPTIONS

A long-range planning study requires several baseline assumptions that will be used throughout this analysis. The baseline assumptions for this study are as follows:

- CHD will continue to operate as a regional general aviation reliever airport through the 20-year planning period;

- CHD will continue to accommodate general aviation tenants, as well as itinerant and/or local aircraft operations by air taxi, general aviation, and military operators;

- The aviation industry will develop through the planning period as projected by the FAA. Specifics of projected changes in national aviation industries are described in Chapter Two – Forecasts;

- The socioeconomic characteristics of the region will generally change as forecast (see Chapter Two); and,

- A federal and state airport improvement program will be in place through the planning period to assist in funding future capital development needs.

MASTER PLAN ELEMENTS AND PROCESS

The Master Plan has 11 elements that are intended to assist in the evaluation of future facility needs and provide the supporting rationale for their implementation. **Exhibit IA** provides a graphical depiction of the process involved with the study.

Element 1 – Initiation includes the development of the scope of services, schedule, and study website. Study material will be assembled in a workbook format. General background information will be established that includes outlining the goals and objectives to be accomplished during the Master Plan.

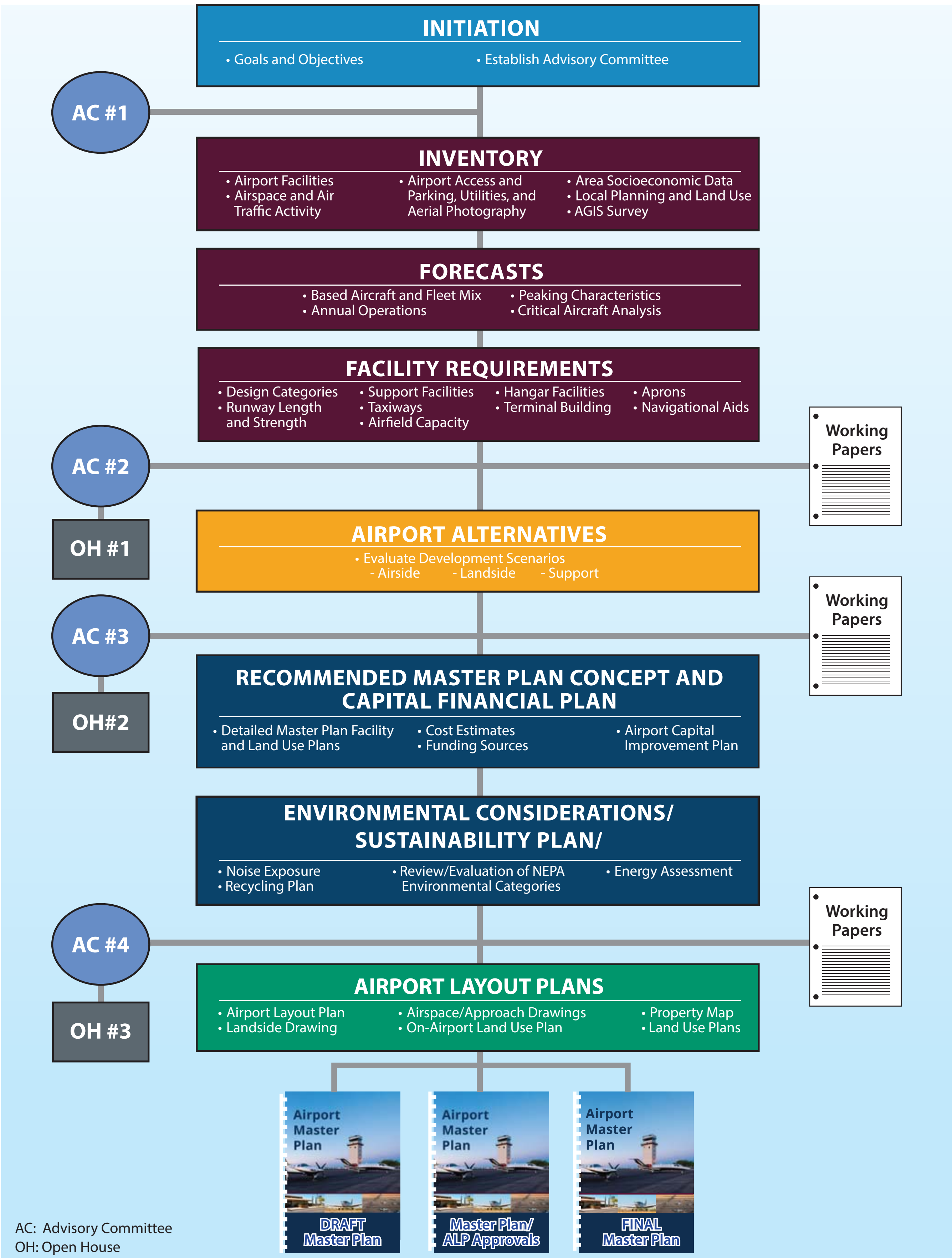

Exhibit IA
PROJECT WORK FLOW

Element 2 – Inventory is focused on collecting and assembling relevant data pertaining to the airport and the area it serves. Information is collected on existing facilities and operations. Local economic and demographic data is collected to define the local growth trends, and environmental information is gathered to identify potential environmental sensitivities that might affect future improvements. Planning studies which may have relevance to the Master Plan are also collected.

Element 3 – Forecasts examines the potential aviation demand at the airport. The analysis utilizes local socioeconomic information, as well as national air transportation trends to quantify the levels of aviation activity which can reasonably be expected to occur at CHD over a 20-year period. An existing and ultimate critical design aircraft, based upon AC 150/5000-17, *Critical Aircraft and Regular Use Determination,* is also established to determine future planning design standards. The results of this effort are used to determine the types and sizes of facilities which will be required to meet the projected aviation demand at the airport through the planning period. This element is one of two elements that are submitted to the FAA for approval.

Element 4 – Facility Requirements determines the available capacities of various facilities at the airport, whether they conform with FAA standards, and what facility updates or new facilities will be needed to comply with FAA requirements and/or projected 20-year demand.

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

Element 6 – Recommended 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 capital improvement program (CIP) is established to define the schedules, costs, and funding sources for the recommended development projects.

Element 7 – Airport Layout Plans is the preparation of the official Airport Layout Plan (ALP) drawings based on the recommended development concept. The ALP set is used by the FAA and ADOT – Aeronautics Group in determining grant eligibility. This element is the second element of the study that is submitted to the FAA for approval.

Element 8 – Environmental Considerations involves providing environmental information to assist in the evaluation of airport development alternatives and to provide information that will help expedite subsequent environmental review under NEPA.

Element 9 – Sustainability Plan consists of two tasks, a recycling plan and an energy assessment. These tasks are intended to help the airport reduce its operating costs and its environmental impacts.

Element 10 – Public Coordination and Communication includes tasks related to the establishment of a Planning Advisory Committee (Committee) for the Master Plan, as well as conducting periodic public information workshops with the aim of engaging the community in the study process. A study website is also developed for the purpose of distributing study materials and notices of public meetings.

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.

COORDINATION AND OUTREACH

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

To assist in the development of the Master Plan, a Master Plan Committee was established to act in an advisory role in the development of the Master Plan. Committee members met four times at designated points during the study to review study materials and provide comments to help ensure that a realistic, viable plan was developed.

Draft working paper materials were prepared at various milestones in the planning process. The working paper process allows for timely input and review during each step within the Master Plan to ensure that all issues are fully addressed as the recommended program develops.

A series of three open-house public information workshops were also conducted as part of the study coordination and outreach efforts. Workshops are designed to allow all interested persons to become informed and provide input concerning the Master Plan process. Notices of meeting times and locations were advertised through local media outlets. All draft reports, meeting notices, and materials were made available to the public on a website.

SWOT ANALYSIS

A SWOT analysis is a strategic business planning technique used to identify **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats associated with an action or plan. The SWOT analysis involves identifying an action, objective, or element, and then identifying the internal and external forces that are positively and negatively impacting that action, objective, or element in a given environment. A SWOT analysis will be conducted at the first Advisory Committee meeting.

SWOT DEFINITIONS

This SWOT analysis groups 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.

The SWOT 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 CHD is based upon information gathered, including a kick-off Master Plan Committee meeting that was conducted in October 2019. As previously discussed, the Committee 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 IA**. These results were used to frame the subjective or judgmental processing of the data presented in the Master Plan.

TABLE IA | SWOT Analysis Results
Chandler Municipal Airport

Strengths	
Strong humanitarian segment	Fast growing community drives demand
Various demand segments operating at CHD	Attracts national/global business
Economic impact of airport on local community	Fully developed airfield/lack of delays
Opportunities it provides to economic climate of the community and wider area	FBOs available providing full range of GA services
Good climate (weather)	Infrastructure in place to support future development
Location/accessibility from highway	Flexibility of airspace/cooperation with regional airspace controllers
Interest in local entities in airport activities	Great airport staff
On-site airport traffic control tower	Large engineering schools in area
Available property for development	Runway length; Can be extended, but only so long
Underutilized large helipad	Flight testing areas close
Close to Phoenix but not too close - away from the worst of land and air congestion	Encroachment on the airfield (at this point) has not restricted operations. Current city administration intent on keeping it that way.
Favorable city government	New fueling capability
Population familiar with unmanned motor vehicles - receptive to UAVs	Expansion areas around the airfield for airport related infrastructure. (Especially since Wingspan fell out.)
Strong business development benefits from CHD's role as a GA reliever	Proximity to Tucson in relation to the other airfields in the Valley
Large industrial base in area	Hangar Cafe
City finances solid - can provide grant matches	

TABLE IA (continued) | SWOT Analysis Results
Chandler Municipal Airport

Weaknesses	
Aging infrastructure/pavements	City owned hangars are nearing end of life/poor condition
Climate	Accessibility to south side of airport/deters development
Available runway length/aircraft insurance restrictions	Low airport staffing levels
Difficult political history/lack of political support	Organizational structure of airport within City departments (airport moves from one department to another leads to confusion)
Land lease renewals have not been renewed	Lack adequate dust control for larger military helicopters
Hangar availability	Environmental issues
All existing instrument approaches cross	Runway length; Can be extended, but only so long
Runway length and ordinance	Land locked - limited areas
Opportunities	
Fast growing community drives demand	Potential for revenue generation
City is visioning to support future development of the community	Sustainability component/considerations
Better cooperation with current mayor and city council	Airpark area development/surrounding land use development
Preparing this master plan to educate/engage local elected officials and public	Available amenities near airport to support businesses/industry
Aircraft hangar waiting list/demand for new hangars	Expanded services/hotels/rental cars to support airport growth
Utilizing data gathered in master plan to supplement economic development tools	Capitalizing on city's welcoming of innovation and startups provides opportunity to airport
Local businesses that supply aviation industry	Attract new aircraft maintenance/rehab (upholstery/aircraft painting) service operators
Attracting new business aviation operators	New staff to attract business aviation
Hangar for experimental aircraft final assembly	Develop a consistent marketing strategy for the airport (business/tourism/educational)
City transportation department is updating its master plan and has a dedicated section on airport	Educate youth in community - next generation - integrate local schools
Engaging with youth	Funding availability from FAA/ADOT
Unmanned aerial vehicles (UAVs)	More hangar space - more comfortable for tenants
Lengthened runway increases fuel sales & business travelers	Strategic partnerships with technology companies
ALP shows longer runway	Update Airpark Area Plan
Favorable political climate to consider runway length	Additional revenue generation for airport = more improvements
Pilot training - next generation	Connection to Intel and all the corporate structure that has grown up around it.
Longer runway = more options	As a somewhat underutilized airfield, opportunity to become the one airfield which can service a new player in the Valley (Especially if the runway is extended)
Building more of a community at the airport / sense of legacy and belonging	
Threats	
Encroachment of surrounding development	Multi-family housing development near airport/residential encroachment
Difficult political history	Pilot shortage/aging pilot population
Potential future constraints of regional airspace	Drop in aircraft ownership among pilots/less investing in aircraft
Lack of hotel accommodations in area/losing tax dollars to other communities	Economic downturns/impact of worldwide events

TABLE IA (continued) | SWOT Analysis Results
Chandler Municipal Airport

Very strong/committed local/regional competition for business aviation operators	Funding availability/uncertainty
Voters/lack of knowledge of airport activities	Cyber security/threats
Public perception - history from longtime residents	Climate change - summer temperatures
Strong competition from other airports	Demographic changes - aging GA pilot population
Traditional airport/aviation businesses will change	Pressure on traditional airport revenue streams
Threat of economic downturn	Legislation (fed, state, local)
Election can change climate/support	Future city administration that values the land more than they value the economic impact of the airport
Change in pilots - more drone pilots, more single pilot aircraft	Chandler City is in late stages of buildout - land around the airport will get more and more premium
Change in air traffic - busier with UAVs	Increasing noise aversion as the population fills in

SUMMARY

Planned development at CHD is focused on accommodating projected growth in activity and meeting FAA airfield design standards. The capital improvement program (CIP) that has been developed identifies both airside (runways, taxiways, navigational aids, etc.) and landside (aprons, access roads, vehicle parking, etc.) facility needs.

To properly plan for future demand that may occur, aviation demand forecasts were prepared. Because of the cyclical nature of the economy, it is virtually impossible to predict with certainty year-to-year fluctuations in activity when looking five, ten, and twenty years into the future. Recognizing this reality, the Master Plan is keyed toward potential demand "horizon" levels rather than future dates in time. These "planning horizons" were established as levels of activity that will call for consideration of the implementation of the next step in the Airport Master Plan program. By developing the Airport to meet the aviation demand levels instead of specific points in time, the Airport will serve as a safe and efficient aviation facility which will meet the operational demands of its users while being developed in a cost-efficient manner. This program allows the City of Chandler to change specific development in response to unanticipated needs or demand.

The forecast approach utilized historical and forecasted general aviation and economic trends resulting in modest growth projections for CHD through the planning period of the Master Plan. The forecast planning horizons are summarized in **Table IB**. These forecasts were reviewed and approved by the FAA on May 5, 2020 (see **Appendix C**).

TABLE IB | Aviation Demand Planning Horizons
Chandler Municipal Airport

	Base Year (2019)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single Engine	379	424	469	552
Multi-Engine	26	24	20	15
Turboprop	6	7	9	13
Jet	8	10	13	20
Helicopter	22	25	29	40
Total Based Aircraft	**441**	**490**	**540**	**640**
ANNUAL OPERATIONS				
Itinerant				
Air Taxi	2,990	3,900	4,400	5,100
General Aviation	67,647	72,500	77,300	87,400
Military	199	213	213	213
Total Itinerant	**70,836**	**76,613**	**81,913**	**92,713**
Local				
General Aviation	149,754	158,300	165,800	181,900
Military	72	62	62	62
Total Local	**149,826**	**158,362**	**165,862**	**181,962**
Total Operations	**220,662**	**234,975**	**247,775**	**274,675**

Source: Coffman Associates analysis

It should be noted that aviation activity can be affected by numerous outside influences that may occur locally, regionally, or nationally. At the time of this writing in March 2021, the biggest factor currently influencing the aviation industry is the COVID-19 pandemic that has resulted in a significant reduction in air travel. While general aviation and business aviation operations have been returning to pre-COVID levels, there is still much uncertainty as to how this health crisis will affect airports in the coming months, or the lasting impacts it may have on the industry as a whole. With that in mind, it is important to note that aviation demand forecasts should be used for advisory purposes only. It is recommended that planning strategies remain flexible to accommodate unforeseen events, and that airport decision-makers be prepared to adapt plans as necessary.

MASTER PLAN CONCEPT

The Master Plan concept includes improvements to the airfield and landside area to satisfy FAA design and safety standards and to meet current and forecast needs. Runway design standards are based upon the characteristics of each runway's critical design aircraft, which is the most physically demanding aircraft that uses each runway for at least 500 operations annually.

Airside Summary

CHD is classified in the FAA's National Plan of Integrated Airports System (NPIAS) as a general aviation reliever airport of regional importance. In this role, CHD is meant to relieve the commercial service airports in the Phoenix Metropolitan Area (Phoenix Sky Harbor and Phoenix-Mesa Gateway) of general aviation traffic including small single-engine aircraft up to mid-sized business jets. The existing airfield, which consists of two runways, is well situated to serve in its role. However, improvements are necessary to meet FAA design standards and the needs of a new generation of aircraft and the businesses that support airport activities. **Table IC** provides a summary of airside improvements, which are depicted on **Exhibit IB**. A more detailed discussion of recommendations can be found in Chapter Five of the Master Plan.

TABLE IC | Airside Summary
Chandler Airport

	EXISTING CONDITION	ULTIMATE CONDITION
RUNWAY 4R-22L (Primary Runway)		
Runway Design Code (RDC)	RDC B-II-5000	RDC B-II-5000
Critical Design Aircraft	Beechcraft King Air 200/300/350	Cessna Citation CJ4/Citation X
Runway Dimensions (l x w) (in feet)	4,870' x 75'	Extend to 5,550 feet to increase utility for mid-sized business jets
Runway Pavement Strength	30,000 lbs. Single Wheel Loading	Maintain
Safety Areas	Standard RSA, ROFA, and ROFZ	Maintain
Runway Protection Zones (RPZs)	RPZs are contained entirely on airport property	The Runway 22L RPZ will shift with the runway extension but will remain on airport property.
RUNWAY 4L-22R (Parallel Runway)		
Runway Design Code (RDC)	RDC B-II-VIS (small)	RDC B-II-5000 (small)
Critical Design Aircraft	Beechcraft King Air 90	Beechcraft King Air 90
Runway Dimensions (l x w) (in feet)	4,401' x 75'	Maintain
Runway Pavement Strength	30,000 lbs. Single Wheel Loading	Maintain
Safety Areas	Standard RSA, ROFA, and ROFZ	Maintain
Runway Protection Zones (RPZs)	RPZs are contained entirely on airport property or on property controlled by avigation easements	Maintain
TAXIWAYS		
Taxiway Design Group (TDG)	TDG-2	TDG-2
Taxiway Width	All taxiways at least 35' wide	Maintain
Taxiway Geometry Issues	Taxiway fillets throughout airfield do not meet design standards	Modify taxiway fillets to meet design standards
	Direct access points: Taxiways F, M, and Q	Relocate Taxiway F and Q and eliminate a portion of Taxiway M
	High-energy area intersections: Taxiways H and N	Eliminate Taxiway H intersection with Runway 4L-22R and shift a portion of Taxiway N outside the Runway 4R-22L high-energy area
	Holding aprons near the ends of both runways are non-standard design	Replace holding aprons with holding bays that meet new FAA design
NAVIGATIONAL AND APPROACH AIDS		
Instrument Approach Procedures	2 published approach procedures including GPS and VOR to Runway 4R	Establish GPS-based instrument approaches with 1-mile or greater visibility minimums to all runway ends
Weather Reporting Station	Automated Weather Observation System (AWOS)	Maintain
Airport Traffic Control Tower	ATCT on north side of airfield	Maintain
Visual Approach Aids	PAPI-4s – all runways	Maintain
	REILs - Runways 4R, 22L	Install REILs on Runway 4L, 22R
LIGHTING, MARKING, AND SIGNAGE		
Lighting	Rotating Beacon	Maintain
	MIRL – both runways	Consider gradual replacement with LED technology
	MITL – all taxiways	Consider gradual replacement with LED technology
Marking	Non-Precision Markings - Runway 4R-22L	Maintain
	Basic Markings – Runway 4L-22R	Potential upgrade to non-precision markings to support instrument approaches
	Runway 4R-22L - Holding position markings 200' from runway centerline	Maintain
	Runway 4L-22R - Holding position markings 125' from runway centerline	Maintain
Signage	Lighted airfield location and directional signage	Consider gradual replacement with LED technology

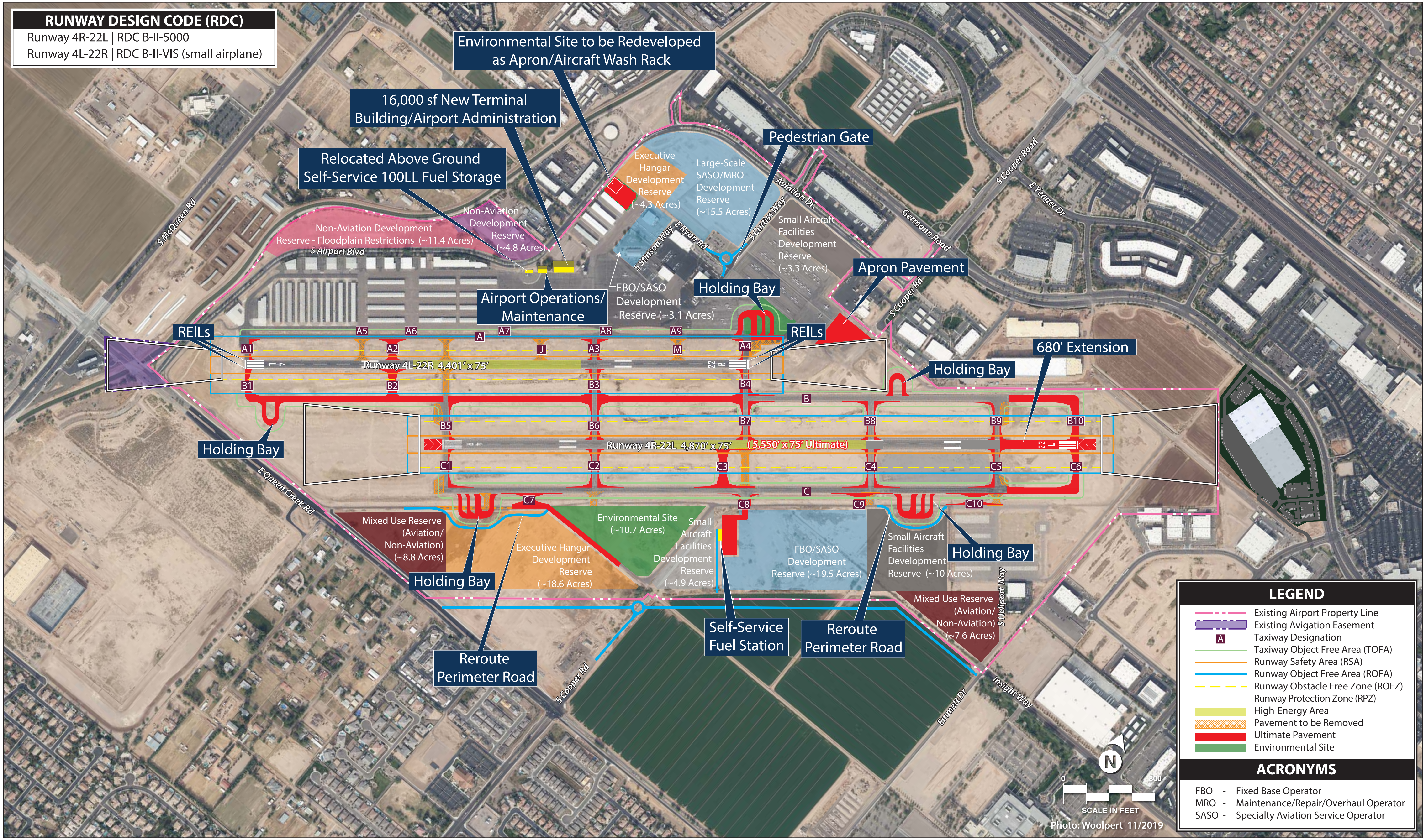

Exhibit IB
AIRPORT DEVELOPMENT CONCEPT

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Landside Summary

Landside facilities at CHD consist of aircraft storage hangars, parking aprons, and businesses providing aviation services (fixed base operators [FBOs] and specialty aviation service operators [SASOs]). Additional landside support facilities include fuel storage tanks, maintenance facilities, and vehicle parking lots and access roads. The master plan provides recommendations on the development of new landside facilities to accommodate the needs of existing and future users.

All hangar-related development should occur only as dictated by demand. The locations of hangar development proposed in the recommended concept are conceptual and are subject to modification based on the needs of a developer and their target customers. The recommended concept is intended to be used strictly as a guide for CHD staff when considering new developments.

A summary of landside recommendations is included below.

- **North Side** | Recommended facilities include a new 16,000 square foot (sf) terminal building to be developed adjacent to the airport traffic control tower (ATCT) to provide a more modern facility for pilot and passenger amenities, as well as offices for airport administration. This site has frontage to the terminal apron that makes it highly visible from the airfield and takes advantage of an existing vehicle parking lot that is currently underutilized. The airport's operations and maintenance equipment storage are planned to be moved to a new facility adjacent to the new terminal to provide a consolidated airport administrative complex. An existing underground storage tank located along S. Airport Boulevard is planned to be replaced with a new above ground tank equipped with spill containment on the terminal apron adjacent to the existing self-service fuel distribution system. Apron pavement on the north side is planned to be expanded by approximately 11,825 square yards (sy). Approximately 39.3 acres of undeveloped property on the north side is planned for a variety of uses including new specialty aviation service operators (SASOs), maintenance/repair/overhaul (MROs) operations, executive hangars and small aircraft facilities, and non-aviation development. The existing terminal building and adjacent unoccupied hangar are planned for redevelopment for FBO/SASO activities.

- **South Side** | The south side of the airport is predominantly undeveloped with approximately 82 acres available for development. Helicopter operations associated with Quantum Helicopters are the primary activity on the south side. A major barrier to development of the south side is a need for expanded utility infrastructure and vehicle access roads. The plan also identifies extensions of Insight Way and S Cooper Road into the south side of the airport for vehicle circulation. Once this infrastructure is in place, the plan reserves parcels for new FBO/SASO development, executive hangar development, small aircraft facilities, and mixed-use development that could include aviation-related or non-aviation related development.

DEVELOPMENT FUNDING

The full implementation of the Airport Master Plan is likely to take two decades or more at a cost of $100.8 million in 2020 dollars. The breakdown of funding over the three planning horizons is presented in **Table ID**. Approximately 40 percent of the total is eligible for grant funding from the FAA or the Arizona

Department of Transportation (ADOT) – Aeronautics Group. The source for FAA funding is the Aviation Trust Fund, which is funded through user fees and taxes on airline tickets, aviation fuel, and aircraft parts. A more detailed discussion of the Capital Improvement Program can be found in Chapter Six of the Master Plan. Private funding is also anticipated for the bulk of the development of new landside facilities including at least partial contribution towards the new terminal building. Private funding sources represent approximately 43 percent of the total capital program.

With the Airport Master Plan Update completed, the most important challenge is implementation. The cost of developing and maintaining aviation facilities is an investment which yields impressive benefits for the City of Chandler. This plan and associated development program provide the tools the City will require to meet the challenges of the future. By providing a safe and efficient facility, CHD will continue to be a valuable asset to the City of Chandler and the surrounding region.

TABLE ID | Development Funding Summary
Chandler Municipal Airport

Planning Horizon	Total Cost	AIP-Eligible Share	ADOT Share	Airport Sponsor Share	Private Funding
Short-Term Program	$21,030,775	$12,569,012	$3,404,474	$5,057,289	$0
Intermediate-Term Program	$49,856,500	$20,982,045	$1,029,977	$2,395,977	$17,448,500
Long-Term Program	$29,985,200	$2,351,169	$115,415	$1,415,415	$26,103,200
Total Program Costs	***$100,872,475***	***$35,902,226***	***$4,549,867***	***$8,868,682***	***$43,551,700***

Note: Funding subtotals do not add up to the estimated total cost due to the uncertainty of funding sources for the new terminal building, which is estimated at $8,000,000.

Sources: Project cost estimates prepared by Dibble Engineering and project staging established by City of Chandler and Coffman Associates.

Chapter One

INVENTORY

Chapter One

INVENTORY

The inventory chapter of existing conditions is the initial step in the preparation of the Chandler Municipal Airport (CHD) Master Plan. The inventory will serve as an overview of the airport's physical and operational features, including facilities, users, and activity levels, as well as specific information related to the airspace, air traffic activity, and role of the airport. Finally, a summary of socioeconomic characteristics and review of existing environmental conditions on and adjacent to the airport are thoroughly detailed, which will provide further input into the study process.

Information provided in Chapter One serves as the baseline for the remainder of the master plan, which is compiled using a wide variety of resources, including: applicable planning documents; on-site visits; interviews with airport staff, tenants, and users; aerial and ground photography; federal, state, and local publications; and project record drawings. Specific sources are those listed below; environmental resources are detailed at the end of this chapter.

CHANDLER
MUNICIPAL AIRPORT
CHD

Inventory Source Documents:

- Chandler Municipal Airport *2007 Airport Master Plan Update*
- City of Chandler's airport website[1]
- Chandler Municipal Airport FAA Form 5010, *Airport Master Record*
- FAA Operations & Performance Data, Operations Network (OPSNET)
- *Chandler General Plan 2016*, passed and adopted by the Mayor and City Council on April 14, 2016
- Maricopa Association of Governments *2040 Regional Transportation Plan Update,* December 19, 2019 (Draft)

AIRPORT SETTING

LOCALE

The Chandler Municipal Airport is located within the City of Chandler, Arizona. With a current population of 263,165[2] as of January 1, 2020, Chandler is the third largest city (after Phoenix and Mesa) among the communities that make up the Phoenix metropolitan area, also known as the "Valley of the Sun." Located in Maricopa County, the City of Chandler is represented in the Maricopa Association of Governments (MAG), which serves as the regional planning agency for the Phoenix metropolitan area. Chandler's Community Vision, as outlined in its *Chandler General Plan 2016* is as follows:

> "The City of Chandler is a major urban center reaching build-out over the next few decades, which requires a shift from outward growth to quality community building. Chandler is connected by an efficient regional system and local multimodal transportation network. The city is the recognized leader for its strong economic foundation, desirable neighborhoods, and outstanding public services and its leaders remain focused on quality, sustained planning that ensures a future better than today. Chandler is a regional employment center and important Arizona economic driver; its world-class corporations, emerging technology businesses, and next-generation entrepreneurs call Chandler home because of its well-educated workforce, exceptional educational achievement and opportunities, and superior quality of life."

CHD is situated on approximately 532.5 acres three miles southeast of downtown Chandler and approximately 20 miles southeast of downtown Phoenix. The airport sits at an elevation of 1,243.1 feet above mean sea level (MSL). The surrounding major surface roadways include East Germann Road to the north; East Queen Creek Road to the south; South Gilbert Road to the east and South McQueen Road and Airport Boulevard to the west. The front side of **Exhibit 1A** depicts the airport in its regional setting. The back side of the exhibit depicts CHD within the regional aviation system,[3] including the various airports serving the Phoenix metropolitan area.

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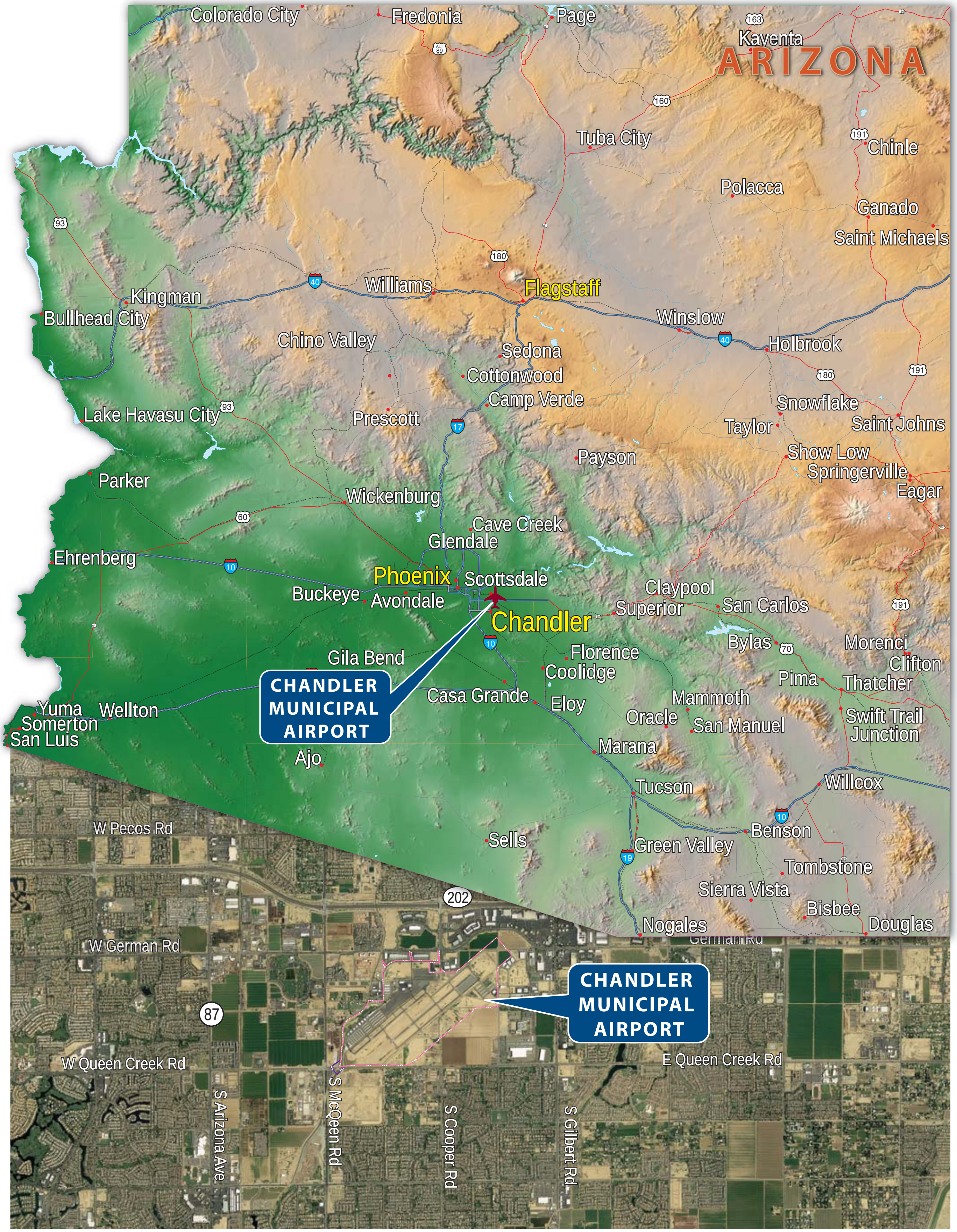
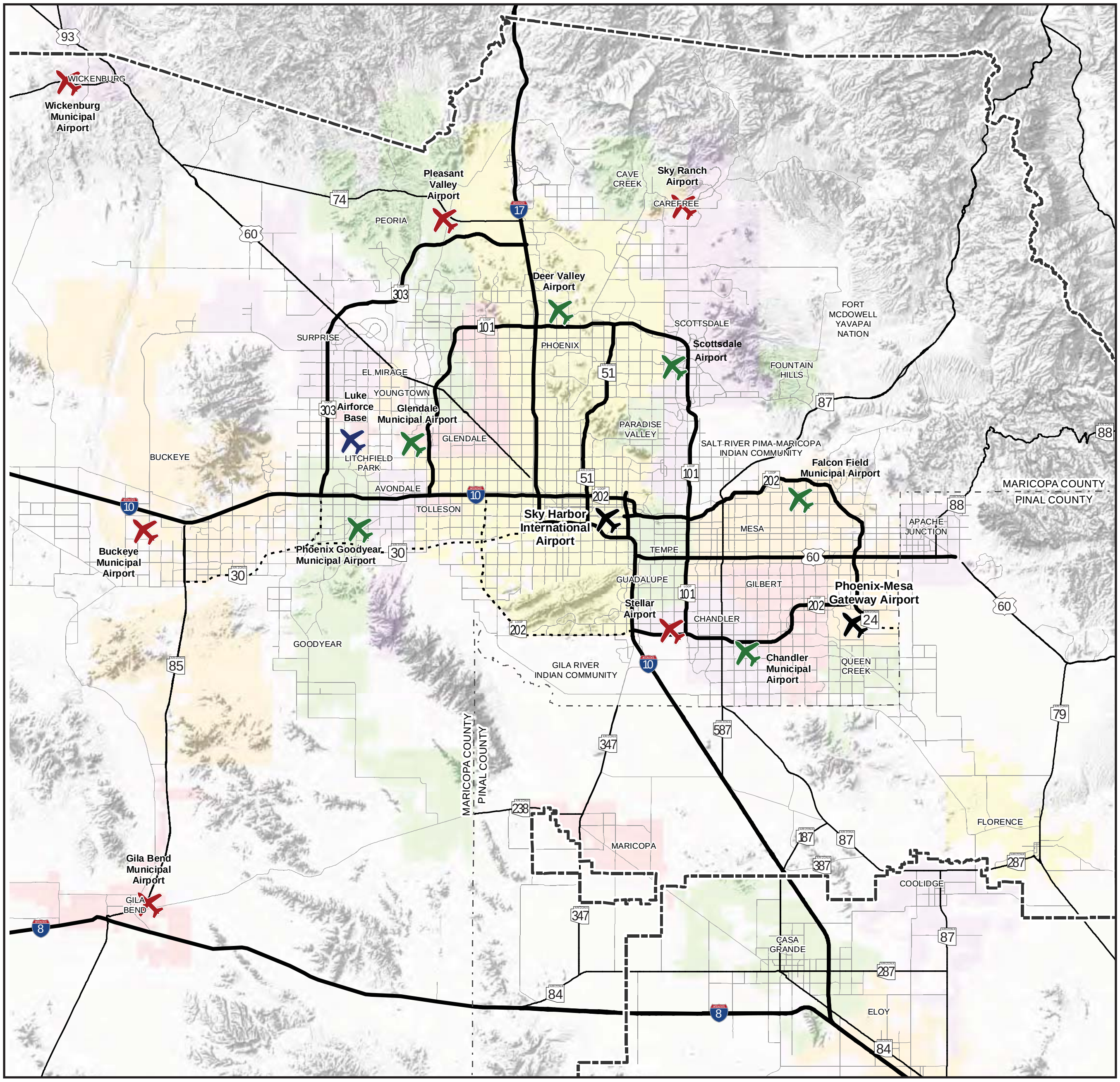
1 https://www.chandleraz.gov/business/chandler-municipal-airport\

2 *City of Chandler Community Profile and Demographics*, retrieved January 16, 2020 from, https://www.chandleraz.gov/explore/living-in-chandler/community-profile-and-demographics

3 Regional Aviation System map sourced from the *2040 Regional Transportation Plan Update*, MAG, as revised on October 29, 2019.


ARIZONA
Colorado City
Fredonia
Page
Kayenta
Tuba City
Chinle
Polacca
Ganado
Saint Michaels
Williams
Flagstaff
Kingman
Bullhead City
Chino Valley
Winslow
Holbrook
Sedona
Cottonwood
Camp Verde
Prescott
Lake Havasu City
Snowflake
Taylor
Saint Johns
Show Low
Springerville
Eagar
Payson
Parker
Wickenburg
Cave Creek
Glendale
Ehrenberg
Phoenix
Scottsdale
Claypool
Superior
San Carlos
Buckeye
Avondale
Chandler
Bylas
Morenci
Clifton
Thatcher
Florence
Coolidge
Gila Bend
Pima
Casa Grande
Eloy
Mammoth
Oracle
San Manuel
Swift Trail Junction
Yuma
Somerton
San Luis
Wellton
Ajo
Marana
Tucson
Willcox
Benson
Sells
Green Valley
Tombstone
Sierra Vista
Bisbee
Douglas
Nogales
CHANDLER MUNICIPAL AIRPORT
W Pecos Rd
202
W German Rd
German Rd
87
CHANDLER MUNICIPAL AIRPORT
W Queen Creek Rd
E Queen Creek Rd
S Arizona Ave
S McQueen Rd
S Cooper Rd
S Gilbert Rd



LEGEND

Airports
- Commercial Service
- Military
- General Aviation Reliever
- General Aviation

Other Features
- Existing Freeway
- Planned Freeway/Highway
- Highways
- Metropolitan Planning Area
- County Boundary

Disclaimer: While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments (MAG) makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

N

0 5 10 15
Miles

rev. 10/29/2019

2040 Regional Transportation Plan Update, Maricopa Association of Governments.

Airport property consists of 28 separate parcels, each of which are identified on **Exhibit 1B**. Data for each parcel, including its acreage, deed date recording information, grantor/deed type, and state/federal grant information is summarized in **Table 1A**.

TABLE 1A | Airport Property Data
Chandler Municipal Airport

Parcel No.	Acres	Deed Date	Grantor/Deed Type	Grant Info
303-32-005	39	5/18/1948	State of Arizona / Warranty	FAAP 9-02-008-6604, 7-14-1959
303-32-001	40	5/28/1948	State of Arizona / Warranty	FAAP 9-02-008-6604, 7-14-1959
303-32-002	39	5/28/1948	State of Arizona / Warranty	FAAP 9-02-008-6604, 7-14-1959
303-32-003	38.96	5/28/1948	State of Arizona / Warranty	FAAP 9-02-008-6604, 7-14-1959
303-32-012L	31.8	1/27/1975	Roosevelt Water Conservation District / Warranty	AIP-3-04-0008-01, 9-24-1984
303-32-011C	6.625	10/24/1985	Roosevelt Water Conservation District / Warranty	N/A
303-32-012P	44.834	3/3/1986	Roosevelt Water Conservation District / Warranty	AIP-3-04-0008-06, 5-18-1989
303-32-012Q	6	12/31/1986	D.J. Patterson / Warranty	AIP-3-04-0008-07, 7-25-1991
303-32-012R	8.914	12/31/1986	D.J. Patterson / Warranty	ADAP-5-04-0008-02, 9-30-1978
303-32-012M	7.83	9/6/1987	Queen Creek Trust / Warranty	AIP-3-04-0008-03, 9-26-1986
303-32-001R	1.464	11/2/1987	Spitler / Warranty	AIP-3-04-0008-03, 9-25-1986
303-32-009B	21.043	3/31/1988	John Demetria LTD. / Warranty	AIP-3-04-0008-04, 8-25-1987
303-31-009F	6.971	6/10/1988	Chandler Airpark Limited Partnership / Warranty	AIP-3-04-0008-04, 8-25-1987
303-30-002B	2.416	7/7/1988	Exeter Real Estate Investors / Warranty	AIP-3-04-0008-04, 8-25-1987
303-30-007B	4.16	7/22/1988	D.W. Patterson / Warranty	AIP-3-04-0008-105, 6-23-1988
303-31-015B	70	9/2/1988	D.W. Patterson / Warranty	AIP-3-04-0008-08, 8-25-1987 and 6-23-1988
303-31-015D	3	8/31/1990	D.W. Patterson / Warranty	AIP-3-04-0008-06, 5-18-1989
303-31-015E	6.728	8/31/1990	D.W. Patterson / Warranty	AIP-3-04-0008-06, 5-18-1989
303-32-014C	19.536	1/4/1993	D.W. Patterson / Warranty	AIP-3-04-0008-06, 5-18-1989
303-31-013C	1.72	1/4/1993	C. Max Killian / Special Warranty Deed	-
303-31-014A	46.589	6/11/1993	D.W. Patterson / Special Warranty Deed	AIP-3-04-0008-08, 6-25-1992
303-32-009C	35.702	1/26/1994	Airport Associates LTD. Liability Company / Warranty	AIP-3-04-0008-09, 9-23-1993
303-31-001N	22.076	9/12/1994	R & E Farms / Special Warranty Deed	AIP-3-04-0008-08, 6-25-1992
303-32-013J	24.65	5/29/2002	AJ Chandler Air Park LLC / Warranty	AIP-3-04-0008-11, ADOT E1135 ADOT E1102, 7-14-2000, 7-1-2000, and 4-2-2001
303-32-013K	0.21	5/29/2002	AJ Chandler Air Park LLC / Warranty	AIP-3-04-0008-11, ADOT E1135 ADOT E1102, 7-14-2000, 7-1-2000, and 4-2-2001
303-32-013L	0.71	5/29/2002	AJ Chandler Air Park LLC / Warranty	AIP-3-04-0008-11, ADOT E1135 ADOT E1102, 7-14-2000, 7-1-2000, and 4-2-2001
303-32-013M	0.43	5/29/2002	AJ Chandler Air Park LLC / Warranty	AIP-3-04-0008-11, ADOT E1135 ADOT E1102, 7-14-2000, 7-1-2000, and 4-2-2001
303-32-013N	2.11	5/29/2002	AJ chandler Air Park LLC / Warranty	AIP-3-04-0008-11, ADOT E1135 ADOT E1102, 7-14-2000, 7-1-2000, and 4-2-2001
Total Acreage	**532.478**			

ADAP | Airport Development Aid Program (federal)
ADOT | Arizona Department of Transportation (state)
AIP | Airport Improvement Program (federal)
FAAP | Federal Aid to Airports Program (federal)
Note: The total acreage shown in this table is the cumulative sum of the above-described parcels, whose acreages were obtained from legal descriptions and other legal documents obtained through the title search, referred to in the “Notice” block.

Source: CHD Airport Property Map, November 22, 2016.

AIRPORT HISTORY

CHD was opened in 1948 with federal aid and consisted of a single runway (Runway 18-36). In 1960 the City constructed a new runway with a northeast-southwest orientation (existing Runway 4L-22R). The entire development at the airport has been constructed and funded under the auspices of the City of Chandler.

Figure 1A highlights significant moments in the airport's history.

City Ordinance No. 3888. - The City Council of the City of Chandler amended the Chandler City Code on December 7, 2006 to "guarantee to the citizens of the City of Chandler the continued quiet enjoyment in and to the homes, schools, churches and work places, the Chandler Municipal Airport shall not be permitted to accommodate, in any fashion, aircraft which require for takeoff a runway longer than 5,700 feet. Extension of the runway shall require voter approved bonds, which specify that the bond monies are for the purpose of extending the runway. In addition, the Chandler Municipal Airport shall not be designed to accommodate aircraft that weigh in excess of 75,000 pounds maximum gross weight, and/or have a wingspan of 79 feet or more."

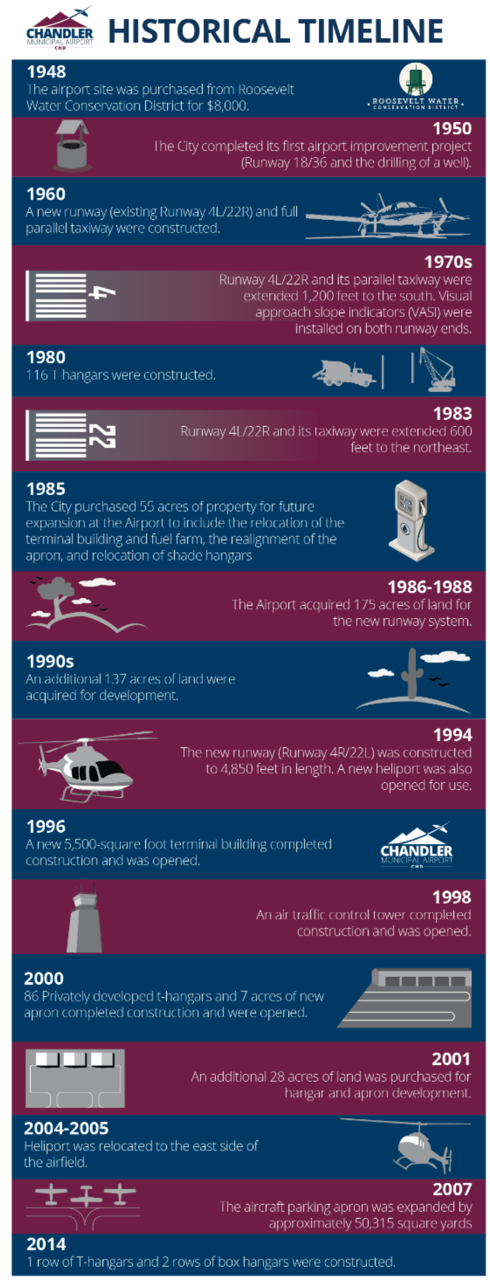
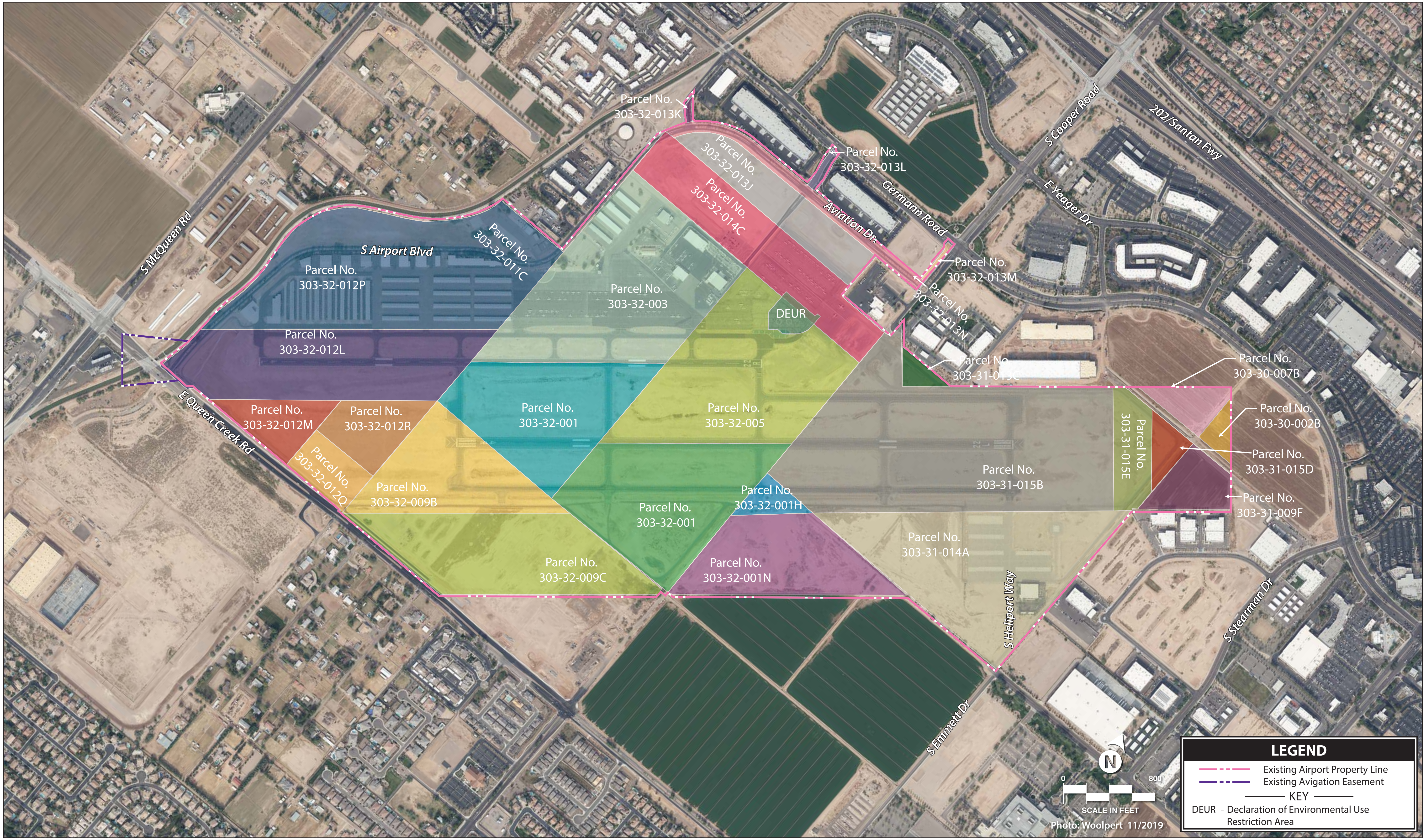


FIGURE 1A – CHD HISTORICAL TIMELINE

AIRPORT ADMINISTRATION

CHD is governed by the Chandler City Council, which is advised by the Airport Commission (Commission). The Commission was established by the City on September 23, 1976, by Ordinance No. 685[4] and consists of seven members appointed by the Mayor and approved by City Council that serve three-year terms. To qualify as a commissioner, you must be a resident of Chandler for one year preceding appointment; one member must be a resident of the Sun Lakes community; one Councilmember is appointed to the commission as an ex officio member to serve as a liaison between the Commission and the City Council. The Commission provides policy advice to the City of Chandler Mayor and Council on the planning and operation of CHD and provides a public forum for all parties interested in the airport's planning and operations.

[4] The ordinance was updated most recently on December 12, 2012 (Ordinance No. 4419); ByLaws adopted December 2016.


S McQueen Rd
S Airport Blvd
E Queen Creek Rd
Aviation Dr.
Germann Road
S Cooper Road
E Yeager Dr
202/Santan Fwy
S Heliport Way
S Emmett Dr
S Stearman Dr
Parcel No. 303-32-013K
Parcel No. 303-32-013J
Parcel No. 303-32-014C
Parcel No. 303-32-013L
Parcel No. 303-32-013M
Parcel No. 303-32-013N
Parcel No. 303-32-011C
Parcel No. 303-32-012P
Parcel No. 303-32-003
DEUR
Parcel No. 303-32-012L
Parcel No. 303-30-007B
Parcel No. 303-30-002B
Parcel No. 303-31-015D
Parcel No. 303-31-009F
Parcel No. 303-32-012M
Parcel No. 303-32-012R
Parcel No. 303-32-001
Parcel No. 303-32-005
Parcel No. 303-31-015E
Parcel No. 303-31-015B
Parcel No. 303-32-012Q
Parcel No. 303-32-009B
Parcel No. 303-32-001H
Parcel No. 303-32-001
Parcel No. 303-31-014A
Parcel No. 303-32-009C
Parcel No. 303-32-001N
N
0
800
SCALE IN FEET
Photo: Woolpert 11/2019
LEGEND
Existing Airport Property Line
Existing Avigation Easement
KEY
DEUR - Declaration of Environmental Use Restriction Area

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The Airport Manager acts as the chief executive responsible for the operation of the airport and serves as a staff liaison to the Commission. The Airport Manager oversees a staff of six people including the following positions:

- (1) Airport Planning Administrator
- (1) Airport Business Coordinator
- (1) Airport Operations and Maintenance Supervisor
- (2) Airport Operation and Maintenance Technicians
- (1) Sr. Administrative Assistant

The airport is staffed seven days a week, holidays excepted, from 8:00 a.m. to 5:00 p.m.

CLIMATE

Local weather conditions can significantly impact an airport's operations. Knowledge of the local climate allows an airport to be better prepared for regional conditions and greatly enhances a pilot's flying capabilities. For example, the airport's runway should be oriented to match predominant wind patterns for the area.

Exhibit 1C displays weather and wind patterns at the airport. July has the highest average maximum temperature of 106.1 degrees. December is the coolest month with an average minimum temperature of 44.8 degrees. Rainfall is most plentiful in July, which averages 1.05 inches. Wind speeds are highest on average during the spring months of April and May with May averaging 7.77 knots.

Table 1B indicates that visual meteorological conditions (VMC) occur 99.64 percent of the time. When under VMC conditions, pilots can operate using visual flight rules (VFR) and are responsible for maintaining proper separation from objects and other aircraft. Instrument meteorological conditions (IMC) account for all weather conditions less than VMC conditions that still allow for aircraft to safely operate under instrument flight rules (IFR). Under IFR, pilots rely on instruments in the aircraft to accomplish navigation. IMC conditions occur 0.25 percent of the time. Less than IMC, or poor visibility conditions (PVC), are present 0.11 percent of the time.

TABLE 1B | Weather Conditions
Chandler Municipal Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1,000' AGL	≥ 3 statute miles	99.64%
IMC	≥ 500' AGL and < 1,000' AGL	≥ 1 to < 3 statute miles	0.25%
PVC	< 500' AGL	< 1 statute mile	0.11%

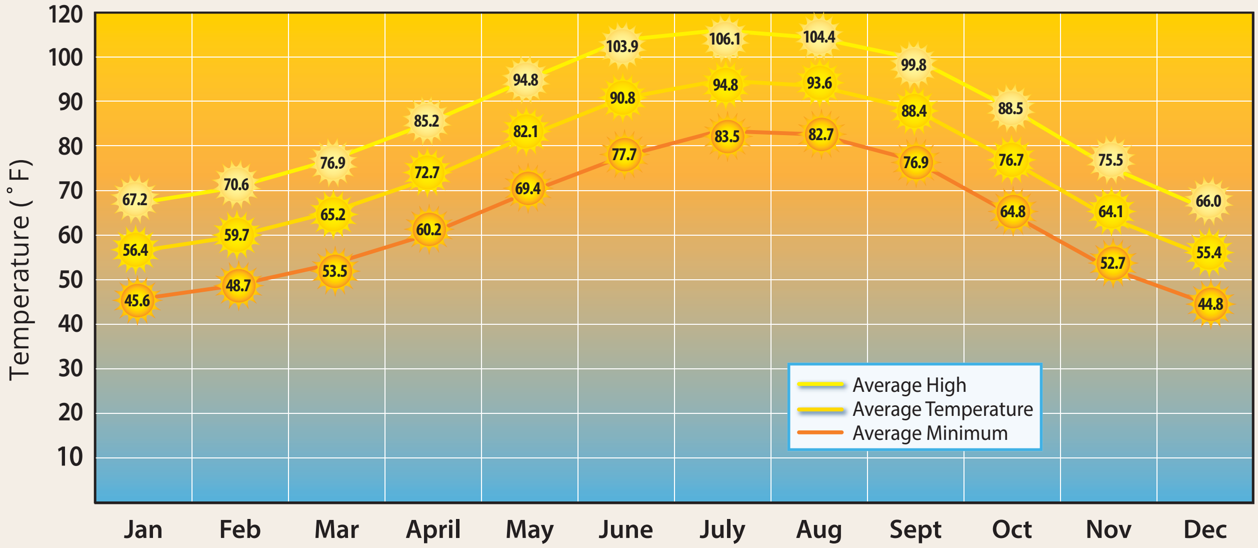
VMC: Visual Meteorological Conditions
IMC: Instrument Meteorological Conditions
PVC: Poor Visibility Conditions
AGL: Above Ground Level

Source: 50,436 All Weather Observations from Jan 1, 2010 thru Dec 31, 2019, Chandler Municipal Airport Weather Station

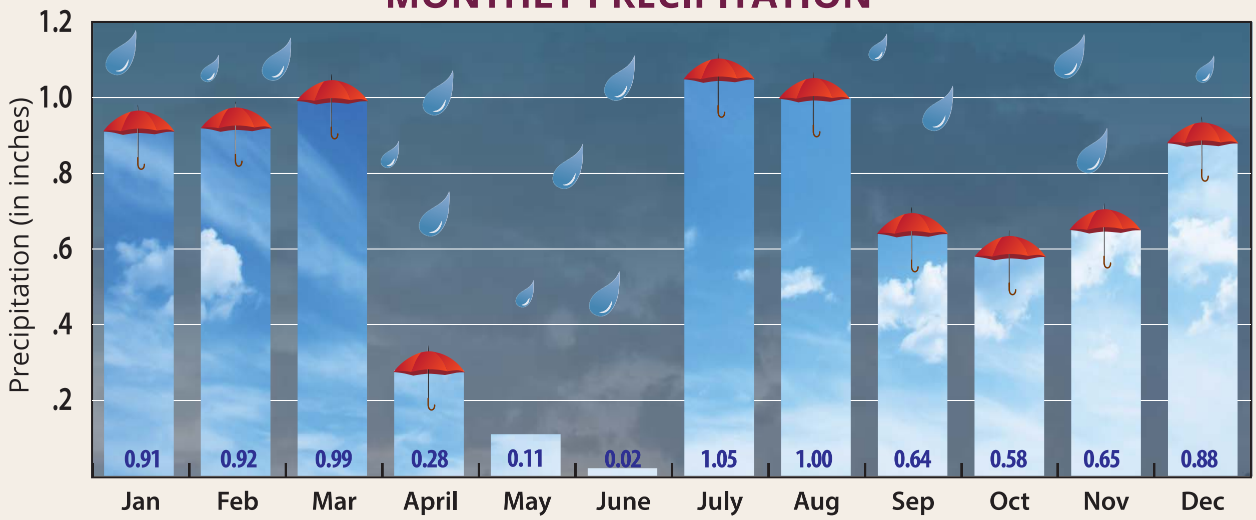
CAPITAL IMPROVEMENT HISTORY

To assist in ongoing capital improvements, the FAA provides funding to CHD through the Airport Improvement Program (AIP).

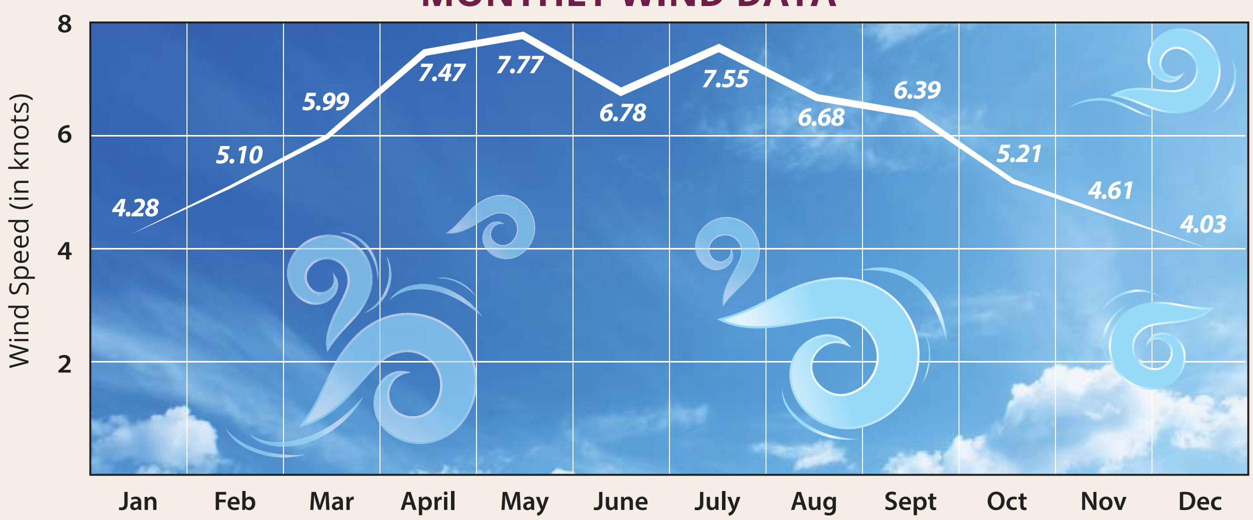
MONTHLY TEMPERATURES



MONTHLY PRECIPITATION



MONTHLY WIND DATA



Source: Phoenix Airport, AZ; GHCND:USW00023183

Table 1C summarizes CHD capital improvement projects undertaken since 2005 that received funding through the FAA's AIP. During this period, the airport received $11.1 million in AIP grants.

TABLE 1C | AIP Grant History: 2005 - 2019
Chandler Municipal Airport

Fiscal Year	Grant Number	Work Description	AIP Funds
2005	16	Construct Heliport/Helipad, Install Airfield Guidance Signs	$1,521,960
2006	17	Conduct Noise Compatibility Plan Study	$272,650
2006	18	Construct Access Road	$150,000
2007	19	Construct Apron	$2,709,244
2009	20	Construct Service Road	$323,693
2011	21	Install Weather Reporting Equipment	$75,000
2012	22	Install Weather Reporting Equipment	$200,393
2013	23	Rehabilitate Apron, Rehabilitate Taxiway Lighting	$393,380
2015	24	Improve Airport Drainage	$1,262,432
2018	26	Rehabilitate Apron	$3,671,699
2019	27	Update Airport Master Plan Study	$546,360
		AIP Total (2005-2019)	**$11,126,811**

Source: FAA AIP Grant History; https://www.faa.gov/airports/aip/grant_histories/lookup/

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

THE AIRPORT'S SYSTEM ROLE

Airport planning takes place at the local, state, and national levels, each of which has a different emphasis and purpose.

- **Local** | CHD has an Airport Master Plan, which was last updated in 2007.
- **State** | CHD is included within the 2006 *Arizona State Airport System Plan* (ASASP). As of 2018, the ASASP is in the process of being updated. ASASP information used in this Master Plan will be updated as new information comes available.
- **National** | CHD is included in the *National Plan of Integrated Airport Systems* (NPIAS), which categorizes overall airport roles and responsibilities based on input from local and state planning efforts (i.e., master plans and state system plans).

LOCAL AIRPORT PLANNING

***2007 Airport Master Plan Update* |** The *2007 Airport Master Plan Update* is the primary local planning document that provides a 20-year airport development vision based on aviation demand forecasts. The *2007 Airport Master Plan Update* used 2005 data for its aviation forecasts baseline. The primary recommendations from the *2007 Airport Master Plan Update* included extending Runway 4R-22L by 850 feet, extension of Taxiway B to the end of Runway 4L, and expansion of landside facilities (aprons/taxilanes/hangars) on the north and southeast sides of the airfield. Since the completion of the previous master plan, the airport has not extended its runway; however, new apron space has been added, new T-hangars have been constructed, and taxiway improvements have been made to meet FAA design standards.

STATE AIRPORT PLANNING

The primary planning document for the State of Arizona is the SASP, which was last updated in October 2018. The SASP focuses on keeping Arizona's airports highly advanced, safe, and responsive to the public's needs today and throughout the 20-year planning horizon. CHD is classified as a reliever airport within the SASP. The SASP definition for a reliever airport is identical to the NPIAS definition, which is an airport that relieves congestion at a commercial service airport. In CHD's case, its purpose is to relieve congestion from Phoenix Sky Harbor International Airport (PHX).

FEDERAL AIRPORT PLANNING

Many of the nation's existing airports were either initially constructed by the federal government or their development and maintenance was partially funded through various federal grant-in-aid programs to local communities. The system of airports existing today is, therefore, due, in large part, to federal policy that promotes the development of civil aviation. As part of a continuing effort to develop a national airport system, the U.S. Congress has maintained a national plan for the development and maintenance of airports.

The FAA maintains a database of airports that are eligible for AIP funding and are for public use called the *National Plan of Integrated Airport Systems* (NPIAS). The NPIAS is published and used by the FAA in administering the AIP, which is the source of federal funds for airport improvement projects across the country. The AIP is funded exclusively by user fees and user taxes, such as those on fuel and airline tickets. An airport must be included in the NPIAS to be eligible for federal funding assistance through the AIP.

The most current plan is the NPIAS 2019-2023, which identified 3,328 public-use airports (3,321 existing and 7 proposed) that are important to national air transportation. The plan estimates that approximately $35.1 billion in AIP-eligible airport projects will require financial assistance between 2019 and 2023.

The NPIAS categorizes airports by the type of activities that take place, including commercial service, cargo service, reliever operations, and general aviation. CHD is currently classified as a reliever airport in the FAA's NPIAS. Due to different operating requirements between small general aviation aircraft and large commercial aircraft, general aviation pilots often find it difficult to use a congested commercial service airport. In recognition of this, the FAA has encouraged the development of high-capacity general aviation airports in major metropolitan areas. These specialized airports, called relievers, provide pilots with attractive alternatives to using congested hub airports. They also provide general aviation access to the surrounding area. To be eligible for reliever designation, these airports must be open to the public, have 100 or more based aircraft, or have 25,000 annual itinerant operations. There are 261 reliever airports within the NPIAS with an average of 177 based aircraft, which in total represents 23 percent of the nation's general aviation fleet.

ECONOMIC IMPACT OF AIRPORTS

In March 2016, the City of Chandler completed an update to its Economic Impact Study for CHD. The study surveyed all airport employers, including the City, and estimated the impact of visitors arriving via CHD using state and hospitality industry data. The results are categorized as either direct or secondary (indirect/induced). Direct impacts are revenues or jobs created by airport employers and air visitors on airport property. Indirect impacts are goods and services purchased in the region with initial business revenues. Induced impacts are spending generated by direct and indirect business revenues. The results of the Economic Impact Study for CHD are summarized in **Table 1D**.

TABLE 1D | Economic Impact
Chandler Municipal Airport

	Revenues (millions)	Payroll (millions)	Jobs
Direct Airport Employer Impacts	$32.52	$6.89	163
Direct Air Visitor Impacts	$34.04	$9.385	312
Secondary Indirect & Induced Impacts	$42.5	$15.184	320
Total Economic Impacts	**$109.06**	**$31.45**	**795**

Source: Chandler Municipal Airport Economic Impact Analysis, March 2016.

AIRPORT FACILITIES AND SERVICES

There are four broad categories of facilities and services at the Airport: airfield, landside, aviation, and support.

- **Airfield facilities** | facilities directly associated with aircraft operations, including runways, taxiways, lighting, markings, navigational aids, and weather reporting.
- **Landside facilities** | facilities necessary to provide a safe transition from surface to air transportation and support aircraft parking, servicing, storage, maintenance, and operational safety.
- **Support facilities** | serve as a critical link to provide the necessary efficiency to aircraft ground operations, such as fuel storage, airport maintenance, firefighting, and fencing.

AIRFIELD FACILITIES

RUNWAYS

CHD has a parallel runway system; Runway 4R-22L is the primary runway and Runway 4L-22R is the secondary runway oriented in a northeast/southwest manner. Information pertaining to both runways is summarized below and on **Exhibit 1D** (front side identifies facilities and back side summarizes pavement conditions). Pavement conditions depicted are a result of an airfield pavement inspection of CHD conducted on May 1, 2017.[5]

[5] The airfield pavement visual inspection was conducted as part of the Arizona Airport Pavement Management System, 2017. PCI ratings range from 0 (failed) to 100 (excellent).

Primary Runway 4R-22L | Runway 4R-22L is paved with asphalt and measures 4,870 feet long and 75 feet wide and has a single wheel (SWL) strength of 30,000 pounds (Pavement Classification Number [PCN] data was not available). The runway has non-precision pavement markings that include a runway end designation, threshold markings, centerline, edge markings, and aiming points. Runway lighting/approach aid systems available include medium intensity runway lighting (MIRL), runway end identifier lights (REILs), and precision approach path indicator (PAPI-4) systems at both ends. The runway slopes down from the 22R end at a gradient of 0.15 percent. Both ends of the runway have 90-foot stopways.[6] The primary runway underwent its most recent maintenance/repair project in January 2020, which was a crack seal and overlay. As of the 2017 pavement inspection, the primary runway was found to have a Pavement Condition Index (PCI) rating of 74 with low and medium severity longitudinal and transverse cracking. Runway 4R-22L has a total pavement area of 440,565 square feet.

Secondary Runway 4L-22R | Runway 4L-22R is constructed of asphalt and measures 4,401 feet long and 75 feet wide and has a SWL strength of 30,000 pounds (PCN data was not available). The runway has basic runway pavement markings including the runway end designation, centerline, edge markings, and aiming points. Runway lighting/approach aid systems available include MIRL and PAPI-4s. The runway slopes down from the 22L end at a gradient of 0.12 percent. This runway is not equipped with stopways and was last rehabilitated on November 3, 2015, when a 1-inch asphalt overlay was applied. As of the 2017 pavement inspection, the secondary runway was found to have a PCI rating of 98 with low severity longitudinal and transverse cracking. Runway 4L-22R has a total pavement area of 328,490 sf.

The parallel runway centerlines are separated by 700 feet, which allows for simultaneous visual flight rule[7] (VFR) operations. Simultaneous operations during instrument flight rule[8] (IFR) conditions are not permitted at CHD.

HELIPAD

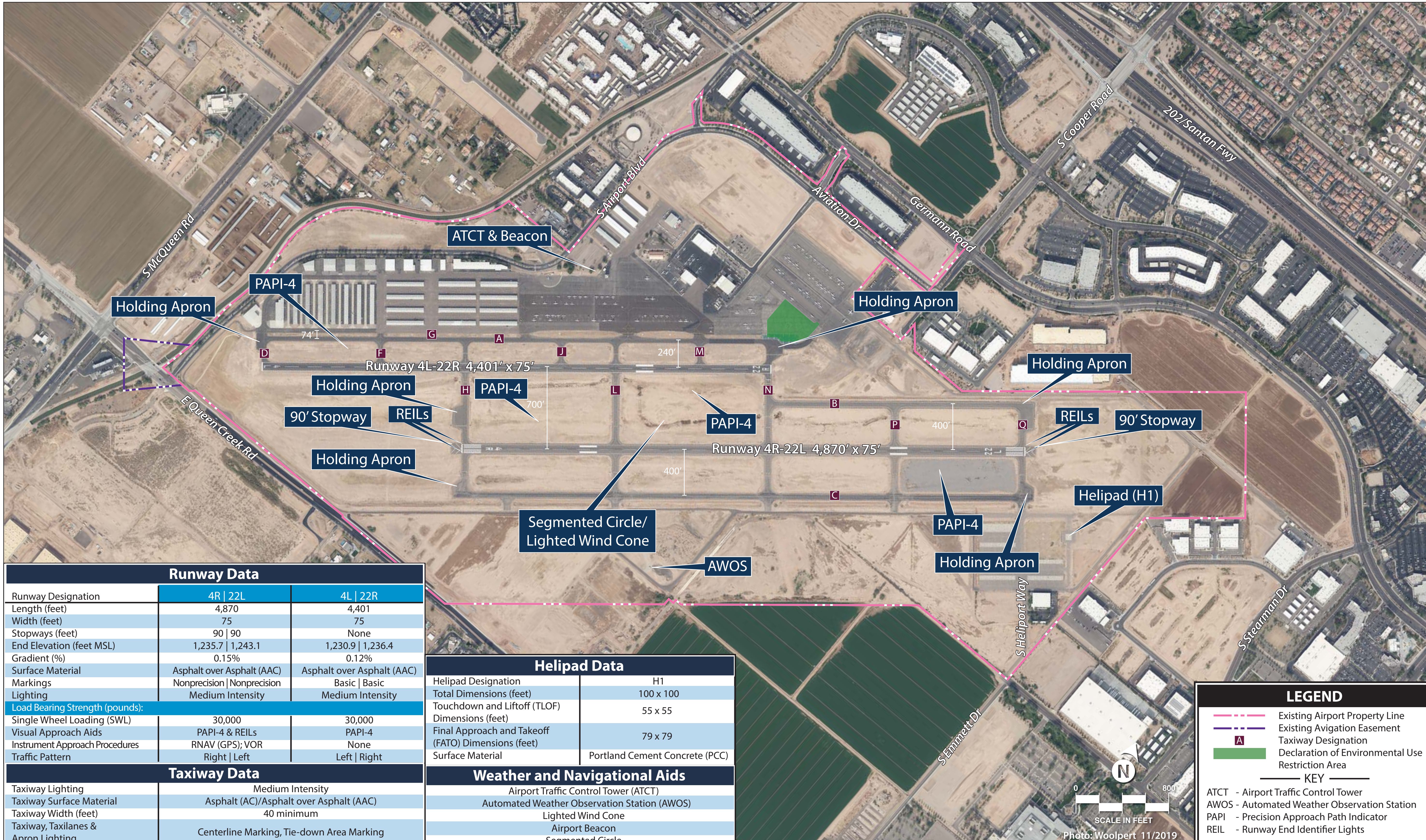
CHD has a helipad, designated H1, located on the south side of the airfield. The helipad is constructed of concrete with a touchdown and liftoff (TLOF) area measuring 55 feet by 55 feet and a final approach and takeoff (FATO) area measuring 79 feet by 79 feet. The helipad is lighted and equipped with a visual approach aid and a lighted wind cone.

HELIPAD AND LIGHTED WIND CONE

TAXIWAYS

The taxiway system at CHD consists of parallel and connector taxiways constructed of asphalt or asphalt overlaid asphalt (AAC) with widths of 40 feet or greater. All taxiways are lighted with blue medium intensity taxiway lighting (MITL) and have yellow centerline markings. Parallel taxiways at CHD include

6 Stopways are areas beyond the takeoff runway centered on the extended runway centerline and designated for use in decelerating an aircraft during an aborted takeoff.
7 VFR conditions are periods when there is at least 1,000-foot cloud ceilings and three miles visibility.
8 IFR conditions are periods when weather conditions are less than VFR.



Runway Data

Runway Designation	4R | 22L	4L | 22R
Length (feet)	4,870	4,401
Width (feet)	75	75
Stopways (feet)	90 | 90	None
End Elevation (feet MSL)	1,235.7 | 1,243.1	1,230.9 | 1,236.4
Gradient (%)	0.15%	0.12%
Surface Material	Asphalt over Asphalt (AAC)	Asphalt over Asphalt (AAC)
Markings	Nonprecision | Nonprecision	Basic | Basic
Lighting	Medium Intensity	Medium Intensity
Load Bearing Strength (pounds):		
Single Wheel Loading (SWL)	30,000	30,000
Visual Approach Aids	PAPI-4 & REILs	PAPI-4
Instrument Approach Procedures	RNAV (GPS); VOR	None
Traffic Pattern	Right | Left	Left | Right

Taxiway Data

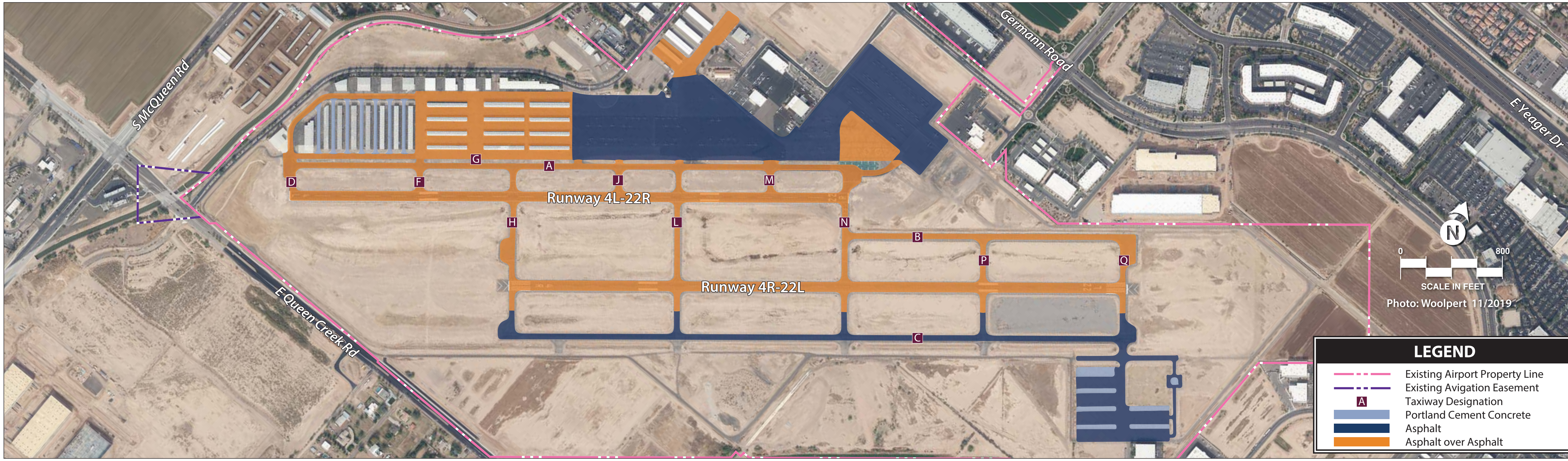
Taxiway Lighting	Medium Intensity
Taxiway Surface Material	Asphalt (AC)/Asphalt over Asphalt (AAC)
Taxiway Width (feet)	40 minimum
Taxiway, Taxilanes & Apron Lighting	Centerline Marking, Tie-down Area Marking

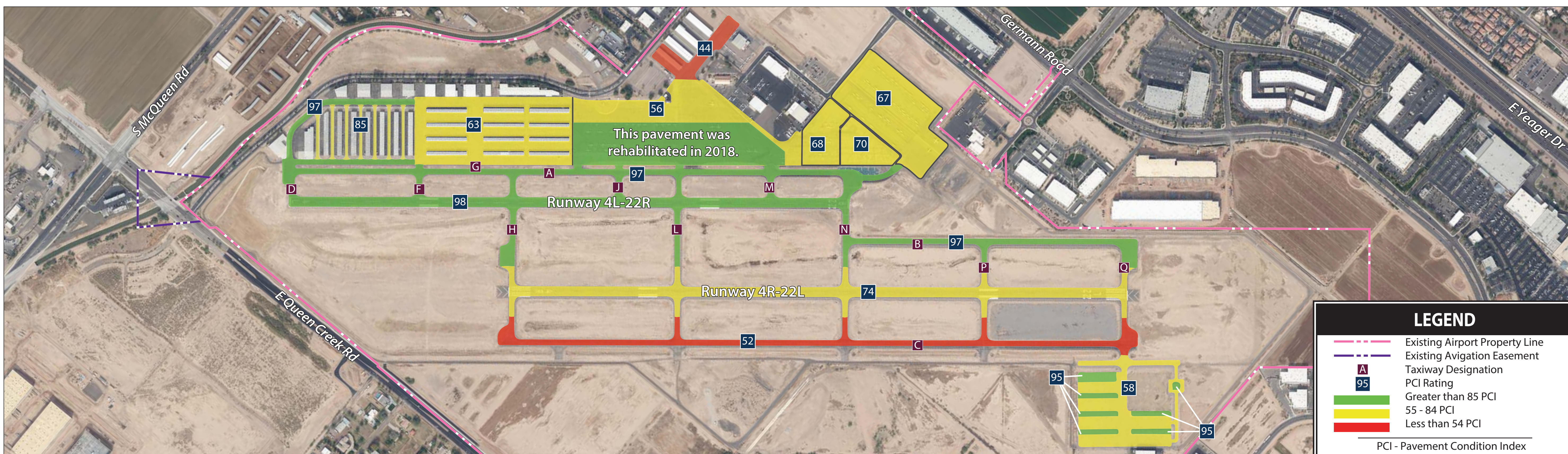
Helipad Data

Helipad Designation	H1
Total Dimensions (feet)	100 x 100
Touchdown and Liftoff (TLOF) Dimensions (feet)	55 x 55
Final Approach and Takeoff (FATO) Dimensions (feet)	79 x 79
Surface Material	Portland Cement Concrete (PCC)

Weather and Navigational Aids

Airport Traffic Control Tower (ATCT)
Automated Weather Observation Station (AWOS)
Lighted Wind Cone
Airport Beacon
Segmented Circle





Source: Arizona Airport Pavement Management System, 2017, Inspection Date: May 1, 2017

Taxiway A, Taxiway B, and Taxiway C. Taxiway A is a full-length parallel on the north side of Runway 4L-22R with a separation distance of 240 feet from the runway centerline. Taxiway B is a partial-parallel taxiway located between the parallel runways extending from the Runway 22L end to Taxiway N for a length of approximately 2,220 feet. Taxiway B has a separation distance of 400 feet from the Runway 4R-22L centerline. Taxiway C is a full-length parallel on the south side of Runway 4R-22L with a separation distance of 400 feet from the runway centerline. The taxiway system along with PCI ratings for each pavement section are identified on **Exhibit 1D**.

AIRFIELD LIGHTING

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

Airport Identification Lighting

The location of the airport at night is universally identified by a rotating beacon. The rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The beacon operates from sunset to sunrise and is located on top of the airport traffic control tower (ATCT) on the north side of the airfield.

Pavement Edge Lighting

Pavement edge lighting defines the lateral limits of the pavement to ensure safe operations during night and/or times of low visibility, which maintains safe and efficient access to and from the runway and aircraft parking areas. Both runways at CHD are equipped with medium intensity runway lighting (MIRL). The MIRL for the primary runway emit white light except in the caution zone,[9] which is the last 2,000 feet of runway where yellow light is emitted in the direction facing the Runway 4R threshold and white light in the opposite direction. The secondary runway is a visual-only runway, so it does not have a caution zone. Each end of both runways is equipped with threshold lights, which emit green light outward from the runway and emit red light toward the runway. Green lights indicate the landing threshold to arriving aircraft and red lights indicate the end of the runway for departing aircraft.


MITL FIXTURE

The entirety of the taxiway system at CHD is equipped with elevated blue medium intensity taxiway lights (MITL).

[9] Yellow lights in the caution zone indicate caution on rollout after landing.

Visual Approach Aid

Visual approach aids are installed at airports to assist pilots in determining the correct descent path to the runway end during landing. Each runway end at CHD is equipped with a four-box precision approach path indicator (PAPI-4) system. PAPIs have an effective visual range of three miles during the day and 20 miles at night. The Runway 4R, 22L, and 22R PAPIs have standard 3.00-degree glide paths and the Runway 4L PAPI has a 3.50-degree glide path, which is in place to clear a pole obstruction located 980 feet from the runway and 90 feet right of centerline.

Runways 4R and 22L are both equipped with runway end identifier lights (REILs). REILs help pilots identify the ends of the runway in areas having a large concentration of light.

PAPI-4

Pilot-Controlled Lighting

During nighttime hours when the ATCT is closed (9:00 p.m. to 6:00 a.m.), pilots can use the pilot-controlled lighting (PCL) system to activate the MIRL and visual approach aids available on both runways from their aircraft through a series of clicks of their radio transmitter using the common traffic advisory frequency (CTAF) (126.1 MHz).

Airfield Signage

Airfield identification signs assist pilots in identifying runways, taxiway routes, holding positions, and critical areas. The airfield at CHD is equipped with lighted location, directional, and mandatory instruction signs.

AIRFIELD SIGNAGE

NAVIGATIONAL AIDS

Navigational aids are electronic devices that transmit radio frequencies that pilots in properly equipped aircraft can translate into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying to/from CHD include the very-high frequency omnidirectional range (VOR), and global positioning system (GPS).

A VOR provides azimuth readings to pilots of properly equipped aircraft by transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility to provide distance as well as direction information to the pilot. Military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. The VORTAC provides distance and direction information to both civil and military pilots. The CHD and greater Phoenix area is served by three VORTACs (Willie – 8.3 miles east of CHD; Phoenix – 12.7 miles north of CHD; Stanfield – 23.5 miles south of CHD). The Willie VORTAC supports a non-precision instrument approach to Runway 4R at CHD.

The U.S. Department of Defense initially developed the global positioning system (GPS) for military navigation around the world. Now, GPS is used extensively for a wide variety of civilian uses, including civil aircraft navigation. GPS uses satellites placed in orbit around the globe to transmit electronic signals, which pilots of properly equipped aircraft use to determine altitude, speed, and navigational information. This provides more freedom in flight planning and allows for more direct routing to the destination. GPS provides for enroute navigation and a non-precision localizer navigation (LNAV) instrument approach to Runway 4R at CHD.

WEATHER AND COMMUNICATION

CHD is served by an automated weather observation station (AWOS). The system updates weather observations every minute, continuously reporting changes by calling (480) 814-9952. The AWOS reports cloud ceiling, visibility, temperature, dew point, wind direction, wind speed, altimeter setting (barometric pressure), and density altitude (airfield elevation corrected for temperature). The AWOS is located on the south side of the airfield approximately 780 feet from the Runway 4R-22L centerline.

CHD also has a lighted wind cone and segmented circle located at midfield between Taxiways L and N. The wind cone informs pilots of the wind direction and speed, while the segmented circle indicates aircraft traffic pattern information.

AREA AIRSPACE AND AIR TRAFFIC CONTROL

The *FAA Act of 1958* established the FAA as the responsible agency for the control and use of navigable airspace within the U.S. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground, in addition to establishing a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS covers the common network of U.S. airspace, including air navigation facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. The system also includes components shared jointly with the military.

AIRSPACE STRUCTURE

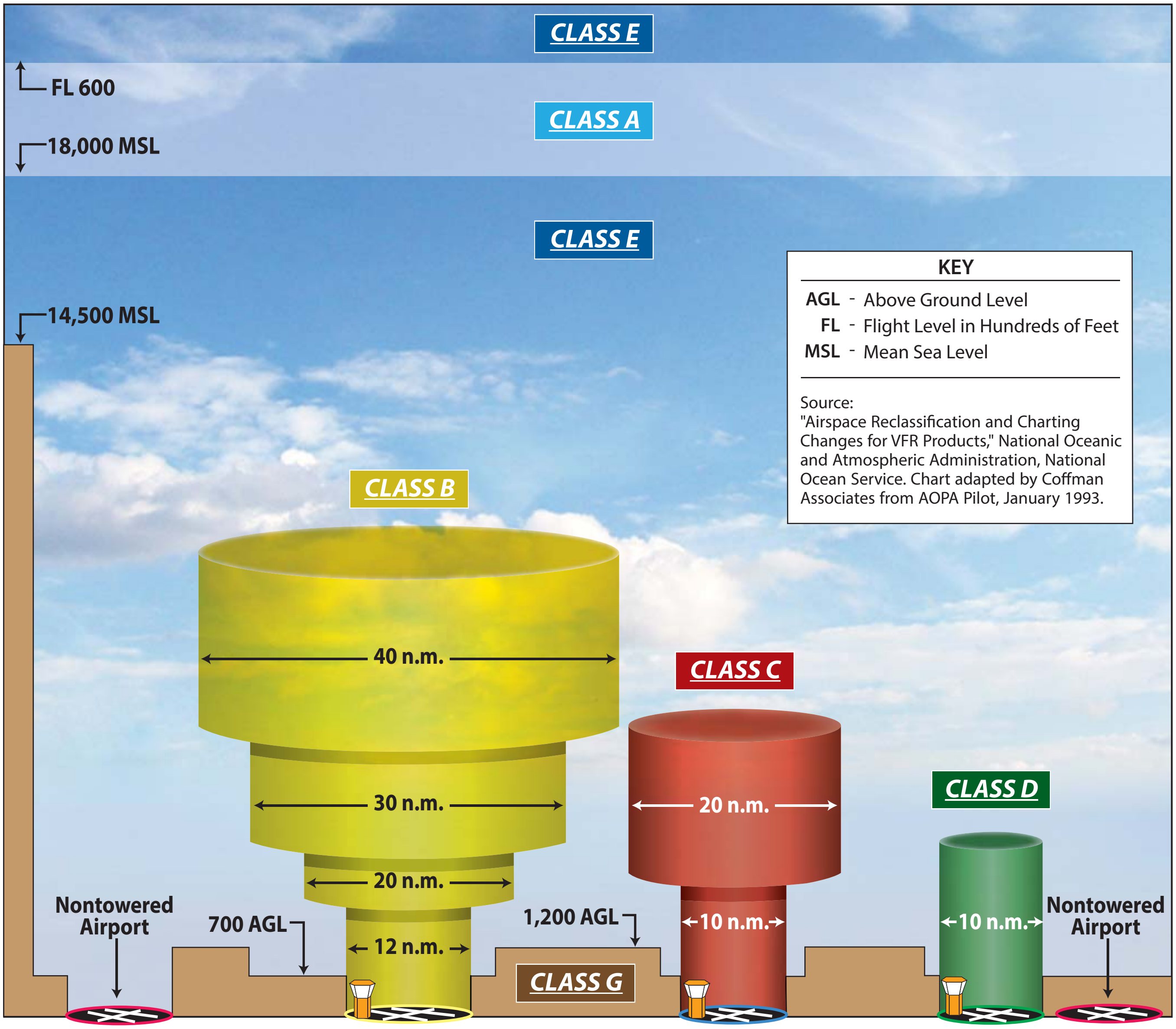
Airspace within the U.S. is broadly classified as either "controlled" or "uncontrolled." The difference between controlled and uncontrolled airspace relates primarily to requirements for pilot qualifications, ground-to-air communications, navigation and air traffic services, and weather conditions. Six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

Class A Airspace | Class A airspace includes all airspace from 18,000 feet MSL to flight level (FL) 600 (approximately 60,000 feet MSL) over the contiguous 48 states and Alaska. This airspace is designated in Federal Aviation Regulation (F.A.R.) Part 71.33 for positive control of aircraft. All aircraft must be on an IFR clearance to operate within Class A airspace.

Class B Airspace | Class B airspace has been designated around some of the country's major airports, such as Phoenix Sky Harbor International Airport (PHX) to separate all aircraft within a specified radius of the primary airport. Each Class B airspace is specifically tailored for its primary airport. All aircraft operating within Class B airspace must have air traffic control clearance. Certain minimum aircraft equipment and pilot certification requirements must also be met. This airspace is the most restrictive controlled airspace routinely encountered by pilots operating under VFR in an uncontrolled environment. CHD is located within PHX's Class B airspace at the convergence of three different sections. Each of the sections in the immediate vicinity of CHD have ceilings of 9,000 feet. Class B airspace floors immediately surrounding CHD are 4,000 feet to the north/east; 5,000 feet to the west; and 6,000 feet to the south.

Class C Airspace | The FAA has established Class C airspace at approximately 120 airports around the country that have significant levels of IFR traffic. 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 fly inside Class C airspace, an aircraft must have a two-way radio, an encoding transponder, and have established communication with the ATC facility. Aircraft may fly below the floor of the Class C airspace or above the Class C airspace ceiling without establishing communication with ATC. The nearest Class C airspace to CHD surrounds Tucson International Airport (TUS) and Davis Monthan Air Force Base (DMA).

Class D Airspace | Class D airspace is controlled airspace surrounding airports with an ATCT. The Class D airspace typically constitutes a cylinder with a horizontal radius of four or five nautical miles (NM) from the airport, extending from the surface up to a designated vertical limit, typically set at approximately 2,500 feet above the airport elevation. As shown on **Exhibit 1E**, CHD operates within Class D airspace beginning at the surface and extending to 3,000 feet MSL during the operational hours of the ATCT. Aircraft operators planning to operate within Class D airspace are required to contact the CHD air traffic control prior to entering or departing CHD airspace and must maintain in contact while within the controlled airspace to land at CHD or to transverse the area. When the ATCT is inactive, CHD airspace reverts to Class E airspace.



CONTROLLED AIRSPACE CLASSIFICATIONS

CLASS A Generally airspace above 18,000 feet MSL up to and including FL 600 (60,000 MSL). All operations conducted under instrument flight rules (IFR)

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

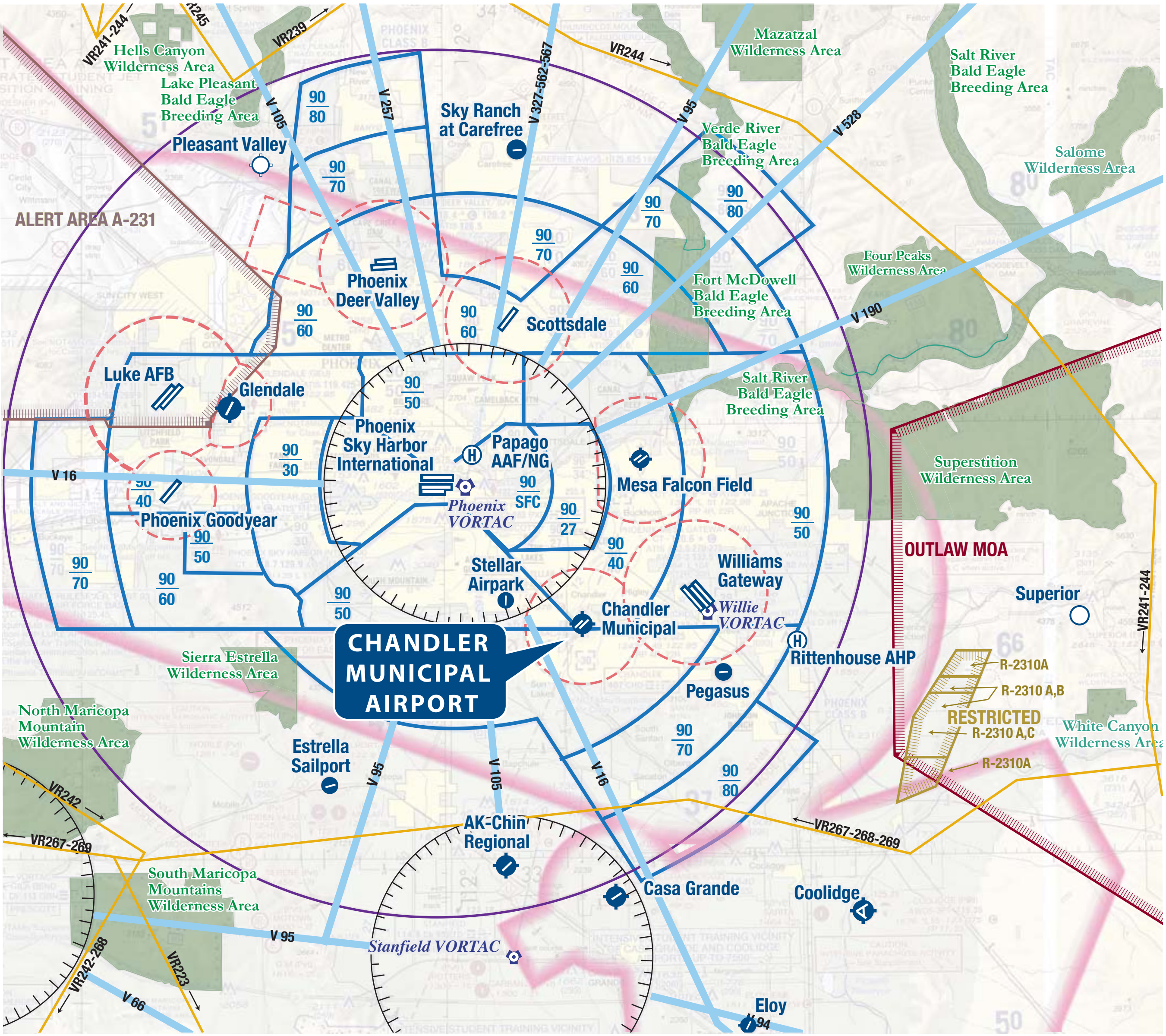
CLASS C Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.

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.

UNCONTROLLED AIRSPACE CLASSIFICATIONS

CLASS G Airspace that is not Class A, Class B, Class C, Class D, or Class E. Extends from the surface to the base of the overlying Class E airspace up to 14,500' MSL



LEGEND

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

NORTH

NOT TO SCALE

Source:
Phoenix Sectional Chart, US Department of Commerce,
National Oceanic and Atmospheric Administration, April 25, 2019

Class E Airspace | Class E airspace consists of controlled airspace designed to contain IFR operations near an airport and while aircraft are transitioning between the airport and enroute environments. Unless otherwise specified, Class E airspace terminates at the base of the overlying airspace. Only aircraft operating under IFR are required to be in contact with ATC when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio communications with ATC facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist.

Class G Airspace | Airspace not designated as Class A, B, C, D, or E is considered uncontrolled, or Class G, airspace. Air traffic control does not have the authority or responsibility to exercise control over air traffic within this airspace. Class G airspace lies between the surface and the overlaying Class E airspace (700 to 1,200 feet above ground level).

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, federal regulations specify minimum altitudes for flight. F.A.R. Part 91.119*, Minimum Safe Altitudes*, generally states that except when necessary for takeoff or landing, pilots must not operate an aircraft over any congested area of a city, town, or settlement, or over any open-air assembly of persons, at an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

Over less congested areas, pilots must maintain an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure. Helicopters may be operated at less than the minimums prescribed above if the operation is conducted without hazard to persons or property on the surface. In addition, each person operating a helicopter shall comply with any routes or altitudes specifically prescribed for helicopters by the FAA.

Victor Airways | For aircraft arriving or departing the regional area using VOR facilities, a 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 1,200 feet above ground level (AGL) to 18,000 feet MSL and extend between VOR navigational facilities. Victor Airways near CHD are identified on **Exhibit 1E**.

Alert Areas / Military Operations Area (MOA) & Military Training Routes (MTRs) / Restricted Areas | Alert areas, MOAs, MTRs, and restricted areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training, military operations/activities, or an unusual type of aerial activity. Pilots should exercise caution near and within these areas. All activity within these areas, if granted by the controlling agency, should be conducted in accordance with regulations, without waiver, and pilots of participating aircraft, as well as pilots transitioning the area, are equally responsible for collision avoidance. The Outlaw MOA, beginning approximately 21.4 nautical miles (NM) east of CHD. Restricted areas (R-2310A, B, and C) are located approximately 23.7 NM southeast of CHD. These restricted areas are used for live fire munitions training and unmanned aerial vehicle (UAV) training.

AIRSPACE CONTROL

Albuquerque Air Route Traffic Control Center (ARTCC) | The FAA has established 21 ARTCCs throughout the continental U.S. 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 Albuquerque Center ARTCC controls IFR airspace enroute to and from the Phoenix metropolitan area, including CHD, at altitudes greater than 10,000 feet above ground level (AGL).

Phoenix Terminal Radar Approach Control (TRACON) | The Phoenix TRACON is responsible for maintaining separation between aircraft operating under 10,000 feet AGL during their approach and departures from airports in the Phoenix metropolitan area. Once aircraft enter CHD airspace (typically within five miles of the airport and below 2,500 feet), the TRACON "hands-off" responsibility for the aircraft to the CHD ATCT. This process is reversed for aircraft departing CHD.


ATCT

Chandler Airport Traffic Control Tower (ATCT) | Approaching, departing, and taxiing aircraft at CHD are managed by the Chandler ATCT controllers. The CHD ATCT was commissioned on July 13, 1998, and is located on the north side of the airfield. The tower operates from 6:00 a.m. to 9:00 p.m. seven days per week. The CHD ATCT is part of the FAA's contract tower program, which utilizes non-federal controllers. Serco Management Services, Inc. is the current ATCT operator.

Flight service stations (FSS) | FSS's are air traffic facilities which provide pilot briefings, flight plan processing, inflight radio communications, search and rescue (SAR) services, and assistance to lost aircraft and aircraft in emergency situations. FSSs also relay air traffic control clearances, process Notice to Airmen (NOTAMs), and broadcast aviation meteorological and aeronautical information.

FLIGHT PROCEDURES

Flight procedures are a set of predetermined maneuvers established by the FAA, using electronic or visual navigational aids that assist pilots in locating and landing or departing from an airport.

Instrument Approach Procedures: Instrument approach procedures are a series of predetermined maneuvers established by the FAA, using electronic navigational aids that assist pilots in locating and landing at an airport, especially during instrument flight conditions. Precision instrument approaches, which provide vertical descent information and course guidance information to the pilot. Non-precision approaches only provide course guidance to the pilot; however, the relatively new GPS localizer performance with vertical guidance (LPV) approaches are currently categorized by the FAA as an approach with vertical guidance (APV), which is not considered a precision approach.

There are currently two published non-precision instrument approach procedures at CHD, both to Runway 4R. The visibility and cloud height minimums associated with the approach define the capability of an instrument approach procedure. Visibility minimums define the horizontal distance the pilot must be able to see to complete the approach. Cloud height defines the lowest level a cloud layer (defined in feet above the ground) can be situated for the pilot to complete the approach. If the observed visibility or cloud ceilings are below the minimums prescribed for the approach, the pilot cannot complete the instrument approach. **Table 1E** summarizes FAA-approved and published instrument approach procedures, including associated weather minimums for CHD.

TABLE 1E | Instrument Approach Procedures
Chandler Municipal Airport

	WEATHER MINIMUMS BY AIRCRAFT TYPE			
	Category A	Category B	Category C	Category D
RNAV (GPS) Runway 4R				
LNAV MDA	1680'/1-mile	1680'/1-mile	1680'/1.25-mile	NA
Circling	1720'/1-mile	1720'/1-mile	1720'/1.5-mile	NA
VOR Runway 4R				
S-4R	1680'/1-mile	1680'/1-mile	1680'/1.25-mile	NA
Circling	1720'/1-mile	1720'/1-mile	1720'/1.5-mile	NA

Aircraft categories are based on the approach speed of aircraft, which is determined as 1.3 times the stall speed in landing configuration as follows:
Category A: 0-90 knots (e.g., Cessna 172)
Category B: 91-120 knots (e.g., Beechcraft King Air)
Category C: 121-140 knots (e.g., Learjet)
Category D: 141-166 knots (e.g., Gulfstream G450)

Abbreviations:
GPS - Global Positioning System
LNAV/RNAV - A technical variant of GPS (Lateral, Area Navigation)
MDA - Minimum Decision Altitude
VOR – Very High Frequency Omnidirectional Range

Note: (xxx'/ x-mile) = Cloud ceiling height/Visibility minimum

Source: U.S. Terminal Procedures (Effective January 2020)

Local Operating Procedures: The traffic pattern at the airport is maintained to provide the safest and most efficient use of the airspace. At CHD, Runways 4L and 22L use left-hand traffic patterns, which means aircraft conduct left-hand turns within the traffic pattern when operating on either of the two runways. Runways 4R and 22R use right-hand traffic patterns. As a result, aircraft operating within Runway 4L-22R's pattern remain north of the airport and aircraft operating within Runway 4R-22L's pattern stay south of the airport. The typical traffic pattern altitude for rotorcraft is 500 feet AGL; piston aircraft is between 800 and 1,000 feet AGL; and 1,500 feet AGL for turbine aircraft. CHD traffic patterns and generalized flight tracks are depicted in **Figure 1B**.

Prevailing wind conditions dictate runway usage (i.e. easterly winds generally favor the use of Runways 4R/4L; westerly winds generally favor Runway 22L/22R). During calm wind conditions, Runways 4R/4L are the preferred runways.

CHD does not have aircraft restrictions, curfews, or a mandatory noise abatement program, as these programs would violate the Federal *Airport Noise and Capacity Act* (ANCA) *of 1990*. Federal law requires the airport to remain open 24 hours a day, 7 days a week, and to accept all civilian and military aircraft that can be safely accommodated.

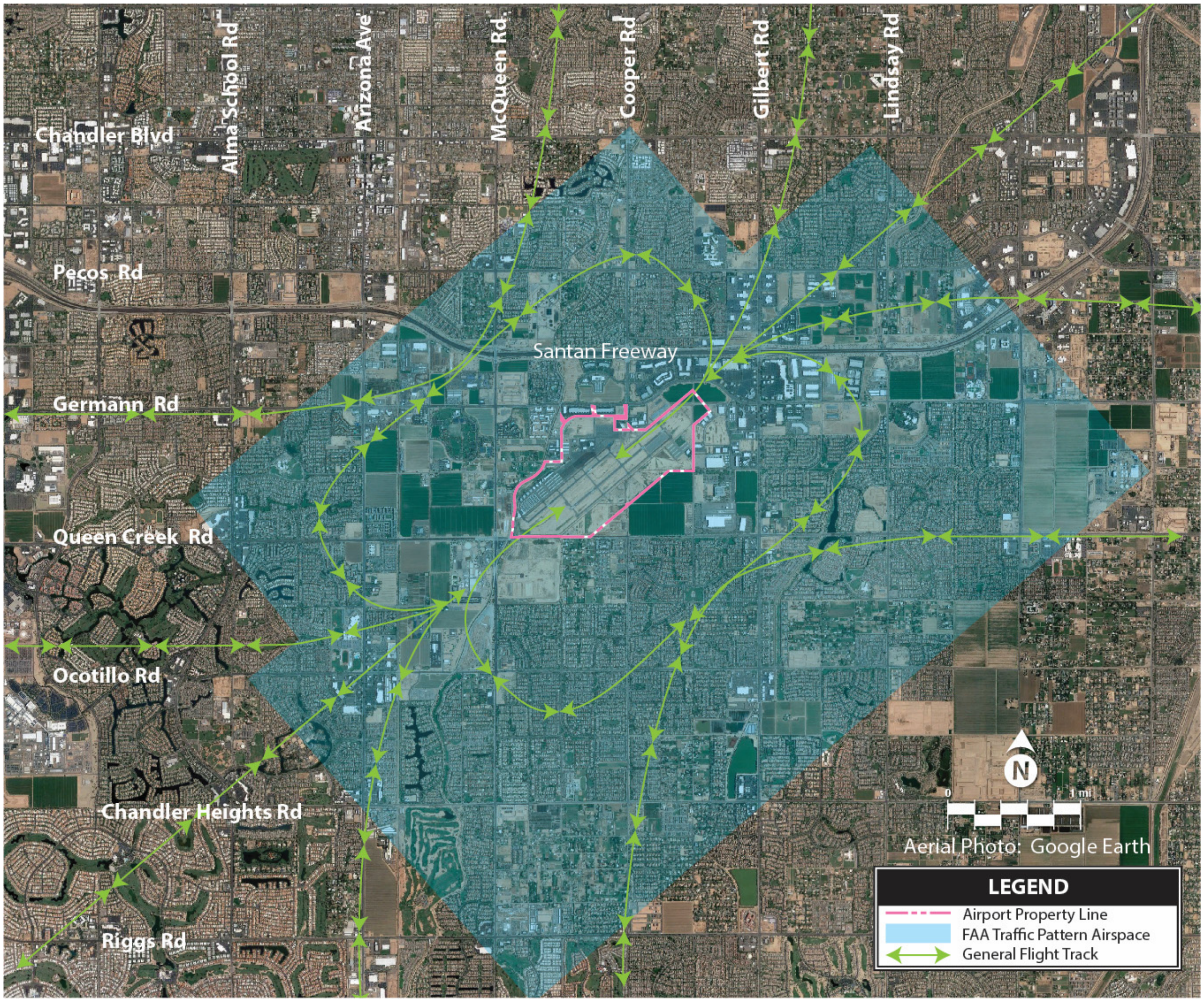


FIGURE 1B – CHD TRAFFIC PATTERN AND GENERALIZED FLIGHT TRACKS

REGIONAL AIRPORTS

A review of other public-use airports with at least one paved runway within a 30-nm radius of CHD was conducted to identify and distinguish the types of air service provided in the region. It is important to consider the capabilities and limitations of these airports when planning for future changes or improvements at CHD. **Table 1F** provides basic level information on 12 public-use airports within the vicinity of CHD. All regional airports, including CHD, combine for over 2.2 million annual operations and over 3,200 based aircraft. A more detailed discussion of regional airports and their impact on CHD's service area is provided in Chapter Two of this report.

TABLE 1F | Airports Within 30 NM from CHD

Airport	Nautical Miles/ Direction from CHD[1]	FAA Service Level[2]	Based Aircraft[1]	Annual Operations[1]	Longest Runway (ft.)[1]	Lowest Visibility Minimum[1]
Chandler Municipal	**--**	**Reliever**	**441**	**220,662**	**4,870’**	**1-mile**
Stellar Airpark	5.5nm/WNW	N/A	176	40,150	4,416’	1-mile
Phoenix-Mesa Gateway	8.1nm/ENE	Primary	126	288,715	10,401’	¾-mile
Falcon Field	12.2nm/NNE	Reliever	644	300,030	5,100	1-mile
Phoenix Sky Harbor	14.1nm/NW	Primary	70	434,715	11,489’	½-mile
Ak-Chin Regional	17.6nm/SSW	GA	13	31,755	4,751’	None
Casa Grande Municipal	19.0nm/S	GA	82	119,720	5,200’	½-mile
Scottsdale	21.8nm/NNW	Reliever	353	183,595	8,249’	1-mile
Coolidge Municipal	27.8nm/SE	GA	38	4,212	5,564’	1-mile
Phoenix Deer Valley	28.6nm/NNW	Reliever	973	378,505	8,196’	1-mile
Glendale Municipal	28.8nm/WNW	Reliever	113	74,825	7,150’	1-mile
Phoenix Goodyear	29.8nm/WNW	Reliever	217	127,750	8,500’	1-mile
Eloy Municipal	30.0nm/SSE	GA	20	29,930	3,901’	None

Sources: [1]www.airnav.com / basedaircraft.com / CHD ATCT operations counts for 2019; [2]NPIAS;

LANDSIDE FACILITIES

TERMINAL BUILDING

Constructed in 1996, the general aviation terminal building at CHD has a total area of approximately 5,500 sf. The terminal is located on the north side of the airfield where it provides space for administration offices, pilot and passenger areas, restrooms, pilot’s lounge, flight planning area, lobby, and conference room.

TERMINAL BUILDING

AIRPORT BUSINESSES

Businesses on the airport are concentrated primarily in the area immediately east/northeast of the terminal building. The following is a description of the various business operations based at CHD:

CHANDLER AIR SERVICE

- **Chandler Air Service, Inc.** | A full-service FBO that provides a variety of services including fueling, FAR Part 141 flight training, aircraft rental, pilot supplies, and aircraft maintenance/parts sales.
- **Chandler Aviation** | A specialty aviation service operator (SASO) that provides a complete line of maintenance-related services, annual inspections, sheet metal repairs, fabric repairs and engine overhauls.
- **Chandler Avionics** | A SASO providing avionics installation and certification.
- **The Hangar Café** | A restaurant located within the Chandler Air Service FBO facility.
- **Quantum Helicopters** | A SASO providing helicopter flight training and charter service. Located on the south side of the airfield. Quantum has provided FAR Part 61 and 141 flight training at CHD since 1993.
- **Southwest Aircraft Charter** | Aircraft charter operations and management. Aircraft fleet includes four Beechcraft Barons, two Beechcraft King Air 200s, and two Learjet 45s.


QUANTUM HELICOPTERS

CHANDLER AVIATION

THE HANGAR CAFÉ

AIRCRAFT HANGAR FACILITIES

Existing hangar facilities at CHD consist of large conventional-style hangars utilized by the various FBO/SASOs on the airport, T-hangars and shade hangars used by small aircraft, and executive-style and box hangars, which are mid-sized hangars. Hangar facilities are described in **Table 1G** and identified on **Exhibit 1F**. In total, CHD has 438,517 sf of hangar storage capacity.

Exhibit 1F
EXISTING LANDSIDE FACILITIES

TABLE 1G | Hangar Building Inventory
Chandler Municipal Airport

Building	Type	Ownership	Hangar Sq.Ft.	Notes
Chandler Air Service	Conventional Hangar	Private	11,000	Additional 2,000 sf of office; includes The Hangar Café and Chandler Avionics
Chandler Air Service	Conventional Hangar	Private	14,000	Additional 7,488 sf of office space; includes Southwest Air Charter
Chandler Aviation	Conventional Hangar	Private	6,500	Additional 3,400 sf of office space
Quantum Helicopters	Conventional Hangar	Private	14,400	Additional 7,000 sf of office space
Buildings M, N, and O	T-Hangars (32 Units)	Private	32,182	Hangars Unlimited – Phase I
Buildings P, Q, and R	T-Hangars (32 Units)	Private	40,188	Hangars Unlimited - Phase II
Buildings S and T	T-Hangars (17 Units)	Private	25,549	Hangars Unlimited - Phase III
Buildings U, V, W, and X	Executive Hangars (14 Units)	Private	33,991	Hangars Unlimited - Phase I (Executive)
Buildings Y, Z, AA, and AB	Executive Hangars (14 Units)	Private	27,300	Hangars Unlimited - Phase II/III (Executive)
Building AC	Executive Hangars (8 Units)	Private	26,307	-
Building AD	Executive Hangars (2 Units)	Private	11,150	-
Building AE	T-Hangar (11 Units)	Private	12,600	-
Building AF	Box Hangar (4 Units)	Private	12,000	-
Building AG	Box Hangar (4 Units)	Private	12,000	-
Buildings A, B, C, D, E, F, G, H, I, J, K, and L	T-Hangars (110 Units)	City	144,800	-
T-Shade	Shade Structure	City	9,750	-
Vacant Hangar	Conventional Hangar	City	4,800	Additional 4,300 sf of office space
		Total Hangar Space	**438,517**	

Sources: CHD records; some hangar measurements derived from Google Earth.

AIRCRAFT PARKING APRONS

There are four aircraft parking aprons at CHD – the terminal apron, FBO apron, north apron, and Heliport apron. All four serve unique purposes for the airport. Each apron is described below and identified on **Figure 1C**.

1. The **terminal apron** provides parking adjacent to the terminal building on the north side of the airfield and serving transient and locally based aircraft. The terminal apron is constructed of asphalt and has an area of approximately 95,228 square yards (sy). There are 88 marked parking positions on this apron and the airport's self-service fuel facilities are on this apron.
2. The **FBO apron** serves Chandler Air Service and Chandler Aviation and the various operators within their facilities on the north side of the airfield. The FBO apron is approximately 22,700 sy of asphalt with 39 marked parking positions.
3. The **north apron** is on the north side of the airfield and serves locally based aircraft. It is 82,833 sy of asphalt with 141 marked parking positions including two for helicopters.
4. The **Heliport apron** is located on the south side of the airfield and serves helicopter activities. It is 35,093 sy. The helicopter parking lanes are constructed of Portland Cement Concrete (PCC) while the taxiways/taxilanes are constructed of asphalt. There is a total of 34 helicopter parking positions with direct access to a heliport.

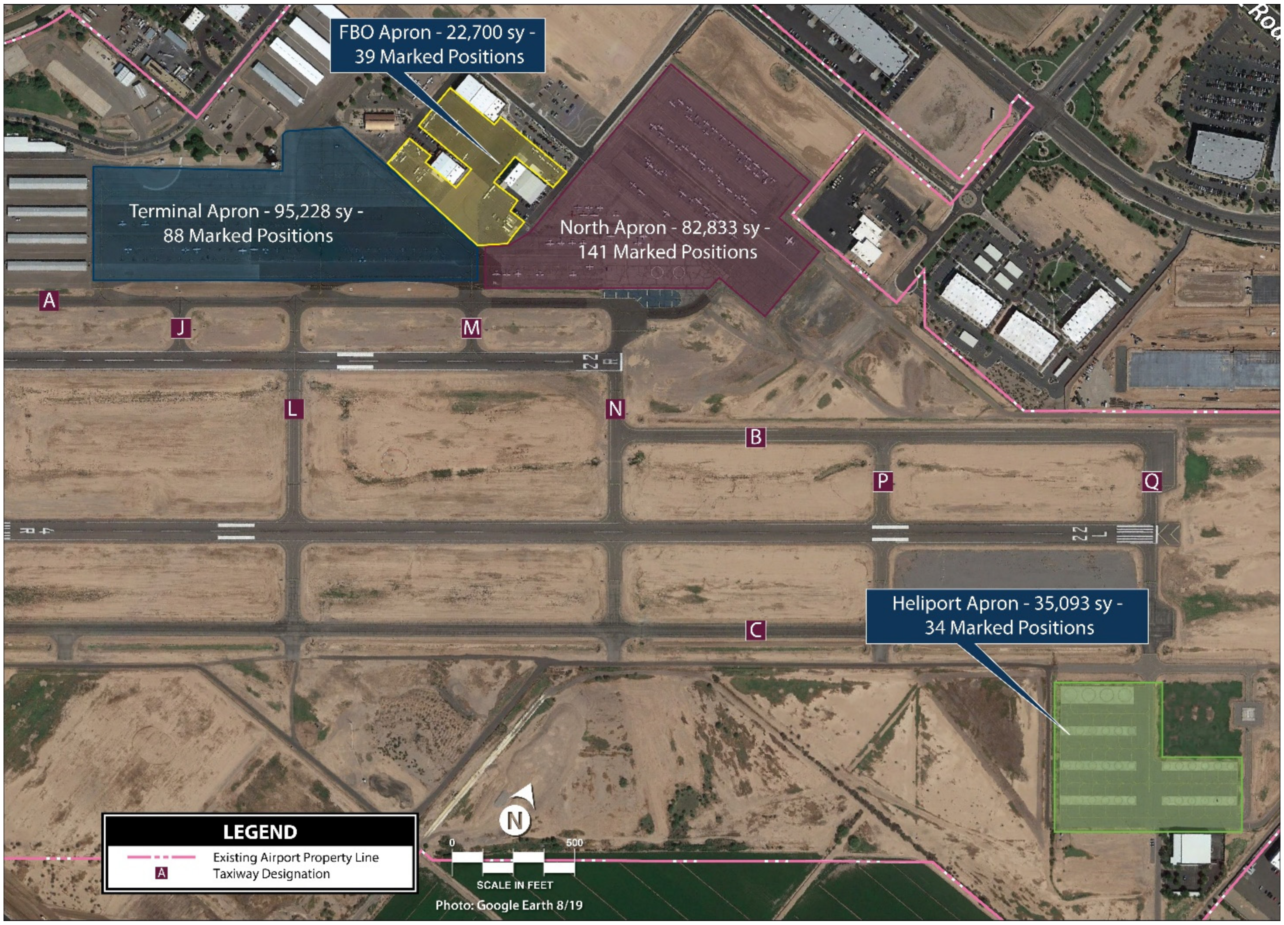


Figure 1C – Aircraft Parking Aprons at CHD

VEHICLE PARKING

Vehicle parking lots are available at the terminal building, adjacent to the tower, and at the various FBO/SASO facilities at CHD. Each parking lot is identified on **Figure 1D**. In total there are 94 marked vehicle parking spaces at CHD, which does not include the tower lot, which is unmarked. Tenants of the executive/T-hangar facilities on the airport are authorized to pass through secured gates with their vehicles so most of these facilities do not have separate vehicle parking areas.

Figure 1D – Vehicle Parking Lots at CHD

SUPPORT FACILITIES

FIREFIGHTING SERVICES

As a general aviation airport, CHD is not required to maintain on-site aircraft rescue and firefighting (ARFF) equipment or services. The nearest fire station is the Gilbert Fire Station 8 located at 1095 E. Germann Road. The nearest City of Chandler fire station is Station 1 located at 1491 E. Pecos Road. The terminal building at CHD is equipped with six fire extinguishers and a fire suppression system. CHD also has a mutual aid agreement with the Town of Gilbert.

FUEL STORAGE

Aviation fueling services at CHD are provided by Chandler Air Service and the City of Chandler. Fuel storage facilities consist of the following:

CITY-OWNED SELF-SERVICE FUEL STATION

- **Chandler Air Service |** Chandler Air Services' fuel farm is located on their leasehold and consists of a 12,000-gallon tank for Jet A and a 10,000-gallon tank for 100LL, both of which are self-service equipped. Chandler Air Service also has four mobile fueling trucks including two Jet A trucks with storage capacities of 3,000 gallons and 1,000 gallons and two 100LL trucks with storage capacities of 1,000 gallons each.

- **City of Chandler |** The City of Chandler's fuel farm is located on the terminal apron and consists of one 100LL 12,000-gallon underground storage tank. The tank is equipped for self-service.

CHANDLER AIR SERVICE FUEL FARM AND TRUCK

Historic fuel flowage data is summarized in **Figure 1E**. 100LL flowage has dropped slightly from 420,113 gallons in 2015 to 407,747 in 2019. Jet A flowage has grown considerably in the past three years going from 190,725 gallons in 2015 to 304,967 gallons in 2019.

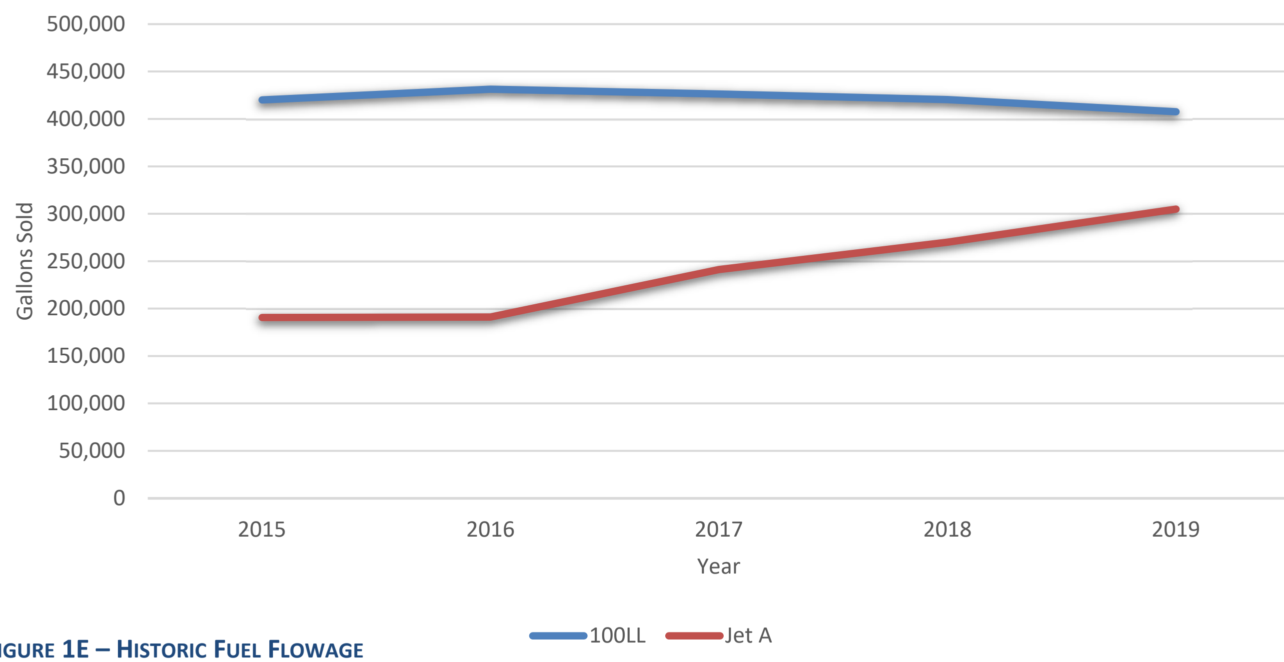


FIGURE 1E – HISTORIC FUEL FLOWAGE

AIRPORT MAINTENANCE FACILITIES

The City of Chandler utilizes the old heliport facilities west of S. Airport Boulevard for the storage of maintenance equipment. Facilities include an old hangar (3,600 sf) and a modular building (2,120 sf).

PERIMETER FENCING AND SERVICE ROAD

Airport administrative staff and emergency service vehicles can access the airfield via a perimeter service road that extends around the entirety of the airfield. The 15-foot-wide perimeter road that is a partially paved and gravel road. The paved portion extends from the heliport to the north apron.

The airfield perimeter is also equipped with security fencing to restrict entry to authorized persons and vehicles. The perimeter fencing is equipped with motorized and manual gates allowing access to all areas of the airfield and landside areas to authorized personnel only.


PERIMETER SERVICE ROAD AND SECURITY FENCING

UTILITIES

Utility services at available at CHD include water, sanitary sewer, electric, and telecommunications. The City of Chandler is the airport's water provider. The City also provides sanitary sewer services to the terminal building, Quantum's facility, and several hangars. All other facilities are on septic systems. Electricity is provided by the Salt River Project (SRP). All power lines on the airport have been buried except at the shade hangar and north of airport property.

Existing water and sanitary sewer lines on and around the airport are depicted on **Exhibit 1G**. Mapping of as-built power lines were not available.

AVIATION ACTIVITY

At general aviation airports, the number of based aircraft and operations (takeoffs and landings) in aggregate and type are key aeronautical activity measures. These indicators are used in subsequent analyses in this master plan to project future aeronautical activity and determine future facility needs. Each of the activity segments is briefly described below.

AIRCRAFT OPERATIONS

Aircraft operational statistics at CHD are recorded by the ATCT, which operates from 6:00 a.m. to 9:00 p.m. daily. Aircraft operations are classified as either local or itinerant. Local operations consist mostly of aircraft training operations conducted within the airport traffic pattern, and touch-and-go and stop-

Exhibit 1G
SANITARY SEWER AND WATER UTILITIES

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and-go operations. Itinerant operations are arriving or departing aircraft which have an origin or destination at another airport. Aircraft operations are further segregated into four general categories: air carrier, air taxi, military, and general aviation.

- **Air Carrier** | Operations performed by aircraft with greater than 60 seats and/or a maximum payload capacity of 18,000 pounds.
- **Air Taxi** | Operations associated with commuter aircraft, but also include for-hire general aviation aircraft.
- **Military** | Operations conducted by airplanes and helicopters with a military identification.
- **General Aviation** | Includes all other aviation activity from small ultralights to large business jets.

Table 1H presents the annual aircraft operations data at CHD since 1996 broken out by type of operation (local or itinerant), as well as the category of operations (air carrier, air taxi, military, or general aviation). The operational data shows CHD reached its peak operations in 2006. From 2007 through 2011, operations declined 39.1 percent likely due to the effects of the national economic recession during that period. Activity at CHD has picked up since 2011 reaching over 220,000 in 2018 and 2019.

TABLE 1H | Historic Operations
Chandler Municipal Airport

Calendar Year	Itinerant Operations					Local Operations			Total Operations
	Air Carrier	Air Taxi	General Aviation	Military	Total Itinerant	General Aviation	Military	Total Local	
1996	0	1,043	59,847	91	60,981	95,204	27	95,231	156,212
1997	0	1,594	66,863	39	68,496	115,624	19	115,643	184,139
1998	0	904	67,429	46	68,379	128,108	24	128,132	196,511
1999	0	1,434	71,467	49	72,950	148,020	48	148,068	221,018
2000	0	1,771	75,713	25	77,509	172,281	21	172,302	249,811
2001	0	2,237	64,675	20	66,932	165,472	45	165,517	232,449
2002	0	1,828	67,302	12	69,142	161,377	19	161,396	230,538
2003	0	1,939	64,780	10	66,729	152,929	13	152,942	219,671
2004	0	2,530	61,626	41	64,197	168,850	32	168,882	233,079
2005	0	2,740	62,826	40	65,606	169,489	16	169,505	235,111
2006	13	3,625	82,292	285	86,215	182,806	51	182,857	269,072
2007	0	4,162	85,217	655	90,034	175,147	31	175,178	265,212
2008	0	2,882	75,280	238	78,400	158,433	9	158,442	236,842
2009	0	2,131	65,580	50	67,761	136,524	85	136,609	204,370
2010	13	2,041	57,122	47	59,223	106,197	377	106,574	165,797
2011	6	2,168	60,891	68	63,133	98,068	388	98,456	161,589
2012	0	2,490	72,816	75	75,381	121,951	95	122,046	197,427
2013	20	2,430	77,234	318	80,002	131,231	423	131,654	211,656
2014	0	1,852	76,702	51	78,605	138,887	57	138,944	217,549
2015	0	1,707	80,604	40	82,351	137,425	77	137,502	219,853
2016	0	1,749	77,860	72	79,681	141,586	206	141,792	221,473
2017	17	3,215	71,440	97	74,769	119,204	251	119,455	194,224
2018	0	3,148	73,107	106	76,361	151,972	256	152,228	228,589
2019	0	2,990	67,647	199	70,836	149,754	72	149,826	220,662

Source: FAA Operations and Performance Data (OPSNET), https://aspm.faa.gov/

BASED AIRCRAFT

Identifying the current number of based aircraft is an important part of the master plan process; however, it can be challenging to be accurate given the transient nature of aircraft storage. CHD maintains a recent record of based aircraft, but data from the FAA's *Terminal Area Forecast* (TAF) and from the previous master plan (airport records) was also consulted to provide a broader history. Historic based aircraft levels at CHD are shown on **Table 1J**. Like operations, based aircraft at CHD peaked in 2005 prior to the national economic recession, which began in 2007. Since that time, based aircraft levels dropped reaching 378 in 2009. However, the current count at CHD has rebounded to 441 FAA-validated based aircraft.

TABLE 1J | Based Aircraft History
Chandler Municipal Airport

Year	Based Aircraft	Source
1990	270	FAA TAF
2000	392	Airport Records
2005	457	Airport Records
2009	378	FAA TAF
2016	440	SASP
2019	441	FAA-Validated Based Aircraft Registry

COMMUNITY PROFILE

For an airport planning study, a profile of the local community including its socioeconomic characteristics are collected and examined to derive an understanding of the dynamics of growth within the study area. Socioeconomic information related to the local area is an important consideration in the master planning process.

The community profile for the City of Chandler on **Exhibit 1H** was compiled by the Maricopa Association of Governments (MAG) and summarizes historic and projected data for population, demographics, education and income, employment, housing, and transportation. From a population perspective, MAG projects the City of Chandler's population to grow from 257,165 in 2018 to 321,100 in 2040, an increase of 25 percent or 63,935 people. Jobs in Chandler are focused on the technology and financial services industries and the median household income for residents of Chandler is 33 percent higher than that of the Phoenix metropolitan statistical area (MSA).

ENVIRONMENTAL INVENTORY

The environmental inventory addresses existing conditions at CHD and its environs. This inventory is intended to help identify relevant environmental issues that should be considered during the preparation of the Airport Master Plan. The inventory is organized using the resource categories contained in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures* (2015). Available information regarding the environmental conditions at the airport and within the surrounding area has been derived from internet resources, agency maps, and existing literature. A comprehensive list of the resources is included in this section.

2018 Population

257,165 Total
Chandler

4,857,962 Total
Phoenix MSA*

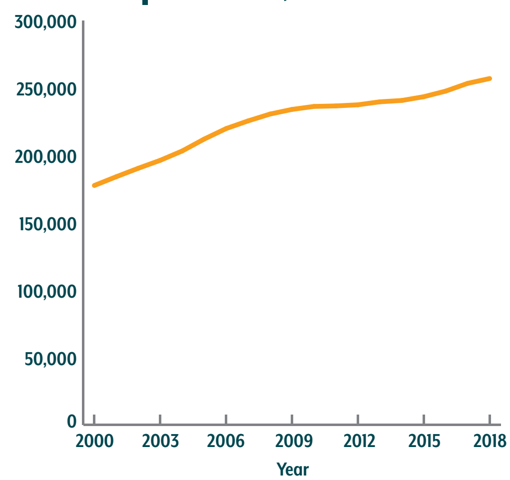
87,290
Households

60,180
Families

1.1%
Average Annual Growth Rate of the Chandler Population 2010-2018

*The Phoenix-Mesa-Scottsdale Metropolitan Statistical Area includes all of Maricopa and Pinal counties.

Population, 2000-2018



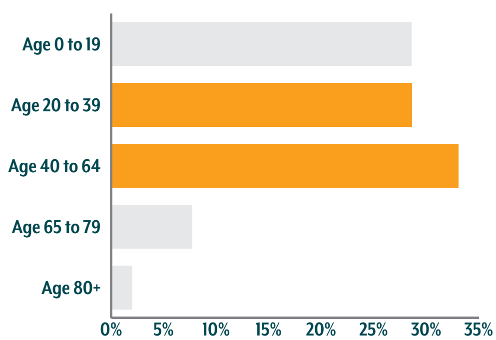
Source: U.S. Census Bureau Intercensal/Postcensal Population Estimates

Median Age

Chandler	Phoenix MSA	United States
35.3	36.2	37.8

Age Groups

62% of the Population is Working Age



Race and Ethnicity*

	Chandler	Phoenix MSA	U.S.
White	59%	56%	62%
Hispanic	22%	31%	18%
Black	5%	4%	12%
Native American	1%	4%	1%
Asian	10%	3%	5%
Multiple/Other	3%	3%	3%

Race categories are for the non-Hispanic population (i.e. white non-Hispanic, Black non-Hispanic, etc). Hispanic can be of any race.

Diversity

Measured by the percent of minorities* in the area.

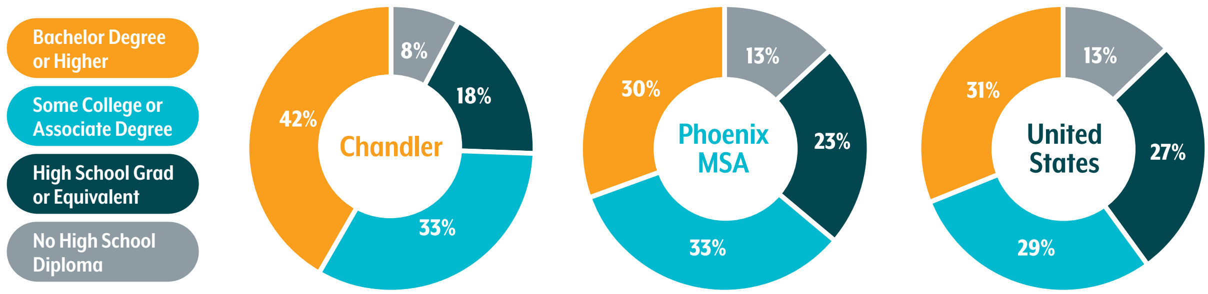
Chandler	41%
Phoenix MSA	44%
United States	39%

Minority is the population who identify as any race or ethnicity other than non-Hispanic white.

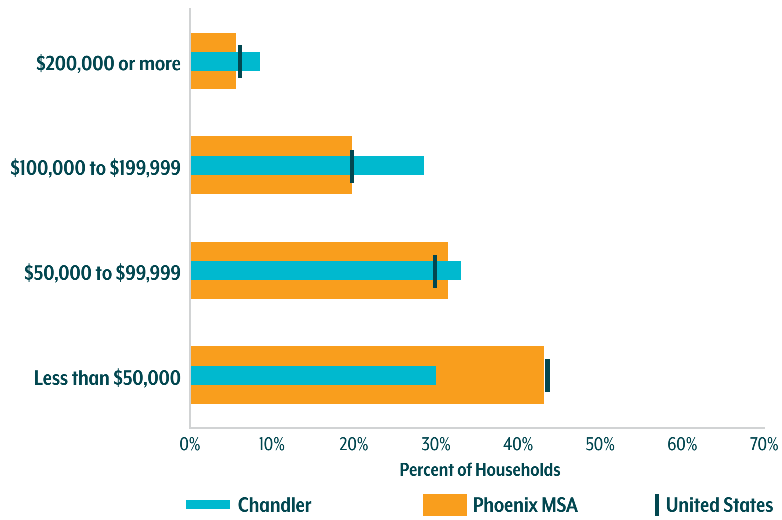
Unless otherwise noted, the source for these data is the U.S. Census Bureau, 2013-2017 American Community Survey (ACS) 5-year Estimates *rev. 9/18/2019*

Source: Maricopa Association of Governments, Community Profile, revised 9/18/2019.

Highest Level of Education
for the population age 25 years and older



Household Income



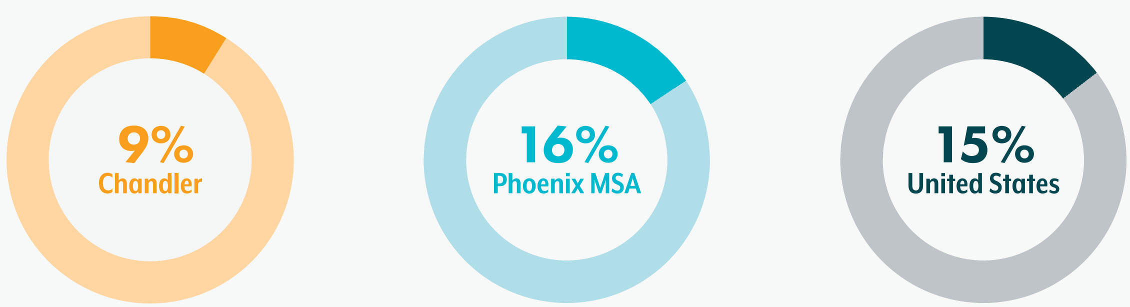
Median Household Income

$77,278 Chandler

$57,935 Phoenix MSA

$57,652 United States

Poverty Rate



Poverty status is determined for all persons except institutionalized people, military personnel in group quarters, people in college dormitories, and unrelated individuals under 15 years old. Poverty levels are determined based on the official Federal Poverty Level thresholds.

Unless otherwise noted, the source for these data is the U.S. Census Bureau, 2013-2017 American Community Survey (ACS) 5-year Estimates *rev. 9/18/2019*

Source: Maricopa Association of Governments, Community Profile, revised 9/18/2019.

Employers in Chandler

2,796 Employers

116,980 Jobs

**Totals reported for employers with 5 or more employees only*

Top 5 Industry Clusters
by Employment

Industry Cluster	Businesses	Jobs
High Tech Manufacturing & Development	106	19,810
Finance, Insurance, & Real Estate	202	16,400
Retail	336	13,310
Consumer Services	550	12,590
Business Services	352	11,490

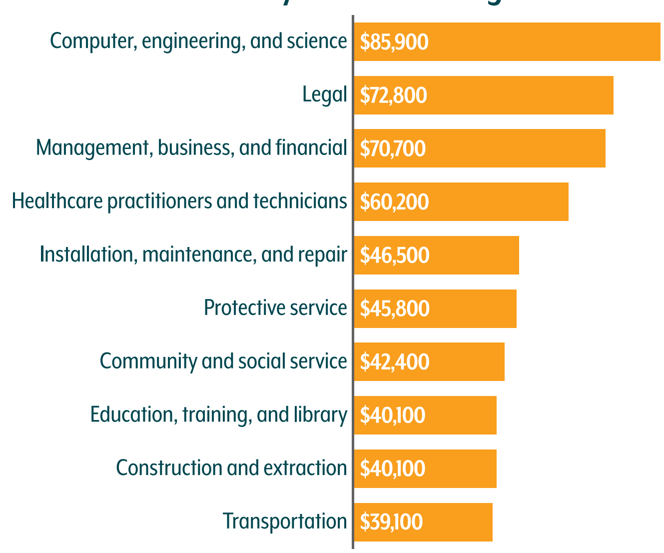
Note: Jobs rounded to nearest ten.
Source: 2018 MAG Employer Database

Top 10 Private Employers

Employer Name	Jobs
Intel Corporation	10,230
Wells Fargo	5,280
Bank of America	3,670
Dignity Health	2,530
Avnet Inc	2,240
Verizon Wireless	1,820
Nxp USA Inc	1,790
Northrop Grumman	1,650
Paypal Inc	1,540
Microchip Technology Inc	1,400

Note: Excludes Government and Education; jobs rounded to nearest 10.
Source: 2018 MAG Employer Database

Top Occupation Categories of Residents
by Median Earnings

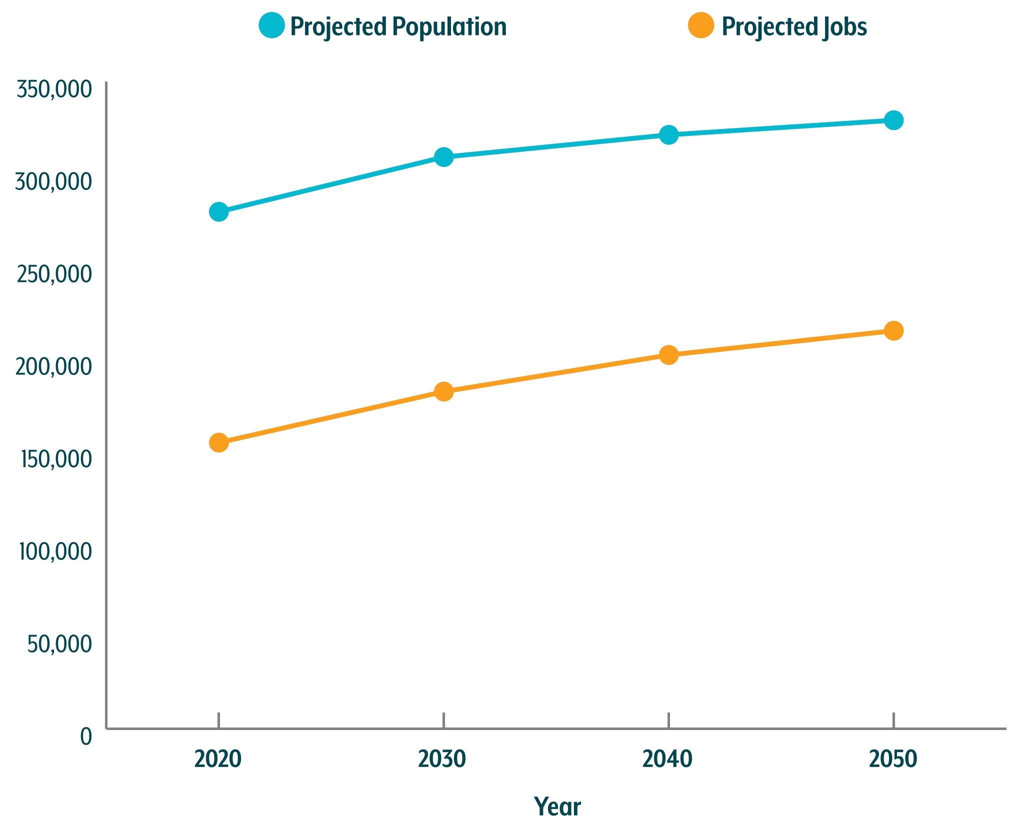


Note: Median earnings rounded to nearest hundred.

Unless otherwise noted, the source for these data is the U.S. Census Bureau, 2013-2017 American Community Survey (ACS) 5-year Estimates *rev. 9/18/2019*

Source: Maricopa Association of Governments, Community Profile, revised 9/18/2019.

Socioeconomic Projections*



Year	Population	Jobs
2020	279,500	154,700
2030	309,100	182,300
2040	321,100	202,100
2050	329,000	215,200
2055	332,400	222,000

Source: MAG Socioeconomic Projections 2019

***The data shown here are for the municipal planning area** (MPA), which delineates the area of planning concern for each jurisdiction. MAG produces population and employment projections by MPA, incorporated jurisdiction, and regional analysis zone (RAZ).

Unless otherwise noted, the source for these data is the U.S. Census Bureau, 2013-2017 American Community Survey (ACS) 5-year Estimates *rev. 9/18/2019*

Source: Maricopa Association of Governments, Community Profile, revised 9/18/2019.

Housing in Chandler

93,783
Total Housing Units

Owner **54,319** | Renter **32,967**
Occupied Housing Units

Vacant **4,178** | Seasonal **2,319**
Vacant Housing Units

Median Home Value

$268,000
Chandler

$216,600
Phoenix MSA

$193,500
United States

Median Gross Rent

$1,198
Chandler

$1,032
Phoenix MSA

$982
United States

Rent Burden

Percent of renter-occupied housing units with a rent burden or severe rent burden

Rent Burden | Severe Rent Burden

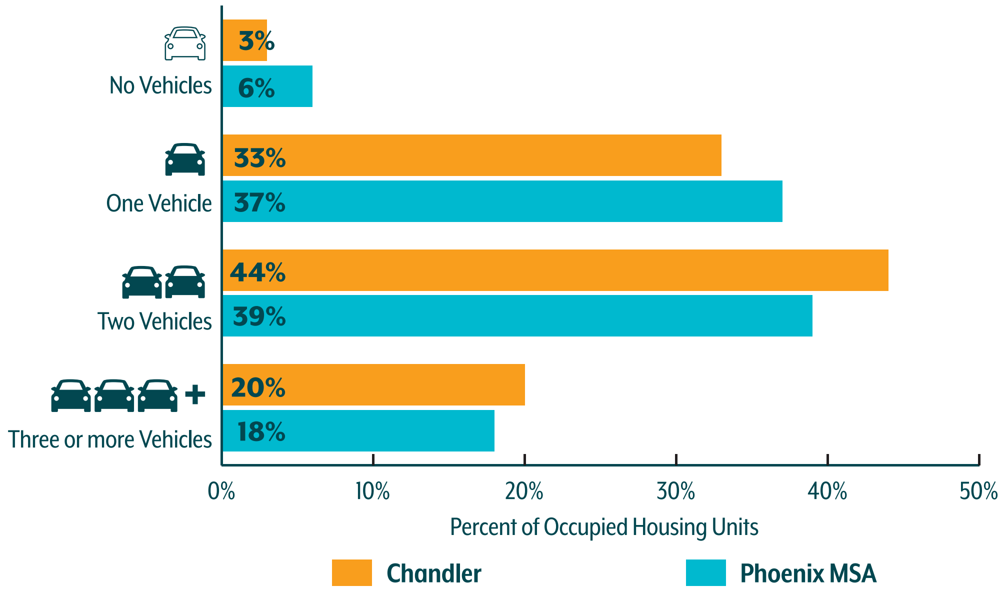
If a household is spending **30%** or more of their income on rent, they are **rent burdened**.

If a household is spending **50%** or more of their income on rent, they have a **severe rent burden**.

Unless otherwise noted, the source for these data is the U.S. Census Bureau, 2013-2017 American Community Survey (ACS) 5-year Estimates *rev. 9/18/2019*

Source: Maricopa Association of Governments, Community Profile, revised 9/18/2019.

Vehicles Available

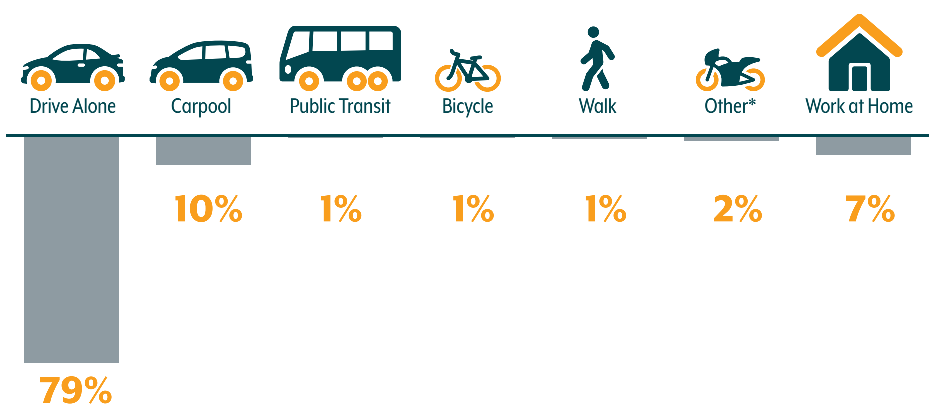


Commute Mode
for Workers in Chandler

Commute Modes in the Phoenix MSA, Ranked:

1. Drive Alone: 77%
2. Carpool: 11%
3. Work from Home: 6%
4. Public Transit: 2%
5. Other* : 1.8%
6. Walk: 1.5%
7. Bicycle: 0.8%

**Other commute modes include motorcycle, taxi, or other means not included in listed categories*



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Maricopa Association of Governments (MAG)
602-254-6300 or mag@azmag.gov

Unless otherwise noted, the source for these data is the U.S. Census Bureau, 2013-2017 American Community Survey (ACS) 5-year Estimates *rev. 9/18/2019*

Source: Maricopa Association of Governments, Community Profile, revised 9/18/2019.

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- and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for criteria pollutants: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb).

Based on federal air quality standards, a specific geographic area can be classified as either an "attainment," "maintenance," or "nonattainment" area for each pollutant. The threshold for nonattainment designation varies by pollutant. Maricopa County is designated as a nonattainment area for 8-hour O_3 (2008 Moderate), 8-hour O_3 (2015 Marginal), and PM_{10} (Serious). The county was previously a nonattainment area for CO and was designated as a maintenance area in 2005.[10] The county is in attainment for all other criteria pollutants.

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). The ESA 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 protected species will result in the implementation of a proposed project. Significant impacts occur when a 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.

On November 5 and 7, 2019, SWCA Environmental Consultants (SWCA) performed a biological survey of the airport and adjacent area to determine the presence of endangered and/or threatened species and habitat.[11] Seventeen species protected under the ESA were identified in Maricopa County, and it was determined that none of these species was observed in or near the project area, nor was critical habitat or proposed critical habitat present near the airport.

The biological survey noted that while critical habitat or proposed critical habitat for five species was present within Maricopa County – acuña cactus (*Echinomastus erectocentrus* var. *acunensis*), Mexican spotted owl (*Strix occidentalis lucida*), razorback sucker (*Xyrauchen texanus*), southwestern willow fly-

[10] U.S. Environmental Protection Agency Green Book (https://www3.epa.gov/airquality/greenbook/anayo_az.html); September 2019.

[11] SWCA Environmental Consultants *Biological Overview for the Chandler Municipal Airport Master Plan Update Project, Maricopa County, Arizona* (November 2019).

catcher (*Empidonax traillii extimus*), and yellow-billed cuckoo (*Coccyzus americanus*) – they are not present at the airport. Additionally, according to the biological report, there are no records of any species listed under the ESA within two miles of the airport.

The USFWS Information for Planning and Consultation (IPaC) report was also considered, and it reports that there are three avian species federally listed as threatened or endangered which have the potential to occur in the vicinity of the airport, identified in **Table 1K** below. Like the biological survey, the IPaC report notes that habitat for these species is not found on airport property.

TABLE 1K | Federally Listed Endangered Species
Chandler Municipal Airport – Maricopa County, AZ

Common Name (*Scientific Name*)	Federal Status	Habitat
California least tern (*Sterna antillarum browni)*	Endangered	The California least tern lives along the coast, nesting on open beaches free of vegetation due to tidal activity.[12] Nests are in shallow depressions on open sandy beaches, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, and drainage systems.
Yellow-billed cuckoo *(Coccyzus americanus)*	Threatened	The yellow-billed cuckoo uses a variety of riparian woodland vegetation (cottonwood, willow, or salt cedar) at elevations below 6,000 amsl*. Dense understory foliage appears to be an important factor in nest site selection and appears to require large blocks of habitat for breeding.[13]
Yuma clapper rail (*Rallus longirostris yumanensis*)	Endangered	The Yuma clapper rail is a marsh bird that prefers dense emergent riparian vegetation, such as fresh-water marshes thick with cattail or bulrush. Habitat for the Yuma clapper rail includes freshwater and alkali marshes with emergent vegetation with areas of open water and drier, upland benches.[14]
*amsl – above mean sea level		

Source: U.S. Fish and Wildlife Service: Information for Planning and Consulting (https://ecos.fws.gov/ipac/); September 2019.

IPaC identified no critical habitat at the airport.

Additional federal laws that may be applicable to the airport are the *Bald and Golden Eagle Protection Act* (BGEPA) and *Migratory Bird Treaty Act* (MBTA), prohibiting activities that would harm eagles and other migratory birds, their eggs, or nests. Birds protected under the BGEPA and MBTA may nest, winter, or migrate throughout the area, including those protected by the ESA. Under the requirements of the BGEPA and MBTA, all project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project.

[12] U.S. Fish and Wildlife Service - California least tern (https://www.fws.gov/sacramento/es_species/Accounts/Birds/ca_least_tern/); December 2019.
[13] U.S. Fish and Wildlife Service – western yellow-billed cuckoo (https://www.fws.gov/sacramento/es_species/Accounts/Birds/yellow_billed_cuckoo/); December 2019.
[14] U.S. Fish and Wildlife Service – Yuma clapper rail (https://www.fws.gov/nevada/protected_species/birds/species/yucr.html); December 2019.

SWCA conducted an evaluation to determine the possible presence of migratory birds at the airport. During the field survey in early November 2019, 21 migratory birds were observed, all of which are protected under the MBTA. Artificial burrows for the western burrowing owl were noted in a grassy area between Airport Boulevard and Chandler Paseo Trail; however, no western burrowing owls were observed during the field survey. Also observed were cavities in a saguaro (*Carnegiea gigantea*) located near the administration building, most likely used as nesting sites for the European starling (*Sturnus vulgaris*) or the gila woodpecker. European starlings are not protected under MBTA.

The IPaC report, which was also consulted, lists five migratory bird species that could be present at the airport, identified in **Table 1L** below.

TABLE 1L | Birds Protected Under the *Migratory Bird Treaty Act*
Chandler Municipal Airport – Maricopa County, AZ

Species Name	Scientific Name	Breeding Season
Bald eagle	*Haliaeetus leucocephalus*	October 15 to August 31
Black-chinned sparrow	*Spizella atrogularis*	April 15 to July 31
Western burrowing owl	*Athene cunicularia*	March 15 to August 31
Costa's Hummingbird	*Calypte costae*	January 15 to June 10
Gila woodpecker	*Melanerpes uropygialis*	April 1 to August 31

Source: U.S. Fish and Wildlife Service: Information for Planning and Consulting (https://ecos.fws.gov/ipac/); September 2019.

COASTAL RESOURCES

Federal activities involving or affecting coastal resources are governed by the *Coastal Barriers Resource Act* (CBRA), the *Coastal Zone Management Act* (CZMA), and Executive Order (E.O.) 13089, *Coral Reef Protection*.

CHD is located approximately 317 miles from the Pacific Ocean, the nearest U.S. protected coastal area. Therefore, the airport is not located within a coastal zone. The closest National Marine Sanctuary is the Channel Islands National Marine Sanctuary, sited approximately 411 miles west of the airport.

CLIMATE

The EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2017* found that the transportation sector, which includes aviation, accounted for approximately 29 percent of U.S. greenhouse gas (GHG) emissions in 2017. Of this, the aviation sector contributed approximately 175.0 million metric tons (MMT) of carbon dioxide equivalent (CO_2e), or nearly 9.4 percent of all transportation emissions.[15, 16] Transportation emission sources include cars, trucks, ships, trains, and aircraft. Most GHG emissions

[15] Aviation activity consists of emissions from jet fuel and aviation gasoline consumed by commercial aircraft, general aviation, and military aircraft.

[16] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017, Table 2-13 (https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2017)

from transportation systems are carbon dioxide (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. From 1990 to 2017, 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 1F** shows all GHG emissions sources in the U.S. in 2017.

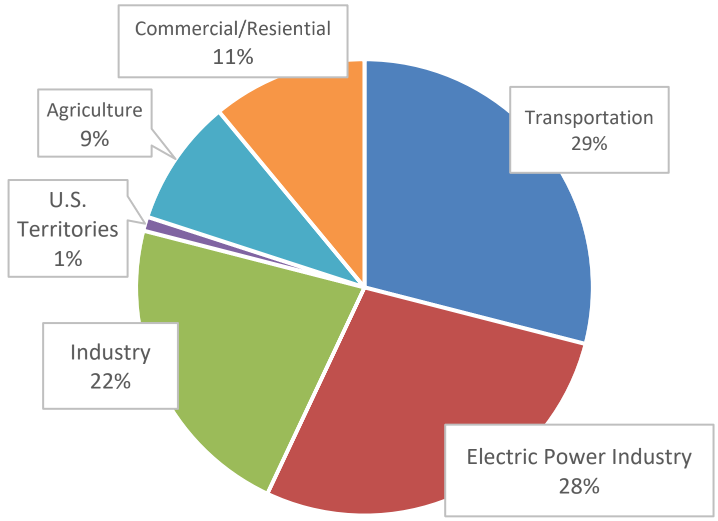


FIGURE 1F - 2017 SOURCES OF GREENHOUSE GAS EMISSIONS IN THE U.S. SOURCE: U.S. EPA (2019)

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. 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), CO_2, CH_4, N_2O, and O_3, are both naturally occurring and anthropogenic (man-made).

The research has established a direct correlation between fuel combustion and GHG emissions. GHGs from anthropogenic sources include CO_2, CH_4, N_2O, 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 for the City of Chandler and surrounding environs, 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 or privately owned historic sites, 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.

Table 1M summarizes properties of each type that may be protected under Section 4(f) of the DOT Act within the vicinity of the airport:

TABLE 1M | Department of Transportation Section 4(f) Resources Within the Vicinity of the Airport
Chandler Municipal Airport – Maricopa County, AZ

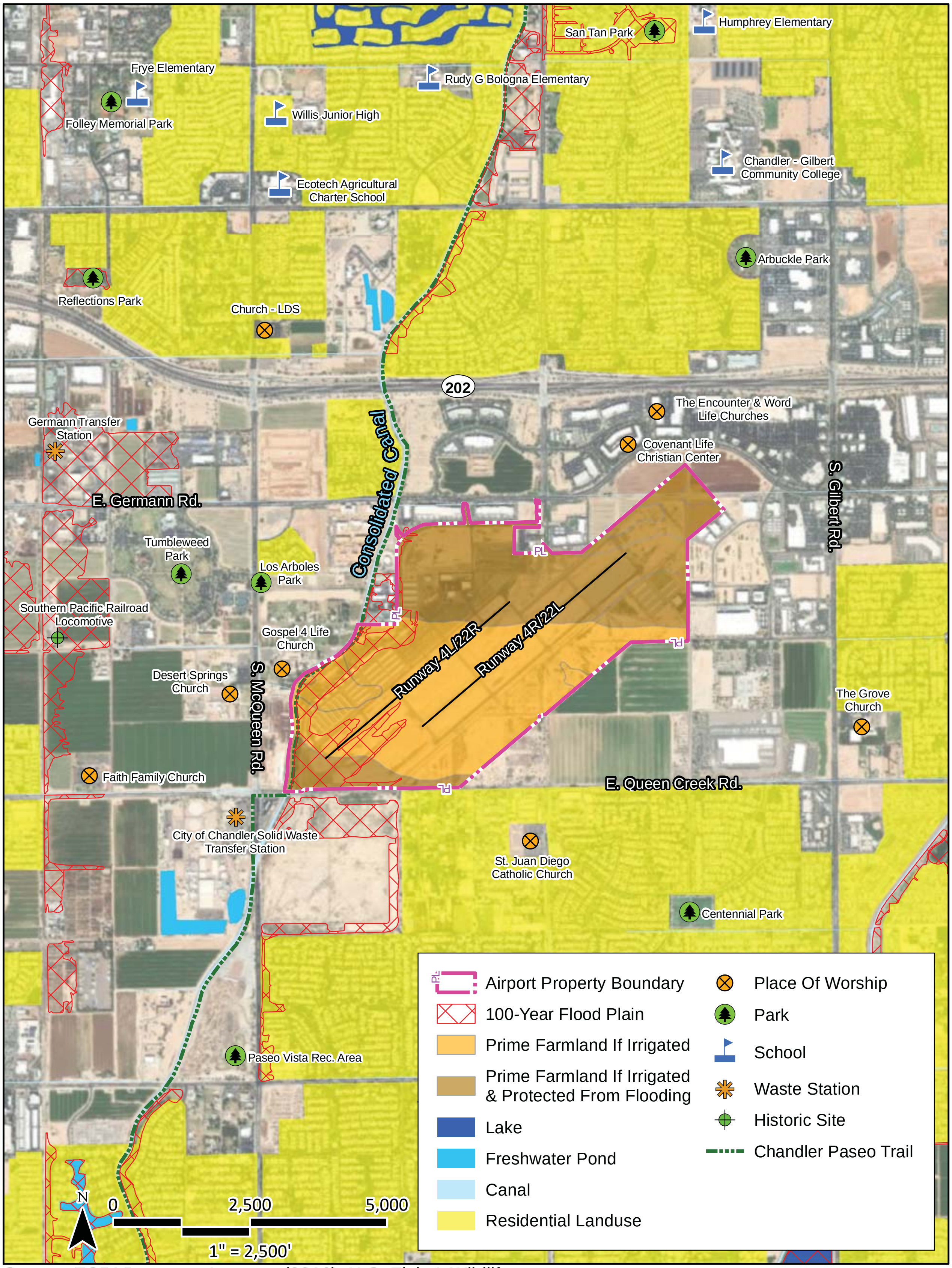
Facility	Distance from Airport (miles)	Direction from Airport
National Register of Historic Places		
Railroad Steam Wrecking Crane and Tool Car	0.8	West
San Marcos Hotel	2.5	Northwest
Chandler Commercial Historic District	2.5	Northwest
Silk Stocking Neighborhood Historic District	2.6	Northwest
National Recreation Area		
Lake Mead National Recreation Area	198.6	Northwest
Wilderness Area		
Superstition Wilderness	21.5	Northeast
Wildlife Refuge		
San Bernardino National Wildlife Refuge	83.0	Southwest
Parks		
Chandler Paseo Trail	<0.1	West
Los Arboles Park	0.1	West
Tumbleweed Park	0.2	Northwest
Reflections Park	0.4	Northwest
Paseo Vista Recreation Area	0.6	Southwest
Arbuckly Park	0.8	North
Paseo Vista Recreation Area Bark Park	0.9	Southwest
Centennial Park	0.8	Southeast
San Tan Park	1.4	North
Folly Memorial Park	2.0	Northwest

Sources: Google Earth Aerial Imagery (dated August 28, 2018); Coffman Associates analysis

FARMLANDS

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal programs on the preservation of farmland, to consider appropriate alternative actions which could lessen adverse effects, and to assure that such federal programs are, to the extent practicable, compatible with state or local government programs and policies to protect farmland. The FPPA guidelines, developed by the U.S. Department of Agriculture (USDA), apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

Information obtained from the Natural Resource Conservation Service's (NRCS) Web Soil Survey (WSS) indicates that soils indicative of important farmlands are present throughout the airport property. The airport has soils that are either classified as "prime farmland if irrigated" or "prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season." **Table 1N** below breaks down the ratio of each soil type and is depicted in **Exhibit 1J**.



Source: ESRI Basemap Imagery (2016), U.S. Fish & Wildlife Service, U.S. Dept. of Agriculture, City of Chandler, AZ Parks & Recreation Dept.

TABLE 1N | Farmland Classification
Chandler Municipal Airport – Maricopa County, AZ

Farmland Classification	Acres of Farmland	Percent of Airport
Prime Farmland if Irrigated	287.1	51.9%
Prime Farmland if irrigated and either protected from flooding or not frequently flooded during the growing season	266	48.1%
Total	**553.1**	**100.0%**

Source: U.S. Department of Agriculture Natural Resources Conservation Service Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx); September 2019.

According to the United States Census Bureau,[17] the airport is in a non-urbanized area.

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 contaminants 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 brownfields sites within five miles of the airport.[18]

A potentially contaminated site subject to a restrictive covenant (a Declaration of Environmental Use Restriction [DEUR]), has been identified under the north apron. The DEUR encumbers property to ensure current and future property owners are aware of contamination, ensures that actions are taken to prevent or mitigate additional contamination, and is monitored by the Arizona Department of Environmental Quality (ADEQ). A triangular-shaped contaminated site has been indicated at the termination of South Cooper Road, south of Runway 4R-22L.

The following municipal solid waste stations are within the vicinity of the airport:

- The City of Chandler Solid Waste Transfer Station is located approximately 0.24 miles southwest; and
- The Germann Transfer Station is approximately 1.2 miles west.

HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act*

[17] United States Census Bureau (https://www.census.gov/).
[18] U.S. Environmental Protection Agency *EJSCREEN* (https://ejscreen.epa.gov/mapper/); September 2019.

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 a proposed project causes an adverse effect on a resource which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance.

In November 2019, SWCA conducted an archaeological field survey of the entire airport to determine if historically significant artifacts are present.[19] During the field survey, six isolated occurrences (IOs) were identified consisting of fragmented sun-colored amethyst glass, whiteware ceramic, colorless glass, milk glass, and a horseshoe; and it was determined these IOs are ineligible for the NRHP. No historic-era buildings or structures were identified during the field survey area.

Prior to the November 2019 archaeological survey performed by SWCA, two previous archaeological surveys have been conducted in the project area. SWCA included the conclusions of these surveys in the November 2019 report, and are summarized as follows:

- In 1998, a linear archaeological survey was conducted on 181 acres for a proposed widening of South McQueen Road, and no cultural resources were identified.
- In 2004, SWCA performed a block survey on approximately 50 acres for a proposed drainage improvement project. Only 15 acres of the survey area was on airport property. One IO was identified during the course of the survey, and it was not located on airport property.

Four sites listed on the National Register of Historic Places (NRHP) are within five miles of the airport. These include:

- Railroad Steam Wrecking Crane and Tool Car
- Chandler Commercial Historic District
- San Marcos Hotel
- Silk Stocking Neighborhood Historic District

The nearest Native American feature is the Gila River Indian Reservation, located approximately four miles east of the airport.

LAND USE

CHD is located within the Chandler Airpark area, which is a nine-square mile business park anchored by the airport. The boundary for the Chandler Airpark and major businesses are depicted in **Figure 1G**. The *Chandler General Plan* prescribes general policies relating to the Airpark, including protecting "the airspace around the Chandler Municipal Airport by requiring that development heights comply with the Federal Aviation Administration filing and flight safety standards."

[19] SWCA Environmental Consultants *Cultural Resources Survey for the Chandler Municipal Airport Master Plan Update Project, Maricopa County, Arizona* (November 2019).

FIGURE 1G – CHANDLER AIRPARK | SOURCE: CITY OF CHANDLER ECONOMIC DEVELOPMENT

Existing land uses in the vicinity of CHD are depicted on **Exhibit 1K**. Land uses immediately adjacent to the airport are a mixture of commercial, industrial, and agricultural. High density, low density, and rural residential uses are also within the vicinity to the northwest and south of the airport.

The City of Chandler *General Plan 2016* designates the airport and airpark area as one of six targeted growth areas in the city. The Future Land Use Plan, depicted on **Exhibit 1L**, shows the airport and surrounding area planned for future employment development.

An Airport Impact Overlay District (AIO) has been codified in Chapter 35, *Land Use and Zoning*, of the *General Ordinances of the City of Chandler*.[20] The purpose and intent of the AIO is to ensure public health around the airport by minimizing exposure to high noise level and accidental hazards associated with airport operations and to encourage surrounding development compatible with the airport. The AIO boundary is codified in Section 35-3001(A) and described as "Sections 1, 2, 3, 10, 11, 12, 13, 14, and 15 of Township 2 South, Range 5 of the Gila and Salt River Meridians."

Three Airport Noise Overlays (ANO) and one Clear Zone Overlay (CZO) areas are established to provide clear and defining boundaries for compatible development around the airport. The ANOs are defined by 2005 noise contours published in the 2010 Chandler Municipal Airport Master Plan,[21] with each ANO

[20] City of Chandler, AZ *General Ordinances of the City of Chandler* (https://www.chandleraz.gov/government/departments/city-clerks-office/city-code-and-charter); accessed September 2019.
[21] Wilbur Smith Associates *Chandler Municipal Airport 2010 Airport Master Plan Update* (April 2010).

zone defined by the 55 day-night average sound level (L_{dn}) – 60 L_{dn}, 60 L_{dn} – 70 L_{dn}, and greater than 70 L_{dn} contours. The CZO is defined as the "area on either side of an extension of the centerline of a runway beginning at a line two hundred (200) feet from the end of a runway and, for Runway 4L-22R of the Chandler Municipal Airport: two hundred fifty (250) feet wide and flaring outward to a width of four hundred fifty (450) feet at a distance of one thousand (1,000) feet; for Runway 4R-22L of the Chandler Municipal Airport: five hundred (500) feet wide and flaring outward to a width of one thousand ten (1,010) feet at a distance of one thousand seven hundred (1,700) feet…"

Permitted uses within the ANO and CZO are permitted with the underlying zoning district; however, uses are subject to additional height and safety regulations set forth in Section 35-3005 of the municipal code.

The Airport District (AP-1) is intended to provide for aircraft operations, air services, and related commercial uses for the airport owned or leased by the City of Chandler. The AP-1 zoning district establishes strict bulk development standards (such as height limitations and setbacks) to ensure the safety and compatibility with airport operations. The boundaries of the AP-1 zoning district are intended to coincide with the airport property line and not be considered for a rezoning classification. Principle uses under this district include those necessary for airport operations, such as aircraft hangars, ATCT, or aviation fuel farms. Additional uses allowed in the AP-1 district are FBOs, heliports, and office space as an accessory to an approved principal use.

NATURAL RESOURCES AND ENERGY SUPPLY

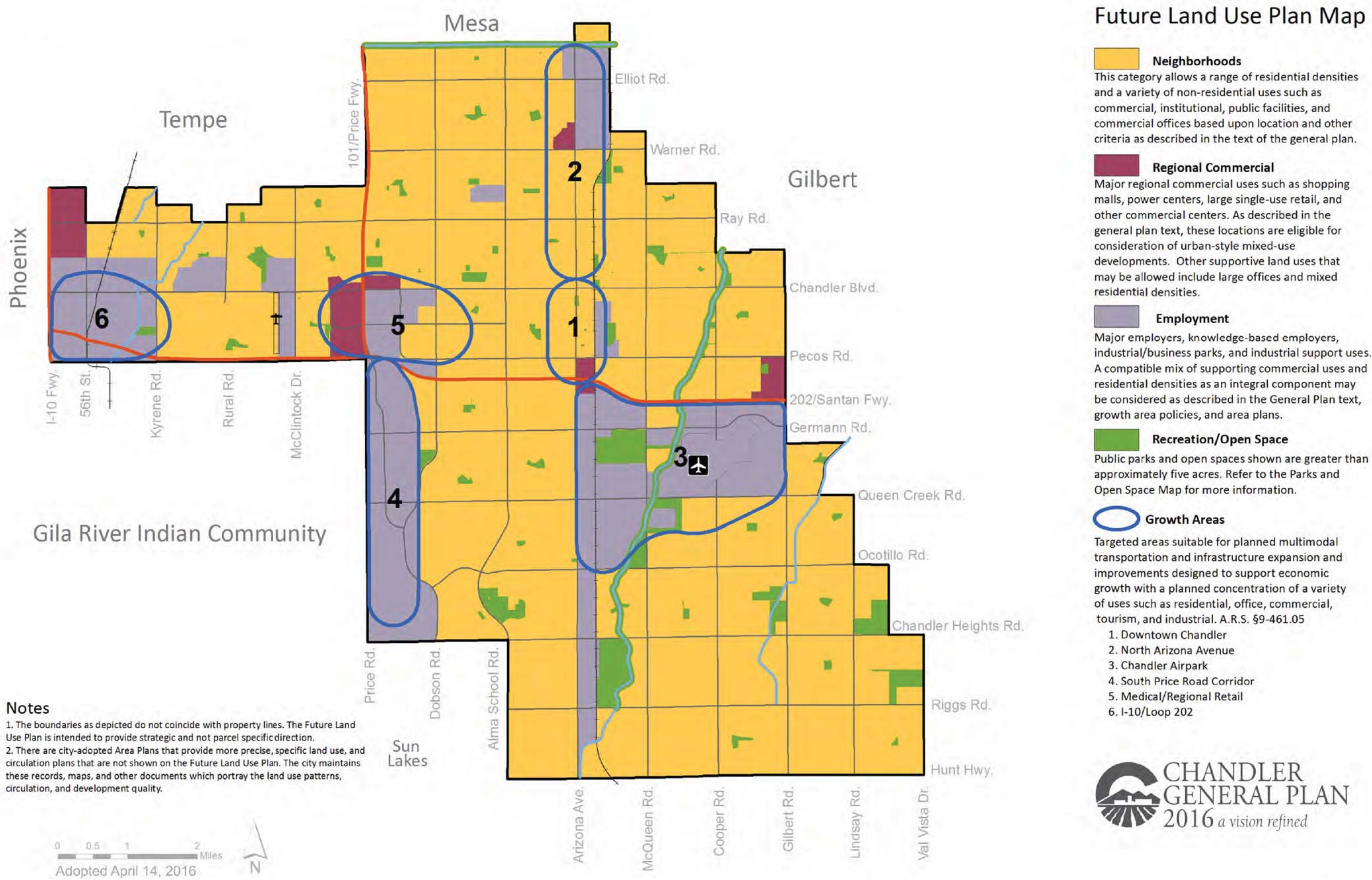
E.O. 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* instructs federal agencies to advance the nation's energy security and environmental performance by achieving specified goals. Natural resources and energy supply provide an evaluation of a project's consumption of natural resources. It is the policy of FAA Order 1053.1, *Energy and Water Management Program for FAA Buildings and Facilities*, to encourage the development of facilities that exemplify the highest standards of design, including principles of sustainability.

Natural resources and energy supply are discussed earlier in this chapter under "Fuel Facilities and Equipment" and "Utilities."

NOISE AND NOISE-COMPATIBLE LAND USE

Federal land use compatibility guidelines are established under 14 Code of Federal Regulations (CFR) 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 (L_{dn}). Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB L_{DN} 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 should also be given to noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR Part 150 do not account for the value, significance, and enjoyment of the area in question.

EXISTING LAND USE



Source: Chandler General Plan 2016

A 14 CFR Part 150 Study was conducted for the airport in the late 1990s, with the FAA issuing a Record of Approval on July 11, 2000.[22] A Noise Exposure Map update was performed in February 2010.

Currently, the AIO incorporated noise overlays established by noise contours generated in 2005. The noise overlay was discussed in detail in the "Land Use" section of this chapter.

Noise-sensitive land uses near the airport consist primarily of residential uses to the west, south, and east. Additional noise-sensitive land uses within approximately one mile of the airport are outlined in **Table 1P** below.

While there are additional noise-sensitive land uses in the City of Chandler, they are beyond one mile of the airport boundary.

TABLE 1P | Noise-Sensitive Land Uses within One Mile of the Airport
Chandler Municipal Airport – Maricopa County, AZ

Facility	Distance from Airport (miles)	Direction from Airport
Schools/Child Care Centers		
Chandler Christian School	0.2	West
Kids Incorporated Learning Center	0.4	East
Archway Lincoln Academy	0.4	East
Great Hearts Academy	0.4	East
Life Christian Child Care	0.7	East
Places of Worship		
Gospel 4 Life Church	0.2	West
Desert Springs Church	0.2	West
Covenant Life Christian Center	0.2	North
The Encounter Church	0.3	North
Word Life Church	0.3	North
Saint Juan Diego Catholic Church	0.4	South
Faith Family Church	0.6	West
The Grove	1.0	East
The Chruch of Jesus Christ of Latter-day Saints	1.0	North
The Chruch of Jesus Christ of Latter-day Saints	1.0	South
Cox Church	1.0	North
Hospitals/Health Care/Senior Care Facilities		
Dignity Health	0.4	East
Four Roses Assisted Living	0.8	South
Parks/Recreational Facilities		
Chandler Paseo Trail	<0.1	West
Los Arboles Park	0.1	West
Tumbleweed Park	0.2	Northwest
Reflections Park	0.4	Northwest
Paseo Vista Recreation Area	0.6	Southwest
Arbuckly Park	0.8	North
Paseo Vista Recreation Area Bark Park	0.9	Southwest
Centennial Park	0.8	Southeast

Sources: Google Earth Aerial Imagery (dated August 28, 2018); Coffman Associates analysis

[22] Federal Aviation Administration *Planning Data and Noise Compatibility Program Status – Arizona* (https://www.faa.gov/airports/envi-ronmental/airport_noise/part_150/states/az/); December 2019.

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

Socioeconomics is an umbrella term used to describe aspects of a project that are either social or economic in nature. A socioeconomic analysis evaluates how elements of the human environment such as population, employment, housing, and public services might be affected by the proposed action and alternative(s).

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. Meaningful Involvement[23] ensures that:

- people have an opportunity to participate in decisions about activities that may affect their environment and/or health;
- the public's contribution can influence the regulatory agency's decision;
- their concerns will be considered in the decision-making process; and
- the decision-makers seek out and facilitate the involvement of those potentially affected.

FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures* 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 identifies the presence of environmental justice areas within the airport environs. The population within five miles of the airport is approximately 237,000, of which 20 percent of the population is considered low-income and 38 percent are considered a minority population. Likewise, according to *EJSCREEN*, seven percent of the population is under the age of five within a five-mile radius of the airport.

VISUAL EFFECTS

Visual effects deal broadly with the extent to which a proposed action or alternative(s) would either (1) produce light emissions that create an annoyance or interfere with activities; or (2) contrast with, or detract from, the visual resources and/or the visual character of the existing environment. Each jurisdiction will typically address outdoor lighting, scenic vistas, and scenic corridors in zoning ordinances and their general plan.

Light emissions include any light that originates from a light source into the surrounding environment, such as airfield and apron floodlighting, navigational aids, parking lot illumination, and roadway lighting. Glare is a type of light emission that occurs when light is reflected off a surface, including solar panels or window glass.

[23] Requirements for meaningful public involvement by minority and low-income populations are addressed in Paragraph 2-5.2.b of FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

Visual character refers to the overall visual makeup of the existing environment where a proposed action or its alternative(s) would be located. For example, areas near densely populated areas generally have a visual character that could be defined as urban, whereas less developed areas could have a visual character defined by the surrounding landscape features, such as open grass fields, forests, mountains, or deserts, etc.

Visual resources include buildings, sites, traditional cultural properties, and other natural or manmade landscape features that are visually important or have unique characteristics. Visual resources may include structures or objects that obscure or block other landscape features. In addition, visual resources can include the cohesive collection of various individual visual resources that can be viewed at once or in concert from the area surrounding the site of the proposed action or alternative(s).
Light Emissions. Light emission impacts typically relate to the extent to which any light or glare results from a source that could create an annoyance for people or would interfere with normal activities. Generally, local jurisdictions will include ordinances in the local code addressing outdoor illumination to reduce the impact of light on surrounding properties.

According to the City of Chandler's Land Use and Zoning Code, "all external lighting shall be located and designed to prevent lighting rays from being directed off the property upon which the lighting is located."

The City of Chandler and its surrounding environs are not designated as dark sky places. However, Tonto National Monument, located approximately 47 miles northeast, is designated as an International Dark Sky Park.[24]

Visual Resources and Visual Character. Impact on visual resources and visual character typically relates to a reduction in the aesthetic quality of the surrounding environs from development, construction, or demolition. When making a determination of visual impacts, consideration should be made whether a proposed project or alternative(s) would have an effect on any visual resources or alter local character.

The City of Chandler's *Land Use and Zoning Code*[25] does not address scenic vistas or corridors. The *Chandler General Plan*[26] states the importance of incorporating open space areas that replicate the natural desert habitat as the city comes to full build-out. According to the Federal Highway Administration, no scenic byways are located within the vicinity of the airport.[27]

WATER RESOURCES

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 E.O. 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

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[24] International Dark Sky Association (https://www.darksky.org/); December 2019.

[25] City of Chandler Planning and Zoning, Chapter 35 *Land Use and Zoning Code* (https://www.chandleraz.gov/government/departments/development-services/planning-and-zoning); December 2019.

[26] City of Chandler Planning and Zoning *Chandler General Plan* (April 2016) (https://www.chandleraz.gov/government/departments/development-services/planning-and-zoning); December 2019.

[27] Federal Highway Administration (https://www.fhwa.dot.gov/byways/states/AZ); December 2019.

or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction." Wetlands can include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, 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 (absent of air or oxygen) conditions during the growing season (hydric).[28]

According to USFWS, which manages the National Wetlands Inventory on behalf of all federal agencies, the Consolidated Canal west of the airport and stormwater drainage along East Germann Road north of the airport has been identified as wetlands; although it is important to note that these areas were identified as wetlands based on a review of undated aerial photography. Upon review of a Google Earth aerial image (image dated August 28, 2018), the canal and drainage ways are still present. No wetlands are identified on airport property.

Based on information from the NRCS-WSS, no hydric soils are present on airport property.

Floodplains | E.O. 11988, *Floodplain Management*, directs federal agencies to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains. A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 04013C2739M and 04013C2743M (dated November 4, 2015) indicates the presence of a Special Flood Area, identified as Zone AH, associated with the Consolidated Canal within the southwest area of the airport, impacting taxiways and Runway 4L-22R. The AH Zone is subject to a 100-year flood event with a one- to three-foot flood depth, with a base elevation of 1,230 feet above sea level.

Surface Waters | The CWA establishes 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 Arizona Pollutant Discharge Elimination System (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 existing FAA facility adjacent to surface waters, or withdrawal of water from surface water for construction or operations. No impaired waters under Section 303(d) of the CWA are located within the vicinity of the airport.

[28] National Resources Conservation Service – U.S. Department of Agriculture (https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961); September 2019.

A review of the National Hydrography Dataset, published by the United States Geological Survey, indicates there is an engineered drainage channel crossing through the north end of the airport along an airport service road north of Runway 4R-22L. A second drainage channel is the Consolidated Canal along the western boundary of the airport.

On November 5, 2019, SWCA performed a field investigation to determine whether the ephemeral drainages on airport property qualify as Waters of the United States (WOTUS).[29] It is concluded that all drainage features on the airport are ephemeral in nature, and only flow during localized precipitation events. These drainages do not show a developed bed or bank and do not have an ordinary high-water mark (OHWM) typical of a WOTUS. Most of these drainages can be described as small erosional features, swales, and/or engineered ditches.

Other small, local canals on and around the airport benefiting individual fields do not receive water from natural surface flow and do not connect downstream to a WOTUS.

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 enjoyment of present and future generations. The closest designated Wild and Scenic River is a segment of the Verde River, located approximately 60 miles north of the airport.[30]

The Nationwide River Inventory (NRI) is a list of over 3,400 rivers or river segments that appear to meet the minimum *Wild and Scenic Rivers Act* eligibility requirements based on their free-flowing status and resource values. The development of the NRI resulted from Section 5(d)(1) in the *Wild and Scenic Rivers Act*, directing Federal agencies to consider potential wild and scenic rivers in the comprehensive planning process.[31] The river closest to the airport which appears on the NRI is a segment of the Arnett/Telegraph Creeks, located approximately 36 miles east of the airport.

Groundwater | Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. The term aquifer is used to describe the geologic layers that store or transmit groundwater, such as 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 geological make-up of the area includes fine-grained deposits of silt and clay, which tends to become more compact and less permeable with depth. Surrounding aquifers are considered basin-fill aquifers, which is typically bounded by low-permeability rock. Some basin-fill aquifers, like those found in parts of California and Arizona, have supplied water for irrigation and other uses.[32]

The Upper Santa Cruz and Avra Basin sole source aquifer is located approximately 40 miles southeast of the airport.[33]

[29] SWCA Environmental Consultants, Inc. *Wetlands and Other Waters of the U.S. Review for Chandler Municipal Airport Master Plan Update Project in Chandler, Maricopa County, Arizona* (November 25, 2019).

[30] National Wild and Scenic Rivers System (https://rivers.gov/wsr-act.php); December 2019.

[31] National Park Service – Nationwide Rivers Inventory (https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm); December 2019.

[32] U.S. Geologive Survey – Aquifers and Groundwater (https://water.usgs.gov/ogw/aquifer/101514-wall-map.pdf); December 2019.

[33] U.S. Environmental Protection Agency Sole Source Aquifer for Drinking Water (https://www.epa.gov/dwssa); September 2019.

ENVIRONMENTAL INVENTORY SOURCES

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

Federal Emergency Management Agency Flood Map Service Center:
https://msc.fema.gov/portal/search?AddressQuery=Chandler%2C%20AZ#searchresultsanchor

Intergovernmental Panel on Climate Change:
https://www.ipcc.ch/

National Wild and Scenic Rivers System:
https://rivers.gov/wsr-act.php

Natural Resources Conservation Service, Web Soil Survey:
https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

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

U.S. Environmental Protection Agency, Green Book National Area and County-Level Multi-Pollutant Information:
https://www3.epa.gov/airquality/greenbook/anayo_az.html

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

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

U.S. Geological Survey National Map:
http://nationalmap.gov/

U.S. National Park Service – National Register of Historic Places:
https://www.nps.gov/subjects/nationalregister/index.htm

Chapter Two

FORECASTS

CHANDLER arizona

Chapter Two

FORECASTS

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, 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 Chandler Municipal Airport (CHD) will primarily consider based aircraft, aircraft operations, and peak activity periods.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. FAA will review individual airport forecasts with the objective of comparing them to its *Terminal Area Forecasts* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). Even though the TAF is updated annually, in the past there was almost always a disparity between the TAF and master planning forecasts. This was primarily because the TAF forecasts are the result of a top-down model that does not consider local conditions or recent trends. While the TAF forecasts are to be a point of comparison for master plan forecasts, they serve other purposes, such as asset allocation by the FAA.

CHANDLER
MUNICIPAL AIRPORT
CHD

When reviewing a sponsor's forecast (from the master plan), the FAA must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. As stated in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), forecasts should be:

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

The forecast process for an airport master plan consists of a series of basic steps that vary in complexity depending upon the issues to be addressed and the level of effort required. 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 documentation and evaluation of the results. FAA Advisory Circular (AC) 150/5070-6C, *Airport Master Plans*, outlines seven standard steps involved in the forecast process, including:

1) **Identify Aviation Activity Measures**: The level and type of aviation activities likely to impact facility needs. For 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 are required to prepare the forecasts, identify data sources, and collect historical and forecast data.
4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.
5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.
6) **Summarize and Document Results**: Provide supporting text and tables as necessary.
7) **Compare Forecast Results with FAA's TAF**: Based aircraft and total operations are considered consistent with the TAF if they meet the following criteria:
    - Forecasts differ by less than 10 percent in the five-year forecast period, and 15 percent in the 10-year forecast period, or
    - Forecasts do not affect the timing or scale of an airport project, or
    - Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems*.

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis for the 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.

The forecasts for this master plan will utilize a base year of 2019 with a long-range forecast out to 2040.

NATIONAL AVIATION TRENDS

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 the 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 upon preparation of this chapter was FAA *Aerospace Forecasts – Fiscal Years 2019-2039*, published in April 2019. 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 that was 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. Since the end of the recession in 2009, U.S. airlines revamped 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. The results of these efforts have been impressive: 2018 marked the tenth consecutive year of profitability for the U.S. airline industry. Prior to the COVID-19 pandemic, there was confidence that U.S. airlines have finally transformed from a capital intensive, highly cyclical industry to an industry that generates solid returns on capital and sustained profits.

The biggest factor affecting aviation trends currently is the COVID-19 pandemic. The effect of the pandemic on the aviation industry has been most devastating to the commercial airline operators with segments of the general aviation industry, such as charters, air taxi, and fractionals, appearing to maintain pre-pandemic levels and in many cases, showing increases as people sought alternatives to flying commercial. At this point, uncertainty persists on what the long-term impacts of the pandemic will be on the aviation industry.

ECONOMIC ENVIRONMENT

According to the FAA forecast, the economic growth of the U.S. is projected to increase by 2.9 percent in 2019 and 2.8 percent in 2020. Over the next 20 years, the annual gross domestic product (GDP) of the U.S. is expected to increase by 1.8 percent. U.S. carrier profitability is projected to remain steady or increase as demand supported by a stable economy offsets rising energy and labor costs. Over the long term, the aviation industry is expected to remain competitive and profitable with an increasing demand for air travel and airfares growing more slowly than inflation.

Prior to the COVID-19 pandemic, the economy was recovering from the most serious economic downturn and slow recovery since the Great Depression. Fundamentally, demand for aviation is driven by economic activity. As economic growth picks up, so will growth in aviation activity. Overall, the FAA forecast calls for passenger growth over the next 20 years to average 1.8 percent annually. Oil prices averaged $64 per barrel in 2018, edging down to $61 in 2019, and the forecast assumed continued increases reaching $98 per barrel by the end of the forecast period in 2039. It remains to be seen how the FAA will adjust these projections based on the impacts of COVID-19.

FAA GENERAL AVIATION FORECASTS

The long-term outlook for general aviation is stable to optimistic, as growth at the high-end offsets continuing retirements at the traditional low end of the segment. The active general aviation fleet is forecast to remain relatively stable between 2019 and 2039. 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 forecast.

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, mostly in the piston category.

Table 2A shows the primary general aviation demand indicators as forecast by the FAA. Since the FAA forecast period extends to 2039, the data was extrapolated to generate estimates for 2040 to match up with the long-range period of this master plan.

TABLE 2A | FAA General Aviation Forecast

Demand Indicator	2019	2040*	CAGR
General Aviation Fleet			
Total GA Fleet	213,375	212,065	-0.03%
Total Fixed Wing Piston	142,295	116,266	-0.96%
Total Fixed Wing Turbine	24,895	36,519	1.84%
Total Helicopters	10,895	15,429	1.67%
Total Other (experimental, light sport, etc.)	35,290	43,851	1.04%
General Aviation Operations			
Total GA Operations	26,895,650	28,625,434	0.30%
Local	12,672,345	13,571,495	0.33%
Itinerant	14,223,305	15,053,939	0.27%

* 2040 data was extrapolated since FAA forecasts only go through 2039.
CAGR: compound annual growth rate (2019-2040)

Source: FAA Aerospace Forecast - Fiscal Years 2019-2039

General Aviation Aircraft Fleet Mix

For 2019, the FAA estimated there were 142,295 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.96 percent from 2019-2040, resulting in 116,266 by 2040. This includes a decline of 1.0 percent annually for single engine pistons and 0.4 percent for multi-engine pistons.

Total turbine aircraft are forecast to grow at an annual growth rate of 1.8 percent through 2040. The FAA estimates there were 24,895 fixed-wing turbine-powered aircraft in the national fleet in 2019, and there will be 36,519 by 2040. This includes annual growth rates of 1.3 percent for turboprops and 2.2 percent for business jets.

Total helicopters are forecast to grow at an annual growth rate of 1.7 percent annually through 2040. The FAA estimates there were 10,895 helicopters in 2019, which are forecast to grow to 15,429 by 2040. This includes annual growth rates of 1.9 percent for piston helicopters and 1.6 percent for turbine helicopters.

The FAA also forecasts experimental aircraft, light sport aircraft, and others. Combined, there were 35,290 other aircraft in 2019 that are forecast to grow to 43,835 by 2040 for an annual growth rate of 1.0 percent.

While the fleet remains level, the number of general aviation operations at towered airports is projected to increase from 26.9 million in 2017 to 30.3 million in 2039 with an average increase of 0.8 percent per year as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed-wing piston hours.

General Aviation Operations

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

General aviation operations, both local and itinerant, declined significantly as a result of the 2008-2009 recession and subsequent slow recovery. Through 2040, total general aviation operations are forecast to grow 0.30 percent annually. This includes annual growth rates of 0.33 percent for local general aviation operations and 0.27 percent for itinerant general aviation operations. Itinerant general aviation operations are expected to increase from 14.2 million in 2019 to 15.1 million in 2040. Local general aviation operations are expected to grow from 12.7 million in 2019 to 13.6 million in 2040.

Exhibit 2A presents the historical and forecast U.S. active general aviation aircraft and operations.

General Aviation Aircraft Shipments and Revenue

The 2008-2009 economic recession had a negative impact on general aviation aircraft production, and the industry has been slow to recover. Aircraft manufacturing declined for three straight years from 2008 through 2010. According to the General Aviation Manufacturers Association (GAMA), there is optimism that aircraft manufacturing will stabilize and return to growth, which has been shown since 2011. **Table 2B** presents historical data related to general aviation aircraft shipments.

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

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
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	2,267	890	129	582	666	20,432
2017	2,325	936	149	563	677	20,201
2018	2,443	954	185	601	703	20,564

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

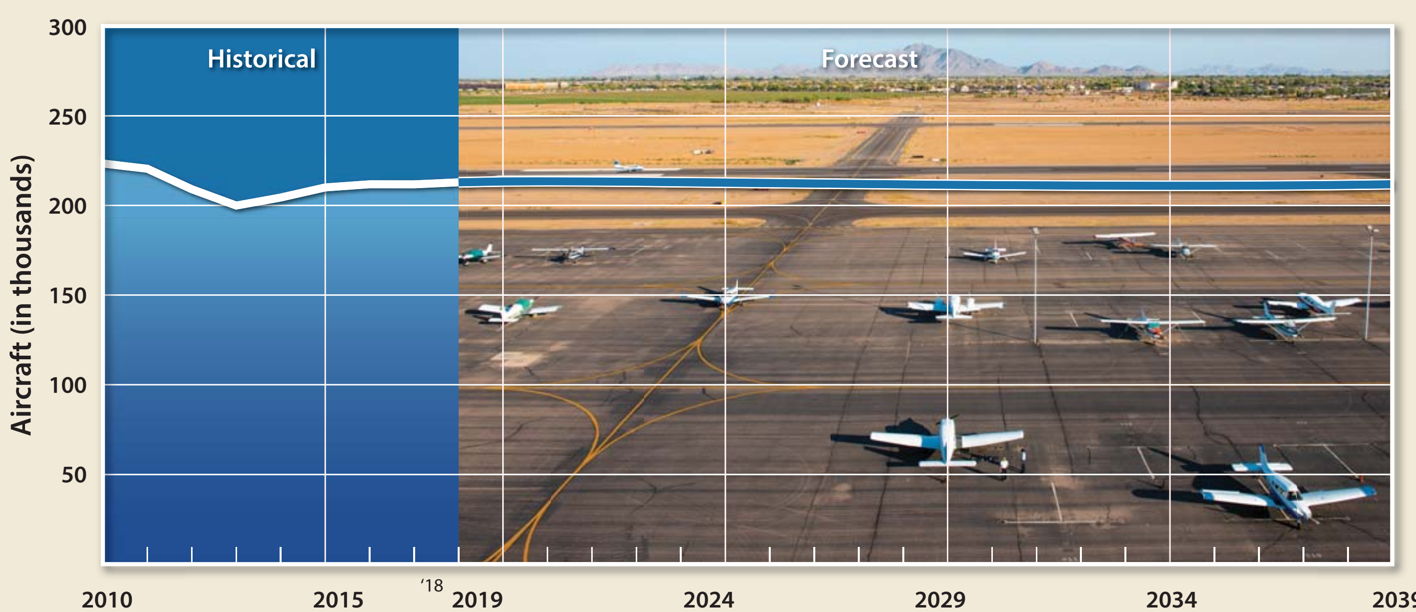
Source: General Aviation Manufacturers Association *2018 Annual Report*

Worldwide shipments of general aviation airplanes increased in 2018 with a total of 2,443 units delivered around the globe compared to 2,325 units in 2017. Worldwide general aviation billings also increased. In 2018, $20.5 billion in new general aviation aircraft were shipped compared to $20.20 billion in 2017.

Business Jets: General aviation manufacturers delivered 703 business jets in 2018, as compared to 677 units in 2017. The industry's continued investment in new products helped maintain the delivery rate for business jets. Nearly two-thirds of business jet shipments were to North American customers in 2018.

U.S. ACTIVE GENERAL AVIATION AIRCRAFT

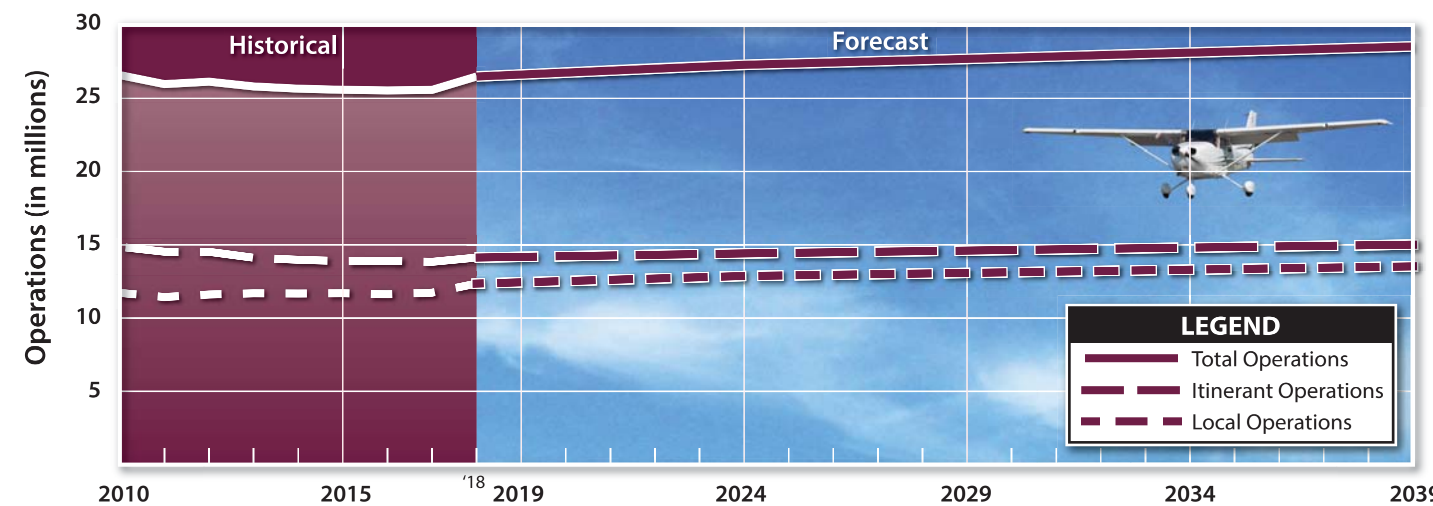
	2018E	2024	2029	2039	AAGR 2019-2039
Fixed Wing					
Piston					
Single Engine	129,885	123,145	116,360	105,195	-1.0%
Multi-Engine	13,040	12,805	12,575	12,085	-0.4%
Turbine					
Turboprop	9,925	10,135	10,770	12,810	1.3%
Turbojet	14,585	17,025	19,110	23,050	2.2%
Rotorcraft					
Piston	3,335	3,775	4,150	4,950	1.9%
Turbine	7,370	8,075	8,700	10,225	1.6%
Experimental					
	27,365	29,465	30,880	33,040	0.9%
Sport Aircraft					
	2,665	3,420	4,100	5,555	3.5%
Other					
	4,715	4,820	4,865	4,890	0.2%
Total Pistons	**146,260**	**139,725**	**133,085**	**122,230**	**-0.9%**
Total Turbines	**31,880**	**35,235**	**38,580**	**46,085**	**1.8%**
Total Fleet	**212,885**	**212,665**	**211,510**	**211,800**	**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 2019-2039*

U.S. GENERAL AVIATION OPERATIONS

	2018E	2024	2029	2039	AAGR 2019-2039
Itinerant					
	14,130,000	14,412,000	14,606,000	15,012,000	0.3%
Local					
	12,354,000	12,870,000	13,081,000	13,526,000	0.3%
Total GA Operations	**26,485,000**	**27,282,000**	**27,687,000**	**28,538,000**	**0.3%**



U.S. AIR TAXI

	2018E	2024	2029	2039	AAGR 2019-2039
Air Taxi/Commuter Operations					
Itinerant	7,126,000	5,484,000	5,752,000	6,361,000	-0.6%

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Turboprops: In 2018, 601 turboprop airplanes were delivered to customers around the world, an increase from the 563 that were delivered in 2017. Overall, the turboprop market is still significantly stronger over the past five years compared to years prior to 2011. Approximately 50 percent of turboprop shipments were to North American customers.

Pistons: Single-engine piston deliveries increased slightly from 936 units during 2017 to 954 in 2018. Multi-engine piston deliveries also increased from 149 in 2017 to 185 in 2018. Approximately 62 percent of piston airplane shipments were to North American customers in 2018.

U.S. PILOT POPULATION

There were 633,317 active pilots certificated by the FAA at the end of 2018. All pilot categories, except for rotorcraft-only and recreational-only certificates, continued to increase. With the exception of student pilots and airline transport pilots (ATP), the number of active general aviation pilots is projected to decrease about 13,250 (down 0.2 percent annually) between 2018 and 2039. The ATP category is forecast to increase by 25,755 (up 0.7 percent annually). The FAA has currently suspended the student pilot forecast for the second year in a row.

RISKS TO THE FORECAST

While the FAA is confident that its forecasts for aviation demand and activity can be reached, this is dependent on several factors, including the strength of the global economy, security (including the threat of international terrorism), and oil prices. Higher oil prices could lead to further shifts in consumer spending away from aviation, dampening a recovery in air transport demand.

As stated previously, the rapid spread of the COVID-19 that began in early 2020 now presents a new risk without clear historical precedent. It is not known at this point how the virus will affect aviation in the long-term; however, impacts were felt in 2020 and have carried over into 2021. The long-term impact of COVID-19 on the aviation industry will not be understood until the full spread or intensity of the human consequences, as well as the breadth and depth of possible economic fallout, is known.

FORECASTING APPROACH

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast. The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include trend line/time-series projections, correlation/regression analysis, and market share analysis. The forecast analyst may elect to not use certain techniques depending on the reasonableness of the forecasts produced using other techniques.

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

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

Regression analysis measures statistical relationships between dependent and independent variables, yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures association between the changes in the dependent variable and the independent variable(s). If the "r^2" value (coefficient determination) is greater than 0.95, it indicates good predictive reliability. A value less than 0.95 may be used, but with the understanding that the predictive reliability is lower.

Market share analysis involves a historical review of the airport 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.

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

A wide range of factors is known to influence the aviation industry and can have significant impacts on the extent and nature of aviation activity in both the local and national markets. Historically, the nature and trend of the national economy has had a direct impact on the level of aviation activity. Recessionary periods have been closely followed by declines in aviation activity. Nonetheless, over time, trends emerge and provide the basis for airport planning.

Future facility requirements, such as hangar, apron, and terminal needs, are derived from projections of various aviation demand indicators. Using a broad spectrum of local, regional, and national socioeconomic and aviation information, and analyzing the most current aviation trends, forecasts are presented for the following aviation demand indicators:

- Based Aircraft
- Based Aircraft Fleet Mix
- General Aviation Operations
- Air Taxi and Military Operations
- Operational Peaks

EXISTING FORECASTS

Consideration is given to any forecasts of aviation demand for the airport that have been completed in the recent past. For CHD, the previous forecasts reviewed are those in the FAA *Terminal Area Forecast* (TAF) and the 2007 master plan.

FAA *TERMINAL AREA FORECAST* (TAF February 2019)

On an annual basis, the FAA publishes the TAF for each airport included in the *National Plan of Integrated Airport Systems* (NPIAS). The TAF is a generalized forecast of airport activity used by FAA for internal planning purposes primarily. It is available to airports and consultants to use as a baseline projection and important point of comparison while developing local forecasts. The TAF was published in February 2019 and is based on the federal fiscal year (October-September).

Table 2C presents the 2019 TAF for CHD. It is important to note that the TAF based aircraft count is significantly lower than the current FAA-validated count from the based aircraft registry. The TAF reflects 160 based aircraft, while the registry reflects 441 based aircraft. The total operations count used in the TAF, however, is only 346 operations less than what was reported by the CHD ATCT for 2019 (ATCT reported 220,662 operations in 2019). The FAA may choose to submit the forecasts developed for this master plan to headquarters to update the TAF.

TABLE 2C | 2019 FAA Terminal Area Forecast
Chandler Municipal Airport

	2019	2025	2030	2040	CAGR 2019-2040
ANNUAL OPERATIONS					
Itinerant					
Air Carrier	0	0	0	0	--
Air Taxi	2,784	2,784	2,784	2,784	0.0%
General Aviation	68,293	68,706	69,916	72,402	0.3%
Military	213	213	213	213	0.0%
Total Itinerant	71,290	71,703	72,913	75,399	0.3%
Local					
General Aviation	148,964	151,488	153,378	157,233	0.3%
Military	62	62	62	62	0.0%
Total Local	149,026	151,550	153,440	157,295	0.3%
Total Operations	***220,316***	***223,253***	***226,353***	***232,694***	0.3%
BASED AIRCRAFT					
Based Aircraft	***160***	***193***	***224***	***301***	3.1%

Source: FAA Terminal Area Forecast (TAF), February 2019

The TAF for CHD shows total operations increasing from 220,316 annually to 232,694 by 2040 for an annual growth rate of 0.3 percent. Air taxi and military categories show a flat-line projection. CHD does not report any air carrier operations now or in the future. Based aircraft are projected in the TAF to grow at a CAGR of 3.1 percent through 2040 adding 141 new planes.

PREVIOUS FORECASTS

Forecasts of aviation activity at CHD were previously prepared within the 2007 Airport Master Plan and the 2018 *Arizona State Aviation System Plan* (SASP). **Table 2D** summarizes both forecasts of operations and based aircraft at CHD. Regarding the previous master plan, the CHD ATCT counts for 2019 report a total of 220,662 operations and the based aircraft count is at 441, which are lower than the base year of the last master plan. As has been previously noted, since the completion of the previous master plan, a national recession caused a significant reduction in aviation activity not only at CHD but across the country. As a result, the projections from the previous master plan are no longer relevant.

TABLE 2D | Previous Forecasts
Chandler Municipal Airport

Year	Itinerant Operations	Local Operations	Total Operations	Based Aircraft
2007 Airport Master Plan (2005 Base Year)				
2005	65,606	169,505	235,111	457
2010	74,939	193,661	268,600	515
2015	85,625	221,275	306,900	581
2020	97,817	252,783	350,600	656
2025	111,767	288,833	400,600	740
2018 *Arizona State Aviation System Plan* Update (2016 Base Year)				
2016	78,750	142,180	220,930	440
2021	89,880	162,290	252,170	481
2026	102,590	185,230	287,820	524
2036	133,650	241,310	374,960	619

Sources: 2007 Master Plan; 2018 Arizona State Aviation System Plan Update

The SASP projections were prepared more recently accounting for the effects of the recession. The SASP forecasted operations to grow by approximately 32,000 and based aircraft to grow by 41 by 2021. Through 2019, activity at CHD has not met these projections with operations remaining relatively static in the 220,000 range and the number of based aircraft declining from the figure reported for 2016 in the SASP. Based on recent activity trends at CHD and the time that has passed since the preparation of these previous forecasts, it is necessary to develop new forecasts utilizing the most current information available.

GENERAL AVIATION FORECASTS

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

The number of based aircraft is the most basic indicator of general aviation demand. By first developing a forecast of based aircraft for the airport, other demand indicators can be projected. The process of developing forecasts of based aircraft begins with an analysis of aircraft ownership in the primary general aviation service area through a review of historical aircraft registrations. An initial forecast of county-wide registered aircraft is developed and will be used as one data point to arrive at a based aircraft forecast for the airport.

BASED AIRCRAFT FORECAST

Forecasts of based aircraft may directly influence needed facilities and the applicable design standards. The needed facilities may include hangars, aprons, taxilanes, etc. The applicable design standards may include separation distances and object-clearing surfaces. The size and type of based aircraft are also an important consideration. The addition of numerous small aircraft may have no effect on design standards, while the addition of a few larger business jets can have a substantial impact on applicable design standards.

Because of the numerous variables known to influence aviation demand, several separate forecasts of based aircraft are developed. Each of the forecasts is then examined for reasonableness and any outliers are discarded or given less weight. The remaining forecasts collectively will create a planning envelope. A single planning forecast is then selected for use in developing facility needs for the airport. The selected forecast of based aircraft can be one of the several forecasts developed or, based on the experience and judgement of the forecaster, it can be a blend of the forecasts.

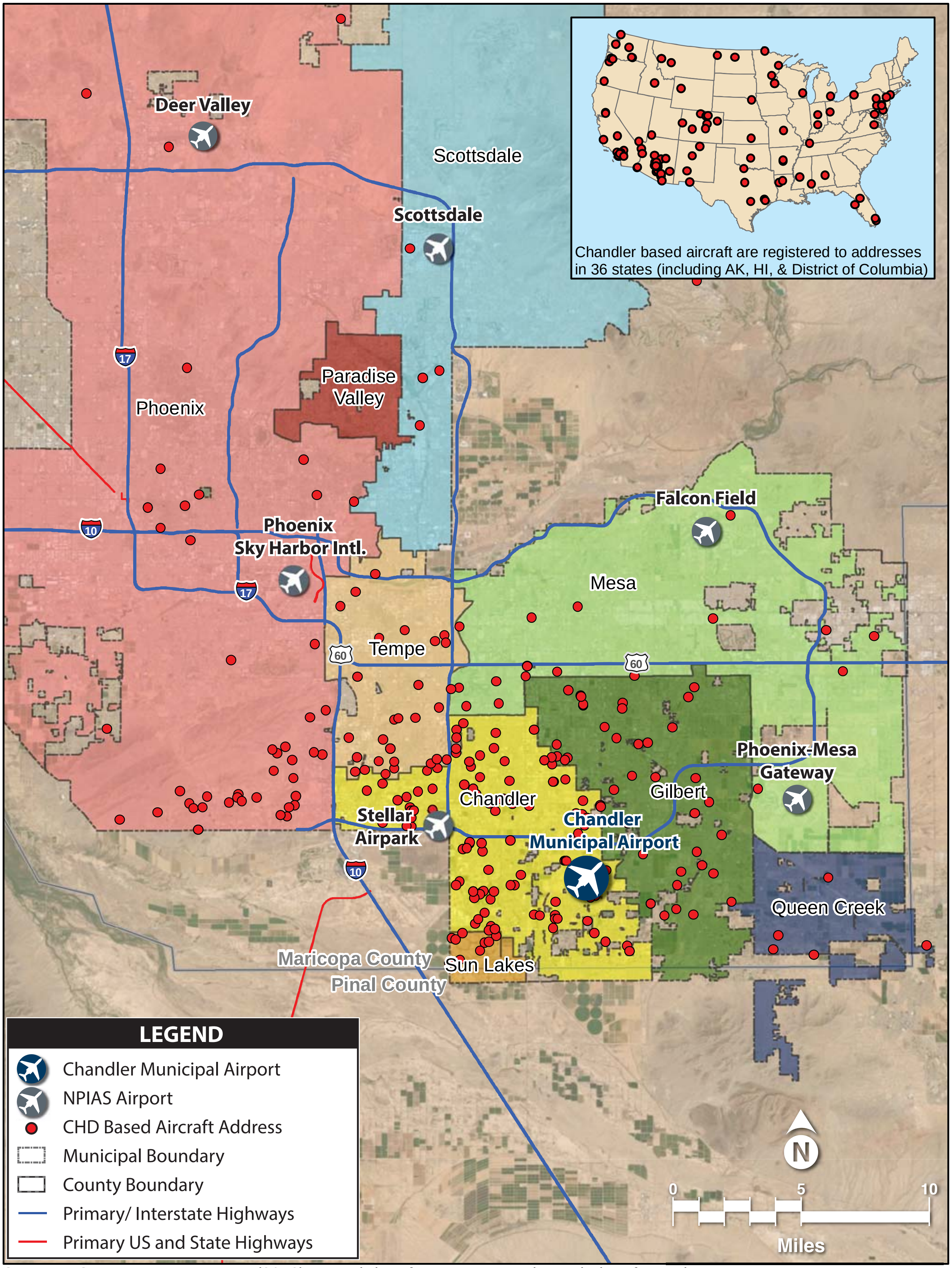
Based Aircraft Inventory

Documentation of the historical number of based aircraft at the airport has been somewhat intermittent. For many years, the FAA did not require airports to report the number of based aircraft. It is only in recent years that the FAA has established a based aircraft inventory in which it is possible to cross-reference based aircraft claimed by one airport with other airports. The FAA is now utilizing this based aircraft inventory as a baseline for determining how many and what type of aircraft are based at any individual airport. This database evolves daily as aircraft are added or removed, and it does not provide an annual history of based aircraft. It is the responsibility of the sponsor (owner) of each airport to input based aircraft information into the FAA database (www.basedaircraft.com).

Airport staff has undertaken a comprehensive physical count and submitted the count to the FAA for validation. The FAA has validated 441 based aircraft (including helicopters) at CHD. The mix of aircraft is comprised of 379 single-engine pistons, 26 multi-engine piston aircraft, six (6) multi-engine turboprops, eight (8) business jets, and 22 helicopters.

As shown on **Exhibit 2B**, based aircraft at CHD are registered to addresses spread throughout the Phoenix metropolitan area and across 36 different states throughout the country. Approximately 74 percent of based aircraft at CHD are registered to addresses in the metropolitan area. Within the communities that make up the metropolitan area, based aircraft are distributed as follows:

- Chandler – 137
- Gilbert – 48
- Phoenix – 46
- Tempe – 31
- Mesa – 23
- Sun Lakes – 9
- Scottsdale – 6
- Queen Creek – 3



Source: ESRI Basemap Imagery (2018), BasedAircraft.com, FAA Registered Aircraft Database

Despite competing with five other reliever airports[1] and five general aviation airports[2] in the region, CHD has managed to attract users from across the metropolitan area. For this reason, the Phoenix metropolitan area is considered CHD's based aircraft service area for purposes of this study.

Registered Aircraft Forecast

Aircraft ownership trends for the primary service area (Phoenix metropolitan area) typically dictate the based aircraft trends for an airport. Since aircraft registration data is only available at the county level, aircraft registration data from Maricopa County will be used to represent the service area. The metropolitan area also extends into Pinal County; however, the overwhelming majority of based aircraft are registered within Maricopa County, so Pinal County has been excluded. As such, a forecast of registered aircraft in Maricopa County is developed for use as an input to the subsequent based aircraft forecast.

In addition to the projections summarized below, several regressions were also prepared considering independent variables ranging from population, income, and employment. None of the resulting regressions produced an r^2 value of better than 0.70, which indicates poor correlation. Therefore, the regressions were not included in the discussion to follow.

Table 2E presents the history of registered aircraft in Maricopa County from 2009 through 2019. These figures are derived from the FAA aircraft registration database that categorizes registered aircraft by county based on the zip code of the registered aircraft. Although this information generally provides a correlation to based aircraft, it is not uncommon for some aircraft to be registered in the county but based at an airport outside the county or vice versa.

Over the ten-year period, aircraft registrations in Maricopa County have declined from almost 5,000 in 2009 to 3,744 in 2019, a drop of 24.9 percent. The fleet mix breakout shows that single-engine piston aircraft, while still accounting for most registered aircraft, has dropped by the largest total number of aircraft. The multi-engine piston category has dropped by the largest percentage (42.2 percent), which matches the national trend. Jet aircraft is the only category that had growth over the period, growing from 296 in 2009 to 305 in 2019. Like most areas of the country, the decline in registered aircraft since 2009 is in part attributable to two primary factors: the impact of the 2008-2009 recession and FAA's re-registration process, which took place between 2010 and 2013. Now that the actual number of registered aircraft has been identified, several projections of future registered aircraft are considered for the 20-year planning horizon.

[1] Falcon Field; Scottsdale Airport; Glendale Municipal; Phoenix Goodyear; and Phoenix Deer Valley
[2] Stellar Airpark; Memorial Airfield; Sky Ranch; Pleasant Valley Airport; and Buckeye Municipal

TABLE 2E | Registered Aircraft Fleet Mix in Maricopa County
Chandler Municipal Airport

Year	Single-Engine Piston	Multi-Engine Piston	Turboprop	Jet	Helicopter	Total
2009	3,723	438	160	296	370	4,987
2010	3,680	439	141	288	351	4,899
2011	3,608	419	130	293	353	4,803
2012	3,215	360	137	314	302	4,328
2013	2,937	337	142	337	265	4,018
2014	2,927	332	134	204	257	3,854
2015	2,949	314	130	220	242	3,855
2016	3,006	316	157	249	246	3,974
2017	3,005	302	139	261	250	3,957
2018	2,824	254	153	274	231	3,736
2019	2,831	253	139	305	216	3,744
10 year % Change	-24.0%	-42.2%	-13.1%	3.0%	-41.6%	-24.9%
Compound Annual Growth Rate from 2009 to 2019						-2.8%

Source: FAA Aircraft Registry Database; FAA Census of U.S. Civil Aircraft

Trend Line/Historic Growth Rate Projection

Utilizing the last 10 years of registered aircraft data, a trendline projection was completed. This resulted in 822 registered aircraft by 2040 (-2.83% CAGR). A five-year trend projection was also prepared, which eliminates years (2010-2013) when there were fluctuations due to the FAA changing aircraft registration requirements. The five-year trendline projection results in 3,233 registered aircraft by 2040 (-0.7% CAGR).

Over the last five years, the number of registered aircraft in Maricopa County has a CAGR of -0.6 percent. By applying this CAGR to the current number of registered aircraft, a forecast emerges resulting in 3,315 by 2040.

Share of U.S. Active General Aviation Aircraft

Maricopa County's 3,744 registered aircraft in 2019 represents approximately 1.755 percent of the U.S. active general aviation fleet of aircraft. If the county maintained a constant market share, it would result in 3,721 registered aircraft by 2040 (-0.03% CAGR). Since the historic trend reflects a decreasing market share, another projection that maintains this trend was prepared, which results in registered aircraft declining to 2,718 by 2040 (-1.51% CAGR). The market share of U.S. active general aviation aircraft projections is included in **Table 2F**.

TABLE 2F | Registered Aircraft Projections – Market Share of U.S. Active GA Aircraft
Chandler Municipal Airport

Year	Registered Aircraft	U.S. Active GA Aircraft	% of U.S. Active GA Aircraft
2009	4,987	223,876	2.228%
2010	4,899	223,370	2.193%
2011	4,803	220,453	2.179%
2012	4,328	209,034	2.070%
2013	4,018	199,927	2.010%
2014	3,854	204,408	1.885%
2015	3,855	210,031	1.835%
2016	3,974	211,794	1.876%
2017	3,957	211,757	1.869%
2018	3,736	212,885	1.755%
2019	3,744	213,375	1.755%
Constant Market Share			
2025	3,728	212,435	1.755%
2030	3,709	211,355	1.755%
2040	3,721	212,065	1.755%
Decreasing Market Share			
2025	3,476	212,435	1.636%
2030	3,209	211,355	1.518%
2040	2,718	212,065	1.282%

Sources: FAA Aerospace Forecasts 2019-2039; Coffman Associates analysis

Ratio of Registered Aircraft to Population

The number of registered aircraft in an area often fluctuates based upon population trends. In 2019, Maricopa County had 0.86 registered aircraft per 1,000 residents. Over the past 10 years, this ratio has declined slightly as a result of a growing population and a decline in total registered aircraft. Two projections have been prepared based upon maintaining the current ratio constant over the forecast period and continuing the trend of a declining ratio. Maintaining the constant ratio (0.86) through 2040 results in 4,896 registered aircraft (1.29% CAGR). A decreasing ratio projection is a more likely scenario since population growth typically outpaces registered aircraft growth. This scenario results in 4,175 registered aircraft by 2040 (0.52% CAGR).

Registered Aircraft Forecast Summary

Table 2G summarizes the seven registered aircraft forecasts for Maricopa County. Five of the seven resulted in a declining CAGR, which based on recent history is not an unreasonable scenario. However, since the end of 2013, which is when the effects of the FAA's new aircraft registration requirements were most greatly felt, registrations have had as many years of increasing numbers as decreasing (three up and three down). The down years were much more drastic than the up years, but it also provides some confidence that aircraft registrations may be stabilizing with potential to grow in the future assuming population growth occurs as forecast and economic conditions continue to improve. As mentioned, it is common for population growth to outpace registered aircraft growth; therefore, for this reason, the decreasing ratio of registered aircraft per 1,000 population will be carried forward as the selected forecast. This modestly optimistic forecast results in 3,841 registered aircraft in 2025; 3,935 in 2030, and 4,175 in 2040.

TABLE 2G | Registered Aircraft Forecast Summary
Chandler Municipal Airport

Projection Sources	2025	2030	2040	CAGR 2019-2040
5-Year Trend	3,629	3,497	3,233	-0.70%
10-Year Trend	2,768	2,119	822	-6.97%
5-Year Growth Rate	3,616	3,513	3,315	-0.58%
Constant % of U.S. Active Aircraft	3,728	3,709	3,721	-0.03%
Decreasing % of U.S. Active Aircraft	3,476	3,209	2,718	-1.51%
Constant Aircraft per 1,000 Population	4,098	4,378	4,896	1.29%
Decreasing Aircraft per 1,000 Population	**3,841**	**3,935**	**4,175**	**0.52%**

Boldface indicates selected forecast.
CAGR: Compound annual growth rate
Source: Coffman Associates analysis

Based Aircraft Market Share of Registered Aircraft Forecast

Utilizing the forecast of registered aircraft in Maricopa County, a market share forecast of based aircraft at CHD has been developed. In 2019, the 441 aircraft based at CHD represented 11.78 percent of the aircraft registered in Maricopa County. By maintaining this market share as a constant through the planning years, a forecast emerges resulting in 492 based aircraft by 2040 (0.5% CAGR). An evaluation of various historical points (2005, 2009, and 2016) indicates that CHD's market share has grown slightly over time. Therefore, an increasing market share projection was also prepared with the assumption that this historic trend would continue to the point that CHD's market share would reach 16 percent of county registrations. This increasing share projection results in 668 based aircraft by 2040 (2.0% CAGR). **Table 2H** presents the two market share projections.

TABLE 2H | Based Aircraft Market Share of Registered Aircraft Forecast
Chandler Municipal Airport

Year	CHD Based Aircraft	Maricopa County Registered Aircraft	CHD Market Share %
2005	457	4,825	9.47%
2009	378	4,987	7.58%
2016	440	3,974	11.07%
2019	441	3,744	11.78%
Constant Market Share			
2025	452	3,841	11.78%
2030	463	3,935	11.78%
2040	492	4,175	11.78%
Increasing Market Share			
2025	493	3,841	12.83%
2030	547	3,935	13.89%
2040	668	4,175	16.00%

Source: Coffman Associates analysis

Statewide TAF Growth Rate Projection

For all NPIAS airports in Arizona, the FAA projects an annual growth rate in based aircraft of 1.49 percent. Assuming CHD's based aircraft count increases at the state's TAF rate, the count would reach 602 by 2040 (1.49% CAGR).

Historic Growth Rate Projection

According to based aircraft records, CHD's count has grown in the last 10 years from 378 in 2009 to 441 in 2019, which is a CAGR of 1.56 percent. Assuming CHD maintains this growth rate over the course of the forecast period, the count grows to 610 by 2040.

Socioeconomic Growth Projections

Based aircraft growth is often related to population and economic activity of the service area. For this reason, based aircraft projections tied to projected growth in population, employment, and gross regional product (GRP) for Maricopa County were also prepared. Through 2040, population in the county is projected to increase at a CAGR of 1.29 percent; employment is projected to have a CAGR of 1.79 percent; and GRP is projected to have a CAGR of 2.68 percent. Applying these CAGRs result in 577 based aircraft for population, 640 for employment, and 769 for GRP by 2040.

Selected Based Aircraft Forecast

Selecting a based aircraft forecast is ultimately based on the judgement of the forecast analyst. A selected forecast should be reasonable and based upon a sound methodology. The methodology presented in this analysis first examines the history of aircraft ownership in Maricopa County, the primary based aircraft service area. Utilizing the selected registered aircraft projection, a market share analysis was conducted based upon maintaining a constant market share and an increasing market share over the forecast period. Additional projections considered the FAA TAF's projection for based aircraft growth in the state, maintaining CHD's 10-year growth rate, and growth rates based on key socioeconomic indicators (population, employment, and GRP). Each of these seven projections are summarized in **Table 2J**.

TABLE 2J | Based Aircraft Forecast Summary
Chandler Municipal Airport

Projection	2025	2030	2040	2019-2040 CAGR
10-Year Growth Rate	484	522	610	1.56%
Constant Market Share of County Registrations	452	463	492	0.52%
Increasing Market Share of County Registrations	493	547	668	2.00%
State TAF Growth Rate	482	519	602	1.49%
County Population Growth Rate	476	508	577	1.29%
County GRP Growth Rate	517	590	769	2.68%
County Employment Growth Rate	**490**	**540**	**640**	**1.79%**

Boldface indicates selected forecast.
CAGR: Compound annual growth rate
Source: Coffman Associates analysis

Another important consideration is whether an airport has a hangar waiting list, which indicates what the current demand level is for new based aircraft. CHD maintains a current waiting list for hangar space that includes 112 individuals. Waiting lists are not verified so the actual demand is likely less than the total number of names on the list; however, this number indicates strong demand for new based aircraft.

The selected based aircraft forecast should account for this potential growth plus room for additional demand that is not represented on the waiting list.

As has been mentioned previously, based aircraft levels are typically tied to economic conditions and availability of hangar space. CHD will likely not see significant based aircraft growth unless new hangar facilities are constructed. CHD has ample developable property for new hangars both on the north and south sides of the airfield so the potential for available hangar space should not be a limiting factor in future based aircraft levels. Economic conditions within the county are also projected to increase at strong rates. Therefore, the employment growth rate projection has been selected as the preferred forecast. The selected forecast is reasonably optimistic and assumes CHD can continue to gain market share of registered aircraft in the county and that continued employment growth in the local area will drive demand for more based aircraft.

Exhibit 2C graphically presents the seven based aircraft forecasts that comprise the planning envelope.

BASED AIRCRAFT FLEET MIX FORECAST

It is important to understand the current and projected based aircraft fleet mix at an airport to ensure the planning of proper facilities. For example, the addition of one or several larger turboprop or business jet aircraft to the airfield can have a significant impact on the separation requirements and the various obstacle-clearing surfaces.

The current based aircraft fleet mix consists of 379 single-engine pistons, 26 multi-engine pistons, six turboprops, eight jets, and 22 helicopters. As a general aviation reliever airport with a significant level of flight training activities, CHD should continue to have a high level of piston-powered aircraft and helicopters; however, turbine aircraft are also becoming more prevalent. The forecasted growth trends in the CHD-based aircraft fleet mix are consistent with FAA projections of the national general aviation fleet mix. **Table 2K** presents the forecast fleet mix for based aircraft at CHD.

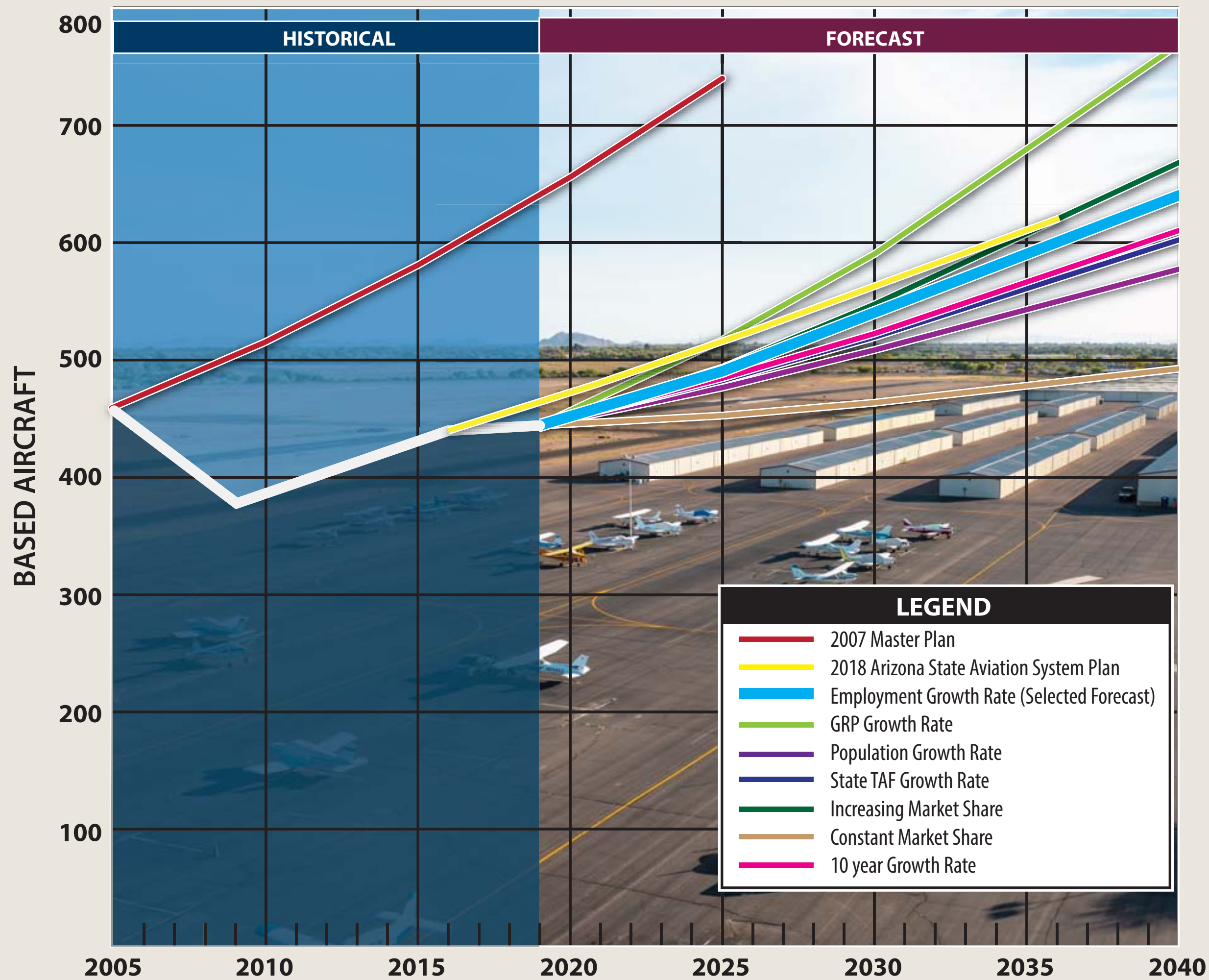
TABLE 2K | Based Aircraft Fleet Mix
Chandler Municipal Airport

Aircraft Type	2019[1]	Percent	2025	Percent	2030	Percent	2040	Percent
SEP	379	85.9%	424	86.5%	469	86.9%	552	86.3%
MEP	26	5.9%	24	4.9%	20	3.7%	15	2.3%
Turboprop	6	1.4%	7	1.4%	9	1.7%	13	2.0%
Jet	8	1.8%	10	2.0%	13	2.4%	20	3.1%
Helicopters	22	5.0%	25	5.1%	29	5.4%	40	6.3%
Total	441	100.0%	490	100.0%	540	100.0%	640	100.0%

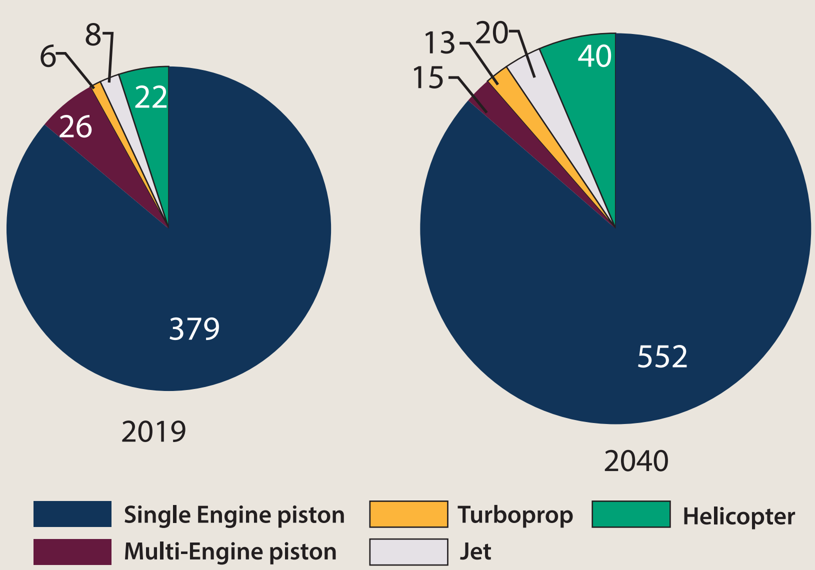
SEP – Single-Engine Piston
MEP – Multi-Engine Piston

Sources: 2019 fleet mix - FAA Based Aircraft Registry; Projections - Coffman Associates analysis

Based Aircraft



Based Aircraft Fleet Mix



OPERATIONS FORECAST

Operations at CHD are classified as either general aviation, air taxi, or military. General aviation operations include a wide range of activity from recreational use and flight training to business and corporate uses. Air taxi operations are those conducted by aircraft operating under FAR Part 135, otherwise known as "for-hire" or "on-demand" activity. Air taxi operations typically include commuter, air cargo, air ambulance, and many fractional ownership operations. Military operations include those operations conducted by various branches of the U.S. military.

It should be noted that the FAA's forecast of air taxi operations is lower than historic levels due to ongoing changes to the scheduled airline aircraft fleet mix. Airlines are transitioning away from 50-seat regional jets that are counted under the air taxi category to larger jets with seating capacities of 60 seats or more that are counted under the air carrier category. This airline fleet mix transition should have no impact on CHD air taxi operations.

Aircraft operations are further classified as local and itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of an airport, or which executes simulated approaches or touch-and-go operations at an airport. Generally, local operations are characterized by training activity. Itinerant operations are those performed by aircraft with a specific origin or destination away from an airport. Typically, itinerant operations increase with business and commercial use since business aircraft are used primarily to transport passengers from one location to another.

Several methods have been employed to develop a reasonable planning envelope. The following sections present several new operations forecasts. Counts from the CHD airport traffic control tower (ATCT) were utilized in this analysis.

Historic Growth Rate Projections

CHD's ATCT count indicate CAGRs of 0.3 percent for itinerant general aviation operations, 0.9 percent for local general aviation operations, and 3.4 percent for air taxi operations. Assuming these rates remain constant over the forecast period results in 2040 operations projections of 72,200 (itinerant general aviation), 181,900 (local general aviation), and 6,100 (air taxi).

Market Share Projections

Market share analysis compares known historical and forecast data points to arrive at a trend for the unknown variable (CHD operations). The first forecast considers the current market share of general aviation (itinerant and local) and air taxi operations at the airport as compared to the FAA national forecast for operations at towered airports. In 2019, CHD accounted for 0.476 percent of U.S. itinerant general aviation operations; 1.182 percent of U.S. local general aviation operations; and 0.042 percent of U.S. air taxi operations. By carrying these percentages forward to the plan years, a constant market share forecast emerges. **Table 2L** shows the results. The constant market share is considered a low-range projection since the historic data indicates that CHD's market share for each operational category is growing.

To carry forward historic trends, a mid-range increasing market share projection was prepared. The mid-range projection takes CHD's 2040 market share of itinerant general aviation operations to 0.580 percent, which is its 10-year high. CHD's 2040 market share of local general aviation operations is taken to 1.230 percent, which is also a 10-year high. CHD's 2040 market share of air taxi operations is taken to 0.061 percent, which reflects the increase in market share experienced between 2009 and 2019. The results of the mid-range projections are also shown on **Table 2L**.

High-range increasing market share projections were also prepared, which consider the potential for operations to exceed the peak periods and growth rates of the past ten years. The resulting projections take CHD's 2040 market shares to 0.600 percent (itinerant general aviation), 1.457 percent (local general aviation), and 0.080 percent (air taxi). The results of the high-range projections are shown on **Table 2L**.

TABLE 2L | Operations Market Share Projections
Chandler Municipal Airport

Year	General Aviation Itinerant			General Aviation Local			Air Taxi		
	CHD	U.S.	CHD Market %	CHD	U.S.	CHD Market %	CHD	U.S.	CHD Market %
2010	57,122	14,863,856	0.384%	106,197	11,716,274	0.906%	2,041	9,410,381	0.022%
2011	60,891	14,527,903	0.419%	98,068	11,437,028	0.857%	2,168	9,278,542	0.023%
2012	72,816	14,521,656	0.501%	121,951	11,608,306	1.051%	2,490	8,994,371	0.028%
2013	77,234	14,117,424	0.547%	131,231	11,688,301	1.123%	2,430	8,803,412	0.028%
2014	76,702	13,978,996	0.549%	138,887	11,675,040	1.190%	1,852	8,439,713	0.022%
2015	80,604	13,886,711	0.580%	137,425	11,691,338	1.175%	1,707	7,894,945	0.022%
2016	77,860	13,904,397	0.560%	141,586	11,632,078	1.217%	1,749	7,579,584	0.023%
2017	71,440	13,838,029	0.516%	119,204	11,731,596	1.016%	3,215	7,179,301	0.045%
2018	73,107	14,130,495	0.517%	151,972	12,354,014	1.230%	3,148	7,125,556	0.044%
2019	67,647	14,223,305	0.476%	149,754	12,672,345	1.182%	2,990	7,196,959	0.042%
Constant Market Share - Low Range									
2025	68,700	14,450,204	0.476%	152,600	12,911,636	1.182%	2,300	5,534,735	0.042%
2030	69,700	14,645,457	0.476%	155,100	13,124,605	1.182%	2,400	5,809,266	0.042%
2040	71,600	15,053,939	0.476%	160,400	13,571,495	1.182%	2,700	6,426,228	0.042%
CAGR	0.27%			0.33%			-0.48%		
Increasing Market Share - Mid Range									
2025	72,500	14,450,204	0.502%	154,100	12,911,636	1.194%	3,400	5,534,735	0.061%
2030	77,300	14,645,457	0.528%	158,300	13,124,605	1.206%	3,600	5,809,266	0.061%
2040	87,400	15,053,939	0.580%	166,900	13,571,495	1.230%	3,900	6,426,228	0.061%
CAGR	1.23%			0.52%			1.27%		
Increasing Market Share - High Range									
2025	73,200	14,450,204	0.507%	161,500	12,911,636	1.251%	3,900	5,534,735	0.070%
2030	78,800	14,645,457	0.538%	173,200	13,124,605	1.319%	4,400	5,809,266	0.075%
2040	90,300	15,053,939	0.600%	197,700	13,571,495	1.457%	5,100	6,426,228	0.080%
CAGR	1.38%			1.33%			2.58%		
CAGR – Compound Annual Growth Rate									

Source: U.S. Operations – FAA Aerospace Forecasts 2019-2039 (2040 extrapolated); Historic CHD operations – CHD ATCT counts; CHD projections - Coffman Associates analysis.

Statewide TAF Growth Rate Forecast

FAA Order 5090.3C, *Field Formulation of the NPIAS,* provides a method for estimating future operations at an airport by applying the statewide TAF growth rate. While this is typically used for non-towered airports, it does provide a useful method for checking the reasonableness of other forecasts and, if determined to be the most reasonable, can be the selected forecast. For all NPIAS airports in Arizona, the FAA projects an annual growth rate of 0.16 percent for itinerant general aviation operations, 0.44 percent for local general aviation operations, and 0.57 percent for air taxi operations in the state. Applying these growth rates results in projections taking CHD's 2040 operations to 70,000 (itinerant general aviation), 164,300 (local general aviation), and 3,400 (air taxi).

Operations Forecast Summary

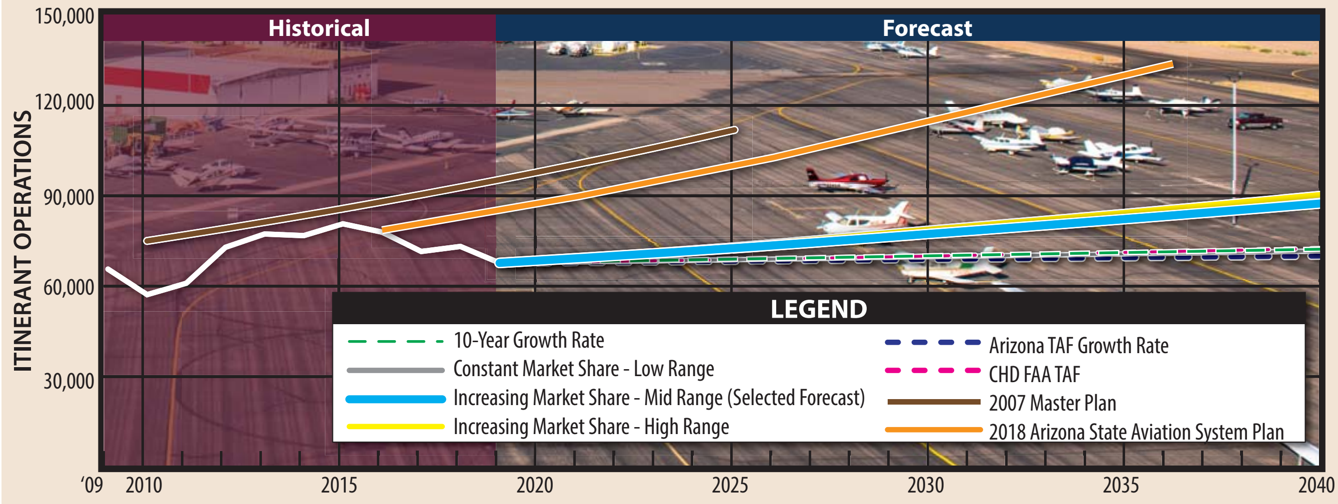
Table 2M summarizes each of the new projections prepared for itinerant and local general aviation operations and air taxi operations at CHD. The selected forecasts for each category represent healthy yet modest growth scenarios for CHD in which itinerant general aviation operations grow to 87,400 by 2040; local general aviation operations grow to 181,900 by 2040; and air taxi operations grow to 5,100 by 2040. **Exhibit 2D** graphically presents the operations projections that comprise the planning envelope. The FAA TAF is included for comparison.

TABLE 2M | Operations Forecast Summary
Chandler Municipal Airport

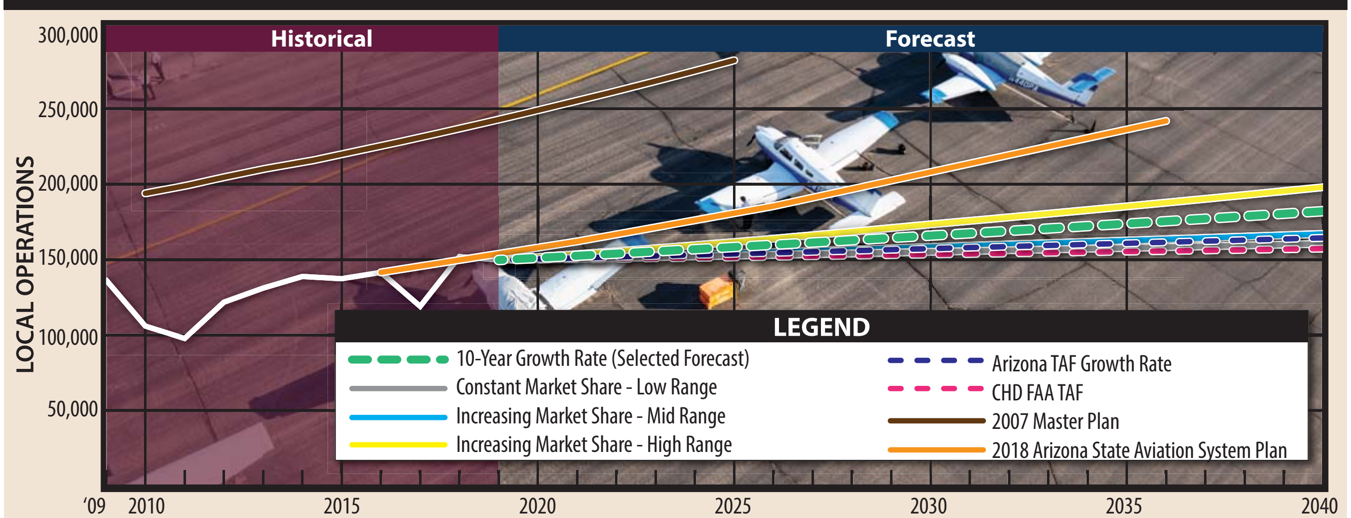
Projections	2019	2025	2030	2040	2019-2040 CAGR
Itinerant General Aviation					
10-Year Growth Rate	67,647	68,900	70,000	72,200	0.31%
Constant Market Share – Low-Range		68,700	69,700	71,600	0.27%
Increasing Market Share – Mid-Range		**72,500**	**77,300**	**87,400**	**1.23%**
Increasing Market Share – High-Range		73,200	78,800	90,300	1.38%
Arizona 2019 TAF Growth Rate		68,300	68,900	70,000	0.16%
CHD 2019 TAF		68,706	69,916	72,402	0.32%
Local General Aviation					
10-Year Growth Rate	149,754	**158,300**	**165,800**	**181,900**	**0.93%**
Constant Market Share – Low-Range		152,600	155,100	160,400	0.33%
Increasing Market Share – Mid-Range		154,100	158,300	166,900	0.52%
Increasing Market Share – High-Range		161,500	173,200	197,700	1.33%
Arizona 2019 TAF Growth Rate		153,800	157,200	164,300	0.44%
CHD 2019 TAF		151,488	153,378	157,233	0.23%
Air Taxi					
10-Year Growth Rate	2,990	3,700	4,300	6,100	3.45%
Constant Market Share – Low-Range		2,300	2,400	2,700	-0.48%
Increasing Market Share – Mid-Range		3,400	3,600	3,900	1.27%
Increasing Market Share – High-Range		**3,900**	**4,400**	**5,100**	**2.58%**
Arizona 2019 TAF Growth Rate		3,100	3,200	3,400	0.61%
CHD 2019 TAF		2,784	2,784	2,784	-0.34%

Boldface indicates selected forecast
CAGR – Compound Annual Growth Rate
Source: Coffman Associates Analysis

GENERAL AVIATION ITINERANT OPERATIONS FORECASTS



GENERAL AVIATION LOCAL OPERATIONS FORECASTS



AIR TAXI OPERATIONS FORECASTS

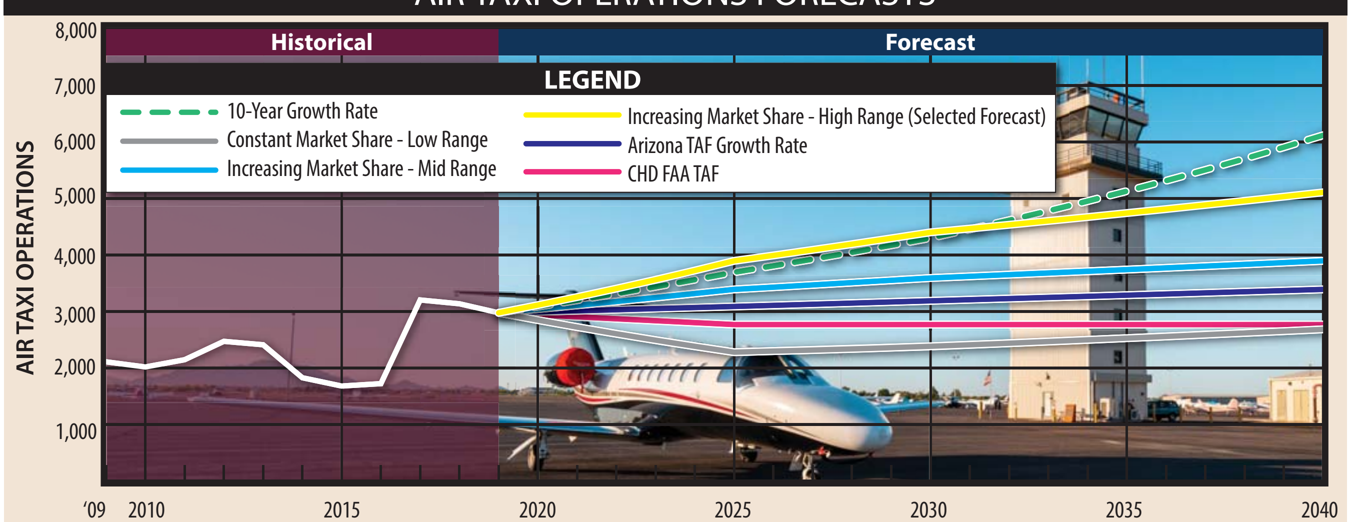


Exhibit 2D
OPERATIONS PROJECTIONS

Military Operations Forecast

Military aircraft can and do utilize civilian airports across the country. CHD does, on occasion, have activity by military aircraft. Forecasts of military activity are inherently difficult to predict because of the national security nature of their operations and the fact that their missions can change without notice. Thus, it is typical for the FAA to use a flat-line forecast for military operations. For CHD, the FAA TAF projects itinerant military and local military operations to remain static at 213 and 62, respectively, over the forecast period. These TAF estimates are also utilized for the master plan forecast.

Total Operations Forecast Summary

Table 2N presents the summary of the selected operations forecasts.

TABLE 2N | Total Operations Forecast Summary
Chandler Municipal Airport

	Itinerant					Local			
Year	**Air Carrier**	**Air Taxi**	**General Aviation**	**Military**	**Total**	**General Aviation**	**Military**	**Total**	**Total Operations**
2019	0	2,990	67,647	199	70,836	149,754	72	149,826	220,662
2025	0	3,900	72,500	213	76,613	158,300	62	158,362	234,975
2030	0	4,400	77,300	213	81,913	165,800	62	165,862	247,775
2040	0	5,100	87,400	213	92,713	181,900	62	181,962	274,675
CAGR	--	2.58%	1.23%	0.32%	1.29%	0.93%	-0.71%	0.93%	1.05%

CAGR = Compound annual growth rate

PEAKING CHARACTERISTICS

Many aspects of facility planning relate to levels of peaking activity – times when an airport is busiest. For example, the appropriate size of terminal facilities can be estimated by determining the number of people that could reasonably be expected to use the facility at a given time. The following planning definitions apply to the peak periods:

- **Peak Month** -- The calendar month when peak aircraft operations occur.
- **Design Day** -- The average day in the peak month.
- **Design Hour** -- The peak hour within the design day.

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

Tower operations data provides an understanding of the peak operational periods for the airport. Over the last three years, the peak month has averaged 10.4 percent of annual operations. The design day is the peak month average divided by the number of days in the peak month. The peak months for the last three years have been a month with 31 days; thus, the peak month is divided by 31 days. The busy day during the average week of the peak month was 41 percent more than the design day. The design hour averaged 15.16 percent of design day operations. **Table 2P** summarizes the peaking operational characteristics for the airport.

TABLE 2P | Peaking Characteristics
Chandler Municipal Airport

Peak Period	2019	205	2030	2040
Annual Operations	220,662	234,975	247,775	274,675
Peak Month	22,930	24,410	25,740	28,540
Busy Day	1,042	1,131	1,192	1,321
Design Day	740	803	846	938
Design Hour	115	125	132	146

Source: Coffman Associates analysis

FORECAST SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the planning period. **Exhibit 2E** presents a summary of the aviation forecasts prepared in this chapter. The base year for these forecasts is 2019, with a 21-year planning horizon to 2040. The primary aviation demand indicators are based aircraft and operations. Based aircraft are forecast to increase from 441 in 2019 to 640 by 2040 (1.79% CAGR). Total operations are forecast to increase from 220,662 in 2019 to 274,675 by 2040 (1.05% CAGR).

Projections of aviation demand will be influenced by unforeseen factors and events in the future. Therefore, it is not reasonable to assume that future demand will follow the exact projection line, but over time, forecasts of aviation demand tend to fall within the planning envelope. The forecasts developed for this master planning effort are considered reasonable for planning purposes. The need for additional facilities will be based upon these forecasts; however, if demand does not materialize as projected, then implementation of facility construction can be slowed. Likewise, if demand exceeds these forecasts, then implementation of facility construction can be accelerated.

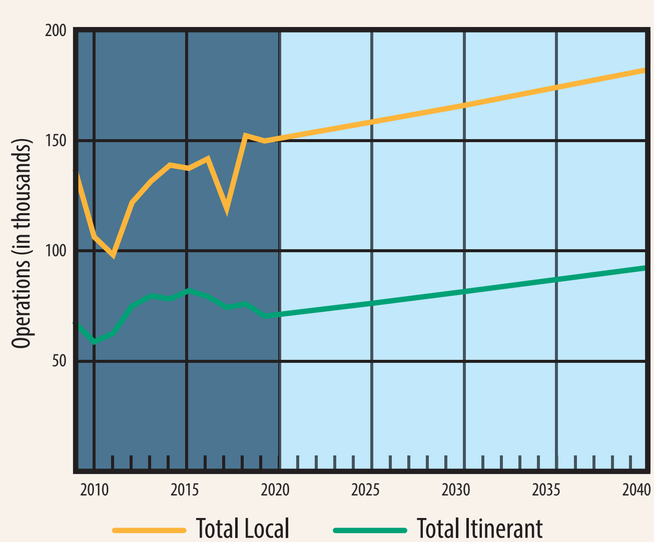
FORECAST COMPARISON TO THE TAF

The FAA reviews the forecasts presented in this aviation planning study for comparison to the *Terminal Area Forecast*. The forecasts are considered consistent with the TAF if they meet the following criteria:

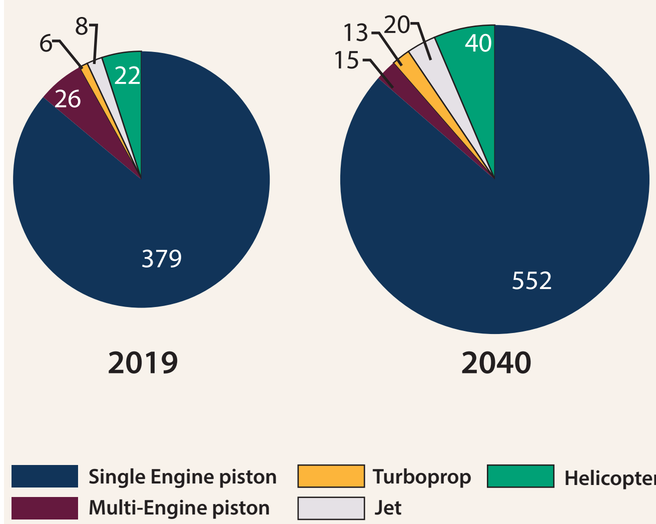
- Forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period, or
- Forecasts do not affect the timing or scale of an airport project, or
- Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems*.

	2019	FORECAST 2025	FORECAST 2030	FORECAST 2040
AIRCRAFT OPERATIONS				
Itinerant				
Air Taxi	2,990	3,900	4,400	5,100
General Aviation	67,647	72,500	77,300	87,400
Military	199	213	213	213
Subtotal	***70,836***	***76,613***	***81,913***	***92,713***
Local				
General Aviation	149,754	158,300	165,800	181,900
Military	72	62	62	62
Subtotal	***149,826***	***158,362***	***165,862***	***181,962***
Total Operations	**220,662**	**234,975**	**247,775**	**274,675**
PEAKING				
Peak Month	22,930	24,410	25,740	28,540
Busy Day	1,042	1,131	1,192	1,321
Design Day	740	803	846	938
Design Hour	115	125	132	146
BASED AIRCRAFT				
Single-Engine Piston	379	424	469	552
Multi-Engine Piston	26	24	20	15
Turboprop	6	7	9	13
Jet	8	10	13	20
Helicopter	22	25	29	40
Total Based Aircraft	**441**	**490**	**540**	**640**

TOTAL OPERATIONS FORECAST



BASED AIRCRAFT FLEET MIX



If the forecasts exceed these parameters, they may be sent to FAA headquarters in Washington, D.C. for further review. **Table 2Q** presents the direct comparison of the master planning forecasts with the TAF published in February 2019.

TABLE 2Q | Forecast Comparison to the *Terminal Area Forecast*
Chandler Municipal Airport

	BASE YEAR	FORECAST		
	2019	2025	2030	2040
Operations				
Master Plan Forecast	220,662	234,975	247,775	274,675
2019 FAA TAF	220,316	223,253	226,353	232,694
% Difference	0.16%	5.12%	9.04%	16.55%
Based Aircraft				
Master Plan Forecast	441	490	540	640
2019 FAA TAF	160	193	224	301
% Difference	93.51%	86.97%	82.72%	72.05%

CAGR: Average annual growth rate
TAF: *Terminal Area Forecast* (published February 2019)

Total operations are within the FAA range for consistency. The based aircraft forecasts are higher than the TAF and are not within the FAA range for consistency. The baseline for based aircraft must be consistent with what is documented in the FAA based aircraft database (www.basedaircraft.com). Currently, there are 441 validated based aircraft at the airport, thus this is the starting point for the based aircraft forecast. The FAA should update the TAF to reflect the actual number of validated based aircraft.

The forecasts are not expected to affect the timing or scale of any major airport projects, and the role of the airport as a reliever general aviation facility is not expected to change.

AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION

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

AIRCRAFT CLASSIFICATION

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or a composite aircraft representing a collection of aircraft with similar characteristics. 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, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2F.**

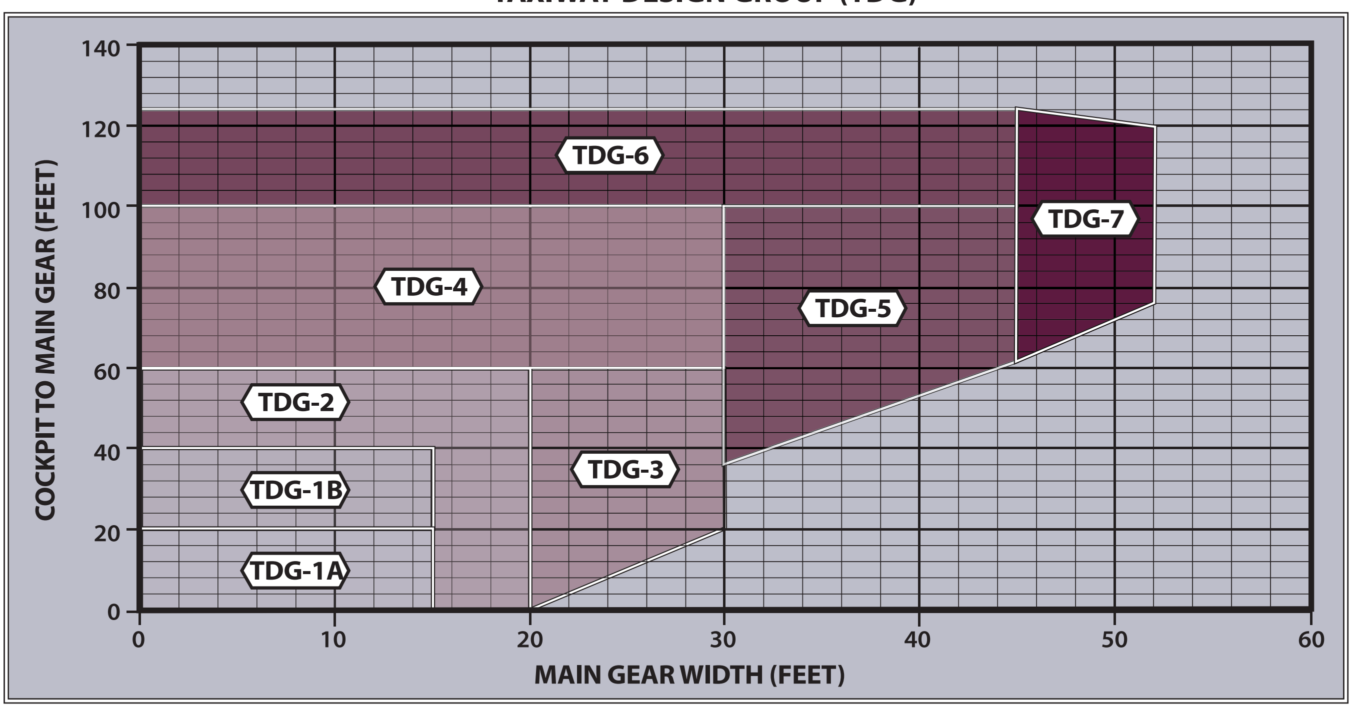
AIRCRAFT APPROACH CATEGORY (AAC)	
Category	**Approach Speed**
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

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

VISIBILITY MINIMUMS	
RVR* (ft)	**Flight Visibility Category (statute miles)**
VIS	3-mile or greater visibility minimums
5,000	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

***RVR:** Runway Visual Range

TAXIWAY DESIGN GROUP (TDG)



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

A-I

Aircraft	TDG
Beech Baron 55	1A
Beech Bonanza	**1A**
Cessna 150, 172	1A
Eclipse 500	1A
Piper Archer, Seneca	1A

B-I

Aircraft	TDG
Beech Baron 58	**1A**
Beech King Air 90	1A
Cessna 421	1A
Cessna Citation CJ1 (525)	1A
Cessna Citation 1 (500)	2
Embraer Phenom 100	1B

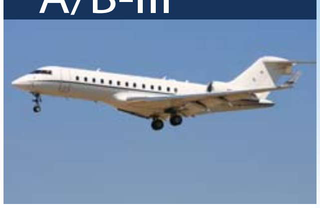
A/B-II *12,500 lbs. or less*

Aircraft	TDG
Beech Super King Air 200	**2**
Cessna 441 Conquest	1A
Cessna Citation CJ2 (525A)	2
Pilatus PC-12	1A

B-II *over 12,500 lbs.*

Aircraft	TDG
Beech Super King Air 350	2
Cessna Citation CJ3(525B), Bravo (550), V (560)	2
Cessna Citation CJ4 (525C)	**1B**
Cessna Citation Latitude/Longitude	1B
Embraer Phenom 300	1B
Falcon 10, 20, 50	1B
Falcon 900, 2000	2
Hawker 800, 800XP, 850XP, 4000	1B
Pilatus PC-24	1B

A/B-III



Aircraft	TDG
Bombardier Dash 8	3
Bombardier Global 5000, 6000, 7000, 8000	**2**
Falcon 6X, 7X, 8X	2

C/D-I

Aircraft	TDG
Lear 25, 31, 45, 55, **60**	**1B**
Learjet 35, 36 (D-I)	1B

C/D-II

Aircraft	TDG
Challenger 600/604/ 800/850	1B
Cessna Citation VII, X+	1B
Embraer Legacy 450/500	1B
Gulfstream IV, 350, 450 (D-II)	2
Gulfstream G200/G280	1B
Lear 70, 75	1B

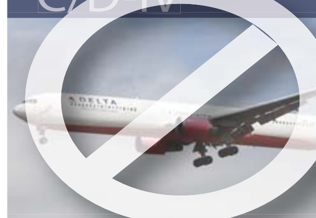
C/D-III *less than 150,000 lbs.*

Aircraft	TDG
Gulfstream V	2
Gulfstream G500, 550, 600, **650 (D-III)**	**2**

C/D-III *over 150,000 lbs.*

Aircraft	TDG
Airbus A319-100, 200	3
Boeing 737 -800, 900, BBJ2 (D-III)	**3**
MD-83, 88 (D-III)	4

C/D-IV



Aircraft	TDG
Airbus A300-100, 200, 600	5
Boeing 757-200	4
Boeing 767-300, **400**	**5**
MD-11	6

D-V

Aircraft	TDG
Airbus A330-200, 300	5
Airbus A340-500, 600	6
Boeing 747-100 - 400	5
Boeing 777-300	6
Boeing 787-8, 9	**5**

Note: Aircraft pictured is identified in bold type.

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

The AAC generally refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards. The AAC, depicted by a letter A through E, is the aircraft approach category and relates to aircraft approach speed (operational characteristics). The AAC generally applies to runways and runway-related facilities, such as runway width, runway safety area (RSA), runway object free area (ROFA), runway protection zone (RPZ), and separation standards.

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

Taxiway Design Group (TDG): A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the design aircraft. The TDG is classified by an alphanumeric system: 1A, 1B, 2, 3, 4, 5, 6, and 7. The taxiway design elements determined by the application of the TDG include the taxiway width, taxiway edge safety margin, taxiway shoulder width, taxiway fillet dimensions, and, in some cases, the separation distance between parallel taxiways/taxilanes. Other taxiway elements, such as the taxiway safety area (TSA), taxiway/taxilane object free area (TOFA), taxiway/taxilane separation to parallel taxiway/taxilanes or fixed or movable objects, and taxiway/taxilane wingtip clearances, are determined solely based on the wingspan (ADG) of the design aircraft utilizing those surfaces. It is appropriate for taxiways to be planned and built to different TDG standards based on expected use.

The back side of **Exhibit 2F** summarizes the classification of the most common aircraft in operation today. Generally, recreational and business piston and turboprop aircraft will fall in AAC A and B, and ADG I and II. Business jets typically fall in AAC B and C, while the larger commercial aircraft will fall in AAC C and D.

AIRPORT AND RUNWAY CLASSIFICATIONS

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

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

The AAC, ADG, and runway visual range (RVR) are combined to form the RDC of a 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 available instrument approach 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 reads "VIS" for runways designed for visual approach use only.

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

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

***Airport Reference Code (ARC)*:** An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely at an airport. The current Airport Layout Plan (ALP) for CHD identifies the ARC as B-II.

CRITICAL DESIGN AIRCRAFT

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

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

The design aircraft is defined as the most demanding aircraft type, 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 importance, since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short-term development does not preclude the reasonable long-range potential needs of the airport.

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

AIRPORT DESIGN AIRCRAFT

There are three elements for classifying the airport design aircraft. The three elements are the AAC, ADG, and the TDG. The AAC and ADG are examined first, followed by the TDG.

The FAA's Traffic Flow Management System Count (TFMSC) database captures an operation when a pilot files a flight plan 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, limited radar coverage, and VFR operations, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type. However, the TFMSC does provide an accurate reflection of IFR activity. Operators of high-performance aircraft, such as turboprops and jets, tend to file flight plans at a high rate. **Exhibit 2G** presents the TFMSC operational mix at the airport for turboprops and jets since 2009. According to this data, operations at CHD within AAC B and ADG II have exceeded the 500 operations threshold each year since 2009. Operations within AAC C at CHD have grown in the past couple years; however, they are still well below the 500 annual operations threshold.

Airport Design Aircraft Summary

The current aircraft approach category is "B." The current airplane design group is "II." The most active B-II airplane at CHD is the Beechcraft King Air 200/300/350, which are TDG 2 aircraft. **Therefore, the current airport design aircraft is classified as B-II-2. The future airport design aircraft is planned to remain as B-II-2 represented by small to mid-sized business jet aircraft such as the Cessna Citation Jet CJ4 or Citation X.** As a general aviation reliever, CHD's operations portfolio is anticipated to remain within the AAC A/B and ADG I/II categories. Operations for AAC C/D and ADG III are not anticipated to exceed 500 annual operations in the future.

RUNWAY DESIGN CODE

The RDC relates to specific FAA design standards that should be met in relation to a runway. The RDC takes into consideration the AAC, ADG, and the RVR. In most cases, the critical design aircraft will also be the RDC for the primary runway.

ARC	Aircraft Model	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
A-I	Cirrus Vision Jet	0	0	0	0	0	0	0	0	4	8
	Eclipse 400/500	4	6	8	22	8	10	18	10	16	8
	Epic Dynasty	0	0	0	0	4	2	2	2	0	0
	Kodiak Quest	2	10	42	24	18	0	0	4	2	2
	Lancair 4	6	0	0	0	0	0	0	0	0	0
	Lancair Evolution/Legacy	6	26	18	20	38	10	4	6	4	36
	Piper Malibu/Meridian	26	28	44	72	90	96	82	136	76	66
	Socata TBM 7/850/900	106	72	76	32	28	26	30	40	126	250
	TOTAL	150	142	188	170	186	144	136	198	228	370
A-II	Cessna Caravan	2	2	4	6	4	4	10	12	14	16
	De Havilland Twin Otter	0	0	0	2	0	2	0	0	0	8
	Pilatus PC-12	36	32	40	66	80	110	50	38	100	114
	TOTAL	38	34	44	74	84	116	60	50	114	138
B-I	Beechjet 400	16	14	18	18	10	14	6	6	0	6
	Cessna 425 Corsair	48	30	24	26	20	46	68	40	34	66
	Citation CJ1	180	218	176	70	70	70	78	124	90	82
	Citation I/SP	2	12	6	22	6	6	10	10	22	8
	Citation M2	0	0	0	0	0	0	0	2	0	2
	Citation Mustang	8	4	14	86	84	82	48	18	16	4
	Falcon 10	4	0	0	0	0	0	0	2	2	2
	Honda Jet	0	0	0	0	0	0	50	28	6	14
	King Air 90/100	124	144	62	46	42	56	76	88	88	96
	Mitsubishi MU-2	22	16	12	2	4	2	0	4	6	2
	Phenom 100	4	22	4	6	18	22	16	8	6	8
	Piaggio Avanti	4	10	4	0	0	0	2	2	2	0
	Piper Cheyenne	14	12	4	0	6	4	10	0	4	2
	Premier 1	0	6	0	2	2	0	4	4	4	0
	TOTAL	426	488	324	278	262	302	368	336	280	292
B-II	Aero Commander 690	32	14	6	16	84	124	90	116	116	88
	Beech 1900	2	2	0	0	0	4	0	0	0	0
	Cessna Conquest	40	54	36	14	22	38	36	20	16	30
	Challenger 300	0	0	2	4	0	2	8	12	16	26
	Citation CJ2/CJ3/CJ4	74	66	142	166	172	160	166	174	218	188
	Citation II/SP/Latitude	4	8	22	8	24	20	36	24	32	46
	Citation Longitude	0	0	0	0	0	0	0	0	0	4
	Citation V/Sovereign	34	72	114	148	136	152	54	92	102	94
	Citation X	0	16	6	14	8	12	10	0	6	8
	Citation XLS	74	36	64	32	30	62	132	82	70	46
	Dornier 328	0	0	0	0	2	0	0	0	4	0
	Falcon 20/50	2	2	0	0	4	2	2	6	2	2
	Falcon 2000	2	0	2	0	0	0	0	0	4	0
	Falcon 900	14	2	0	8	2	0	0	2	0	0
	King Air 200/300/350	212	260	180	146	212	230	226	264	348	340
	King Air F90	2	0	2	0	0	0	0	0	0	0
	Phenom 300	0	6	4	2	10	26	36	70	62	50
	Swearingen Merlin	0	0	0	2	2	4	0	0	2	0
	TOTAL	492	538	580	560	708	836	796	862	998	922

ARC	Aircraft Model	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
B-III	Bombardier Global Express	0	0	0	0	0	0	0	0	2	0
	Grumman E-2 Hawkeye	0	0	0	0	0	0	0	0	2	0
	TOTAL	0	0	0	0	0	0	0	0	4	0
C-I	BAe HS 125 Series	2	0	0	0	0	0	0	0	0	0
	Learjet 20 Series	4	0	0	4	0	8	14	18	4	0
	Learjet 31	10	0	0	2	0	0	0	2	2	4
	Learjet 40 Series	6	22	16	2	0	6	2	98	152	250
	Learjet 60 Series	2	0	2	2	2	0	2	4	4	0
	Westwind II	0	0	0	0	0	2	0	0	2	0
	TOTAL	24	22	18	10	2	16	18	122	164	254
C-II	Challenger 600/604	0	0	0	0	2	2	2	2	2	2
	Citation III/VI	0	2	2	4	2	0	2	2	0	0
	Embraer ERJ-135/140/145	0	0	0	2	0	0	0	0	0	0
	Gulfstream 100/150	8	6	2	6	4	4	8	2	6	4
	Gulfstream 280	0	0	0	0	0	0	0	2	0	0
	Hawker 800 (Formerly Bae-125-800)	4	2	10	4	6	4	6	4	4	2
	Learjet 70 Series	0	0	0	0	0	0	0	0	0	2
	TOTAL	2	10	14	16	14	10	18	12	12	10
D-I	Learjet 35/36	4	0	0	0	4	0	6	0	0	0
	TOTAL	4	0	0	0	4	0	6	0	0	0
D-II	Gulfstream 200	2	0	0	0	0	2	0	0	0	0
	Gulfstream 450	0	0	2	0	0	0	6	2	4	0
	TOTAL	2	0	2	0	0	2	6	2	4	0

ARC CODE SUMMARY

ARC CODE	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
A-I	150	142	188	170	186	144	136	198	228	370
A-II	38	34	44	74	84	116	60	50	114	138
B-I	426	488	324	278	262	302	368	336	280	292
B-II	492	538	580	560	708	836	796	862	998	922
B-III	0	0	0	0	0	0	0	0	4	0
C-I	24	22	18	10	2	16	18	122	164	254
C-II	12	10	14	16	14	10	18	12	12	10
D-I	4	0	0	0	4	0	6	0	0	0
D-II	2	0	2	0	0	2	6	2	4	0
TOTAL	1,148	1,234	1,170	1,108	1,260	1,426	1,408	1,582	1,804	1,986

APPROACH CATEGORY SUMMARY

AC	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
A	188	176	232	244	270	260	196	248	342	508
B	918	1,026	904	838	970	1,138	1,164	1,198	1,282	1,214
C	36	32	32	26	16	26	36	134	176	264
D	6	0	2	0	4	2	12	2	4	0
TOTAL	1,148	1,234	1,170	1,108	1,260	1,426	1,408	1,582	1,804	1,986

AIRPLANE DESIGN GROUP SUMMARY

DG	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
I	604	652	530	458	454	462	528	656	672	916
II	544	582	640	650	806	964	880	926	1,128	1,070
III	0	0	0	0	0	0	0	0	4	0
TOTAL	1,148	1,234	1,170	1,108	1,260	1,426	1,408	1,582	1,804	1,986

Note: ARC- Airport Reference Code *Source: Traffic Flow Management System Counts*

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Current RDC

Runway 4R-22L, as the primary runway, should be designed to accommodate the overall airport design aircraft, which has been identified as B-II-2. The primary runway is 4,870 feet long, 75 feet wide, and has non-precision instrument approaches with visibility minimums as low as one mile on the Runway 4R end. Based on the current activity, the applicable RDC is **B-II-5000**.

Runway 4L-22R, as the secondary runway, has been previously planned to accommodate primarily small aircraft that weigh less than 12,500 pounds. As such, the applicable RDC for the secondary runway is **B-II-VIS (small aircraft exclusive)**.

Future RDC

Since the future critical design aircraft for CHD remains within the B-II category, the future RDC for Runway 4R-22L is planned to remain as **B-II-5000**. The future RDC for Runway 4L-22R is also planned to remain as RDC B-II-VIS (small aircraft exclusive).

APPROACH AND DEPARTURE REFERENCE CODES

The approach and departure reference codes (APRC and DPRC) describe the current operational capabilities of each runway and the adjacent parallel taxiways, where no special operating procedures are necessary. Essentially, the APRC and DPRC describe the current conditions at an airport in runway classification terms when considering the parallel taxiway.

The parallel taxiway for Runway 4R-22L is located 400 feet from the runway (centerline to centerline). Runway 4R has non-precision instrument approaches with one-mile visibility minimums. The APRC for Runway 4R-22L is D/IV/5000 and D/V/5000 and its DPRC is D/IV and D/V.

Runway 4L-22R is separated from its parallel taxiway by 240 feet and has no published instrument approaches. Therefore, its APRC is B/II/VIS and its DPRC is B/II.

CRITICAL AIRCRAFT SUMMARY

Table 2R summarizes the airport and runway classification currently and in the future. The critical aircraft is now defined by those aircraft in ARC B-II and is expected to remain in this category.

TABLE 2R | Airport and Runway Classifications
Chandler Municipal Airport

	Runway 4R-22L (existing/ultimate)	Runway 4L-22R (existing/ultimate)
Airport Reference Code (ARC)	B-II	B-II (small airplane)
Airport Design Aircraft	B-II-2	B-II-2 (small airplane)
Critical Aircraft (Typ.)	Beechcraft King Air 200/300/350 (existing) Cessna Citation Jet CJ4/Citation X (ultimate)	Beechcraft King Air C/F90
Runway Design Code (RDC)	B-II-5000	B-II-VIS (small airplane)
Approach Reference Code (APRC)	D/IV/5000 and D/V/5000	B/II/VIS
Departure Reference Code (DPRC)	D/IV and D/V	B/II

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

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the planning period, as well as the critical design aircraft for the airport. Based aircraft are forecast to grow from 441 currently to 640 by 2040. Operations are forecast to grow from 220,662 in 2019 to 274,675 by 2040. The projected growth is driven by FAA's positive outlook for general activity nationwide, as well as positive outlooks for socioeconomic growth (population, employment, and income/GRP) in the Phoenix metropolitan area.

The critical design aircraft for the airport was determined by examining the FAA TFMSC database of flight plans. The current critical design aircraft is described as B-II-2 and is best represented by a Beechcraft King Air 200/300/350, a twin-engine turboprop typically utilized for business operations or air charters. The future design aircraft is projected to remain in the same category represented by small to mid-sized business jets such as the Cessna Citation Jet CJ4 or Citation X.

As noted previously, the forecasts of aviation demand were developed in 2019 prior to the Covid-19 pandemic and the associated economic downturn. Commercial aviation throughout the country has experienced a significant downturn; however certain segments of general aviation, specifically charters, air taxi, and fractionals have appeared to maintain pre-pandemic levels and in many cases, were showing increases as people sought alternatives to flying commercial. Prior to implementation of suggested projects identified later in this report, the forecast element may need to be re-validated. Based upon the types of aircraft using CHD throughout its history, the proposed existing and ultimate design aircraft are considered reasonable and valid for planning purposes.

The next step in the planning process is to assess the capabilities of the existing facilities to determine what upgrades may be necessary to meet future demands. The range of forecasts developed here will be taken forward in the next chapter as planning horizon activity levels that will serve as milestones or activity benchmarks in evaluating facility requirements.

Chapter Three

FACILITY REQUIREMENTS

CHANDLER arizona

CHANDLER arizona

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 Chandler Municipal Airport (CHD) 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

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 determine 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.

CHANDLER MUNICIPAL AIRPORT CHD

The facility requirements for CHD 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 5090.5, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) and the Airports Capital Improvement Plan (ACIP)*

DEMAND-BASED PLANNING HORIZONS

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

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

It is important to consider that the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand by allowing airport management the flexibility to make decisions and develop facilities based upon need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program. **Table 3A** presents the short-, intermediate-, and long-term planning horizon milestones for each aircraft activity level forecasted in Chapter Two.

TABLE 3A | Aviation Demand Planning Horizons
Chandler Municipal Airport

	Base Year (2019)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single Engine	379	424	469	552
Multi-Engine	26	24	20	15
Turboprop	6	7	9	13
Jet	8	10	13	20
Helicopter	22	25	29	40
TOTAL BASED AIRCRAFT	441	490	540	640
ANNUAL OPERATIONS				
Itinerant				
Air Taxi	2,990	3,900	4,400	5,100
General Aviation	67,647	72,500	77,300	87,400
Military	199	213	213	213
Total Itinerant	70,836	76,613	81,913	92,713
Local				
General Aviation	149,754	158,300	165,800	181,900
Military	72	62	62	62
Total Local	149,826	158,362	165,862	181,962
TOTAL OPERATIONS	220,662	234,975	247,775	274,675

Source: Coffman Associates analysis

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 near or surpass the ASV, delay factors increase exponentially. The airport's ASV was examined utilizing FAA AC 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis takes into account 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 CHD and include airfield layout, weather conditions, aircraft mix, and operations.

- **Runway Configuration –** The existing airfield configuration consists of parallel runways supported by full-length and partial-length parallel taxiways. Runway 4R-22L is 4,870 feet long and 75 feet wide. Runway 4L-22R is 4,401 feet long and 75 feet wide. The runways have a separation distance of 700 feet, which allows for simultaneous visual flight rule (VFR) operations.

- **Runway Use –** Runway use in capacity conditions is controlled by wind and/or airspace conditions. For CHD, the direction of takeoffs and landings is typically determined by the speed and direction of the wind or as directed by the airport traffic controller. 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.

AIRFIELD LAYOUT

Runway Configuration

Runway Use

Number of Exits

WEATHER CONDITIONS

VMC- Visual Meteorological Conditions

IMC- Instrument Meteorological Conditions

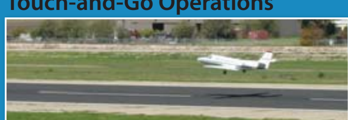
PVC- Poor Visibility Conditions

OPERATIONS

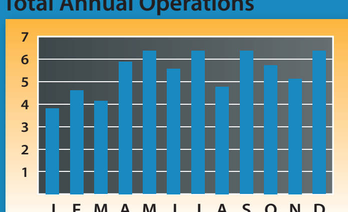
Arrivals

Departures

Touch-and-Go Operations

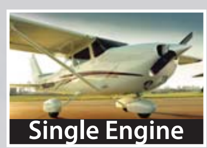


Total Annual Operations



AIRCRAFT MIX

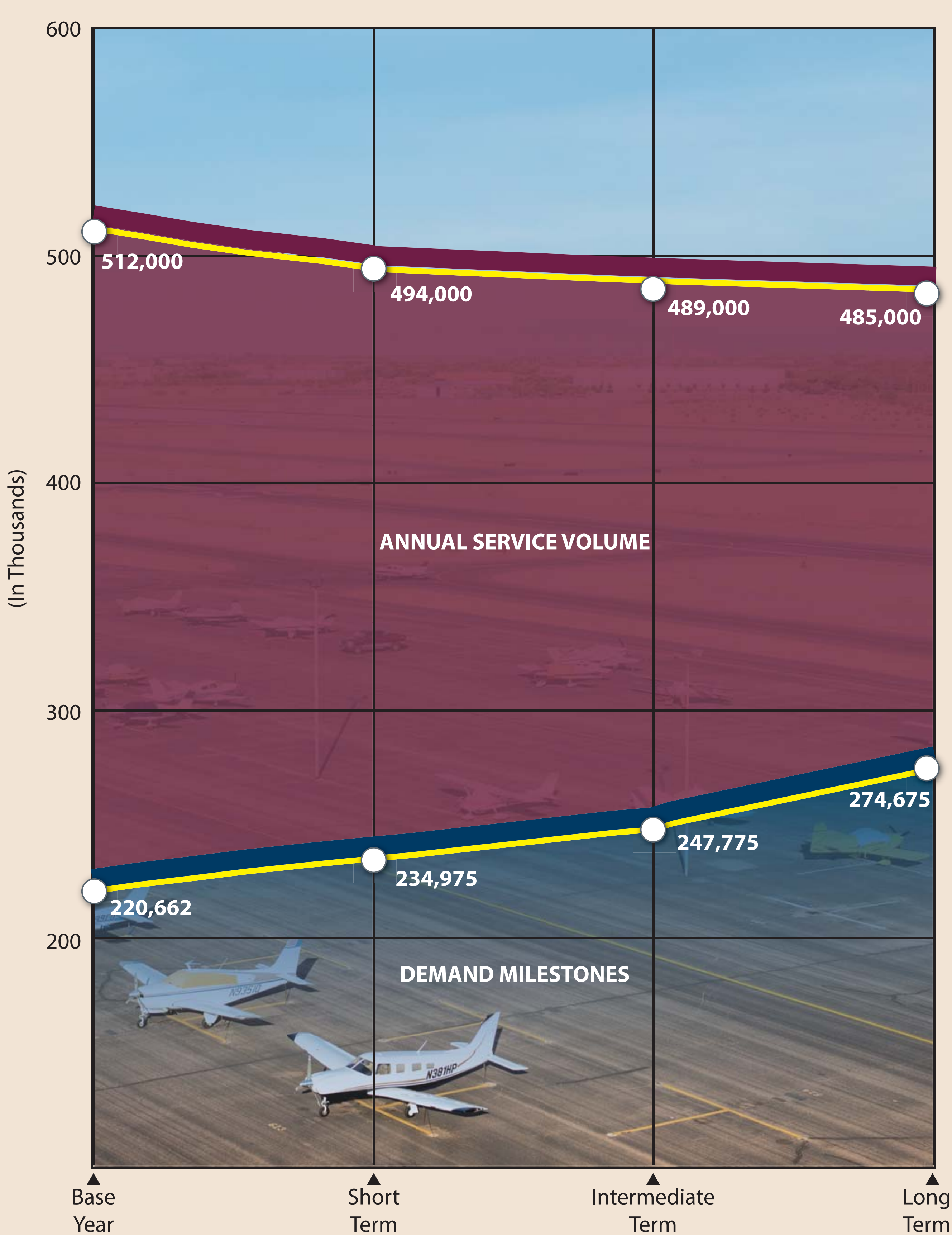
Category A & B Aircraft



Category C Aircraft

Category D Aircraft

Exhibit 3A
AIRFIELD CAPACITY FACTORS


600
500
400
300
200
(In Thousands)
512,000
494,000
489,000
485,000
ANNUAL SERVICE VOLUME
274,675
247,775
234,975
220,662
DEMAND MILESTONES
Base Year
Short Term
Intermediate Term
Long Term

Discussions with the CHD airport traffic control tower indicate that Runway 4R-22L is used primarily for touch-and-go activity, which positions flight training traffic patterns on the south side of the airport. Runway 4L-22R, is used more frequently for transient operations since it is closer to the FBO/SASO operations on the north side. Direction of operations is equally split between Runways 4 and 22 as dictated by wind conditions and ATCT.

- **Exit Taxiways –** Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determine the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runways. Based upon mix, only exit taxiways between 2,000 feet and 4,000 feet from the landing threshold count in the exit rating at CHD. The exits must be at least 750 feet apart to count as separate exit taxiways. Utilizing these criteria, both runways are credited with two exit taxiways in each direction.

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

  According to local meteorological data, the airport operates under visual meteorological conditions (VMC) approximately 99 percent of the time. VMC exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. According to the weather observations, IMC and PVC prevailed less than one percent of the time. **Table 3B** summarizes the weather conditions experienced at the airport over a 10-year period of time.

TABLE 3B | Weather Conditions
Chandler Municipal Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1,000' AGL	> 3 statute miles	99.64%
IMC	≥ 500' AGL to < 1,000' AGL	1-3 statute miles	0.25%
PVC	< 500' AGL	< 1 statute mile	0.11%

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

Source: 50,436 All Weather Observations from Jan 1, 2010 thru Dec 31, 2019, Chandler Municipal Airport Weather Station

- **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. Most operations at CHD are by Classes A and B aircraft. 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. According to the FAA's Traffic Flow Management System Count (TFMSC) data for 2019, there were approximately 1,200 total operations by Class C aircraft at CHD, which represents approximately 0.5 percent of all operations. Over the course of the planning period, it is anticipated that Class C operations will increase as these aircraft become more prevalent in the local and national fleet mix. Despite this, Class C operations are not anticipated to make up more than two percent of total operations by the long-range planning horizon. 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 CHD.

- **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 CHD accounted for 68 percent of total annual operations in 2019. This percentage is anticipated to drop slightly as itinerant operations are expected to grow at a slightly faster pace; however, touch-and-go operations will still account for most operations 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.

CALCULATION OF ANNUAL SERVICE VOLUME

The preceding information was used in conjunction with the airfield capacity methodology developed by the FAA to determine airfield capacity for CHD.

Hourly Runway Capacity

The first step in determining ASV involves the computation of the hourly capacity of the runway configuration. The percentage use of the runway, the amount of touch-and-go activity, and the number and locations of runway exits are the important factors in determining hourly capacity.

As the operational mix of aircraft at the airport changes to include a higher percentage of large aircraft weighing over 12,500 pounds, the hourly capacity of the system declines slightly. This is a result of the additional spacing and time required by larger aircraft in the traffic pattern and on the runway.

The current and future weighted hourly capacities are presented in **Table 3C**. Weighted hourly capacity is the measure of the maximum number of aircraft operations that can be accommodated on the airfield in a typical hour. It is a composite of estimated hourly capacities for different airfield operating configurations adjusted to reflect the percentage of time in an average year that the airfield operates under each specific configuration. The current weighted hourly capacity on the airfield is 267 operations; likewise, the capacity is expected to decline slightly to 258 operations by the long-term horizon.

TABLE 3C | Airfield Capacity Summary
Chandler Municipal Airport

	Base Year (2019)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Operational Demand				
Annual	220,662	234,975	247,775	274,675
Capacity				
Annual Service Volume	512,000	494,000	489,000	485,000
Percent Capacity	43.1%	47.6%	50.7%	56.6%
Weighted Hourly Capacity	267	263	260	258

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

Annual Service Volume

The ASV is determined by the following equation:

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

The current ASV for the airfield has been estimated at 512,000 operations. The increasing percentage of larger Class C aircraft over the planning period will attribute to a decline in ASV, lowering it to a level of approximately 485,000 operations by the end of the planning period. With 2019 operations at 220,662, the airport is currently at 43.1 percent of its ASV. Long range annual operations are forecast to reach 274,675, which would equate to 56.6 percent of the Airport's ASV.

Table 3C and the back side of **Exhibit 3A** summarize and compare the airport's ASV and projected annual operations over the short, intermediate, and long-range planning horizons.

AIRCRAFT DELAY

The affect that the anticipated ratio of demand to capacity will have on users of CHD can be measured in terms of delay. As the number of annual aircraft operations approaches the airfield's capacity, increasing operational delays begin to occur. Delays occur to arriving and departing aircraft in all weather conditions. Arriving aircraft delays result in aircraft holding outside the airport traffic pattern area. Departing aircraft delays result in aircraft holding at the runway end until they can safely takeoff.

Aircraft delay can vary depending on different operational activities at an airport. At airports where large air carrier aircraft dominate, delay can be greater given the amount of time these aircraft require in the traffic pattern and on approach to land. For airports that accommodate primarily small general aviation aircraft, such as CHD, experienced delay is typically less since these aircraft are more maneuverable and require less time in the airport traffic pattern.

Table 3D summarizes the potential aircraft delay for CHD. Estimates of delay provide insight into the impacts that steady increases in aircraft operations have on the airfield and signify the airport's ability to accommodate projected annual aircraft operations. The delay per operation represents an average delay per aircraft. It should be noted that delays of five to ten times the average could be experienced by individual aircraft during peak periods. As an airport's percent capacity increases toward the ASV, delay increases exponentially. Furthermore, complexities in the airspace system that surrounds an airport can also factor into additional delay experienced at the facility.

TABLE 3D | Airfield Delay Summary
Chandler Municipal Airport

	Base Year (2019)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
Percent Capacity	43.1%	47.6%	50.7%	56.6%
Delay				
Per Operation (Minutes)	0.28	0.30	0.39	0.43
Total Annual (Hours)	1,030	1,175	1,611	1,969

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

Current annual delay is estimated at 0.28 minutes per aircraft operation or 1,030 annual hours. Analysis of delay factors for the long-term planning horizon indicates that annual delays can be expected to reach 0.43 minutes per aircraft operation, or 1,969 annual hours.

CAPACITY ANALYSIS CONCLUSION

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, indicates that improvements for airfield capacity purposes should be considered when operations reach 60 to 75 percent of the ASV. This is an approximate level to begin the detailed planning of capacity improvements. When 80 percent of the ASV is reached, capacity improvement projects should become higher priority capital improvements. According to this analysis, operations levels at CHD are not anticipated to reach these percentages in the next 20 years. 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

Airside facilities include those facilities related to the arrival, departure, and ground movement of aircraft. Airside facility requirements are based primarily upon the Runway Design Code (RDC) for each runway. Analysis in Chapter Two identified the existing/ultimate RDC as RDC B-II-5000 for Runway 4R-22L and RDC B-II-VIS (small Aircraft) for Runway 4L-22R.

RUNWAYS

Runway conditions, such as orientation, length, width, and pavement strength, were analyzed at CHD. From this information, requirements for runway improvements were determined for the airport.

Runway Orientation

Key considerations in the runway configuration of an airport involve the orientation for wind coverage and the operational capacity of the runway system. FAA AC 150/5300-13A, *Airport Design*, recommends that a crosswind runway should be made available when the primary runway orientation provides less than 95 percent wind coverage for any aircraft forecast to use the airport on a regular basis.

The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARC A-I and B-I; 13 knots (15 mph) for ARC A-II and B-II; 16 knots (18 mph) for ARC A-III, B-III, and C-I through D-II; and 20 knots (23 mph) for ARC C-III through D-IV.

Exhibit 3B presents the all-weather wind rose for the airport. The previous 10 years of wind data[1] was obtained from the on-airport AWOS and has been analyzed to identify wind coverage provided by the existing runway orientations. At CHD, the orientation of the parallel runways (4-22) provides 94.97 percent coverage for the 10.5-knot component, 97.52 percent coverage for 13 knots, and greater than 99 percent coverage for 16- and 20-knot components. Thus, the current runway orientation at CHD provides adequate wind coverage for all-weather conditions.

Runway Length

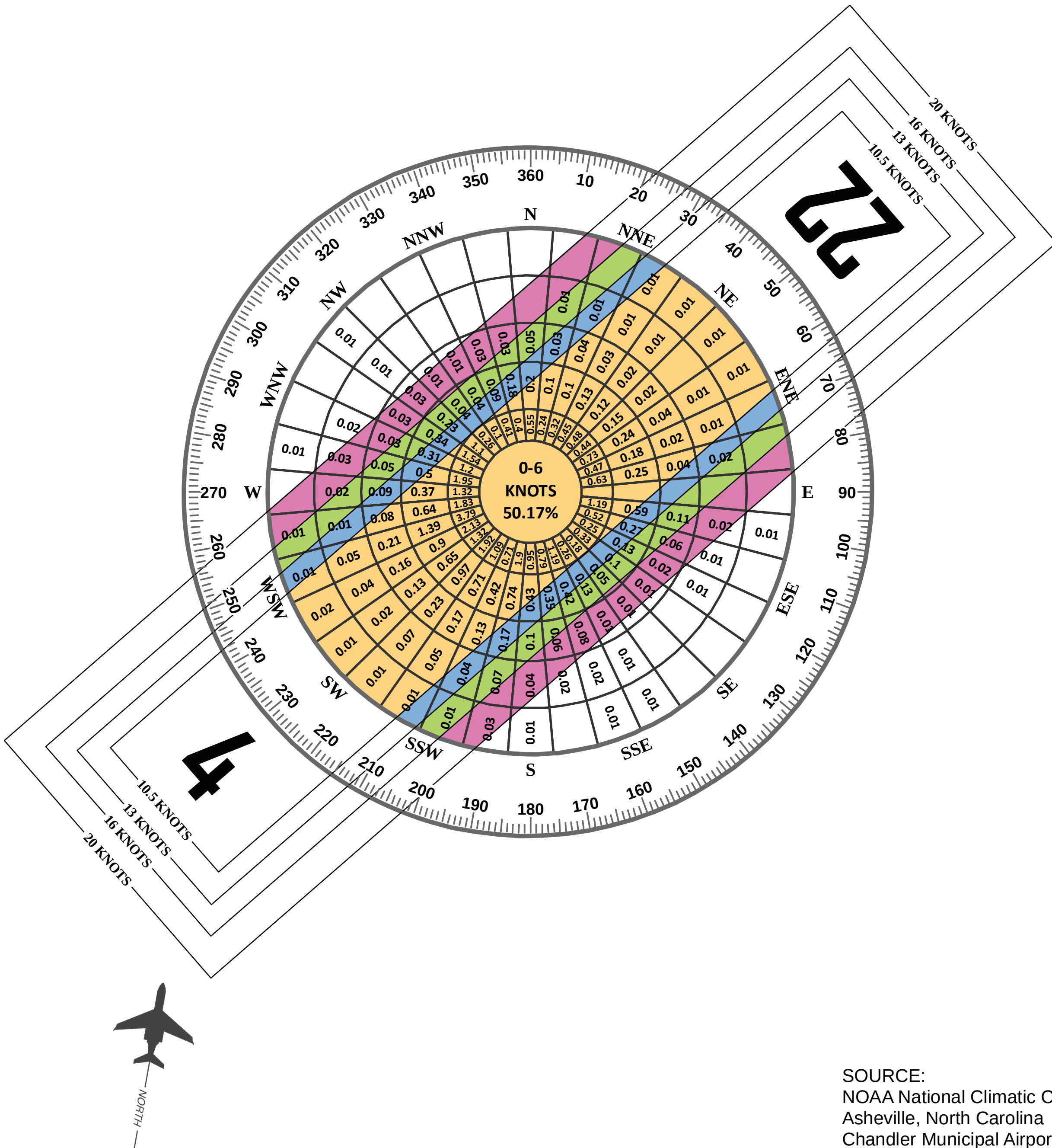
AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. A draft revision of this AC is currently available (150/5325-4C) and the FAA is utilizing the draft revision in most cases when evaluating runway length needs for airports.

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

- Mean maximum temperature of hottest month
- Airport elevation

[1] 50,436 observations were collected for the period January 1, 2010 through December 31, 2019.

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 4-22	94.97%	97.52%	99.21%	99.75%



Magnetic Declination
10° 02' 00" East (January 2020)
Annual Rate of Change
00° 06' 00" West (January 2020)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Chandler Municipal Airport
Chandler, AZ

OBSERVATIONS:
50,436 All Weather Observations
Jan. 1, 2010 - Dec, 31 2019

- 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 CHD is 106.1 degrees Fahrenheit (F), which occurs in July. The airport elevation is 1,243.1 feet mean sea level (MSL). The primary runway (4R-22L) has a gradient of 0.15 percent and secondary runway (4L-22R) has a gradient of 0.12 percent. As such, both runways conform to FAA design standards for gradient.

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 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

Most operations at CHD are conducted using smaller single engine piston-powered aircraft weighing less than 12,500 pounds. Following guidance from AC 150/ 5325-4B, to accommodate 95 percent of these small aircraft with less than 10 passenger seats, a runway length of 3,700 feet is recommended. For 100 percent of these small aircraft, a runway length of 4,400 feet is recommended. For small aircraft with 10 or more passenger seats, 4,800 feet of runway length is also 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 3E** presents a partial list of common aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3E | Business Jet Categories for Runway Length Determination

75 Percent of the National Fleet	MTOW (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 Takeoff Weight					

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

Table 3F presents the results of the runway length analysis for business jets developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 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 7,100 feet is recommended.

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at 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 8,300 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 11,100 feet is recommended.

TABLE 3F | Runway Length Requirements
Chandler Municipal Airport

Airport Elevation	1,243.1 feet MSL
Average High Monthly Temperature	106.1 degrees F (July)
Primary Runway End Elevation Difference	7.4’

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length with Gradient Adjustment (+74')	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
75% of fleet at 60% useful load	5,200	5,274	5,500	5,500
100% of fleet at 60% useful load	7,000	7,074	5,500	7,100
75% of fleet at 90% useful load	8,200	8,274	7,000	8,300
100% of fleet at 90% useful load	11,000	11,074	7,000	11,100
*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*

Another method to determine runway length requirements for aircraft at CHD 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 106.1 degrees F at a field elevation of 1,243.1 feet MSL. **Table 3G** provides a detailed runway length analysis for several of the most common turbine aircraft 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 length of 4,870 feet on Runway 4R-22L presents weight restrictions for 16 of the 39 aircraft evaluated beginning at 60 percent useful load. The average takeoff length needed for all turbine aircraft analyzed at 60 percent useful load is 4,500 feet. Progressively fewer turbine aircraft can operate on the available runway at CHD as the useful load increases. Only 10 evaluated turbine aircraft can operate at 90 percent useful load and only seven can operate at 100 percent useful load. Ultimately, the average length needed in the 70 percent useful load and higher categories exceeds the available runway length at CHD.

Table 3H 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. Part 91k and Part 135 rules regarding landing operations require operators to land at the destination airport within 60 percent of the effective runway length. An additional rule allows for operators to land within 80 percent of the effective runway length if the operator has an approved destination airport analysis in the airport's program operating manual. The landing length analysis conducted accounts for both scenarios.

The landing length analysis shows that all but one aircraft can land on the available runway length at CHD under Part 25 or under the 80 percent rule during dry runway conditions. Only 14 of 39 aircraft evaluated can land at CHD under the 60 percent rule during dry runway conditions. Under wet runway conditions, the number of aircraft that are capable of landing at CHD is further restricted. In fact, none of the jet aircraft evaluated are capable of landing under the 60 percent rule.

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at CHD. The airport should strive to accommodate business jets and turboprop aircraft to the greatest extent possible as demand would dictate. Runway 4R-22L is currently 4,870 feet long and can accommodate many of these aircraft under moderate loading conditions, especially with shorter trip lengths and during cool to warm temperatures. It is the hotter days and heavier useful loads that limit business jets at CHD.

Justification for any runway extension to meet the needs of turbine aircraft would require regular use on the order of 500 annual itinerant operations. This is the minimum threshold required to obtain FAA grant funding assistance. The current Airport Layout Plan (ALP) for CHD includes an extension to 5,550 feet for Runway 4R-22L to meet the needs of turbine aircraft operators. Analysis in the next chapter will examine potential extensions on Runway 4R-22L, while considering appropriate safety design standards (these standards will be detailed later in this chapter).

At 4,401 feet, Runway 4L-22R can accommodate all small general aviation piston-powered aircraft and some small turbine aircraft. Since the secondary runway is intended to serve primarily small aircraft, its current length is adequate and should be maintained through the planning period.

TABLE 3G | Business Aircraft Takeoff Length Requirements
Chandler Municipal Airport

Aircraft Name	MTOW lbs.	Takeoff Length Requirements (feet) Useful Load 60%	70%	80%	90%	100%
Pilatus PC-12	9,921	2,312	2,508	2,714	2,930	3,156
King Air C90B	10,100	2,789	3,402	3,638	3,899	4,183
Citation Ultra	16,300	3,160	3,441	3,727	4,037	4,372
Beechjet 400A	16,300	3,288	4,870	5,249	5,659	O/L
Citation CJ3	13,870	3,316	3,581	3,875	4,228	4,642
Citation Sovereign	30,300	3,430	3,676	3,942	4,232	4,578
Citation Mustang	8,645	3,508	3,944	4,433	5,174	O/L
Citation Encore	16,630	3,563	3,928	4,333	4,781	5,283
Citation (525A) CJ2	12,375	3,645	3,938	4,253	4,602	O/L
Citation II (550)	13,300	3,689	4,101	4,543	5,015	5,514
Citation V (Model 560)	15,900	3,810	3,466	3,769	4,088	4,429
King Air 200 GT	12,500	3,818	3,976	4,118	4,242	4,353
Citation Bravo	14,800	3,836	4,143	4,499	4,902	5,342
Citation 560 XLS	20,200	3,942	4,265	4,629	5,046	O/L
King Air 350	15,000	4,004	4,168	4,330	4,646	5,002
King Air 1900D	17,120	4,276	4,551	4,875	4,964	5,602
Lear 40XR	21,000	4,290	4,634	5,034	5,514	6,086
Lear 45XR	21,500	4,446	4,836	5,273	5,884	6,494
Hawker 900 XP	28,000	4,668	5,144	5,661	6,229	O/L
Hawker 4000	39,500	4,725	5,129	5,588	6,121	9,500
Gulfstream 350	70,900	4,770	5,207	5,686	6,202	6,748
Premier 1A	12,500	4,807	5,230	5,659	6,156	6,838
Gulfstream 300	72,000	4,844	5,163	5,745	6,304	6,917
Global 5000	92,500	4,894	5,443	6,020	6,626	O/L
Falcon 900EX	49,200	4,920	5,500	6,140	6,830	7,510
Falcon 7X	70,000	4,929	5,468	6,079	6,741	7,459
Challenger 300	38,850	5,070	5,552	6,053	6,586	7,210
Citation X	35,700	5,128	5,609	6,168	O/L	O/L
Gulfstream 450	74,600	5,131	5,664	6,244	6,858	7,557
Gulfstream 550	91,000	5,320	6,044	6,893	7,757	8,754
Global Express	98,000	5,346	5,991	6,671	O/L	O/L
Falcon 2000	35,800	5,361	5,826	6,298	6,998	8,398
Challenger 604/605	48,200	5,538	6,094	6,740	7,442	8,165
Gulfstream 100	24,650	5,680	6,303	6,956	7,603	O/L
Embraer 135	49,604	5,682	6,223	6,467	7,272	7,929
Lear 60	23,500	6,008	6,552	7,187	7,876	8,615
Gulfstream 200	35,450	6,157	6,902	7,728	O/L	O/L
Lear 55	21,500	6,485	7,245	8,068	O/L	O/L
Gulfstream II/IISP	65,500	6,626	7,205	O/L	O/L	O/L
Average Takeoff Length		**4,500**	**5,000**	**5,400**	**5,700**	**6,300**

Green figures are less than or equal to the length of the primary runway at CHD. Red figures are greater than the length of the primary runway at CHD. O/L indicates the input data is outside the operating limits of the aircraft planning manual. Runway length calculation assumptions: 1,243.1 MSL field elevation; 106.1° F ambient temperature; 0.15% runway grade. MTOW - Maximum Takeoff Weight

Source: Ultranav software

TABLE 3H | Business Aircraft Landing Length Requirements
Chandler Municipal Airport

Aircraft Name	MLW lbs.	Landing Length Requirements (feet)					
		Dry Runway Condition			Wet Runway Condition		
		Part 25	80% Rule	60% Rule	Part 25	80% Rule	60% Rule
King Air 200 GT	12,500	1,276	1,595	2,127	N/A	N/A	N/A
King Air C90B	9,600	1,312	1,640	2,187	N/A	N/A	N/A
Pilatus PC-12	9,921	2,451	3,064	4,085	N/A	N/A	N/A
Citation II (550)	12,700	2,567	3,209	4,278	N/A	N/A	N/A
Citation Mustang	8,000	2,637	3,296	4,395	3,706	4,633	6,177
Challenger 300	33,750	2,671	3,339	4,452	5,119	6,399	8,532
Hawker 800XP	23,350	2,726	3,408	4,543	4,247	5,309	7,078
Global 5000	78,600	2,730	3,413	4,550	3,139	3,924	5,232
Global Express	78,600	2,730	3,413	4,550	3,139	3,924	5,232
Embraer 135	40,785	2,757	3,446	4,595	3,161	3,951	5,268
Gulfstream 550	75,300	2,843	3,554	4,738	5,177	6,471	8,628
Challenger 604/605	38,000	2,871	3,589	4,785	4,554	5,693	7,590
King Air 350	15,000	2,901	3,626	4,835	N/A	N/A	N/A
Citation Sovereign	27,100	2,906	3,633	4,843	3,698	4,623	6,163
Lear 40XR	19,200	2,962	3,703	4,937	3,809	4,761	6,348
Falcon 7X	62,400	3,000	3,750	5,000	3,450	4,313	5,750
Falcon 50 EX	35,715	3,002	3,753	5,003	3,453	4,316	5,755
King Air 1900D	16,765	3,019	3,774	5,032	3,472	4,340	5,787
Citation CJ3	12,750	3,080	3,850	5,133	4,194	5,243	6,990
Citation III	19,000	3,100	3,875	5,167	4,377	5,471	7,295
Citation Encore	15,200	3,116	3,895	5,193	4,674	5,843	7,790
Citation Ultra	15,200	3,151	3,939	5,252	4,681	5,851	7,802
Citation V	15,200	3,180	3,975	5,300	4,720	5,900	7,867
Gulfstream 150	21,700	3,192	3,990	5,320	4,604	5,755	7,673
Falcon 2000	33,000	3,205	4,006	5,342	3,685	4,606	6,142
Citation (525A) CJ2	11,500	3,257	4,071	5,428	4,722	5,903	7,870
Citation VII	20,000	3,264	4,080	5,440	4,423	5,529	7,372
Hawker 4000	33,500	3,302	4,128	5,503	3,797	4,746	6,328
Gulfstream 350	66,000	3,344	4,180	5,573	3,845	4,806	6,408
Gulfstream 450	66,000	3,344	4,180	5,573	5,800	7,250	9,667
Citation 560 XLS	18,700	3,512	4,390	5,853	5,533	6,916	9,222
Premier 1A	11,600	3,531	4,414	5,885	4,538	5,673	7,563
Lear 55	18,000	3,535	4,419	5,892	5,656	7,070	9,427
Gulfstream 200	30,000	3,648	4,560	6,080	4,195	5,244	6,992
Citation Bravo	13,500	3,754	4,693	6,257	5,900	7,375	9,833
Falcon 900EX	44,500	3,763	4,704	6,272	4,328	5,410	7,213
Lear 60	19,500	3,773	4,716	6,288	5,102	6,378	8,503
Beechjet 400A	15,700	3,879	4,849	6,465	5,693	7,116	9,488
Citation X	31,800	3,925	4,906	6,542	5,603	7,004	9,338
Average Landing Length		**3,200**	**4,000**	**5,300**	**4,400**	**5,500**	**7,400**

Green figures are less than or equal to the length of the primary runway at CHD. Red figures are greater than the length of the primary runway at CHD.
Runway length calculation assumptions: 1,243' MSL field elevation; 106.1° F ambient temperature; 0.15% runway grade.
MLW – Maximum Landing Weight
N/A – Not Applicable. Turboprop aircraft landing lengths are not adjusted for wet runway conditions.

Source: Ultranav software

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 4R-22L, existing RDC B-II-5000 design criteria stipulate a runway width of 75 feet. For Runway 4L-22R, RDC B-II-VIS (small aircraft) standards stipulate a runway width of 75 feet. Both runways are 75 feet wide and therefore meet the existing and ultimate design standards.

Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA reports the pavement strength for both runways at 30,000 pounds single wheel loading (SWL). SWL indicates an aircraft with a single wheel on each landing gear.

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

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 ratings are adequate to accommodate most aircraft that currently operate at the airport and are forecast to continue utilizing the airport in the future.

Runway Stopways

A runway stopway is a surface beyond the end of the runway that can support an aircraft during an aborted takeoff without causing structural damage to the aircraft. Runway 4R-22L has 90-foot long and 90-foot wide stopways off both ends of the runway. The stopways should be maintained in their current location until such time that the runway is extended.

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions. 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. RPZs should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in place which ensure the RPZ remains free of incompatible development. The various airport safety areas are presented on **Exhibit 3C**. **Table 3J** presents the FAA design standards as they apply to each runway at CHD.

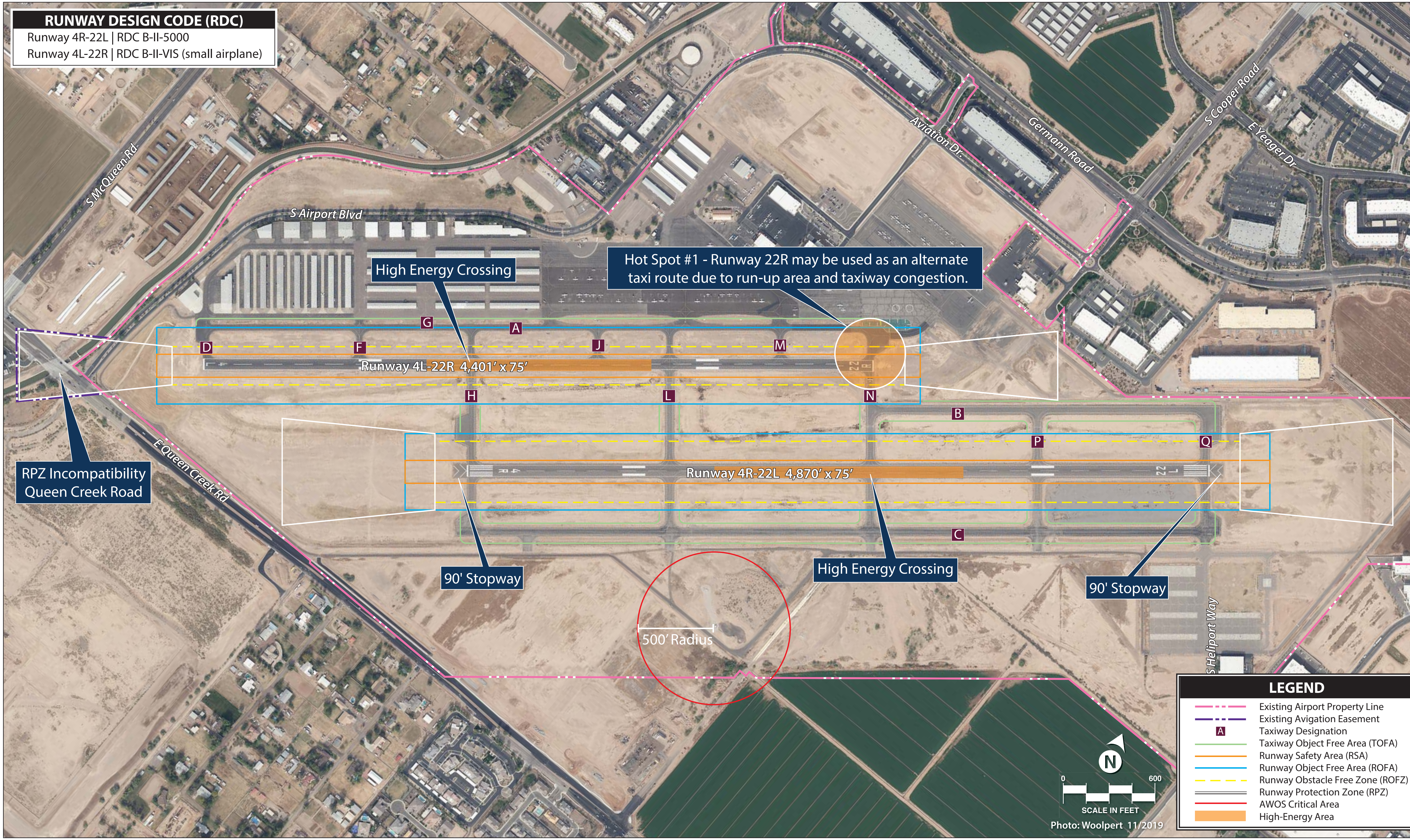
TABLE 3J | Runway Design Standards
Chandler Municipal Airport

	Runway 4R-22L (Existing/Ultimate)	Runway 4L-22R (Existing/Ultimate)
Runway Design Code	B-II-5000	B-II-VIS (small aircraft)
Visibility Minimums	≥ 1 mile (4R end)	Visual only (both ends)
Runway Design		
Runway Width	75	75
Stopway Length/Width	90’x90’	None
RUNWAY PROTECTION		
Runway Safety Area		
Width	150	150
Length Beyond Departure End	300	300
Length Prior to Threshold	300	300
Runway Object Free Area		
Width	500	500
Length Beyond Departure End	300	300
Length Prior to Threshold	300	300
Runway Obstacle Free Zone		
Width	400	250
Length Beyond Runway End	200	200
Approach Runway Protection Zone		
Inner Width	500	250
Outer Width	700	450
Length	1,000	1,000
Departure Runway Protection Zone		
Inner Width	500	250
Outer Width	700	450
Length	1,000	1,000
RUNWAY SEPARATION		
Runway Centerline to:		
Hold Line Position	200	125
Parallel Taxiway	240	240
Aircraft Parking Apron	250	250
Note: All dimensions in feet unless otherwise noted.		

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

Runway Safety Area

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


RUNWAY DESIGN CODE (RDC)
Runway 4R-22L | RDC B-II-5000
Runway 4L-22R | RDC B-II-VIS (small airplane)
S McQueen Rd
S Airport Blvd
Aviation Dr.
Germann Road
S Cooper Road
E Yeager Dr
High Energy Crossing
Hot Spot #1 - Runway 22R may be used as an alternate taxi route due to run-up area and taxiway congestion.
Runway 4L-22R 4,401' x 75'
Runway 4R-22L 4,870' x 75'
RPZ Incompatibility Queen Creek Road
E Queen Creek Rd
90' Stopway
High Energy Crossing
90' Stopway
500' Radius
S Heliport Way
A
B
C
D
F
G
H
J
L
M
N
P
Q
LEGEND
Existing Airport Property Line
Existing Avigation Easement
Taxiway Designation
Taxiway Object Free Area (TOFA)
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
AWOS Critical Area
High-Energy Area
N
0
600
SCALE IN FEET
Photo: Woolpert 11/2019

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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, *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-5000 and B-II-VIS (small aircraft) design standards, the FAA calls for the RSA to be 150 feet wide and extend 300 feet beyond the runway ends. An examination of the RSAs for both runways did not identify any non-standard conditions.

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 with the critical design aircraft utilizing the runway.

For RDC B-II-5000 and B-II-VIS (small aircraft) design, the FAA calls for the ROFA to be 500 feet wide, extending 300 feet beyond each runway end. An evaluation of both ROFAs did not identify any non-standard conditions.

Runway Obstacle Free Zone

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

For all runways serving aircraft over 12,500 pounds, the ROFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. This standard applies to Runway 4R-22L at CHD. For Runway 4L-22R, a smaller ROFZ applies since the runway is served by aircraft weighing 12,500 pounds or less. In this case, the ROFZ is dimensioned at 250 feet wide and extends 200 feet beyond the runway ends. Under current evaluation with available data, there are no ROFZ obstructions at the airport. Future planning should maintain the ROFZ for the appropriate runway type.

Runway Protection Zone

The RPZ is a trapezoidal area centered on the runway, 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, to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the ROFA. The controlled activity area is any remaining portions of the RPZ. The dimensions of the RPZ vary per the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

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

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

Any other land uses considered within RPZ land owned by the airport sponsor must be evaluated and approved by the FAA Office of Airports. The FAA has published *Interim Guidance on Land Uses within a Runway Protection Zone* (September 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; and
- Above-ground utility infrastructure (i.e., electrical substations), including any type of solar panel installations.

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

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

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

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

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

As shown on **Exhibit 3C**, the airport owns all property within the Runway 4R, 22L and 22R RPZs. A portion of the Runway 4L RPZ extends beyond airport property but is controlled by an avigation easement. E. Queen Creek Road, a public-use road, extends through the Runway 4L RPZ. Public roadways are considered an incompatible land use within an RPZ; however, since it is an existing condition the FAA can "grandfather" the condition so that no corrective action is necessary. The perimeter service road passes through the Runway 22L and 22R RPZs but since this is a non-public use road it is not considered an incompatible RPZ land use.

RUNWAY SEPARATION STANDARDS

There are several other standards related to separation distances from runways. Each of these is designed to enhance the safety of the airfield.

Runway/Taxiway Separation

The design standard for the separation between runways and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimum. The separation standard for both runways at CHD is 240 feet from the runway centerline to the parallel taxiway centerline. Parallel Taxiway A is 240 feet north of Runway 4L-22R, and Taxiways B and C are both 400 feet from the Runway 4R-22L centerline.

Hold Line Position Separation

Hold line position markings are placed on taxiways leading to runways. When instructed, pilots are to stop short of the holding position marking line. For Runway 4R-22L, hold line position markings are situated 200 feet from the runway centerline, which meets the B-II-5000 standard. For Runway 4L-22R, hold line position markings are situated 125 feet from the runway centerline, which meets the B-II-VIS (small airplane) standard.

Aircraft Parking Area Separation

Aircraft parking areas at CHD should be at least 250 feet from either runway centerline. The nearest parking positions on the north side are greater than 350 feet from the Runway 4L-22R centerline and the helicopter parking positions south of Runway 4R-22L are over 600 feet from the centerline. Therefore, the standard is met.

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 both runways is ADG II. **Table 3K** presents the various taxiway design standards related to ADG II.

TABLE 3K | Taxiway Dimensions and Standards
Chandler Municipal Airport

STANDARDS BASED ON WINGSPAN	ADG II	
Taxiway Protection		
Taxiway Safety Area width (feet)	79	
Taxiway Object Free Area width (feet)	131	
Taxilane Object Free Area width (feet)	115	
Taxiway Separation		
Taxiway Centerline to:		
Fixed or Movable Object (feet)	65.5	
Parallel Taxiway/Taxilane (feet)	105	
Taxilane Centerline to:		
Fixed or Movable Object (feet)	57.5	
Parallel Taxilane (feet)	97	
Wingtip Clearance		
Taxiway Wingtip Clearance (feet)	26	
Taxilane Wingtip Clearance (feet)	18	
STANDARDS BASED ON TDG	**TDG 1A/1B**	**TDG 2**
Taxiway Width Standard (feet)	25	35
Taxiway Edge Safety Margin (feet)	5	7.5
Taxiway Shoulder Width (feet)	10	15
ADG: Airplane Design Group TDG: Taxiway Design Group		

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

An examination of the taxiway system at CHD identified no taxiway safety area (TSA) or taxiway object free area (TOFA) incompatibilities. One area of note is that the separation distance between Taxiway A and the edge taxilane on the south side of the T-Hangar complex is 74 feet. This distance does not meet the ADG II standard of 105 feet; however, it does meet the ADG I separation standard of 70 feet. Aircraft should use caution in this area to ensure wingtip clearance is maintained with other aircraft particularly when Taxiway A is in use by an ADG II aircraft. The affected area is identified in **Figure 3A**.

FIGURE 3A – ADG I TAXIWAY CENTERLINE SEPARATION AREA

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 both runways should be TDG 2. As such, the taxiways on the airfield should be at least 35 feet wide. The entire taxiway system at CHD is at least 40 feet wide. Certain portions of the landside area that are utilized exclusively by small aircraft, such as the T-hangar areas, should adhere to TDG 1A/1B standards.

All taxiway widths on the airfield should at least 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 CHD 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 over-steering," 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. CHD has taken steps to correct non-standard taxiway geometry conditions including relocating some taxiways to eliminate direct-access points from the north apron to Runway 4L-22R. There are, however, additional taxiway geometry issues still to be addressed.

The FAA has identified one taxiway hot spot at CHD. It is located at the Runway 22R threshold and is described as follows: Runway 22R may be used as an alternate taxi route due to run-up area and taxiway congestion.

Additional non-standard taxiway geometry conditions at CHD include:

- Taxiways F, M, and Q provide direct access to a runway from an apron area (see **Figure 3B**).
- Taxiway H crosses Runway 4L-22R in the high-energy area.
- Taxiway N crosses Runway 4R-22L in the high-energy area.

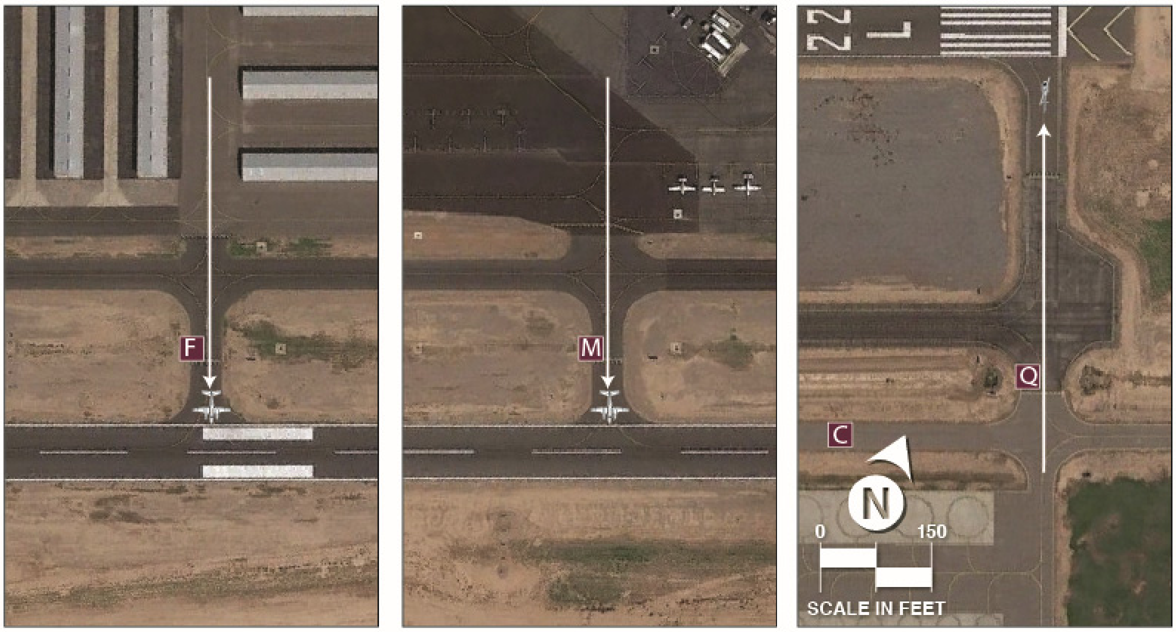

FIGURE 3B – DIRECT-ACCESS TAXIWAY POINTS

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.

Instrument Approach Aids

CHD has two published non-precision straight-in instrument approach procedures to Runway 4R. These procedures provide down to one-mile visibility minimums and 500-foot cloud ceilings. Each of the procedures include circling approaches, allowing for minimums to any runway end at the airport. Analysis in the next chapter will consider improvements necessary for enhancing instrument approach capabilities to the runway system including achieving lower visibility minimums.

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, each runway end at CHD is equipped with 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 4R-22L. REILs should also be considered for Runway 4L-22R.

Weather Reporting Aids

CHD has a lighted wind cone and segmented circle. The wind cone provides information to pilots regarding wind speed and direction. Typically, the wind cone is centralized on the airfield system and often co-located within a segmented circle, which is the case at CHD. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots.

CHD is equipped with an AWOS, 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. This system should be maintained through the planning period.

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 | CHD's rotating beacon is located on top of the ATCT. The beacon is in good working order and should be maintained through the planning period.

Runway and Taxiway Lighting | Both runways at CHD are equipped with medium intensity runway lighting (MIRL) systems. These systems are adequate and should be maintained. The taxiway system is equipped with medium intensity taxiway lighting (MITL). This system is also adequate and should be maintained. Planning should consider expansion of the MIRL and MITL systems when/if new pavements are constructed.

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 4R-22L has non-precision markings which aid in accommodating the instrument approach procedures to Runway 4R and provides enhanced identification for both ends of the runway. These runway markings should be maintained through the long-term planning horizon. Runway 4L-22R has basic markings, which are adequate for existing and ultimate conditions.

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.

It should be noted that many airports are transitioning to light emitting diode (LED) lighting systems. LEDs have many advantages, including lower energy consumption, longer lifespan, increased durability, reduced size, greater reliability, and faster switching. While a larger initial investment is required upfront, the energy savings and reduced maintenance costs will outweigh any additional costs in the long run. As systems need to be repaired/replaced, consideration should be given to upgrading to LED systems.

A summary of the airside facilities at CHD is presented on **Exhibit 3D**.

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 CHD, this includes components for general aviation needs and support facilities.

GENERAL AVIATION ACTIVITIES

General aviation facilities are those necessary for handling general aviation aircraft, passengers, and cargo while on the ground. This section is devoted to identifying future general aviation facility needs during the planning period for the following types of facilities normally associated with general aviation terminal areas.

	AVAILABLE	SHORT TERM	LONG TERM
RUNWAYS		**Runway 4R-22L**	
	RDC B-II-5000	RDC B-II-5000	RDC B-II-5000
	4,870' x 75'	Maintain	Examine potential extension alternatives
	30,000 lbs. SWL	Maintain	Maintain
	Standard RSA; ROFA; ROFZ	Maintain	Maintain
	RPZs: 100% Owned by Airport Sponsor	Maintain	Maintain
		Runway 4L-22R	
	RDC B-II-VIS (small aircraft)	RDC B-II-VIS (small aircraft)	RDC B-II-VIS (small aircraft)
	4,401' x 75'	Maintain	Maintain
	30,000 lbs. SWL	Maintain	Maintain
	Standard RSA; ROFA; ROFZ	Maintain	Maintain
	RPZs: 100% Owned/Controlled by Avigation Easements	Maintain	Maintain
TAXIWAYS			
	TDG-2	TDG-2	TDG-2
	All taxiways at least 40' wide	Maintain	Maintain
	FAA Hot Spot #1	Consider Corrective Measures	Maintain Corrected Condition
	Direct Access Points - Taxiways F, M, and Q	Consider Corrective Measures	Maintain Corrected Condition
	High-Energy Crossings - Taxiways H and N	Consider Corrective Measures	Maintain Corrected Condition
NAVIGATIONAL AND APPROACH AIDS			
	RNAV (GPS) 1-Mile Visibility Minimums (4R)	Consider Improving to 3/4-Mile Visibility Minimums	Maintain
	VOR 1-Mile Visibility Minimums (4R)	Maintain	Maintain
	Runways 4L, 22R, 22L - Visual Only	Consider One-Mile or Greater GPS-based Instrument Approach	Maintain
	AWOS	Maintain	Maintain
	ATCT	Maintain	Maintain
	Segmented Circle/Lighted Windcone	Maintain	Maintain
	PAPI-4s (4R-22L) (4L-22R)	Maintain	Consider gradual replacement with LED technology
	REILs (4R-22L)	Consider REILs (4L-22R)	Consider gradual replacement with LED technology
LIGHTING, MARKING, AND SIGNAGE			
	Rotating Beacon	Maintain	Maintain
	Non-Precision Markings (4R-22L)	Maintain	Maintain
	Basic Markings (4L-22R)	Maintain	Maintain
	MIRL - (4R-22L & 4L-22R)	Maintain	Consider gradual replacement with LED technology
	MITL - All Taxiways	Maintain	Consider gradual replacement with LED technology
	Holding Position Markings - 200' from Runway 4R-22L Centerline	Maintain	Maintain
	Holding Position Markings - 125' from Runway 4L-22R Centerline	Maintain	Maintain
	Lighted airfield location and directional signage	Maintain	Consider gradual replacement with LED technology

ABBREVIATIONS

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

Exhibit 3D
AIRSIDE FACILITY REQUIREMENTS SUMMARY

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- General Aviation Terminal Services
- Aircraft Hangars
- Aircraft Parking Aprons

General Aviation Terminal Services

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 CHD, general aviation terminal services are provided by the terminal building and the FBO, Chandler Air Service. The terminal building is 5,500 square feet (sf) and Chandler Air Service has approximately 2,000 sf of terminal services-equivalent space.

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 1.5 in the short term, increasing to 2.5 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 larger aircraft operations through the long-term. These operations typically support larger turboprop and jet aircraft, which can accommodate an increasing passenger load factor. Such is the case at CHD, where an increasing number of turbine operations are anticipated.

Table 3L outlines the space requirements for general aviation terminal services at CHD through the long-term planning period. As shown in the table, up to 7,900 sf of additional space could be needed in the long-term for general aviation passengers. The amount of space currently offered by the terminal building and FBO combined is approximately 7,500 sf. Other SASOs on the airfield also provide space for pilots and passengers; however, these areas are not widely utilized by transient operators.

TABLE 3L | General Aviation Terminal Area Facilities
Chandler Municipal Airport

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need
General Aviation Services Facility Area (s.f.)	7,500	7,800	11,000	15,400
General Aviation Design Hour Passengers		62	88	123
Passenger Multiplier		1.5	2.0	2.5
Terminal Vehicle Parking Spaces	29	31	44	61
FBO/SASO Vehicle Parking Spaces	169	185	207	237

N/A - Approximate terminal space offered by FBOs is unknown.
[a] Includes total spaces at the terminal building and within the FBO/SASO areas.
Source: Coffman Associates analysis

General aviation vehicle parking demands have also been determined for CHD. Space determinations for passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs. There are currently 29 individual spaces at the terminal building and 169 spaces serving the FBO/SASOs at the airport. Parking requirements for general aviation activity call for approximately 29 terminal spaces in the short-term, increasing to approximately 61 spaces in the long-term planning horizon. For the FBO/SASO areas of the airport, vehicle parking needs are estimated at 185 in the short-term and 237 in the long-term reflecting growth in operational activity along with additional employee needs.

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. It was mentioned in Chapter Two that CHD maintains waiting lists for both T-hangars and the shade hangar. In total there are 112 individuals waiting for hangar space at CHD.

While most aircraft owners prefer enclosed aircraft storage, several 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.

As discussed in Chapter One, hangar types vary greatly in size and function. T-hangars, box hangars, and shade 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 289,069 sf of storage space at the airport comprised of T-hangars, box hangars, and shade 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 single engine, multi-engine, turboprop, and jet aircraft, as well as helicopters. Executive box hangar space at CHD is estimated at 98,748 sf. For future planning, a standard of 3,000 sf per turboprop, 5,000 sf per jet, and 1,500 sf per helicopter 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 five conventional hangars at CHD totaling approximately 50,700 sf. The same aircraft sizing standards utilized for executive hangars is also utilized for conventional hangars. Since portions of the hangars are known to be used for aircraft maintenance servicing, requirements for maintenance/service hangar area were estimated using a planning standard of 125 square feet per based aircraft. In total, there is currently approximately 31,900 sf of conventional hangar space that is cross utilized for aircraft maintenance and storage on the airport.

Future hangar requirements for the airport are summarized in **Table 3M**. 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.

TABLE 3M | Aircraft Hangar Requirements
Chandler Municipal Airport

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Total Based Aircraft	441	490	540	640	+199
Hangar Area Requirements					
T-Hangar, Box Hangar, Shade (sf)	289,069	322,900	373,800	475,700	+186,631
Executive Box Hangar Area (sf)	98,748	102,700	116,200	148,000	+49,252
Conventional Hangar Area (sf)	50,700	59,500	73,000	104,800	+54,100
- Aircraft Maintenance Area (sf)	31,900	61,300	67,500	80,000	+48,100
Total Hangar Area (sf)	**438,517**	**485,100**	**563,000**	**728,500**	**+289,983**

Source: Coffman Associates analysis

The analysis shows that future hangar requirements indicate a potential need for almost 290,000 sf of new hangar storage capacity through the long-term planning period. This includes a mixture of hangar types, with the largest needs projected in the T-hangar/box hangar/shade hangar category. 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.

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 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 20 percent of the busy day itinerant operations for general aviation operations. A planning standard of 800 square yards (sy) 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 sy per aircraft position was used. In addition, CHD has aircraft that use outside aircraft tiedowns for storage. It is assumed that these aircraft require less space than transient aircraft; therefore, a planning standard of 650 sy per aircraft was applied. For local tiedown needs, an additional 10 percent was added for maintenance activities and temporary storage needs. Apron parking requirements are presented in **Table 3N**. Transient apron parking needs are divided into business jet needs and smaller single and multi-engine aircraft needs.

TABLE 3N | Aircraft Parking Apron Requirements
Chandler Municipal Airport

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Local Aircraft Parking (sy)		164,515	175,110	193,700	
Transient General Aviation (sy)		59,200	63,200	71,200	
Jet/Turboprop Aircraft Parking (sy)		8,000	9,600	14,400	
Total Apron Area (sy)	**235,854**	**231,715**	**247,910**	**279,300**	**+43,446**

Source: Coffman Associates analysis

Currently, existing general aviation aircraft parking aprons at the airport total approximately 235,854 sy of space and provide 302 marked fixed-wing and helicopter parking positions. This includes tiedowns on all four aprons (terminal, FBO, north, and heliport). As shown in the table, the apron area currently available is adequate through the short-term period; however, an additional 43,446 sy of capacity is needed by the long-term period.

A summary of the general aviation landside facilities previously discussed is presented on **Exhibit 3E**.

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
- Perimeter Fencing and Gates

Aviation Fuel Storage

Chandler Air Service and the City of Chandler are the airport's only public fuel service providers. Chandler Air Service has a 12,000-gallon Jet A tank and a 10,000-gallon 100LL tank. The City of Chandler provides 100LL fuel utilizing a 12,000-gallon tank.

Based upon historic fuel flowage records provided by airport management, in 2019, the airport pumped 304,967 gallons of Jet A and 407,747 gallons of 100LL. Utilizing operations reported by the FAA's Traffic Flow Management System Count database, the number of turbine operations in 2019 totaled approximately 1,986 with the remainder (218,676) being piston operations. Dividing the total fuel flowage by

	AVAILABLE	SHORT-TERM	INTERMEDIATE-TERM	LONG-TERM
GENERAL AVIATION TERMINAL FACILITIES AND PARKING				
Building Space (sf)	7,500	7,800	11,000	15,400
Total GA Parking Spaces	198	216	251	298

AIRCRAFT STORAGE HANGAR REQUIREMENTS				
T-Hangar/Box/Shade Area (sf)	289,069	321,700	373,800	475,700
Executive Hangar Area (sf)	98,748	102,700	116,200	148,000
Conventional Hangar Area (sf)	50,700	59,500	73,000	104,800
Service/Maintenance Area (sf)	31,900	61,300	67,500	80,000
Total Hangar Storage Area (sf)	438,517	483,900	563,000	728,500

AIRCRAFT PARKING APRON				
Transient Single/Multi-Engine Aircraft (sy)		59,200	63,200	71,200
Transient Business Jet/Turboprop (sy)		8,000	9,600	14,400
Local Based (sy)		164,515	175,110	193,700
Total Apron Area (sy)	235,854	231,715	247,910	279,300

SUPPORT FACILITIES				
14-Day Fuel Storage - 100LL	22,000	16,600	17,400	18,900
14-Day Fuel Storage - Jet A	12,000	14,400	30,400	67,400

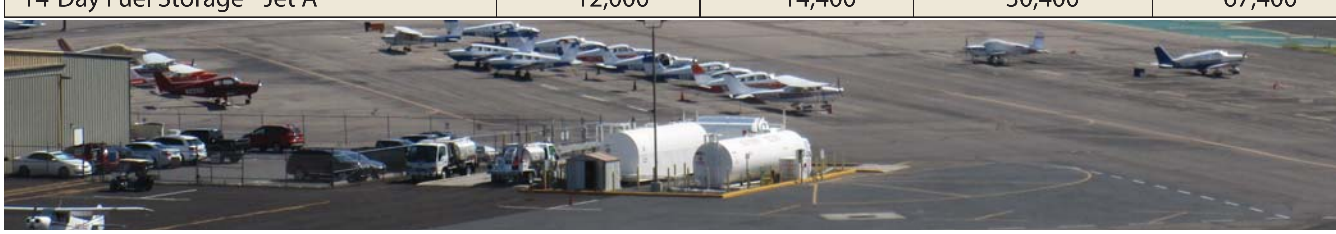


Exhibit 3E
LANDSIDE FACILITY REQUIREMENTS

the total number of operations provides a ratio of fuel flowage per operation. In 2019, the airport pumped approximately 153.6 gallons of Jet A per turbine operation and 1.9 gallons of 100LL per piston operation. It is anticipated that, over the course of the planning period, the Jet A flowage ratio will remain around 160 gallons per operation and the AvGas flowage ratio will remain static at 1.9 gallons per operation.

Maintaining a 14-day fuel supply would allow the airport to limit the impact of a disruption of fuel delivery. Currently, the airport has enough static fuel storage to meet the 14-day supply criteria for 100LL fuel through the long-term horizon. The forecasted fuel storage requirements summarized in **Table 3P** show a need to expand Jet A fuel storage capacity by up to 55,400 gallons by the long-term horizon.

TABLE 3P | Fuel Storage Requirements
Chandler Municipal Airport

			Planning Horizon		
	Capacity	2019 Need	Short-Term	Intermediate-Term	Long-Term
Jet A					
Daily Usage (gal.)	12,000	836	1,030	2,172	4,816
14-Day Supply (gal.)		11,700	14,400	30,400	67,400
Annual Usage (gal.)		304,967	376,000	792,900	1,757,900
AvGas					
Daily Usage (gal.)	22,000	1,117	1,188	1,241	1,347
14-Day Supply (gal.)		15,600	16,600	17,400	18,900
Annual Usage (gal.)		407,747	433,800	452,800	491,700

Sources: Historic fuel flowage data provided by airport administration; Fuel supply projections prepared by Coffman Associates.

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.

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; and
- Limits inadvertent access to the aircraft operations area by wildlife.

CHD operations areas are completely enclosed by a six-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. A series of controlled access gates are also available for use at the airport.

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at CHD 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 CHD.

Chapter Four

AIRPORT ALTERNATIVES

Chapter Four

AIRPORT ALTERNATIVES

In the previous chapter, aviation facilities required to satisfy airside and landside demand through the long-term planning period of the master plan were identified. In addition, various Federal Aviation Administration (FAA) standards were discussed that apply to airfield design. The next step in the planning process is to evaluate reasonable ways these facilities can be provided, and the design standards can be met. The purpose of this chapter is to formulate and examine rational development alternatives that 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 that 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 and discussion.

Some airports become constrained due to limited availability of space, while others may be constrained due to adjacent land use development. Careful consideration should be given to the layout of future facilities and impacts to potential airfield improvements at Chandler Municipal Airport (CHD). Proper planning at this time can ensure the long-term viability of the airport for aviation and economic growth.

The primary goal of this planning process is to develop a feasible plan for meeting the needs resulting from the projected market demand over the next 20 years. The plan of action should be developed in a manner that is consistent with the future goals and objectives of the City of Chandler, airport users, the local community, and the surrounding region, all of whom have a vested interest in the development and operation of CHD.

The goal is to develop an underlying rationale which supports the final recommended concept. Through this process, an evaluation of the highest and best uses of airport property will be made, while also weighing local development goals, efficiency, physical and environmental factors, capacity, and appropriate safety design standards.

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 the City of Chandler, CHD management, 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 planning considerations and alternatives presented in this chapter can be considered a beginning point in the evolution of a recommended concept for the future of CHD.

PLANNING OBJECTIVES

A set of basic planning objectives has been established to guide the alternatives development process. It is the goal of this master planning effort to produce a development plan for the airport that addresses forecast aviation demand and meets FAA design standards to the greatest degree possible. As owner and operator, the City of Chandler provides the overall guidance for the operation and development of the airport. It is of primary concern that CHD is marketed, developed, and operated for the betterment of the community and its users. The following basic planning principles and objectives will be utilized as general guidelines during this planning effort:

- To develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations;
- To preserve and protect public and private investments in existing airport facilities;
- To provide a means for the airport to grow as dictated by demand;
- To put into place a plan to ensure the long-term viability of the airport as well as to promote compatible land uses surrounding the airport;
- To develop a facility that is readily responsive to the changing needs of all aviation users;
- To be reflective and supportive of the long-term planning efforts currently applicable to the region;
- To develop a facility with a focus on self-sufficiency in both operational and developmental cost recovery; and,
- To ensure that future development is environmentally compatible.

REVIEW OF PREVIOUS AIRPORT PLANS

The previous master plan for CHD was completed in 2007. More recently, the Airport Layout Plan (ALP) was updated in 2016.

The existing Airport Layout Drawing is shown on **Exhibit 4A**. The Airport Layout Drawing graphically depicts airside and landside recommendations based upon previous airport planning that include:

- Extending Runway 4R-22L by 681 feet to the northeast for a full length of 5,550 feet.
- Taxiway improvements, including the extension of Taxiway B to the Runway 4L threshold, and geometry improvements to eliminate direct-access points from the apron to the runway and high-energy area crossings.
- Taxiway fillet improvements to meet current FAA design standards.
- Additional landside development in the form of T-hangars and shade hangars.

The analysis presented in this chapter will revisit the recommendations presented on the Airport Layout Drawing as well as in the previous Master Plan. Since completion of the last plan, the FAA has made significant modifications to design standards as outlined in the previous chapter. As such, some of the previous plan's elements may be carried over to this master plan and others may be changed and/or removed from further consideration.

NO ACTION/NON-DEVELOPMENT ALTERNATIVES

The City of Chandler is charged with managing the airport for the economic betterment of the community and region. In some cases, alternatives may include a no action option; however, for CHD, this would effectively reduce the quality of services being provided to the public, affect the aviation facility's ability to meet FAA design standards, and affect the region's ability to support aviation needs. The ramifications of a no action alternative extend into impacts on the economic well-being of the region. **An analysis of the economic benefit of the airport completed in 2016 found that CHD generates $109.06 million dollars in revenue and almost 800 jobs.** If facilities are not maintained and improved so that the airport provides a pleasant experience for the visitor or business traveler, or if delays become unacceptable, then activity and business may shift elsewhere. The no action alternative is also inconsistent with the long-term goals of the FAA and Arizona Department of Transportation (ADOT) – Aeronautics Group, which is to enhance local and interstate commerce. Therefore, a no action alternative is not considered further in this master plan.

Likewise, this study will not consider the relocation of services to another airport or development of a new airport site. The development of a new facility such as CHD is a very complex and expensive option. A new site will require greater land area, duplication of investment in facilities, installation of supporting infrastructure that is already available at the existing site, and greater potential for negative impacts to natural, biological, and cultural resources.

The purpose of this master plan is to examine aviation needs at CHD over the course of the next 20 years. Therefore, this master plan will examine the needs of the existing airport and will present a program of needed capital improvement projects to cover the scope of the plan. The airport is a lucrative business, transportation utility, and economic asset for the region. It can accommodate existing and future demand and should be developed accordingly to support the interests of local residents and businesses which rely upon it. Ultimately, the final decision with regards to pursuing development rests with the City of Chandler and the FAA on an individual project basis. The analysis to follow considers airside and landside development alternatives that take into account an array of facility demands, including safety, capacity, access, and efficiency.

AIRFIELD ALTERNATIVES

The development alternatives are categorized into two functional areas: airfield and landside. The airfield relates to runways, taxiways, navigational aids, lighting and marking aids, etc., which require the greatest commitment of land area to meet the physical layout of an airport, as well as the required airfield safety standards. The design of the airfield also defines minimum set-back distances from the runway and object clearance standards. These criteria are defined first to ensure that the fundamental needs of CHD are met. The landside includes terminal services, hangars, aircraft parking aprons, 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. This section focuses on airfield facilities.

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 CHD will meet the needs of the surrounding area, both during and beyond the planning period of this study.

As part of this alternatives analysis, Coffman Associates' subconsultant (Dibble Engineering) has prepared preliminary build-out cost estimates for each of the airfield and landside alternatives. Dibble Engineering is providing engineering support for the master plan and is familiar with CHD. A cost breakdown is provided at the end of each alternative description that outlines individual proposed projects so that a financial comparison can be made. These costs are planning-level estimates only that will need to be refined during the project design phase.

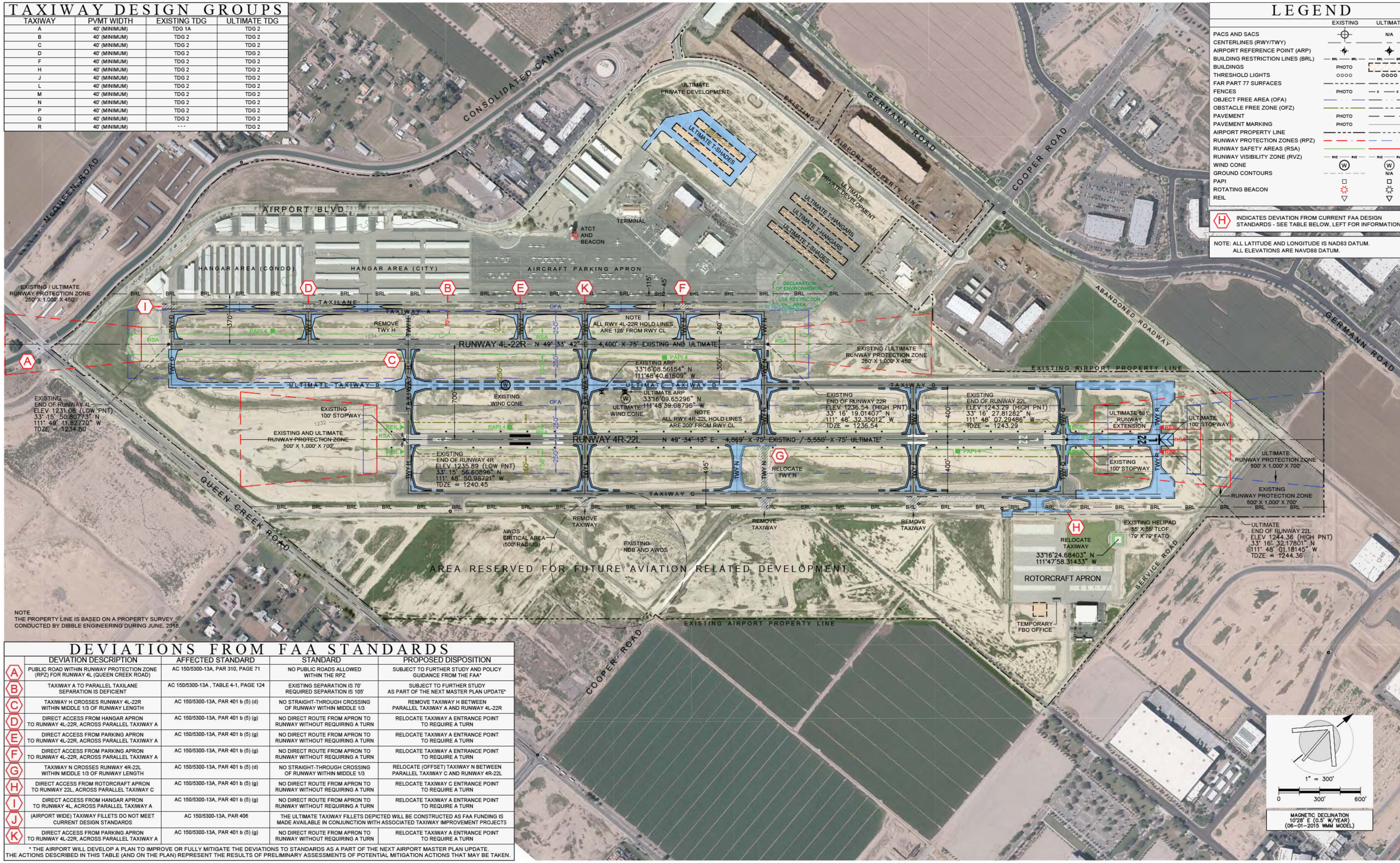
AIRFIELD CONSIDERATIONS

Table 4A presents a summary of the primary airfield planning considerations for the alternatives analysis. Landside planning considerations are outlined later in the chapter. These considerations are the result of the findings of the aviation demand forecasts and facility requirements evaluations, as well as input from the PAC, CHD management, and the public. In addition to these considerations, both runways should continue to meet applicable runway design code (RDC) standards[1]. Runway 4R-22L is planned to meet RDC B-II-5000 standards and Runway 4L-22R is planned to meet RDC B-II-VIS (small airplane) design standards.

[1] Applicable RDC standards are detailed in the Facility Requirements chapter.

TAXIWAY DESIGN GROUPS

TAXIWAY	PVMT WIDTH	EXISTING TDG	ULTIMATE TDG
A	40' (MINIMUM)	TDG 1A	TDG 2
B	40' (MINIMUM)	TDG 2	TDG 2
C	40' (MINIMUM)	TDG 2	TDG 2
D	40' (MINIMUM)	TDG 2	TDG 2
F	40' (MINIMUM)	TDG 2	TDG 2
H	40' (MINIMUM)	TDG 2	TDG 2
J	40' (MINIMUM)	TDG 2	TDG 2
L	40' (MINIMUM)	TDG 2	TDG 2
M	40' (MINIMUM)	TDG 2	TDG 2
N	40' (MINIMUM)	TDG 2	TDG 2
P	40' (MINIMUM)	TDG 2	TDG 2
Q	40' (MINIMUM)	TDG 2	TDG 2
R	40' (MINIMUM)	- - -	TDG 2



DEVIATIONS FROM FAA STANDARDS

	DEVIATION DESCRIPTION	AFFECTED STANDARD	STANDARD	PROPOSED DISPOSITION
A	PUBLIC ROAD WITHIN RUNWAY PROTECTION ZONE (RPZ) FOR RUNWAY 4L (QUEEN CREEK ROAD)	AC 150/5300-13A, PAR 310, PAGE 71	NO PUBLIC ROADS ALLOWED WITHIN THE RPZ	SUBJECT TO FURTHER STUDY AND POLICY GUIDANCE FROM THE FAA*
B	TAXIWAY A TO PARALLEL TAXILANE SEPARATION IS DEFICIENT	AC 150/5300-13A , TABLE 4-1, PAGE 124	EXISTING SEPARATION IS 70' REQUIRED SEPARATION IS 105'	SUBJECT TO FURTHER STUDY AS PART OF THE NEXT MASTER PLAN UPDATE*
C	TAXIWAY H CROSSES RUNWAY 4L-22R WITHIN MIDDLE 1/3 OF RUNWAY LENGTH	AC 150/5300-13A, PAR 401 b (5) (d)	NO STRAIGHT-THROUGH CROSSING OF RUNWAY WITHIN MIDDLE 1/3	REMOVE TAXIWAY H BETWEEN PARALLEL TAXIWAY A AND RUNWAY 4L-22R
D	DIRECT ACCESS FROM HANGAR APRON TO RUNWAY 4L-22R, ACROSS PARALLEL TAXIWAY A	AC 150/5300-13A, PAR 401 b (5) (g)	NO DIRECT ROUTE FROM APRON TO RUNWAY WITHOUT REQUIRING A TURN	RELOCATE TAXIWAY A ENTRANCE POINT TO REQUIRE A TURN
E	DIRECT ACCESS FROM PARKING APRON TO RUNWAY 4L-22R, ACROSS PARALLEL TAXIWAY A	AC 150/5300-13A, PAR 401 b (5) (g)	NO DIRECT ROUTE FROM APRON TO RUNWAY WITHOUT REQUIRING A TURN	RELOCATE TAXIWAY A ENTRANCE POINT TO REQUIRE A TURN
F	DIRECT ACCESS FROM PARKING APRON TO RUNWAY 4L-22R, ACROSS PARALLEL TAXIWAY A	AC 150/5300-13A, PAR 401 b (5) (g)	NO DIRECT ROUTE FROM APRON TO RUNWAY WITHOUT REQUIRING A TURN	RELOCATE TAXIWAY A ENTRANCE POINT TO REQUIRE A TURN
G	TAXIWAY N CROSSES RUNWAY 4R-22L WITHIN MIDDLE 1/3 OF RUNWAY LENGTH	AC 150/5300-13A, PAR 401 b (5) (d)	NO STRAIGHT-THROUGH CROSSING OF RUNWAY WITHIN MIDDLE 1/3	RELOCATE (OFFSET) TAXIWAY N BETWEEN PARALLEL TAXIWAY C AND RUNWAY 4R-22L
H	DIRECT ACCESS FROM ROTORCRAFT APRON TO RUNWAY 22L, ACROSS PARALLEL TAXIWAY C	AC 150/5300-13A, PAR 401 b (5) (g)	NO DIRECT ROUTE FROM APRON TO RUNWAY WITHOUT REQUIRING A TURN	RELOCATE TAXIWAY C ENTRANCE POINT TO REQUIRE A TURN
I	DIRECT ACCESS FROM HANGAR APRON TO RUNWAY 4L, ACROSS PARALLEL TAXIWAY A	AC 150/5300-13A, PAR 401 b (5) (g)	NO DIRECT ROUTE FROM APRON TO RUNWAY WITHOUT REQUIRING A TURN	RELOCATE TAXIWAY A ENTRANCE POINT TO REQUIRE A TURN
J	(AIRPORT WIDE) TAXIWAY FILLETS DO NOT MEET CURRENT DESIGN STANDARDS	AC 150/5300-13A, PAR 406	THE ULTIMATE TAXIWAY FILLETS DEPICTED WILL BE CONSTRUCTED AS FAA FUNDING IS MADE AVAILABLE IN CONJUNCTION WITH ASSOCIATED TAXIWAY IMPROVEMENT PROJECTS	
K	DIRECT ACCESS FROM PARKING APRON TO RUNWAY 4L-22R, ACROSS PARALLEL TAXIWAY A	AC 150/5300-13A, PAR 401 b (5) (g)	NO DIRECT ROUTE FROM APRON TO RUNWAY WITHOUT REQUIRING A TURN	RELOCATE TAXIWAY A ENTRANCE POINT TO REQUIRE A TURN

* THE AIRPORT WILL DEVELOP A PLAN TO IMPROVE OR FULLY MITIGATE THE DEVIATIONS TO STANDARDS AS A PART OF THE NEXT AIRPORT MASTER PLAN UPDATE.
THE ACTIONS DESCRIBED IN THIS TABLE (AND ON THE PLAN) REPRESENT THE RESULTS OF PRELIMINARY ASSESSMENTS OF POTENTIAL MITIGATION ACTIONS THAT MAY BE TAKEN.

CHANDLER MUNICIPAL AIRPORT (CHD)
Chandler, Arizona

△	REVISION DESCRIPTION	DATE

AIRPORT LAYOUT DRAWING

CHANDLER MUNICIPAL AIRPORT (CHD)
CHANDLER, ARIZONA

Planning: NJP
Drawn: NJP
Checked: DE
Date: 11 / 22 / 2016

Sheet No. 2 of 11

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TABLE 4A | Airfield Planning Considerations
Chandler Municipal Airport

#	Non-Standard/Deficient Condition	Applicable Design Standard	Proposed Action(s) to be Evaluated
1	Runway 4R-22L, at 4,870 feet long, is deficient in length to safely serve most business jet aircraft.	FAA AC 150/5325-4B, *Runway Length Requirements for Airfield Design,* Paragraph 306.	Extend Runway 4R-22L.
2	Runway 4L-22R should be equipped with runway end identifier lights (REILS) to improve pilot situational awareness.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 317.a.(4).	Add REILs to both ends of Runway 4L-22R.
3	Taxiways F, M, and Q provide direct access from apron areas to the runways, which can result in a runway incursion.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 401.b.(5).(g).	Offset connecting taxiways to force pilots to make a turn prior to entering a runway.
4	Taxiways H and N create high-energy area runway intersections with a runway.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 401.b.(5).(d).	Move crossings to areas outside the high-energy area (middle 1/3rd of the runway).
5	Existing holding aprons are non-standard design.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 412.b.	Construct new holding bays that meet design standard.
6	Hot Spot #1 – Runway 22R may be used as an alternate taxi route due to run-up area and taxiway congestion.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 401.	Extend Taxiway B and redesign holding bay to mitigate congestion.
7	Existing blast pads at the ends of Runway 4R-22L do not meet design standards.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 304.d.	Upgrade blast pads at both ends of Runway 4R-22L.
8	Runway 4L-22R basic markings do not meet design standard for a non-precision approach runway.	FAA AC 150/5300-13A, Change 1, *Airport Design,* Paragraph 205.b.(2)	If non-precision approaches are established to the runway, the markings should be upgraded to include threshold markings.

Source: Coffman Associates analysis.

Consideration #1 – Runway Length

The primary runway at CHD, Runway 4R-22L, is currently 4,870 feet long and 75 feet wide. The existing width meets RDC B-II-5000 design standards; however, the length is insufficient to safely accommodate most turbine powered aircraft, particularly during hot weather conditions and when aircraft operate with heavier loads. The current Airport Layout Plan (ALP) for CHD includes a 680-foot extension of the runway to the northeast for a full length of 5,550 feet. Constraints in the form of E. Queen Creek Road to the southwest and the development of the SOLLiD Cabinetry facility along Germann Road to the northeast prohibit any further extension of the runway beyond the currently planned 680-foot extension. For this reason, the 680-foot northeast extension is the only extension alternative considered.

Consideration #2 – Visual Aids

Both runways are equipped with precision approach path indicator (PAPI) systems and the primary runway is equipped with runway end identifier lights (REILs). Parallel Runway 4L-22R is not equipped with REILS, which help pilots locate and identify the end of the runway, particularly when an airport is located within a developed area with many light sources. As a result, REILs are recommended for both ends of Runway 4L-22R. The alternative exhibits to follow each reflect adding REILs to the parallel runway.

Consideration #3 – Direct-Access Points

FAA taxiway geometry design standards recommend offsetting taxiway connections between aprons and runways to mitigate the potential of pilots unfamiliar with the airport layout unintentionally taxiing directly onto a runway resulting in a runway incursion. Taxiways F, M, and Q provide for direct access to the runway and are, therefore, non-standard design. The airfield alternatives present options for eliminating the direct-access points and forcing pilots to make turns, which increases a pilot's situational awareness.

Consideration #4 – High Energy Intersections

FAA taxiway geometry design standards recommend avoiding runway/taxiway intersections in the middle third of a runway where a pilot can least maneuver. High energy intersections include Taxiway H and Runway 4L-22R, and Taxiway N and Runway 4R-22L. The airfield alternatives present options for eliminating the high energy area intersections.

Consideration #5 – Holding Bays

The airport has six existing holding bays: two of which are located at the end of Runway 4L-22R (north side) and four located near the end of Runway 4R-22L (north and south sides). These holding aprons are a traditional design consisting of a wide pavement area that allows aircraft to pull aside and perform pre-flight engine checks. The traditional design for these holding aprons is now considered non-standard since the wide expansive pavement area makes signage and lighting more difficult for pilots to see, which can lead to pilot confusion, particularly near the entrance of a runway. In 2014, the FAA changed the holding bay design standard to incorporate clearly marked entrance/exits with independent parking areas separated by islands that allow aircraft to safely bypass each other, while also decreasing the amount of pavement. The airfield alternatives consider closing the traditional holding bays and propose options for constructing new holding bays that meet current design standards.

Consideration #6 – Hot Spot Mitigation

Hot spot #1 at CHD has resulted from pilots using Runway 22R as an alternate route due to run-up area and taxiway congestion. Previous planning has included extending Taxiway B to the southwest to expand taxiway circulation routes, which would alleviate congestion at the end of Runway 22R. The alternatives analysis will examine this and other taxiway layouts to mitigate the hot spot. Furthermore, redesigning the holding bay at the Runway 22R end will also contribute to mitigating the hot spot issues.

Consideration #7 – Blast Pads

Runway 4R-22L is planned to accommodate more frequent operations by jet aircraft. Jet blast can cause soil erosion and sends dust and debris into the air. The existing blast pads on Runway 4R-22L, which also function as stopways, are 90 feet long and 90 feet wide. The RDC B-II-5000 blast pad design standard is 95 feet wide and 150 feet long. The airfield alternatives depict adding new blast pads to both ends of the runway that meet these dimensions.

Consideration #8 – Runway 4L-22R Markings

Runway 4L-22R does not currently have published instrument approach capabilities. It is recommended that the airport consider establishing non-precision approaches to both ends of the runway with visibility minimums of one mile or greater. Implementing a non-precision approach to the runway would not change the dimensions of the safety areas, including the Runway Protection Zones (RPZs), nor would it require the installation of new on-site equipment; however, the runway markings would need to be upgraded to include threshold markings. Each of the airfield alternatives reflect the upgraded non-precision markings on Runway 4L-22R.

AIRFIELD ALTERNATIVE 1

Depicted on **Exhibit 4B**, Airfield Alternative 1 presents a scenario focused on correcting non-standard airfield geometry and maintaining the primary runway at its current length of 4,870 feet. This is an important scenario to consider since an extension to Runway 4R-22L is not a foregone conclusion. **A runway extension still requires justification with the FAA to be eligible for funding through the Airport Improvement Program (AIP). Justification typically involves documentation of at least 500 annual operations by operators and aircraft expressing a need for the additional runway. An environmental assessment (EA) process would also need to be completed, along with extensive public outreach. If justification for a runway extension is not achieved for several years or ever, a contingency airfield plan should be available.**

The features of Airfield Alternative 1 include:

1. REILs are added to both ends of Runway 4L-22R.
2. Taxiway B is extended south to Taxiway H to improve taxiway circulation and mitigate hot spot #1 by providing additional access points to Taxiway B via Taxiway L.
3. The portion of Taxiway F north of Taxiway A is closed and the pavement removed to prevent direct access to the runway.
4. The portion of Taxiway H between Taxiway A and Runway 4L-22R is closed and the pavement removed to eliminate the high energy runway crossing point.
5. The portion of Taxiway M between Taxiway A and Runway 4L-22R is closed and the pavement removed to prevent direct access to the runway.
6. The holding bay at the Runway 22R end and the taxilane extending to the north along the edge of the environmental site is closed and the pavement removed. The holding bay and taxilane create a wide expansive pavement area that is non-standard.
7. The existing holding bays throughout the airfield are closed and the pavement removed. New single lane holding bays are added along Taxiway B east of the Runway 22R RPZ, west of Taxiway H, and south of Taxiway C near the ends of the runway.
8. The portion of Taxiway N between Runway 4R-22L and Taxiway C is closed, and the pavement removed to eliminate the high energy runway crossing point. A new connecting taxiway is added approximately 200 feet west of the section to be closed.

9. The portion of Taxiway Q south of Taxiway C connecting to the heliport apron is closed and the pavement removed to prevent direct access to the runway. A new connecting taxiway to Taxiway C is added, approximately 100 feet west of the section to be closed.
10. Blast pads at the ends of Runway 4R-22L are expanded to meet design standards.
11. Upgraded Runway 4L-22R to non-precision markings by adding threshold markings.

Airfield Alternative 1 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	Runway 4R-22L	
1	Construct Blast Pads at both runway ends	$470,000
	Runway 4L-22R	
2	Install REILS at both runway ends	$110,000
	Parallel Taxiway A *(and projects along Taxiway A)*	
3	Remove Run-up near TWY A/D intersection	$110,000
4	Remove Run-up near TWY A/N intersection	$210,000
5	Remove Connector TWY H between TWY A and RWY 4L-22R	$120,000
6	Remove Connector TWY M between TWY A and RWY 4L-22R	$120,000
	Parallel Taxiway B *(and projects along Taxiway B)*	
7	Extend TWY B between TWY L and TWY N	$1,600,000
8	Extend TWY B between TWY N and TWY H	$1,600,000
9	Remove Run-up on TWY H between RW 4R-22L & RW 4L 22R	$140,000
10	Remove Run-up near TWY B/Q intersection	$180,000
11	Construct Holding Bay near TWY B/H intersection (1 aircraft)	$470,000
12	Construct Holding Bay near TWY B/P intersection (1 aircraft)	$450,000
13	Construct Connector TWY M between TWY B and RWY 4L-22R	$420,000
	Parallel Taxiway C *(and projects along Taxiway C)*	
14	Remove Run-up near TWY C/H intersection	$130,000
15	Remove Run-up near TWY C/Q intersection	$140,000
16	Construct Holding Bay near TWY C/H intersection (1 aircraft)	$510,000
17	Construct Holding Bay near TWY C/P intersection (1 aircraft)	$510,000
18	Relocate TWY N between TWY C and RWY 4R-22L	$630,000
19	Relocate TWY Q between TWY C and hangar area	$510,000
	TOTAL	**$8,430,000**

Source: Dibble Engineering

AIRFIELD ALTERNATIVE 2

Depicted on **Exhibit 4C**, Airfield Alternative 2 incorporates a 680-foot extension to Runway 4R-22L for a full length of 5,550 feet. This added length will make the airport more accessible to jet aircraft, particularly during hot weather conditions.

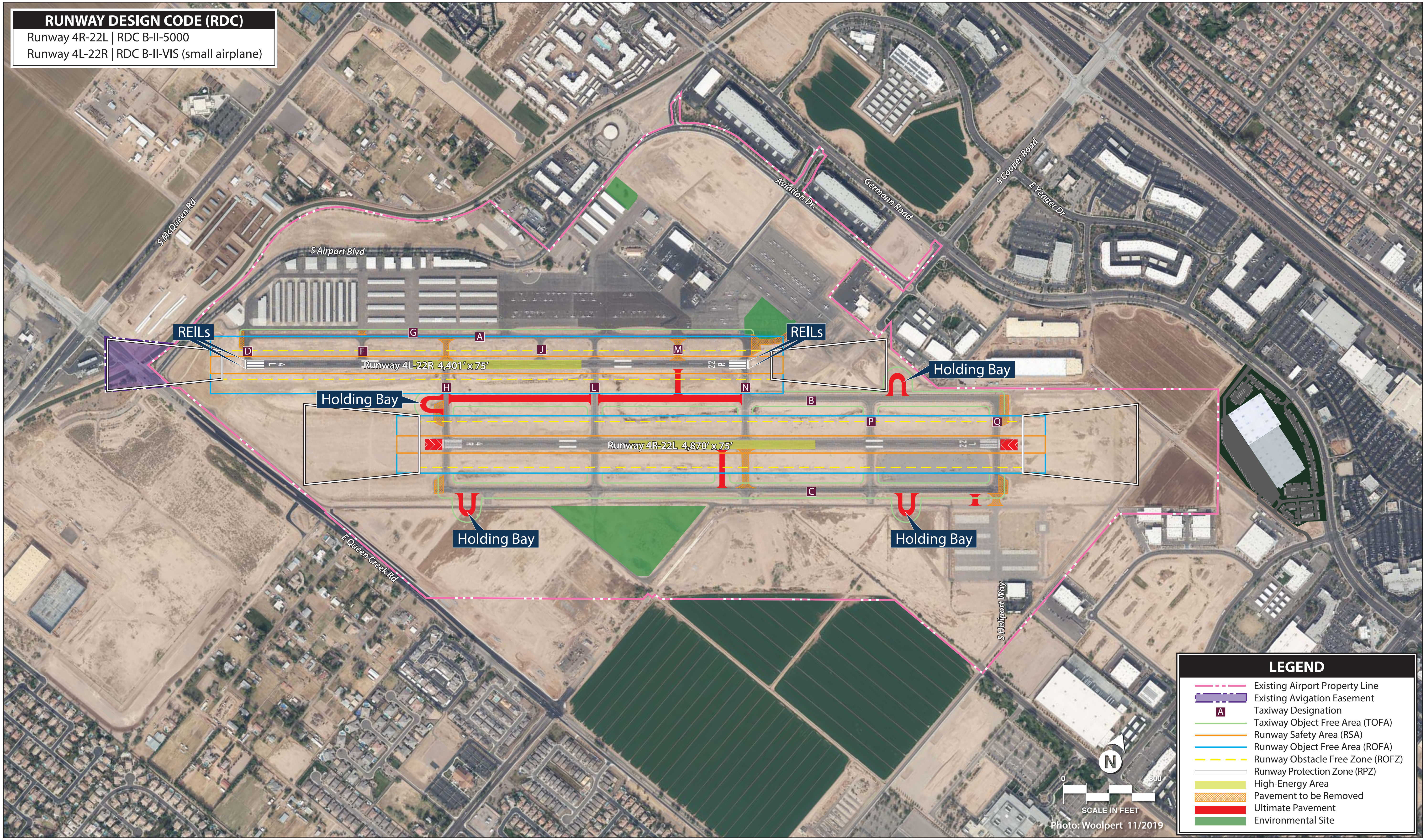

Exhibit 4B
AIRFIELD ALTERNATIVE 1

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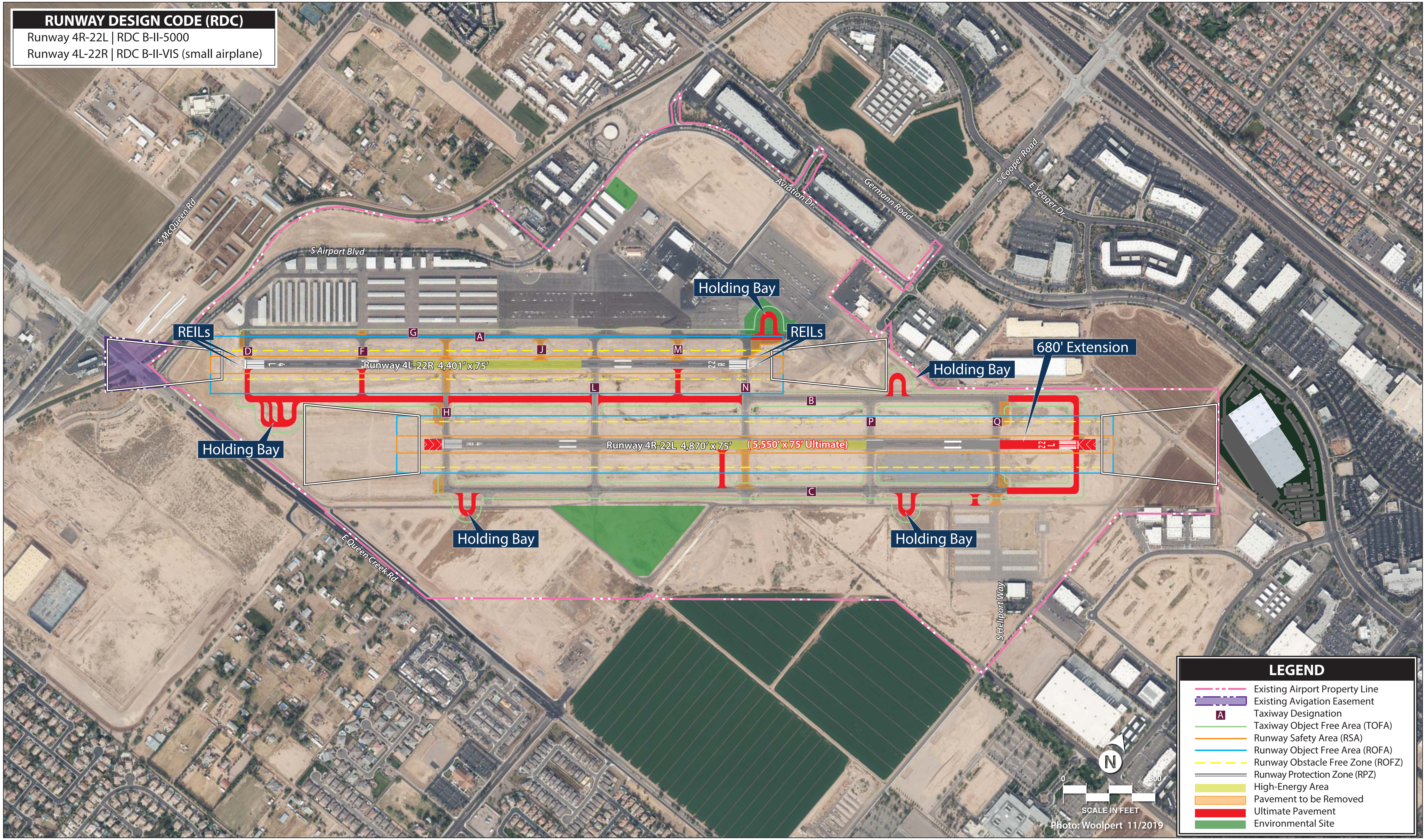

Exhibit 4C
AIRFIELD ALTERNATIVE 2

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The features of Airfield Alternative 2 include:

1. Runway 4R-22L is extended by 680 feet to the northeast for a full length of 5,550 feet. The associated RDC B-II-5000 safety areas are extended for the same distance but remain entirely on airport property.
2. Taxiways B and C are extended to the new Runway 22L threshold.
3. Runway 4L-22R is maintained at its current length of 4,401 feet and fully meets RDC B-II-VIS (small airplane) design standards.
4. REILs are added to both ends of Runway 4L-22R.
5. Taxiway B is extended south to the Runway 4L threshold to improve taxiway circulation and mitigate hot spot #1 by providing additional access points to Taxiway B via Taxiway L and F.
6. The portion of Taxiway F north of Taxiway A is closed and the pavement removed to prevent direct access to the runway.
7. Taxiway J is closed, and the pavement removed. Taxiway J is located approximately 475 feet from Taxiway L. Taxiway exits should be spaced 750 feet or greater to have an effect on capacity. Since Taxiway J does not meet this spacing recommendation, it can be considered for removal.
8. The portion of Taxiway H between Taxiway A and Taxiway B (excluding the runway pavement) is closed and the pavement removed to eliminate the high energy runway crossing point. An alternate route is created by extending Taxiway F from Runway 4L-22R to Taxiway B.
9. The portion of Taxiway M between Taxiway A and Runway 4L-22R is closed and the pavement removed to prevent direct access to the runway.
10. The holding bay at the Runway 22R end and the taxilane extending to the north along the edge of the environmental site is closed and the pavement removed. The holding bay and taxilane create a wide expansive pavement area that is non-standard.
11. The existing holding bays throughout the airfield are closed and the pavement removed. New single lane holding bays are added on the environmental site near the Runway 22R threshold, east of the Runway 22R RPZ and south of Taxiway C.
12. A multi-lane holding bay is located near the Runway 4L threshold along Taxiway B. A multi-lane holding bay can accommodate multiple aircraft at once, ideally suited for areas that can become congested.
13. The portion of Taxiway N between Runway 4R-22L and Taxiway C is closed and the pavement removed to eliminate the high energy runway crossing point. A new connecting taxiway is added approximately 200 feet west of the section to be closed.
14. The portion of Taxiway Q south of Taxiway C connecting to the heliport apron is closed and the pavement removed to prevent direct access to the runway. A new connecting taxiway to Taxiway C is added approximately 100 feet west of the section to be closed.
15. Blast pads at the ends of Runway 4R-22L are expanded to meet design standards.
16. Upgrade Runway 4L-22R to non-precision markings by adding threshold markings.

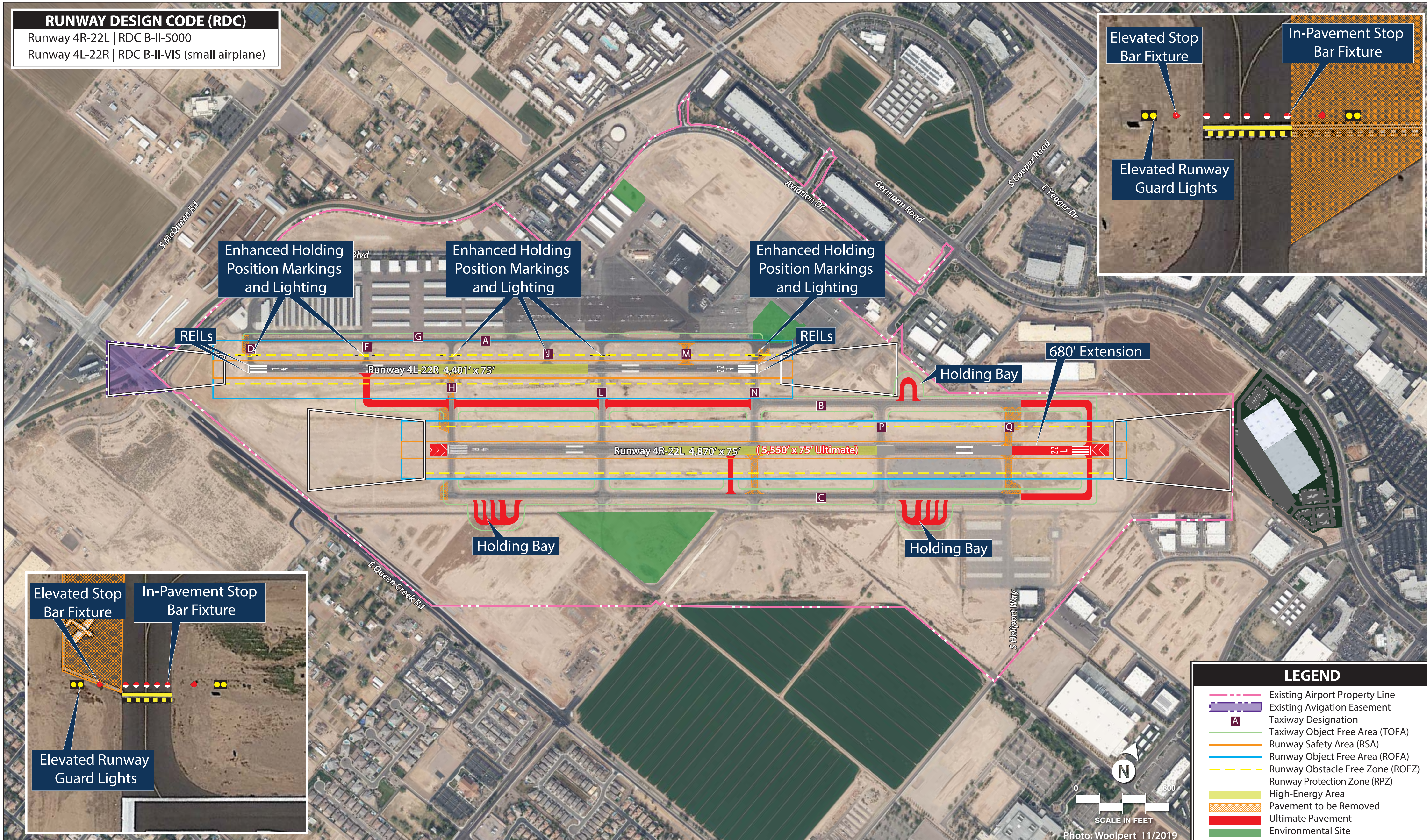
Airfield Alternative 2 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	Runway 4R-22L	
1	Runway Extension (680') + TW B & TW C Extensions	$2,930,000
2	Construct Blast Pads at both runway ends	$470,000
	Runway 4L-22R	
3	Install REILS at both runway ends	$110,000
	Parallel Taxiway A *(and projects along Taxiway A)*	
4	Remove Run-up near TWY A/D intersection	$110,000
5	Remove Run-up near TWY A/N intersection	$210,000
6	Construct Holding Bay near TWY A/N intersection (1 aircraft)	$670,000
7	Remove Connector TWY H between TWY A and RWY 4L-22R	$120,000
8	Remove Connector TWY J between TWY A and RWY 4L-22R	$130,000
9	Remove Connector TWY M between TWY A and RWY 4L-22R	$120,000
	Parallel Taxiway B *(and projects along Taxiway B)*	
10	Extend TWY B between TWY L and TWY N	$1,600,000
11	Extend TWY B between TWY N and TWY H	$1,600,000
12	Extend TWY B between TWY H and TWY D, with new RWY End Connector	$2,050,000
13	Remove Run-up on TWY H between RW 4R-22L & RW 4L 22R	$140,000
14	Remove Run-up near TWY B/Q intersection	$180,000
15	Construct Holding Bay near TWY B/D intersection (3 aircraft)	$800,000
16	Construct Holding Bay near TWY B/P intersection (1 aircraft)	$450,000
17	Construct Connector TWY F between TWY B and RWY 4L-22R	$430,000
18	Construct Connector TWY M between TWY B and RWY 4L-22R	$430,000
	Parallel Taxiway C *(and projects along Taxiway C)*	
19	Remove Run-up near TWY C/H intersection	$130,000
20	Remove Run-up near TWY C/Q intersection	$140,000
21	Construct Holding Bay near TWY C/H intersection (1 aircraft)	$510,000
22	Construct Holding Bay near TWY C/P intersection (1 aircraft)	$510,000
23	Relocate TWY N between TWY C and RWY 4R-22L	$630,000
24	Relocate TWY Q between TWY C and hangar area	$510,000
	TOTAL	**$14,980,000**

Source: Dibble Engineering

AIRFIELD ALTERNATIVE 3

Depicted on **Exhibit 4D**, Airfield Alternative 3 also includes a 680-foot extension to Runway 4R-22L for a full length of 5,550 feet. The primary difference between Alternative 3 and the others is that it limits the number of taxiways being closed in favor of incorporating enhanced lighting and marking to mitigate direct access points.


RUNWAY DESIGN CODE (RDC)
Runway 4R-22L | RDC B-II-5000
Runway 4L-22R | RDC B-II-VIS (small airplane)
Elevated Stop Bar Fixture
In-Pavement Stop Bar Fixture
Elevated Runway Guard Lights
Enhanced Holding Position Markings and Lighting
Enhanced Holding Position Markings and Lighting
Enhanced Holding Position Markings and Lighting
REILs
REILs
Holding Bay
680' Extension
Runway 4L-22R 4,401' x 75'
Runway 4R-22L 4,870' x 75' (5,550' x 75' Ultimate)
Holding Bay
Holding Bay
Elevated Stop Bar Fixture
In-Pavement Stop Bar Fixture
Elevated Runway Guard Lights
S McQueen Rd
Aviation Dr
Germann Road
S Cooper Road
E Yeager Dr
E Queen Creek Rd
S Heliport Way
LEGEND
Existing Airport Property Line
Existing Avigation Easement
Taxiway Designation
Taxiway Object Free Area (TOFA)
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
High-Energy Area
Pavement to be Removed
Ultimate Pavement
Environmental Site
SCALE IN FEET
Photo: Woolpert 11/2019

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The features of Airfield Alternative 3 include:

1. Runway 4R-22L is extended by 680 feet to the northeast for a full length of 5,550 feet. The associated RDC B-II-5000 safety areas are extended for the same distance but remain entirely on airport property.
2. Taxiways B and C are extended to the new Runway 22L threshold.
3. Runway 4L-22R is maintained at its current length of 4,401 feet and fully meets RDC B-II-VIS (small airplane) design standards.
4. REILs are added to both ends of Runway 4L-22R.
5. Taxiway B is extended west to Taxiway F to improve taxiway circulation and mitigate hot spot #1 by providing additional access points to Taxiway B via Taxiway L and F.
6. All holding position markings on the north side of Runway 4L-22R would be equipped with enhanced holding position markings, elevated guard lights, and in-pavement stop bar fixtures for the purpose of raising pilot situational awareness to prevent runway incursions. These systems could eliminate the need to remove pavement to mitigate direct access points.
7. The portion of Taxiway H between Runway 4L-22R and Taxiway B is closed and the pavement removed to eliminate the high energy runway crossing point. An alternate route is created by extending Taxiway F from Runway 4L-22R to Taxiway B.
8. The portion of Taxiway M between Taxiway A and Runway 4L-22R is closed and the pavement removed to prevent direct access to the runway. Taxiway M is a highly trafficked direct access point for the fixed base operator (FBO). This alternative maintains its removal rather than utilizing enhanced holding position markings and lighting to ensure operational safety.
9. The holding bay at the Runway 22R end and the taxilane extending to the north along the edge of the environmental site is closed and the pavement removed. The holding bay and taxilane create a wide expansive pavement area that is non-standard.
10. The existing holding bays throughout the airfield are closed and the pavement removed. A new single lane holding bay is added east of the Runway 22R RPZ.
11. Two multi-lane holding bays are located south of Taxiway C. As development occurs on the south side, it may become necessary to expand the holding bay capacity with multiple lanes to mitigate congestion.
12. The portion of Taxiway N between Runway 4R-22L and Taxiway C is closed and the pavement removed to eliminate the high energy runway crossing point. A new connecting taxiway is added approximately 200 feet west of the section to be closed.
13. Taxiway Q is closed, and the pavement removed to prevent direct access to the runway from heliport apron.
14. Blast pads at the ends of Runway 4R-22L are expanded to meet design standards.
15. Upgrade Runway 4L-22R to non-precision markings by adding threshold markings.

Airfield Alternative 3 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	Runway 4R-22L	
1	Runway Extension (680') + TW B & TW C Extensions	$2,930,000
2	Construct Blast Pads at both runway ends	$470,000
	Runway 4L-22R	
3	Install REILS at both runway ends	$110,000
4	Install Enhanced Holding Position Markings and Lighting, (at 6 locations - Connectors D, F, H, J, L & N, between RWY 4L-22R and TWY A)	$650,000
	Parallel Taxiway A *(and projects along Taxiway A)*	
5	Remove Run-up near TWY A/D intersection	$110,000
6	Remove Run-up near TWY A/N intersection	$210,000
7	Remove Connector TWY M between TWY A and RWY 4L-22R	$120,000
	Parallel Taxiway B *(and projects along Taxiway B)*	
8	Extend TWY B between TWY L and TWY N	$1,600,000
9	Extend TWY B between TWY N and TWY H	$1,600,000
10	Extend TWY B between TWY H and TWY F, with new connector	$1,280,000
11	Remove Run-up on TWY H between RW 4R-22L & RW 4L 22R	$140,000
12	Remove Run-up near TWY B/Q intersection	$180,000
13	Construct Holding Bay near TWY B/P intersection (1 aircraft)	$450,000
14	Remove Existing Connector TWY Q between TWY B and RWY 4R-22L (Relocated with Extension of TWY B)	$180,000
15	Remove Connector TWY H between TWY B and RWY 4L-22R	$130,000
	Parallel Taxiway C *(and projects along Taxiway C)*	
16	Remove Run-up near TWY C/H intersection	$130,000
17	Remove Run-up near TWY C/Q intersection	$140,000
18	Construct Holding Bay near TWY C/H intersection (3 aircraft)	$960,000
19	Construct Holding Bay near TWY C/P intersection (3 aircraft)	$960,000
20	Relocate TWY N between TWY C and RWY 4R-22L	$630,000
21	Remove Existing Connector TWY Q between TWY C and RWY 4L-22R (Relocated with Extension of TWY C)	$180,000
	TOTAL	**$13,160,000**

Source: Dibble Engineering

AIRFIELD SUMMARY

The sections above outlined seven planning considerations for the airfield at CHD. The primary issue at play on the airfield is addressing non-standard airfield geometry. While it may be simple enough to move forward with an alternative to close taxiway pavement that might correct the issue, it is equally important to consider any unintended consequences of those actions. If circulation is impacted, alternate routes need to be provided to ensure new bottlenecks are not created. For this reason, it is vitally important that the PAC, airport/city management, and the public offer their feedback so that the best course of action is selected.

LANDSIDE ALTERNATIVES

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. 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. Consideration will also be given to non-aviation uses that can provide additional revenue support to the airport and support economic development for the region.

LANDSIDE CONSIDERATIONS

Landside planning considerations, summarized in **Table 4B**, will focus on strategies following a philosophy of separating activity levels. Landside facility development at CHD is focused primarily on the north side, including a terminal building, aprons, a variety of hangar facilities, and fixed base operator (FBO) or specialty aviation service operator (SASO) related facilities. Helicopter-related facilities are currently the only development on the south side. Of the airport's 532.478 acres, approximately 68 percent has been developed, leaving approximately 170 acres available for new development.

Consideration #1 – Terminal Services

Operations at CHD are projected to continue to increase over the course of the next 20 years. As operations grow, so will the need for more terminal service space, which includes passenger and pilot lounges, flight planning equipment, concessions, airport management offices, and storage space. The existing terminal building (constructed in 1996), combined with the available FBO spaces dedicated to these uses, will become undersized and outdated over time. For the airport to attract new high-end clientele, consideration should be given to developing a new, modern terminal building with all appropriate amenities to compete with other Phoenix area reliever airports. The airport and its terminal services are a very important link to the entire region, whether it is for business or pleasure. Consideration to aesthetics should be given high priority in all public areas, as the terminal will serve as the first impression a visitor may have of the community.

TABLE 4B | Landside Planning Considerations
Chandler Municipal Airport

#	Landside Component	Existing Capacity/Condition	Consideration
1	Terminal Services	Existing 5,500 sf terminal on north side; 2,000 sf provided by FBO; 7,500 sf total	Expand terminal capacity to at least 15,400 sf. With the development on the south side, consider relocating main terminal to south side.
2	Hangars	438,517 sf (T-hangars, T-shades, executive, and conventional hangars)	Increase total capacity by at least 290,000 sf.
3	Aprons	235,854 sy	Increase capacity by at least 43,500 sy.
4	Fuel Storage	12,000 gallons (Jet A) 22,000 gallons (AvGas)	Increase Jet A storage capacity by at least 55,400 gallons. Consider new self-service fueling stations particularly on south side to support future development. Relocate existing underground AvGas storage tank at the airport operations and maintenance facility to the terminal apron.
5	Airport Operations & Maintenance	Utilizes old helipad site north of S. Airport Boulevard	Consider relocation of these facilities to provide better access to the airfield and to be in closer proximity to airport administration offices.
6	Aircraft Wash Rack	Not available	Consider sites for a wash rack to expand available airport amenities.
7	General Aviation Pilot's Lounge	Not available	Consider sites for a general aviation pilot's lounge.
8	Land Development	Approximately 363 acres (68%) of the airport's 532.478 acres is developed predominantly for aviation-related uses.	Consider appropriate aviation and non-aviation-related uses for the future development of undeveloped property and consider redevelopment opportunities for under-utilized areas.

sf – square feet | sy – square yards
Source: Coffman Associates analysis.

Consideration #2 – Hangars

With a hangar space waiting list of 87 people as of June 2020, there is demand for additional hangar capacity at CHD today. The landside alternatives will consider areas for the development of various hangar styles, including small aircraft facilities, executive hangars, and FBO/SASO hangars. These areas are further defined below.

- **Small aircraft facilities** typically consist of T-hangars/T-shades. These facilities often have lower levels of activity and, as such, can be located away from the primary apron areas in more remote locations of the airport. Limited utility services are needed for these areas.

- **Executive hangars** consist primarily of clear span hangars of less than 10,000 sf, which can accommodate small aviation businesses, one larger aircraft, or multiple smaller aircraft. These hangar areas typically require all utilities and segregated roadway access.

- **FBO/SASOs** are businesses that offer services, including but not limited to, aircraft rental and flight training, flight testing, aircraft manufacturing, aircraft charters, aircraft maintenance, line service, and aircraft fueling. The facilities associated with FBOs/SASOs include large conventional-type hangars that hold several aircraft. High levels of activity often characterize these operations, with a need for apron space for the storage and circulation of aircraft. These facilities are best placed along ample apron frontage with good visibility from the runway system for transient aircraft. Utility services are needed for these types of facilities, as well as vehicle parking areas.

Conceptual/order-of-magnitude costs for a range of hangar sizes is provided below. It is important to note that these costs are not inclusive of significant engineering/site preparations that may be required for unique site conditions and do not include special amenities, such as office space, conference areas, etc.

- 8,000 SF ~ $450,000
- 20,000 SF ~ $1,100,000
- 30,000 SF ~ $1,700,000
- T-Hangars ~ $45-$50/SF

Consideration #3 – Aprons

CHD has 235,854 sy of apron space for aircraft parking and circulation. Based on projected growth in based aircraft and transient operations, an additional 43,500 sy of apron capacity is needed over the next 20 years. Since apron space is typically co-located with hangar facilities, the landside alternatives assume areas of hangar development will also include apron space.

Consideration #4 – Fuel Storage

Additional fuel storage capacity for Jet A fuel is needed over the course of the planning period driven by increased activity by turbine aircraft. Since these facilities are typically associated with FBO/SASO operators, the landside alternatives assume new fuel storage facilities will be added in these areas. Additionally, the existing underground 100LL fuel storage tank, located on the north side of S. Airport Boulevard near the airport operations/maintenance facilities, is planned to be relocated to the terminal apron near the existing self-service station.

Consideration #5 – Airport Operations & Maintenance

The existing operations and maintenance facilities are located on the old heliport site between S. Airport Boulevard and the drainage canal. This site is not ideal, with it being separated from the entirety of the airport by a public road. New sites for airport operations and maintenance facilities are considered in the landside alternatives.

Consideration #6 – Aircraft Wash Rack

Wash racks are amenities provided at many airports so that aircraft owners can clean aircraft. A wash rack is typically a paved area with a central drain equipped with an oil/water separator, which prevents cleaning products from entering the stormwater system. Sites for an aircraft wash rack are considered in the landside alternatives.

Consideration #7 – General Aviation Pilot's Lounge

A general aviation pilot's lounge is a dedicated facility for pilots to socialize and hold events that might otherwise interfere with the day-to-day functions of the terminal building. They can also house other terminal-related functions, such as flight planning equipment and flight training classrooms. Consideration is given to potential sites for a pilot's lounge in the landside alternatives.

Consideration #8 – Land Development

The landside alternatives present development and redevelopment areas on the airport for aviation-related and non-aviation related uses, considering highest and best use potential. Aviation-related uses are typically reserved for property with direct access to the airfield. For property that is segregated from the airfield, an airport should consider non-aviation related development. The FAA typically requires airports to receive approval through a land-use release to lease airport-owned land for non-aviation related purposes. The FAA stipulates that all land with reasonable airside access should be used or reserved for aviation purposes. The only portion of airport property that is completely segregated from the airfield is the old heliport site, consisting of approximately 16.2 acres located between S. Airport Boulevard and the drainage canal on the north side. A portion of this site is currently utilized for aircraft operations and maintenance equipment storage. Approximately 11.4 acres of this area is within a floodplain.

Construction within a floodplain is regulated by the Maricopa County Flood Control District. Permits are required for any building or site alterations to ensure maximum protection against flooding is maintained. It should also be noted that any development proposed within a floodplain requires additional analysis and protections for any proposed structures and would likely result in significant off-site drainage improvements to offset the drainage impacts.

LANDSIDE ALTERNATIVES

The following section describes a series of landside alternatives as they relate to considerations detailed above. The alternatives focus on designating generalized land uses as opposed to proposing specific facility types, sizes, and configurations. This is beneficial in that a generalized land use gives flexibility for the development of a site to meet the needs of clients with no predetermined layout constraints.

Six alternatives have been prepared, three for the north side and three for the south side. The alternatives provide potential development plans aimed at meeting the needs of general aviation through the long-term planning period and, in some cases, beyond.

The alternatives to be presented are not the only reasonable 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 overall intent of this exercise is to outline basic development concepts to spur collaboration for a final recommended plan. The final recommended plan only serves as a guide for the airport, which will aid the City of Chandler in the strategic planning of airport property. 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, and aviation activity can be protected.

NORTH LANDSIDE ALTERNATIVE 1

Depicted on **Exhibit 4E**, North Landside Alternative 1 focuses primarily on small aircraft related facilities with the assumption that facilities catering to larger aircraft would be focused on the south side. The features of North Landside Alternative 1 include:

1. Redevelopment of the existing terminal building site with a 16,000-sf terminal with the orientation shifted south to align with the angle of the terminal apron. The vehicle parking lot is also reconfigured and expanded to support the new terminal building.
2. A roundabout is added to replace the intersection of S. Curtis Way and E. Ryan Road, which is a style consistent with the surrounding Chandler Airpark. A secured pedestrian gate would also be added to the perimeter fence providing access to the apron area.
3. The 100LL underground fuel storage tank currently located north of S. Airport Boulevard would be relocated and made an above ground tank in support of the self-service station on the terminal apron.
4. The vehicle parking lot adjacent to the airport traffic control tower (ATCT) would be redeveloped as an airport operations/maintenance site providing better access to airport facilities and the airfield and closer proximity to airport administrative offices.
5. An aircraft wash rack is considered at the east edge of the north apron.
6. Redevelopment of an approximately one-acre environmental site located northwest of the terminal building as apron pavement for aircraft tiedowns. This environmental site was previously used as a dump site for construction debris sometime between 1949 and 1964. The City of Chandler has determined that this site can be capped with asphalt and returned to useable airport property.
7. Reservation of approximately 20.5 acres of property south of Aviation Drive and split by S. Curtiss Way for small aircraft facilities development and redevelopment reserve. This could include new T-hangars, T-shades, apron, and a dedicated GA pilot's lounge.
8. Reservation of approximately 5.9 acres of property along Aviation Drive/S. Airport Boulevard northwest of the terminal for executive hangar development.
9. Reservation of approximately 11.4 acres of the old heliport site for non-aviation development, including the potential for a solar farm photovoltaic array. This site is subject to floodplain restrictions.
10. Reservation of approximately 4.8 acres of the old heliport site that is currently used for airport operations/maintenance for non-aviation development.

North Landside Alternative 1 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	North Landside Developments	
1	New Terminal Building (16,000 FT)	$8,000,000
2	Relocated Above Ground Self-Service 100LL Fuel Storage	$800,000
3	Aircraft Wash Rack	$425,000
4	Shade Structures	$300,000
5	Parking Lot	$126,000
6	Pedestrian Gate	$5,000
	Utilities/Sitework	
7	Non-Aviation Development Reserve – Floodplain Restrictions	$4,470,000
8	Non-Aviation Development Reserve	$1,890,000
9	Airport Operations/Maintenance	$510,000
10	Executive Hangar Development Reserve	$2,320,000
11	Small Aircraft Facilities Development Reserve (12.4 Acres)	$4,870,000
12	Small Aircraft Facilities Development Reserve (5.2 Acres)	$2,320,000
13	Small Aircraft Facilities Redevelopment Reserve	$1,140,000
	Roadways	
14	New Roundabout	$300,000
	TOTAL	**$27,476,000**

Source: Dibble Engineering

NORTH LANDSIDE ALTERNATIVE 2

Depicted on **Exhibit 4F**, North Landside Alternative 2 focuses on providing a more diverse range of facilities on the north side, including areas for small aircraft facility development up to large-scale SASO or maintenance/repair/overhaul (MRO) operators. The features of North Landside Alternative 2 include:

1. Development of a new 16,000 sf terminal building adjacent to the ATCT. This site is closer to the runway and would give the terminal better visibility from the airfield. The existing parking lot at the ATCT could also be revamped to support the terminal building.
2. A roundabout is added to replace the intersection of S. Curtis Way and E. Ryan Road, which is a style consistent with the surrounding Chandler Airpark. A secured pedestrian gate would also be added to the perimeter fence providing access to the apron area.
3. The 100LL underground fuel storage tank currently located north of S. Airport Boulevard would be relocated and made an above ground tank in support of the self-service station on the terminal apron.
4. The existing terminal site would be redeveloped for airport operations/maintenance facilities. This site provides better access to airport facilities and is near airport administration offices in the new terminal building.
5. An aircraft wash rack is considered on the north side of the north apron along Aviation Drive.


Environmental Site to be Redeveloped as Apron
Executive Hangar Development Reserve (~5.9 Acres)
Small Aircraft Facilities Development Reserve (~12.4 Acres)
New Terminal Building - 16,000 sf
Non-Aviation Development Reserve (~4.8 Acres)
Non-Aviation Development Reserve - Floodplain Restrictions (~11.4 Acres)
Small Aircraft Facilities Development Reserve (~5.2 Acres)
Small Aircraft Facilities Redevelopment Reserve (~2.9 Acres)
Airport Operations/ Maintenance (~1.3 Acre)
Pedestrian Gate
Relocated Above Ground Self-Service 100LL Fuel Storage
Declaration of Environmental Use Restriction Area (~2.3 Acres)
Aircraft Wash Rack
S McQueen Rd
S Airport Blvd
S Stinson Way
E Ryan Rd
S Curtiss Way
Aviation Dr.
Germann Road
S Cooper Rd
Runway 4L-22R
Runway 4R-22L
A
B
D
F
G
H
J
L
M
N
LEGEND
Existing Airport Property Line
Taxiway Designation
Pavement/Building to be Removed
Ultimate Pavement
Ultimate Roads/Parking
Ultimate Building
Environmental Site
N
0
400
SCALE IN FEET
Photo: Woolpert 11/2019

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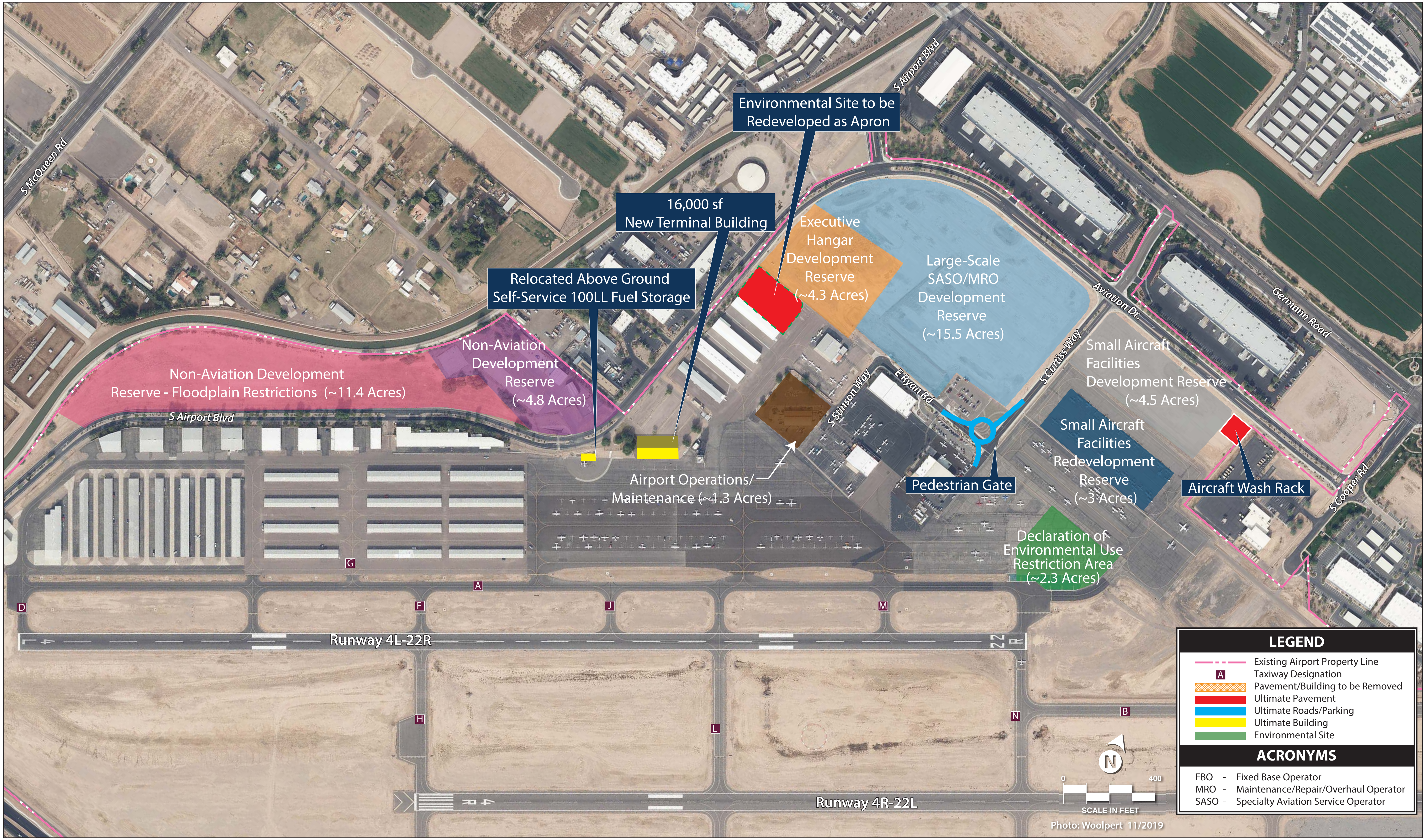
Environmental Site to be Redeveloped as Apron
16,000 sf New Terminal Building
Relocated Above Ground Self-Service 100LL Fuel Storage
Executive Hangar Development Reserve (~4.3 Acres)
Large-Scale SASO/MRO Development Reserve (~15.5 Acres)
Non-Aviation Development Reserve - Floodplain Restrictions (~11.4 Acres)
Non-Aviation Development Reserve (~4.8 Acres)
Small Aircraft Facilities Development Reserve (~4.5 Acres)
Small Aircraft Facilities Redevelopment Reserve (~3 Acres)
Airport Operations/ Maintenance (~1.3 Acres)
Pedestrian Gate
Aircraft Wash Rack
Declaration of Environmental Use Restriction Area (~2.3 Acres)
S McQueen Rd
S Airport Blvd
S Stinson Way
E Ryan Rd
S Curtiss Way
Aviation Dr.
Germann Road
S Cooper Rd
Runway 4L-22R
Runway 4R-22L
A
B
D
F
G
H
J
L
M
N
LEGEND
Existing Airport Property Line
Taxiway Designation
Pavement/Building to be Removed
Ultimate Pavement
Ultimate Roads/Parking
Ultimate Building
Environmental Site
ACRONYMS
FBO - Fixed Base Operator
MRO - Maintenance/Repair/Overhaul Operator
SASO - Specialty Aviation Service Operator
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SCALE IN FEET
Photo: Woolpert 11/2019

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6. Redevelopment of an approximately one-acre environmental site located northwest of the terminal building as apron pavement for aircraft tiedowns. This environmental site was previously used as a dump site for construction debris sometime between 1949 and 1964. The City of Chandler has determined that this site can be capped with asphalt and returned to useable airport property.
7. Reservation of approximately 7.5 acres of property on and near the north apron for small aircraft facilities development and redevelopment reserve. This could include new T-hangars, T-shades, apron, and a dedicated GA pilot's lounge.
8. Reservation of approximately 4.3 acres of property along Aviation Drive/S. Airport Boulevard northwest of the terminal for executive hangar development.
9. Reservation of approximately 15.5 acres north of the terminal and south of Aviation Drive for a large-scale SASO/MRO complex or an aircraft manufacturer.
10. Reservation of approximately 11.4 acres of the old heliport site for non-aviation development, including the potential for a solar farm photovoltaic array. This site is subject to floodplain restrictions.
11. Reservation of approximately 4.8 acres of the old heliport site that is currently used for airport operations/maintenance for non-aviation development.

North Landside Alternative 2 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	North Landside Developments	
1	New Terminal Building (16,000 FT)	$8,000,000
2	Relocated Above Ground Self-Service 100LL Fuel Storage	$800,000
3	Aircraft Wash Rack	$425,000
4	Shade Structures	$300,000
5	Pedestrian Gate	$5,000
	Utilities/Sitework	
6	Non-Aviation Development Reserve – Floodplain Restrictions	$4,470,000
7	Non-Aviation Development Reserve	$1,890,000
8	Airport Operations/Maintenance	$510,000
9	Executive Hangar Development Reserve	$1,690,000
10	Large-Scale SASO/MRO Development Reserve	$6,080,000
11	Small Aircraft Facilities Development Reserve	$1,770,000
12	Small Aircraft Facilities Redevelopment Reserve	$1,180,000
	Roadways	
13	New Roundabout	$300,000
	TOTAL	**$27,420,000**

Source: Dibble Engineering

NORTH LANDSIDE ALTERNATIVE 3

Depicted on **Exhibit 4G**, North Landside Alternative 3 considers relocating the terminal north of its current location and co-locating future FBO/SASO development. This would give more focus to servicing larger aircraft on the north side as opposed to the south side. The features of North Landside Alternative 3 include:

1. Development of a new 16,000 sf terminal building north of the existing location with taxiway access and adjacent apron. An adjacent vehicle parking lot would support the new terminal building as well as the surrounding FBO/SASO development sites. This site is further from the airfield and, based on how the FBO/SASO sites are developed, could make visibility an issue.
2. A roundabout is added to replace the intersection of S. Curtiss Way and E. Ryan Road, which is a style consistent with the surrounding Chandler Airpark. A secured pedestrian gate would also be added to the perimeter fence providing access to the apron area.
3. The 100LL underground fuel storage tank currently located north of S. Airport Boulevard would be relocated and made an above ground tank in support of the self-service station on the terminal apron.
4. An aircraft wash rack is considered adjacent to the ATCT, along with a dedicated GA pilot's lounge.
5. Redevelopment of an approximately one-acre environmental site located northwest of the terminal building as apron pavement for aircraft tiedowns. This environmental site was previously used as a dump site for construction debris sometime between 1949 and 1964. The City of Chandler has determined that this site can be capped with asphalt and returned to useable airport property.
6. Reservation of approximately 5.2 acres of property near the north apron for small aircraft facilities development and redevelopment reserve.
7. Reservation of approximately 4.1 acres of property along S. Curtiss Way for executive hangar development.
8. Reservation of approximately 15.6 acres of property surrounding the new terminal building FBO/SASO development.
9. Reservation of approximately 11.4 acres of the old heliport site for non-aviation development, including the potential for a solar farm photovoltaic array. This site is subject to floodplain restrictions.
10. Reservation of approximately 4.8 acres of airport operations/maintenance facilities, including a new building for equipment storage and office space.


Environmental Site to be Redeveloped as Apron
16,000 sf New Terminal Building
FBO/SASO Development Reserve (~5 Acres)
Relocated Above Ground Self-Service 100LL Fuel Storage
FBO/SASO Development Reserve (~7 Acres)
Executive Hangar Development Reserve (~4.1 Acres)
Small Aircraft Facilities Development Reserve (~5.2 Acres)
FBO/SASO Development Reserve (~3.6 Acres)
Non-Aviation Development Reserve - Floodplain Restrictions (~11.4 Acres)
Airport Operations/ Maintenance (~4.8 Acres)
GA Pilot's Lounge
Aircraft Wash Rack
Pedestrian Gate
Declaration of Environmental Use Restriction Area (~2.3 Acres)
S McQueen Rd
S Airport Blvd
S Stinson Way
E Ryan Rd
S Curtiss Way
Aviation Dr.
Germann Road
S Cooper Rd
Runway 4L-22R
Runway 4R-22L
A
B
D
F
G
H
J
L
M
N
LEGEND
Existing Airport Property Line
Taxiway Designation
Ultimate Pavement
Ultimate Roads/Parking
Ultimate Building
Environmental Site
ACRONYMS
FBO - Fixed Base Operator
SASO - Specialty Aviation Service Operator
N
0
400
SCALE IN FEET
Photo: Woolpert 11/2019

North Landside Alternative 3 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	North Landside Developments	
1	New Terminal Building (16,000 FT)	$8,000,000
2	Relocated Above Ground Self-Service 100LL Fuel Storage	$800,000
3	Aircraft Wash Rack	$425,000
4	GA Pilot Lounge	$150,000
5	Shade Structures	$300,000
6	Parking Lot	$470,000
7	Pedestrian Gate	$5,000
	Utilities/Sitework	
8	Non-Aviation Development Reserve – Floodplain Restrictions	$4,470,000
9	Airport Operations/Maintenance	$1,890,000
10	FBO/SASO Development Reserve	$6,120,000
11	Executive Hangar Development Reserve	$1,610,000
12	Small Aircraft Facilities Development Reserve	$2,040,000
13	Small Aircraft Facilities Redevelopment Reserve	$1,180,000
	Roadways	
14	New Roundabout	$300,000
	TOTAL	**$27,760,000**

Source: Dibble Engineering

SOUTH LANDSIDE ALTERNATIVE 1

Depicted on **Exhibit 4H**, South Landside Alternative 1 focuses on providing a mix of general aviation services catering to FBO/SASOs, executive hangars, and small aircraft facilities. This alternative does not include a new terminal facility with the assumption that the terminal would remain on the north side. The features of South Landside Alternative 1 include:

1. Development of a new self-service fuel station equipped with above ground storage tanks for 100LL and Jet A fuels. The station would be accessible to aircraft via a new taxilane from Taxiway C and to supply trucks via new surface roads extending from S. Cooper Road and E. Ryan Road.
2. Reservation of approximately 24.2 acres of property for small aircraft facilities. This includes T-hangars, T-shades, apron, and a dedicated GA pilot's lounge and wash rack.
3. Reservation of approximately 28.7 acres of property for executive hangar development.
4. Reservation of approximately 19.5 acres for FBO/SASO development.

South Landside Alternative 1 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	South Landside Developments	
1	Self-Service Fuel Station	$800,000
	Utilities/Sitework	
2	Executive Hangar Development Reserve	$11,260,000
3	Small Aircraft Facilities Development Reserve (4.9 Acres)	$1,930,000
4	Small Aircraft Facilities Development Reserve (19.3 Acres)	$7,570,000
5	FBO/SASO Development Reserve	$7,650,000
	Roadways	
6	New Roundabout	$400,000
7	Additional Roadway	$4,200,000
	TOTAL	**$33,010,000**

Source: Dibble Engineering

SOUTH LANDSIDE ALTERNATIVE 2

Depicted on **Exhibit 4J**, South Landside Alternative 2 considers the relocation of the terminal building and focusing on accommodating more transient activity on the south side. The features of South Landside Alternative 2 include:

1. Development of a new 16,000 sf terminal building near the Runway 4R threshold and a co-located self-service fuel station for both Jet A and 100LL fuels. A terminal apron fronts the terminal to the north with a vehicle parking lot to the south.
2. Reservation of approximately 21.1 acres of property for small aircraft facilities. This includes T-hangars, T-shades, apron, and a dedicated GA pilot's lounge and wash rack.
3. Reservation of approximately 21.1 acres of property for executive hangar development.
4. Reservation of approximately 14.6 acres for FBO/SASO development.
5. Reservation of approximately 8.4 acres for a large-scale SASO operation, such as an MRO or aircraft manufacturer.

South Landside Alternative 2 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	South Landside Developments	
	Utilities/Sitework	
1	FBO/SASO Development Reserve	$3,610,000
2	GA Terminal/Apron/Fuel Facilities Reserve	$3,650,000
3	Large-Scale SASO Development Reserve	$3,300,000
4	Small Aircraft Facilities Development Reserve	$16,550,000
5	FBO/SASO Development Reserve	$7,650,000
	Roadways	
6	Additional Roadway	$4,340,000
	TOTAL	**$39,100,000**

Source: Dibble Engineering

Exhibit 4H
SOUTH LANDSIDE ALTERNATIVE 1

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Exhibit 4J
SOUTH LANDSIDE ALTERNATIVE 2

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SOUTH LANDSIDE ALTERNATIVE 3

Depicted on **Exhibit 4K**, South Landside Alternative 3 is like the previous alternative as it also considers relocating the terminal to the south side. This alternative focuses more on dedicating land for FBO/SASO and executive hangar development with less focus on small aircraft facilities. The features of South Landside Alternative 3 include:

1. Development of a new 16,000 sf terminal building near the Runway 4R threshold with apron frontage to the north and vehicle parking to the south. The site would also include a self-service fuel station for Jet A and 100LL fuels.
2. Reservation of approximately 19.9 acres of property for small aircraft facilities. This includes T-hangars, T-shades, apron, and a dedicated GA pilot's lounge and wash rack.
3. Reservation of approximately 24.6 acres of property for executive hangar development.
4. Reservation of approximately 17.1 acres for FBO/SASO development.

South Landside Alternative 3 Estimated Construction Cost

Item No.	Proposed Projects	Estimated Cost
	South Landside Developments	
	Utilities/Sitework	
1	FBO/SASO Development Reserve	$5,730,000
2	GA Terminal/Apron/Fuel Facilities Reserve	$6,320,000
3	Executive Hangar Development Reserve (28.7 Acres)	$11,260,000
4	Executive Hangar Development Reserve (15.1 Acres)	$5,920,000
5	Small Aircraft Facilities Development Reserve	$7,490,000
	Roadways	
6	New Roundabout	$400,000
7	Additional Roadway	$4,900,000
	TOTAL	**$42,020,000**

Source: Dibble Engineering

LANDSIDE SUMMARY

The landside alternatives presented look to accommodate an array of aviation activities that either currently occur or could be expected to occur at CHD in the future. There is demand for new facilities at CHD and with a changing fleet mix of aircraft that includes more sophisticated aircraft, airport management will need to determine how to develop its property in an organized and thoughtful way. 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.

SUMMARY

This chapter is intended to present analysis of various options that may be considered for specific airport elements. The need for alternatives is typically spurred by projections of aviation demand growth and/or by the need to resolve non-standard airport elements. FAA design standards are frequently updated with the intent of improving the safety and efficiency of aircraft movements on and around airports, which can lead to certain pavement geometries now being classified as non-standard when previously they qualified to meet standard.

Several development alternatives related to both the airside and the landside have been presented. On the airside, the major considerations involve extending Runway 4R-22L and improving airfield geometry to meet proper taxiway design standards. For the landside, alternatives were presented to consider additional aviation development on the north and south sides of the airport. As the airport's fleet mix transitions to include more jets and turboprops, it will be important to clearly delineate development areas for facilities to accommodate those aircraft. Segregating jet and turboprop traffic from small aircraft operators contributes to operational safety and presents a more organized and efficient airport.

The next step in the master plan development process is to arrive at a recommended development concept. Participation of the PAC and the public will be important considerations. Additional consultation with the FAA may also be required. Once a consolidated development plan is identified, a 20-year capital improvement program, with a list of prioritized projects tied to aviation demand and/or necessity, will be presented. Finally, a financial analysis will be presented to identify potential funding sources and to show airport management what local funds will be necessary to implement the plan.

Exhibit 4K
SOUTH LANDSIDE ALTERNATIVE 3

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Chapter Five

RECOMMENDED MASTER PLAN CONCEPT

CHANDLER arizona

CHANDLER arizona

Chapter Five

RECOMMENDED MASTER PLAN CONCEPT

The airport master plan for Chandler Municipal Airport (CHD) has progressed through a systematic and logical process with a goal of formulating a recommended 20-year development plan. The process began with an evaluation of existing and future operational demand, which aided in creating an assessment of future facility needs and were used to develop alternative facility plans. Each step in the planning process included the development of draft working papers, which were presented and discussed at Planning Advisory Committee (PAC) meetings and public information workshops and were available on the project website.

In the previous chapter, several development alternatives were analyzed to explore options for the future growth and development of CHD. The development alternatives have been refined into a single recommended concept for the master plan. This chapter describes, in narrative and graphic form, the recommended direction for the future use and development of CHD.

The recommended concept provides the ability to meet the disparate needs of the array of airport operators. The goal of this plan is to ensure the airport can continue, and even improve, in its role of serving general aviation operators and military aviation in and around the City of Chandler and the Phoenix metropolitan area. The plan has been specifically tailored to support existing and future growth in all forms of potential aviation activity as the demand materializes.

The recommended airport development 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 Federal Aviation Administration (FAA) design standards. The phased implementation of the recommended development concept will be presented in Chapter Six. The following sections describe the key details of the recommended master plan concept.

AIRSIDE CONCEPT

The airside plan generally considers those improvements related to the runway and taxiway system and navigational aids.

DESIGN 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 Runway Design Code (RDC) to relate these design aircraft factors to airfield design standards. The most restrictive RDC is also considered the overall Airport Reference Code (ARC).

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.

The applicable RDC and critical design aircraft for each runway at CHD in the existing and ultimate conditions, as established in Chapter Two, are summarized in **Table 5A**.

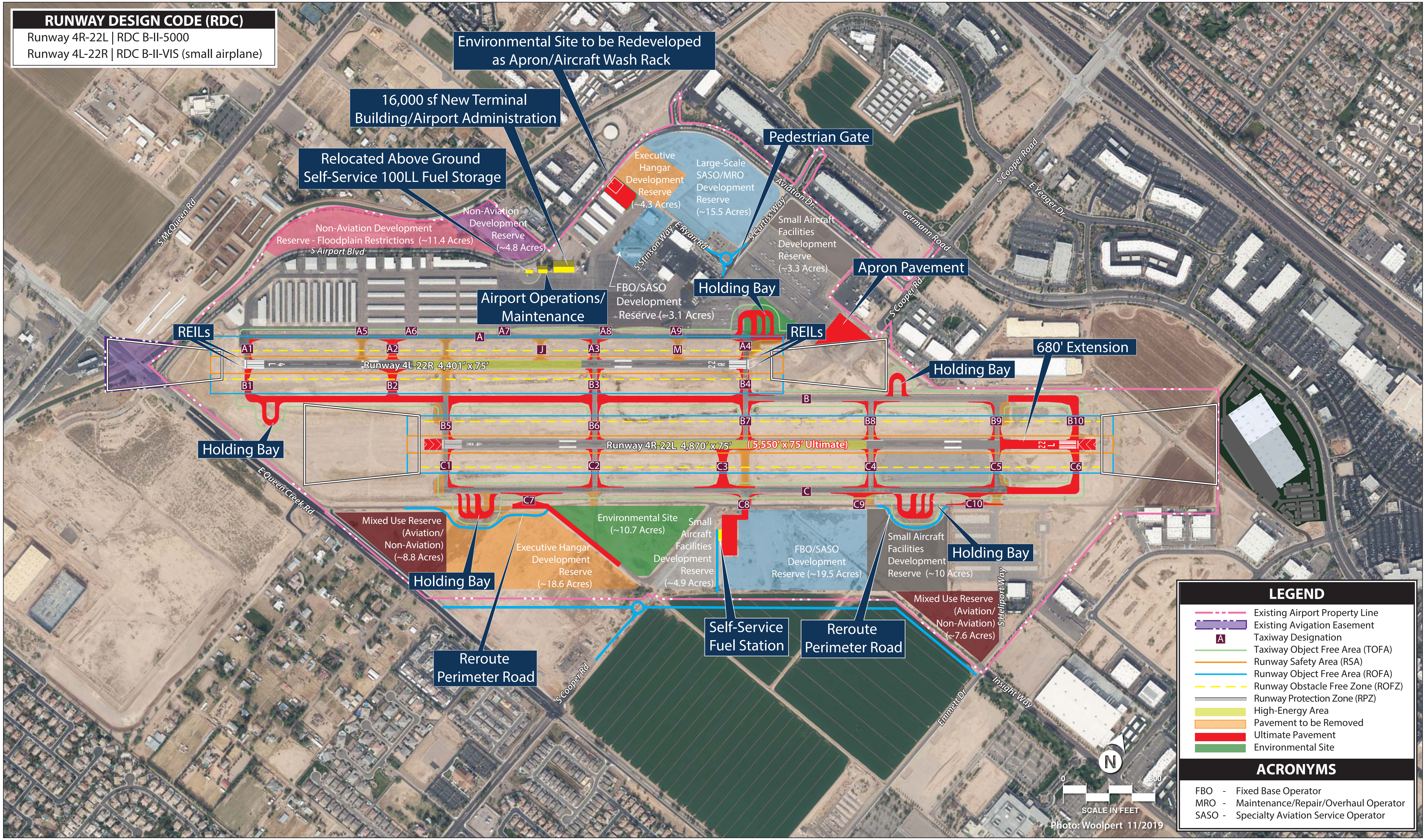
RUNWAY DESIGN CODE (RDC)
Runway 4R-22L | RDC B-II-5000
Runway 4L-22R | RDC B-II-VIS (small airplane)
Environmental Site to be Redeveloped as Apron/Aircraft Wash Rack
16,000 sf New Terminal Building/Airport Administration
Relocated Above Ground Self-Service 100LL Fuel Storage
Pedestrian Gate
Executive Hangar Development Reserve (~4.3 Acres)
Large-Scale SASO/MRO Development Reserve (~15.5 Acres)
Small Aircraft Facilities Development Reserve (~3.3 Acres)
Non-Aviation Development Reserve (~4.8 Acres)
Non-Aviation Development Reserve - Floodplain Restrictions (~11.4 Acres)
S Airport Blvd
FBO/SASO Development Reserve (~3.1 Acres)
Airport Operations/ Maintenance
Holding Bay
Apron Pavement
REILs
680' Extension
Runway 4L-22R 4,401' x 75'
Runway 4R-22L 4,870' x 75'
(5,550' x 75' Ultimate)
Mixed Use Reserve (Aviation/ Non-Aviation) (~8.8 Acres)
Executive Hangar Development Reserve (~18.6 Acres)
Environmental Site (~10.7 Acres)
Small Aircraft Facilities Development Reserve (~4.9 Acres)
FBO/SASO Development Reserve (~19.5 Acres)
Small Aircraft Facilities Development Reserve (~10 Acres)
Mixed Use Reserve (Aviation/ Non-Aviation) (~7.6 Acres)
Self-Service Fuel Station
Reroute Perimeter Road
S McQueen Rd
E Queen Creek Rd
S Cooper Rd
Germann Road
E Yeager Dr
Aviation Dr
S Curtiss Way
S Stinson Way
E Ryan Rd
S Heliport Way
Insight Way
Emmett Dr
SCALE IN FEET
Photo: Woolpert 11/2019
LEGEND
Existing Airport Property Line
Existing Avigation Easement
Taxiway Designation
Taxiway Object Free Area (TOFA)
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
High-Energy Area
Pavement to be Removed
Ultimate Pavement
Environmental Site
ACRONYMS
FBO - Fixed Base Operator
MRO - Maintenance/Repair/Overhaul Operator
SASO - Specialty Aviation Service Operator

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TABLE 5A | Airport and Runway Classifications
Chandler Municipal Airport

	Runway 4R-22L (existing/ultimate)	Runway 4L-22R (existing/ultimate)
Airport Reference Code (ARC)	B-II	B-II (small airplane)
Critical Aircraft (Typ.)	Beechcraft King Air 200/300/350 (existing) Cessna Citation Jet CJ4/Citation X (ultimate)	Beechcraft King Air C/F90
Runway Design Code (RDC)	B-II-5000	B-II-VIS (small airplane)
Approach Reference Code (APRC)	D/IV/5000 and D/V/5000	B/II/VIS
Departure Reference Code (DPRC)	D/IV and D/V	B/II
Taxiway Design Group (TDG)	2	2

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

PRIMARY RUNWAY 4R-22L

Runway Designation | A runway's designation is based upon its magnetic headings, which are determined by the magnetic declination for the area. The magnetic declination in the area of CHD is 10° 2'E[1]. The primary runway is oriented northeast/southwest with a true heading of 049°/229°. Adjusting for the magnetic declination, the current magnetic heading of the runway is 039°/219°. As a result, ***Runway 4R-22L should maintain this designation.***

Runway Dimensions | The primary runway is currently 4,870 feet long and 75 feet wide, meeting RDC B-II-5000 design standards. At these current dimensions, the runway is capable of safely accommodating all small general aviation aircraft. Business jets can also operate on this runway under moderate loading conditions with shorter trip lengths and during cool to warm temperatures. Longer trips and hot summer days significantly limit business jet capabilities. As a general aviation reliever airport, CHD's role is to relieve the larger airports in the region of general aviation traffic, including business jets. Increasing the utility of the runway to safely accommodate business jets will also expand CHD's market potential, attracting new itinerant operators, based aircraft, and businesses that provide services to business jet clients. For these reasons, ***a 680-foot extension of the runway is planned to achieve an ultimate length of 5,550 feet***.

Connected actions to the extension of Runway 4R-22L include the following items:

- Extensions to Taxiway B and Taxiway C to the ultimate runway end.
- Relocation of the PAPI-4 and runway end identifier light (REIL) units on the Runway 22L end.
- All new runway pavement would be equipped with medium intensity runway edge lighting (MIRL).
- The ultimate runway's declared distances[2] (TORA, TODA, ASDA, and LDA) would equal the full pavement length of 5,550 feet.

The runway width of 75 feet meets the RDC B-II-5000 design standard. No change in runway width is planned.

[1] Source: NOAA, 02/06/2020.
[2] Declared distances are described in detail in Chapter Four, Airside Alternatives section.

Pavement Strength | Runway 4R-22L is currently strength-rated for up to 30,000 pounds for single wheel loading aircraft (SWL), which is adequate for all small aircraft and most small to mid-sized business jets. The critical design aircraft (Cessna Citation Jet CJ4 and Beechcraft King Air 200/300/350) have maximum takeoff weights (MTOWs) of 30,000 pounds or less. The Cessna Citation X has a MTOW of 36,100 pounds on a dual-wheel main gear configuration, which also can be accommodated by the existing pavement strength on a regular basis. The existing strength rating is adequate for all aircraft operating at CHD currently and in the future. Therefore, ***no plans to strengthen the primary runway are recommended.***

Instrument Approach Procedures | Runway 4R has two published one-mile visibility instrument approach procedures. Runway 22L is a visual-only runway. The plan includes maintaining instrument approach capabilities for Runway 4R at a one-mile visibility and coordinating with the FAA on establishing one-mile visibility procedures to Runway 22L. No new on-site equipment is needed to establish a GPS-based approach procedure to Runway 22L, and the size of the associated Runway Protection Zone (RPZ), would not be changed.

Runway Protection Zones (RPZs) | The existing one mile or greater visibility minimum RPZs for both ends of the runway encompass 13.77 acres. The RPZs are located on property owned by the airport. If the runway is extended as planned to the northeast, the Runway 22L RPZ will shift in the same direction but will still be located entirely on property owned by the airport. The existing perimeter service road will ultimately pass through the RPZ; however, this is not a public-use road, so it is not considered an incompatible land use.

Blast Pads | The blast pads at the ends of the runway are undersized. The plan includes expanding the blast pads to 95 feet wide and 150 feet long to meet design standards.

PARALLEL RUNWAY 4L-22R

Runway Designation | Similar to the primary runway, Runway 4L-22R's current magnetic heading, accounting for magnetic declination, is 039°/219°. Therefore, the existing designation should be maintained.

Runway Dimensions | The runway is currently 4,401 feet long and 75 feet wide. These dimensions adequately accommodate the small aircraft this runway is intended to serve. Therefore, ***no modifications to the runway dimensions are currently justified or planned.***

Pavement Strength | The runway is currently strength-rated for up to 30,000 pounds for SWL aircraft. This strength rating is more than adequate for the types of aircraft currently using, and planned to use, the runway, which are small aircraft weighing 12,500 pounds or less.

Instrument Approach Procedures | Both ends of this runway are visual-only, meaning there are no published instrument approach procedures available. The plan allows for the possibility of establishing GPS-based approach procedures with one-mile or greater visibility minimums. These types of procedures do not require the installation of on-site equipment and would not alter the dimensions of the RPZs. If instrument approach procedures are established on this runway, markings will need to be improved to non-precision markings by adding threshold markings.

Runway Protection Zones (RPZs) | The RPZ dimensions for the parallel runway will remain the same as they are currently, at 8.035 acres. A portion of the Runway 4L RPZ extends beyond property owned by the airport over E Queen Creek Road; however, this property is controlled by an avigation easement. There are no plans to extend the runway or alter its design standards; therefore, E Queen Creek Road can be allowed to remain within the RPZ. The Runway 22R RPZ is located entirely on property owned by the airport without incompatibilities.

Visual Approach Aids | The parallel runway is not currently equipped with Runway End Identifier Lights (REILs). The plan includes adding REILs at both ends of the runway to improve pilot situational awareness.

TAXIWAY IMPROVEMENTS

Taxiway Design | The entirety of the CHD taxiway system is planned to meet Taxiway Design Group (TDG) 2 standards. Many of the taxiway intersections on the airfield do not currently meet proper taxiway fillet design standards. Taxiway fillets are tapered pavement sections at intersections that allow aircraft to turn while maintaining taxiing speed and obstruction clearance. Additional taxiway fillet pavement to meet design standards are depicted on **Exhibit 5A**.

Taxiway Nomenclature | Current taxiway designations do not meet FAA Engineering Brief (EB) 89, *Taxiway Nomenclature Convention* standards. According to the EB, stub taxiways associated with a parallel taxiway should be designated with a letter and number, such as A1, A2, A3, etc., beginning with the northernmost stub for north/south taxiways and starting with the westernmost stub for east/west taxiways. Ultimate taxiway designations that meet the EB standards, along with the additional taxiway extensions/improvements, are identified on **Exhibit 5A**.

Taxiway A | Taxiway A, the full-length parallel taxiway supporting parallel Runway 4L-22R, is 40 feet wide, which exceeds the TDG 2 width standard of 35 feet. Improvements planned for Taxiway A and its connectors include removing pavement sections of Taxiway F to eliminate direct-access from the apron to the runway. New connecting Taxiway A2 is planned to replace the portion of Taxiway F that is being removed.

The southwest portion of Taxiway A from Taxiway A1 to A7 is separated from the T-hangar area edge taxilane by 74 feet, which meets only Airplane Design Group (ADG) I separation standards (ADG II standards require separation of 105 feet). As a result, ADG II aircraft should use caution in this area to ensure wingtip clearance is maintained with other aircraft. **Figure 5A** depicts the ADG I limitation area.

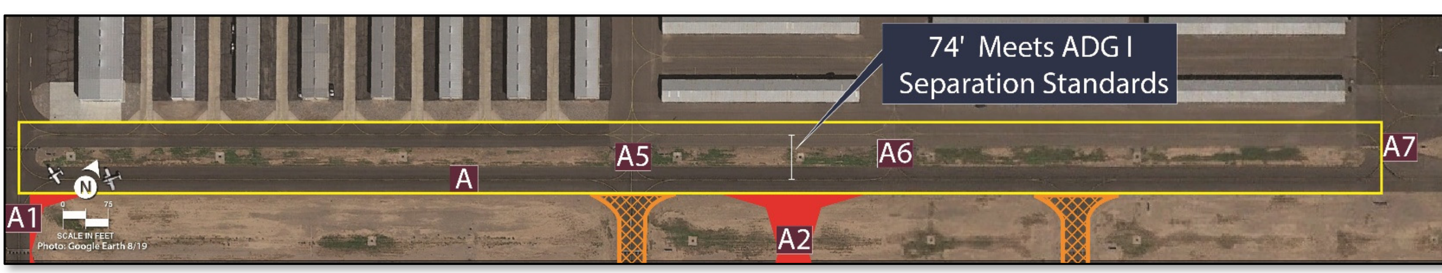

FIGURE 5A – TAXIWAY A ADG I SEPARATION AREA

Taxiway B | Taxiway B is located between the two runways and is 40 feet wide. Taxiway B is planned to be extended to the northeast and southwest to coincide with the extension to Runway 4R-22L and to provide for improved airfield circulation. For aircraft taxiing to the Runway 22L end from the north side, there is currently only one access route that does not require multiple runway crossings. The southwest extension of Taxiway B will create a full-length parallel for both runways and multiple routes for aircraft to access the Runway 22L end from the north side without having to cross both runways. The expansion of Taxiway B is also planned in phases to alleviate congestion issues at the Runway 22R threshold that has resulted in Hot Spot #1. All new Taxiway B pavement is planned to be equipped with LED medium intensity taxiway lighting (MITL) and airfield signage.

Taxiway C | Taxiway C is the 40-foot-wide south parallel taxiway to the primary runway. This taxiway is planned to be extended to the northeast to coincide with the runway extension. Existing Taxiway N, which is planned to be re-designated as part of the taxiway nomenclature change, is planned to be relocated south of Runway 4R-22L. This section of taxiway pavement will be shifted to the southwest to eliminate a crossing intersection in the high-energy area of the runway. The shifted connector will ultimately be designated Taxiway C3.

Taxiway Geometry Improvements | Previous chapters have discussed non-standard taxiway geometry issues at CHD, including where taxiways provide direct access from the apron area to the runway and where taxiways intersect with runways in the high-energy area. Existing direct-access taxiways include: Taxiway F (to the southwest end of Runway 4L), M (to the northeast end of Runway 22R), and Q (to the Runway 22L threshold). The plan includes removing pavement sections on these taxiways to eliminate runway access. Specific changes are described in the bullets below:

- The portion of Taxiway F pavement that connects Taxiway A to Runway 4L-22R will be removed and relocated to the east to become ultimate Taxiway A2.
- Taxiway J is located approximately 475 feet from Taxiway L (ultimate A3). As previously mentioned, taxiway exits should be spaced 750 feet or greater to effect capacity. Since it does not meet this spacing recommendation, it is planned for removal.
- Taxiway M (ultimate A9), between Taxiway A and the runway is planned to be removed to eliminate the direct-access point. The connection from the apron area to Taxiway A will remain. Taxiway M is located less than 750 feet from Taxiway L (ultimate A3) and Taxiway N (ultimate A4). Taxiway exits should be spaced 750 feet or greater to effect capacity. Since it does not meet this spacing recommendation, it is planned for removal.
- Taxiway Q (ultimate C5) between Taxiway C and the heliport apron will be removed. A new connecting taxiway (C10) is planned to be constructed 100 feet west to create a new access point to the heliport apron.

Holding Bays | The traditional holding aprons on the airfield are now considered non-standard since the wide expansive pavement area makes signage and lighting more difficult for pilots to see, which can lead to pilot confusion near the entrance to a runway. Therefore, the plan includes eliminating the existing holding aprons and replacing them with taxiway holding bays. Holding bays have clear entrance/exit points and independent parking areas separated by islands. Single-lane holding bays are planned for the west end of Taxiway B at the Runway 4L threshold, and on Taxiway B east of the Runway 22R RPZ. Multi-lane holding bays are planned for the east end of Taxiway A[3] and on the south side of Taxiway B near the runway ends. The holding bays on the south side will encroach upon the existing perimeter service road. The plan includes rerouting the perimeter service road in these areas so that it does not pass through the taxiway object free area (TOFA). Each holding bay is designed to accommodate ADG II aircraft.

LANDSIDE CONCEPT

The primary goal of landside facility planning is to provide adequate space to meet reasonably anticipated general aviation needs, while also optimizing operational efficiency and land use. Achieving these goals yields a development scheme that segregates functional uses while maximizing the airport's revenue potential. The CHD landside concept reflects generalized land use areas as opposed to specific facility/hangar layouts, which are likely to change depending on the needs of the developer and its target customers.

The key issues to be addressed in the landside areas at CHD are typical of most general aviation airports and include providing an expanded terminal services facility, increasing hangar and apron capacities, expanding Jet A fuel storage capacity, and adding amenities to accommodate existing users and attract new users.

As a reminder, all general aviation-related development, such as new hangar construction, should occur only as dictated by demand. The recommended concept is intended to be used strictly as a guide for CHD staff when considering new developments.

Sections below describe reserving portions of airport property for non-aviation uses. Generally, airport property is subject to Airport Improvement Program (AIP) grant assurances; therefore, CHD will need to request a release of these properties of federal obligations by the FAA. Once a release of federal obligation is issued by the FAA, CHD would be able to lease or sell these certain properties to support revenue diversification and generation. The FAA Reauthorization Act of 2018, Section 163 changed how the FAA's Office of Airport's staff reviews and considers the release of airport property for non-aviation uses. The section focuses FAA's review and approval of Airport Layout Plans (ALPs) to those portions of the ALP that materially impact the safe and efficient operation of airports; the safety of people and property on the ground adjacent to the airport; and the value of prior Federal investments to a significant extent. In effect, this new guidance is intended to ease the process of gaining FAA approval of land releases.

NORTH SIDE

The north side concept is depicted in **Figure 5B**. Features of the north side concept are described below.

[3] This site is an existing Declaration of Environmental Use Restriction (DEUR) site that has already been paved. This project repurposes that pavement as a holding bay.

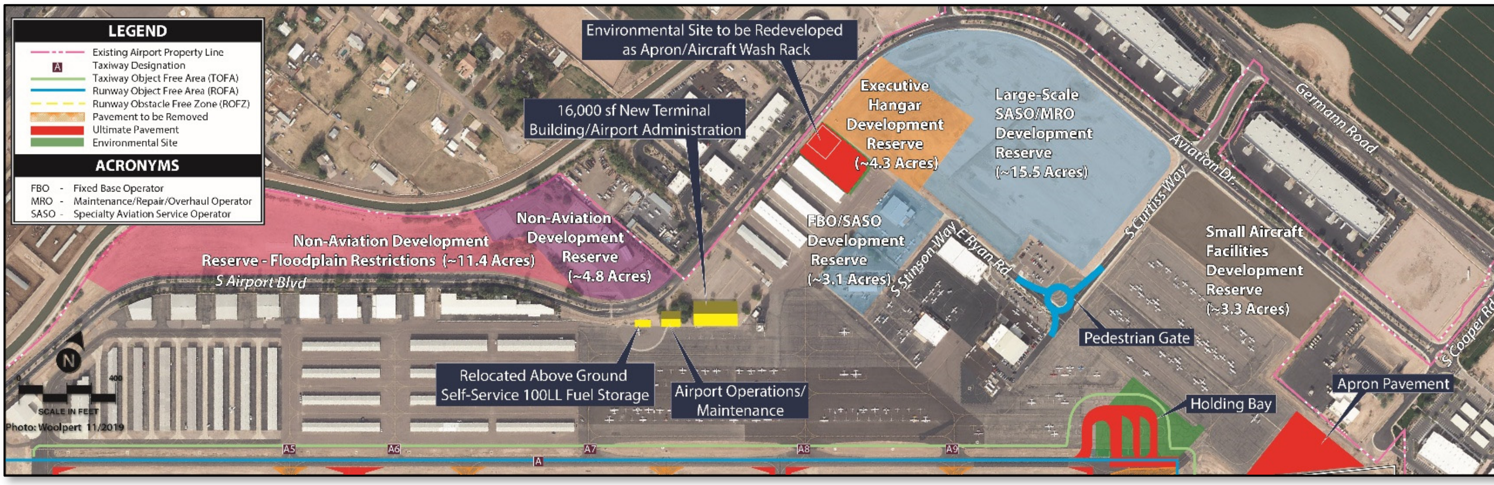

FIGURE 5B – NORTH LANDSIDE DEVELOPMENT CONCEPT

Terminal Building | The alternatives analysis considered several options for development of the north and south sides of the airfield. Of most importance was the location for a new terminal building that would provide a larger and more modern facility for pilot and passenger amenities, as well as offices for airport administration. As the focal point for landside facilities, the location of the terminal building influences surrounding development that would cater to transient operators, such as fixed base operators (FBOs) and specialized aviation service operators (SASOs). Consideration was given to locating the terminal building on the south side of the airfield adjacent to the primary runway, which can accommodate larger aircraft; it was ultimately determined, however, that south-side development is not likely to occur for several years, and the additional supporting FBO/SASO activity has already been established on the north side. Therefore, a new 16,000 square foot (sf) terminal facility is planned to be developed on the north side adjacent to the existing airport traffic control tower (ATCT). This site has frontage to the terminal apron that makes it highly visible from the airfield and takes advantage of an existing vehicle parking lot that is currently underutilized. Utility infrastructure is also already in place in this site to accommodate a new terminal building.

Airport Operations/Maintenance | Airport maintenance equipment is currently housed in a hangar on the old heliport site north of S. Airport Boulevard. It is the desire of airport management to relocate maintenance facilities near the new terminal building to provide a consolidated airport administrative complex. Being located adjacent to the new terminal would also eliminate the need for operations and maintenance personnel to cross a public road and improve responsiveness to airfield issues. The planned operations/maintenance facility is located immediately west of the new terminal building along the terminal apron.

Fuel Storage | The bulk of fuel storage capacity at CHD is provided by the airport's FBO; however, the City of Chandler has a 12,000-gallon 100LL underground storage tank located adjacent to the existing maintenance/operations facility along S. Airport Boulevard. The self-service distribution system for this tank is located south of S. Airport Boulevard on the terminal apron. Underground storage tanks are susceptible to leaking, which can create environmental hazards, so it is preferred to replace the underground tank with an above ground tank that is equipped with spill containment. The plan includes eliminating the existing underground tank and replacing it with an above ground fuel storage tank on the terminal apron adjacent to the existing self-service fuel distribution system.

Apron Expansion | There is currently approximately 235,854 square yards (sy) of apron pavement at CHD. Additional apron capacity is needed over the course of the next 20 years to accommodate growth in based aircraft, as well as spaces for transient operators. Much of the flight line on the north side has already been developed with apron pavement or for hangars. The plan includes adding approximately 4,700 sy of new pavement on an environmental site north of the existing terminal building adjacent to Hangar AG. The 1-acre environmental site was previously used as a dump site for construction debris sometime between 1949 and 1964. The City of Chandler has determined this site can be capped with asphalt and returned to useable airport property. This new apron space provides new aircraft parking spaces and a site for a potential future aircraft wash rack. The taxilane access to this site allows for up to ADG II aircraft.

FBO/SASO Development | CHD's current FBOs and SASOs are all located on the north side of the airfield. The plan includes reserving vacant space and redeveloping the existing terminal area for new or expanded FBO/SASO facilities and activities. The existing terminal facility and parking lot, along with an adjacent conventional hangar that is currently vacant, makes up an approximately 3.1-acre redevelopment site that could be developed with larger (10,000+ sf) conventional hangars and apron space. The proximity to the new terminal site would also make this site convenient for servicing transient operators. An additional 15.5 acres of undeveloped property along Aviation Drive has been reserved for a large-scale SASO or maintenance/repair/overhaul (MRO) operations. This parcel size provides for a future developer to construct any type of facility needed for a major operation, including an aircraft manufacturer.

Executive Hangar Development | Executive hangars are typically conventional-style hangars that provide storage capacities larger than a typical T-hangar, up to 10,000 sf. This style of hangar can accommodate a single large aircraft or multiple small aircraft. The plan reserves approximately 4.3 acres for executive hangar development, including associated taxilanes and vehicle access roads, north of the terminal on undeveloped property along Aviation Drive.

Small Aircraft Facilities Development | Small aircraft makeup the bulk of the based aircraft and operations at CHD. The type of facilities that cater to small aircraft are T-hangars, shaded parking structures, and uncovered parking aprons. The plan reserves approximately 3.3 acres north of the north apron along Aviation Drive for the development of new small aircraft facilities.

Non-Aviation Development | The airport owns approximately 16.2 acres of property between S. Airport Boulevard and the drainage canal north of the airport. This property was previously used as the airport's heliport, but since helicopter operations were relocated to the south side of the airport the site has been used for the storage of airport maintenance equipment. Because this site is not accessible to the airfield, it cannot be developed for aviation-related uses. For this reason, the plan reserves this area for non-aviation development to include compatible commercial or industrial developments. Approximately 11.4 acres of this site is within a floodplain and would include development restrictions.

Vehicle Access | The intersection of S. Curtis Way and E. Ryan Road is planned for a roundabout. It is desired for the airport's roadway network to be consistent with the surrounding Chandler Airpark, which features several roundabouts. A secured pedestrian access gate is also planned at the apron area to provide access to the apron area.

SOUTH SIDE

Planned south side development areas are depicted in **Figure 5C**.

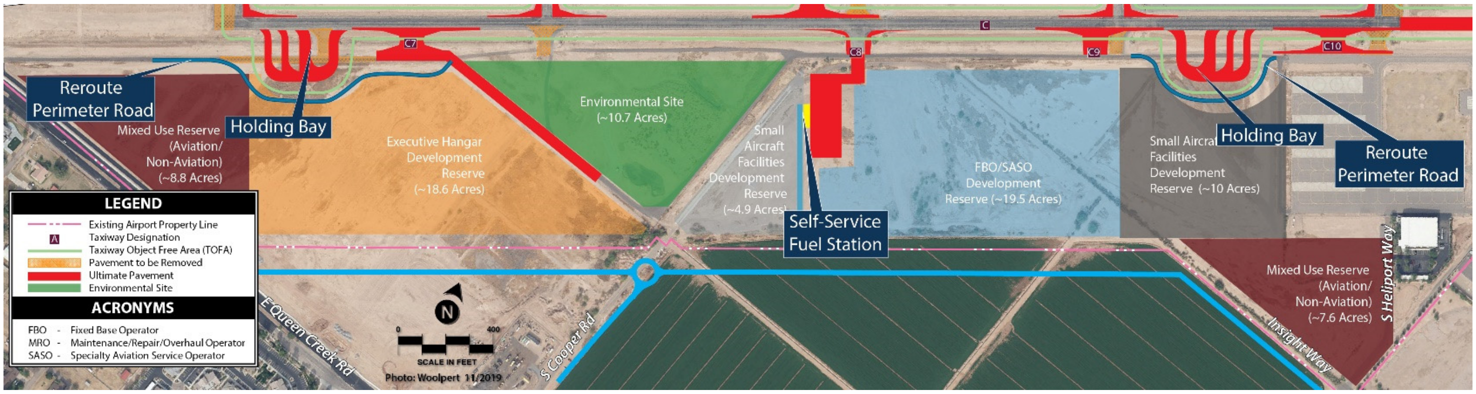

FIGURE 5C – SOUTH LANDSIDE DEVELOPMENT CONCEPT

The south side of the airport is predominantly undeveloped with approximately 82 acres (excluding 10.7 acres of an environmental site) available for development. Helicopter operations associated with Quantum Helicopters are the primary activity on the south side. It is anticipated that once the north side reaches a built-out condition, new development will begin on the south side. A major barrier to development of the south side is a need for expanded utility infrastructure and vehicle access roads. The plan also identifies extensions of Insight Way and S Cooper Road into the south side of the airport for vehicle circulation. Once this infrastructure is in place, the plan reserves parcels for new FBO/SASO development (19.5 acres); executive hangars (27.4 acres); and small aircraft facilities (24.4 acres). A dedicated fuel storage facility will also be necessary on the south side to eliminate the need for fuel trucks to travel from the north to fuel aircraft.

AIRPORT RECYCLING, REUSE, AND WASTE REDUCTION

REGULATORY GUIDELINES

FAA Modernization and Reform Act of 2012

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 the 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 the FMRA added a provision requiring airports that have 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.

State of Arizona Solid Waste Management Plan

The *Arizona Solid Waste Management Plan* (1981)[4] was adopted to promote environmentally sound waste management. General goals of the waste management plan include:

- Promote improved and environmentally sound methods of solid waste management and disposal;
- Promote recovery and reuse of valuable material and energy resources from solid waste;
- Provide policy and procedural guidance to state, substate, and local agencies in the proper management of solid waste; and
- Fulfill requirements of *Resource Conservation and Recovery Act* (RCRA) and secure the state's continued eligibility for federal financial assistance.

Currently, there is no state law or regulation addressing solid waste management reduction thresholds. However, other means such as education, outreach, voluntary recycling, and non-profit organizations have been employed to reduce the quantity of solid waste in Arizona.

SOLID WASTE

Typically, airport sponsors have purview over waste handling services in facilities it owns and operates, such as the terminal building, city-owned hangars, 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 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.

For airports, waste can generally be divided into eight categories:[5]

- **Municipal Solid Waste** (MSW) is more commonly known as trash or garbage consisting of everyday items that are used and then discarded, e.g. 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,

[4] Arizona Department of Environmental Quality *Arizona Solid Waste Management Plan* (March 1981) (https://legacy.azdeq.gov/environ/waste/solid/)
[5] Recycling, Reuse and Waste Reduction at Airports, FAA (April 24, 2013)

including concrete, wood, metals, drywall, carpet, plastic, pipe, cardboard, and salvaged building components. C&D is also generally labeled as MSW.

- **Green Waste** is a form of MSW 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 and is also considered MSW.
- **Deplaned Waste** is waste removed from passenger aircrafts. Deplaned waste includes bottles, cans, mixed paper (newspapers, napkins, paper towels), plastic cups, service ware, food waste, and food soiled paper/packaging.
- **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[6] 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 Clean 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 RCRA, as well as the regulations in 40 Code of Federal Regulations (CFR) Subtitle C, Parts 260 to 270. The U.S. Environmental Protection Agency (EPA) developed less stringent regulations for certain hazardous waste, known as universal waste, described in 40 CFR Part 237, *The Universal Waste Rule*.

As seen on **Exhibit 5B**, there are multiple areas where CHD potentially contributes to the waste stream, including the terminal and pilot's lounge, airfield, hangars, airport construction projects, and airport traffic control tower. To create a comprehensive waste reduction and recycling plan for the airport, all potential inputs must be considered.

EXISTING SERVICES

Currently, waste management services for the airport are managed by the City of Chandler through a franchise agreement with Republic Services. Three MSW dumpsters are located airside adjacent to the municipal hangars, one dumpster is located landside adjacent to the terminal, and one more is by the airport maintenance equipment storage facility. No information is available regarding the weight of MSW hauled or the cost of service. Dumpsters are emptied weekly on Fridays. Currently, there is not a designated individual or department onsite at the airport to oversee waste management for the facility.

The airport engages in recycling services, also provided by Republic Services. The airport provides small recycling containers inside the terminal lobby, flight planning room, and within individual airport administration offices. Recyclables are collected weekly, and the most common recycled materials at the airport include paper, corrugated cardboard, glass, and aluminum cans. All materials accepted for recycling by Republic Services are depicted on **Exhibit 5C**.[7]

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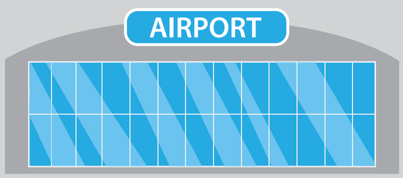
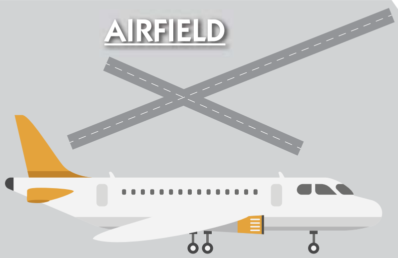
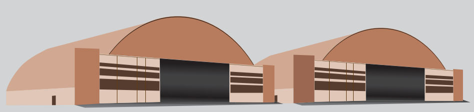
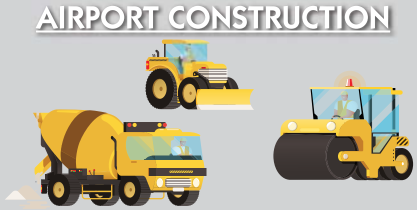
[6] A triturator facility turns lavatory waste into fine particulates for further processing.
[7] Republic Services (https://www.republicservices.com/)

AIRPORT WASTE STREAMS for CHANDLER MUNICIPAL AIRPORT

AIRPORT AREA	POTENTIAL INPUTS	POTENTIAL OUTPUTS
TERMINAL/PILOT'S LOUNGE 	Employees Pilots	Food Waste Paper, Plastic Aluminum Cans Trash, Cardboard
AIRFIELD 	Aircraft Operations	Runway Rubber Green Waste
HANGARS 	Goods Movements	Plastic Wood Vehicle Waste (Tires & Fluids)
AIRPORT TRAFFIC CONTROL TOWER 	Employees	Paper, Trash, Aluminum Cans
AIRPORT CONSTRUCTION 	Construction Re-Construction Demolition	Reused Concrete Reused Asphalt Vehicle Waste Soils, Building Materials Wood, General Waste

Source: Recycling, Reuse, and Waste Reduction at Airports, FAA (April 24, 2013)

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 (2020)

SOLID WASTE MANAGEMENT SYSTEM

Airports generally utilize either a *centralized* or a *decentralized* waste management system. The differences between these two methods are described below and summarized in **Exhibit 5D**.

- **Centralized waste management system.** With a centralized waste management system, the airport provides receptables for the collection of waste, recyclables, or compostable materials and contracts for the removal by a single local provider.[8] The centralized waste management system allows for more participation from airport tenants who may not be incentivized to recycle on their own and can reduce the overall cost of service for all involved. A centralized strategy can be inefficient for some airports as it requires more effort and oversight on the part of airport management. However, the centralized system is advantageous in that is has less players involved in the overall management of the solid waste and recycling efforts, and allows greater control by the city over the type, placement, and maintenance of dumpsters, thereby saving space and eliminating the need for each tenant to have their own containers.

- **Decentralized waste management system.** Under a decentralized waste management system, the airport provides waste containers and contracts for the hauling of waste materials in airport-operated spaces only. Airport tenants, such as fixed-base operators, retail shops, and other tenants manage the waste from their leased spaces with separate contracts, billing, and hauling schedules. A decentralized waste management system can increase both the number of receptacles on airport property and the number of trips by a waste collection service provider, should the collection schedule for the tenant differ from the airport.

Currently, the airport participates in a decentralized waste management system since airport tenants are responsible to oversee their waste management. Airport tenants include fixed based operators, specialty aviation service operators, the Hangar Café, and privately owned hangars. Airport staff should actively engage tenants to create a centralized waste management system at the airport to streamline waste management and recycling efforts at CHD.

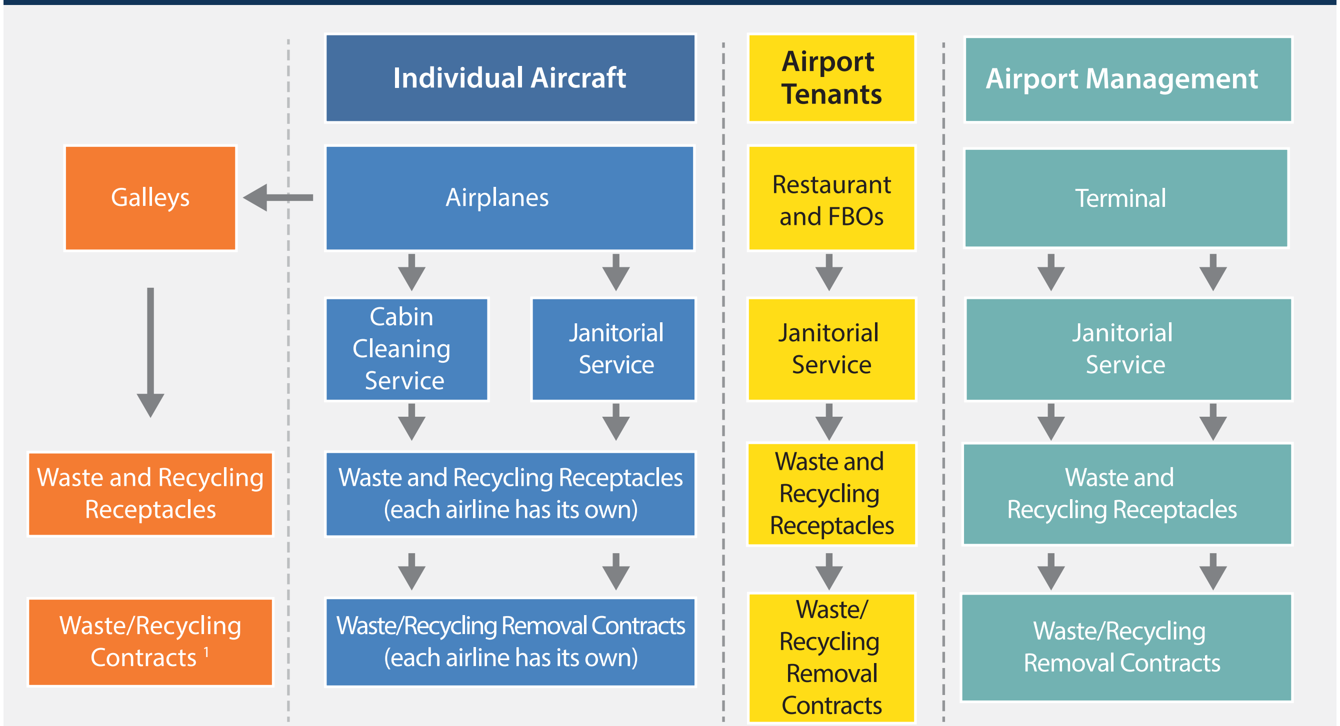
GOALS AND RECOMMENDATIONS

Solid Waste and Recycling Goals

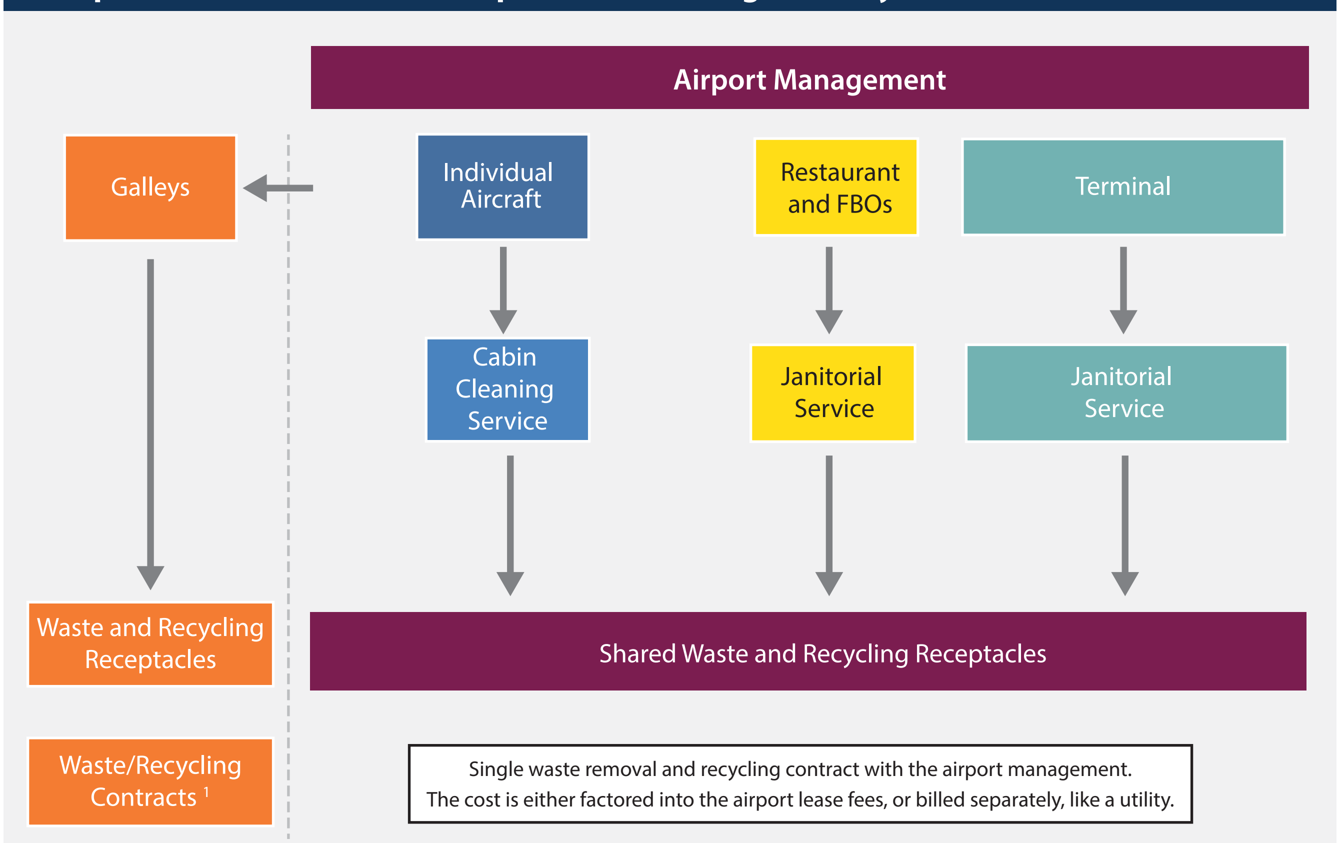
While the airport may or may not expand the existing waste management system with additional landside recycle dumpsters in other locations at the airport, there are other opportunities for improvement. **Table 5B** outlines objectives that could help reduce waste generation and increase recycling efforts 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.

[8] *Airport Waste Management and Recycling Practices* (2018) The National Academies of Sciences, Engineering, and Medicine Airport Cooperative Research Program, Synthesis 92.

Components of a Decentralized Airport Waste Management System



Components of a Centralized Airport Waste Management System



[1] Galleys typically manage their own waste even if an airport relies on a centralized system

Source: Natural Resources Defense Council, Trash Landings: How Airlines and Airports Can Clean Up Their Recycling Programs, December 2006.

TABLE 5B | Waste Management and Recycling Goals
Chandler Municipal Airport

Goals	Objectives
Reduce amount of solid waste generated	Switch to online bill pay to eliminate monthly paper bills
	Conduct a waste audit to identify most common types of waste
	Eliminate purchase of items that are not recyclable (e.g., Styrofoam, plastic bags)
Reuse of materials or equipment	Reuse grass clippings as mulch
	Offer reusable dishes to employees
	Recycle cardboard boxes for storage
Increase amount of materials recycled	Promote the expansion of recycling services to all areas of the airport
	Improve waste and recycling 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 & recycle construction & demolition waste

Source: Coffman Associates, Inc.

Recommendations

To maximize waste reduction and increase recycling efforts at the airport, the following recommendations are made:

- **Assign the responsibility of waste management to a dedicated individual(s).** Having one person or a group of people oversee and manage solid waste and recycling at the airport will create efficient and cost saving solutions to solid waste management. People dedicated to this operational aspect of the airport will have a familiarity of processes and will help identify areas of improvement and cost-cutting measures.

- **Audit the current waste management system.** The continuation of an effective program requires accurate data of current waste and recycling rates. There are several ways an airport can gain insight into their waste stream, such as requesting weights from the hauler, tracking the volume, or reviewing the bills. But managing the waste system first starts with a waste audit. A waste audit is an analysis of the types of waste produced and is the most comprehensive and intensive way to assess waste stream composition, opportunities for waste reduction, and capture of recyclables. A waste audit should include the following actions:

    - Examination of records
        - Waste hauling and disposal records and contracts
        - Supply and equipment invoices
        - Other waste management costs (commodity rebates, container costs, etc.)
        - Track waste from the point of origin
        - Establishes a baseline for metrics

    - Facility walk-through conducted by the airport
        - Qualitative waste information to determine major waste components and waste-generating processes

        - Identify the locations of the airport that generate waste
        - Identify what type of waste is generated by the airport to determine what can be reduced, reused, or recycled
        - Understanding waste pickup and hauling practices

    - Waste sort
        - Provides quantitative data on total airport waste generation
        - Allows problem solving design/enhancing the recycling program for the airport

- **Create a tracking and reporting system.** Continuing to track the solid waste that is generated will allow the airport to identify areas where a significant amount of waste is generated and will help the airport estimate annual waste volumes. Understanding the cyclical nature of waste generation will allow the airport to estimate costs and identify areas of improvement. Since the airport engages in recycling services, the airport can track recycling rates and waste quantities to identify cost saving measures that are currently unidentified simply based on the lack of quantitative data.

- **Reduce waste through controlled purchasing practices.** The airport can control the amount of waste generated by prioritizing the purchase of items or supplies that are reusable, recyclable, compostable, or made from recycled materials.

- **Enhance the existing recycling program at the airport.** To guarantee the airport continues to reduce the amount of waste hauled to the landfill, materials that cannot be reused or avoided should be recycled, if possible. The city should review internal procedures to ensure there are no unacceptable items contaminating recycling containers, or recyclables thrown in the trash. Clearly marked signage of what is and is not accepted placed near the solid waste and recycling containers is another significant component of a consistent, effective recycling program. CHD should actively work with Republic Services to ensure waste and recycling containers are right sized to the existing operation, as well as be on a collection schedule that picks up only when the containers are full.

- **Provide ongoing tenant education.** It is crucial to encourage tenant participation to assure buy-in of the airport's recycling efforts. To ensure recycling is part of the airport's everyday business, airport administration can provide training and educational to support personnel, tenants, and others who conduct business at the airport. In-person meetings with airport tenants could be held to create mutual understanding of the airport's solid waste and recycling goals, and how tenants play a vital role in the airport's overall success.

- **Create a centralized waste management system at the airport.** The airport should actively engage tenants to create a centralized waste management system at the airport to streamline waste management and recycling efforts at CHD.

- **Incorporate an airport-wide waste reduction strategic plan.** Designing an airport-wide waste reduction strategic plan will create consistency in waste deposal mechanisms, ultimately resulting in the reduction of materials sent to the landfill.

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 recommended airport development concept plan and associated capital program at the airport to determine whether 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 recommended airport development concept plan 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 potential impacts to existing resources that could result from implementation of the planned improvements outlined in the recommended airport development concept plan.

POTENTIAL ENVIRONMENTAL CONCERNS

Table 5C summarizes potential environmental concerns associated with implementation of the recommended master plan development concept for CHD. 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
- Construction of a facility that adversely affects the visual character of a neighborhood.

Indirect impacts are those impacts caused by the action but are later in time or farther removed in distance but are still 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 5C | Summary of Potential Environmental Concerns
Chandler Municipal Airport

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 recommended airport development concept plan (**Exhibit 5A**) will likely result in additional emissions. Maricopa County is currently designated as a nonattainment area for ozone (O_3) and coarse particulate matter (PM_{10}). Maricopa County was previously a nonattainment area for carbon monoxide (CO); however, was designated as a maintenance area in 2005. Prior to the start of airport construction activities outlined on the recommended airport development concept plan, an air quality analysis during the NEPA process to determine whether O_3, PM_{10}, and CO emissions exceed *de minimis* thresholds established by the NAAQS may be required. Prior to the start of construction activities, the contractor will be required to obtain a dust control permit from the Maricopa County Air Quality Department. Condition of permit approval will require best management practices (BMPs) to control construction-related fugitive dust relating to construction equipment and earth moving activities, the primary source of PM_{10}.
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.	<u>For federally listed species</u> **No Impact.** The USFWS Information for Planning and Consultation (IPaC) report identified three threatened or endangered avian species: California least tern (endangered), the yellow-billed cuckoo (threatened), and the Yuma clapper rail (endangered) that should be considered when evaluating development in the area. As noted in Chapter One, these avian species prefer coastal or riparian nesting habitat. The airport is free from these habitat types and are unlikely to nest at the airport. <u>Designed Critical Habitat</u> **No Impact.** Critical habitat has not been identified within the vicinity of the airport. <u>Non-Listed Species</u> **Potential Impact.** Non-listed species of concern include those protected by the MBTA and the BGEPA. There are presently five non-listed species of concern that could be impacted by activities at the airport. Habitat to support breeding for this species may be near the airport, therefore, the potential for impacts to migratory birds should be evaluated

	on a project-specific basis. To ensure that nest sites for the birds listed on the MBTA or BGEPA are not present at the start of airport activities, pre-construction nesting surveys may be required prior to the implementation of projects outlined in the master plan.
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 recommended airport development concept plan. 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.
COASTAL RESOURCES	
FAA has not established a significant threshold for Coastal Resources.	**No Impact.** The airport is not located within a coastal zone.
***DEPARTMENT OF TRANSPORTATION ACT*, SECTION 4(F)**	
Threshold: The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource. Resources that are protected by Section 4(f) are publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; and publicly or privately owned land from an historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.	**Potential Impact.** Initial assessments should be made to determine whether physical (temporary or permanent) or constructive use of this Section 4(f) resource applies. The Chandler Paseo Trail is located along the western boundary of the airport. Proposed non-aviation development along the southwestern boundary of the airport, will be adjacent to the trail, and could potentially affect this resource. Coordination with the City of Chandler may be needed to determine any necessary temporary closures to the trail or avoidance measures as needed, which could result in a temporary constructive use during construction activities. The Railroad Steam Wrecking Crane and Tool Car, which is listed on the National Register of Historic Places list and is a protected resource under Section 4(f), is located approximately one mile from the airport. If necessary, the FAA will consider several types of impacts to historical properties. The Section 4(f) compliance process involves the preparation of a Section 4(f) statement by the airport, which evaluates other feasible alternatives. Planned airport projects present potential constructive use of other Section 4(f) properties identified in Chapter One in Table 1N. The proposed expansion to Runway 4R-22L outlined in the recommended airport development concept plan can affect Tumbleweed Park or Reflections Park (both located northeast of the airport) as the protected runway area and an altered air traffic pattern may result from runway improvements. The responsible FAA official will be required to consult with all appropriate Federal, state, and local officials having jurisdiction over the affected Section 4(f) properties to determine whether project-related impacts will substantially impair the resource. Consultation will occur as part of the NEPA process as specific projects are initiated.

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. The whole of the airport is classified as either "prime farmland if irrigated" or "prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season" by the NRCS, identified on Exhibit 1J. However, according to the U.S. Census Bureau 2010 Census,[9] the airport is located in a non-urbanized area. Additionally, the airport is not currently used for agricultural purposes or irrigated for agricultural uses; therefore, FPPA will not apply to airport activities proposed on the recommended airport development concept plan.

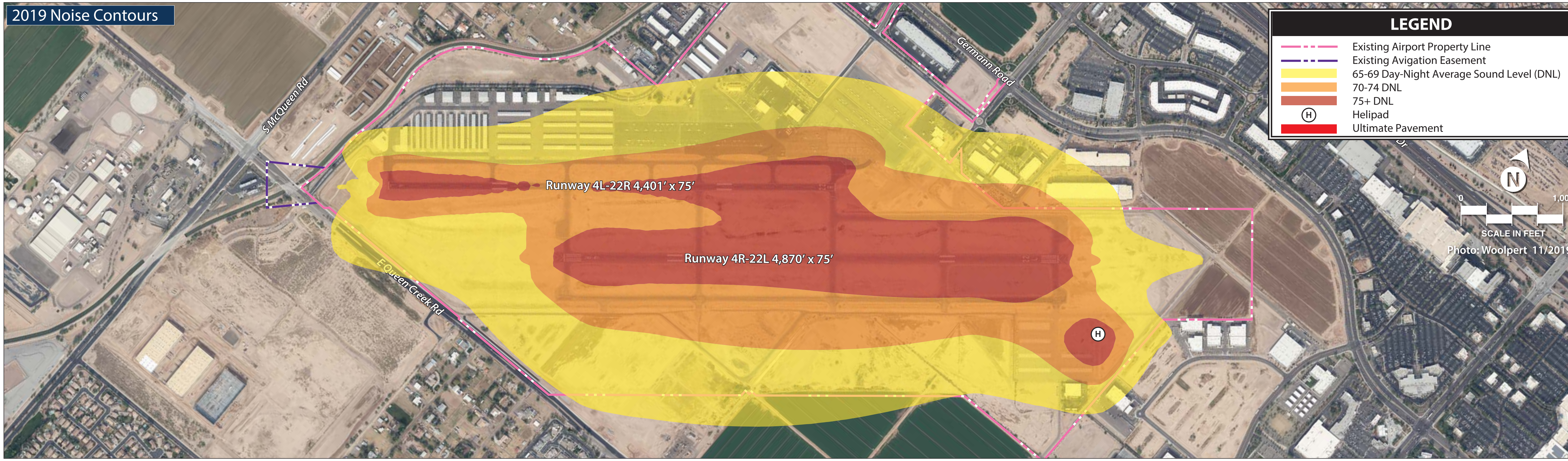
HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION	
FAA has not established a significance threshold for Hazardous Materials, Solid Waste, and Pollution Prevention. However, factors to consider are if an action would have the potential to: • Violate applicable federal, state, tribal, or local 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 self-serve fuel island along South (S.) Airport Boulevard and provides opportunity for 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 and the Arizona Department of Environmental Quality (ADEQ). Currently, the tanks for this fuel island are underground (USTs) and located west of S. Airport Boulevard, while aircraft fueling occurs east of S. Airport Boulevard. The airport development concept plan recommends the USTs to be permanently removed and the fuel island will utilize above ground storage tanks (ASTs) adjacent to fueling activities. Removal of the USTs will require the airport to obtain a Noncorrective Action UST Permanent Closure Program certificate through the Arizona Department of Environmental Quality (ADEQ). The recommended airport development concept plan proposed the relocation of the 100LL fuel island to a site adjacent to South (S.) Airport Boulevard and a new fuel island southeast of Runway 4R-22L. The owner(s) of the ASTs are

9 U.S. Census Bureau Urbanized Area Maps (https://www2.census.gov/geo/maps/dc10map/UAUC_RefMap/ua/)

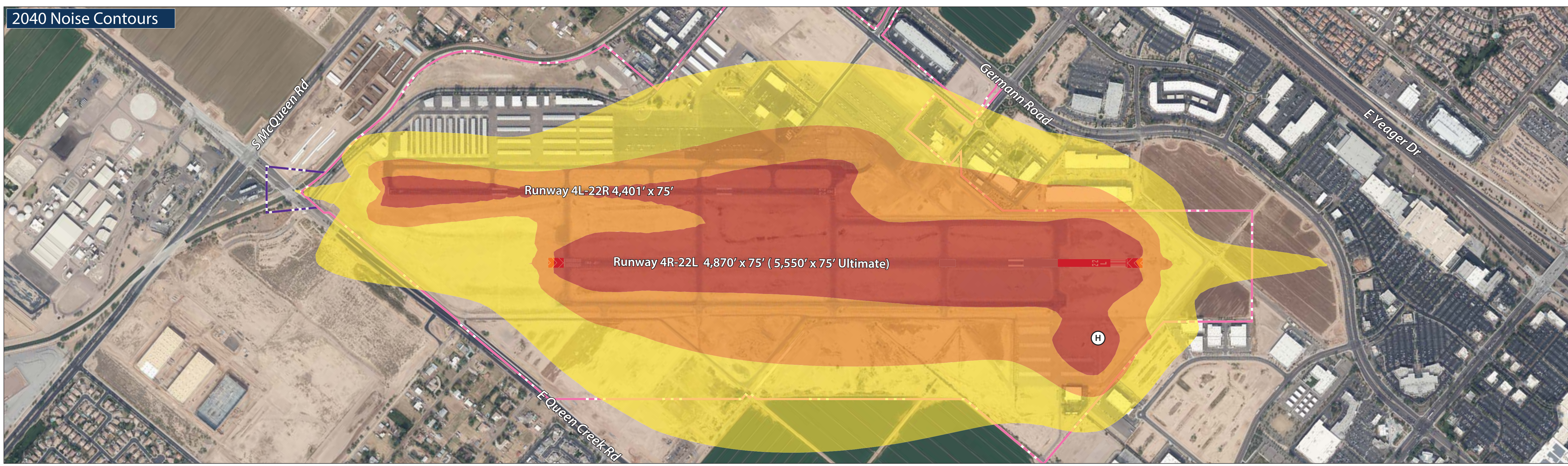
	required to be permitted through the Arizona Department of Fire, Building, and Life Safety. The recommended airport development concept plan does not include land uses that would produce an appreciably different quantity or type of hazardous waste. However, should this type of land use be proposed, further NEPA review and/or permitting would be required. There are no known hazardous materials or waste contamination sites currently on airport property. There will be no impact to Superfund or brownfields sites since they are not within five miles of the airport.
HISTORIC, 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).	**No Impact.** As identified in Chapter One, one historic resource, the Railroad Steam Wrecking Crane and Tool Car, is located less than one mile from the airport. However, it is unlikely airport activities will impact this structure because the crane is located west of South McQueen Street, within the Arizona Railway Museum located at the west end of Tumbleweed Park approximately one mile west. Due to this separation, it is unlikely the crane will be affected by airport development activities. All other historic resources identified in Chapter One are located more than one mile from the airport and will not be affected by airport development activities.
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.	**No Impact.** One historic resource is located west of the airport; however, it is located west of South McQueen Street, which is approximately one mile from the airport. Due to this distance, it is unlikely to be impacted by airport activities. Single-family residential, a noise-sensitive land use, is present south of East Queen Creek Road, less than 0.5 mile from the Executive Hangar Development Reserve area identified on **Exhibit 5A**.
NATURAL RESOURCE AND ENERGY SUPPLY	
FAA has not established a significance threshold for Natural Resources and Energy Supply. However, factors to consider are if an action would have the potential to cause demand to exceed available or future supplies of these resources.	**Potential Impact**. Planned development projects at the airport could increase demands on energy utilities, water supplies and treatment, and other natural resources during construction; however, impacts are not anticipated to be long-term. Should long-term impacts be a concern, coordination with service providers is recommended.
NOISE AND NOISE-SENSITIVE 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	**Potential Impact. Exhibit 5E** depicts both 2019 and 2040 noise contours. In both existing and future conditions, the 65 DNL contour extends off airport property at the north, east, and south end of the airport. To both scenarios, the 65 DNL contour is anticipated to encompass commercial or industrial land uses but is not anticipated to affect any residential structures.

where the land use compatibility guidelines in Title 14 Code of Federal Regulations (CFR) part 150 are not relevant to the value, significance, and enjoyment of the area in question.	
SOCIOECONOMIC, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH AND SAFETY RISKS	
Socioeconomic	
FAA has not established a significance threshold for Socioeconomics. However, factors to consider are if an action would have the potential to: • induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area); • disrupt or divide the physical arrangement of an established community; • cause extensive relocation when sufficient replacement housing is unavailable; • cause extensive relocation of community businesses that would cause severe economic hardship for affected communities; • disrupt local traffic patterns and substantially reduce the levels of service of roads serving the airport and its surrounding communities; or • produce a substantial change in the community tax base.	**Potential Impact.** The proposed development plan for the airport could potentially encourage economic growth for the City of Chandler and surrounding communities. Results include new construction jobs, new jobs for the airport and other commercial uses, new housing, and increase the local tax base. The proposed concept plan does not include any recommendations to acquire residences or relocate businesses. New commercial development could change the level of service to roads leading to and within the airport, such as along East Queen Creek Road and S. Airport Boulevard. 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. Executive Order (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 for 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 Health and Safety Risks	
FAA has not established a significance threshold for Children's Environmental Health and Safety Risks. However, factors to consider are whether an action will have the potential to lead to a disproportionate health or safety risk to children.	**Potential Impact.** Per E.O. 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, federal agencies are directed to identify and assess environmental health and safety risks that may disproportionately affect children. These risks include those that are attributable to products or substances that a child is likely to encounter or ingest, such as air, food, drinking water, recreational waters, soil, or products to which they may be exposed. Within a close vicinity of the airport, seven schools have been identified (the location of these schools are labeled on Exhibit 1J in the Environmental

2019 Noise Contours



2040 Noise Contours



	Inventory). BMPs should be implemented to decrease environmental health risks to children. During construction of the projects outlined in the recommended concept plan, appropriate measures should be taken to prevent access by unauthorized persons to construction project areas.
VISUAL EFFECTS	
Light Emissions	
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.	**Potential Impact.** New lighting associated with the recommended airport development concept plan 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.
Visual Resources/Visual Character	
FAA has not established a significance threshold for Visual Resources/Visual Character. However, a factor to consider is the extent an action would have 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.	**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.
WATER RESOURCES	
Wetlands	
Threshold: The action would: **1. Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;** **2. Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;** **3. Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);** **4. Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands;** **5. Promote development of secondary activities or services that would cause the circumstances listed above to occur; or** **6. Be inconsistent with applicable state wetland strategies.**	**Potential Impact.** There is an engineered canals/drainage way (Consolidated Canal) identified as a wetland adjacent to airport boundary and proposed development, although this information is based on aerial photography interpretation from undated aerial photography. Field surveys and wetland delineations may be required to determine the presence or absence of wetlands in project areas. Removal or relocation of 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.

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.** A 100-year floodplain associated with the Consolidated Canal was identified by FEMA on airport property (depicted in Chapter One on Exhibit 1J). E.O. 11988, *Floodplain Management*, requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of 100-year floodplains and to avoid direct or indirect support of floodplain development where there is a practicable alternative. The proposed recommended airport development concept plan proposes the extension of Taxiway B and new non-aviation development along S. Airport Boulevard within the 100-year floodplain (**Exhibit 5A**). According to Maricopa County, the airport may be required to obtain a Floodplain Use Permit for any development or site improvements in a floodplain identified on the Official Floodplain Map. The Floodplain Manager shall review and approve this permit, if the development complies with the regulations set forth by the county. Per E.O. 11988, *Floodplain Management, and Department of Transportation Order* (DOT) 5650.2, *Floodplain Management and Protection*, agencies are required to provide the public an opportunity for early public review of any plan or proposal encroaching into a floodplain.
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 waters 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 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 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.
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;	**No Impact.** The nearest designated Wild and Scenic River, the Verde River, is located approximately 60 miles from the airport. The closest river on the NRI is a segment of the Arnett/Telegraph Creeks, which is located approximately 36 miles east of the airport. The recommended airport projects will not have adverse effects on these river's outstanding remarkable values (i.e., scenery, recreation, geology, fish, wildlife, and history).

• 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).	
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 outlined on the recommend concept plan will 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.

Source: Coffman Associates, Inc analysis

SUMMARY

This chapter has been prepared to help the City of Chandler make decisions on the future growth and development of CHD by describing narratively and graphically the Recommended Master Plan Concept. It details environmental and land use conditions that must be taken into consideration when implementing the development plan. The plan represents an airfield facility that fulfills aviation needs for the airport, while conforming to safety and design standards to the extent practicable. It also provides a landside complex that can be developed as demand dictates and is subject to further refinement pending comments from the PAC, City of Chandler, and public.

Flexibility will be very important to future development at the airport, as activity may not occur as predicted. The Recommended Master Plan Concept provides stakeholders with a general guide that, if followed, can maintain the airport's long-term viability, and allow it to continue to provide air transportation service to the region. The next chapter of this master plan will provide a reasonable schedule for undertaking the projects based on safety and demand over the course of the next 20 years.

Chapter Six

CAPITAL FINANCIAL PLAN

CHANDLER arizona

CHANDLER arizona

Chapter Six

CAPITAL FINANCIAL PLAN

The Master Plan Concept presented in the previous chapter outlined airside and landside improvements for Chandler Municipal Airport (CHD) that provide the City of Chandler with a plan to preserve and develop the airport to meet future aviation demands. Using the Recommended Master Plan Concept as a guide, this chapter will provide a description and overall cost for projects 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 is 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 (ADOT) – Aeronautics Group 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 concept and specific needs and improvements for the airport having been established, the next step is to determine a realistic schedule for project implementation and 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 using planning horizons instead of specific years, the City of Chandler will have greater flexibility to adjust capital needs as demand dictates. **Table 6A** summarizes the key aviation demand milestones projected at CHD for each of the three planning horizons.

TABLE 6A | Aviation Demand Planning Horizons
Chandler Municipal Airport

	Base Year (2019)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single Engine	379	424	469	552
Multi-Engine	26	24	20	15
Turboprop	6	7	9	13
Jet	8	10	13	20
Helicopter	22	25	29	40
Total Based Aircraft	***441***	***490***	***540***	***640***
ANNUAL OPERATIONS				
Itinerant				
Air Taxi	2,990	3,900	4,400	5,100
General Aviation	67,647	72,500	77,300	87,400
Military	199	213	213	213
Total Itinerant	***70,836***	***76,613***	***81,913***	***92,713***
Local				
General Aviation	149,754	158,300	165,800	181,900
Military	72	62	62	62
Total Local	***149,826***	***158,362***	***165,862***	***181,962***
Total Operations	***220,662***	***234,975***	***247,775***	***274,675***

Source: Coffman Associates analysis

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 expanding utility infrastructure and site preparation for constructing new landside facilities to support aircraft activity. Demand for new 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. 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 airfield improvements to meet FAA design standards. These projects need to be programmed in a timely manner regardless of changes in demand indicators and should be monitored regularly by Airport management.

At CHD, some hangars are owned and managed by the airport and leased to individual tenants, while others are privately owned and managed on land leased from the airport. Because of economic realities, many airports rely on private developers to construct new hangars. In some cases, private developers can keep construction costs lower which, in turn, lowers the monthly lease rates necessary to amortize a loan. The CIP for CHD assumes that site preparation and development for landside facilities will be constructed privately. This assumption does not preclude the possibility of the airport constructing new hangars. Ultimately, the City of Chandler will determine, based upon demand and the specific needs of a potential developer, whether to self-fund landside facility development or to rely on private developers.

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. These estimates include design, construction administration, and contingency costs that may arise on the project. ***Capital costs presented here should be viewed only as "order-of-magnitude" estimates subject to further refinement during engineering/architectural design.*** Nevertheless, they are considered sufficient for planning purposes. Cost estimates for each of the development projects in the CIP are based on present-day construction, design, and administration costs. Adjustments will need to be applied over time to account for inflation and changes in construction and capital equipment costs. Cost estimates for these projects were provided by Dibble Engineering, who is providing engineering support for the master plan and is familiar with CHD. Cost estimates for each of the development projects in the CIP are in current dollars.

Exhibit 6A presents the proposed 20-year CIP for CHD. Two things must be considered. First, the proposed CIP is a point-in-time analysis which will change annually based on actual demand and changing needs. Second, an estimate of grant (FAA and/or ADOT – Aeronautics Group) funding eligibility has been included, although actual funding is not guaranteed. For those projects that would be eligible for federal funding, Airport Improvement Program (AIP) reauthorization provides for 91.06 percent of the total project cost for CHD. The remaining amount (8.94 percent) would be equally shared (4.47 percent each) between ADOT – Aeronautics Group and the City of Chandler. This eligibility breakdown is based upon the airport's classification, in addition to the amount of public land within the State of Arizona. Other projects, such as the implementation of certain landside facilities (roadways), are typically not eligible for AIP grants (outside of non-primary entitlements) or would rank low on the priority scale. As a result, these projects should be planned for airport sponsor funding or funding through specific ADOT – Aeronautics Group programs.

As detailed in the CIP, most 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 – Aeronautics Group. It should be noted that certain projects listed in the CIP, while eligible for federal and state funding, are designated for state funding assistance only per the airport's current CIP on file with the FAA and ADOT – Aeronautics Group.

The FAA utilizes a national priority rating system to help objectively evaluate potential airport projects. Projects are weighted toward safety, infrastructure preservation, meeting design standards, and capacity enhancement. The FAA may participate in the highest priority projects before considering lower priority projects, even if a lower priority project is considered a more urgent need by the local sponsor. Nonetheless, the project should remain a priority, 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 – Aeronautics Group. There are three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA) that include categorical exclusions (CatEx), Environmental Assessments (EA), and Environmental Impact Statements (EIS). Each level requires more time to complete and more detailed information. Guidance on what level of documentation is required for a specific project is provided in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The Environmental Overview presented in Chapter Five addresses NEPA and provides an evaluation of various environmental categories for CHD.

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.

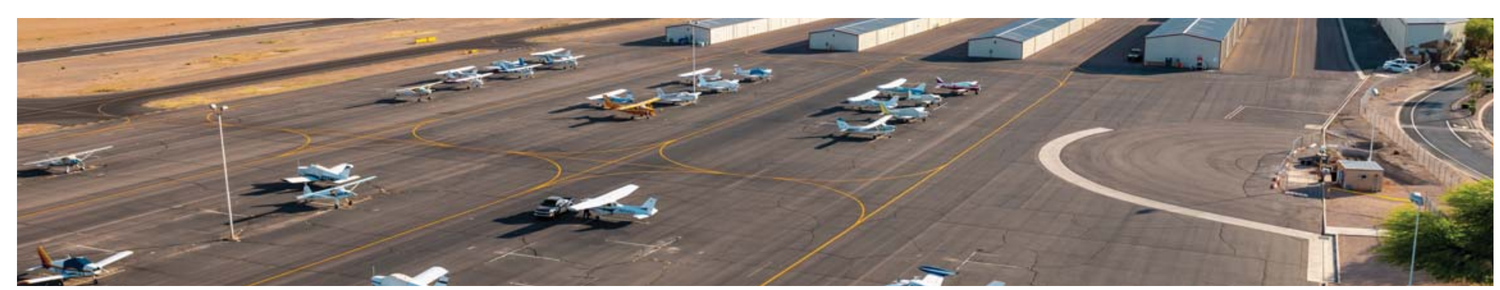
SHORT-TERM PROGRAM

The short-term projects are those anticipated to be needed during the first five years of the 20-year CIP. The projects listed are subject to change based on federal and state funding priorities. 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/rehabilitating existing airfield pavements and improving airfield safety. The short-term program considers 18 projects for the planning period as presented on **Exhibit 6A** and depicted on **Exhibit 6B**. The following provides a detailed breakdown of each project.

Project #1: Annual Pavement Maintenance Program - Runway 4L-22R
Description: This project will rehabilitate the runway pavement to maintain a safe operating environment.
Cost Estimate: $368,500
Funding Breakdown: Airport Sponsor – 100.00%

Fiscal Year	Project No.	Project	Estimated Cost	Funding Sources: AIP	ADOT	Airport Sponsor	Private
Short-Term Projects							
2021	1	Annual Pavement Maintenance Program - Runway 4L-22R	$368,500	$0	$0	$368,500	$0
2021	2	Replace Tower Transceiver Radios	$851,000	$0	$0	$851,000	$0
2021	3	Airfield Lighting Improve/Rwy 4L-22R PAPI Replacement	$1,724,000	$1,569,874	$77,063	$77,063	$0
2022	4	Annual Pavement Maintenance Program - Taxiway A and Connectors	$664,200	$0	$0	$664,200	$0
2022	5	Rehabilitate Runway 4R-22L Pavement and Lighting Rehabilitation	$2,825,000	$2,572,445	$126,278	$126,278	$0
2022	6	Airport Fuel Tank Relocation	$610,000	$0	$0	$610,000	$0
2022	7	Taxiway B Extension - Phase I	$2,035,200	$0	$1,831,680	$203,520	$0
2023	8	Annual Pavement Maintenance Program - City Hangars Asphalt (A-L)	$433,125	$0	$0	$433,125	$0
2023	9	Runway 4R-22L Extension - (Professional Services)	$350,000	$0	$0	$350,000	$0
2023	10	North Terminal Apron Reconstruction Phase II	$1,860,000	$1,693,716	$83,142	$83,142	$0
2023	11	Wildlife Exclusion Perimeter Fence	$1,062,000	$0	$955,800	$106,200	$0
2024	12	Annual Pavement Maintenance Program - Taxiway B	$243,750	$0	$0	$243,750	$0
2024	13	Runway 4R-22L Extension - (Environmental)	$427,000	$388,826	$19,087	$19,087	$0
2024	14	Rehabilitate Hangar Area Pavement	$3,092,000	$2,815,575	$138,212	$138,212	$0
2024	15	Rehabilitate Armory Apron Pavement - Phase I	$1,720,000	$1,566,232	$76,884	$76,884	$0
2025	16	Annual Pavement Maintenance Program - San Tan Ramp Tie-downs	$610,000	$0	$0	$610,000	$0
2025	17	Runway 4R-22L Extension - (Design)	$435,000	$396,111	$19,445	$19,445	$0
2025	18	Rehabilitate Armory Apron Pavement - Phase II	$1,720,000	$1,566,232	$76,884	$76,884	$0
Intermediate-Term Projects							
FY 2026-2030	19	Annual Pavement Maintenance Program - Terminal North Apron Phase 1/2; Taxiway C	$861,000	$0	$0	$861,000	$0
	20	Runway 4R-22L Extension - (Construction)	$5,404,000	$4,920,882	$241,559	$241,559	$0
	21	Rehabilitate North Terminal Apron Taxilane	$378,000	$344,207	$16,897	$16,897	$0
	22	San Tan Apron Reconstruction	$670,000	$610,102	$29,949	$29,949	$0
	23	Heliport Area Reconstruction	$2,600,000	$2,367,560	$116,220	$116,220	$0
	24	Taxiway B Extension - Phase II	$4,080,000	$3,715,248	$182,376	$182,376	$0
	25	Construct Blast Pads - Runway 4R-22L	$470,000	$427,982	$21,009	$21,009	$0
	26	Taxiway Fillet Improvements to Meet TDG 2 Standards	$2,600,000	$2,367,560	$116,220	$116,220	$0
	27	Remove Taxiway M Connector to Runway 4L-22R Remove Taxiway J Connector to Runway 4L-22R Remove Taxiway H Connector to Runway 4L-22R North of Taxiway B Relocate Taxiway F Connector from Apron to Taxiway A Remove Holding Apron at East End of Taxiway A (Runway 22R Threshold)	$1,090,000	$992,554	$48,723	$48,723	$0
	29	Relocate Taxiway Q from Heliport Apron (Ultimate C10) Relocate Taxiway N Connector to Runway 4R-22L (Ultimate C3)	$1,140,000	$1,038,084	$50,958	$50,958	$0
	28	Remove Holding Apron at Taxiway B and H (Ultimate B5) Intersection Remove Holding Apron at Taxiway B and Q (Ultimate B9) Intersection Construct Single-Lane Holding Bay at East End of Taxiway B Construct Single-Lane Holding Bay at West End of Taxiway B	$1,220,000	$1,110,932	$54,534	$54,534	$0
	30	Replace Airfield Signage to Reflect Taxiway Nomenclature Changes	$618,000	$562,751	$27,625	$27,625	$0
	31	Install REILs - Runway 4L-22R	$110,000	$100,166	$4,917	$4,917	$0
	32	Construct New Terminal Building (16,000 sf)	$8,000,000	All potential funding sources will be explored.			
	33	Construct Airport Operations/Maintenance Facility	$510,000	$464,406	$22,797	$22,797	$0
Intermediate-Term Projects (continued)							
FY 2026-2030	34	Construct Apron and Aircraft Wash Rack (4,700 sy)	$1,522,000	$1,385,933	$68,033	$68,033	$0
	35	Construct Apron Pavement (7,125 sy)	$630,000	$573,678	$28,161	$28,161	$0
	36	Install Pedestrian Gate Near E Ryan Rd and S Curtiss Way Intersection	$5,000	$0	$0	$5,000	$0
	37	Utilities/Sitework for Non-Aviation Development Reserve Site with Floodplain Restrictions (11.4 Acres)	$4,470,000	$0	$0	$0	$4,470,000
	38	Utilities/Sitework for Non-Aviation Development Reserve Site (4.8 Acres)	$1,890,000	$0	$0	$0	$1,890,000
	39	Utilities/Sitework for North Side Executive Hangar Development Reserve Site (4.3 Acres)	$2,320,000	$0	$0	$0	$2,320,000
	40	Utilities/Sitework for North Side Small Aircraft Facilities Development Reserve Site (3.3 Acres)	$1,472,300	$0	$0	$0	$1,472,300
	41	Utilities/Sitework for North Side Large-Scale SASO/MRO Reserve Site (15.5 Acres)	$6,080,000	$0	$0	$0	$6,080,000
	42	Utilities/Sitework for North Side FBO/SASO Development Reserve Site (3.1 Acres)	$1,216,200	$0	$0	$0	$1,216,200
	43	Pavement Maintenance Management	$500,000	$0	$0	$500,000	$0
Long-Term Projects							
FY 2031-2040	44	Utilities/Sitework for South Side Executive Hangar Development Reserve Site (27.4 Acres)	$10,750,000	$0	$0	$0	$10,750,000
	45	Utilities/Sitework for South Side Small Aircraft Facilities Development Reserve Site (17.6 Acres)	$6,903,200	$0	$0	$0	$6,903,200
	46	Utilities/Sitework for South Side FBO/SASO Development Reserve Site (19.5 Acres)	$7,650,000	$0	$0	$0	$7,650,000
	47	Install South Side Fuel Farm	$800,000	$0	$0	$0	$800,000
	48	Remove Holding Apron at Taxiway C and H (Ultimate C1) Intersection	$270,000	$245,862	$12,069	$12,069	$0
		Remove Holding Apron at Taxiway C and Q (Ultimate C5) Intersection					$0
	49	Reroute Perimeter Service Road Around Taxiway C Holding Bays	$712,000	$648,347	$31,826	$31,826	$0
	50	Construct Multi-lane Holding Bay at West End of Taxiway C	$800,000	$728,480	$35,760	$35,760	$0
	51	Construct Multi-lane Holding Bay at East End of Taxiway C	$800,000	$728,480	$35,760	$35,760	$0
	52	Construct Roundabout at E Ryan Rd and S Curtiss Way	$300,000	$0	$0	$300,000	$0
	53	Pavement Maintenance Management	$1,000,000	$0	$0	$1,000,000	$0
		Short-Term CIP Subtotal	$21,030,775	$12,569,012	$3,404,474	$5,057,289	$0
		Intermediate-Term CIP Subtotal	$49,856,500	$20,982,045	$1,029,977	$2,395,977	$17,448,500
		Long-Term CIP Subtotal	$29,985,200	$2,351,169	$115,415	$1,415,415	$26,103,200
		Total Master Plan CIP	$100,872,475	$35,902,226	$4,549,867	$8,868,682	$43,551,700

Note: Funding subtotals do not add up to the estimated total master plan CIP due to the uncertainty of funding sources for the new terminal building.



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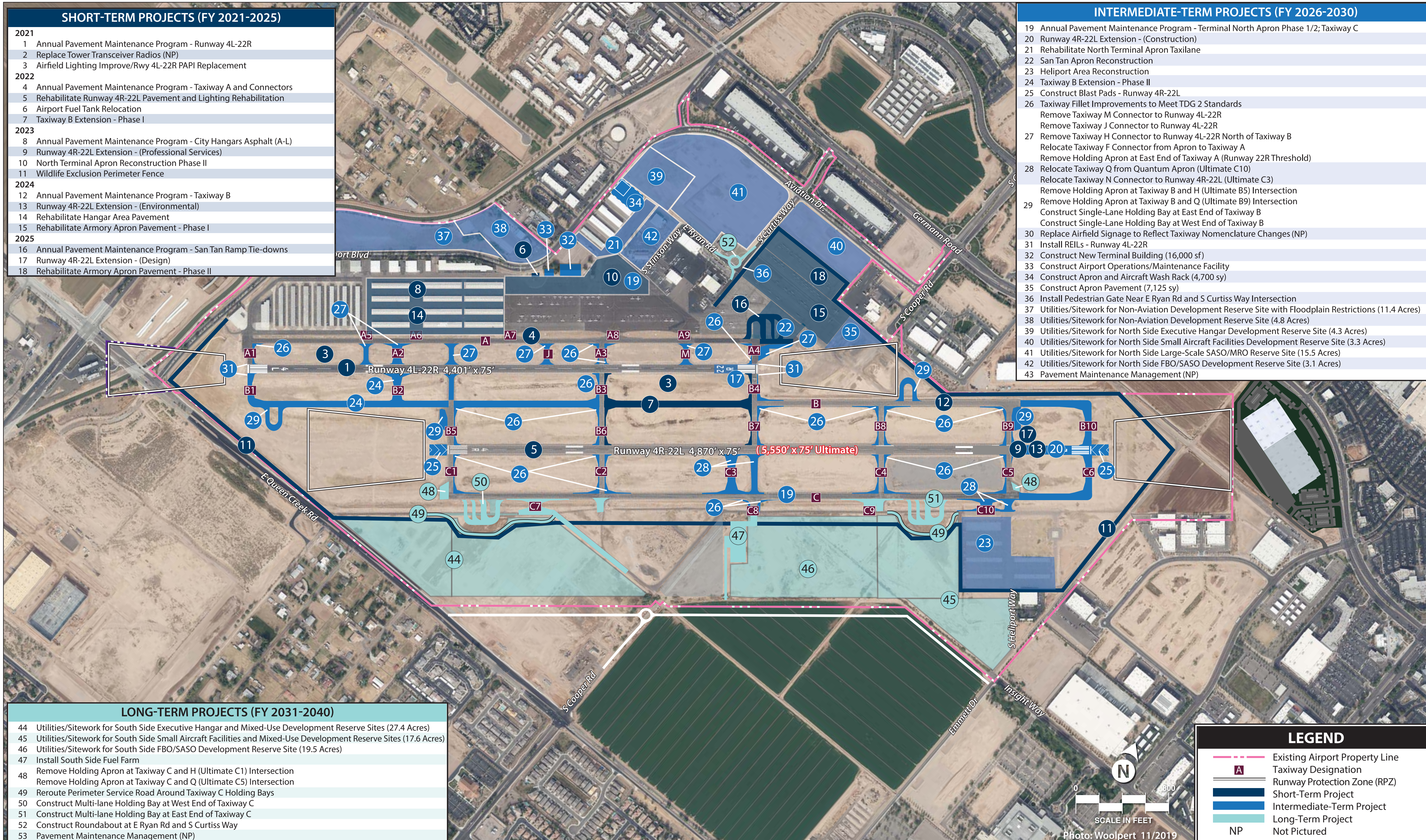

SHORT-TERM PROJECTS (FY 2021-2025)

2021	
1	Annual Pavement Maintenance Program - Runway 4L-22R
2	Replace Tower Transceiver Radios (NP)
3	Airfield Lighting Improve/Rwy 4L-22R PAPI Replacement
2022	
4	Annual Pavement Maintenance Program - Taxiway A and Connectors
5	Rehabilitate Runway 4R-22L Pavement and Lighting Rehabilitation
6	Airport Fuel Tank Relocation
7	Taxiway B Extension - Phase I
2023	
8	Annual Pavement Maintenance Program - City Hangars Asphalt (A-L)
9	Runway 4R-22L Extension - (Professional Services)
10	North Terminal Apron Reconstruction Phase II
11	Wildlife Exclusion Perimeter Fence
2024	
12	Annual Pavement Maintenance Program - Taxiway B
13	Runway 4R-22L Extension - (Environmental)
14	Rehabilitate Hangar Area Pavement
15	Rehabilitate Armory Apron Pavement - Phase I
2025	
16	Annual Pavement Maintenance Program - San Tan Ramp Tie-downs
17	Runway 4R-22L Extension - (Design)
18	Rehabilitate Armory Apron Pavement - Phase II

INTERMEDIATE-TERM PROJECTS (FY 2026-2030)

19	Annual Pavement Maintenance Program - Terminal North Apron Phase 1/2; Taxiway C
20	Runway 4R-22L Extension - (Construction)
21	Rehabilitate North Terminal Apron Taxilane
22	San Tan Apron Reconstruction
23	Heliport Area Reconstruction
24	Taxiway B Extension - Phase II
25	Construct Blast Pads - Runway 4R-22L
26	Taxiway Fillet Improvements to Meet TDG 2 Standards
	Remove Taxiway M Connector to Runway 4L-22R
	Remove Taxiway J Connector to Runway 4L-22R
27	Remove Taxiway H Connector to Runway 4L-22R North of Taxiway B
	Relocate Taxiway F Connector from Apron to Taxiway A
	Remove Holding Apron at East End of Taxiway A (Runway 22R Threshold)
28	Relocate Taxiway Q from Quantum Apron (Ultimate C10)
	Relocate Taxiway N Connector to Runway 4R-22L (Ultimate C3)
29	Remove Holding Apron at Taxiway B and H (Ultimate B5) Intersection Remove Holding Apron at Taxiway B and Q (Ultimate B9) Intersection Construct Single-Lane Holding Bay at East End of Taxiway B Construct Single-Lane Holding Bay at West End of Taxiway B
30	Replace Airfield Signage to Reflect Taxiway Nomenclature Changes (NP)
31	Install REILs - Runway 4L-22R
32	Construct New Terminal Building (16,000 sf)
33	Construct Airport Operations/Maintenance Facility
34	Construct Apron and Aircraft Wash Rack (4,700 sy)
35	Construct Apron Pavement (7,125 sy)
36	Install Pedestrian Gate Near E Ryan Rd and S Curtiss Way Intersection
37	Utilities/Sitework for Non-Aviation Development Reserve Site with Floodplain Restrictions (11.4 Acres)
38	Utilities/Sitework for Non-Aviation Development Reserve Site (4.8 Acres)
39	Utilities/Sitework for North Side Executive Hangar Development Reserve Site (4.3 Acres)
40	Utilities/Sitework for North Side Small Aircraft Facilities Development Reserve Site (3.3 Acres)
41	Utilities/Sitework for North Side Large-Scale SASO/MRO Reserve Site (15.5 Acres)
42	Utilities/Sitework for North Side FBO/SASO Development Reserve Site (3.1 Acres)
43	Pavement Maintenance Management (NP)

LONG-TERM PROJECTS (FY 2031-2040)

44	Utilities/Sitework for South Side Executive Hangar and Mixed-Use Development Reserve Sites (27.4 Acres)
45	Utilities/Sitework for South Side Small Aircraft Facilities and Mixed-Use Development Reserve Sites (17.6 Acres)
46	Utilities/Sitework for South Side FBO/SASO Development Reserve Site (19.5 Acres)
47	Install South Side Fuel Farm
48	Remove Holding Apron at Taxiway C and H (Ultimate C1) Intersection Remove Holding Apron at Taxiway C and Q (Ultimate C5) Intersection
49	Reroute Perimeter Service Road Around Taxiway C Holding Bays
50	Construct Multi-lane Holding Bay at West End of Taxiway C
51	Construct Multi-lane Holding Bay at East End of Taxiway C
52	Construct Roundabout at E Ryan Rd and S Curtiss Way
53	Pavement Maintenance Management (NP)

LEGEND

(pink dash-dot line)	Existing Airport Property Line
A	Taxiway Designation
(outlined area)	Runway Protection Zone (RPZ)
(dark blue)	Short-Term Project
(blue)	Intermediate-Term Project
(light blue)	Long-Term Project
NP	Not Pictured

Exhibit 6B
DEVELOPMENT STAGING

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Project #2: Replace Tower Transceiver Radios
Description: Per a 1997 operating agreement with the Federal Aviation Administration (FAA), the City is responsible for maintaining the equipment necessary for the Air Traffic Control Tower's (ATCT's) operation. The ATCT has six receivers and five transmitters that allow the air traffic controllers to communicate with aircraft in the air and on the airfield. These radios are nearing the end of their service life and the manufacturer has notified the airport that support will be ending in the near future, resulting in a lack of parts availability. This project will replace the eleven units and install a new 800-megahertz, 16-channel radio.
Cost Estimate: $851,000
Funding Breakdown: Airport Sponsor – 100.00%

Project #3: Airfield Lighting Improve/Runway 4L-22R PAPI Replacement
Description: Existing electrical wiring was installed in early 1990s and is at the end of its useful life. System has low megger readings and aging light fixtures and PAPIs. This project replaces the airfield wiring, light fixtures, and PAPIs to meet standards.
Cost Estimate: $1,724,000
Funding Breakdown: FAA – 91.06 percent / ADOT – 4.47 percent / Airport Sponsor – 4.47 percent.

Project #4: Annual Pavement Maintenance Program - Taxiway A and Connectors
Description: This project will rehabilitate the taxiway pavement to maintain a safe operating environment.
Cost Estimate: $664,200
Funding Breakdown: Airport Sponsor – 100.00%

Project #5: Rehabilitate Runway 4R-22L Pavement and Lighting
Description: Runway 4R-22L is experiencing large block cracking and some surface raveling. This project will rehabilitate the runway pavement and runway lighting to maintain a safe operating environment.
Cost Estimate: $2,825,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #6: Airport Fuel Tank Relocation
Description: This project replaces the existing underground storage tank with an above ground tank adjacent to the existing self-service station on the terminal apron.
Cost Estimate: $610,000
Funding Breakdown: Airport Sponsor – 100.00%

Project #7: Taxiway B Extension - Phase I
Description: There is currently only one access point to the Runway 22L threshold from the north side. Extending Taxiway B west to Taxiway L improves circulation and mitigates airfield hot spot #1 (congestion on Taxiway N at the Runway 22R threshold).
Cost Estimate: $2,035,200
Funding Breakdown: ADOT – 90.00% / Airport Sponsor – 10.00%

Project #8: Annual Pavement Maintenance Program - City Hangars Asphalt (A-L)
Description: This project will rehabilitate the taxilane pavement to maintain a safe operating environment.
Cost Estimate: $433,125
Funding Breakdown: Airport Sponsor – 100.00%

Project #9: Runway 4R-22L Extension (Professional Services)
Description: An extension to the primary runway is planned to improve operational safety for turbine aircraft operating at CHD. This project involves initial professional services.
Cost Estimate: $350,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #10: North Terminal Apron Reconstruction Phase II
Description: The terminal apron has many wide cracks throughout and has become a safety hazard to aircraft and pedestrians. Full-depth reconstruction of approximately 22,000 square yards (sy) is planned.
Cost Estimate: $1,860,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #11: Wildlife Exclusion Perimeter Fence
Description: CHD experiences continual coyote presence and other ground species encroaching into the movement area. The current fence is inadequate to prevent burrowing animals. This project involves the design and installation of 27,000 linear feet (lf) of enhanced fencing along the airport perimeter in accordance with the airport's analysis of strategies to mitigate wildlife within the airfield system.
Cost Estimate: $1,062,000
Funding Breakdown: ADOT – 90.00% / Airport Sponsor – 10.00%

Project #12: Annual Pavement Maintenance Program - Taxiway B
Description: This project will rehabilitate the taxiway pavement to maintain a safe operating environment.
Cost Estimate: $243,750
Funding Breakdown: Airport Sponsor – 100.00%

Project #13: Runway 4R-22L Extension (Environmental)
Description: An extension to the primary runway is planned to improve operational safety for turbine aircraft operating at CHD. This project involves the preparation of an Environmental Assessment to evaluate potential environmental impacts of an extension.
Cost Estimate: $427,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #14: Rehabilitate Hangar Area Pavement
Description: Significant raveling, block cracking, and some alligator cracking on this apron requires reconstruction to maintain safe operating conditions. This project would reconstruct approximately 56,000 sy.
Cost Estimate: $3,092,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #15: Rehabilitate Armory Apron Pavement - Phase I
Description: The armory apron pavement is experiencing significant wide cracking and is becoming a safety concern for aircraft wheelgear and pedestrians. This project would reconstruct approximately 25,000 sy.
Cost Estimate: $1,720,000
Funding Breakdown: ADOT – 90.00% / Airport Sponsor – 10.00%

Project #16: Annual Pavement Maintenance Program - San Tan Ramp Tie-downs
Description: This project will rehabilitate the apron pavement to maintain a safe operating environment.
Cost Estimate: $610,000
Funding Breakdown: Airport Sponsor – 100.00%

Project #17: Runway 4R-22L Extension (Design)
Description: This project is the final design and construction of a 680-foot extension to the primary runway. The resulting full-length of the runway will be 5,550 feet.
Cost Estimate: $435,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #18: Rehabilitate Armory Apron Pavement - Phase II
Description: The armory apron pavement is experiencing significant wide cracking and is becoming a safety concern for aircraft wheelgear and pedestrians. This project would reconstruct approximately 25,000 sy.
Cost Estimate: $1,720,000
Funding Breakdown: ADOT – 90.00% / Airport Sponsor – 10.00%

Short-Term Program Summary

The short-term CIP includes projects that enhance the overall safety, efficiency, and maintenance of the airfield. The total investment necessary for the short-term CIP is approximately $21.03 million as detailed on **Exhibit 6A**. A significant amount of the short-term program costs are associated with pavement rehabilitation. As previously discussed, further engineering analysis will determine the degree of pavement rehabilitation associated with the runways and apron areas. Of the overall short-term CIP total, approximately $15.97 million is eligible for federal and state funding assistance. The remaining approximate $5.06 million is to be provided through airport sponsor funding outlets.

INTERMEDIATE-TERM PROGRAM

The intermediate-term projects are those that are anticipated to be necessary in years six through 10 of the Master Plan. These projects are not tied to specific years for implementation; instead, they have been prioritized so that airport management has the flexibility to determine when they need to be pursued based on current conditions. It is not unusual for certain projects to be delayed or advanced based on changing conditions, such as funding availability or changes in the aviation industry. This planning horizon includes 25 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 #19: Annual Pavement Maintenance Program - Terminal North Apron Phase 1/2; Taxiway C
Description: This project will rehabilitate the apron and taxiway pavement to maintain a safe operating environment.
Cost Estimate: $861,000
Funding Breakdown: Airport Sponsor – 100.00%

Project #20: Runway 4R-22L Extension (Construction)
Description: This project is the construction of a 680-foot extension to the primary runway. The resulting full-length of the runway will be 5,550 feet.
Cost Estimate: $5,404,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #21: Rehabilitate North Terminal Apron Taxilane
Description: This pavement area is cracking and has not been sealed or patched since 2014. This project would repair approximately 11,300 sy of pavement that is planned to support new landside facility development on the north side.
Cost Estimate: $378,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #22: San Tan Apron Reconstruction
Description: The San Tan apron is approximately 14,000 sy of apron pavement that caps a Declaration of Environmental Use Restriction (DEUR) area north of the Runway 22R threshold. This pavement is cracking, which allows stormwater into the subgrade, which exacerbates contamination. This project will reconstruct this pavement and add multi-lane holding bay markings.
Cost Estimate: $670,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #23: Heliport Area Reconstruction
Description: This pavement has poor subgrade, which has settled, shifted, and shrunk, resulting in cracks and heaving in the apron pavement. This project reconstructs approximately 33,400 sy.
Cost Estimate: $2,600,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #24: Taxiway B Extension - Phase II
Description: This project extends Taxiway B to the Runway 4L threshold, creating a full-length taxiway between both runways. This will improve airfield circulation and operational safety.
Cost Estimate: $4,080,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #25: Construct Blast Pads - Runway 4R-22L
Description: The existing blast pads on the primary runway are undersized. This project will expand the blast pads to 95 feet wide and 150 feet long to meet design standards.
Cost Estimate: $470,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #26: Taxiway Fillet Improvements to Meet TDG 2 Standards
Description: Existing fillets do not meet taxiway design group (TDG) 2 standards. This project adds fillet pavement to accommodate safe aircraft transitions at airfield intersections.
Cost Estimate: $2,600,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #27: Remove/Relocate Taxiway Pavement to Improve Airfield Geometry (North Side)
Description: This project involves the removal of existing taxiway connectors that provide for direct-access points from the north side apron areas to Runway 4L-22R, or intersecting pavement in the runway's high energy area. These improvements are intended to mitigate the potential for runway incursions and comply with FAA design standards.
Cost Estimate: $1,090,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #28: Relocate Taxiway Pavement to Improve Airfield Geometry (South Side)
Description: This project relocates connecting taxiways on the south side of the airfield to eliminate a direct access point to Runway 4R-22L and to eliminate a high-energy area intersection.
Cost Estimate: $1,140,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #29: Replace Holding Aprons with Holding Bays
Description: The existing holding aprons on the airfield are out of compliance with FAA design standards. This project removes the existing holding aprons along Taxiway B and replaces them with single lane holding bays.
Cost Estimate: $1,220,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #30: Replace Airfield Signage to Reflect Taxiway Nomenclature Changes
Description: The taxiway system designations do not meet FAA standards. This project redesignates out-of-compliance taxiways and includes replacement of airfield signage to reflect the new designations.
Cost Estimate: $618,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #31: Install REILs - Runway 4L-22R
Description: REILs improve operational safety by providing pilots with improved situational awareness and helping them to identify the runway end. This project adds REILs to Runway 4L-22R.
Cost Estimate: $110,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #32: Construct New Terminal Building (16,000 sf)
Description: A new terminal building will provide for expanded and modernized terminal services. The new building will include administrative office space as well as leasable space for aviation businesses.
Cost Estimate: $8,000,000
Funding Breakdown: General aviation terminal buildings are not typically eligible for FAA or ADOT grant funding assistance. However, there are often opportunities for public/private partnerships in developing major public-use infrastructure such as this. All potential funding options will be explored in the development of the new terminal building.

Project #33: Construct Airport Operations/Maintenance Facility
Description: A new operations/maintenance facility located adjacent to the new terminal building will consolidate these activities in a centralized location on the airport. This will allow for better responsiveness to airport users and more efficient coordination among airport staff.
Cost Estimate: $510,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #34: Construct Apron and Aircraft Wash Rack
Description: Aircraft wash racks are common amenities at many general aviation airports. This project adds a wash rack and additional apron pavement to a one-acre site that was previously used as a dump site for construction debris sometime between 1949 and 1964. The City of Chandler has determined this site can be capped with asphalt and returned to useable airport property.
Cost Estimate: $1,522,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #35: Construct Apron Pavement (7,125 sy)
Description: New apron pavement on the north side to provide additional aircraft parking/tiedown capacity.
Cost Estimate: $630,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #36: Install Pedestrian Gate Near E Ryan Rd and S Curtiss Way Intersection
Description: Airport tenants have requested an access gate be added in this location to improve accessibility to aircraft parked on the Armory apron.
Cost Estimate: $5,000
Funding Breakdown: Airport Sponsor – 100.00%

Project #37: Utilities/Sitework for Non-Aviation Development Reserve Site with Floodplain Restrictions (11.4 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $4,470,000
Funding Breakdown: Private Developer – 100.00%

Project #38: Utilities/Sitework for Non-Aviation Development Reserve Site (4.8 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $1,890,000
Funding Breakdown: Private Developer – 100.00%

Project #39: Utilities/Sitework for North Side Executive Hangar Development Reserve Site (4.3 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $2,320,000
Funding Breakdown: Private Developer – 100.00%

Project #40: Utilities/Sitework for North Side Small Aircraft Facilities Development Reserve Site (3.3 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $1,472,300
Funding Breakdown: Private Developer – 100.00%

Project #41: Utilities/Sitework for North Side Large-Scale SASO/MRO Reserve Site (15.5 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $6,080,000
Funding Breakdown: Private Developer – 100.00%

Project #42: Utilities/Sitework for North Side FBO/SASO Development Reserve Site (3.1 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $1,216,200
Funding Breakdown: Private Developer – 100.00%

Project #43: Pavement Maintenance Management
Description: As airfield pavements deteriorate over time, it is necessary to undergo overlay/rehabilitation/reconstruction projects.
Cost Estimate: $500,000
Funding Breakdown: Airport Sponsor – 100.00%

Intermediate-Term Program Summary

The total costs associated with the intermediate term program are estimated at $49.86 million as presented on **Exhibit 6A**. Of this total, approximately $22.01 million could be eligible for federal/state funding, and the airport sponsor share is projected at $2.40 million. Private funding is estimated at $17.45 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.

Project #44: Utilities/Sitework for South Side Executive Hangar Development Reserve Site (27.4 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $10,750,000
Funding Breakdown: Private Developer – 100.00%

Project #45: Utilities/Sitework for South Side Small Aircraft Facilities Development Reserve Site (17.6 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $6,903,200
Funding Breakdown: Private Developer – 100.00%

Project #46: Utilities/Sitework for South Side FBO/SASO Development Reserve Site (19.5 Acres)
Description: This project involves adding appropriate utility infrastructure and sitework that would accommodate new development. The airport plans to make minimal improvements to this site, which will allow potential developers greater flexibility in developing the site to meet their needs.
Cost Estimate: $7,650,000
Funding Breakdown: Private Developer – 100.00%

Project #47: Install South Side Fuel Farm
Description: As activity levels grow with new south side developments, it will become necessary to install a fuel farm to eliminate the need for fuel trucks to travel to the south side.
Cost Estimate: $800,000
Funding Breakdown: Private Developer – 100.00%

Project #48: Remove Holding Aprons on Taxiway C
Description: The existing holding aprons on the airfield are out of compliance with FAA design standards. This project removes the existing holding aprons along Taxiway C so they can be replaced with holding bays.
Cost Estimate: $270,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #49: Reroute Perimeter Service Road Around Taxiway C Holding Bays
Description: The perimeter service road will need to be rerouted to allow for the construction of two new holding bays on Taxiway C. The road will need to be rerouted so that it lies outside of the taxiway object free area (TOFA).
Cost Estimate: $712,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #50: Construct Multi-Lane Holding Bay at West End of Taxiway C
Description: New multi-lane holding bays are planned that will allow for greater aircraft circulation on the south side of the airfield.
Cost Estimate: $800,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #51: Construct Multi-Lane Holding Bay at East End of Taxiway C
Description: New multi-lane holding bays are planned that will allow for greater aircraft circulation on the south side of the airfield.
Cost Estimate: $800,000
Funding Breakdown: FAA – 91.06% / ADOT – 4.47% / Airport Sponsor – 4.47%

Project #52: Construct Roundabout at E Ryan Rd and S Curtiss Way
Description: A roundabout at this intersection is a safety improvement and will be consistent with the surrounding Chandler Airpark roadway network, which features several roundabouts.
Cost Estimate: $300,000
Funding Breakdown: Airport Sponsor – 100.00%

Project #53: Pavement Maintenance Management
Description: As airfield pavements deteriorate over time, it is necessary to undergo overlay/rehabilitation/reconstruction projects.
Cost Estimate: $1,000,000
Funding Breakdown: Airport Sponsor – 100.00%

Long-Term Program Summary

The total investment necessary for the long-term CIP detailed on **Exhibit 6A** is approximately $29.99 million. Approximately $2.47 million is eligible for federal/state funding assistance. The airport's share of long-term projects is projected at $1.42 million. Private development funding is projected at $26.10 million.

CAPITAL IMPROVEMENT PROGRAM SUMMARY

The CIP is intended as a road map of improvements to help guide the City of Chandler, the FAA, and ADOT – Aeronautics Group. The plan as presented will help accommodate increases in forecast demand at CHD over the next 20 years and beyond. The sequence of projects may change due to availability of funds or changing priorities based on an annual review by airport management, the FAA, and ADOT – Aeronautics Group. Nonetheless, this is a comprehensive list of capital projects the airport should consider in the next 20+ years.

The total CIP proposes approximately $100.8 million in airport development needs. Of this total, approximately $40.45 million could be eligible for federal/state funding assistance. The local funding estimate for the proposed CIP is $8.87million. Private development makes up a significant portion of the CIP at $43.55million, accounting for the bulk of the landside development.

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 CHD will not rely solely on the financial resources of the City of Chandler. 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 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. The *FAA Modernization and Reform Act of 2012*, enacted on February 17, 2012, 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 CHD, 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 6B 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. CHD 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 6B | Federal AIP Funding Distribution
Chandler Municipal Airport

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 CHD 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 CHD is eligible for and receives 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, CHD is eligible for funds from this source.

Discretionary Funds

In several cases, airports face major projects that will require funds in excess of the airport's annual entitlements. Thus, additional funds from discretionary apportionments under AIP become desirable. The primary feature about discretionary funds is that they are distributed on a priority basis. The priorities are established by the FAA, utilizing a priority code system. Under this system, projects are ranked by their purpose. Projects ensuring airport safety and security are ranked as the most important priorities, followed by maintaining current infrastructure development, mitigating noise and other environmental impacts, meeting standards, and increasing system capacity.

It is important to note that competition for discretionary funding is not limited to airports in the State of Arizona or those within the FAA Western-Pacific Region. The funds are distributed to all airports in the country and, as such, are more difficult to obtain. High priority projects will often fare favorably, while lower priority projects may not receive discretionary grants.

Set-Aside Funds

Portions of AIP funds are set-asides designed to achieve specific funding minimums for noise compatibility planning and implementation, select former military airfields (Military Airports Program), and select reliever airports. As a reliever airport, CHD qualifies for set-aside funding.

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

The 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. CHD 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.

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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*.

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 then 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 participating system airports. ADOT – Aeronautics Group ensures that the APMS database is kept current, in compliance with FAA requirements.

Every year, ADOT – Aeronautics Group, utilizing the APMS, will identify airport pavement maintenance projects eligible for funding for the upcoming five years. These projects will appear in the state's Five-Year Airport Development Program. Once a project has been identified and approved for funding by the State Transportation Board, the airport sponsor may elect to accept a state grant for the project and not participate in the APPP, or the sponsor may sign an Inter-Government Agreement (IGA) with ADOT-MPD – Aeronautics Group to participate in the APPP. CHD participates 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. Nonetheless, standard lease rates should fall within an acceptable range.

Bonding

Bonding is a common method to finance large capital projects at airports. A bond is an instrument of indebtedness of the bond issuer to the bond holders, thus a bond is a form of loan or IOU. While bond terms are negotiable, typically the bond issuer is obligated to pay the bond holder interest at regular intervals and/or repay the principal at a later date.

Leasehold Financing

Leasehold financing refers to a private 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.

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 private developer then pays the monthly lease rate and constructs and uses the compatible facility. Certain areas at CHD have been reserved for non-aviation development. It should be noted that each individual proposed non-aviation development must be reviewed and approved by the FAA.

Special Events

Another common revenue-generating option is permitted use of airport property for temporary or single events. For example, some airports host open house or fly-in events that attracts thousands of 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.

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 CHD 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 – Aeronautics Group grant funding. Nonetheless, 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 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. Nonetheless, 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 the City of Chandler 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.

Appendix A

GLOSSARY OF TERMS

CHANDLER
MUNICIPAL AIRPORT
CHD

CHANDLER
arizona

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 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.

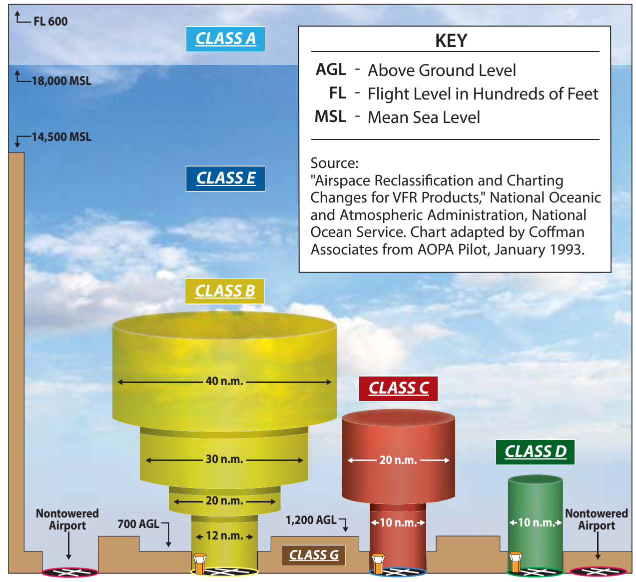
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

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 RUN 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.

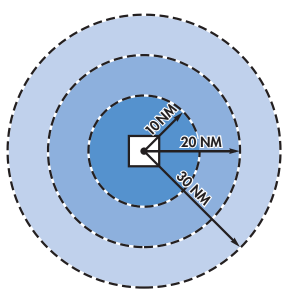
- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

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 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

LOCAL-AREA AUGMENTATION SYSTEM: (LAAS) is an all-weather aircraft landing system based on real-time differential correction of the GPS signal.

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 their 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.

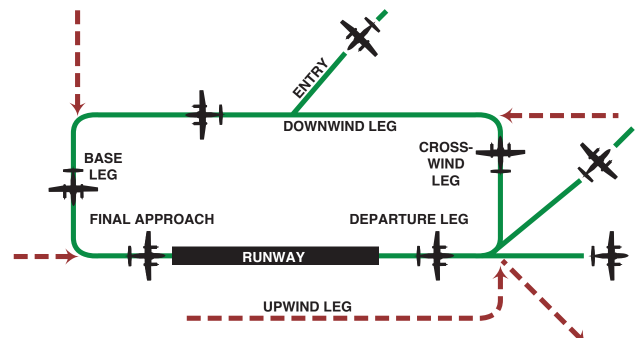
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

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.

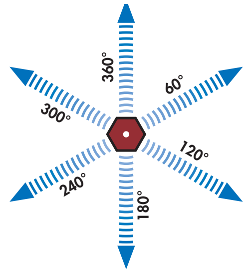
UPWIND LEG: A flight path parallel to the landing runway in the direction of landing. See "traffic pattern."

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.

WINDSOCK/WINDCONE: A visual aid that indicates the prevailing wind direction and intensity at a particular location.

Abbreviations

AC: advisory circular

ACIP: airport capital improvement program

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

ATC(T): 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

GA: general aviation

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

LAAS: local area augmented system

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)

NPDES: 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

WAAS: wide area augmentation system

Appendix B

ASHRAE LEVEL II ENERGY AUDIT REPORT

CHANDLER MUNICIPAL AIRPORT CHD

CHANDLER arizona

Chandler Municipal Airport

Chandler, Arizona

ASHRAE Level II Energy Audit Report

Provided by

Quest energy group

June 2020

Table of Contents

Executive Summary

As part of the updated Master Plan for Chandler Municipal Airport, Quest Energy Group performed a comprehensive energy audit of selected buildings at the airport to assist in identifying and prioritizing potential energy conservation measures (ECMs).

This audit meets or exceeds the Level II requirements established by the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (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 International Performance Measurement and Verification Protocol (IPMVP) compliant baseline calibration in order to validate energy savings estimates.

Key Audit Findings

The Chandler Municipal Airport spent about $59,000 on electricity from January 2019 to December 2019. The results of the audit yielded the following findings listed below and are summarized in the following table and figure. Additionally, individual energy conservation opportunities are detailed within each individual building/area report following this Executive Summary.

- Incorporating all ECMs over a ten year timeline could reduce total energy costs by almost 38%. Incorporating a PV system to offset all energy usage onsite, would result in a payback of 13 years and make the Chandler Municipal Airport a Net-Zero Energy facility.
- Upgrading to LED fixtures and proper lighting controls results in an overall energy reduction of almost **6%** with an overall simple payback close to **5.3 years**.
- Small control upgrades to HVAC equipment in the Administration Building and ATCT would provide quick paybacks and reduce energy costs by **2.5%**.
- Upgrading to a Variable Refrigerant Flow (VRF) system in the Administration building should be considered at the end of life of the current equipment. A VRF system could reduce total airport energy costs by up to **5%**.
- LED upgrades to the airport landing lighting fixtures requires a significantly high first cost and results in an unfavorable economic return.
- Installing a solar PV system for individual buildings results in an average payback of about 16 years. This is mainly due to the Salt River Project (SRP) utility buyback rate of only $0.02-$0.03 per kWh instead of the full retail rate of $0.09 kWh (on average).

ECM	Measure Description	Estimated Initial Costs	Utility Cost Savings	Potential SRP Incentives	Simple Payback
ECM1	LED Lighting Upgrades	$13,400	$2,753	$2,280	4.0
ECM2	High Performance Lighting Controls	$7,250	$430	$1,450	13.5
ECM3	LED Exterior Lighting Upgrades	$51,040	$2,475	$1,500	20.0
ECM4	HVAC Controls Upgrades	$2,150	$1,351	$600	1.1
ECM5	HVAC Equipment Upgrades	$46,500	$2,953	$2,250	15.0
ECM6	Landing Lights LED Replacement	$110,000	$4,420	$4,000	24.0
ECM7	Instantaneous Hot Water Heaters	$2,425	$128	$99	18.2
ECM8	Receptacle Load Upgrades	$500	$336	$177	1.0
ECM9	Individual Solar PV Installations	$126,540	$7,873	$0	16.1

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	534,943	$58,928	0.0%
ECM1	LED Lighting Upgrades	513,653	$56,175	4.7%
ECM2	High Performance Lighting Controls	509,672	$55,744	5.4%
ECM3	LED Exterior Lighting Upgrades	482,814	$53,269	9.6%
ECM4	HVAC Controls Upgrades	470,672	$51,919	11.9%
ECM5	HVAC Equipment Upgrades	446,062	$48,965	16.9%
ECM6	Landing Lights LED Replacement	405,142	$44,545	24.4%
ECM7	Instantaneous Hot Water Heaters	403,999	$44,417	24.6%
ECM8	Receptacle Load Upgrades	401,201	$44,081	25.2%
ECM9	Individual Solar PV Installations	313,751	$36,208	38.6%

Figure 2 – Annual Results Breakdown for Aggregated Measures (All Meters)

Solar PV Discussion

The project team has indicated the area highlighted the image below as a potential location for a solar PV system. Based on the site visit, the following items need to be confirmed to determine whether the site could house a solar PV system:

- Federal Aviation Administration (FAA) regulations for glare and other flight impact issues.
- No underground piping or sewer systems that would require access
- Proper spacing between solar PV system and existing structures/roads/construction.

Figure 3: Potential Solar PV Location

Additionally, two major financial considerations need to be considered for the installation of a solar PV system:

1. 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 City of Chandler, thus lowering the net cost of the project, while potentially avoiding or mitigating some of the barriers mentioned below.

   a. Taxpayer/ public approval of funding
   b. Utility connectivity issues and/or production arrangements
   c. Other airport operational constraints

2. SRP only offers about a $0.02-$0.03 per kWh credit for excess generation on an hourly basis. This means that if the PV system generates more energy than the property/building consumes, the project will only be credited $0.02-$0.03 per kWh instead of the retail rate of about $0.09 per kWh. Therefore, it is important to consider the installation of batteries for this project to store excess energy generation so that it can be used on site. SRP currently does not offer battery storage incentives to commercial customers, only to residential customers.

There are many potential options for installing solar PV at the Chandler Municipal airport. The following PV systems were evaluated with and without battery storage assuming that the airport enters into a power purchase agreement (PPA) with a third party developer and will not own their own system.

1. PV System to Offset All Airport Energy Usage
2. PV System to Offset Administration Building Energy Usage
3. PV System to Offset ATCT Energy Usage

The following table shows the financial results of the solar PV analysis including the following key metrics:

1. Internal Rate of Return - calculates the discount rate that results in the net present value of all cash flows for the project to equal zero over a 20 year period. This value can be used to compare investments and their profitability.
2. Straight Line Payback – the time required to earn back the amount invested in the project.
3. 20-year Cash Flow – the net amount of cash generated by the project over the 20-year period.

It should be noted that an hourly/daily analysis is needed to determine more specifically the first cost for battery storage and total excess generation from the PV system. Currently, conservative factors are being used, and further investigation into hourly loads could reduce the first cost and payback for the systems.

PV System Options without Battery Storage					
System Type	PV System Size	First Cost	Straight Line Payback (years)	Internal Rate of Return (IRR)	20-year Cash Flow
Offset all Airport Energy Usage	325 kW	$450,875	13.33	6.5%	$262,885
Offset Admin. Bldg Energy Usage	18 kW	$33,300	18.01	1.2%	$4,570
Offset ATCT Energy Usage	35 kW	$51,800	14.95	3.3%	$21,836

PV System Options with Battery Storage					
System Type	PV System Size	First Cost	Straight Line Payback (years)	Internal Rate of Return (IRR)	20-year Cash Flow
Offset all Airport Energy Usage	325 kW	$605,875	15.06	8.0%	$350,760
Offset Admin. Bldg Energy Usage	18 kW	$44,400	18.17	1.4%	$7,429
Offset ATCT Energy Usage	35 kW	$82,140	19.15	0.7%	$6,805

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 John Daniels on May 19th, 2020 as well as 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 Administration Building at the airport. The collected information was also used to develop engineering grade spreadsheets of the remaining buildings and energy consuming equipment in scope: Air Traffic Control Tower, Maintenance Building, Hangars, Exterior Lighting, and Landing Lights. 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 Administration 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

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Chandler, AZ 85286

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Baseline Utility Summary

Electricity bills from January 2019 to December 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 **$58,969 per year** on electricity at a unit cost of about **$0.11 per kWh.** The areas that account for the majority of electricity usage are the landing lights Air Traffic Control Tower (ATCT), and the Administration Building.

Utility Meter	Location	Electricity Usage kWh/year	Unit Cost $/kWh	Total Cost $/year	% of Total Usage
117-280-004	Runway Lights	264,960	$0.11	$ 28,622	49.5%
858-480-004	ATCT	72,073	$0.09	$ 6,664	13.5%
036-390-004	Administration Bldg	69,560	$0.119	$ 8,280	13.0%
223-360-001	Exterior Lighting	45,200	$0.10	$ 4,632	8.4%
956-201-006	Unknown	35,004	$0.11	$ 3,749	6.5%
814-680-005	T-Hangars	27,596	$0.11	$ 2,926	5.2%
013-722-007	Maintenance Bldg	7,030	$0.15	$ 1,052	1.3%
402-980-004	Fuel Building	5,174	$0.17	$ 900	1.0%
863-754-006	Abandoned Bldg	4,000	$0.24	$ 960	0.7%
148-375-004	Unknown	2,969	$0.23	$ 671	0.6%
085-304-007	Unknown	1,377	$0.37	$ 513	0.3%
	Total	**534,943**	**$0.11**	$ 58,969	

Figure 4: Electricity Usage and Cost by Utility Meter

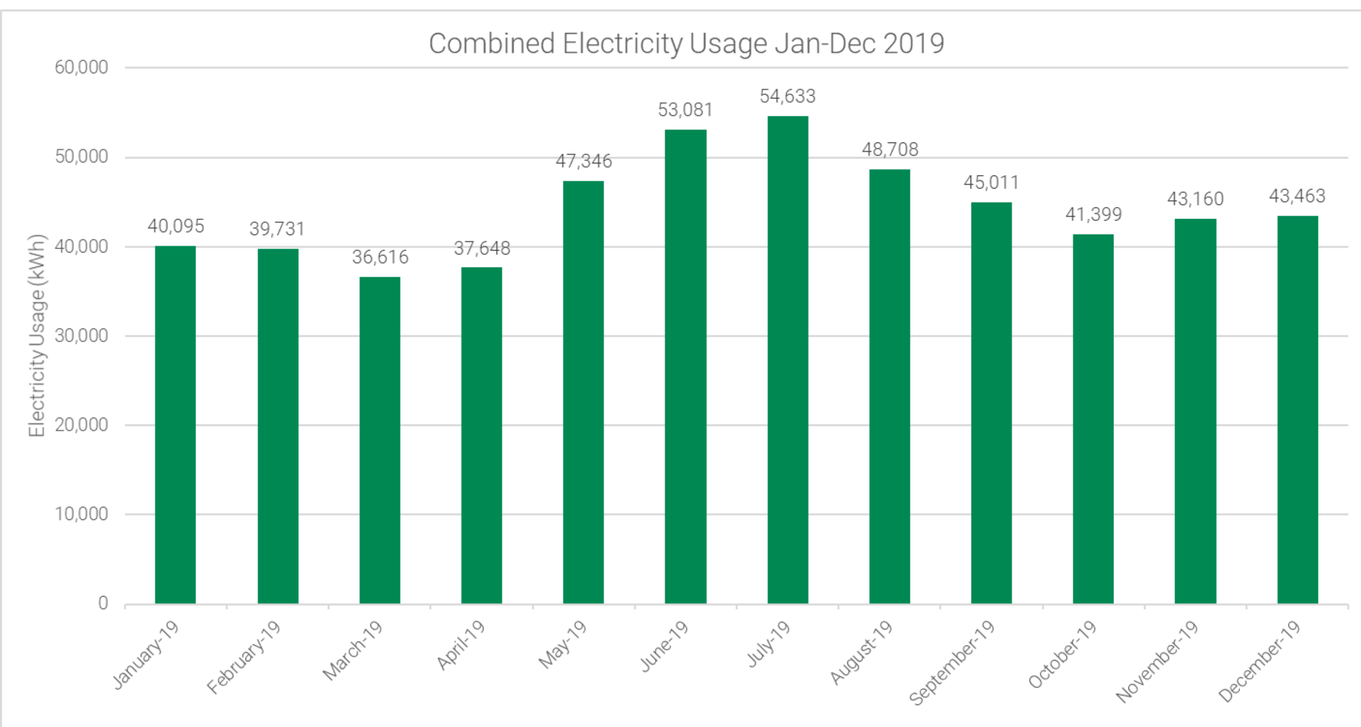


Figure 5 – Total Electricity Usage from Jan to Dec 2019

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).

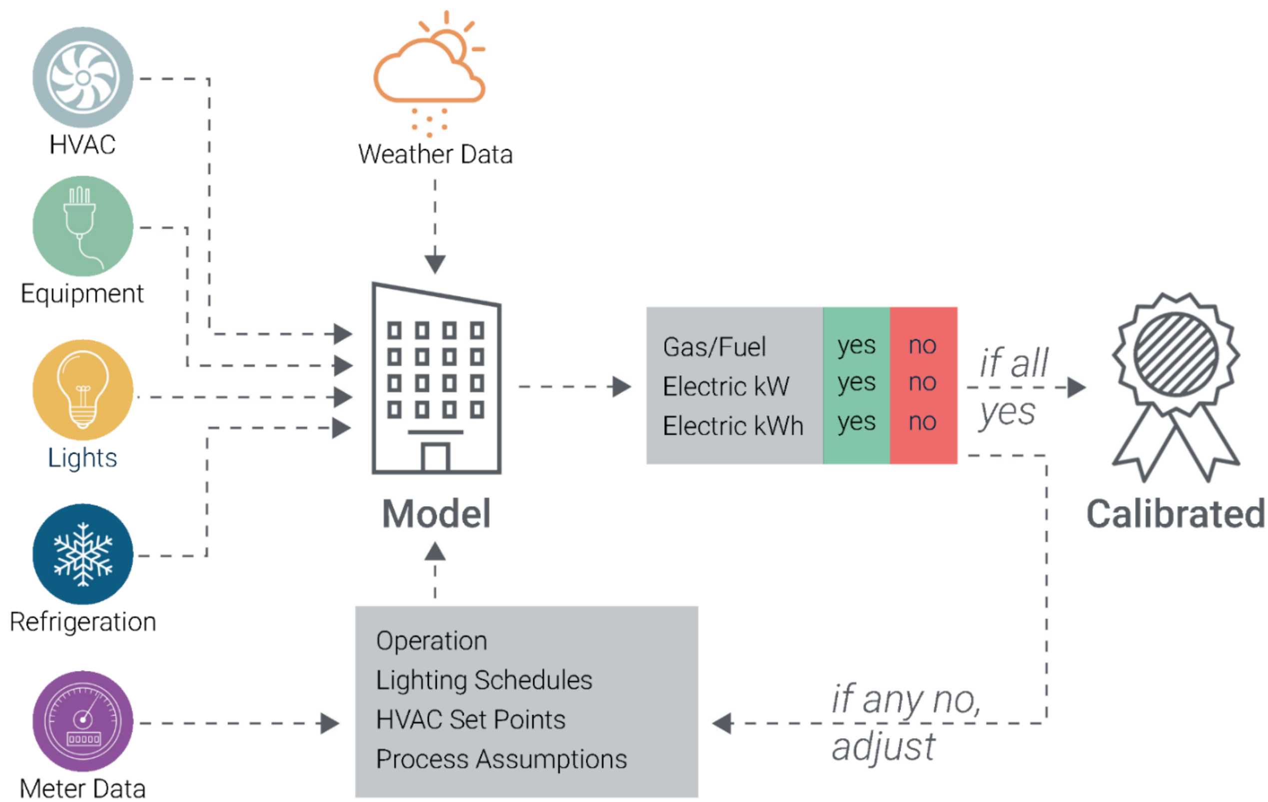
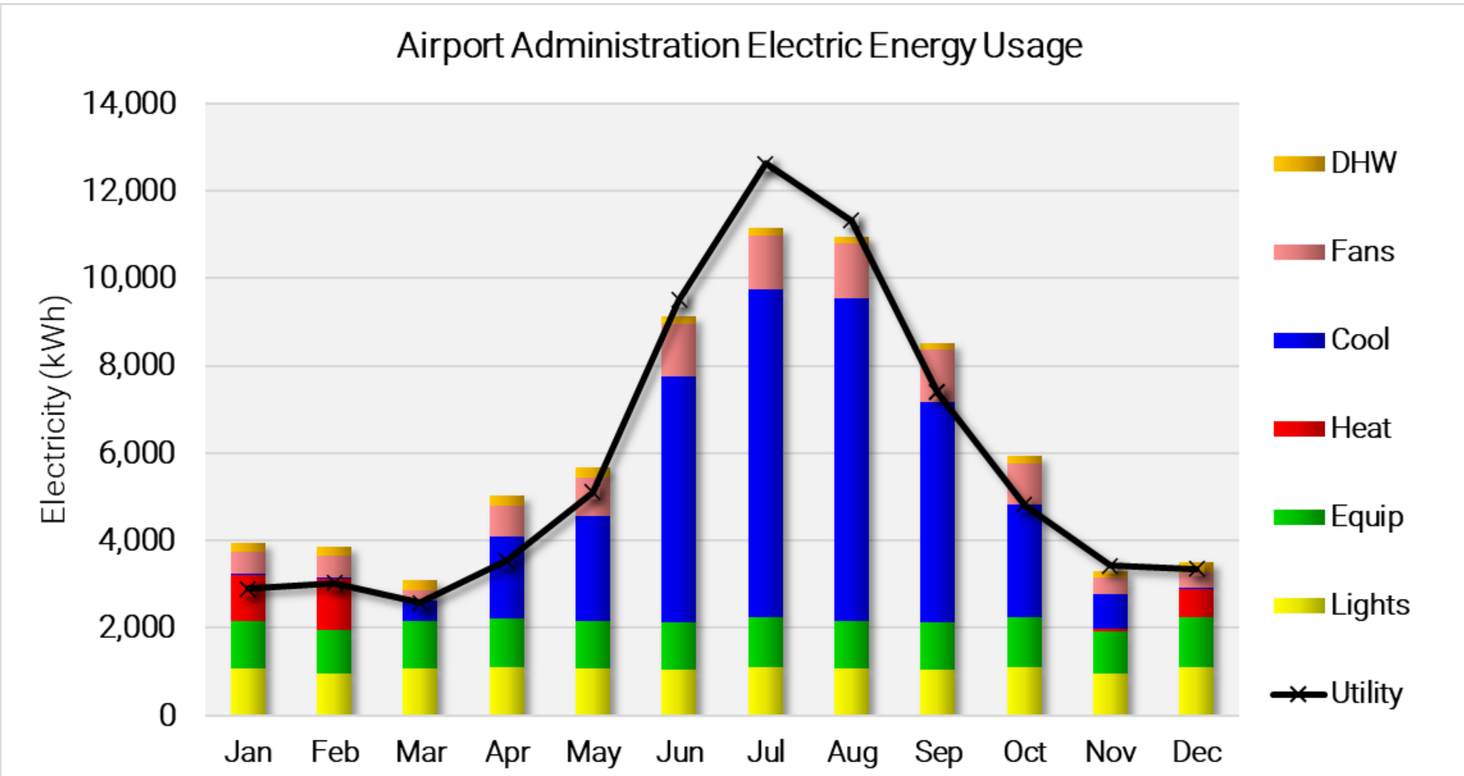


Figure 6 – Calibration Process Flowchart

Baseline Energy Use Analysis & Calibration

The building modeled and calibrated through eQUEST was the Administration Building. All other buildings/utility metered were calibrated utilizing engineering grade excel sheets. The figure below illustrates the simulated eQUEST electrical energy usage predicted throughout the one-year period (Jan 2019 – Dec 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%).



Analysis Reports

Administration Building

Air Traffic Control Tower

Maintenance Building

T-Hangars A to I

Exterior and Canopy Lights

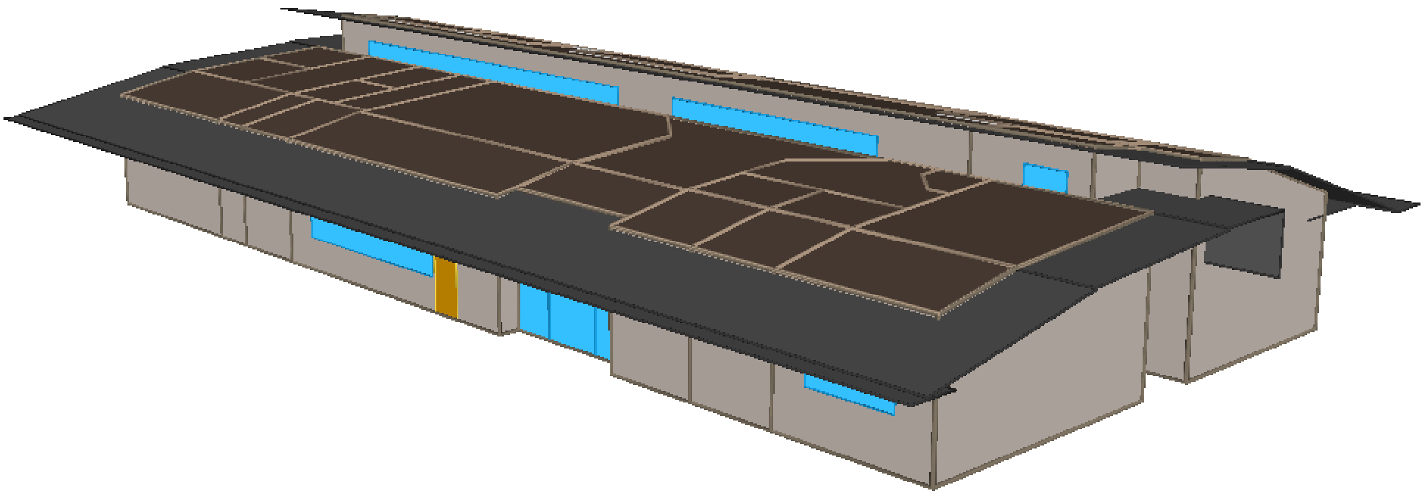
Runway and Taxiway Lights

Solar PV Analysis

Airport Administration Building

Building Description

The airport administration building is comprised of private office, meeting/conference, lobby, and amenity areas. The total square footage of the building is about 5,000 SF. A 3D eQUEST rendering of the building is shown in the figure below.



Operational Schedules

The airport administration building is expected to be occupied from 7AM to 5PM Monday through Friday. Based on conversation with facility personnel, when the airport gets busier, the occupancy schedule changes to 6AM to 9PM Monday through Friday.

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

AA1: Replace Linear and Compact Fluorescent Lamps with LEDs

Existing Condition

The airport administration building utilizes a mixture of 2-lamp, 4ft. T8 fluorescent fixtures and recessed incandescent 60W lamps 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 Hallways

Recommended Action

Replace all fluorescent lamps with LED lamps. Use a 12W GE LED12ET8/g/4/840 linear LED lamp or similar to replace linear fluorescent lamps. Replace all 60W incandescent lamps with LED 9W lamp. 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.

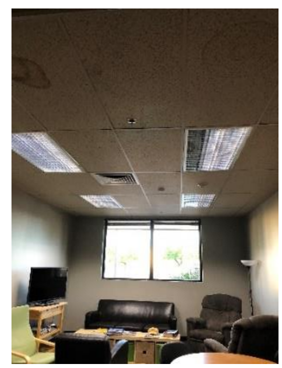


Figure 2: Dark Walls and Ceiling in Pilot's Lounge

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 and replacement costs. As a bonus, LED lamps contain no mercury, helping to streamline its recycling process.

It is also recommended that maintenance staff consider painting the walls to a brighter color (such as white) and replacing the old ceiling tiles with new, whiter ceiling tiles. Brighter colors have a higher reflectivity than darker colors meaning the brighter surfaces would reflect more light to the room. Less output from the lighting fixtures would be needed to provide the same lighting levels in the space. Thus, fewer fixtures would need to be installed, and it would require less energy to illuminate the space.

Energy and Cost Savings

Replacing all fluorescent and incandescent lamps with LED lamps would result in electrical savings of about **7,292 kWh per year.** Total cost savings would be about **$875 per year**.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to **$600** 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 **$3,000**, and the simple payback would be **2.7 years,** including the incentive.

AA2: Install High Performance Lighting Controls

Existing Condition

Currently, only the bathrooms and conference rooms in the administration building utility occupancy sensors. Based on conversation with airport personnel and observations during the site visit, the building has highly variable occupancy and it was noticed that lights were left on in spaces that were unoccupied.

Figure 3: Occupancy Sensor in the Restroom

Additionally, spaces such as the conference rooms and offices utilize significant amounts of natural light. There is opportunity to utilize daylight harvesting controls to dim lighting fixtures when sufficient natural light enters the space.

Recommended Action

It is recommended to expand the installation of occupancy sensors to the whole building and install daylighting controls in perimeter spaces with large quantity of windows. The occupancy sensors should turn off lighting fixtures within 20 minutes of people leaving the room. Daylighting controls should automatically dim perimeter lighting fixtures near windows to maintain a constant lighting level of 30 fc (typical for office spaces).

There are numerous lighting control companies that offer occupancy and daylighting control solutions such as Lutron, Lithonia, Leviton, etc. This installation is best implemented at the same time as upgrading lighting fixtures to LED fixtures since many lighting companies will offer LED upgrades and lighting control upgrades as a packaged deal.

Energy and Cost Savings

Installing high performance lighting controls including occupancy and daylighting sensors would result in electrical savings of about 1,682 kWh per year. Total cost savings would be about $202 per year.

SRP offers a lighting rebate of $0.40 per watt controlled. It is therefore estimated that this recommendation could receive up to $750 in incentive rebates.

Based on RSMeans and manufacturing data, each occupancy and daylight sensor would cost about $250 to purchase and install. Utilizing this information, the implementation cost would be about $3,750, and the simple payback would be over 10 years, including the incentive. It is thus recommended that this ECM be coupled with ECM AA1. Combining the two ECMs, the simple payback would be closer to 5.0 years.

AA3: Replace Indirect Lighting and Optimize Natural Light in Corridors and Lobby

Existing Condition

The corridors and main lobby of the administration building have significant amounts of linear fluorescent fixtures that provide indirect lighting to illuminate the higher walls and ceiling. Additionally, there are windows located near the ceiling, as shown on the right, that provide natural lighting to illuminate the ceiling and upper walls. Small amounts of the indirect lighting actually reach the work plane making it an inefficient form of providing light to the space. Replacing the indirect lighting with direct lighting would provide a more efficient operation and the natural lighting would still illuminate the ceiling and high walls.

Figure 4: Indirect Lighting and Natural Lighting in the Lobby

Recommended Action

It is recommended to remove the indirect linear fluorescent lamps with direct linear LED fixtures. This can be accomplished by simply repositioning the lighting covers to direct the light towards the ground instead of the ceiling. Alternatively, linear fixtures could be installed and suspended from the ceiling (below the level of the windows) to direct light to the work plane. Either scenario would minimize the lighting output and energy usage to illuminate the space while also maintaining an illuminated ceiling.

This recommendation should be considered with ECM AA1 and AA2. Installing daylighting controls would maximize the usage of natural lighting from the windows and minimize the energy output of the lighting fixtures.

Energy and Cost Savings

Removing indirect lighting and optimizing natural lighting would would result in electrical savings of about 375 kWh per year. Total cost savings would be about $45 per year.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to $30 in incentive rebates.

It is assumed that this recommendation would be included in ECM AA1 LED upgrades. Based on RSMeans data, installing new ceiling hung fixtures would cost about $140 each. Each fixture would take about one hour to install at a labor rate of $125 per hour. Utilizing this information and cost data, the implementation cost would be about $800, and the simple payback would be over 10 years, including the incentive. Coupling this recommendation with ECM AA1 and AA2, the total simple payback would be closer to 5.5 years.

AA4: Install New Thermostats with Optimized Temperature Controls

Existing Condition

During the site visit, it was noticed that only two thermostats exist; however, there are four HVAC units serving the administration building. It is unclear how the two thermostats are controlling the four HVAC units. Additionally, it was noticed that the existing thermostats are very old and do not have the ability for scheduling or automatic controls, as shown on the right. Given that the building is not occupied 24/7, installing thermostats with scheduling and automatic controls would reduce heating, cooling, and fan energy by the HVAC units.

The cooling setpoints shown on the thermostats are around 71-72 °F. These cooling setpoint temperatures are very low and typical offices in Phoenix, Arizona maintain occupied cooling setpoint temperature around 74 °F.

Figure 5: Thermostats in Administration Building

Recommended Action

It is recommended that the existing thermostats be replaced with four, new thermostats so that each HVAC unit is served by its own thermostat. Each thermostat should have scheduling capability and controls that allow for automatic temperature setbacks overnight and during unoccupied times. Examples of companies that produce these thermostats would include Honeywell, Google, or Samsung. These thermostats can be found at Home Depot or Lowes.

Onsite personnel indicated that the office areas are occupied from 7AM to 5PM Monday through Sunday. Thus, it is recommended that the staff program the thermostats to be 70 °F for heating and 74 °F for cooling during occupied hours. Schedules should be implemented so that the setback temperatures are 82 °F for cooling and 60 °F for heating from 6PM to 6AM Monday through Friday and all day on Saturday and Sunday. These schedules can be adjusted during busier times of the year.

Energy and Cost Savings

Installing four new thermostats and programming setback schedules would result in electrical energy savings of about 8,270 kWh per year. Total cost savings would be about $992 per year.

SRP offers a smart thermostat rebate of $150 per thermostat. Thus, the total rebate would be $600.

Based on cost data from sources like Home Depot and Lowes, smart thermostats cost about $250 each. Each thermostat would take about one hour to install at a labor rate of $125 per hour. Utilizing this information and cost data, the implementation cost would be about $1,500, and the simple payback would be 0.9 years, including the incentive.

AA5: Replacing Existing Heat Pump Units with Ductless VRF System

Existing Condition

The administration building currently utilizes four, 7.5-ton RHEEM heat pump units that were installed around 2012. The published efficiency of the units is 11 EER for cooling and 3.3 COP for heating. Given the age of the equipment, it is expected that the efficiency of the units is closer to 10.5 EER and 3.0 COP, respectively.

The Air Traffic Control Tower building has upgraded their HVAC system to VRF units. There is opportunity in the administration building to upgrade the current equipment to a high efficiency VRF system.

Figure 6: One of four Condenser Units serving the Admin Building

Recommended Action

It is recommended that the existing HVAC system be replaced with a VRF system similar to the Air Traffic Control Tower. These systems utilize the inverter control technology to modulate the compressor and fans to meet part load conditions and eliminate the inefficiencies of cycling compressors. VRF systems have cooling and heating efficiencies up to 28 IEER and 4.2 COP and utilizing ductless VRF units could reduce fan energy usage by nearly 50%. Additionally, a VRF system is a zonal system so each room would have its own control over temperature setpoints and thermal comfort. This system type would allow for optimized HVAC controls to be able to implement temperature setbacks based on occupancy or time of day for each room in the building.

Energy and Cost Savings

Installing a VRF system to replace the existing heat pump units would result in electrical energy savings of about 24,610 kWh per year. Total cost savings would be about $2,953 per year.

SRP offers a $75 per ton rebate for installing multi-split variable refrigerant flow systems. Based on the current equipment tonnage, the rebate is estimated at $2,250.

Based on RSMeans cost data, each evaporator unit would cost about $2,650 and each condensing unit would cost about $20,000, for a total implementation cost of $46,500. The simple payback would be over 10 years, including the incentive.

AA6: Insulate Domestic Hot Water Pipes

Existing Condition

The administration building currently utilizes an electric domestic hot water (DHW) storage tank to provide hot water to restrooms and the pantry sink. During the site visit, it was noticed that all DHW pipes were uninsulated, as shown on the right. Uninsulated pipes result in significant heat loss in the distribution of hot water to the restrooms and pantry area.

Figure 7: Uninsulated copper DHW pipes

Recommended Action

It is recommended that 1”-1.5” insulation be installed on the DHW pipes to reduce distribution heat loss. Insulating DHW pipes not only reduces the energy consumed by the water heater, but also reduces the wait time for occupants wanting hot water at the pantry or restrooms.

Energy and Cost Savings

Installing DHW piping insulation would result in electrical energy savings of about 173 kWh per year. Total cost savings would be about $21 per year.

Based on typical cost data, it estimated the material cost to insulate DHW pipes would cost about $50. It is assumed that installing insulation would take about 30 minutes a labor rate of $25 per hour (which assumes internal staff). Using this cost data, total implementation cost would be about $75, and the simple payback would be 3.6 years, including the incentive.

AA7: Install Instantaneous, Tankless Electric Water Heaters

Existing Condition

The administration building currently utilizes a 30 gallon electric domestic hot water (DHW) storage tank to provide hot water to restrooms and the pantry sink, as shown on the right. While electric water heaters are about 97% efficient, there is significant distribution losses from the storage tank and uninsulated piping. Given that the only end uses for DHW are restrooms, shower, and a pantry sink, the 30 gallons storage tank seems unnecessary, and there is opportunity to pursue instantaneous, tankless electric water heaters.

Figure 8: 30 gal DHW Storage Tank

Recommended Action

It is recommended that instantaneous, tankless electric water heaters be installed 1) at the pantry sink and 2) in each restroom. Instantaneous water heaters eliminate tank storage heat losses and distribution piping heat losses.

Energy and Cost Savings

Installing instantaneous electric water heaters would result in electrical savings of about 663 kWh per year. Total cost savings would be about $76 per year.

SRP offers custom rebates of $0.10 per kWh saved, up to 60% of the implementation cost. This recommendation would qualify for a rebate of about $66.

Based RSMeans costs and cost from retail stores, the material cost for three instantaneous hot water heaters rated at 1.27 gpm would be about $170 each. Estimated installation cost would be about $300 per unit. Thus, the total implementation cost would be about $1,410, and the simple payback would be over 10 years, including the incentive.

AA8: Install Receptacle Load Controls to Turn Off Equipment

Existing Condition

The administration building utilizes a wide range of appliances such as printers/scanners, TVs, compact refrigerators, and more. Given that the building has variable occupancy, there are times when this equipment will remain on even when no one is present or utilizing the equipment. Based on previous project experience, as much as 50% of miscellaneous equipment can be left on overnight for a typical office space. Installing controls to automatically turn off TVs, computers, coffee makers, etc. could significantly reduce wasted energy usage.

Figure 9: Administration Pantry Area

Recommended Action

It is recommended that receptacle load controls be implemented for all office, pantry, copy room, and conference areas to turn off equipment overnight and during unoccupancy. Many lighting manufacturers have incorporated receptacle load controls into their lighting controls, and thus, this recommendation should be considered alongside ECMs AA1 and AA2.

Receptacle load controls can come in a variety of forms. New outlets can be installed that are separately circuited to include one outlet for equipment that can be turned off and another outlet that remains on. Another form of receptacle control is the use of power strips or wireless remote control plug-ins. The power strips and plug ins can be controlled directly from a lighting control system or simply from an App on your phone. These controls are typical for home retrofits but apply to small office spaces such as the administration building. The following link to The Home Depot website shows examples of these controls: https://www.homedepot.com/b/Electrical-Wiring-Devices-Light-Controls-Plug-Adapters/Remote-Control/N-5yc1vZcjvpZ1z0r7we.

Energy and Cost Savings

Installing receptacle load controls to turn off equipment during unoccupancy would result in electrical savings of about 1,771 kWh per year. Total cost savings would be about $213 per year.

SRP offers custom rebates of $0.10 per kWh saved, up to 60% of the implementation cost. This recommendation would qualify for a rebate of about $177.

Based on RSMeans data and retail store cost data, purchasing simple plug-in and power strip controls would cost about $500. Installing the equipment and programming could be completed in-house since it only requires the use of a smart phone. If so, the implementation cost would be about $500, and the simple payback would be 1.5 years.

AA9: Implement Policy to Purchase Energy Star Equipment

Existing Condition

The administration building utilizes a wide range of appliances such as printers/scanners, TVs, compact refrigerators, and more. Based on site observations, a number of these equipment were not Energy Star certified. These pieces of equipment are typically left on overnight or utilize significant amounts of power when not in use. Upgrading to Energy Star equipment would minimize usage during operation and non-operation.

Many corporations have begun instituting policies that require the purchase of Energy Star equipment. There is opportunity to implement similar practices across the airport buildings to minimize energy usage due to miscellaneous equipment.

Recommended Action

It is recommended that the airport implement a policy to purchase Energy Star equipment when purchasing new equipment or replacing existing equipment. All Energy Star rated equipment from office, pantry, and AV equipment can be found on the following website: https://www.energystar.gov/productfinder/. Many of the products found on this site can be purchased from local retail stores such as Home Depot, Lowes, Best Buy, etc.

Energy and Cost Savings

Implementing a policy to purchase Energy Star equipment would result in electrical savings of about 1,027 kWh per year. Total cost savings would be about $123 per year.

Based on the Energy Star website, the cost between standard and Energy Star equipment is negligible, and thus, there is no implementation cost and the simple payback is immediate.

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:

- Implementing all recommendations could reduce the total building energy usage by nearly 60% and reduce energy costs by more than 50%.
- Installing LED lighting and high performance controls can reduce electrical energy costs by 13% with a 5.5 year payback.
- Installing proper temperature controls and setpoints can reduce energy costs by about 11% with a very short payback.
- Replacing HVAC equipment should only be considered at the end of life. However, upgrading to a VRF system with optimized zone controls can reduce energy costs by nearly 33%.
- Utilizing instantaneous hot water heaters can reduce hot water energy usage by nearly 30%.
- Installing Energy Star equipment and providing optimized controls of plug loads can reduce energy cost by 4% with minimal implementation cost.

Chandler Aiport Administration Building									
					HVAC				Electric
#	Run	Ambient Lighting (kWh)	Misc Equip (kWh)	DHW Electric (kWh)	Heating Electric (kWh)	Cooling Electric (kWh)	Vent Fans (kWh)	Total HVAC (kWh)	Total Electric (kWh)
0	Calibrated Model	12,750	13,015	2,495	2,921	33,717	9,381	46,019	74,319
AA1	0+Replace Fluorescents with LED Fixtures	6,375	13,015	2,496	3,502	32,316	9,281	45,099	67,027
AA2	L1+Install High Performance Lighting Controls	4,912	13,015	2,496	3,632	31,994	9,254	44,880	65,345
AA3	L2+Optimize Natural Lighting and Remove Uplighting	4,585	13,015	2,496	3,660	31,922	9,250	44,832	64,970
AA4	L3+Install New Thermostats with Temperature Setbacks	4,585	13,015	2,492	1,627	27,663	7,289	36,579	56,700
AA5	M1+Replace Heat Pumps with VRF System	4,585	13,015	2,492	1,032	8,023	2,916	11,971	32,090
AA6	M2+Insulate Domestic Hot Water Pipes	4,585	13,015	2,325	1,035	8,016	2,915	11,966	31,917
AA7	P1+Install Instantaneous Electric Water Heaters	4,585	13,015	1,693	1,035	8,016	2,915	11,966	31,284
AA8	P2+Install Receptacle Load Controls	4,585	11,346	1,693	1,064	7,904	2,894	11,862	29,513
AA9	R1+Install Energy Star Equipment	4,585	10,372	1,693	1,082	7,841	2,886	11,809	28,486
	Savings relative to Previous Measure								
AA1	0+Replace Fluorescents with LED Fixtures	6,375	-	(1)	(581)	1,401	100	920	7,292
AA2	L1+Install High Performance Lighting Controls	1,463	-	-	(130)	322	27	219	1,682
AA3	L2+Optimize Natural Lighting and Remove Uplighting	327	-	-	(28)	72	4	48	375
AA4	L3+Install New Thermostats with Temperature Setbacks	-	-	4	2,033	4,259	1,961	8,253	8,270
AA5	M1+Replace Heat Pumps with VRF System	-	-	-	595	19,640	4,373	24,608	24,610
AA6	M2+Insulate Domestic Hot Water Pipes	-	-	167	(3)	7	1	5	173
AA7	P1+Install Instantaneous Electric Water Heaters	-	-	632	-	-	-	-	633
AA8	P2+Install Receptacle Load Controls	-	1,669	-	(29)	112	21	104	1,771
AA9	R1+Install Energy Star Equipment	-	974	-	(18)	63	8	53	1,027
	Total Savings								
	Totals:	8,165	2,643	802	1,839	25,876	6,495	34,210	45,833
	Percent of Baseline:	64.0%	20.3%	32.1%	63.0%	76.7%	69.2%	74.3%	61.7%

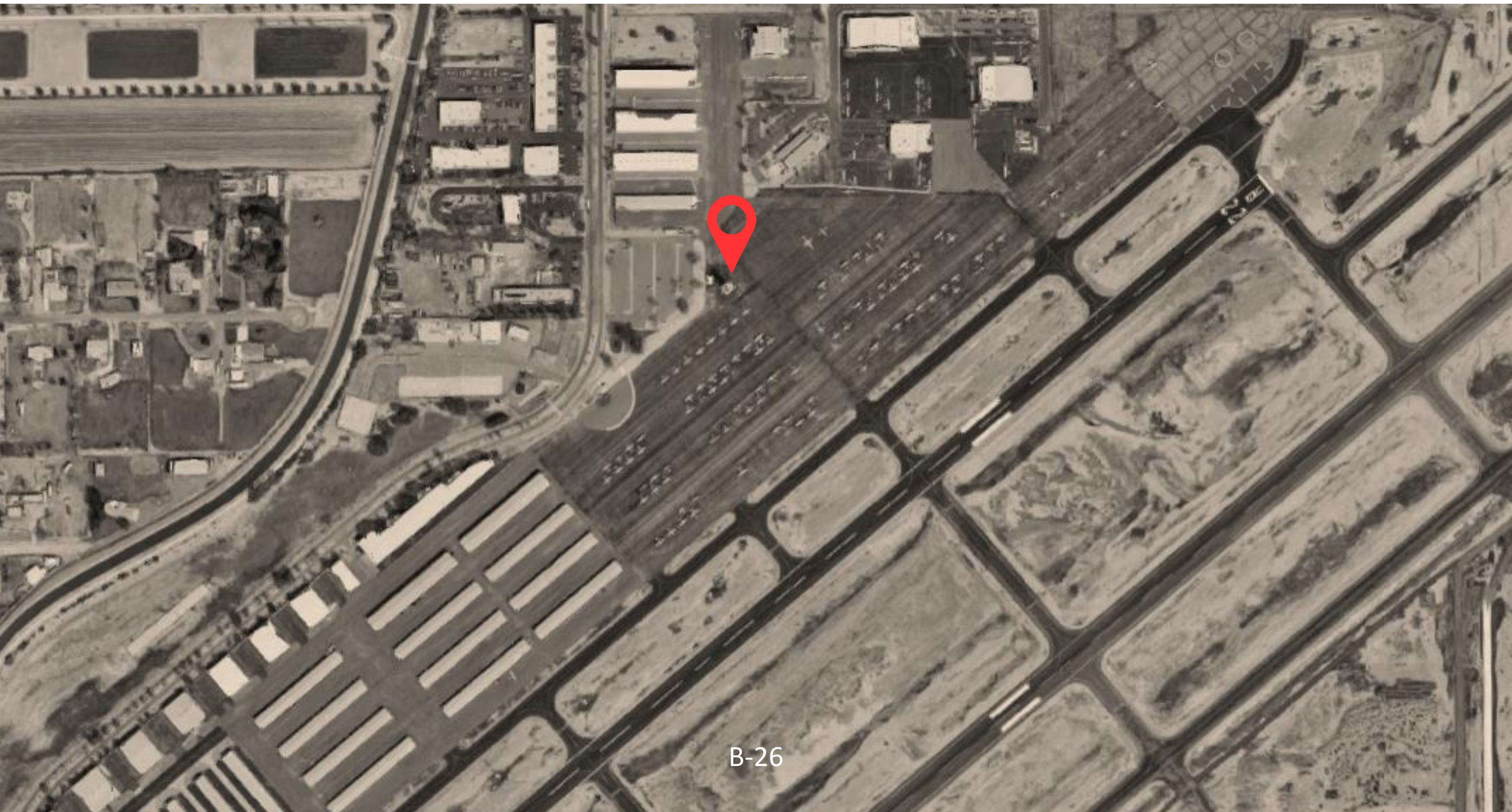
Figure 10: Energy and Cost Summary for Each ECM

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	SRP Incentive	Simple Payback
AA1	0+Replace Fluorescents with LED Fixtures	$3,000	$875	$600	2.7
AA2	L1+Install High Performance Lighting Controls	$3,750	$202	$750	14.9
AA3	L2+Optimize Natural Lighting and Remove Uplighting	$800	$45	$30	17.1
AA4	L3+Install New Thermostats with Temperature Setbacks	$1,500	$992	$600	0.9
AA5	M1+Replace Heat Pumps with VRF System	$46,500	$2,953	$2,250	15.0
AA6	M2+Insulate Domestic Hot Water Pipes	$75	$21	$0	3.6
AA7	P1+Install Instahot Water Heaters	$1,410	$76	$66	17.7
AA8	P2+Install Receptacle Load Controls	$500	$213	$177	1.5
AA9	R1+Install Energy Star Equipment	$0	$123	$0	Immediate

Figure 11 – Economic Results Summary

Air Traffic Control Tower



Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

AT1: Replace Linear and Compact Fluorescent Lamps with LEDs

Existing Condition

The air traffic control building utilizes a mixture of 2-lamp 4ft. T8 fluorescent fixtures and recessed incandescent 60W lamps 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 ATCT

Recommended Action

Replace all fluorescent lamps with LED lamps. Use a 12W GE LED12ET8/g/4/840 linear LED lamp or similar to replace linear fluorescent lamps. Replace all 60W incandescent lamps with 9W LED lamp. 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 and replacement costs. As a bonus, LED lamps contain no mercury, helping to streamline its recycling process.

Energy and Cost Savings

Replacing all fluorescent and incandescent lamps with LED lamps would result in electrical savings of about 4,912 kWh per year. Total cost savings would be about $454 per year.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to $600 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 $2,500, and the simple payback would be 4.2 years, including the incentive.

AT2: Install High Performance Lighting Controls

Existing Condition

Currently, the air traffic control tower building does not utilize any occupancy sensors. Based on conversation with airport personnel and observations during the site visit, the building has highly variable occupancy on multiple floors and it was noticed that lights were left on in spaces that were unoccupied.

Figure 2: Lighting Fixture in Electrical Room

Recommended Action

It is recommended to install occupancy sensors throughout the building. The occupancy sensors should turn off lighting fixtures within 20 minutes of people leaving the room.

There are numerous lighting control companies that offer occupancy and daylighting control solutions such as Lutron, Lithonia, Leviton, etc. This installation is best implemented at the same time as upgrading lighting fixtures to LED fixtures since many lighting companies will offer LED upgrades and lighting control upgrades as a package.

Energy and Cost Savings

Installing high performance lighting controls including occupancy and daylighting sensors would result in electrical savings of about 1,403 kWh per year. Total cost savings would be about $130 per year.

SRP offers a lighting rebate of $0.40 per watt controlled. It is therefore estimated that this recommendation could receive up to $450 in incentive rebates.

Based on RSMeans and manufacturing data, each occupancy and daylight sensor would cost about $250 to purchase and install. Utilizing this information, the implementation cost would be about $2,250, and the simple payback would be over 10 years, including the incentive. It is thus recommended that this ECM be coupled with ECM AA1. Combining the two ECMs, the simple payback would be closer to 6.7 years.

AT3: Replace the HPS 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.

Figure 3: Beacon Light at top of ATCT

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.

Energy and Cost Savings

Replacing the existing beacon fixture with a new, higher efficient light would result in electricity savings of about **4,380 kWh per year** and cost savings of about **$405** per year.

SRP offers custom rebates of $0.10 per kWh. This recommendation could qualify for **$438** in rebates.

Based on previous projects and manufacturing data, the expected cost for the beacon light would be about **$10,000**. The simple payback would be **over 10 years,** including incentives.

AT4: Program Thermostats with Optimized Temperature Setbacks

Existing Condition

During the site visit, each room in the ATCT utilizes the smart thermostat as shown on the right. However, it was noticed that the thermostats have not been programmed or scheduled. Additionally, the thermostats were locked from editing and were not able to be programmed during the visit. Given that the building is not occupied 24/7 and has variable occupancy, programming the thermostats for temperature setback modes would reduce heating, cooling, and fan energy by the HVAC units.

Figure 4: Existing Smart Thermostats in ATCT

Recommended Action

It is recommended that the existing thermostats be programmed with optimized schedules for temperature setbacks. Schedules should be implemented so that the setback temperatures are 82 °F for cooling and 60 °F for heating from 9PM to 6AM everyday of the week. These schedules can be adjusted during busier times of the year.

Energy and Cost Savings

Installing four new thermostats and programming setback schedules would result in electrical energy savings of about 2,880 kWh per year. Total cost savings would be about $266 per year.

It is estimated that an LG electrician would need about 30 minutes per thermostat to reprogram at a labor rate of $125 per hour. If so, the implementation cost would be about $500, and the simple payback would be 1.9 years, including the incentive.

AT5: Adjust Thermostat Setpoints to 74° F for Cooling in IT Rooms

Existing Condition

During the site visit, it was noticed that the IT rooms had cooling temperature setpoints between 68-70 °F, as shown in the image on the right. While IT rooms need to be conditioned to relatively cool temperatures, IT equipment can operate at temperatures up to 78 °F without malfunction or reduced speed. Setpoints of 68 °F are not needed and should be adjusted closer to 74 °F.

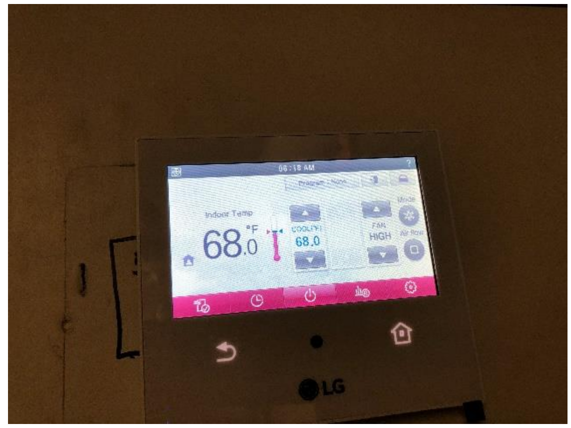


Figure 5: Thermostat in IT Room

Recommended Action

It is recommended that temperature setpoints in the IT rooms be adjusted from 68-70 °F to 74 °F. Increasing the temperature in the space to 74 °F does not hinder the function of the IT equipment and reduces cooling energy consumption considerably.

Energy and Cost Savings

Adjusting temperature setpoints in the IT rooms would result in electrical energy savings of about 561 kWh per year. Total cost savings would be about $52 per year.

Adjusting setpoints requires no implementation cost, and thus, the simple payback is immediate.

AT6: Remove Old AC Units and Insulate Walls

Existing Condition

There exist a number of old, AC units in the air traffic control tower as the one shown on the right. Given that all spaces now utilize newer VRF units, the old AC units can be removed so that the spot that once held the AC unit can be covered and insulated.

Figure 6: Window Unit in ATCT

Recommended Action

It is recommended that all old AC units be removed, and the wall be filled with at a minimum R-13 Batt insulation between 4in wood studs. Reducing the infiltration and heat transfer through the envelope reduces the cooling load on the VRF unit and results in significant energy savings.

Energy and Cost Savings

Insulating the wall to minimize infiltration and heat transfer would result in in electrical energy savings of about **432 kWh per year**. Total cost savings would be about **$40 per year**.

Based on typical construction cost and RSMeans data, the cost to install R-13 batt insulation between 4in wood studs is about $5 per SF. It is estimated that a total of 15 SF would be needed to fully cover and insulate the holes in the wall. If so, the implementation cost would be about **$150,** and the simple payback would be about **3.8 years**.

AT7: Install Instantaneous, Tankless Electric Water Heaters

Existing Condition

The air traffic control tower building currently utilizes a 6 gallon electric domestic hot water (DHW) storage tank to provide hot water to restrooms, as shown on the right. While electric water heaters are about 97% efficient, there is significant distribution losses from the storage tank and uninsulated piping. Given that the only end uses for DHW are restrooms and breakroom, the 6 gallon storage tank seems unnecessary, and there is opportunity to pursue instantaneous, tankless electric water heaters.

Figure 7: 6 Gallon DHW Storage Tank

Recommended Action

It is recommended that instantaneous, tankless electric water heaters be installed in each restroom. Instantaneous water heaters eliminate tank storage heat losses and distribution piping heat losses.

Energy and Cost Savings

Installing instantaneous electric water heaters would result in electrical savings of about 337 kWh per year. Total cost savings would be about $31 per year.

SRP offers custom rebates of $0.10 per kWh saved, up to 60% of the implementation cost. This recommendation would qualify for a rebate of about $33.

Based RSMeans costs and cost from retail stores, the material cost for two instantaneous hot water heaters rated at 1.27 gpm would be about $170 each. Estimated installation cost would be about $300 per unit. Thus, the total implementation cost would be about $940, and the simple payback would be over 10 years, including the incentive.

Analysis Results

Economic Results Summary

Energy results for each of the ECMs described above are shown in the table below. Key findings from the energy analysis include:

- Implementing all recommendations could reduce the ATCT energy usage by nearly 21%
- Installing LED lighting and high performance controls can reduce electrical energy costs by 15%.
- Installing proper temperature controls and setpoints can reduce energy costs by about 5% with a very short payback.
- Utilizing instantaneous hot water heaters can reduce hot water energy usage by nearly 30% and overall energy usage by about 0.5%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	72,073	$6,664	0.0%	$0	0.0%
AT1	Replace Fluorescent Lamps with LEDs	67,161	$6,210	6.8%	$454	6.8%
AT2	Install High Performance Lighting Controls	65,758	$6,080	8.8%	$130	1.9%
AT3	Replace HPS Beacon Light with LED Fixture	61,378	$5,675	14.8%	$405	6.1%
AT4	Program Thermostats with Optimized Temperature Setbacks	58,498	$5,409	18.8%	$266	4.0%
AT5	Adjust Thermostat Setpoints to 74 °F in IT Rooms	57,937	$5,357	19.6%	$52	0.8%
AT6	Remove Old AC Units and Insulate Walls	57,505	$5,317	20.2%	$40	0.6%
AT7	Install Instantaneous, Tankless Electric Water Heaters	57,168	$5,286	20.7%	$31	0.5%

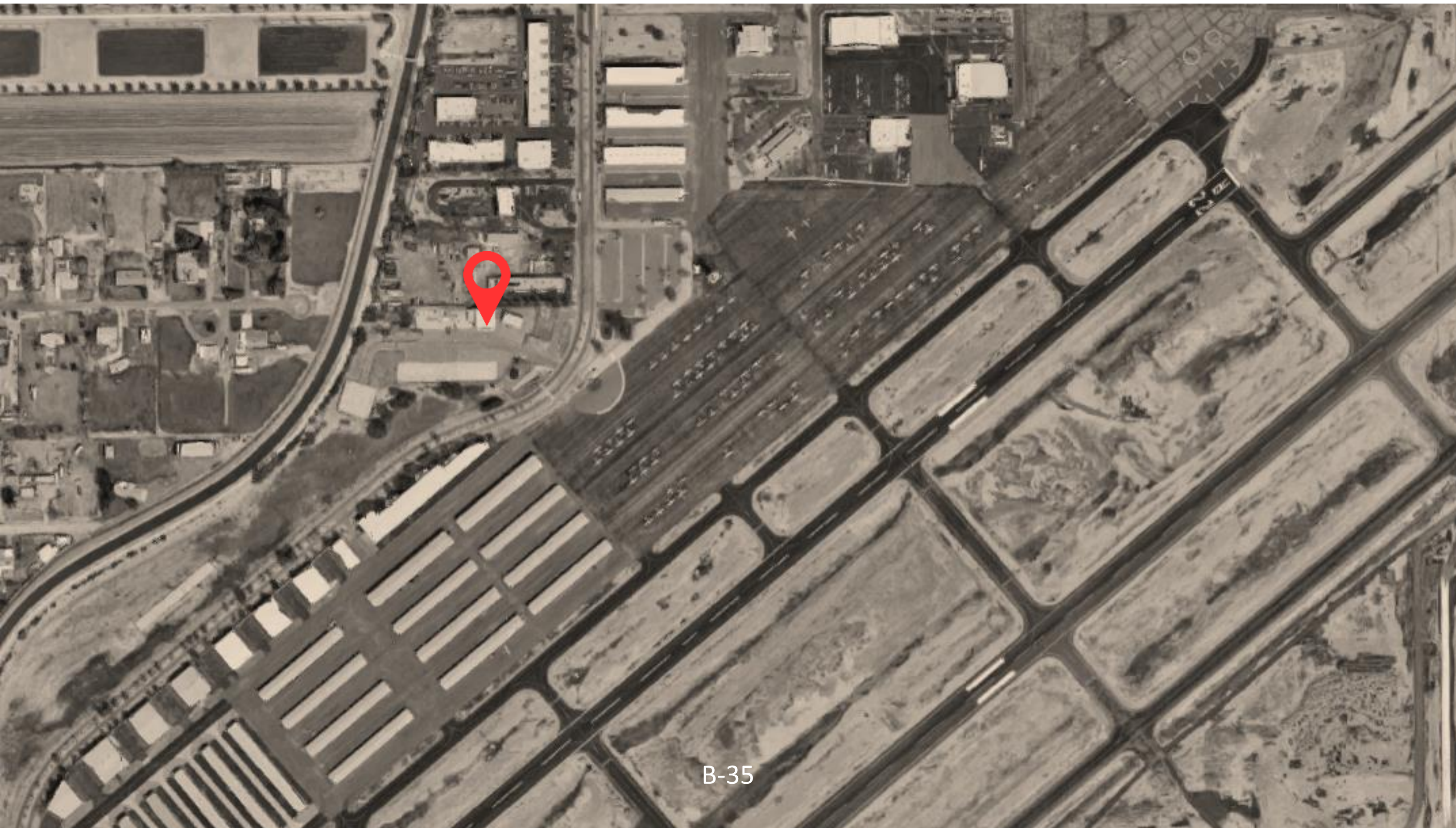
Figure 8: Energy and Cost Summary for Each ECM

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	SRP Incentives	Simple Payback (years)
AT1	Replace Fluorescent Lamps with LEDs	$2,500	$454	$600	4.2
AT2	Install High Performance Lighting Controls	$2,500	$130	$450	15.8
AT3	Replace HPS Beacon Light with LED Fixture	$10,000	$405	$438	23.6
AT4	Program Thermostats with Optimized Temperature Setbacks	$500	$266	$0	1.9
AT5	Adjust Thermostat Setpoints to 74 °F in IT Rooms	$0	$52	$0	Immediate
AT6	Remove Old AC Units and Insulate Walls	$150	$40	$0	3.8
AT7	Install Instantaneous, Tankless Electric Water Heaters	$940	$31	$33	29.1

Figure 9 – Economic Results Summary

Maintenance Building



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 savings, implementation cost, and simple payback are calculated for each conservation measure.

M1: Replace All Linear Fluorescent Fixtures with LED Fixtures

Existing Condition

The airport maintenance facility utilizes a 4-lamp, 4-ft. T8 linear fluorescent fixtures. 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: Interior Linear Fluorescent Fixtures

Recommended Action

It is recommended that each T8 lamp should be replaced with a 12W GE LED12ET8/g/4/840 linear LED lamp or similar. 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 linear fluorescent fixtures with LED fixtures would result in electrical energy savings of about **2,868 kWh per year** and cost savings of about **$316 per year**.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that 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 **$1,100**, and the simple payback would be **3.0 years,** including the incentive.

M2: Install High Performance Lighting Controls

Existing Condition

Based on the site visit, the maintenance building currently does not utilize occupancy sensors to control lighting fixtures. Given that this building has low occupancy and high variability during the day, installing occupancy sensors can significantly reduce energy usage and run time for the lighting fixtures.

Additionally, the maintenance building utilizes significant amounts of skylights. There is opportunity to utilize daylight harvesting controls to dim lighting fixtures when sufficient natural light enters the space.

Figure 2: Linear Fluorescent Fixtures in the Maintenance Building

Recommended Action

It is recommended to install a couple of occupancy and daylighting sensors in the maintenance building to control lighting fixtures. The occupancy sensors should turn off lighting fixtures within 20 minutes of people leaving the space. Daylighting controls should automatically dim lighting fixtures near windows to maintain a constant lighting level of 40 fc (typical for warehouse/manufacturing spaces).

There are numerous lighting control companies that occupancy and daylighting control solutions such as Lutron, Lithonia, Leviton, etc. This installation is best implemented at the same time as upgrading lighting fixtures to LED fixtures since many lighting companies will offer LED upgrades and lighting control upgrades as a package.

Energy and Cost Savings

Installing high performance lighting controls including occupancy and daylighting sensors would result in electrical savings of about 896 kWh per year. Total cost savings would be about $99 per year.

SRP offers a lighting rebate of $0.40 per watt controlled. It is therefore estimated that this recommendation could receive up to $250 in incentive rebates.

Based on RSMeans and manufacturing data, each occupancy and daylight sensor would cost about $250 to purchase and install. Utilizing this information, the implementation cost would be about $1,000, and the simple payback would be 7.6 years, including the incentive. It is thus recommended that this ECM be coupled with ECM AA1. Combining the two ECMs, the simple payback would be closer to 4.1 years.

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 and installing lighting controls could reduce total energy consumption for the Maintenance Building by **39%**.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	7,030	$1,052	0%	$0	0%
M1	Replace All Linear Fluorescents w/ LEDs	4,162	$736	30%	$316	30%
M2	Install High Performance Lighting Controls	3,265	$638	39%	$99	9%

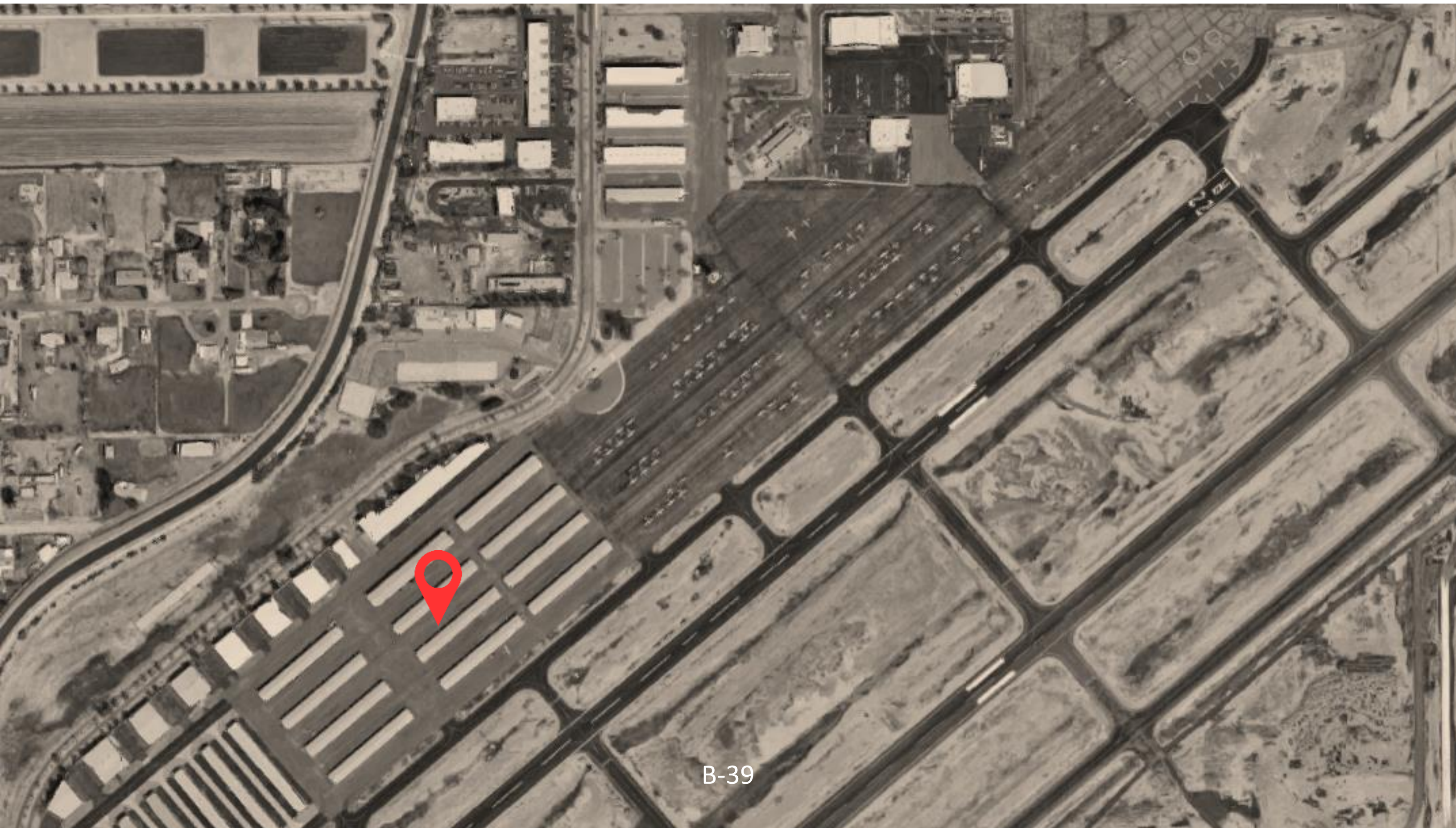
Figure 3: Energy Results Summary

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	SRP Incentives	Simple Payback (years)
M1	Replace All Linear Fluorescents w/ LEDs	$1,100	$316	$150	3.0
M2	Install High Performance Lighting Controls	$1,000	$99	$250	7.6

Figure 4 – Economic Results Summary

T-Hangars A Through I



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 savings, implementation cost, and simple payback are calculated for each conservation measure.

H1: Replace All Linear Fluorescent Fixtures with LED Fixtures

Existing Condition

The hangars utilize a mixture of linear fluorescent fixtures. 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: Exterior T-Hangars

Recommended Action

It is recommended that each T12 fixture in the hangars be replaced with a Series SKD 8ft. 80W LED fixture or similar. Each T8 fixture should be replaced with a 12W GE LED12ET8/g/4/840 linear LED lamp or similar. 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 linear fluorescent fixtures in the hangars with LED fixtures would result in electrical energy savings of about 5,842 kWh per year and cost savings of about $643 per year.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to $900 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 $6,000, and the simple payback would be 7.9 years, including the incentive.

H2: Replace All Exterior Lighting with LED Fixtures

Existing Condition

Based on the site visit, the hangars utilize 60-100W incandescent and halide exterior fixtures that are controlled by a photocell. 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 fixture be replaced with a 50W LED Flat Corn Light or similar. 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 2,652 kWh per year and cost savings of about $292 per year.

SRP offers an exterior lighting rebate of $200 per kW of reduced installed demand for qualified LEDs. It is estimated that this recommendation could receive up to $400 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 $2,300, and the simple payback would be 6.5 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 32%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	27,596	$2,926	0%	$0	0%
H1	Replace All Linear Fluorescents w/ LEDs	21,753	$2,283	22%	$643	22%
H2	Replace All Exterior Lighting w/ LEDs	19,101	$1,991	32%	$292	10%

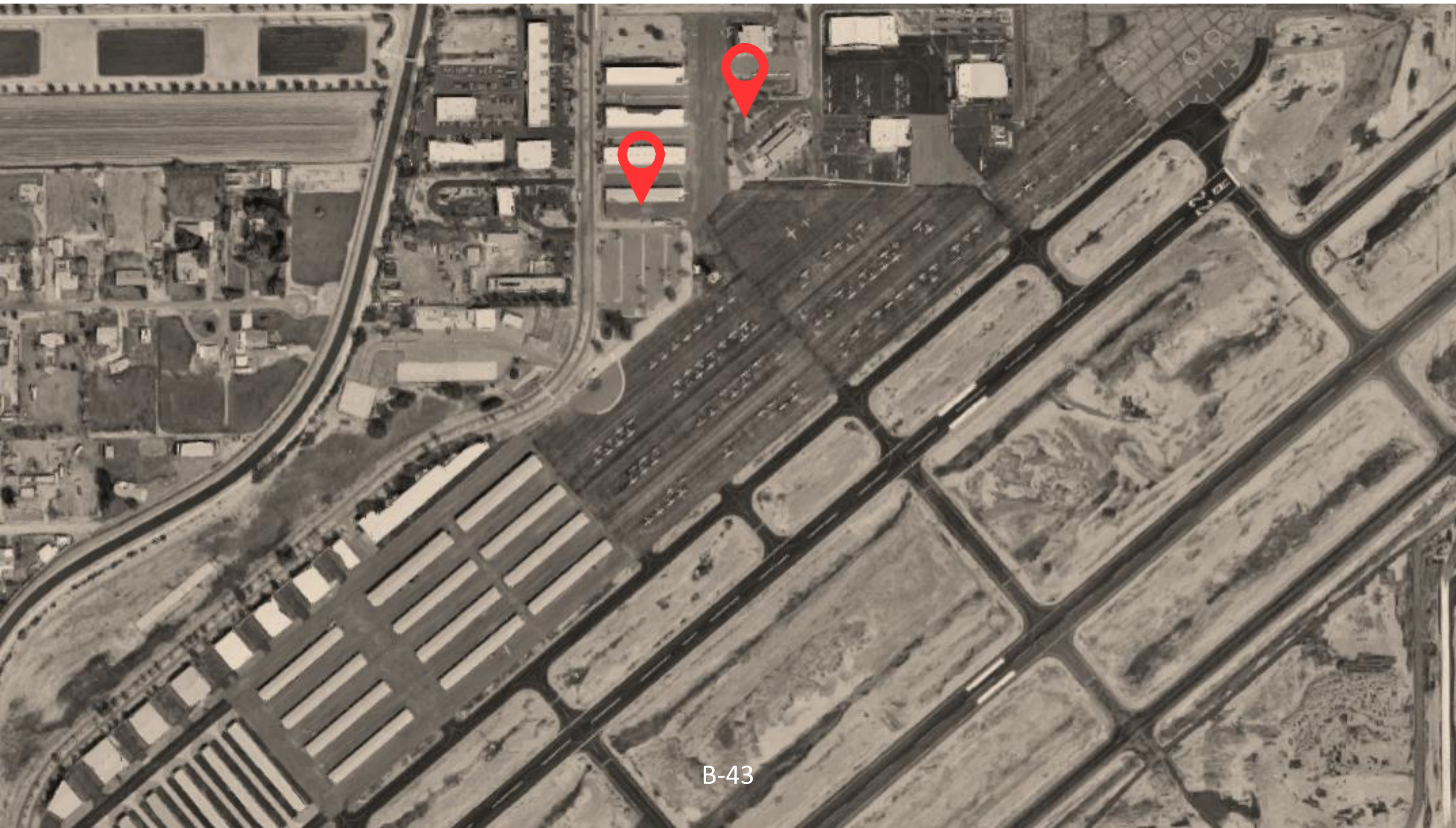
Figure 3: Energy Results Summary

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	SRP Incentives	Simple Payback (years)
H1	Replace All Linear Fluorescents w/ LEDs	$6,000	$643	$900	7.9
H2	Replace All Exterior Lighting w/ LEDs	$2,300	$292	$400	6.5

Figure 4 – Economic Results Summary

Parking Lot and Canopy Lighting



Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

E1: Replace All 100W HPS Exterior Pole Fixtures with 50W LED Fixtures

Existing Condition

The parking lot for the airport administration building utilizes 12, 100W HPS exterior pole lights. Additionally, it is expected that all streetlights utilize inefficient halogen or HPS fixtures. The fixtures are controlled by photocells to turn on at dusk and turn off at dawn. The 100W pole lamps draw a significant amount of power, and there is opportunity to replace the current fixtures with 50W LED fixtures.

Figure 1: Exterior HPS Fixtures in Parking Lot

Recommended Action

It is recommended that all exterior pole fixtures be replaced with a 50W 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 20,189 kWh per year and cost savings of about $2,019 per year.

SRP offers a lighting rebate of $200 per kW of reduced installed demand for qualified exterior LEDs. It is estimated that this recommendation could receive up to $1,000 in incentive rebates.

It is assumed that each fixture would take about one hour to replace the lamps at a labor rate of $125 per hour. Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $48,500 and the simple payback would be over 10 years, including the incentive.

E2: Replace Incandescent Lamps with LED in Canopy Parking Area

Existing Condition

The canopy parking area currently utilizes about eight incandescent lamps to illuminate the area overnight. There is opportunity to replace these lamps with low wattage LED lamps.

Figure 2: Existing Canopy Lighting Fixtures

Recommended Action

Replace all 60W incandescent lamps with LED 9W lamp. 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 and replacement costs. As a bonus, LED lamps contain no mercury, helping to streamline its recycling process.

Energy and Cost Savings

Replacing all fluorescent and incandescent lamps with LED lamps would result in electrical savings of about 1,647 kWh per year. Total cost savings would be about $165 per year.

SRP offers a lighting rebate of $200 per kW of reduced installed demand for qualified exterior LEDs. It is estimated that 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. Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $240 and the simple payback would be 0.8 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 exterior lighting by 48%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	45,200	$4,632	0%	$0	0%
E1	Replace Exterior Street and Parking Lot Pole Lights w/ LEDs	25,011	$2,613	44%	$2,019	44%
E2	Replace Canopy Incandescents with LED Lamps	23,364	$2,448	47%	$165	4%

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	SRP Incentives	Simple Payback (years)
E1	Replace Exterior Street and Parking Lot Pole Lights w/ LEDs	$48,500	$2,019	$1,000	23.5
E2	Replace Canopy Incandescents with LED Lamps	$240	$165	$100	0.8

Figure 4 – Economic Results Summary

Runway and Taxiway Lights

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.

L1: Consider Replace Runway Fixtures with LED Fixtures

Existing Condition

The runway and taxiways currently utilize 30W halogen lamp to illuminate the 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.

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 halogen 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 **40,490 kWh per year** and cost savings of about **$4,420** per year.

SRP offers custom rebates of $0.10 per kWh. This recommendation could qualify for **$4,000** in rebates.

Based on previous projects and manufacturing data, the expected cost for each runway fixture would be about $200. It is expected that there are over 500 fixtures installed. If so, the total implementation cost would be about **$100,000**. 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 could reduce costs by about **15%**

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	264,960	$28,622	0%	$0	0%
L1	Replace Runway Lights with LED Fixtures	224,040	$24,202	15%	$4,420	15%

Figure 1: 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	SRP Incentives	Simple Payback (years)
L1	Replace Runway Lights with LED Fixtures	$100,000	$4,420	$4,000	21.7

Figure 2 – Economic Results Summary

Solar PV Potential

Background

The climate at Chandler Municipal Airport provides an ideal location for solar energy production. The project team has indicated the area highlighted in the image below as a potential location for a solar PV system. Based on the site visit, the following items need to be confirmed to determine whether the site could house a solar PV system:

- Federal Aviation Administration (FAA) regulations for glare and other flight impact issues.
- No underground piping or sewer systems that would require access
- Proper spacing between solar PV system and existing structures/roads/construction.

Figure 1: Potential Solar PV Location

Financial Cost Considerations

From a utility cost standpoint, SRP only offers about a $0.02-$0.03 per kWh credit for excess generation on an hourly basis. This means that if the PV system generates more energy than the property/building consumes, the project will only be credited $0.02-$0.03 per kWh instead to the retail rate of about $0.09 per kWh. Therefore, it is important to consider the installation of batteries for this project to store excess energy generation so that it can be used on site. SRP currently does not offer battery storage incentives to commercial customers, only to residential customers.

Additionally, 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 the City of Chandler, thus lowering the net cost of the project**, while potentially avoiding or mitigating some of the barriers mentioned below.

- Taxpayer/public approval of funding
- Utility connectivity issues and/or production arrangements
- Other airport operational constraints

Potential Solar PV Installations and Financial Costs

There are many potential options for installing solar PV at the Chandler Municipal Airport. The following sections summarize the potential solar PV installations and financial costs with the following considerations:

1. PV systems serving specific buildings
2. PV system to serve all buildings in scope
3. Inclusion of Battery Storage

All options outlined below assume that airport will enter into a power purchase agreement (PPA) with a third party developer and will not own their own system. This allows the project to take advantage of the 26% federal tax credit.

PV System to Offset Energy Usage of All Buildings

Based on the potential location for a solar PV installation, there is sufficient area to generate 100% of the airport's energy needs, plus much more, potentially. However, a solar PV system can only be attached to one meter. Given that the airport has 10+ meters, coordination with SRP would be required to install a master meter and/or consolidate the multiple meters on site.

From the utility analysis, the municipal airport consumes about **534,943 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 **325 kW** solar PV array would need to be installed. The following map highlights the potential location and actual size of the 325 kW ground mount solar PV array.

Figure 2: Potential Location and Size for 325 kW Solar PV Array

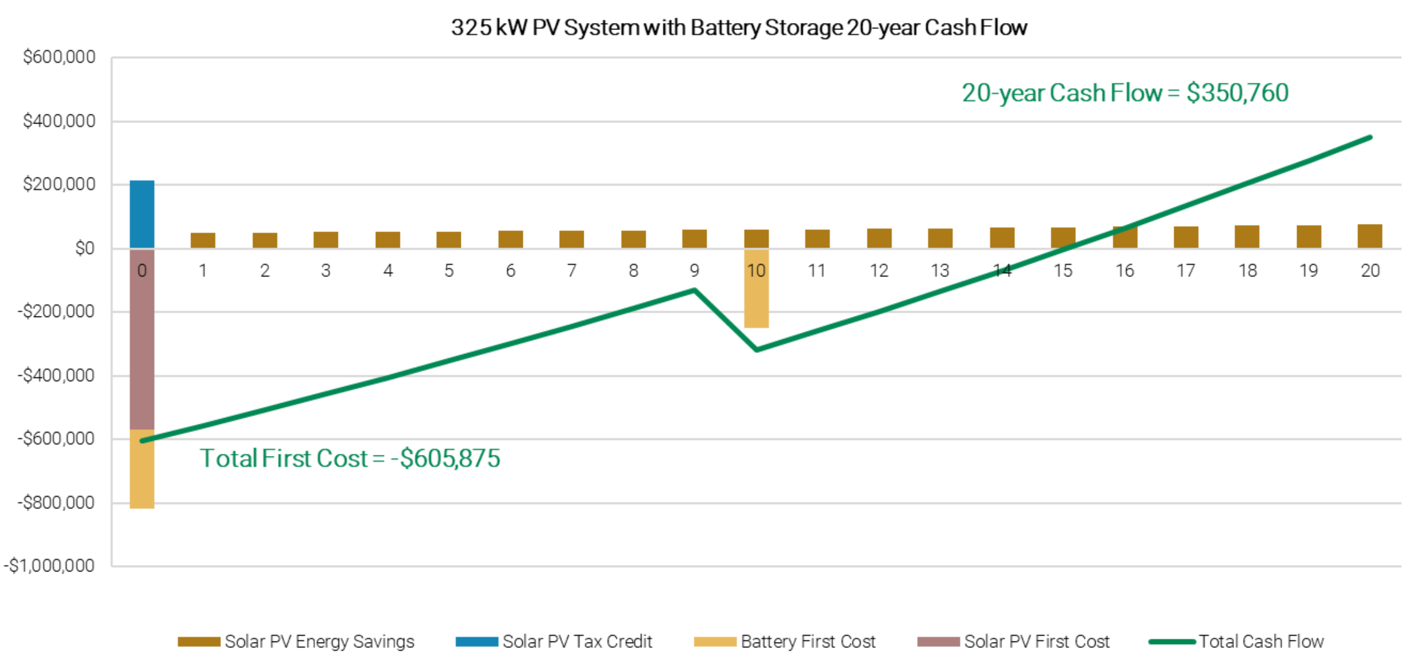
As mentioned previously, the buyback rate for excess energy generation is only a third of the retail rate, and thus, the potential for a battery storage system should be evaluated. The following table shows the financial inputs for the 325 kW ground mount solar PV system with and without a battery storage system. It is estimated that the cost of batteries is roughly $500 per kWh in addition to the cost of the PV system itself.

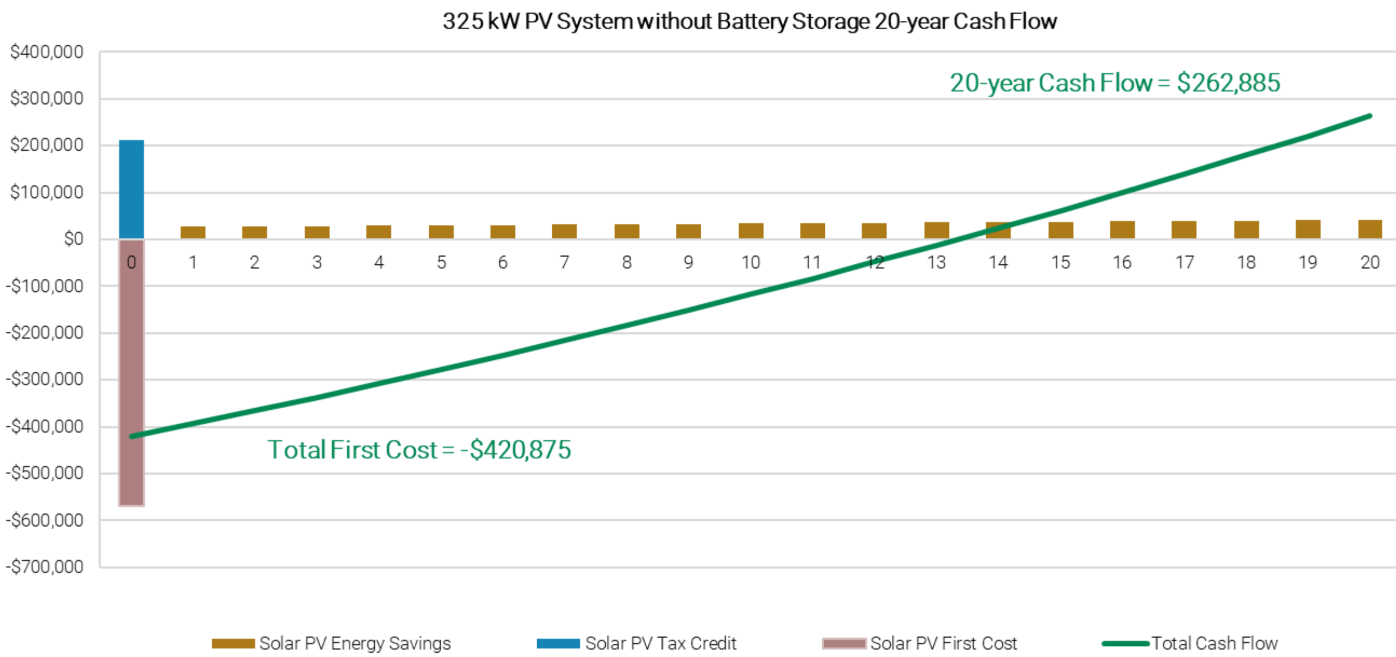
Solar PV Cost Inputs			
	w/ Battery	w/out Battery	
Solar PV First Cost	$1.75	$1.75	/Watt
Battery Storage First Cost	$500	N/A	/kWh
Federal Tax Incentive	26%	26%	-
Energy Escalation Rate	2.8%	2.8%	-
Solar PV Equipment Lifetime	20	10	years
Battery Equipment Lifetime	10	N/A	years
Solar Utility Rate	$0.09	$0.09	$/kWh
Buyback Rate	N/A	$0.03	$/kWh

The following table summarizes the financial results for both system options. As noted, both options result in a simple payback of over **13 years**. The financial results are slightly more favorable to a solar PV system without batteries; however, the battery system results in a greater cash flow after 20 years.

Financial Results			
	w/ Battery	w/out Battery	
20-year NPV	$21,459	$30,319	-
Straight Line Payback	15.06	13.33	years
Year-1 ROI	8.0%	6.5%	-
IRR	4.4%	4.7%	-

The following graphs show the 20 year cash flow for the solar PV system with and without battery storage incorporating first cost, federal tax credit, solar depreciation, and cost savings.





PV System to Offset Administration Building Energy Use

If all ECMs for the administration building were to be implemented, the airport administration building would consume about **28,486 kWh per year** of electrical energy. Therefore, to offset the total energy consumption for the building, an **18 kW** solar PV array would need to be installed. At this size, it is possible to install a carport solar PV installation on the adjacent parking lot. The following map highlights the potential location and actual size of the 18 kW carport solar PV array.

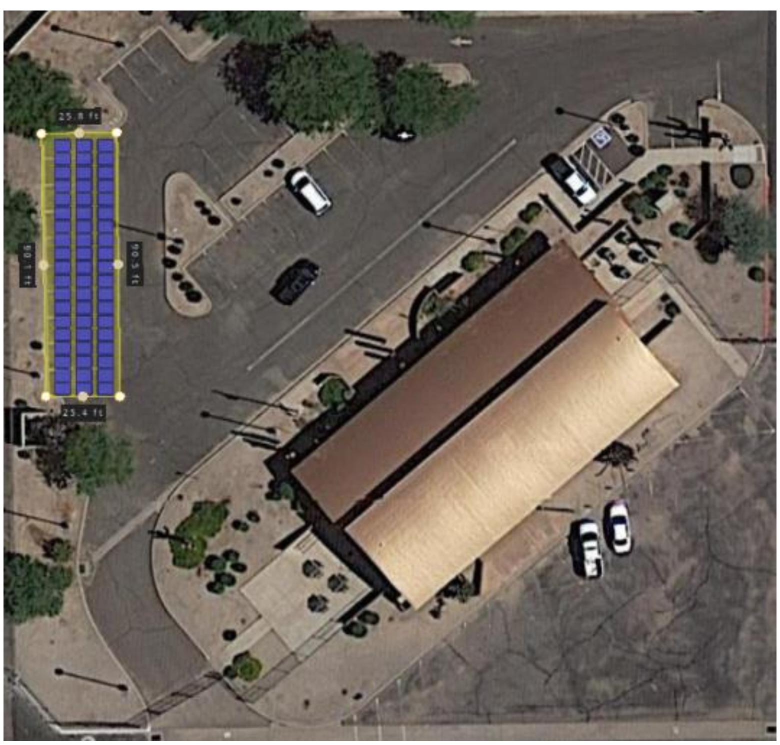


Figure 3: Potential Location and Size of 18 kW PV System

The following table shows the financial inputs for the 18 kW carport solar PV system with and without a battery storage system.

Solar PV Cost Inputs			
	w/ Battery	w/out Battery	
Solar PV First Cost	$3.00	$3.00	/Watt
Battery Storage First Cost	$500	N/A	/kWh
Federal Tax Incentive	26%	26%	-
Energy Escalation Rate	2.8%	2.8%	-
Solar PV Equipment Lifetime	20	10	years
Battery Equipment Lifetime	10	N/A	years
Solar Utility Rate	$0.09	$0.09	$/kWh
Buyback Rate	N/A	$0.03	$/kWh

The following table summarizes the financial results for both system options. As noticed, both options result in a simple payback of about **18 years**. The financial results are slightly more favorable to a solar PV system without batteries; however, the battery system results in a greater cash flow after 20 years.

Financial Results			
	w/ Battery	w/out Battery	
20-year NPV	-$10,435	-$8,311	-
Straight Line Payback	18.17	18.01	years
Year-1 ROI	6.0%	4.5%	-
IRR	1.4%	1.2%	-
20-year Cash Flow	$7,429	$4,570	-

PV System to Offset Air Traffic Control Tower Energy Use

If all ECMs for the air traffic control tower (ATCT) were to be implemented, the ATCT would consume about **57,168 kWh per year** of electrical energy. Therefore, to offset the total energy consumption for the building, a **35 kW** solar PV array would need to be installed. The following map highlights the potential location and actual size of the 35 kW solar PV array.

Figure 4: Potential Location and Size of 35 kW PV System

The following table shows the financial inputs for the 35 kW carport solar PV system with and without a battery storage system.

Solar PV Cost Inputs			
	w/ Battery	w/out Battery	
Solar PV First Cost	$2.00	$2.00	/Watt
Battery Storage First Cost	$500	N/A	/kWh
Federal Tax Incentive	26%	26%	-
Energy Escalation Rate	2.8%	2.8%	-
Solar PV Equipment Lifetime	20	20	years
Battery Equipment Lifetime	10	N/A	years
Solar Utility Rate	$0.09	$0.09	$/kWh
Buyback Rate	N/A	$0.03	$/kWh

The following table summarizes the financial results for both system options. As noticed, the system without battery storage results in a 15 year payback while the battery storage option is around a 19 year payback. This is mainly due to having to size the battery storage system larger to fully cover the large overnight loads from the IT rooms.

Financial Results			
	w/ Battery	w/out Battery	
20-year NPV	-$24,091	-$3,210	-
Straight Line Payback	19.15	14.95	years
Year-1 ROI	6.3%	5.7%	-
IRR	0.7%	3.3%	-
20-year Cash Flow	$6,805	$21,836	-

Appendix 1:
Equipment Specifications

GE
Lighting

Refit Solutions from GE

Application illustration only, subject lamps not used in photo.

Integrated LED Tubes - 2, 3 and 4 foot - Improved Lumens

Convert your existing linear fluorescent fixture to LED lighting without needing a comprehensive reinstall. LED tubes are ideal for those seeking high energy savings with minimal installation time. Each LED tube is operated by an internal GE Lightech™ driver. GE integrated LED tubes run on electronic T8 instant-start or programmed start ballasts.

FEATURES

- 2', 3' & 4' tubes
- 950 – 3,050 lumens
- >100 total system lumens per watt (LPW)
- Available in 3000K, 3500K, 4000K, and 5000K color temperatures
- 50,000-hour rated life
- Dimmable
- DLC listed (2ft. and 4ft.)
- UL and cUL listed
  – in compliance with UL 1598 certification
- Open or Enclosed Fixtures
- 5 year limited warranty

BENEFITS

- Fast and easy LED upgrade
- Low energy LFL replacement
- 66% longer life than LFL (50,000 vs. 30,000 hours)
- Better quality of light
  - no UV
  - instant on
- Shatter resistant
  - prevents breakage and downtime
- Easy disposal, non-hazardous waste

To learn more about saving money and energy, go to: **gelighting.com/ThinkLED**

When you Think LED lighting, Think GE.

ecomagination℠

imagination at work

Product Specifications

Integrated Refit LED Tubes

GE DLC Listed Code	Description	Bulb Shape	Base	Low BF Watts	Normal BF Watts	High BF Watts	Case Qty	Length (In)	Low BF Intital Lumens	Normal BF Initial Lumens	High BF Initial Lumens	Color Temp (°K)	CRI	Rated Life (L70)	DLC Listed
2ft LED Tube															
31557	LED9ET8/2/830	T8	Med Bi-Pin(G13)	8	9	13	25	24"	950	1100	1600	3000	80	50,000	Yes
26635	LED9ET8/2/835	T8	Med Bi-Pin(G13)	8	9	13	25	24"	950	1100	1600	3500	80	50,000	Yes
26648	LED9ET8/2/840	T8	Med Bi-Pin (G13)	8	9	13	25	24"	950	1100	1600	4000	80	50,000	Yes
26676	LED9ET8/2/850	T8	Med Bi-Pin(G13)	8	9	13	25	24"	950	1100	1600	5000	80	50,000	Yes
3ft LED Tube															
31554	LED12ET8/3/830	T8	Med Bi-Pin(G13)	10	12	16	25	36"	1150	1350	1800	3000	80	50,000	-
26544	LED12ET8/3/835	T8	Med Bi-Pin(G13)	10	12	16	25	36"	1200	1400	1900	3500	80	50,000	-
26625	LED12ET8/3/840	T8	Med Bi-Pin (G13)	10	12	16	25	36"	1200	1400	1900	4000	80	50,000	-
26627	LED12ET8/3/850	T8	Med Bi-Pin(G13)	10	12	16	25	36"	1250	1500	2000	5000	80	50,000	-
4ft LED Tube															
61218	LED12ET8/4/830	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1350	1550	2050	3000	80	50,000	Yes
61223	LED12ET8/4/835	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1400	1600	2150	3500	80	50,000	Yes
61271	LED12ET8/4/840	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1400	1600	2150	4000	80	50,000	Yes
61327	LED12ET8/4/850	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1500	1700	2250	5000	80	50,000	Yes
61329	LED12ET8/4/865	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1400	1600	2150	6500	80	50,000	Yes
62339	LED15ET8/4/830	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1650	1850	2450	3000	80	50,000	Yes
62401	LED15ET8/4/835	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1750	1950	2600	3500	80	50,000	Yes
62402	LED15ET8/4/840	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1750	1950	2600	4000	80	50,000	Yes
62409	LED15ET8/4/850	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1800	2050	2700	5000	80	50,000	Yes
62410	LED15ET8/4/865	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1750	1950	2600	6500	80	50,000	Yes
31550	LED18ET8/4/830	T8	Med Bi-Pin(G13)	15	18	23	25	48"	1950	2150	2850	3000	80	50,000	Yes
93133	LED18ET8/4/835	T8	Med Bi-Pin (G13)	15	18	23	25	48"	2050	2250	3000	3500	80	50,000	Yes
93135	LED18ET8/4/840	T8	Med Bi-Pin(G13)	15	18	23	25	48"	2050	2250	3000	4000	80	50,000	Yes
93140	LED18ET8/4/850	T8	Med Bi-Pin(G13)	15	18	23	25	48"	2100	2350	3100	5000	80	50,000	Yes

System Watts - Refit LED Tubes

Ballast Factor	LED18ET8/4/xxx Rated Lumens	LED Approx. System Watts per tube	F32T8 Approx. System Watts per lamp
L (232MAX-G-L)	2050	17	25
N (232MAX-G-N)	2250	20	28
H (232MAX-G-N	3000	27	37

Lumen and wattage numbers above are approximations that can be used for estimates only.
LED System Watts - Add 10%-12% to LED Tube wattage for driver losses.

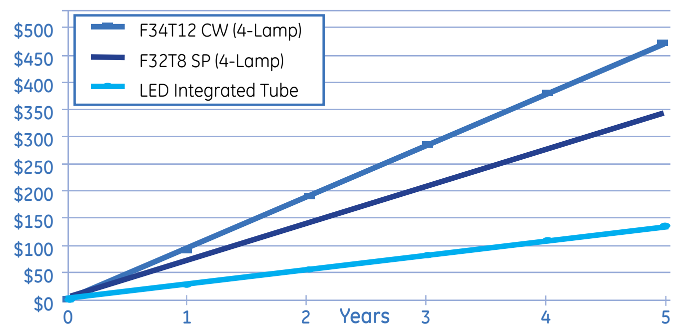
Savings Breakdown

Save 66% compared to standard T8 (4-lamp) light fixtures over a five-year period.

Provides 4400 lumens at 36W vs. 6600 lumens at 148W in a 4 lamp T12 system.

Check ballast compatibility at **www.gelighting.com/LEDTUBES-ballast-compatibility**

Cumulative Energy Costs - Cumulative Costs



Savings calculations are based on energy costs using $0.11 per kWh and 16 hours of daily operation.

ecomagination[SM]

Product is compliant with material restriction requirements of RoHS

www.gelighting.com

LEDL029 (Rev 5/27/16)

Series SKD
2"W Low Profile LED Surface Mount

FEATURES & SPECIFICATIONS

INTENDED USE
Full body micro silhouette makes a bold statement with a minimal design in brushed nickel powder coated finish (consult factory for other finishes). Scaled to the LED module the matte white diffuser surrounds the LEDs for soft lighting. Brushed nickel fixture can be surface mounted on wall or ceiling or pendant mounted with specially engineering cable mounting kit.

SIZE L x W x D in inches
- 22.5" or 46" or 92"L x 2"W x 2.6"D
- 22.5" or 46" or 92"L x 3"W x 3"D

MATERIALS & FEATURES
- Fully assembled housing is formed and welded, 22 gauge steel, chemically treated to resist corrosion and enhance paint adhesion
- Available in brushed nickel. Consult for other finishes
- Available with smooth frosted lens
- Clean body - No knock-outs on sides or ends
- Knock-outs on back accept standard electrical fittings (by others) Consult factory for other locations
- Dimming ballast options available (consult factory for availability and system compatibility)

MOUNTING
Surface mount or Pendant mount.
Horizontal or Vertical.

TYPICAL OPTIONS AND ACCESSORIES
Whips, hanging kits, and cord sets. See options page at the end of the T02Strip section, or contact factory for more details.

ACCESSORIES
SKD-HC301WH - 5'cable kit w/white canopy*
SKD-HC301BN - - 5'cable kit w/brushed nickel*
SKD-HC501BN - 4' Cable Mounting Kit*

*Includes canopy for cable only and a canopy for cable & power chord.

ORDERING INFORMATION

Example: **SKDFR24LE12W1200LDMV40KWH**

2FT - STANDARD

SKD | FR | 24L | E12W1200L | DMV | 40K | WH | (Options)

Series
SKD Low Profile LED Surface Mount 2" Width Body

Lens
FR Frosted Smooth

Width
24L 22.5"

Wattage and Lumen
E12W1200L 12 System Watts, 1200 Delivered Lumens

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture

30K	3000K
35K	3500K
40K	4000K
50K	5000K

Finish

WH	White
BN	Brushed Nickel
BK	Black
BZ	Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

2FT - HIGH OUTPUT

SKD | FR | 24L | H18W1750L | DMV | 40K | WH | (Options)

Series
SKD Low Profile LED Surface Mount 2" Width Body

Lens
FR Frosted Smooth

Width
24L 24"

Wattage and Lumen
H18W1750L 18 System Watts, 1750 Delivered Lumens

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture

30K	3000K
35K	3500K
40K	4000K
50K	5000K

Finish

WH	White
BN	Brushed Nickel
BK	Black
BZ	Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

SKD-HC301WH - 5'cable kit w/white canopy*
SKD-HC301BN - - 5'cable kit w/brushed nickel*
SKD-HC501BN - 4' Cable Mounting Kit*
*Includes canopy for cable only and a canopy for cable & power chord.

Series SKD

3"W Low Profile LED Surface Mount

PL&T

4FT - STANDARD

Example: **SKDWBMW48LE48W4800LDMV40KBN**

SKDWB | MW | 48L | E48W4800L | DMV | 40K | BN |

Series

SKDWB
Low Profile LED
Surface Mount
3" Width Body

Lens

MW	White Lens
FR	Frosted Lens

Size

48L	46"

Wattage and Lumen

E32W3450L	32 System Watts, 3450 Delivered Lumens
E48W4800L	48 System Watts, 4800 Delivered Lumens
E57W5400L	57 System Watts, 5400 Delivered Lumens

Driver

DMV	0-10V Dimming *Field installed-Dimming Wire
DMVFID	0-10V Dimming *Factory installed-Dimming Wire

Color Temperture

30K	3000K
35K	3500K
40K	4000K
50K	5000K

Finish

WH	White
BN	Brushed Nickel
BK	Black
BZ	Bronze

Options

WP	6 ft. 3 wire 18 gauge whip
CS	8ft. 3/18 3 prong (5-15P) cord & plug

4FT - HIGH OUTPUT

SKDWB | MW | 48L | R72W7000L | DMV | 40K | BN |

Series

SKDWB
Low Profile LED
Surface Mount
3" Width Body

Lens

MW	White Lens
FR	Frosted Lens

Size

48L	46"

Wattage and Lumen

R72W7000L	72 System Watts, 7000 Delivered Lumens

Driver

DMV	0-10V Dimming *Field installed-Dimming Wire
DMVFID	0-10V Dimming *Factory installed-Dimming Wire

Color Temperture

30K	3000K
35K	3500K
40K	4000K
50K	5000K

Finish

WH	White
BN	Brushed Nickel
BK	Black
BZ	Bronze

Options

WP	6 ft. 3 wire 18 gauge whip
CS	8ft. 3/18 3 prong (5-15P) cord & plug

8FT - STANDARD

SKDWB | MW | 96L | E114W10800L | DMV | 40K | BN |

Series

SKDWB
Low Profile LED
Surface Mount
3" Width Body

Lens

MW	White Lens
FR	Frosted Lens

Size

96L	92"

Wattage and Lumen

H80W8000L	80 System Watts, 8000 Delivered Lumens
E114W10800L	114 System Watts, 10800 Delivered Lumens

Driver

DMV	0-10V Dimming *Field installed-Dimming Wire
DMVFID	0-10V Dimming *Factory installed-Dimming Wire

Color Temperture

30K	3000K
35K	3500K
40K	4000K
50K	5000K

Finish

WH	White
BN	Brushed Nickel
BK	Black
BZ	Bronze

Options

WP	6 ft. 3 wire 18 gauge whip
CS	8ft. 3/18 3 prong (5-15P) cord & plug

8FT - HIGH OUTPUT

SKDWB | MW | 96L | R144W14000L | DMV | 40K | BN |

Series

SKDWB
Low Profile LED
Surface Mount
3" Width Body

Lens

MW	White Lens
FR	Frosted Lens

Size

96L	92"

Wattage and Lumen

R144W14000L	144 System Watts, 14000 Delivered Lumens

Driver

DMV	0-10V Dimming *Field installed-Dimming Wire
DMVFID	0-10V Dimming *Factory installed-Dimming Wire

Color Temperture

30K	3000K
35K	3500K
40K	4000K
50K	5000K

Finish

WH	White
BN	Brushed Nickel
BK	Black
BZ	Bronze

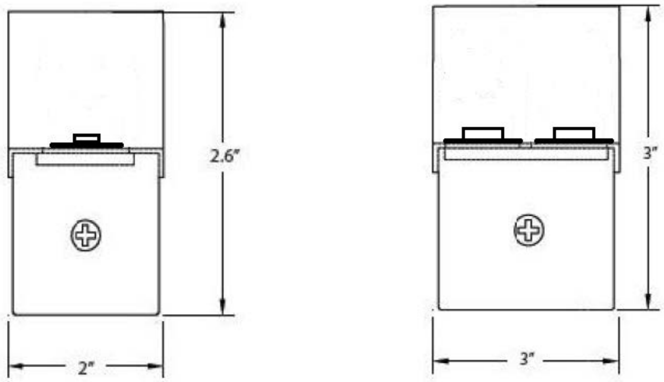
Options

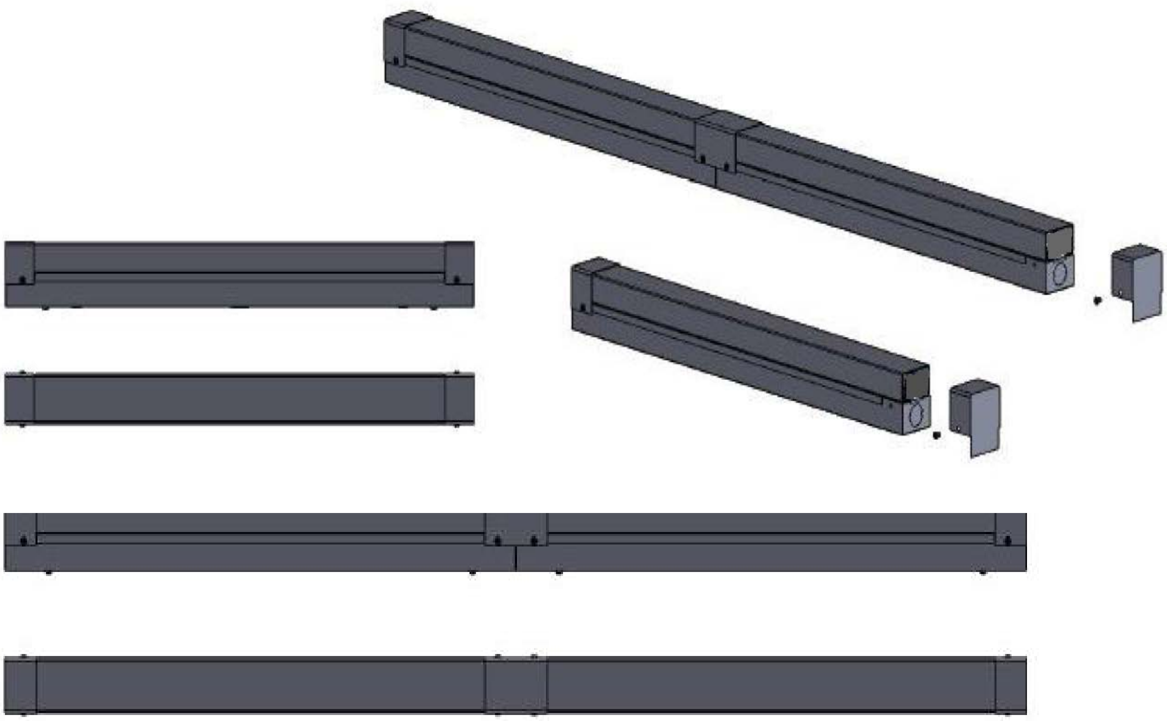
WP	6 ft. 3 wire 18 gauge whip
CS	8ft. 3/18 3 prong (5-15P) cord & plug

C ETL LISTED US
Intertek

DIMENSIONS

All dimensions are inches.
Specifications subject to change without notice.





C ETL US LISTED Intertek

9W LED Lamp Replacement

Model # B7A19A60WUL38 Store SKU #1002861726

Best Seller

EcoSmart >

60-Watt Equivalent A19 Non-Dimmable LED Light Bulb Daylight (8-Pack)

★★★★½ (3029) Write a Review Questions & Answers (22)

- Daylight color temperature provides stimulating, cool light
- Ideal for indoor/covered outdoor use and enclosed fixtures
- $62 estimated lifetime energy savings per bulb

Includes 8 bulbs ($1.35 /bulb)

$10.78

Save up to $100* on your qualifying purchase.
Apply for a Home Depot Consumer Card

Number of Bulbs Included: **8**

1 PACK | 4 PACK | 8 PACK

Exterior LED Parking and Street Light Fixture

ACUITY AMERICAN ELECTRIC

LED Parking Lot Light Fixture, 4000K Color Temperature, 120 to 277VAC, Arm Mount Type, 6101 lm

Item # **53XH17** Mfr. Model # **ATBS G MVOLT R3** Catalog Page # **455** UNSPSC # **39111605**

Clearance Price

$364.50 / each

~~Web Price $405.00~~

1 **Add to Cart**

+ Add to List |

Shipping Pickup

Expected to arrive **Mon. Jun 15.**

Ship To 80201 (Change)

Shipping Weight **14.5 lbs.**

Country of Origin **Mexico** | *Country of Origin is subject to change.*

Note: Product availability is real-time updated and adjusted continuously. The product will be reserved for you when you complete your order. ***More***

Technical Specs

Item	Parking Lot Light Fixture	Lumens per Watt	122
Mount Type	Arm	Socket Type	None
Lumens	6101 lm	Standards	CSA
Fixture Wattage	50W	Warranty	5 yr.
Light Distribution Shape	Type III	Fixture Lumens Range	6001 lm and Greater
LED Replacement For	100 to 200W HPS/MH	Wattage Range	41 to 100W
Fixture Sensor Type	Photocell Receptacle	Fixture Rated Life	100,000 hr.
Light Technology	LED	Fixture Height	4-1/2"
Color Temperature	4000K	Fixture Length	23-3/4"
Color Rendering Index	70	Fixture Temp. Range	-40 Degrees to 40 Degrees C
Voltage	120 to 277VAC	Fixture Width	11-1/4"
Fixture Housing Color	Gray	Green Environmental Attribute	Product Contributes To Reducing Energy Consumption
Fixture Housing Material	Die-Cast Aluminum	Green Certification or Other Recognition	DesignLights Consortium (DLC)(R) Listed
Fixture Lens Material	No Lens		

LED Flat Corn Lights

Applications

ELEDLIGHTS' Flat Corn Light LED Retrofit Light are an easy and economical way to convert your existing fixtures to energy-saving LED lighting technology. It can easily be installed and is rotatable to get precise angle in shoebox/parking lot lights, wall packs, canopy lights, street lights and more. This flat corn light will immediately reduce power consumption by more than 65% and outperforms other retrofit kits by a wide margin.

Features

- Direct replacement for metal halide
- E39 mogul base
- Easy installation
- Advanced heat dissipation
- Internal driver
- 180° beam angle
- 5000K cold white light
- 50,000-hour operating life
- DLC, UL certified
- 5 year warranty

Specifications

Specifications	115W	54W	27W
Light Output	13,500 lumens	6,600 lumens	3,300 lumens
Luminous Efficacy	118 lm/W	122 lm/W	122 lm/W
Power Consumption	115W	54W	27W
Average Lamp Life	50,000 hours	50,000 hours	50,000 hours
Color	Cold White: 5000K	Cold White: 5000K	Cold White: 5000K
Base Type	E39 - Mogul	E39 - Mogul	E26 - Edison
CRI	73	73	73
Reflector Beam Angle	180°	180°	180°
Dimensions	11.7" x 5.4" x 3.4"	11.7" x 5.4" x 3.4"	9.6" x 4.4" x 3.1"
Housing Material	Magnesium Alloy, Aluminum Heat Sink, and PC Cover		
Housing Color	Black and Silver	Black and Silver	Black and Silver
Number of LEDs	196	112	56
Certification	DLC, UL	DLC, UL	DLC, UL
Warranty	5 Years	5 Years	5 Years

7835 Wilkerson Ct, San Diego, CA 92111 • 858.581.0597 • 1610 Republic Road, Huntingdon Valley, PA 19006 • 215.355.7200
Email: lights@eledlights.com • www.eledlights.com

Smart Thermostats

Compare

More Options Available

Best Seller **Google** Nest Learning Thermostat 3rd Gen in Stainless Steel
Model# T3007ES
★★★★★ (10639)
$249.00
Limit 5 per order

✔ Free delivery
✔ 31 in stock at Santa Fe
Check nearby stores

Compare

More Options Available

Google Nest Thermostat E
Model# T4000ES
★★★★★ (3490)
BULK PRICE ELIGIBLE $169.00
Buy 2 or more $159.00

✔ Free delivery
✔ 8 in stock at Santa Fe
Check nearby stores

Compare

ecobee SmartThermostat with Voice Control
Model# EB-STATE5-01
★★★★★ (470)
$249.00

✔ Free delivery
✔ 8 in stock at Santa Fe
Check nearby stores

Compare

ecobee 3 Lite Smart Thermostat
Model# EB-STATE3LT-02
★★★★★ (2009)
$169.00
Get up to $150 in Rebates

✘ Delivery unavailable
✔ 2 in stock at Santa Fe
Check nearby stores

Instantaneous DHW Heaters

Model # POU 6T

EcoSmart >

6.5 kW Point of Use Electric Tankless Water Heater

★★★☆☆ (155) Write a Review Questions & Answers (7)

- Self-modulating technology
- Versatile to mount in different ways
- Intelligently control temperature from 80 to 140-degrees F

($169.00 /unit)

$169.00

Save up to $100 on your qualifying purchase.
Apply for a Home Depot Consumer Card

Flow Rate @ 35 F Rise (gallons/min): **1.27 gal (US)/min**

0.68 gal (US)/min | .78 gal (US)/min | 1.07 gal (US)/min | **1.27 gal (US)/min**

Controlled Power Cords and Plug-in Devices

Compare

TP-LINK 6-Outlet Wi-Fi Smart Power Strip
Model# HS300
★★★★★ (11)
$79.99

Compare

Vivitar Smart Home Wi-Fi Power Strip
Model# HA-1007-HD-DRP
★★★☆☆ (2)
$41.19

Compare

Globe Electric Wi-Fi Smart 4 ft. Cord 4-Outlet Surge Protector 2 USB Port Power Strip, No Hub Required and Voice Activated, White
Model# 50077

View the Globe Smart Home Collection

★★★★☆ (9)
$37.14

Compare

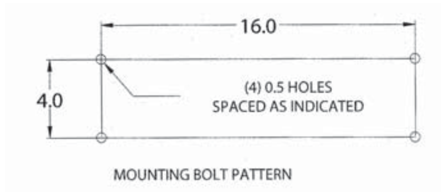
WireLogic Smart Surge Strip 216,000 Amp and 3240 Joules 10-Outlet - Black
Model# WLPOWER10
$129.99

Appendix 2:
Landing Lights Specifications

RBMI

Airport Rotating Beacon

MEDIUM INTENSITY



Compliance with Standards

FAA: L-801 AC 150/5345-12 (Current Edition)
ICAO: Annex 14, para. 5.3.3

Uses

L-801 beacons are designed primarily for night operation as identification and location markers for airports.

Features

- Patented belt-drive system eliminates the lubrication required by conventional gear-drive beacons. (U.S. Patent No. 5,339,224)
- Patented liquid-filled lamp connector eliminates the slip rings and brushes found on conventional beacons (U.S. Patent No. 5,816,678)
- Two 13,000 lumen, 150-watt pulse-start metal-halide lamps
- 12,000 hour typical lamp life (3 years)
- One clear lens and one aviation green lens
- No maintenance except lamp replacement
- All moving parts are permanently lubricated
- Impedance-protected motor eliminates burn outs
- 12 rpm rotation, 24 flashes per minute
- Lamps preset at 5° above horizontal, adjustable
- Weatherproof steel cabinet with powder-coated international orange finish
- Optional photocell and/or tell-tale relay
- Mountable on a Hali-Brite Tipdown Pole. See catalog sheet 2035 for photo and details.
- Electrical Power – The beacon operates on 120 VAC, 60 Hz or 220-240 VAC, 50/60 Hz
- Power Consumption–Class I: 395W; Class II: 795W
- Made in the USA and ETL certified by Hali-Brite, Inc., Crosby, MN

Operating Conditions

Temperature:	Class I: -22 °F to +131 °F (-30 °C to +55 °C) Class II: -67 °F to +131 °F (-55 °C to +55 °C)
Wind:	Velocities up to 100 mph (161 kph)

Ordering Code

44A4837- 1 0

Type
0 = Airport

Style
1 = Standard Base, Belt-Driven

Power
0 = 120 VAC, 60 Hz, without heater, Class I
1 = 220-240 VAC, 50 Hz, without heater, Class I
2 = 120 VAC, 60 Hz, with heater, Class II
3 = 220-240 VAC, 50 Hz, with heater, Class II
4 = 220-240 VAC, 60 Hz, without heater, Class I
5 = 220-240 VAC, 60 Hz, with heater, Class II

Notes
- 220-240 VAC must be single wire with neutral.
- Add tell-tale relay for monitoring (see options below).

Spare Components

Description	Part No.
Ballast Assembly 50 Hz	0200-0024
Ballast Assembly 60 Hz	0200-0023
Belt	0600-0003
Fuse, motor, 0.5 A	2300-0002
Fuse, lamp, 6.25 A	2300-0010
Lamp, 150 W pulse-start metal-halide	3400-0125
Lens, amber	2800-0025
Lens, clear	2800-0006
Lens, green	2800-0043
Lens clip	1500-0011

Optional Accessories

Description	Part No.
Tell-Tale Relay, 120 VAC	L801/802 T/T HBM 120
Tell-Tale Relay, 220/240 VAC	L801/802 T/T HBM 240
Tell-Tale Relay, 220/240 VAC, 50 Hz	L801/802 T/T 240/50
Tower Mounting Kit	4200-0000

Packaging

Cube Shipping Volume:	48 x 25 x 25 in (122 x 63.5 x 63.5 cm)
Weight:	110 lb (49.9 kg) - shipping 75 lb (34 kg) - unpackaged

ADB Airfield Solutions
Leuvensesteenweg 585
B-1930 Zaventem
Belgium
Telephone: +32 (0)2 722.17.11
www.adb-air.com

ADB Airfield Solutions, LLC
977 Gahanna Parkway
Columbus, OH 43230
USA
Telephone: +1 614.861.1304
+1 800.545.4157

Product specifications may be subject to change, and specifications listed here are not binding. Confirm current specifications at time of order.

Appendix 3:
HVAC Equipment Specifications

NEW!

VRV IV

Air-Cooled Heat Pump
RXYQ_TATJU / RXYQ_TAYDU

Commercial.
Renovation.
New construction.

Daikin's VRV IV systems integrate advanced technology to provide comfort control with high energy efficiency and reliability. VRV IV provides heating and cooling solutions for multi-family residential to large commercial applications. Daikin VRV IV is the first variable refrigerant flow (VRF) system assembled in North America.

Main features and benefits:

- Total comfort solution for heating, cooling, ventilation and controls.
- Redesigned and optimized for low total Life Cycle Cost (LCC).
- Available in large capacity single modules up to 14 tons and systems up to 34 tons allowing for a more flexible system design.
- Year-round comfort and energy efficiency delivered by combining VRV and VRT technologies.
- High energy efficiency with IEER values up to 27.3.
- Integrated inverter technology delivers high efficiency during part load conditions and provides precise individual zone control.
- Design flexibility with long piping lengths up to 3,280 ft. total, and up to 100 ft. vertical separation between indoor units.
- Corrosion resistant 1000 hr. salt-spray tested Daikin PE blue fin heat exchanger.
- Reduced commissioning time with VRV configuration software and Graphical User Interface (GUI), as compared to VRV III.
- VRV IV takes advantage of Daikin's unique zone and centralized controls that are optimized for the specific needs of North America.
- Outstanding 10-year limited parts warranty* as standard.

Additional information

Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer.

FIND OUT MORE ABOUT DAIKIN VRV.

*Complete warranty details available from your local distributor, manufacturer's representative, www.daikincomfort.com or www.daikinac.com.

VRV IV Operations

Variable Refrigerant Temperature

Lower capacity is required to cool and heat a building during mid-season.

A VRV system adapts to the required changes in capacity by varying the refrigerant volume. This results in an increase in efficiency at part load operation.

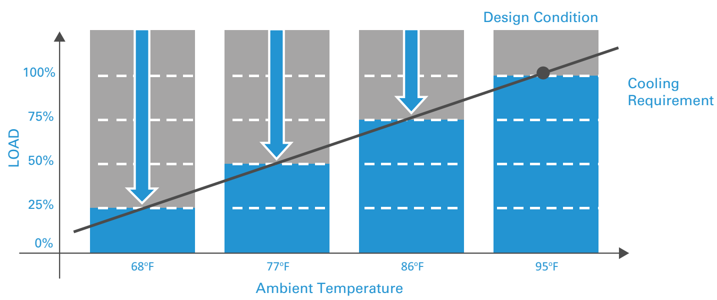
+

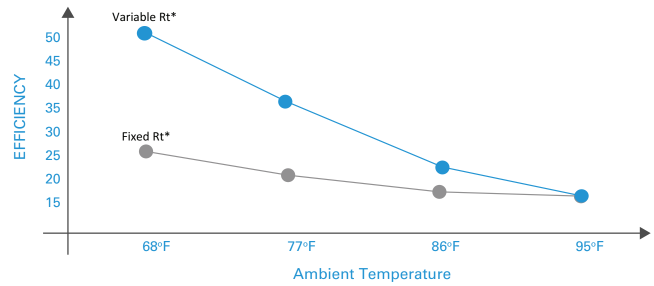
The efficiency of the VRV IV system is further increased by adjusting the refrigerant temperature depending on space load and weather conditions.

Up to 28% Improved Seasonal Cooling Efficiency vs. VRV III

VRV IV VRT Advantages

The graphs below are intended only to depict how new Daikin VRV IV efficiency is increased by using VRT.





*Data based on RXYQ96 outdoor unit only with 100% connection ratio.

Technical Data for VRV IV Heat Pump Outdoor Units

			6 Ton	8 Ton	10 Ton	12 Ton	14 Ton
Model	208-230V/3Ph/60Hz		RXYQ72TATJU	RXYQ96TATJU	RXYQ120TATJU	RXYQ144TATJU	RXYQ168TATJU
	460V/3Ph/60Hz		RXYQ72TAYDU	RXYQ96TAYDU	RXYQ120TAYDU	RXYQ144TAYDU	RXYQ168TAYDU
Performance	Rated Cooling Capacity	Btu/h	69,000	92,000	114,000	138,000	160,000
	Rated Heating Capacity	Btu/h	73,000	103,000	129,000	154,000	176,000
	Operation Range - Cooling	°F DB	10*-122	10*-122	10*-122	10*-122	10*-122
	Operation Range - Heating	°F WB	-4 - 60	-4 - 60	-4 - 60	-4 - 60	-4 - 60
	Sound Pressure	dB(A)	58	61	61	64	65
	IEER (Ducted / Non-Ducted)		20.7 / 25.9	22.5 / 27.3	22 / 25.4	22.6 / 24.8	19.8 / 22.6
	Airflow	cfm	5,544	5,827	6,286	8,228	8,228
Refrigerant Piping	Vertical Pipe Length Above	ft.	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)
	Vertical Pipe Length Below	ft.	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)
	Vertical Pipe Length Between IDU	ft.	100	100	100	100	100
	Actual Pipe Length	ft.	540	540	540	540	540
	Equivalent Pipe Length	ft.	620	620	620	620	620
	Total Pipe Length	ft.	3,280	3,280	3,280	3,280	3,280
Unit	Weight (RXYQ_TAT / RXYQ_TAY)	lbs.	435 / 451	525 / 553	528 / 556	695 / 709	
	Dimensions (H x W x D)	in.	66-11/16 x 36-11/16 x 30-3/16	66-11/16 x 48-7/8 x 30-3/16			

			16 Ton	18 Ton	20 Ton	22 Ton	24 Ton
Model	208-230V/3Ph/60Hz		RXYQ192TATJU	RXYQ216TATJU	RXYQ240TATJU	RXYQ264TATJU	RXYQ288TATJU
	460V/3Ph/60Hz		RXYQ192TAYDU	RXYQ216TAYDU	RXYQ240TAYDU	RXYQ264TAYDU	RXYQ288TAYDU
	Combination		1 x RXYQ120T 1 x RXYQ72T	1 x RXYQ120T 1 x RXYQ96T	2 x RXYQ120T	1 x RXYQ144T 1 x RXYQ120T	2 x RXYQ144T
Performance	Rated Cooling Capacity	Btu/h	184,000	206,000	228,000	250,000	274,000
	Rated Heating Capacity	Btu/h	206,000	230,000	256,000	282,000	308,000
	Operation Range - Cooling	°F DB	23-122	23-122	23-122	23-122	23-122
	Operation Range - Heating	°F WB	-4 - 60	-4 - 60	-4 - 60	-4 - 60	-4 - 60
	Sound Pressure	dB(A)	63	64	64	66	67
	IEER (Ducted/Non-Ducted)		21.2 / 22.2	21.1 / 20.5	20.9 / 20.8	19.6 / 20.3	19.6 / 20.1
	Airflow	cfm	5,544 + 6,286	5,827 + 6,286	6,286 + 6,286	6,286 + 8,228	8,228 + 8,228
Refrigerant Piping	Vertical Pipe Length Above	ft.	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)
	Vertical Pipe Length Below	ft.	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)
	Vertical Pipe Length Between IDU	ft.	100	100	100	100	100
	Actual Pipe Length	ft.	540	540	540	540	540
	Equivalent Pipe Length	ft.	620	620	620	620	620
	Total Pipe Length	ft.	3,280	3,280	3,280	3,280	3,280
Unit	Weight (RXYQ_TAT / RXYQ_TAY)	lbs.	435 + 528 / 451 + 556	525 + 528 / 553 + 556	528 + 528 / 556 + 556	528 + 695 / 556 + 709	695 + 695 / 709 + 709
	Dimensions (H x W x D)	in.	(66-11/16 x 48-7/8 x 30-3/16) + (66-11/16 x 36-11/16 x 30-3/16)	(66-11/16 x 48-7/8 x 30-3/16) x 2			

			26 Ton	28 Ton	30 Ton	32 Ton	34 Ton
Model	208-230V/3Ph/60Hz		RXYQ312TATJU	RXYQ336TATJU	RXYQ360TATJU	RXYQ384TATJU	RXYQ408TATJU
	460V/3Ph/60Hz		RXYQ312TAYDU	RXYQ336TAYDU	RXYQ360TAYDU	RXYQ384TAYDU	RXYQ408TAYDU
	Combination		1 x RXYQ168T 1 x RXYQ144T	2 x RXYQ168T	3 x RXYQ120T	1 x RXYQ168T 1 x RXYQ120T 1 x RXYQ96T	1 x RXYQ168T 1 x RXYQ144T 1 x RXYQ96T
Performance	Rated Cooling Capacity	Btu/h	296,000	312,000	334,000	352,000	372,000
	Rated Heating Capacity	Btu/h	334,000	344,000	372,000	400,000	435,000
	Operation Range - Cooling	°F DB	23-122	23-122	23-122	23-122	23-122
	Operation Range - Heating	°F WB	-4 - 60	-4 - 60	-4 - 60	-4 - 60	-4 - 60
	Sound Pressure	dB(A)	68	68	66	68	68
	IEER (Ducted/Non-Ducted)		18.8 / 19.9	18.5 / 20.6	18.5 / 19.4	18.5 / 21.1	19.0 / 21.1
	Airflow	cfm	8,228 + 8,228	8,228 + 8,228	6,286 + 6,286 + 6,286	5,827 + 6,286 + 8,228	6,286 + 6,286 + 8,228
Refrigerant Piping	Vertical Pipe Length Above	ft.	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)
	Vertical Pipe Length Below	ft.	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295/w/outdoor setting)	130 (295 w/outdoor setting)
	Vertical Pipe Length Between IDU	ft.	100	100	100	100	100
	Actual Pipe Length	ft.	540	540	540	540	540
	Equivalent Pipe Length	ft.	620	620	620	620	620
	Total Pipe Length	ft.	3,280	3,280	3,280	3,280	3,280
Unit	Weight (RXYQ_TAT / RXYQ_TAY)	lbs.	695 + 695 / 709 +709	695 + 695 / 709 +709	528 + 528 + 528 / 525 +528 + 695	525 + 528 + 695 / 553 + 556 + 709	525 + 695 + 695 / 553 + 709 + 709
	Dimensions (H x W x D)	in.	(66-11/16 x 48-7/8 x 30-3/16) x 2		(66-11/16 x 48-7/8 x 30-3/16) x 3		

For all equipment installation and application limitations please refer to the specific Engineering Data Books. * Application rules apply.

Appendix C

FORECAST APPROVAL LETTER

CHANDLER
MUNICIPAL AIRPORT
CHD

CHANDLER
arizona

U.S. Department
of Transportation
Federal Aviation Administration

Federal Aviation Administration
Phoenix Airports District Office

3800 N Central Ave
Suite 1025
Phoenix, AZ 85012

May 5, 2020

Chris Andres
Airport Administrator
Chandler Municipal Airport
2380 S. Stinson Way
Chandler, AZ 85286

Dear Mr. Andres:

Chandler Municipal Airport (CHD)
Aviation Activity Forecast Approval

The Federal Aviation Administration (FAA) has reviewed the aviation forecast for Chandler Municipal Airport (CHD) submitted March 30, 2020. The FAA approves both this forecast and the use of B-II for both the existing and future critical design aircraft for airport planning purposes, including Airport Layout Plan development.

The forecast was developed using current data and appropriate methodologies, therefore the forecast is approved for planning purposes at CHD. 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 602-792-1073.

Sincerely,

Kyler Erhard

Kyler Erhard
Lead Program Manager

Appendix D

AIRPORT LAYOUT PLANS

CHANDLER arizona

CHANDLER arizona

Appendix D
AIRPORT LAYOUT PLAN

As part of this master plan, the Federal Aviation Administration (FAA) requires the development of Airport Layout Plan (ALP) drawings detailing specific parts of the 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 of the airport. The ALP drawings will be reviewed by the FAA to be sure all applicable federal regulations are met. The FAA will use the ALP as the basis for justification for funding decisions.

It should be noted that FAA require that any changes to the airfield (i.e., runway and taxiway system, navigational aids, etc.) 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 upon 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 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.

2) 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.

3) 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.

4) The ALP can be a working tool for the airport sponsor, including its development and maintenance staff.

5) An approved ALP is necessary for the airport to receive financial assistance under the terms of the *Airport and Airway Improvement Act of 1982*, as amended, and to be able to impose and use Passenger Facility Charges. An airport must keep its ALP current and follow that plan because those are grant assurance requirements of the Airport Improvement Program (AIP) and previous airport development programs, including the 1970 *Airport Development Aid Program* (ADAP) and *Federal Aid Airports Program* (FAAP) of 1946, as amended.

The FAA requires that any planned changes to the airfield (i.e., runway and taxiway system, etc.) be represented on the drawings. However, the ALP drawing set is not intended to provide design engineering accuracy.

AIRPORT LAYOUT PLAN DRAWING SET

The ALP drawing set for the Airport Master Plan 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 Airport Master Plan.

AIRPORT LAYOUT PLAN DRAWING

An official ALP drawing has been developed for Chandler Municipal Airport, a draft of which is included in this appendix. The ALP drawing graphically presents the existing and future airport facilities and layout plan. The ALP drawing includes, but is not limited to, such elements as the physical airport features, wind data tabulation, location of airfield facilities (i.e., runways, taxiways, navigational aids), and landside development. Also presented on the ALP 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 subsequent planning and design efforts, and can be easily updated in the future to reflect new development and more detail concerning existing conditions as made available through design surveys.

TERMINAL AREA PLAN DRAWING

The terminal area plan drawing presents a large-scale depiction of areas with significant terminal facility development. This drawing is an enlargement of a portion of the ALP. The drawing includes the landside facility areas as well as the supporting infrastructure, including access roads and parking facilities. The terminal area drawings include a listing of all airport buildings and identifies the aircraft apron areas.

FAR PART 77 AIRPORT AIRSPACE DRAWING

Federal Aviation Regulation (F.A.R.) Part 77, *Objects Affecting Navigable Airspace*, was established for use by local authorities to control the height of objects near airports. The FAR Part 77 Airport Airspace drawing included in this Airport Master Plan is a graphic depiction of this regulatory criterion. The FAR Part 77 Airport Airspace drawing is a tool to aid local authorities in determining if proposed development could present a hazard to aircraft using the airport. The FAR Part 77 Airport Airspace drawing can be a critical tool for the airport sponsor's use in reviewing proposed development near the airport.

The FAR Part 77 Airport 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 FAR Part 77 imaginary surfaces include the primary surface, approach surface, transitional surface, horizontal surface, and conical surface.

The airport sponsor should do all in their power to ensure development stays below the FAR Part 77 surfaces to protect the role of the airport. The drawing includes a table detailing the penetrations to any of the FAR Part 77 surfaces. A recommended action or disposition is also presented for each penetration. This drawing is based on the planned future condition of the airport.

Penetrations of the FAR Part 77 surfaces indicate an obstruction. Once an obstruction is identified, the FAA determines if the obstruction is a hazard to air navigation. When an obstruction is determined to be a hazard, a variety of actions can be taken to mitigate the hazard. The table included on the drawing presents a recommended action or disposition; however, the FAA is responsible to make the final determination as to what course of action should be taken. Potential mitigating measures include removing the hazard, lowering the hazard, adding an obstruction light, increasing instrument approach visibility minimums, or displacing runway landing thresholds. The following discussion will describe those surfaces that make up the recommended FAR Part 77 surfaces.

Primary Surface: The primary surface is longitudinally centered on the runways and extends 200 feet beyond each runway end. The elevation of any point on the primary surface is the same as the elevation along the nearest associated point on the runway centerline. The primary surface for Runway 4R-22L is 500 feet wide as centered on the runway and 250 feet wide for Runway 4L-22R. If non-precision instrument approaches are established to either end of Runway 4L-22R in the future, the primary surface will increase to 500 feet wide.

Approach Surface: An approach surface is also established for each runway end. The approach surface begins at the end of the primary surface, extends upward and outward, and is centered along an extended runway centerline. The dimensions of the approach surface leading to each runway is based upon the type of instrument approach available (instrument or visual) or planned.

With visibility minimums of not lower than one-mile for Runway 4R, the approach surface extends a horizontal distance of 10,000 feet at a 34:1 slope. The outer width of the approach surface is 3,500 feet. Runways 4L, 22R, and 22L are visual-only runways currently so the approach surfaces have an outer width of 1,500 feet and extend a horizontal distance of 5,000 feet at a 20:1 slope. If instrument approaches of one-mile or greater minimums are established to these runways, the approach surface will match that of Runway 4R.

Transitional Surface: Each runway has a transitional surface that begins at the outside edge of the primary surface at the same elevation as the runway. The transitional surface rises at a slope of 7:1, up to a height 150 feet above the highest runway elevation. At that point, the horizontal surface begins where the transitional surface ends.

Horizontal Surface: The horizontal surface is established at 150 feet above the highest elevation of the runway surface. Having no slope, the horizontal surface connects the transitional and approach surfaces to the conical surface at a distance of 10,000 feet from the end of the primary surfaces of each runway.

Conical Surface: The conical surface begins at the outer edge of the horizontal surface. The conical surface then continues for an additional 4,000 feet horizontally at a slope of 20:1. Therefore, at 4,000 feet from the horizontal surface, the elevation of the conical surface is 350 feet above the highest airport elevation.

INNER APPROACH SURFACE DRAWING

The inner approach surface drawing provides greater detail of penetrations to the approach surface and the obstacle clearance surface (OCS) within a few thousand feet of the runway end. Any penetrations are documented in the obstruction table. The obstruction table includes a description of the object, its top elevation, the depth of penetration, and a recommended disposition to mitigate the penetration.

DEPARTURE SURFACE DRAWING

For primary runways supporting instrument departures, a separate drawing depicting the departure surface is required. The departure surface, when clear, allows pilots to follow standard departure procedures. The departure surface emanates from the departure end of the runway to a distance of 10,200 feet. The inner width is 1,000 feet and the outer width is 6,466 feet. The slope of the departure surface is 40:1.

Obstacles frequently penetrate the departure surface. Where object penetrations exist, the departure procedure can be adjusted by:

a) Non-standard climb rates, and/or
b) Non-standard (higher) departure minimums.

Therefore, it is important for the airport sponsor to identify and remove departure surface obstacles whenever possible in order to enhance takeoff operations at the airport. The airport sponsor should also prevent any new obstacles from developing.

AIRPORT LAND USE DRAWING

The objective of the airport 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, which 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.

EXHIBIT A - AIRPORT PROPERTY MAP

The airport property map provides a drawing depicting the airport property boundary, the various tracts of land that were acquired to develop the airport, the method of acquisition, and other information on the property under airport control that is 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.

AIRPORT LAYOUT PLAN

for the

CHANDLER
MUNICIPAL AIRPORT
CHD

Prepared for
the City of Chandler, Arizona

LOCATION MAP

NOT TO SCALE

VICINITY MAP

DRAWING INDEX

1. TITLE SHEET
2. AIRPORT DATA SHEET
3. AIRPORT LAYOUT PLAN DRAWING
4. AIRPORT AIRSPACE DRAWING
5. APPROACH PROFILES FOR RUNWAYS 4R-22L AND 4L-22R
6. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 4R
7. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 22L
8. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 4L-22R
9. DEPARTURE SURFACE DRAWING RUNWAY 4R-22L
10. DEPARTURE SURFACE DRAWING RUNWAY 4L-22R
11. TERMINAL AREA DRAWING - NORTH
12. TERMINAL AREA DRAWING - SOUTH
13. LAND USE DRAWING
14. EXHIBIT "A" AIRPORT PROPERTY INVENTORY MAP

Source: ESRI USA Counties 2013

COUNTY MAP

FOR APPROVAL BY

Digitally signed by Kevin Hartke
Date: 2021.09.15 14:24:33 -07'00'

Mayor ***Date***

NO.	REVISIONS	DATE	BY	APP'D.

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

CHANDLER MUNICIPAL AIRPORT (CHD)

TITLE SHEET

CHANDLER, ARIZONA

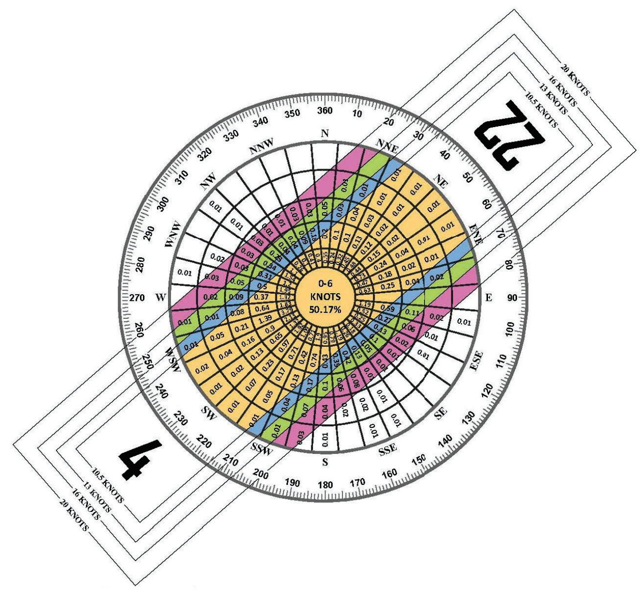
PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 SHEET 1 OF 14

Coffman Associates
Airport Consultants
www.coffmanassociates.com

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 4-22	94.97%	97.52%	99.21%	99.75%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Chandler Municipal Airport
Chandler, AZ

OBSERVATIONS:
50,436 All Weather Observations
Jan. 1, 2010 - Dec, 31 2019

RUNWAY DATA TABLE

		RUNWAY 4R-22L				RUNWAY 4L-22R			
		EXISITING		ULTIMATE		EXISITING		ULTIMATE	
RUNWAY IDENTIFICATION		4R	22L	4R	22L	4L	22R	4R	22L
RUNWAY DESIGN CODE (RDC)		B-II-5000		SAME		B-II-VIS		SAME	
APPROACH REFERENCE CODE (APRC)		B/II/5000		SAME		B/II/VIS		SAME	
DEPARTURE REFERENCE CODE (DPRC)		D/VI		SAME		D/VI		SAME	
RUNWAY SURFACE MATERIAL		ASPHALT		SAME		ASPHALT		SAME	
RUNWAY PAVEMENT STRENGTH WHEEL (IN THOUSAND LBS.)[1]		45(S)/85(D)/125(DT)/265(DDT)		SAME		22(S)/60(D)		SAME	
RUNWAY PAVEMENT STRENGTH PCN		20/F/D/X/T		SAME		3/F/D/Y/T		SAME	
RUNWAY PAVEMENT SURFACE TREATMENT		NONE		SAME		NONE		SAME	
RUNWAY EFFECTIVE GRADIENT		0.25%		SAME		1.32%		SAME	
RUNWAY WIND COVERAGE	10.5 knots	91.93%		SAME		88.15%		SAME	
	13 knots	95.13%		SAME		94.35%		SAME	
	16 knots	97.97%		SAME		96.22%		SAME	
RUNWAY DIMENSIONS (LENGTH X WIDTH)		6,827' x 150'		8,000' x150'		6,725' x 75'		SAME	
RUNWAY DISPLACED THRESHOLD ELEVATION (NAVD88)		NONE	NONE	SAME	SAME	NONE	NONE	SAME	SAME
RUNWAY SAFETY AREA DIMENSION DESIGN STANDARD (WIDTH x LENGTH BEYOND END)		500' X 1,000'	500' X 1,000'	SAME	SAME	150' X 300'	150' X 300'	SAME	SAME
RUNWAY SAFETY AREA DIMENSION ACTUAL (WIDTH x LENGTH BEYOND END)		500' X 1,000'	500' X 1,000'	SAME	SAME	150' X 300'	150' X 300'	SAME	SAME
RUNWAY END COORDINATES	LAT	35°15'05.350"N	35°15'53.075"N	SAME	35°16'04.380"N	35°16'12.351"N	35°15'05.854"N	SAME	SAME
	LONG	115°56'53.178"W	113°55'54.961"W	SAME	113°55'44.860"W	113°56'09.762"W	113°56'09.800"W	SAME	SAME
DISPLACED THRESHOLD COORDINATES	LAT	NA	NA	SAME	SAME	NA	NA	SAME	SAME
	LONG	NA	NA	SAME	SAME	NA	NA	SAME	SAME
RUNWAY LIGHTING TYPE		MIRL		SAME		MIRL		SAME	
APPROACH RUNWAY PROTECTION ZONE DIMENSIONS		500' X 1,010' X 1,700'	500' X 1,010' X 1,700'	1,000' X 1,510' X 1,700'	1,000' X 1,510' X 1,700'	500' X 700' X 1,000'	500' X 700' X 1,000'	SAME	SAME
DEPARTURE RUNWAY PROTECTION ZONE DIMENSIONS		500' X 1,010' X 1,700'	500' X 1,010' X 1,700'	SAME	SAME	500' X 700' X 1,000'	500' X 700' X 1,000'	SAME	SAME
RUNWAY MARKING TYPE		NON-PREC	NON-PREC	SAME	SAME	BASIC	BASIC	NON-PREC	NON-PREC
14 CFR PART 77 APPROACH SLOPE		34:1	34:1	SAME	SAME	20:1	20:1	34:1	34:1
14 CFR PART 77 APPROACH TYPE		NON-PREC	NON-PREC	SAME	SAME	VSUAL	VSUAL	NON-PREC	NON-PREC
VISIBILITY MINIMUMS		≥1 MILE	≥1MILE	≥3/4 MILE	≥3/4 MILE	VISUAL	VISUAL	≥1 MILE	≥1 MILE
TYPE OF AERONAUTICAL SURVEY REQUIRED FOR APPROACH		NON-VERTICALLY GUIDED		SAME		NON-VERTICALLY GUIDED		SAME	
DEPARTURE SURFACE (YES/NO)		YES		SAME		YES		SAME	
RUNWAY OBJECT FREE AREA DIMENSION DESIGN STANDARD (WIDTH x LENGTH BEYOND END)		800' X1,000'	800' X1,000'	SAME	SAME	500' X 300'	500' X 300'	SAME	SAME
RUNWAY OBJECT FREE AREA DIMENSION ACTUAL (WIDTH x LENGTH BEYOND END)		800' X1,000'	800' X1,000'	SAME	SAME	500' X 300'	500' X 300'	SAME	SAME
RUNWAY OBSTACLE FREE ZONE DIMENSION DESIGN STANDARD (WIDTH x LENGTH BEYOND END)		400' X 200'	400' X 200'	SAME	SAME	400' X 200'	400' X 200'	SAME	SAME
RUNWAY OBSTACLE FREE ZONE DIMENSION ACTUAL (WIDTH x LENGTH BEYOND END)		400' X 200'	400' X 200'	SAME	SAME	400' X 200'	400' X 200'	SAME	SAME
OBSTACLE CLEARANCE SURFACE (OCS)		4	4	SAME	SAME	3	3	SAME	SAME
RUNWAY VISUAL AND INSTRUMENT NAVAIDS		PAPI-4	PAPI-4	SAME	SAME	PAPI-2	PAPI-2	SAME	SAME
		REILS	REILS	SAME	SAME	REILS	REILS	SAME	SAME
		VOR/DME,GPS	VOR/DME,GPS	SAME	SAME	NONE	NONE	GPS	GPS
		LIGHTED WIND CONES	LIGHTED WIND CONES	SAME	SAME	LIGHTED WIND CONES	LIGHTED WIND CONES	SAME	SAME
		ROTATING BEACON	ROTATING BEACON	SAME	SAME	ROTATING BEACON	ROTATING BEACON	SAME	SAME
TOUCHDOWN ZONE ELEVATION (TDZE)		3,411.4'	3,394.6'	SAME	3391.7'	3,360'	3448.8'	SAME	SAME
VERTICAL DATUM		NAVD88		SAME		NAVD88		SAME	
HORIZONTAL DATUM		NAD83		SAME		NAD83		SAME	

AIRPORT DATA

City: Chandler, Arizona		County: Maricopa	Owner: City of Chandler
Airport Name & ID: Chandler Municipal Airport (CHD)		EXISTING	ULTIMATE
Airport Reference Code (ARC)		B-II	B-II
Mean Maximum Temperature of Hottest Month		106.1° F	SAME
Airport Elevation (NAVD 88)		1243.1'	SAME
Airport Navigational Aids		RNAV (GPS) 1 MILE (4R)	RNAV (GPS) 1 MILE 22L, 4L ,22R
		VOR 1 MILE (4R)	SAME
		PAPIs-4	SAME
		REILs (4R-22L)	REILs (4L-22R)
Airport Reference Point (ARP) Coordinates	Latitude	33° 16 ' 8.80"N	33° 16 ' 09.65"N
	Longitude	111° 48'40.00"W	111° 48'39.09"W
Miscellaneous Facilities		AWOS	SAME
		SEGMENTED CIRCLE	SAME
		LIGHTED WINDCONE	SAME
Design Critical Aircraft		KING AIR 200/300/350	CJ4/X
Wingspan of Design Aircraft (Feet)		57.92'	63.58
Approach Speed of Design Aircraft (Knots)		107	111/112
Undercarriage Width of Design Aircraft (Feet)		16.25'	28.67
Magnetic Declination (Degrees)		09°58'E	
Declination Date		Oct-20	
Declination Source		NOAA	
NPIAS Code		RELIEVER	SAME
State System Plan Role		RELIEVER	SAME

ELECTRONIC AIRPORT NAVAID OWNERSHIP

NAVAID	OWNER
RNAV (GPS)	FAA
VOR 1mile 4R	FAA
AWOS	City of Chandler

RUNWAY DECLARED DISTANCE

	EXISTING		ULTIMATE		EXISTING		ULTIMATE	
	4R	22L	4R	22L	4L	22R	4L	22R
Takeoff Run Available (TORA)	4,870'	4,870'	5,550'	5,550'	4,401'	4,401'	SAME	SAME
Takeoff Distance Available (TODA)	4,870'	4,870'	5,550'	5,550'	4,401'	4,401'	SAME	SAME
Accelerate-Stop Distance Available (ASDA)	4,870'	4,870'	5,550'	5,550'	4,401'	4,401'	SAME	SAME
Landing Distance Available (LDA)	4,870'	4,870'	5,550'	5,550'	4,401'	4,401'	SAME	SAME

MODIFICATIONS TO STANDARDS APPROVAL TABLE

APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
None Required			

TAXIWAY DATA

	STANDARD TDG PER CRITICAL AIRCRAFT		PARALLEL TAXIWAYS					
	EXISTING	ULTIMATE	EXISTING			ULTIMATE		
AIRPLANE DESIGN GROUP	II	II						
EXISTING TAXIWAY DESIGNATION	-	-	A	B	C	-	-	-
ULTIMATE TAXIWAY DESIGNATION	-	-	-	-	-	A	B	C
TAXIWAY DESIGN GROUP	2	2	2	2	2	2	2	2
EXISTING TAXIWAY WIDTH	40	40	40	40	40	40	40	40
ULTIMATE TAXIWAY WIDTH	40	40	40	40	40	40	40	40
TAXIWAY SAFETY AREA (TSA) WIDTH	79	79	79	79	79	79	79	79
TAXIWAY OBJECT FREE AREA (TOFA) WIDTH	131	131	131	131	131	131	131	131
TAXIWAY CENTERLINE TO FIXED OR MOVEABLE OBJECT	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
TAXIWAY WING TIP CLEARANCE	26	26	26	26	26	26	26	26
TAXIWAY EDGE SAFETY MARGIN	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
TAXIWAY SHOULDER WIDTH	15	15	15	15	15	15	15	15
OBJECTS LOCATED IN TSA/TOFA	-	-	NO	NO	NO	NO	NO	NO
DISTANCE TO OBJECT FROM CENTERLINE	-	-	N/A	N/A	N/A	N/A	N/A	N/A
TAXIWAY LIGHTING	-	-	MITL	MITL	MITL	MITL	MITL	MITL

	ENTRANCE/EXIT TAXIWAYS (EXISTING/ULTIMATE)															
EXISTING TAXIWAY DESIGNATION	D	F	G	H	H	H	J	L	L	L	L	M	N	N	N	P
ULTIMATE TAXIWAY DESIGNATION	A1	A2	A6	-	B5	C1	-	A3	B3	B6	C2	-	A4	B4	B7	B8
TAXIWAY DESIGN GROUP	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
EXISTING TAXIWAY WIDTH	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
ULTIMATE TAXIWAY WIDTH	45	45	40	0	45	45	0	45	45	45	45	0	45	45	45	45
TAXIWAY SAFETY AREA (TSA) WIDTH	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
TAXIWAY OBJECT FREE AREA (TOFA) WIDTH	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
TAXIWAY CENTERLINE TO FIXED OR MOVEABLE OBJECT	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
TAXIWAY WING TIP CLEARANCE	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
TAXIWAY EDGE SAFETY MARGIN	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
TAXIWAY SHOULDER WIDTH	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
OBJECTS LOCATED IN TSA/TOFA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
DISTANCE TO OBJECT FROM CENTERLINE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TAXIWAY LIGHTING	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL

	ENTRANCE/EXIT TAXIWAYS (EXISTING/ULTIMATE)															
EXISTING TAXIWAY DESIGNATION	P	Q	Q	-	-	-	-	-	-	-	-	-	-	-	-	-
ULTIMATE TAXIWAY DESIGNATION	C4	B9	C5	A5	A7	A8	A9	B1	B2	B10	C3	C6	C7	C8	C9	C10
TAXIWAY DESIGN GROUP	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
EXISTING TAXIWAY WIDTH	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
ULTIMATE TAXIWAY WIDTH	45	45	45	45	40	40	40	45	45	45	45	45	45	45	45	45
TAXIWAY SAFETY AREA (TSA) WIDTH	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
TAXIWAY OBJECT FREE AREA (TOFA) WIDTH	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
TAXIWAY CENTERLINE TO FIXED OR MOVEABLE OBJECT	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
TAXIWAY WING TIP CLEARANCE	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
TAXIWAY EDGE SAFETY MARGIN	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
TAXIWAY SHOULDER WIDTH	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
OBJECTS LOCATED IN TSA/TOFA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
DISTANCE TO OBJECT FROM CENTERLINE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TAXIWAY LIGHTING	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL	MITL

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

AIRPORT DATA SHEET

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 | SHEET 2 OF 14

Coffman Associates
Airport Consultants
www.coffmanassociates.com

EXISTING AIRPORT FACILITES

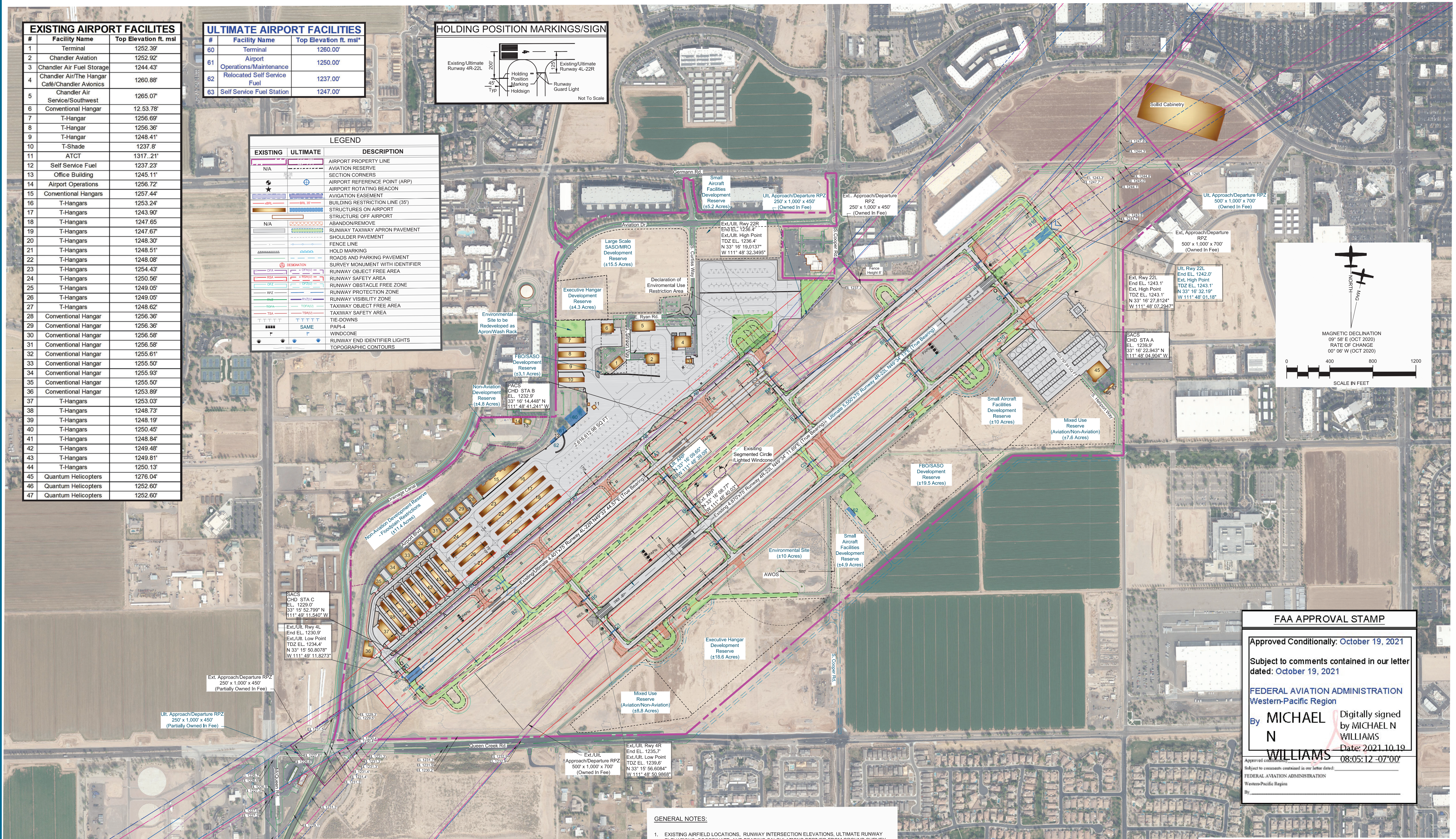
#	Facility Name	Top Elevation ft. msl
1	Terminal	1252.39'
2	Chandler Aviation	1252.92'
3	Chandler Air Fuel Storage	1244.43'
4	Chandler Air/The Hangar Café/Chandler Avionics	1260.88'
5	Chandler Air Service/Southwest	1265.07'
6	Conventional Hangar	12.53.78'
7	T-Hangar	1256.69'
8	T-Hangar	1256.36'
9	T-Hangar	1248.41'
10	T-Shade	1237.8'
11	ATCT	1317..21'
12	Self Service Fuel	1237.23'
13	Office Building	1245.11'
14	Airport Operations	1256.72'
15	Conventional Hangars	1257.44'
16	T-Hangars	1253.24'
17	T-Hangars	1243.90'
18	T-Hangars	1247.65
19	T-Hangars	1247.67'
20	T-Hangars	1248.30'
21	T-Hangars	1248.51'
22	T-Hangars	1248.08'
23	T-Hangars	1254.43'
24	T-Hangars	1250.56'
25	T-Hangars	1249.05'
26	T-Hangars	1249.05'
27	T-Hangars	1248.62'
28	Conventional Hangar	1256.36'
29	Conventional Hangar	1256.36'
30	Conventional Hangar	1256.58'
31	Conventional Hangar	1256.58'
32	Conventional Hangar	1255.61'
33	Conventional Hangar	1255.50'
34	Conventional Hangar	1255.93'
35	Conventional Hangar	1255.50'
36	Conventional Hangar	1253.89'
37	T-Hangars	1253.03'
38	T-Hangars	1248.73'
39	T-Hangars	1248.19'
40	T-Hangars	1250.45'
41	T-Hangars	1248.84'
42	T-Hangars	1249.48'
43	T-Hangars	1249.81'
44	T-Hangars	1250.13'
45	Quantum Helicopters	1276.04'
46	Quantum Helicopters	1252.60'
47	Quantum Helicopters	1252.60'

ULTIMATE AIRPORT FACILITIES

#	Facility Name	Top Elevation ft. msl*
60	Terminal	1260.00'
61	Airport Operations/Maintenance	1250.00'
62	Relocated Self Service Fuel	1237.00'
63	Self Service Fuel Station	1247.00'

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
32 33 / 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
ESMT	ESMT(U)	AVIGATION EASEMENT
xBRL	BRL 35'	BUILDING RESTRICTION LINE (35')
		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
RVZ	RVZ(U)	RUNWAY VISIBILITY ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
		RUNWAY END IDENTIFIER LIGHTS
3660		TOPOGRAPHIC CONTOURS



FAA APPROVAL STAMP

Approved Conditionally: October 19, 2021

Subject to comments contained in our letter dated: October 19, 2021

FEDERAL AVIATION ADMINISTRATION
Western-Pacific Region

By MICHAEL N WILLIAMS — Digitally signed by MICHAEL N WILLIAMS Date: 2021.10.19 08:05:12 -07'00'

Approved conditionally_____
Subject to comments contained in our letter dated:_____
FEDERAL AVIATION ADMINISTRATION
Western-Pacific Region
By_____

GENERAL NOTES:

1. EXISTING AIRFIELD LOCATIONS, RUNWAY INTERSECTION ELEVATIONS, ULTIMATE RUNWAY ELEVATIONS, COORDINATE, AND BEARING CALCULATIONS DERIVED FROM GROUND SURVEY PREPARED BY WOOLPERT AUGUST 12, 2020.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88.
3. UNLESS NOTED OTHERWISE, EXISTING BUILDING ELEVATIONS IN THIS ALP FROM SURVEY DATA PREPARED BY WOOLPERT AUGUST 12, 2020.
4. MAGNETIC DECLINATION FROM NOAA NATIONAL GEOPHYSICAL DATA CENTER.
5. SEE INNER PORTION OF THE APPROACH SURFACE DRAWINGS FOR THRESHOLD SITING SURFACE PENETRATIONS.
6. ROAD ELEVATIONS ARE GROUND ELEVATIONS FROM WOOLPERT SURVEY DATED AUGUST 12, 2020.
7. THE SOLLID CABINETRY FACILITY DEPICTED ON THIS DRAWING IS BASED ON A JUNE 2018 PRELIMINARY SITE PLAN. THE OBSTRUCTION EVALUATION WILL BE UPDATED TO REFLECT THE BUILDING'S SURVEYED TOP ELEVATION ONCE CONSTRUCTION IS COMPLETED, AND THAT INFORMATION IS MADE AVAILABLE.

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

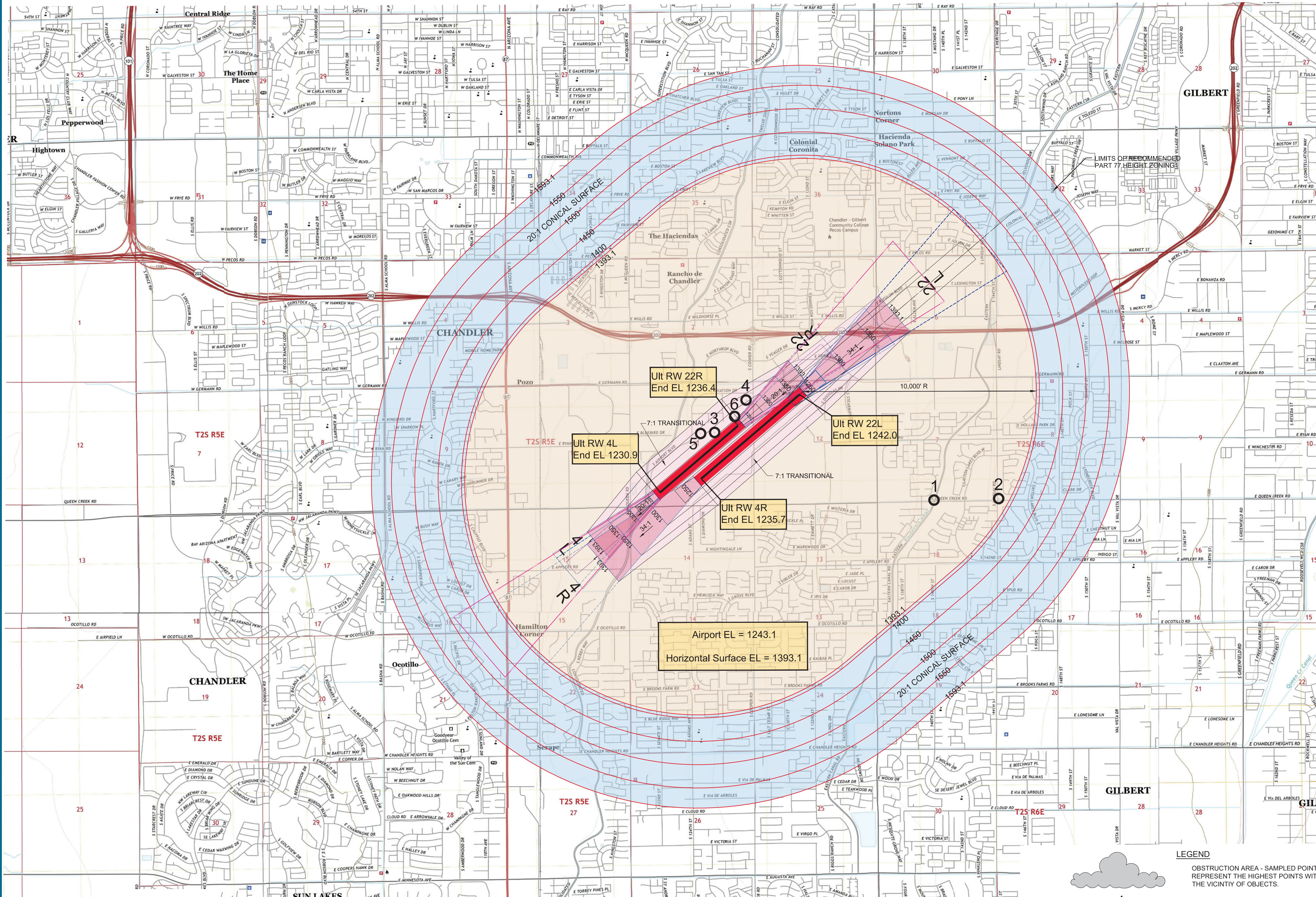
AIRPORT LAYOUT PLAN DRAWING

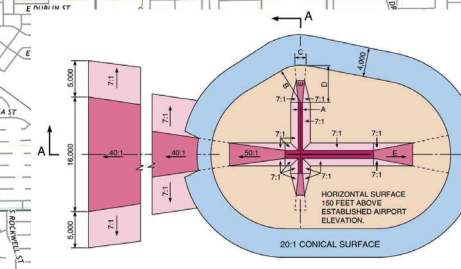
CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 — SHEET 3 OF 14

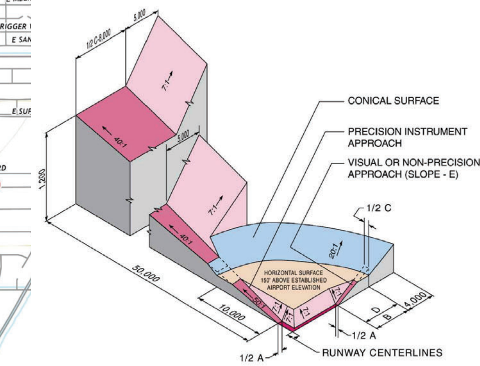
Coffman Associates — Airport Consultants — www.coffmanassociates.com





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

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



ISOMETRIC VIEW OF SECTION A-A

SOURCE: FAA Order JO 7400.2J, Figure 6-3-3

GENERAL NOTES:

1. OBSTRUCTION SURVEY DATED AUGUST 12, 2020 BY WOOLPERT.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OSTRUCTIONS IDENTIFIED BY COFFMAN ASSOCIATES FROM WOOLPERT OF GROUND SURVEY.
4. SUPPLEMENTAL DATA EXAMINED INCLUDE FAA DIGITAL OBSTACLE FILE (DOF), RELEASE DATE AUGUST 12, 2020.
5. THE FOLLOWING USGS 7.5 QUAD MAPS OF THE STATE OF NEW MEXICO WERE APPLIED AS BACKGROUND: GUADALUPE, CHANDLER, HIGLEY, GILA BUTTE NW, GILA BUTTE, CHANDLER HEIGHTS
6. SEE INNER PORTION OF THE APPROACH SURFACE DRAWINGS FOR CLOSE-IN APPROACH DETAILS.
7. ALL ELEVATIONS IN MSL FEET.

ID	Feature	Ground Elevation (ft. msl.)	Top Elevation (ft. msl.)	Surface Penetrated	Penetration Value (ft.)	DOF Object #	Disposition
1	Tower	Unknown	1,319.03	Transitional	0.64	04-000583	Add Obstruction Light
2	Tank	1,235.00	1,267.00	Transitional	6.03	04-000319	Add Obstruction Light
3	Light Pole	Unknown	1,280.96	Transitional	16.38	04-021790	Add Obstruction Light
4	Control Tower	1,234.00	1,337.00	Transitional	21.70	04-020613	Add Obstruction Light
5	Transmission Line	Unknown	1,394.65	Horizontal	1.55	04-000576	Add Obstruction Light
6	Transmission Line	Unknown	1,395.83	Horizontal	2.73	04-000577	Add Obstruction Light

LEGEND

OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINTIY OF OBJECTS.

OBSTRUCTION IDENTIFIER

0 2000 4000
SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

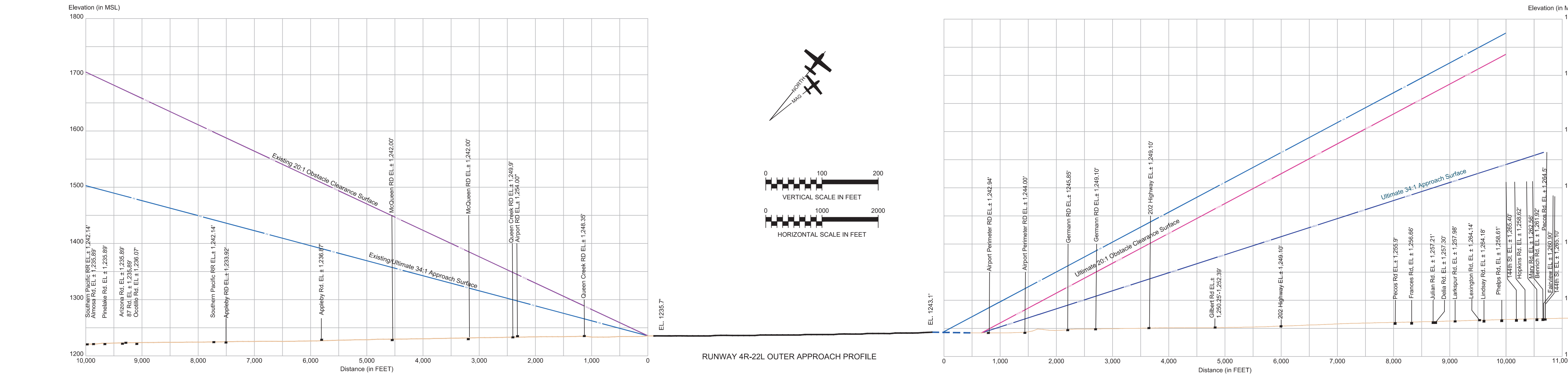
AIRPORT AIRSPACE

CHANDLER, ARIZONA

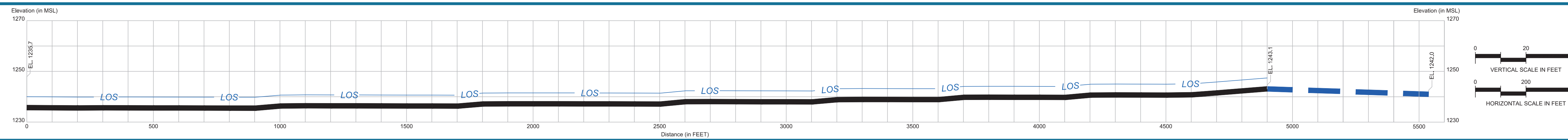
PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021

Coffman Associates
Airport Consultants
www.coffmanassociates.com



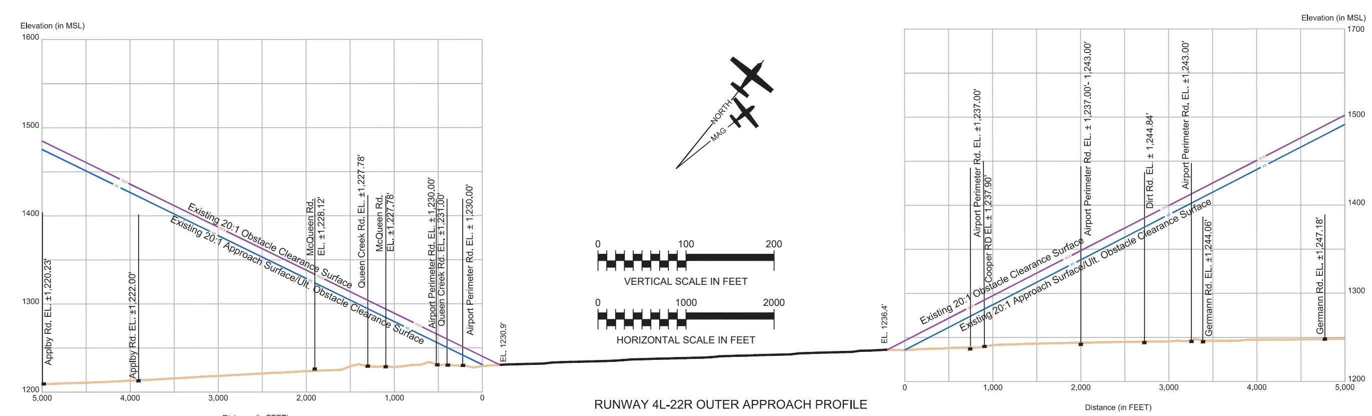
RUNWAY 4R-22L OUTER APPROACH PROFILE



Runway 4R Obstructions						
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values		Disposition
				4R Approach	4R OCS	
No Obstructions						

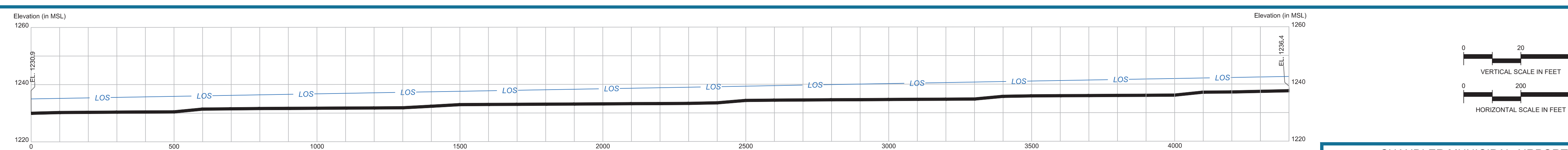
Runway 22L Obstructions									
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values				DOF Object #	Disposition
				Existing 22L Approach	Ultimate 22L Approach	Existing 22L OCS	Ultimate 22L OCS		
1	Airport Perimeter Road	10.00	1,252.97	N/A	2.97	N/A	N/A	N/A	To Remain - Airport Controlled Road

Runway 4L Obstructions									
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values				DOF Object #	Disposition
				Existing 4L Approach	Ultimate 4L Approach	Existing 4L OCS	Ultimate 4L OCS		
1	Pole	26.00	1,255.00	N/A	6.36	N/A	N/A	04-020176	Lower/Relocate
2	Pole	33.00	1,263.00	N/A	5.59	N/A	5.59	04-020606	Lower/Relocate
3	Pole	33.00	1,263.00	1.71	1.71	N/A	1.71	04-020607	Lower/Relocate



RUNWAY 4L-22R OUTER APPROACH PROFILE

Runway 22R Obstructions									
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values				DOF Object #	Disposition
				Existing 4L Approach	Ultimate 4L Approach	Existing 4L OCS	Ultimate 4L OCS		
No 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 inner portion of the approach surfaces, are illustrated on the Inner Portion of the Approach Surface for Runway 4R-22L sheet 6 and Runway 4L-22R Sheet 7 of these plans.
3. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated PART 77 Airspace Plan.
4. Survey used for obstruction data from Woolpert 18B survey dated August 12, 2020.
5. Obstruction Data for groups represent the tallestt (Natural or Man Made) object within the group.

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

APPROACH PROFILES FOR RUNWAYS 4R-22L AND 4L-22R

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 — SHEET 5 OF 14

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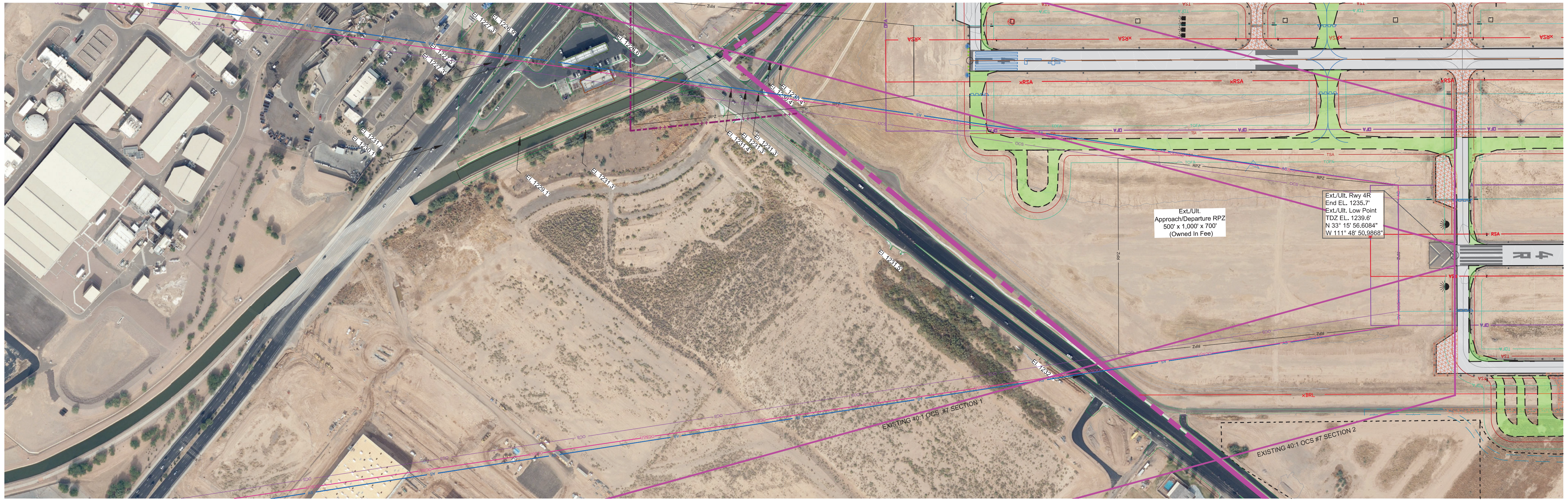

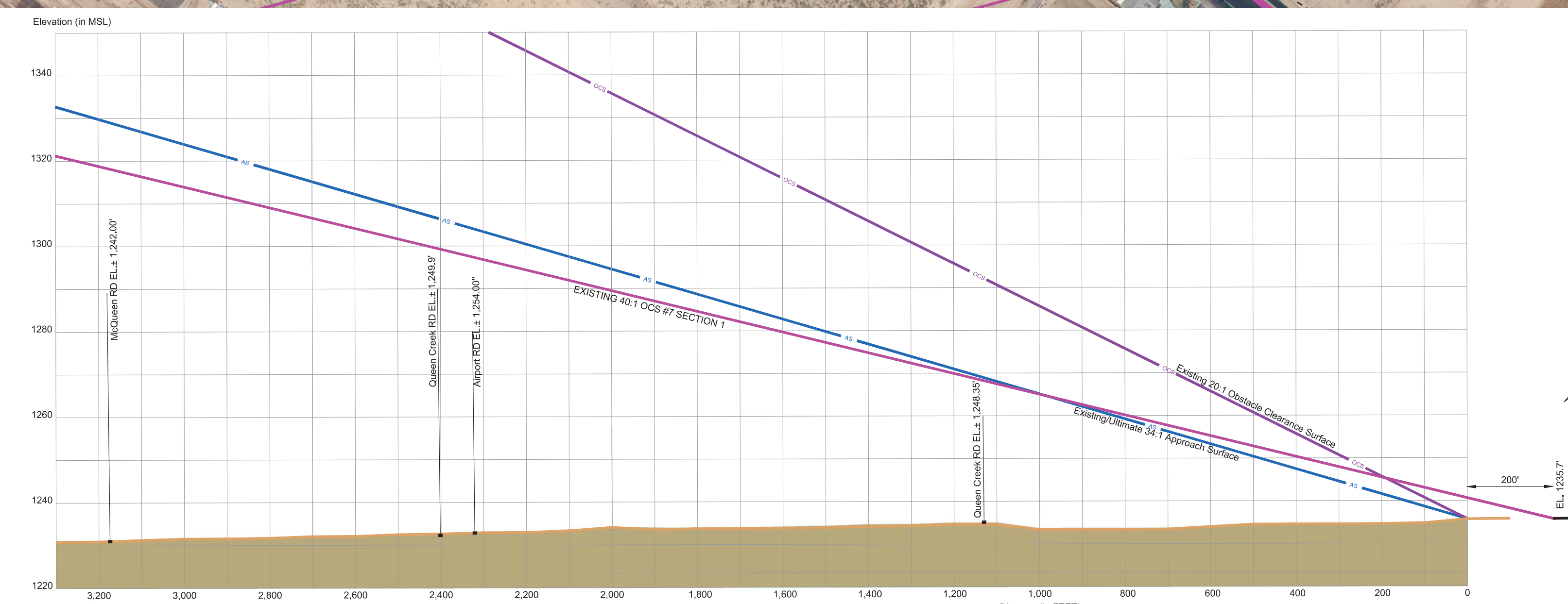

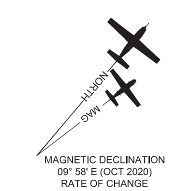

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

Runway 4R Obstructions						
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values		Disposition
				4R Approach	4R OCS	
No Obstructions						

Runway 4R End Departure Obstructions							
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft)		DOF Object #	Disposition
				Existing 22L End Departure	Ultimate 22L End Departure		
No Obstructions							

APPLY STANDARDS SET FORTH IN FAA ORDER 8260.46E DEPARTURE PROCEDURE (DP) PROGRAM

PROFILE VIEW SIGNIFICANT OBJECT PROFILE VIEW

(000)

SIGNIFICANT OBJECT/OBSTRUCTION CALLOUT

1

GENERAL NOTES:

1. GROUND SURVEY DATED AUGUST 12, 2020 BY WOOLPERT.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
   VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OSTRUCTIONS IDENTIFIED BY COFFMAN ASSOCIATES FROM WOOLPERT. DATED AUGUST 12, 2020
4. SUPPLEMENTAL DATA EXAMINED INCLUDE FAA DIGITAL OBSTACLE FILE (DOF).
5. ALL ELEVATIONS IN MSL FEET.
6. THE DEPARTURE SURFACE (OCS #7) IS BEING SHOWN ON THIS SHEET AT THE REQUEST OF THE AIRPORT. SECTION 2 IS NOT VISIBLE IN THE PROFILE VIEW.

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 4R

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021

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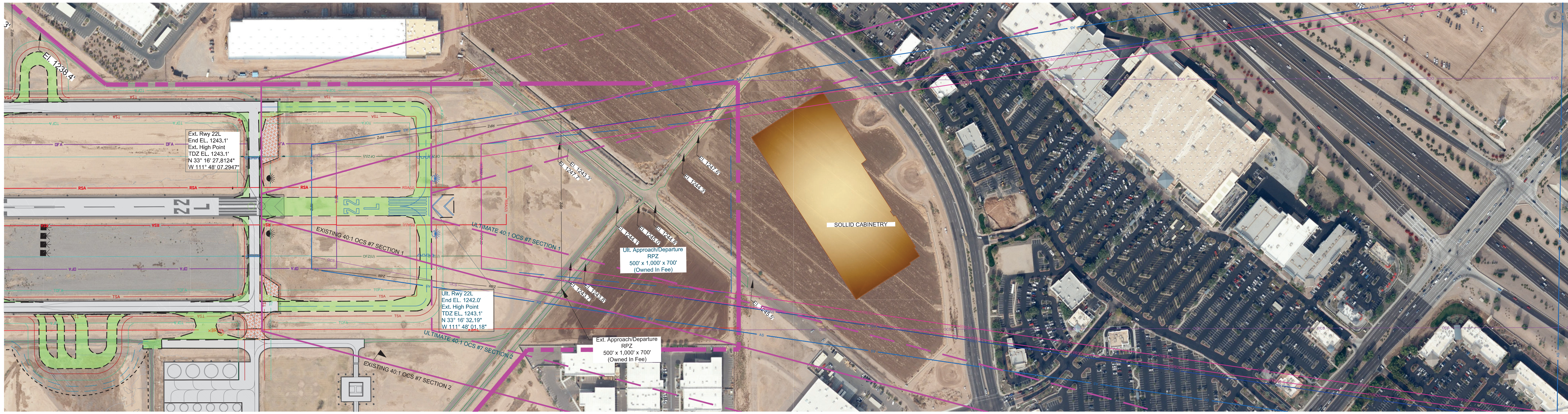
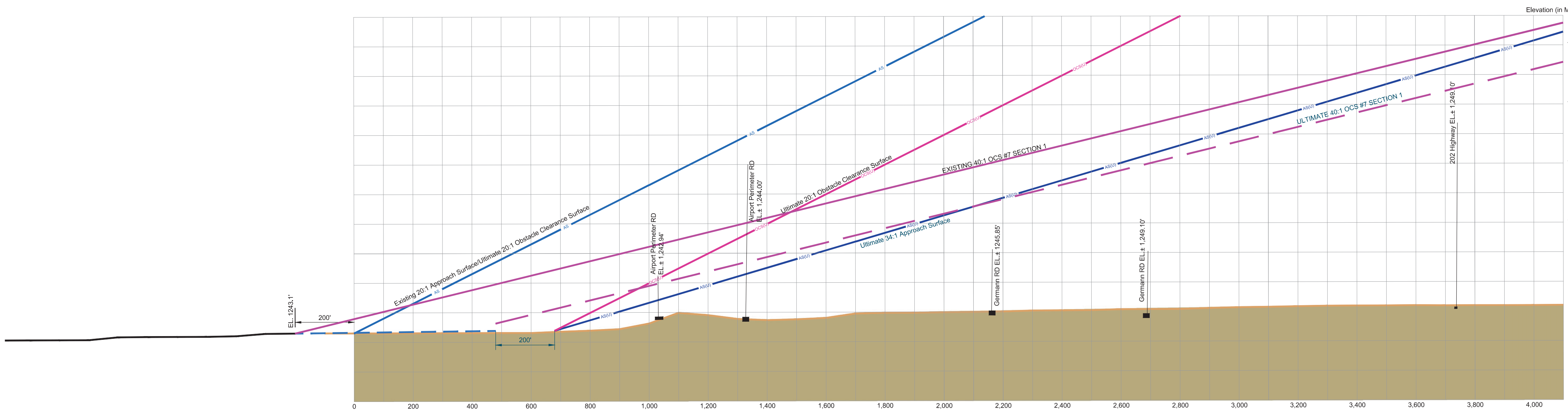
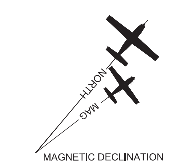






MAGNETIC DECLINATION
09° 58' E (OCT 2020)
RATE OF CHANGE
00° 06' W (OCT 2020)

Runway 22L Obstructions									
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values: Existing 22L Approach	Penetration Values: Ultimate 22L Approach	Penetration Values: Existing 22L OCS	Penetration Values: Ultimate 22L OCS	DOF Object #	Disposition
NO OBSTRUCTIONS									

Runway 22L End Departure Obstructions							
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft): Existing 22L End Departure	Penetration Value (ft): Ultimate 22L End Departure	DOF Object #	Disposition
No Obstructions							

APPLY STANDARDS SET FORTH IN FAA ORDER 8260.46E DEPARTURE PROCEDURE (DP) PROGRAM

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

GENERAL NOTES:

1. GROUND SURVEY DATED AUGUST 12, 2020 BY WOOLPERT.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OSTRUCTIONS IDENTIFIED BY COFFMAN ASSOCIATES FROM WOOLPERT. DATED AUGUST 12, 2020 SUPPLEMENTAL DATA EXAMINED INCLUDE FAA DIGITAL OBSTACLE FILE (DOF).
4. ALL ELEVATIONS IN MSL FEET.
5. THE SOLLID CABINETRY FACILITY DEPICTED ON THIS DRAWING IS BASED ON A JUNE 2018 PRELIMINARY SITE PLAN. THE OBSTRUCTION EVALUATION WILL BE UPDATED TO REFLECT THE BUILDING'S SURVEYED TOP ELEVATION ONCE CONSTRUTION IS COMPLETED, AND THAT INFORMATION IS MADE AVAILABLE.
6. THE DEPARTURE SURFACE (OCS #7) IS BEING SHOWN ON THIS SHEET AT THE REQUEST OF THE AIRPORT. SECTION 2 IS NOT VISIBLE IN THE PROFILE VIEW.

PROFILE VIEW SIGNIFICANT OBJECT PROFILE VIEW

SIGNIFICANT OBJECT/OBSTRUCTION CALLOUT

NO.	REVISIONS	DATE	BY	APP'D.

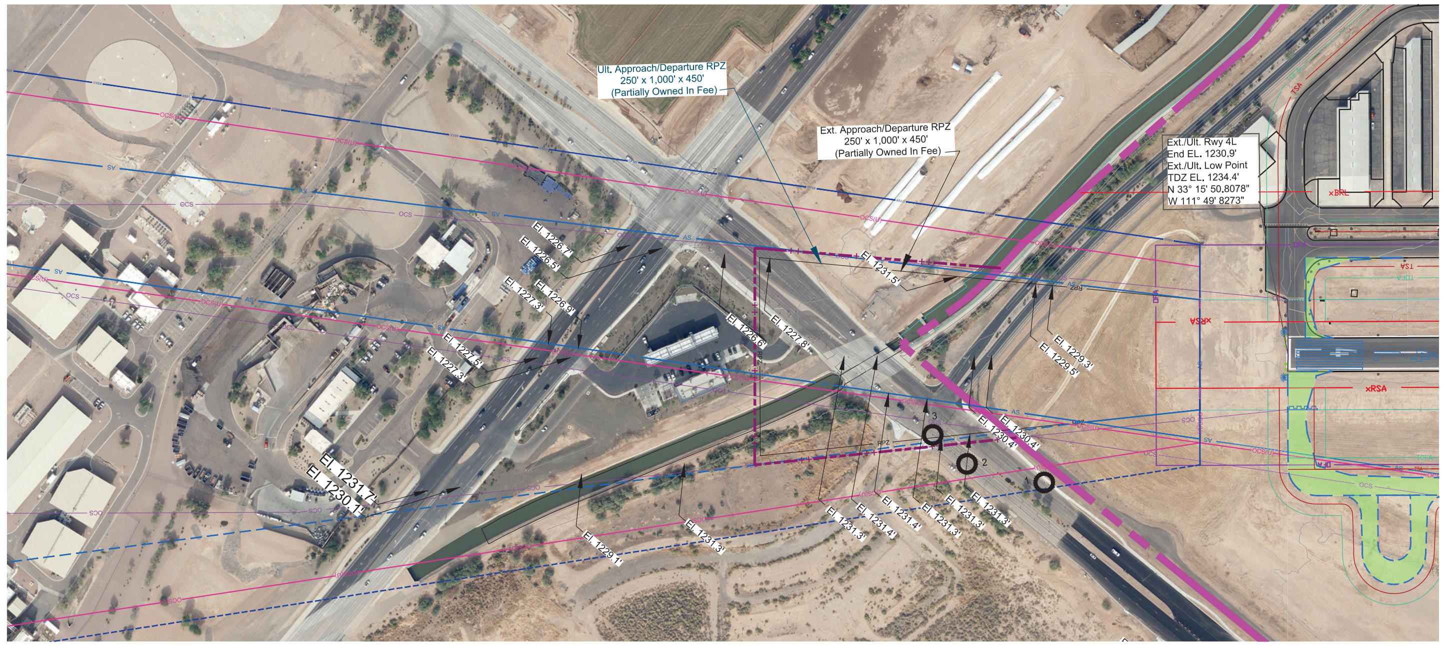
"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

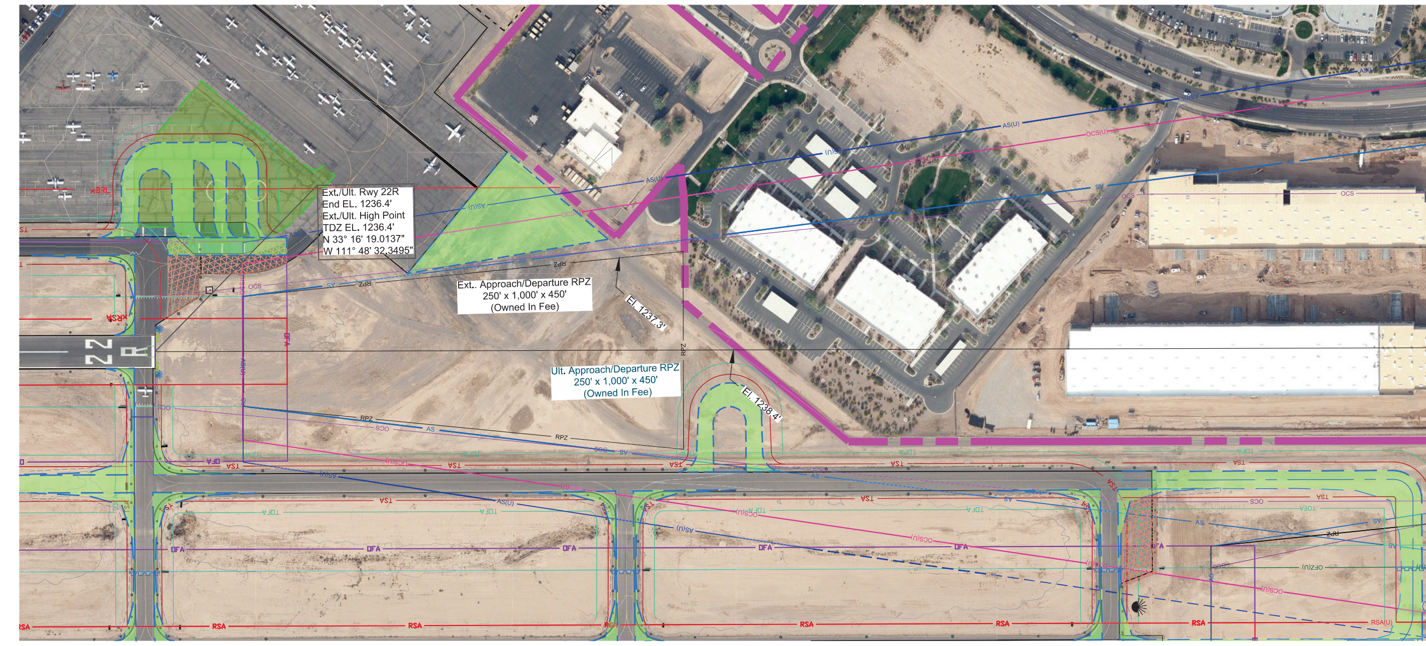
CHANDLER MUNICIPAL AIRPORT (CHD)
INNER PORTION OF THE APPROACH SURFACE DRAWING
RUNWAY 22L
CHANDLER, ARIZONA

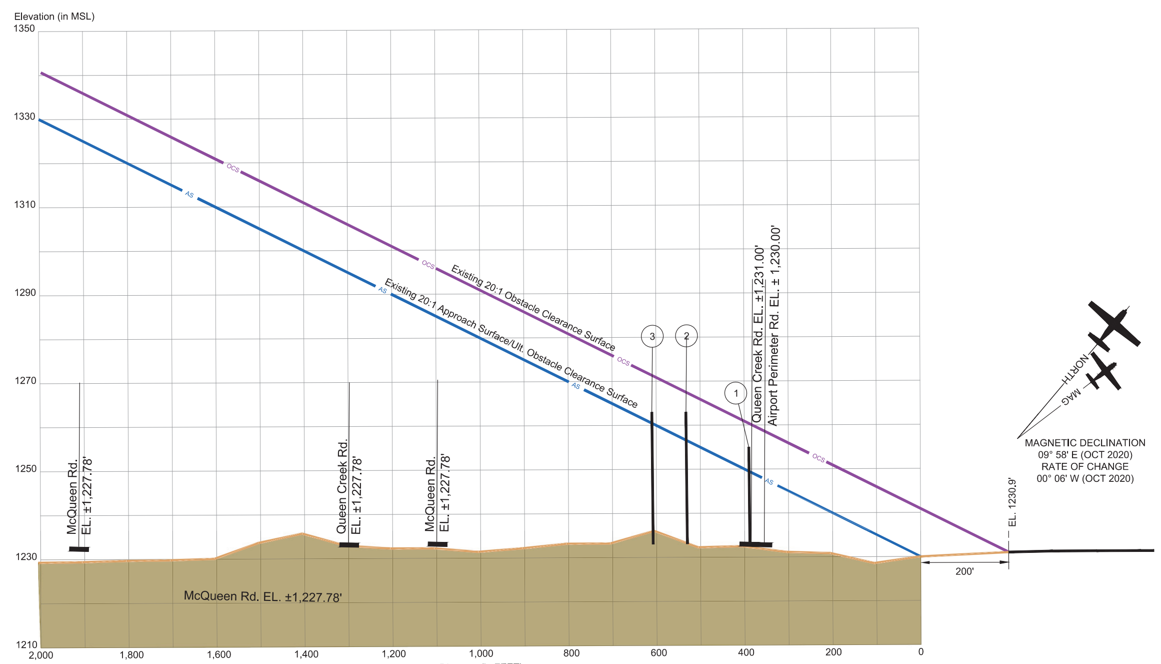
PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 SHEET 7 OF 14

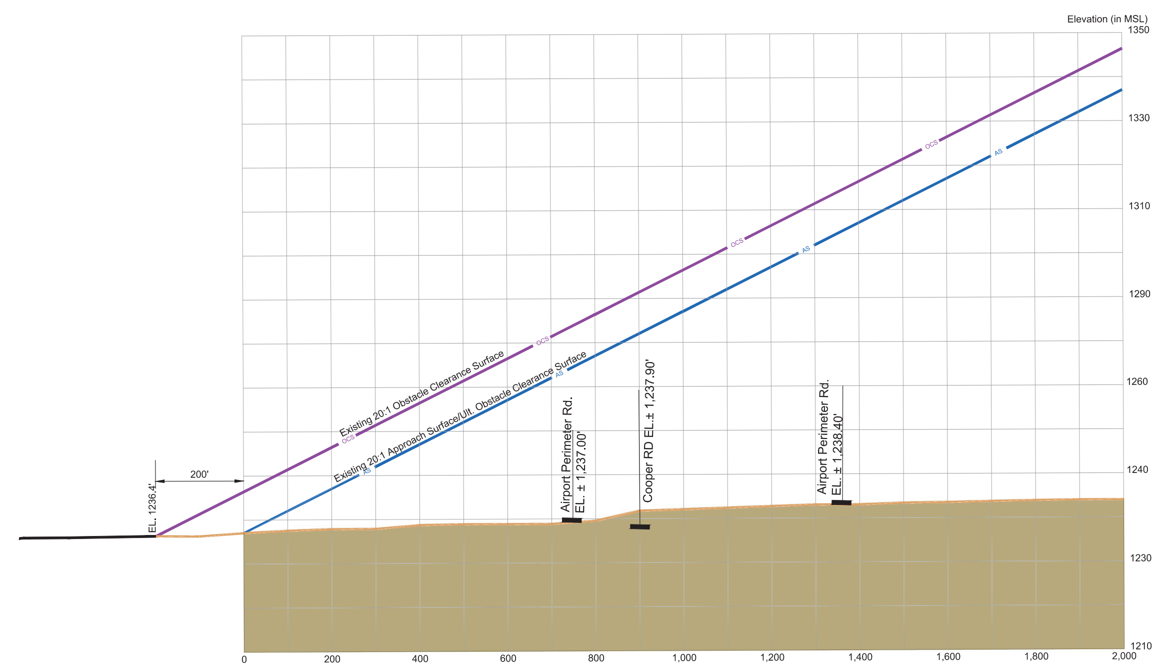
Coffman Associates
Airport Consultants
www.coffmanassociates.com







MAGNETIC DECLINATION
09° 58' E (OCT 2020)
RATE OF CHANGE
00° 06' W (OCT 2020)



Runway 4L Obstructions									
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values				DOF Object #	Disposition
				Existing 4L Approach	Ultimate 4L Approach	Existing 4L OCS	Ultimate 4L OCS		
1	Pole	26.00	1,255.00	N/A	6.36	N/A	N/A	04-020176	Lower/Relocate
2	Pole	33.00	1,263.00	N/A	5.59	N/A	5.59	04-020606	Lower/Relocate
3	Pole	33.00	1,263.00	1.71	1.71	N/A	1.71	04-020607	Lower/Relocate

Runway 22R Obstructions									
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Values				DOF Object #	Disposition
				Existing 4L Approach	Ultimate 4L Approach	Existing 4L OCS	Ultimate 4L OCS		
No Obstructions									

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

GENERAL NOTES:

1. GROUND SURVEY DATED AUGUST 12, 2020 BY WOOLPERT.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
   VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OSTRUCTIONS IDENTIFIED BY COFFMAN ASSOCIATES FROM WOOLPERT. DATED AUGUST 12, 2020
4. SUPPLEMENTAL DATA EXAMINED INCLUDE FAA DIGITAL OBSTACLE FILE (DOF).
5. ALL ELEVATIONS IN MSL FEET.

PROFILE VIEW SIGNIFICANT OBJECT PROFILE VIEW

SIGNIFICANT OBJECT/OBSTRUCTION CALLOUT

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)
INNER PORTION OF THE APPROACH SURFACE DRAWING
RUNWAY 4L-22R
CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 SHEET 8 OF 14

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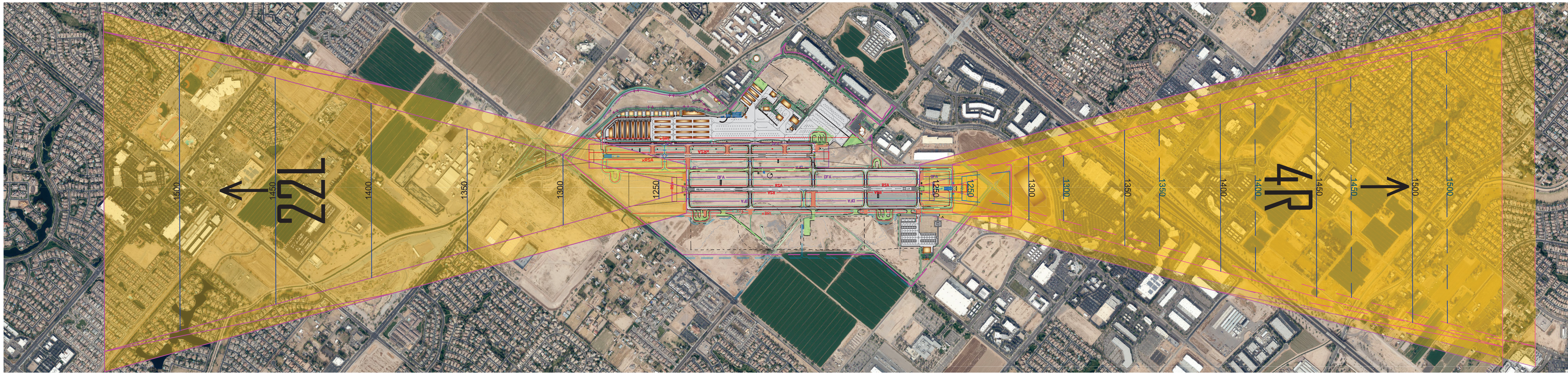

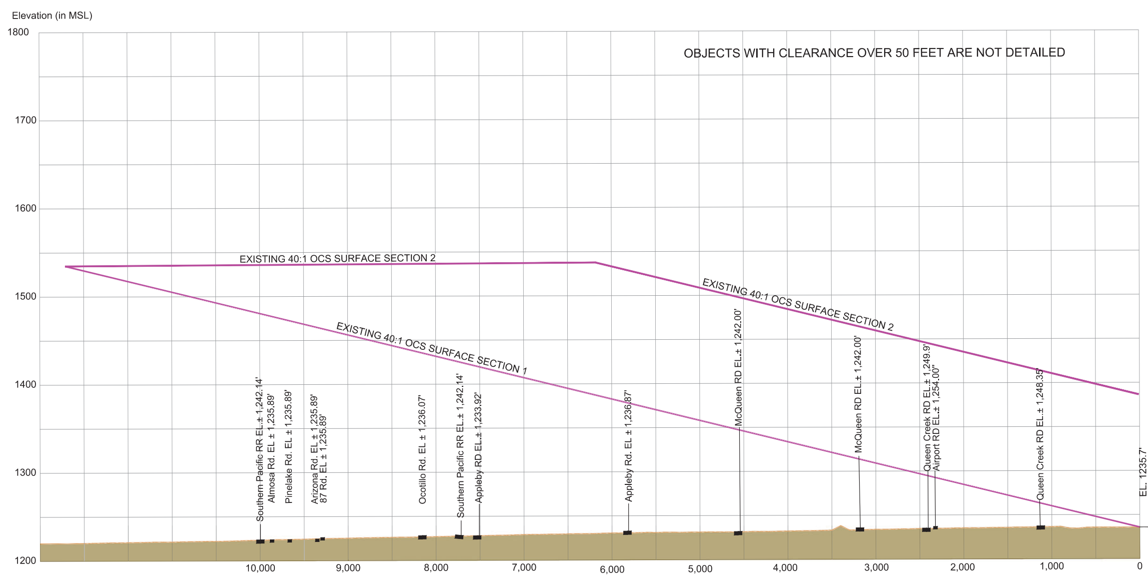

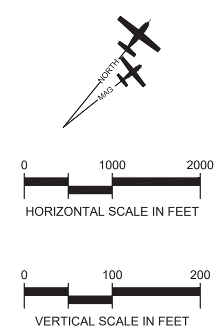

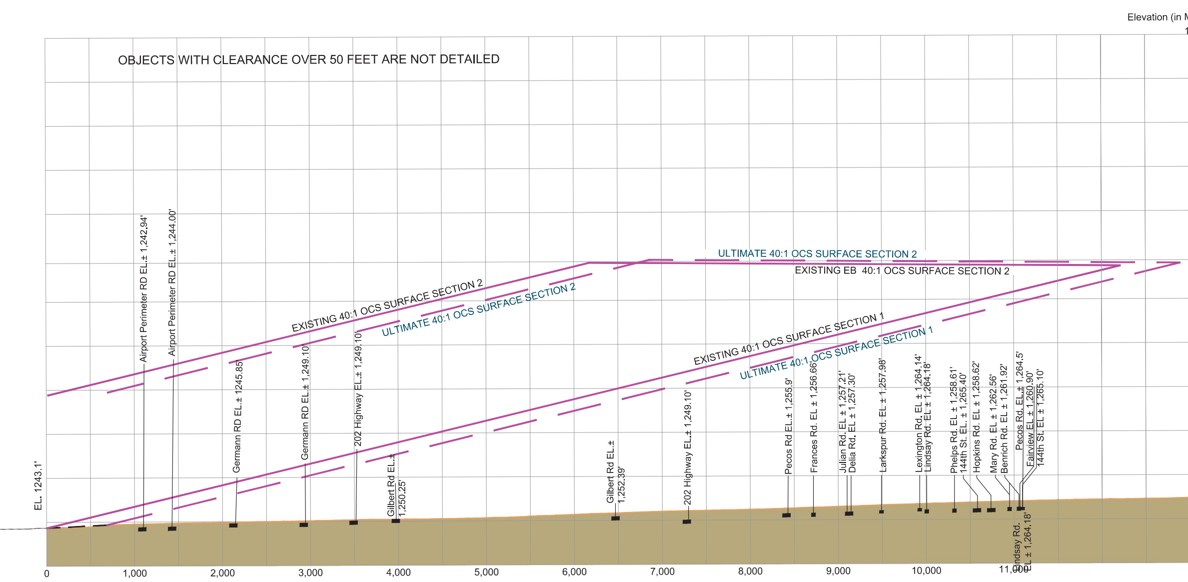

Runway 4R End Departure Obstructions							
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft) Existing 22L End Departure	Penetration Value (ft) Ultimate 22L End Departure	DOF Object #	Disposition
No Obstructions							

APPLY STANDARDS SET FORTH IN FAA ORDER 8260.46E DEPARTURE PROCEDURE (DP) PROGRAM

Runway 22L End Departure Obstructions							
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft) Existing 22L End Departure	Penetration Value (ft) Ultimate 22L End Departure	DOF Object #	Disposition
No Obstructions							

APPLY STANDARDS SET FORTH IN FAA ORDER 8260.46E DEPARTURE PROCEDURE (DP) PROGRAM

Legend

- Significant Object/Obstruction Callout
- Ground Profile
- Ultimate Departure
- Existing Departure
- Profile Ground Composite

GENERAL NOTES:

1. ADDITIONAL DATA SOURCE INCLUDES GROUND SURVEY PREPARED BY WOOLPERT AUGUST 12, 2020.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88.
3. MAGNETIC DECLINATION FROM NOAA NATIONAL GEOPHYSICAL DATA CENTER.
4. OBSTRUCTIONS WITHIN THIS GROUPING REPRESENT TALLEST MANMADE AND/OR NATURAL FEATURE.
5. THE SOLLID CABINETRY FACILITY DEPICTED ON THIS DRAWING IS BASED ON A JUNE 2018 PRELIMINARY SITE PLAN. THE OBSTRUCTION EVALUATION WILL BE UPDATED TO REFLECT THE BUILDING'S SURVEYED TOP ELEVATION ONCE CONSTRUCTION IS COMPLETED, AND THAT INFORMATION IS MADE AVAILABLE

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

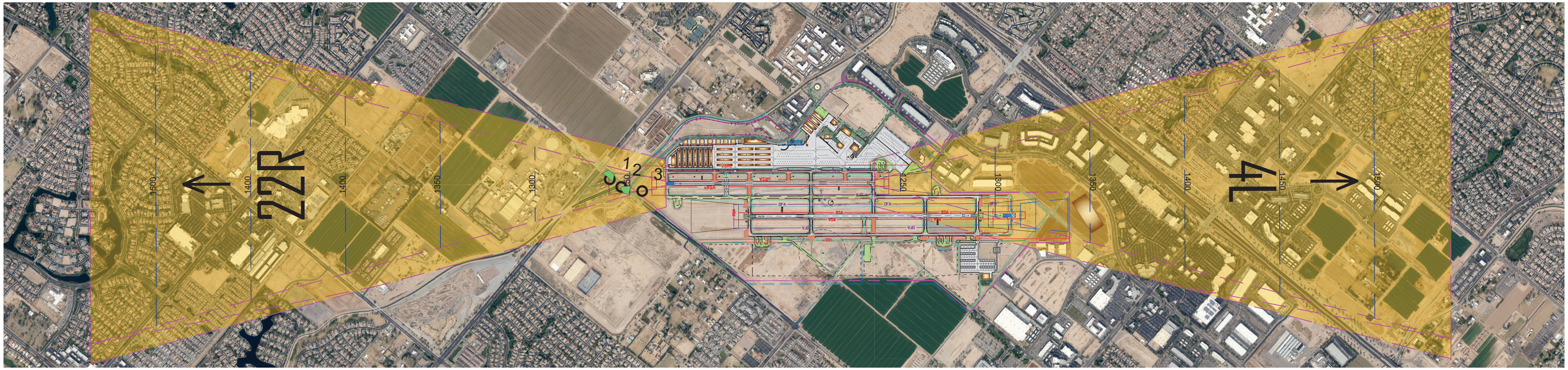
RUNWAY 4R-22L DEPARTURE SURFACE DRAWING

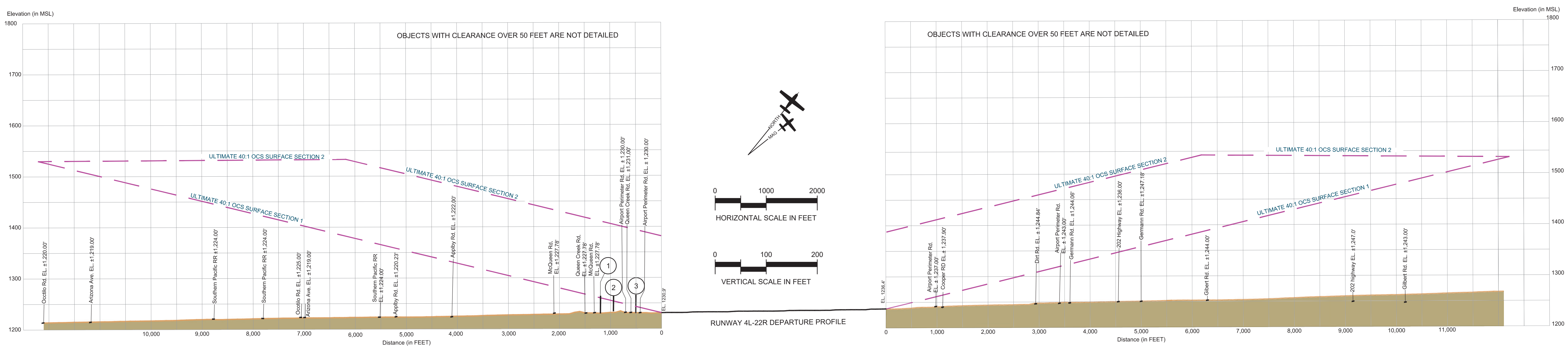
CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 SHEET 9 OF 14

Coffman Associates Airport Consultants www.coffmanassociates.com





Ultimate Runway 4L End Departure Obstructions						
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft)	DOF Object #	Disposition
1	Pole	16.00	1,245.00	1.76	04-020175	Lower/Relocate
2	Pole	35.00	1,264.00	9.56	04-020608	Lower/Relocate
3	Pole	37.00	1,266.00	5.57	04-020609	Lower/Relocate

APPLY STANDARDS SET FORTH IN FAA ORDER 8260.46E DEPARTURE PROCEDURE (DP) PROGRAM

Ultimate Runway 22R End Departure Obstructions						
ID	Feature	Height Above Ground (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft)	DOF Object #	Disposition
No Obstructions						

APPLY STANDARDS SET FORTH IN FAA ORDER 8260.46E DEPARTURE PROCEDURE (DP) PROGRAM

Legend

- Significant Object/Obstruction Callout
- Obstruction Group
- Ground Profile
- Ultimate Departure
- Profile Ground Composite

GENERAL NOTES:

1. ADDITIONAL DATA SOURCE INCLUDES GROUND SURVEY PREPARED BY WOOLPERT AUGUST 12, 2020.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
   VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88.
3. MAGNETIC DECLINATION FROM NOAA NATIONAL GEOPHYSICAL DATA CENTER.
4. OBSTRUCTIONS WITHIN THIS GROUPING REPRESENT TALLEST MANMADE AND/OR NATURAL FEATURE.
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CHANDLER MUNICIPAL AIRPORT (CHD)

RUNWAY 4L-22R DEPARTURE SURFACE DRAWING

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 SHEET 10 OF 14

Coffman Associates
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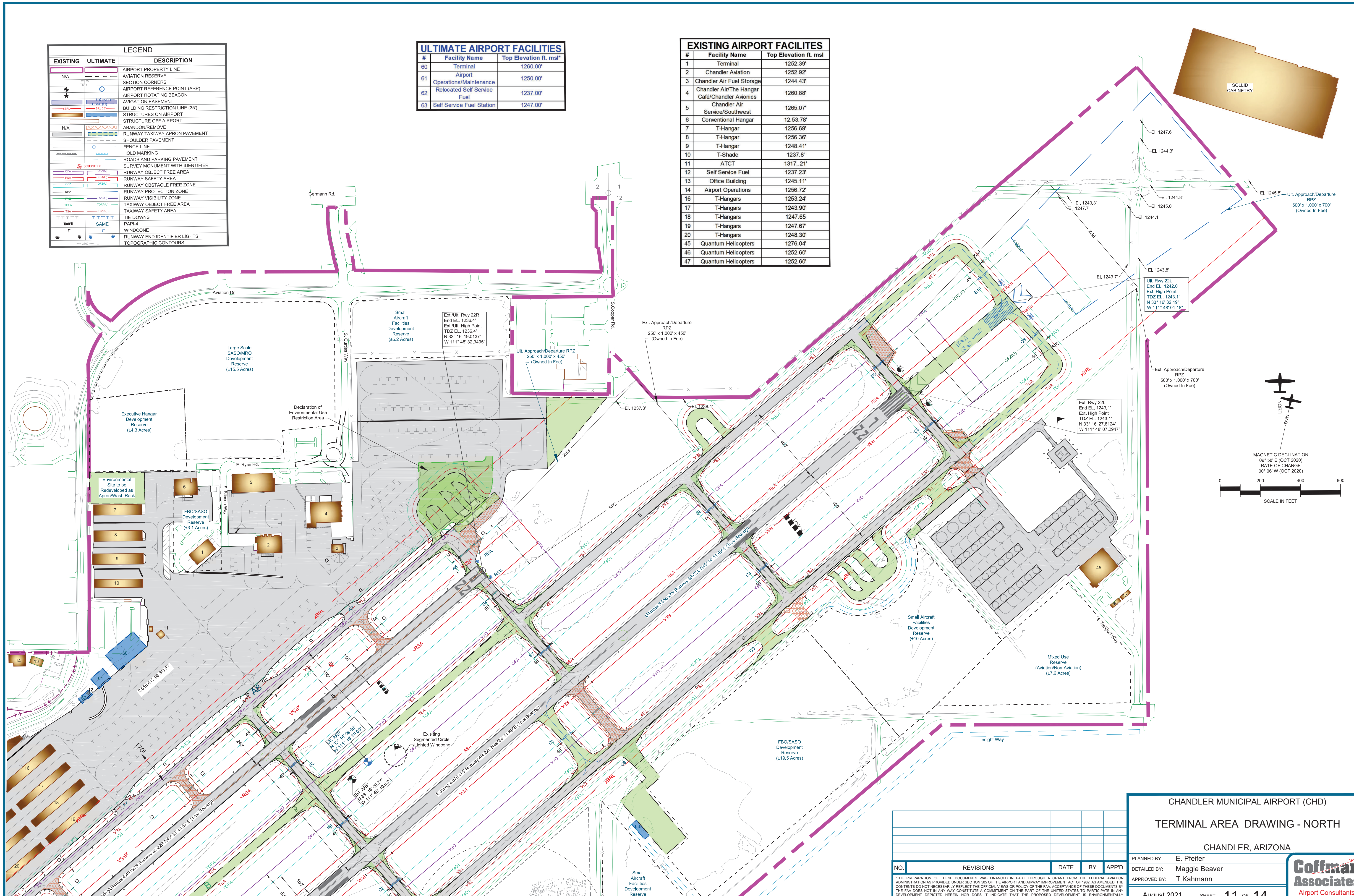
www.coffmanassociates.com



LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
	ESMT(U)	AVIGATION EASEMENT
xBRL	BRL 35'	BUILDING RESTRICTION LINE (35')
		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
RVZ	RVZ(U)	RUNWAY VISIBILITY ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
		RUNWAY END IDENTIFIER LIGHTS
3660		TOPOGRAPHIC CONTOURS

ULTIMATE AIRPORT FACILITIES

#	Facility Name	Top Elevation ft. msl*
60	Terminal	1260.00'
61	Airport Operations/Maintenance	1250.00'
62	Relocated Self Service Fuel	1237.00'
63	Self Service Fuel Station	1247.00'

EXISTING AIRPORT FACILITES

#	Facility Name	Top Elevation ft. msl
1	Terminal	1252.39'
2	Chandler Aviation	1252.92'
3	Chandler Air Fuel Storage	1244.43'
4	Chandler Air/The Hangar Café/Chandler Avionics	1260.88'
5	Chandler Air Service/Southwest	1265.07'
6	Conventional Hangar	12.53.78'
7	T-Hangar	1256.69'
8	T-Hangar	1256.36'
9	T-Hangar	1248.41'
10	T-Shade	1237.8'
11	ATCT	1317..21'
12	Self Service Fuel	1237.23'
13	Office Building	1245.11'
14	Airport Operations	1256.72'
16	T-Hangars	1253.24'
17	T-Hangars	1243.90'
18	T-Hangars	1247.65
19	T-Hangars	1247.67'
20	T-Hangars	1248.30'
45	Quantum Helicopters	1276.04'
46	Quantum Helicopters	1252.60'
47	Quantum Helicopters	1252.60'

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CHANDLER MUNICIPAL AIRPORT (CHD)

TERMINAL AREA DRAWING - NORTH

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021

Coffman Associates
Airport Consultants
www.coffmanassociates.com

EXISTING AIRPORT FACILITES

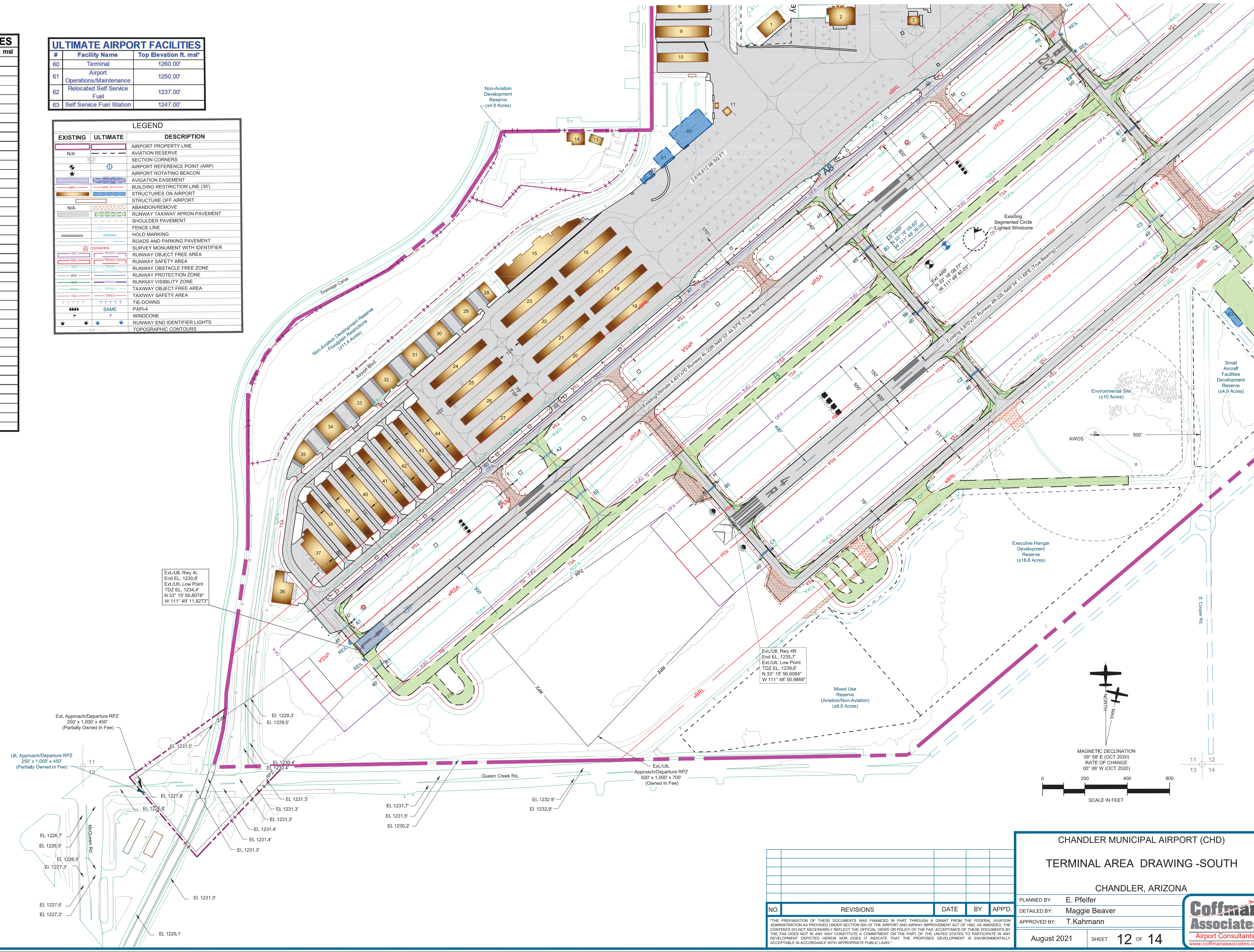
#	Facility Name	Top Elevation ft. msl
1	Terminal	1252.39'
2	Chandler Aviation	1252.92'
3	Chandler Air Fuel Storage	1244.43'
8	T-Hangar	1256.36'
9	T-Hangar	1248.41'
10	T-Shade	1237.8'
11	ATCT	1317..21'
12	Self Service Fuel	1237.23'
13	Office Building	1245.11'
14	Airport Operations	1256.72'
15	Conventional Hangars	1257.44'
16	T-Hangars	1253.24'
17	T-Hangars	1243.90'
18	T-Hangars	1247.65
19	T-Hangars	1247.67'
20	T-Hangars	1248.30'
21	T-Hangars	1248.51'
22	T-Hangars	1248.08'
23	T-Hangars	1254.43'
24	T-Hangars	1250.56'
25	T-Hangars	1249.05'
26	T-Hangars	1249.05'
27	T-Hangars	1248.62'
28	Conventional Hangar	1256.36'
29	Conventional Hangar	1256.36'
30	Conventional Hangar	1256.58'
31	Conventional Hangar	1256.58'
32	Conventional Hangar	1255.61'
33	Conventional Hangar	1255.50'
34	Conventional Hangar	1255.93'
35	Conventional Hangar	1255.50'
36	Conventional Hangar	1253.89'
37	T-Hangars	1253.03'
38	T-Hangars	1248.73'
39	T-Hangars	1248.19'
40	T-Hangars	1250.45'
41	T-Hangars	1248.84'
42	T-Hangars	1249.48'
43	T-Hangars	1249.81'
44	T-Hangars	1250.13'

ULTIMATE AIRPORT FACILITIES

#	Facility Name	Top Elevation ft. msl*
60	Terminal	1260.00'
61	Airport Operations/Maintenance	1250.00'
62	Relocated Self Service Fuel	1237.00'
63	Self Service Fuel Station	1247.00'

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
N/A		AVIATION RESERVE
32 33 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
	ESMT(U)	AVIGATION EASEMENT
xBRL	BRL 35'	BUILDING RESTRICTION LINE (35')
		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
RVZ	RVZ(U)	RUNWAY VISIBILITY ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY SAFETY AREA
		TIE-DOWNS
	SAME	PAPI-4
		WINDCONE
		RUNWAY END IDENTIFIER LIGHTS
3660		TOPOGRAPHIC CONTOURS



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CHANDLER MUNICIPAL AIRPORT (CHD)

TERMINAL AREA DRAWING -SOUTH

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 — SHEET 12 OF 14

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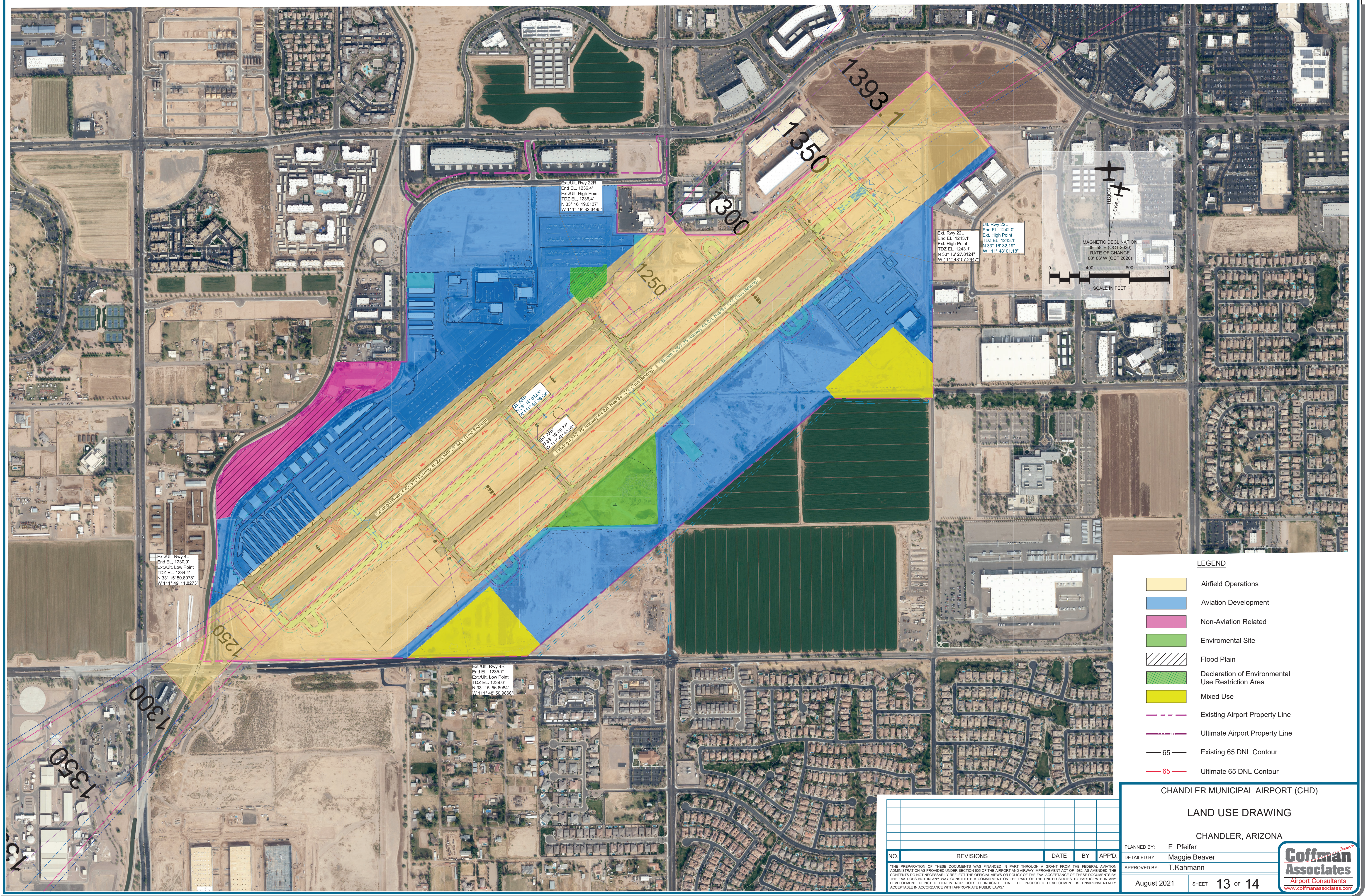

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CHANDLER MUNICIPAL AIRPORT (CHD)

LAND USE DRAWING

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021 SHEET 13 OF 14

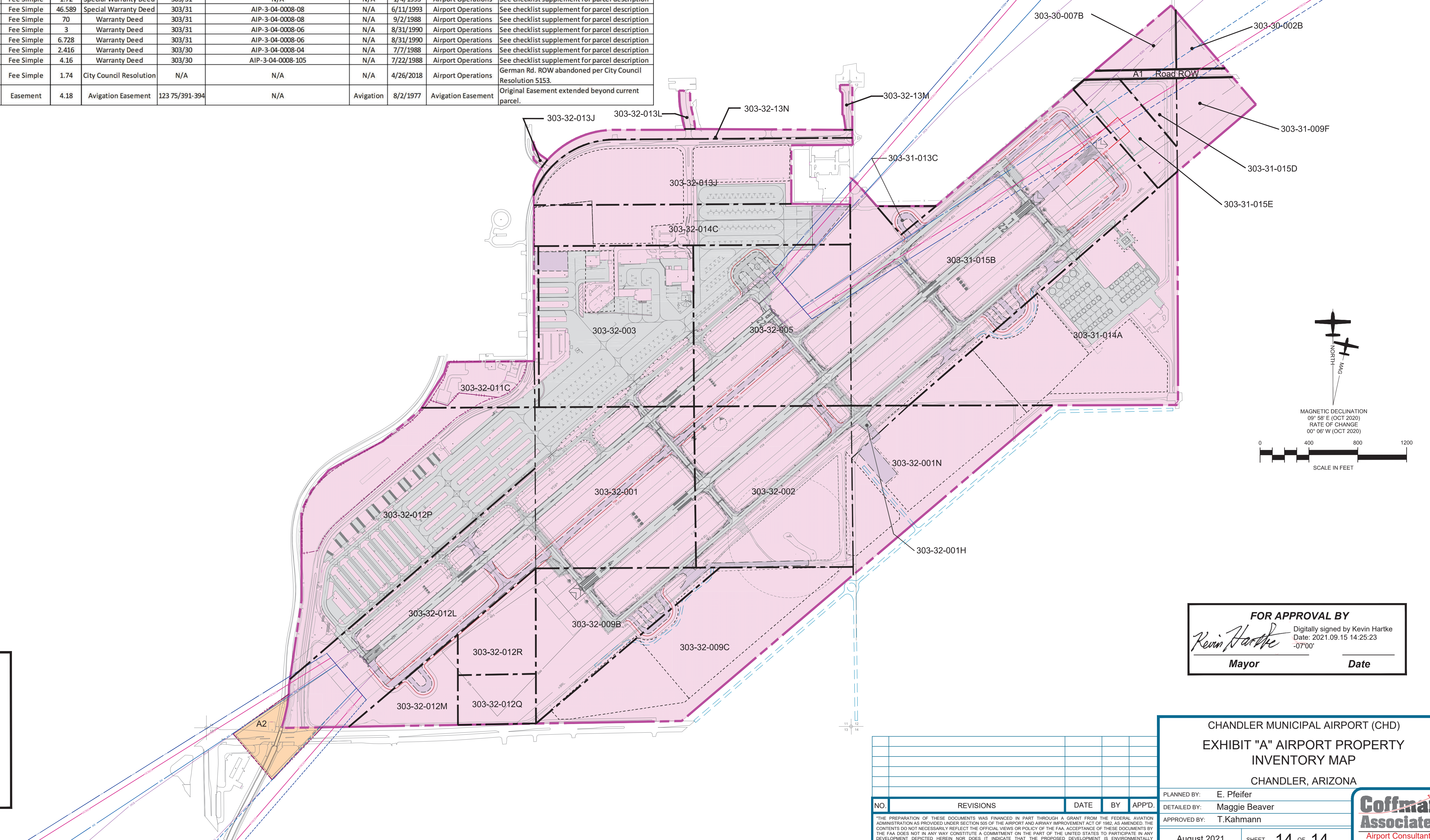
Coffman Associates
Airport Consultants
www.coffmanassociates.com

Tract ID	Parcel ID	Grantor	Interest Type	Acreage	Instrument	Book/Page	FAA Grant #	Easement	Date	PurposeofAcquisition	Notes
1	303-32-001	State of Arizona	Fee Simple	40	Warranty Deed	303/32	FAAP 9-02-008-6604	N/A	5/28/1948	Airport Operations	See checklist supplement for parcel description
2	303-32-002A	State of Arizona	Fee Simple	39	Warranty Deed	303/32	FAAP 9-02-008-6604	N/A	5/28/1948	Airport Operations	See checklist supplement for parcel description
3	303-32-003E	State of Arizona	Fee Simple	38.96	Warranty Deed	303/32	FAAP 9-02-008-6604	N/A	5/28/1948	Airport Operations	See checklist supplement for parcel description
4	303-32-005A	State of Arizona	Fee Simple	39	Warranty Deed	303/32	FAAP 9-02-008-6604	N/A	5/28/1948	Airport Operations	See checklist supplement for parcel description
5	303-32-009B	John Demetria LTD.	Fee Simple	21.043	Warranty Deed	303/32	AIP-3-04-0008-04	N/A	3/31/1988	Airport Operations	See checklist supplement for parcel description
6	303-32-009C	Airpark Associates LTD.	Fee Simple	35.702	Warranty Deed	303/32	AIP-3-04-0008-09	N/A	1/26/1994	Airport Operations	See checklist supplement for parcel description
7	303-32-011H	Roosevelt Water Conservation District	Fee Simple	6.625	Warranty Deed	303/32	N/A	N/A	10/24/1985	Airport Operations	See checklist supplement for parcel description
8	303-32-012L	Roosevelt Water Conservation District	Fee Simple	31.8	Warranty Deed	303/32	AIP-3-04-0008-01	N/A	1/27/1975	Airport Operations	See checklist supplement for parcel description
9	303-32-012M	Queen Creek Trust	Fee Simple	7.83	Warranty Deed	303/32	AIP-3-04-0008-03	N/A	9/6/1987	Airport Operations	See checklist supplement for parcel description
10	303-32-012Q	D.J. Patterson	Fee Simple	6	Warranty Deed	303/32	AIP-3-04-0008-07	N/A	12/31/1986	Airport Operations	See checklist supplement for parcel description
11	303-32-012R	D.J. Patterson	Fee Simple	8.914	Warranty Deed	303/32	ADAP-5-04-0008-02	N/A	12/31/1986	Airport Operations	See checklist supplement for parcel description
12	303-32-012X	Roosevelt Water Conservation District	Fee Simple	44.834	Warranty Deed	303/32	AIP-3-04-0008-06	N/A	3/3/1986	Airport Operations	See checklist supplement for parcel description
13	303-32-013J	AJ Chandler Air Park LLC	Fee Simple	24.65	Warranty Deed	303/32	AIP-3-04-0008-11 ADOT E1135, ADOT E1102	N/A	5/29/2002	Airport Operations	See checklist supplement for parcel description
14	303-32-013K	AJ Chandler Air Park LLC	Fee Simple	0.21	Warranty Deed	303/32	AIP-3-04-0008-11 ADOT E1135, ADOT E1102	N/A	5/29/2002	Airport Operations	See checklist supplement for parcel description
15	303-32-013L	AJ Chandler Air Park LLC	Fee Simple	0.71	Warranty Deed	303/32	AIP-3-04-0008-11 ADOT E1135, ADOT E1102	N/A	5/29/2002	Airport Operations	See checklist supplement for parcel description
16	303-32-013M	AJ Chandler Air Park LLC	Fee Simple	0.43	Warranty Deed	303/32	AIP-3-04-0008-11 ADOT E1135, ADOT E1102	N/A	5/29/2002	Airport Operations	See checklist supplement for parcel description
17	303-32-013J	AJ Chandler Air Park LLC	Fee Simple	2.11	Warranty Deed	303/32	AIP-3-04-0008-11 ADOT E1135, ADOT E1102	N/A	5/29/2002	Airport Operations	See checklist supplement for parcel description
18	303-32-014C	D.W. Patterson	Fee Simple	19.536	Warranty Deed	303/32	AIP-3-04-0008-06	N/A	1/4/1993	Airport Operations	See checklist supplement for parcel description
19	303-31-001R	Spitler	Fee Simple	1.464	Warranty Deed	303/31	AIP-3-04-0008-03	N/A	11/2/1987	Airport Operations	See checklist supplement for parcel description
20	303-31-001S	R&E Farms	Fee Simple	22.076	Special Warranty Deed	303/31	AIP-3-04-0008-08	N/A	9/12/1994	Airport Operations	See checklist supplement for parcel description
21	303-31-009F	Chandler Airpark Limited Parnership	Fee Simple	6.971	Warranty Deed	303/31	AIP-3-04-0008-04	N/A	6/10/1988	Airport Operations	See checklist supplement for parcel description
22	303-31-013C	C. Max Killian	Fee Simple	1.72	Special Warranty Deed	303/31	N/A	N/A	1/4/1993	Airport Operations	See checklist supplement for parcel description
23	303-31-014A	D.W. Patterson	Fee Simple	46.589	Special Warranty Deed	303/31	AIP-3-04-0008-08	N/A	6/11/1993	Airport Operations	See checklist supplement for parcel description
24	303-31-015F	D.W. Patterson	Fee Simple	70	Warranty Deed	303/31	AIP-3-04-0008-08	N/A	9/2/1988	Airport Operations	See checklist supplement for parcel description
25	303-31-015D	D.W. Patterson	Fee Simple	3	Warranty Deed	303/31	AIP-3-04-0008-06	N/A	8/31/1990	Airport Operations	See checklist supplement for parcel description
26	303-31-015E	D.W. Patterson	Fee Simple	6.728	Warranty Deed	303/31	AIP-3-04-0008-06	N/A	8/31/1990	Airport Operations	See checklist supplement for parcel description
27	303-30-002B	Exeter Real Estate Investors	Fee Simple	2.416	Warranty Deed	303/30	AIP-3-04-0008-04	N/A	7/7/1988	Airport Operations	See checklist supplement for parcel description
28	303-30-007B	D.W. Patterson	Fee Simple	4.16	Warranty Deed	303/30	AIP-3-04-0008-105	N/A	7/22/1988	Airport Operations	See checklist supplement for parcel description
A1	A1	City Of Chandler	Fee Simple	1.74	City Council Resolution	N/A	N/A	N/A	4/26/2018	Airport Operations	German Rd. ROW abandoned per City Council Resolution 5153.
A2	A2	Roosevelt Water Conservation District	Easement	4.18	Avigation Easement	123 75/391-394	N/A	Avigation	8/2/1977	Avigation Easement	Original Easement extended beyond current parcel.

GENERAL NOTES:

1. APN's used as tract ID's on previous ALP Exhibit "A". New ID's of A1and A2 were created for this version.

2. Parcel descriptions are on an attachment to the SOP 3.0 Checklist



Legend

- Existing Property
- Existing Avigation Easement
- Parcel Lines

FOR APPROVAL BY

Digitally signed by Kevin Hartke
Date: 2021.09.15 14:25:23 -07'00'

Mayor **Date**

NO.	REVISIONS	DATE	BY	APP'D.

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CHANDLER MUNICIPAL AIRPORT (CHD)

EXHIBIT "A" AIRPORT PROPERTY INVENTORY MAP

CHANDLER, ARIZONA

PLANNED BY: E. Pfeifer
DETAILED BY: Maggie Beaver
APPROVED BY: T.Kahmann

August 2021

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