City of BRENHAM

BRENHAM

MUNICIPAL AIRPORT MASTER PLAN

AIRPORT MASTER PLAN

For

Brenham Municipal Airport
Brenham, Texas

Prepared by

Coffman Associates
Airport Consultants

March 2024

TABLE OF CONTENTS

TABLE OF CONTENTS

Introduction

Chapter One – Inventory

Chapter One – Inventory (continued)

Chapter Two – Forecasts

Chapter Two – Forecasts (continued)

Chapter Three – Airport Facility Requirements

Chapter Four – Airport Development Alternatives

Chapter Four – Airport Development Alternatives (continued)

Chapter Five – Recommended Master Plan Concept

Chapter Six – Financial Management Plan

EXHIBITS

Introduction

Inventory

Forecasts

Airport Facility Requirements

Airport Development Alternatives

Appendix A - GLOSSARY OF TERMS

Appendix B – AIRPORT LAYOUT PLANS

Appendix C – DRAFT HEIGHT/HAZARD ZONING ORDINANCE

INTRODUCTION

INTRODUCTION

Brenham Municipal Airport is a thriving general aviation airport located in east-central Texas, halfway between Austin and Houston. The airport plays an important role in linking the community to the national airspace system, as well as serving as a vital economic engine for the City of Brenham and the region.

As the airport's sponsor, the city recognizes the value the airport brings to the community, and the commitment to undertake this airport master plan is evidence. With a sound and realistic development plan in place, Brenham Municipal Airport can maintain its role as an important link to the regional, state, and national air transportation systems.

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 for Brenham Municipal Airport was completed in 1986, with an Airport Development Plan and Airport Layout Plan (ALP) update completed in 2005. The City of Brenham has received a grant from the Texas Department of Transportation (TxDOT) – Aviation Division which fully funds the cost to update the airport master plan.

The City is responsible for funding capital improvements at the airport, as well as obtaining FAA and TxDOT 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 TxDOT.

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 study demonstrates the City's commitment to maintaining a safe and efficient airport that is capable of meeting aviation needs now and in the future. 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 for Brenham Municipal Airport was completed more than 30 years ago.
- Funded by the FAA through the Airport Improvement Program (AIP), which provides 90% of the total project costs. The remaining 10% is funded by the American Rescue Plan Act (ARPA).
- A City of Brenham document that will ultimately be presented for approval to the City Council. TxDOT 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. Up to two (2) 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 might never materialize.
- A guarantee that the City of Brenham, TxDOT, or the AIP will fund any planned projects. Project funding is considered on a project-by-project basis and requires appropriate need and demand. Certain projects may require the completion of a benefit-cost analysis.
- Environmental clearance for specific projects. The Master Plan includes an environmental overview that identifies potential environmental sensitivities per the *National Environmental Policy Act of 1969* (NEPA) guidelines. 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 of 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 Strand Associates. Strand Associates is a locally based engineering firm that will provide support and offer insights into development alternatives and estimates of probable costs.

The airport master plan update will be prepared in accordance with FAA requirements, including Advisory Circular (AC) 150/5300-13B, *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 TxDOT. The plan will also be coordinated with the City of Brenham, 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:

- Evaluate the airport's Mission and Vision Statements, and if appropriate, recommend revisions to more accurately summarize the City's and airport's purpose and goals for the future
- Analyze the current situation at Brenham Municipal Airport by conducting an inventory of existing conditions and operational data
- Identify aviation demand forecasts for airport operations and based aircraft for 5, 10, and 20 years into the future
- Determine facility requirements necessary to meet forecasted demand
- Draft alternatives for airport development and operation, in line with facility requirements
- Select a preferred development concept, which will be reflected on the Airport Layout Plan (ALP)
- Develop a 20-year demand-based Capital Improvement Plan (CIP), including a recommended phasing plan
- Prepare an updated ALP drawing set of existing and proposed facilities
- Analyze the airport's business and development needs and recommend an implementation strategy to maximize airport revenue
- Develop a height and hazard zoning ordinance update to ensure proper protection of local and regional airspace is enforced

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:

- Brenham Municipal Airport will continue to operate as a local general aviation airport through the 20-year planning period;
- The airport 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 eight 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 and schedule, as well as the establishment of an Airport Master Plan Committee (AMPC). A custom project website will be developed to house draft materials and allow for public comment and will be maintained for the duration of the study. General background information will be established that includes outlining the goals and objectives to be accomplished during the master Plan.

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 Brenham Municipal Airport over a 20-year period. An existing and ultimate critical 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 TxDOT and FAA for approval.

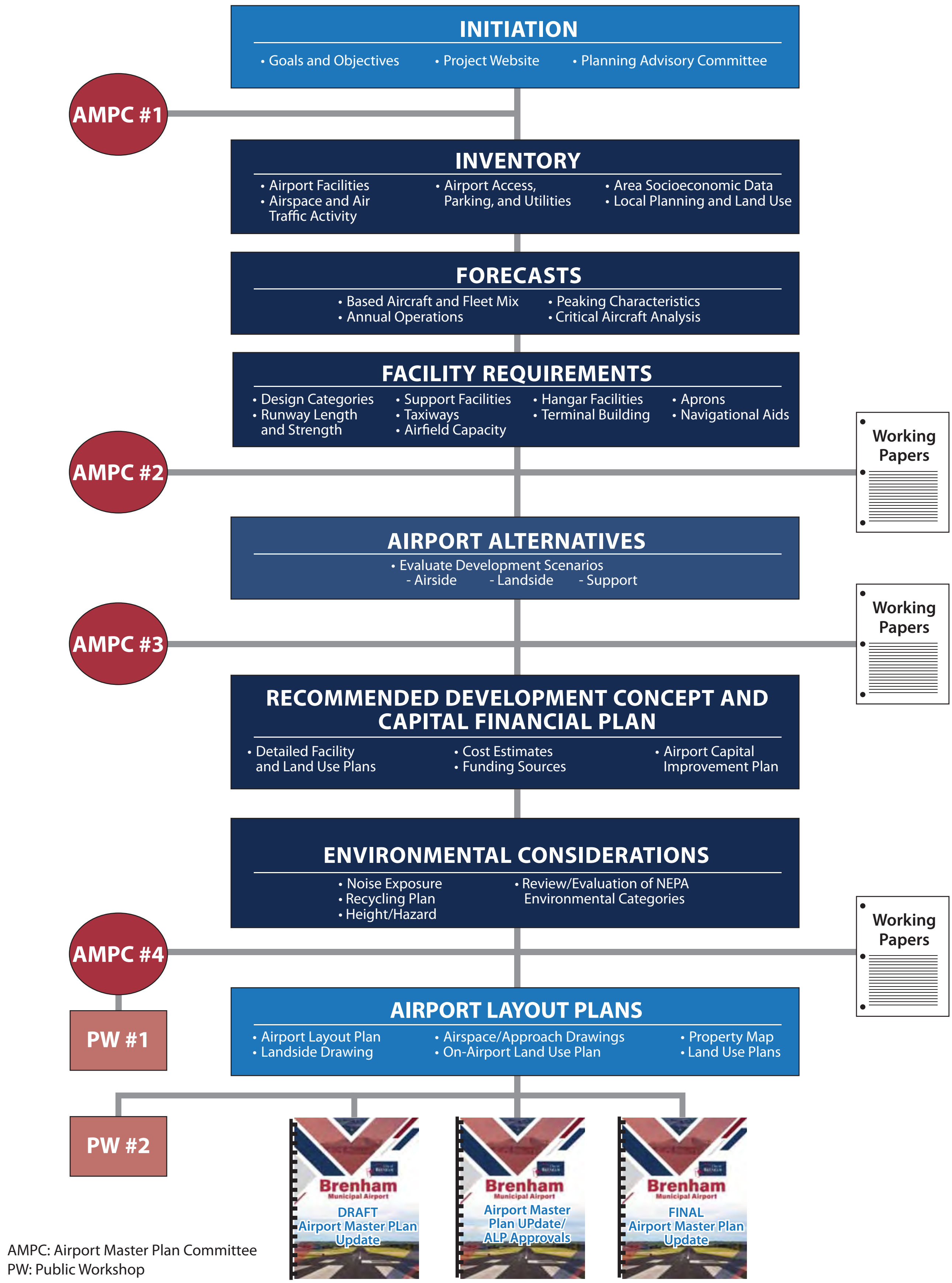


Exhibit IA
PROJECT WORKFLOW

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 – Airport Plans and Land Use Compatibility provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the airport. Updated ALP drawings will be developed based on the recommended development concept. The ALP set is used by the FAA and TxDOT in determining grant eligibility. This element is the second element of the study that is submitted to TxDOT and the FAA for approval. The recommended plan will be examined from an environmental perspective to provide information that will help expedite subsequent environmental review under NEPA. A recycling plan is also developed to assess the airport's existing waste management program and develop recommendations for improving on-airport recycling. This element also includes a review of land use controls and zoning ordinances and an update to the airport's noise contours.

Element 7 – Financial Management and Development analyzes the costs that may be associated with the development plan, with in-depth financial analysis to estimate capital funds required from federal and state grant-in-aid programs. A 20-year capital program and development schedule that prioritizes projects will be established. Tenant lease agreements will also be evaluated and methods for improving lease management will be explored.

Element 8 – 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 Brenham Municipal Airport Master Plan is of interest to many within the local community and region. This includes local citizens, local businesses, community organizations, City officials, airport users/tenants, and aviation organizations. As a component of the regional, state, and national aviation systems, the airport 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, an AMPC was established to act in an advisory role during preparation of the study. Committee members are scheduled to meet four times at designated points during the study to review study materials and provide comments to help ensure that a realistic, viable plan is developed.

Draft working paper materials will be 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.

Two open-house public information workshops will also be 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 will be advertised through local media outlets, and all draft reports, meeting notices, and materials will be made available to the public on the project website at https://brenham.airportstudy.net/

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 was conducted with the AMPC in June 2022. A summary of this exercise and discussion is included below.

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.

It is important to note that some attributes may fit into multiple categories. For example, something can be considered both a strength and a weakness, depending on the perspective of the person or entity describing it.

S STRENGTHS	• 6,000-foot runway can accommodate a wide range of aircraft • Non-towered (easier, more convenient) • Good location (close to both Austin and Houston) • Unique events in Brenham draw visitors • GPS approaches below 1-mile to both runway ends • Airport surveillance radar (ASR) on-site	• Convenient for emergency response • Popular restaurant on-site • Automated weather observing system (AWOS) on-site • Crew car available for pilots and passengers • Excellent support from city staff and community leaders
W WEAKNESSES	• Cost of fuel • 75-foot-wide runway • Lack of developable space within existing property boundary • Lack of aircraft storage space, including lack of transient hangar • Lack of aircraft parking apron space • Water and other utilities need to be upgraded • Not part of the Avfuel card program	• Geographical constraints, including road network • No fire suppression capability • Lack of security features (inadequate fencing, cameras, etc.) • Access road does not extend to all hangars • General upgrades and maintenance needed (taxiway lighting; limited hangar/apron lighting) • No white glove service • No 3-phase electric power
O OPPORTUNITIES	• White glove service • Transient hangar space • Encroachment from Austin and Houston brings money to Brenham • Transition to "executive" airport	• Increased funding opportunities with 2022 infrastructure bill • On-airport flight training school • Updating policies (leases, etc.) • Updating branding and messaging
T THREATS	• Electric aircraft • Competition from other airports in the area • Adjacent land ownership	• Surrounding land uses & encroachment (residential development on east side) • National pilot shortage

AIRPORT MISSION AND VISION

To be both effective and proactive, organizations – including airports – should develop guiding statements. Guiding statements are written documents developed by key stakeholders that lay out a plan for the organization's future. These statements include elements such as the organization's mission and vision and provide direction for everything that happens within the organization. These statements are action oriented, with a focus on developing measurable objectives and achieving goals.

MISSION STATEMENT

A mission statement summarizes the purpose and goals of an organization. It conveys what the organization does and what its primary contribution is. The overarching purpose of an airport's mission statement is to guide decision-making and dictate conduct at all levels, and also to shape performance on a day-to-day basis. Therefore, it is crucial that all aspects of the operation and management of an airport be linked to its mission statement.

Mission Statement Options

1. Brenham Municipal Airport will operate in a safe and efficient manner while offering high-quality services and reliability to all users. The Airport will continue to seek opportunities for growth and increased economic output.

2. The mission of Brenham Municipal Airport is to function as a premier general aviation airport by providing superior facilities and reliable services. The airport will prioritize safety and efficiency while serving as an economic development engine for the City.

3. The mission of the Brenham Municipal Airport is to be a major driver in the economic growth of the Brazos Valley. The Airport will remain competitive by providing first-class customer service, maintaining safety, and increasing regional access.

4. To provide exceptional general aviation services to the City of Brenham and the region, while serving as a reliable community asset that contributes to the local economy. The airport shall continue to evolve to meet the changing needs of aviation users.

Selected Mission Statement

The mission of Brenham Municipal Airport is to be a premier general aviation airport by providing superior facilities and reliable services. The Airport will prioritize safety and efficiency while serving as an economic development engine for the Brenham/Washington County Community.

VISION STATEMENT

A vision statement is an extension of the mission statement. While a mission statement describes the "what" of an organization (i.e., its purpose and goals), the vision statement provides the "how." In other words, a vision statement articulates the aspirations for the airport and defines how the airport will attain those ambitions.

Vision Statement Options

1. Brenham Municipal Airport will support the continued growth of the Brenham economy by providing high-quality aviation services.

2. Brenham Municipal Airport will strive to maintain financial solvency and will identify and pursue areas with revenue-generating potential on the airport.

3. Brenham Municipal Airport will elevate safety and efficiency for all airport users and visitors.

4. Brenham Municipal Airport will prioritize growth opportunities to broaden economic contributions and meet increasing aviation demand in the region.

5. Brenham Municipal Airport will focus on attracting more cabin class and jet aircraft to stay abreast with evolving trends in aviation.

Selected Vision Statement

Brenham Municipal Airport will support the continued growth of the Brenham economy by offering reliable, high-quality aviation services.

Chapter One

INVENTORY

City of BRENHAM

Chapter One
INVENTORY

The inventory chapter of existing conditions is the initial step in the preparation of the Brenham Municipal Airport 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, and environmental resources are detailed at the end of this chapter.

Inventory Source Documents:

- City of Brenham's airport website[1]
- City of Brenham Comprehensive Plan, *Historic Past, Bold Future Plan 2040*
- 2005 Airport Development Plan
- Brenham Municipal Airport Federal Aviation Administration (FAA) Form 5010, *Airport Master Record*

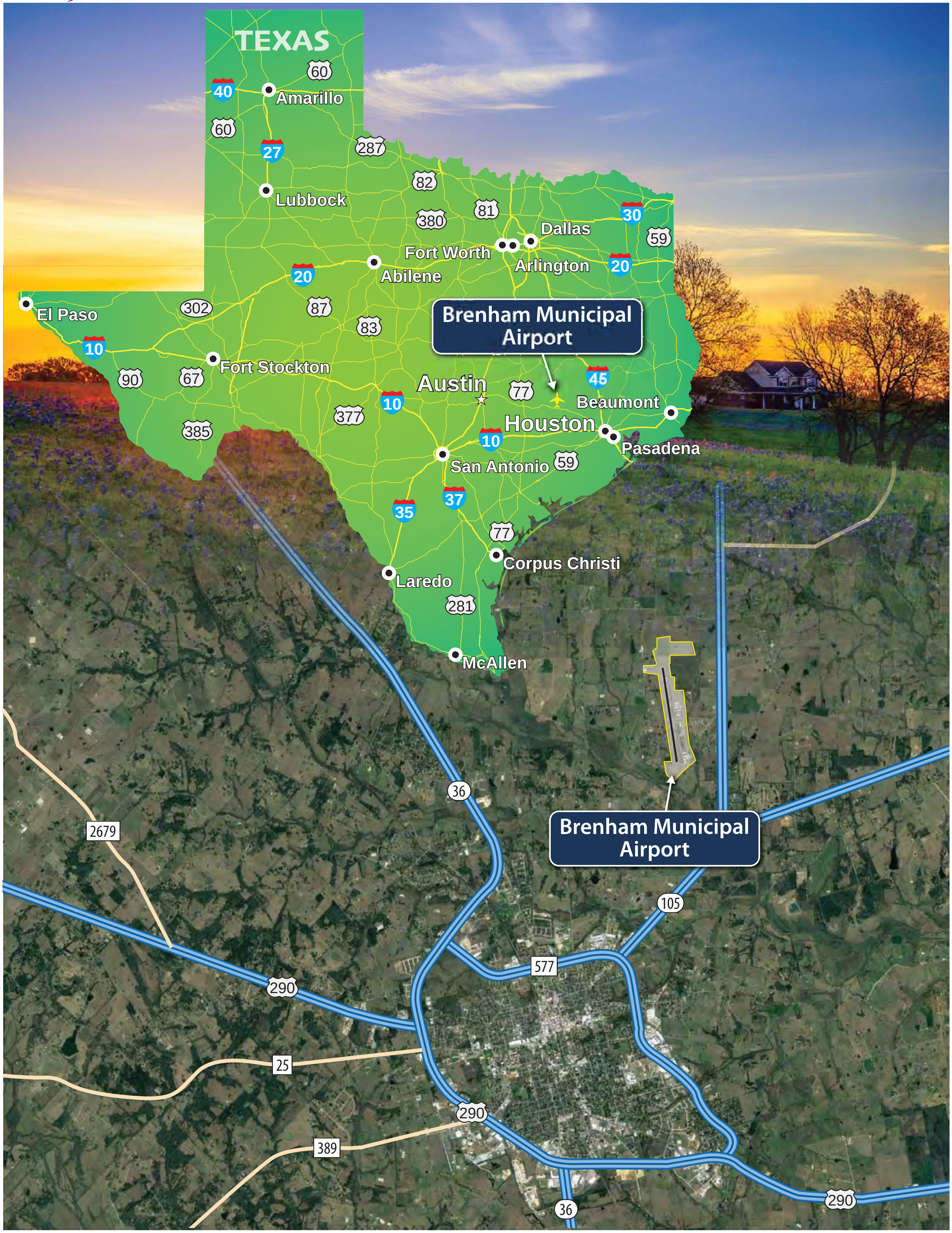
AIRPORT SETTING AND BACKGROUND

LOCALE

Located halfway between Austin and Houston in east-central Texas, the City of Brenham is the county seat of Washington County. The city was initially settled in 1843 and has a rich history as one of Texas' original railroad communities, which ultimately led to the growth and prosperity Brenham continues to experience today. According to the U.S. Census Bureau, the city had a population of 17,369[2] in 2020 and is the largest city in the county. Primary industries include food, manufacturing, and education. Brenham is also home to several festivals and events, attracting tourists and contributing significantly to the local economy.

Brenham Municipal Airport is situated approximately five miles northeast of the city center and encompasses approximately 281 acres. The airport sits at an elevation of 317.7 feet above mean sea level (MSL). The surrounding major surface roadways include U.S. Highway 290 which provides east-west access to the city and State Highway 36 that runs north and south. The airport can be accessed from FM 50 via Airport Road and Aviation Way. **Exhibit 1A** depicts the airport in its regional setting.

[1] https://www.cityofbrenham.org/city_government/departments/development_services/airport.php
[2] U.S. Census Bureau, https://data.census.gov/cedsci/profile?g=1600000US4810156


TEXAS
Amarillo
Lubbock
Dallas
Fort Worth
Arlington
Abilene
El Paso
Fort Stockton
Austin
Houston
Beaumont
Pasadena
San Antonio
Corpus Christi
Laredo
McAllen
Brenham Municipal Airport
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AIRPORT HISTORY

In 1964, the City of Brenham purchased more than 173 acres to construct the airport. Construction began that same year and included a runway, taxiway, apron, and entrance road. Other improvements, such as runway lighting, a rotating beacon, lighted wind cone, and perimeter fencing were added soon after. In 1965, a terminal building and hangar were constructed to better serve airport users and provide a storage facility for aircraft. Improvements continued throughout the 70s, 80s, and 90s, as aviation activity steadily increased and the City recognized the importance of continued development to meet demand. The early 2000s brought about a significant change at the airport with the construction of a new terminal building, which remains in use today. In the nearly six decades since the airport originated, Brenham Municipal Airport has continued to grow and is a thriving facility serving the aviation needs of users in the area, while providing an important economic contribution to the community.

AIRPORT ADMINISTRATION

Brenham Municipal Airport is owned and operated by the City of Brenham. The airport was historically directed by an Airport Advisory Board that had advisory and oversight responsibilities regarding policies, fees, and general operations at the airport. The Board was disbanded in December 2021. Since January 2022, the airport has been overseen by an airport liaison who is appointed by City Council and serves a two-year term, as well as ad-hoc working groups including a business committee and facility committee. In April 2022, the City also established a new position, an on-site airport manager, who provides day-to-day oversight of the airport and its maintenance and serves as a staff liaison to the City of Brenham.

CLIMATE

Climate and local weather conditions are an important consideration in the master planning process as they can significantly impact an airport's operations. For example, high surface temperatures and humidity increase runway length requirements, and runway orientation is dependent upon predominant wind patterns for the area. Cloud cover percentages and frequency of other climatic conditions also determine the need for navigational aids and light.

Brenham experiences long, hot summers and mild winters, with evenly distributed precipitation throughout the year. **Exhibit 1B** displays weather patterns at the airport. August has the highest average maximum temperature of 84.4 degrees. January is the coolest month with an average minimum temperature of 39.6 degrees. Annual rainfall is approximately 48 inches and is most plentiful during the spring and fall, with May and October recording more than five inches of rain each month.

Table 1A indicates that visual meteorological conditions (VMC) occur 88.34 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 7.06 percent of the time. Less than IMC, or poor visibility conditions (PVC), are present 4.60 percent of the time. These weather conditions are lower than instrument approach minimums, making the airport inaccessible to most air traffic.

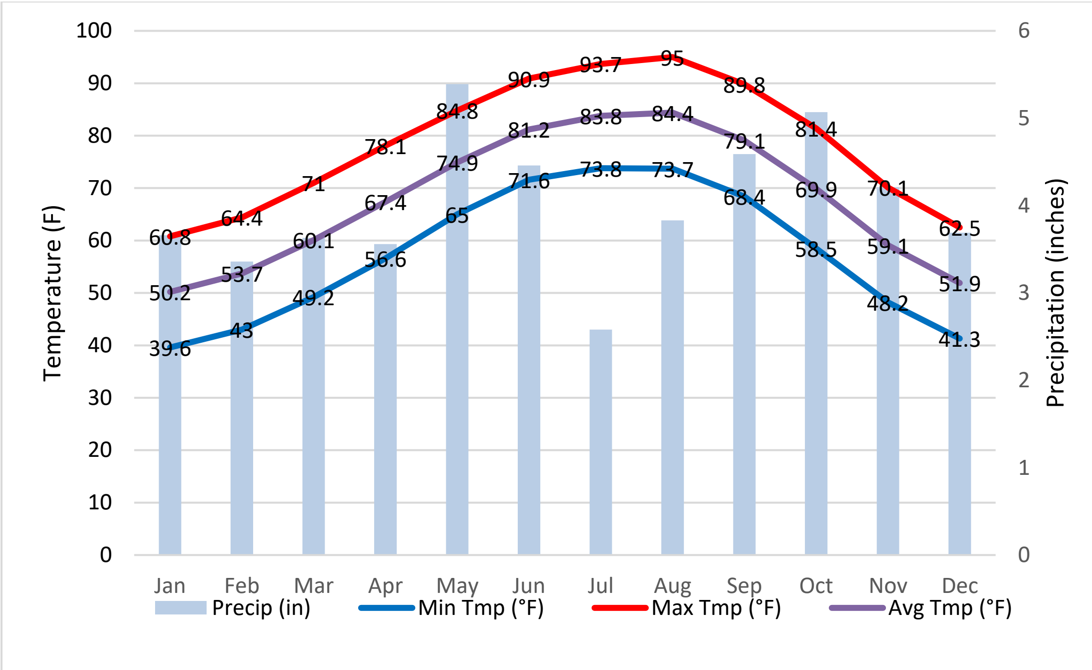


Exhibit 1B – Brenham Weather Patterns

Table 1A | Weather Conditions			
Condition	**Cloud Ceiling**	**Visibility**	**Percent of Total**
VMC	≥ 1,000’ AGL	≥ 3 statute miles	88.34%
IMC	≥ 500’ AGL and < 1,000’ AGL	≥ 1 to < 3 statute miles	7.06%
PVC	< 500’ AGL	< 1 statute mile	4.60%
VMC: Visual Meteorological Conditions IMC: Instrument Meteorological Conditions PVC: Poor Visibility Conditions AGL: Above Ground Level			

Source: Station - Brenham Municipal Airport – A0000253928, Observations from 1/1/2012 thru 12/31/2021

CAPITAL IMPROVEMENT HISTORY

Significant improvements have been made to the airport since its establishment. To assist in funding capital improvements, the FAA and Texas Department of Transportation (TxDOT) – Aviation Division have provided funding assistance to Brenham Municipal Airport through the Airport Improvement Program (AIP). Airport improvement funds are collected through user fees, additional taxes on airline airfares, and aviation fuel taxes. As airports grow, or safety standards change over time, funding is needed to maintain a safe and efficient airport environment. The *Airport and Airway Development and Revenue Act* of 1970 established the Aviation Trust Fund which funds the AIP. Texas is a member of the FAA’s Block Grant Program, giving TxDOT the responsibility, among other things, for administering AIP grants to reliever and general aviation airports, including Brenham Municipal Airport. The State of Texas also offers funding opportunities that the airport is eligible for, which are listed below.

- **Routine Airport Maintenance Program (RAMP)**. TxDOT matches local government grants up to $50,000 for basic improvements, such as parking lots, fencing, and other airside and landside needs.
- **Terminal Building Grants**. TxDOT has funded terminal building construction on a 50/50 basis, up to a $1.0 million total project costs, though consideration has recently been given to upgrading the total cost allowance on a case-by-case basis.
- **Airport Traffic Control Tower (ATCT) Grants**. TxDOT funds the construction of up to two ATCTs statewide each year. ATCT funding could be provided on a 90/10 basis, up to a total construction cost of $1.67 million.
- **Federal Aviation Grants**. Provides federal and state grant funding for maintenance and improvement projects to airport included in the NPIAS.

Table 1B summarizes airport capital improvement projects and maintenance undertaken since 2002, with funding coming from federal, state, and local sources. During this period, the airport has been awarded more than $7.0 million dollars in State and Federal grants, with local funding sources responsible for more than $1.3 million in improvements to the airport.

Table 1B | Airport Capital Improvement Project History

FY	Agency	Local ($)	State ($)	Federal ($)	Project Description
2002	TXDOT	$159,822	$0	$1,399,342	Rehabilitate runway (5,500x75), apron, parallel taxiway and cross taxiways; reconstruct hangar access taxiways (2900 sy); construct T-hangar access taxiway (4,200 sy), run-up pads (2,200 sy); expand apron (230x200); realign terminal area stub taxiway (240x40); install PAPI-4 (Runway 34), REILs (Runway 34) and relocate Runway 16; replaced threshold lights; rehabilitate corporate hangar access taxiway (50x400); install 6 apron security lights; paint beacon tower; construct auto parking for new terminal (200x100); relocate fuel farm
2003	TXDOT	$45,092	$0	$150,000	Construct south corporate apron (2,456 sy) and hangar access taxiway (35x165)
2003	TXDOT	$11,252	$11,252	$0	RAMP: Reconstruct entrance road, herbicide, lighting, and NADIN fees
2004	TXDOT	$5,000	$45,000	$0	Prepare an airport development plan
2004	TXDOT	$23,744	$23,744	$0	RAMP: Reconstruction of entrance road, replacement lighting, herbicide, AWOS, and NADIN fees
2005	TXDOT	$29,530	$29,530	$0	RAMP: TxDOT to contract for AWOS maintenance, County to contract NADIN fee, AWOS repairs, reconstruction of airport entrance road, airport lighting maintenance and supplies, screening of terminal patio, and landscaping
2006	TXDOT	$3,729	$33,562	$0	Prepare an airport layout plan.
2006	TXDOT	$9,371	$9,371	$0	RAMP: TxDOT to contract for AWOS maintenance, sponsor to contract for NADIN monthly fee, AWOS repairs
2006	TXDOT	$153,799	$0	$692,076.00	Design and construction for hangar and hangar access pavement
2007	TXDOT	$82,070	$0	$738,633.00	Acquire land (34 ac); engineering design to extend Runway 16-34, 16 end (500x75); extend MIRL on Runway 16-34 (500 lf); erosion/sedimentation controls; relocate PAPI-2 & REILs (Runway 16); construct run-up pad; extend parallel taxiway to Runway 16 (800x40); install fencing (1,360 lf); install signage; rehabilitate runway, stub taxiways and apron; mark Runway 16-34
2007	TXDOT	$9,745	$9,745	$0	RAMP: TxDOT to contract for AWOS maintenance, Sponsor to contract for NADIN, AWOS repairs
2008	TXDOT	$101,255	$0	$911,296	Extend Runway 16-34, 16 end (500x75); engineering/RPR/cont./testing; extend MIRL on Runway 16-34 (500 lf); erosion/sedimentation controls; relocate PAPI-2 & REILs (Runway 16); construct run-up pad; extend parallel taxiway to Runway 16 (800x40); install fencing (1,360 lf); install signage; rehabilitate runway, stub taxiways and apron; mark runway.

Table 1B | Airport Capital Improvement Project History (continued)					
FY	Agency	Local ($)	State ($)	Federal ($)	Project Description
2008	TXDOT	$30,326	$30,326	$0	RAMP: TxDOT to contract for AWOS maintenance; Sponsor to contract for AWOS AviMet and AWOS repairs/parts replacement. Other projects TBD and added by amendment.
2009	TXDOT	$9,461	$9,461	$0	RAMP: AWOS maintenance; Sponsor for AWOS AviMet, AWOS repairs/parts replacement
2010	TXDOT	$20,456	$20,456	$0	RAMP: TxDOT to contract for AWOS maintenance; Sponsor to contract for AWOS AviMet Data Link and AWOS repairs/parts replacement. TxDOT to contract for entrance road crack seal; sponsor to contract for herbicide application, lighting and terminal repairs/maintenance, and environmental compliance measures
2011	TXDOT	$29,819	$29,819	$0	RAMP: TxDOT to contract for AWOS maintenance; Sponsor to contract for AWOS AviMet Data Link and AWOS repairs/parts replacement
2012	TXDOT	$28,185	$28,185	$0	RAMP: TxDOT to contract for AWOS Maintenance; Sponsor to contract for airport general maintenance projects.
2013	TXDOT	$180,414	$0	$1,623,728	Widen hangar access taxiway; construct south hangar access taxiway; construct cross taxiway (standards); engineering and design for taxiway and hangar project; construct 10-unit T-hangar; construct new electrical vault; construct north hangar access taxiway; contingency, RPR, admin for taxiway and hangar project
2013	TXDOT	$31,004	$31,004	$0	RAMP: TxDOT Contract for AWOS Maintenance; Sponsor to perform airport general maintenance
2014	TXDOT	$31,369	$31,369	$0	RAMP: TxDOT Contract for AWOS Maintenance; Sponsor to perform airport general maintenance
2015	TXDOT	$50,000	$50,000	$0	RAMP: Sponsor to perform airport general maintenance
2016	TXDOT	$28,297	$28,297	$0	RAMP: Sponsor to perform airport general maintenance
2017	TXDOT	$27,415	$27,415	$0	RAMP: Sponsor to perform airport general maintenance
2018	TXDOT	$48,000	$48,000	$0	RAMP: Sponsor to perform airport general maintenance
2019	TXDOT	$70,596	$0	$635,361	Re-mark Runway 34 end; displaced threshold (for construction); design - partial runway reconstruction/rehab; reconstruct 400' section of Runway 16-34 for grades and pavement markings
2019	TXDOT	$28,913	$28,913	$0	RAMP: Sponsor to perform airport general maintenance
2020	TXDOT	$50,000	$50,000	$0	RAMP: Sponsor to perform airport general maintenance
2021	TXDOT	$50,000	$50,000	$0	RAMP: Sponsor to perform airport general maintenance
2022	TXDOT	$0	$0	$316,532	Prepare airport master plan
Totals		**$1,348,664**	**$625,449**	**$6,466,968**	
Note: Over this time period, RAMP funds have increased from a maximum of $40,000 per fiscal year to $100,000 per fiscal year (state and local funding combined). The maximum match from TxDOT was not requested/received during some years due to city budget constraints.					

Source: Airport Project History, Texas Airport System Plan

ECONOMIC IMPACT

Brenham Municipal Airport is a significant economic asset to the region. The airport serves all segments of aviation, including corporate air travel and recreational flying, and is utilized by a wide range of general aviation aircraft from smaller, piston-driven aircraft to larger corporate jets. In 2018, TxDOT undertook a state-wide economic impact study to measure how the state's airports stimulated the economy. Each airport was evaluated based on its direct impacts to the economy, as well as indirect or induced impacts. The study found that Brenham Municipal Airport generates approximately $5.8 million annually in total economic activity and supports 43 jobs with $1.7 million in total earnings. **Exhibit 1C** details the airport's economic impact.

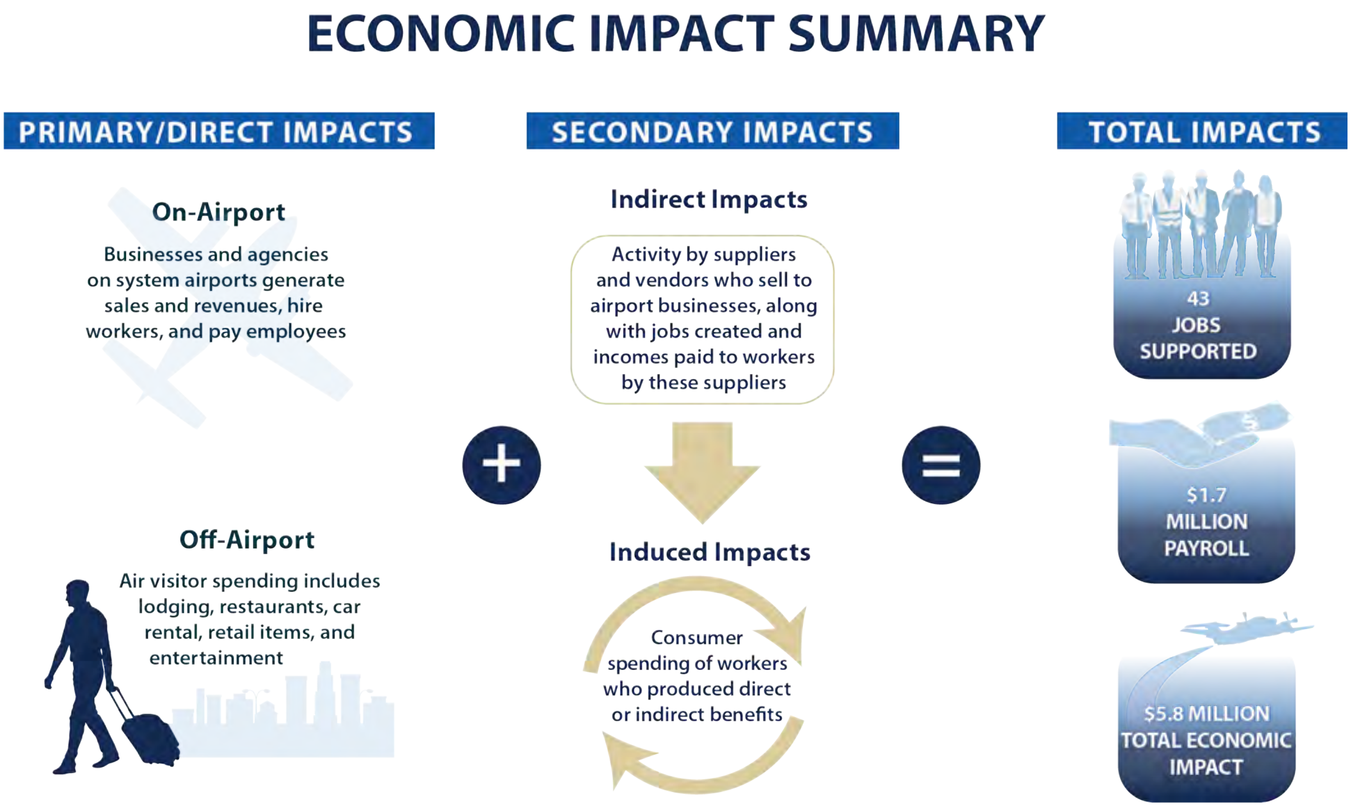


Exhibit 1C – Brenham Municipal Airport Economic Impact

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** | Brenham Municipal Airport has an airport master plan, which was last updated in the 1990s.
- **State** | Brenham Municipal Airport is included within the 2010 *Texas Airport System Plan* (TASP).
- **National** | Brenham Municipal Airport 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

The most common local airport planning document is an airport master plan, which the FAA recommends an airport update every seven to 10 years. In addition to a master plan, entities often provide additional local planning through a variety of studies, including strategic plans, sub-area plans, etc.

The airport master plan is the primary planning document at the local level. It is intended to provide a 20-year vision for airport development based on aviation demand forecasts. Over time, the forecast element of the master plan typically becomes less reliable due to changes in aviation activity and/or the economy.

Brenham Municipal Airport's last master plan was completed more than 30 years ago, in 1986. In 2005, the City of Brenham undertook an Airport Development Plan that included an update to the Airport Layout Plan (ALP). Significant changes in the aviation industry and in the region have occurred since that time, as well as major economic shifts and changes to FAA design standards. Therefore, this is a very appropriate time to update the master plan based on current economic, industry, and local/regional conditions.

STATE AIRPORT PLANNING

The primary planning document for the State of Texas is the TASP, which was last updated in 2010. The TASP focuses on keeping Texas' airports highly advanced, safe, and responsive to the public's needs today and throughout the 20-year planning horizon. Brenham Municipal Airport is classified as a Business/Corporate (BC) airport within the TASP. According to the TASP, BC airports provide access to turboprop and jet activity and support a moderate to high level of business jet activity. They serve areas of concentrated population, purchasing power, or mineral production and are forecast to have 500 or more business/corporate aircraft operations with at least two permanently based jets.[3] Brenham Municipal Airport is one of 67 BC airports in the state.

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 2021-2025, which identified 3,310 public-use airports (3,304 existing and six proposed) that are important to national air transportation. The plan estimates that approximately $43.6 billion in AIP-eligible airport projects will require financial assistance between 2021 and 2025, which is an increase of $8.5 billion identified in the previous NPIAS report.

The NPIAS categorizes airports by the type of activities that take place, including commercial service, cargo service, reliever operations, and general aviation. Brenham Municipal Airport is currently classified as a Regional GA airport in the FAA's NPIAS, which means it serves to support regional economies with interstate and some long-distance flying. Regional airports have high levels of activity, including jets and multi-engine propeller aircraft.

[3] https://ftp.txdot.gov/pub/txdot-info/avn/tasp_2010.pdf

AIRPORT FACILITIES AND SERVICES

There are three broad categories of facilities and services at the airport: airfield, landside, 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.

AIRSIDE FACILITIES

RUNWAY

As depicted on **Exhibit 1D**, Brenham Municipal Airport has a single runway, Runway 16-34, that is oriented north/south. Runway 16-34 measures 6,003 feet long by 75 feet wide and is constructed of asphalt. The runway has a weight-bearing capacity of 30,000 pounds for single wheel (SWL) aircraft. Both runway ends are equipped with nonprecision markings. The runway slopes down from the 16 end at an average gradient of 1.12 percent.

Runway 16-34

TAXIWAYS

The taxiway system at Brenham Municipal Airport consists of a full-length parallel taxiway with five connectors, as identified on **Exhibit 1D**. The taxiways are 40 feet in width and are constructed of asphalt. Taxiway A serves as the full-length parallel taxiway with a 240-foot separation from the runway. Taxiway A provides access to Runway 16, and Taxiway E provides access to Runway 34. Taxiway D connects from the runway to the terminal apron.

Taxiway A

In Spring 2023, taxiway nomenclature is planned to be updated in accordance with FAA's Engineering Brief (EB) No. 89, *Taxiway Nomenclature*

Airfield Data		
RUNWAY		
Runway Designation	**16**	**34**
Length	6,003'	
Width	75'	
End Elevation	317.7'	250.4'
Gradient	1.12%	
Surface Material	Asphalt	
Markings/Condition	Non-precision/Good	Non-precision/Good
Runway Edge Lighting	MIRL	
Other Lighting	REILs	REILs
Load Bearing Strength - SWL	30,000 lbs SWL	
Visual Approach Aids	PAPI-2	PAPI-4
Instrument Approach Procedures	LPV (GPS)	LPV (GPS)
Traffic Pattern	Left	Left

Airfield Data	
TAXIWAYS	
Lighting	Green Centerline Reflectors
Surface Material	Asphalt
Width	40'
WEATHER AND NAVIGATIONAL AIDS	
AWOS	
ASR-11	
Lighted Wind Cone, Supplemental Windcone	
Segmented Circle	
Airport Beacon	

LEGEND

- Airport Property Line
- A Existing Taxiway Designation
- A1 Ultimate Taxiway Designation

KEY

- ASR-11 - Airport Surveillance Radar
- AWOS - Automated Weather Observation Station
- GPS - Global Positioning System
- LPV - Localizer Performance with Vertical Guidance
- PAPI - Precision Approach Path Indicator
- REILs - Runway End Identification Lighting
- SWL - Runway Weight Bearing Capacity for Aircraft with Single-Wheel Tandem Type Landing Gear

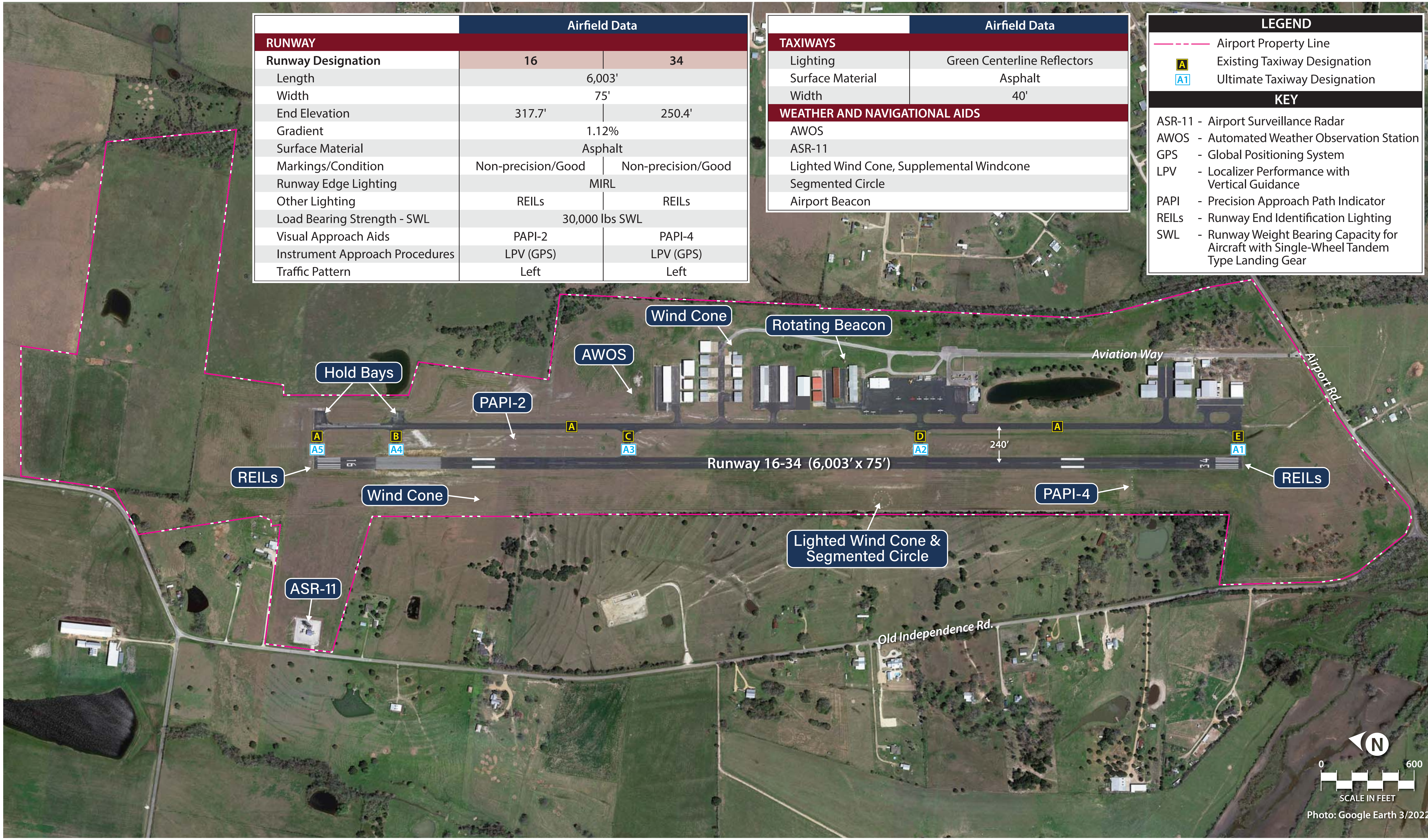
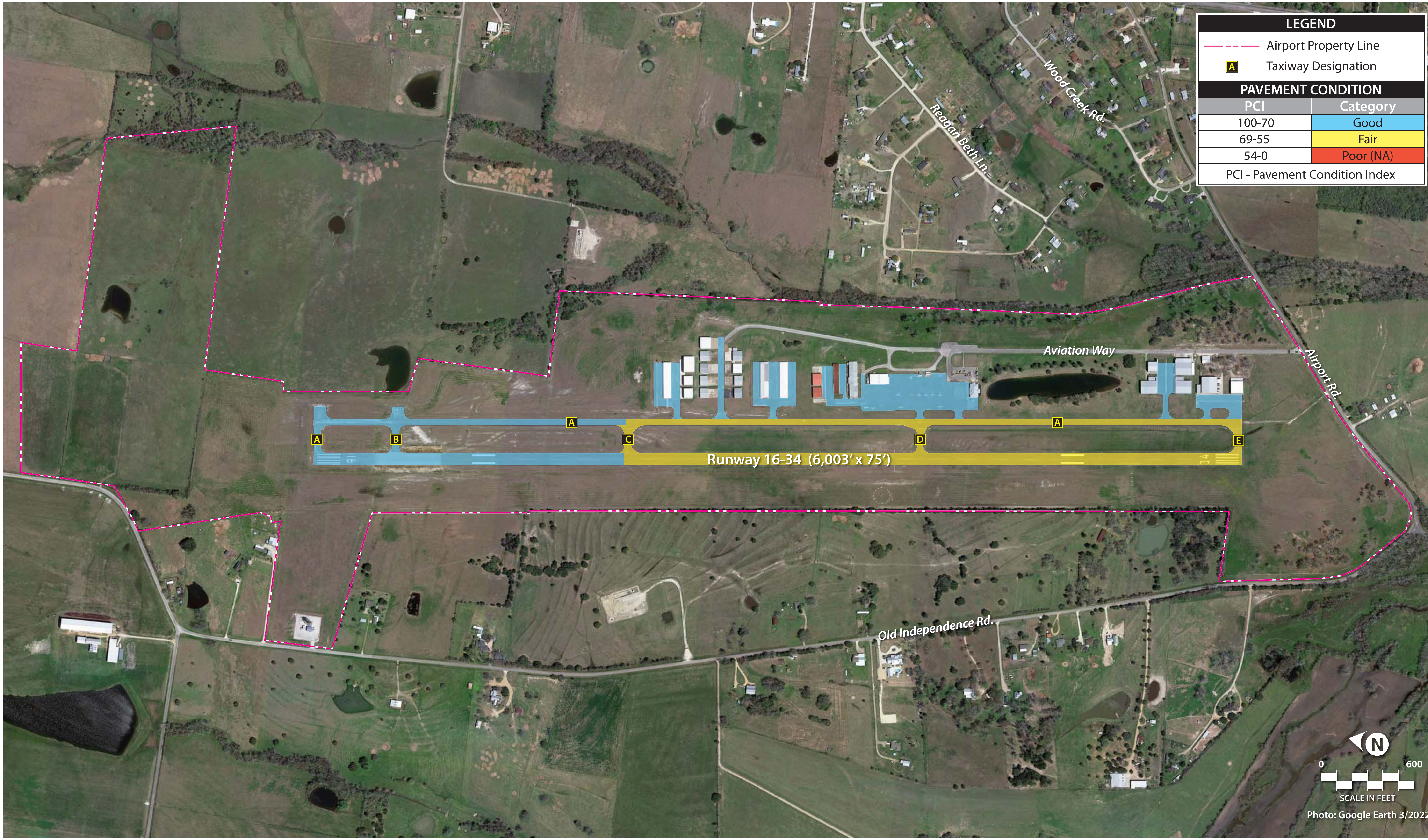


Exhibit 1D
EXISTING AIRSIDE FACILITIES


LEGEND
Airport Property Line
A Taxiway Designation
PAVEMENT CONDITION
PCI | Category
100-70 | Good
69-55 | Fair
54-0 | Poor (NA)
PCI - Pavement Condition Index
Wood Creek Rd.
Reagan Beth Ln.
Aviation Way
Airport Rd.
Old Independence Rd.
Runway 16-34 (6,003' x 75')
A
B
C
D
E
N
0
600
SCALE IN FEET
Photo: Google Earth 3/2022

Convention. Connector taxiways between the runway and parallel taxiway are planned to be redesignated as A1, A2, A3, A4, and A5, from south to north. As such, this study will utilize the updated designators from this point forward.

PAVEMENT CONDITION

A pavement condition survey was conducted for Brenham Municipal Airport in 2018 and evaluated the runways, taxiways, and apron.[4] The inspection resulted in a pavement condition index (PCI) rating for each section of pavement. PCI ratings are determined through a visual assessment in accordance with FAA Advisory Circular 150/5380-6 and range from 0 (failed) to 100 (excellent) and are categorized as poor (PCI between 0 and 54), fair (PCI between 55 and 69), and good (PCI between 70 and 100). According to the 2018 pavement inspection, the north portion of the runway and parallel taxiway extending from the Runway 16 threshold to Taxiway A3 is in good condition, while the remaining runway and taxiway pavement is reported to be in fair condition. The runway has PCI ratings ranging from 64 to 76. The aprons and taxilanes are reported to be in good condition. The back side of **Exhibit 1D** illustrates the pavement condition at Brenham Municipal Airport.

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.

Rotating Beacon

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 northeast of the terminal apron.

Runway Threshold Lighting

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. Runway 16-34 is equipped with medium intensity runway lighting (MIRL). Each

[4] Pavement Condition Report, Texas A&M Transportation Institute, 2018

runway end 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.

There is no taxiway lighting at Brenham Municipal Airport. Rather, the taxiways are identified by green centerline reflectors embedded in the pavement.

Taxiway Centerline Reflector

Visual Approach Aids

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 Brenham Municipal Airport is equipped with a precision approach path indicator (PAPI) system. PAPIs have either two or four lights and an effective visual range of three miles during the day and 20 miles at night. Runway 16 is equipped with a two-box system (PAPI-2) with a standard 3.00-degree glide path, while Runway 34 has a four-box system (PAPI-4) with a 3.50-degree glide path.

PAPI-2

Runway end identification lights (REILs) provide a visual identification of the runway end for landing aircraft. The REILs consist of two synchronized flashing lights, located laterally on each side of the runway end, facing the approaching aircraft. These flashing lights can be seen day or night for up to 20 miles depending on visibility conditions. Both runway ends are equipped with REILs.

Runway End Identifier Light

Pilot-Controlled Lighting

During nighttime hours, pilots can use the pilot-controlled lighting (PCL) system to activate the MIRL and visual approach aids from their aircraft through a series of clicks of their radio transmitter using the common traffic advisory frequency (CTAF) (123.07 MHz).

AIRFIELD SIGNAGE AND MARKINGS

Airfield identification signs assist pilots in identifying runways, taxiway routes, holding positions, and critical areas. Brenham Municipal Airport is equipped with lighted runway and taxiway designations and routing/directional signage.

Pavement markings aid in the movement of aircraft along surfaces at the airport and identify closed or hazardous areas. The airport provides and maintains marking systems in accordance with Advisory Circular (AC) 150/5340-1, *Standards for Airport Marking*. As mentioned previously, both runway ends are equipped with nonprecision markings that include the runway centerline, designation, threshold markings, and aiming points. All taxiways at the airport are marked with yellow centerline, holding position markings, and leadoff lines on normally used exits. Centerline markings assist pilots in maintaining proper clearance from pavement edges and objects near the taxiway edges. Aircraft holding positions are marked at each runway/taxiway intersection. Holding positions are located 200 feet from centerline on Runway 16-34.

Airfield Signage


Aircraft Holding Position Marking

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 very high frequency omnidirectional range (VOR), in general, provides azimuth readings to pilots of properly equipped aircraft transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility (VOR/DME) to provide distance as well as direction information to the pilot. 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 Brenham area is served by two VOR/DMEs (Navasota, 16.9 nautical miles [nm] northeast; Eagle Lake, 33.5 nm south; and the following VORTACs: Industry, 18.6 nm southwest; College Station, 23.2 nm north; Humble, 55.8 nm southeast; and Leona, 58.1 nm north-northeast.

A non-directional beacon (NDB) is a radio transmitter at a known location, used as an aviation or marine navigational aid. The signal transmitted does not include *inherent* directional information, in contrast to other navigational aids, such as a VOR. NDB signals follow the curvature of the Earth, so they can be received at much greater distances at lower altitudes, a major advantage over VOR. The nearest active NDB to Brenham is the Huntsville NDB located 51.2 nm northeast.

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

INSTRUMENT APPROACH PROCEDURES

Instrument approach procedures assist pilots in locating and landing at an airport during low visibility and cloud ceiling conditions. They are categorized as either precision, approach with vertical guidance (APV), or non-precision. Precision instrument approach aids provide an exact course alignment and vertical descent path for an aircraft on final approach to a runway with a height above threshold (HAT) lower than 250 feet and visibility lower than ¾ mile. APVs also provide course alignment and vertical guidance but have HATs of 250 feet or more and visibility minimums of ¾-mile or greater. Non-precision instrument approaches provide only course alignment information with no vertical guidance.

Approach minimums are published for different aircraft categories (aircraft categories are described in greater detail in Chapter 2) and consist of a minimum "decision" altitude and required visibility. According to 14 Code of Federal Regulations (CFR) 91.175, a pilot must be able to make a safe landing, have the runway in sight, and the visibility requirement be met. For a precision approach or approach with vertical guidance, the decision altitude (DA) is the point at which the pilot must meet all three criteria for landing, otherwise they cannot land using the published instrument approach. For a non-precision approach, the minimum descent altitude (MDA) is a specified altitude at which the required visual reference must be made, or a missed approach initiated.

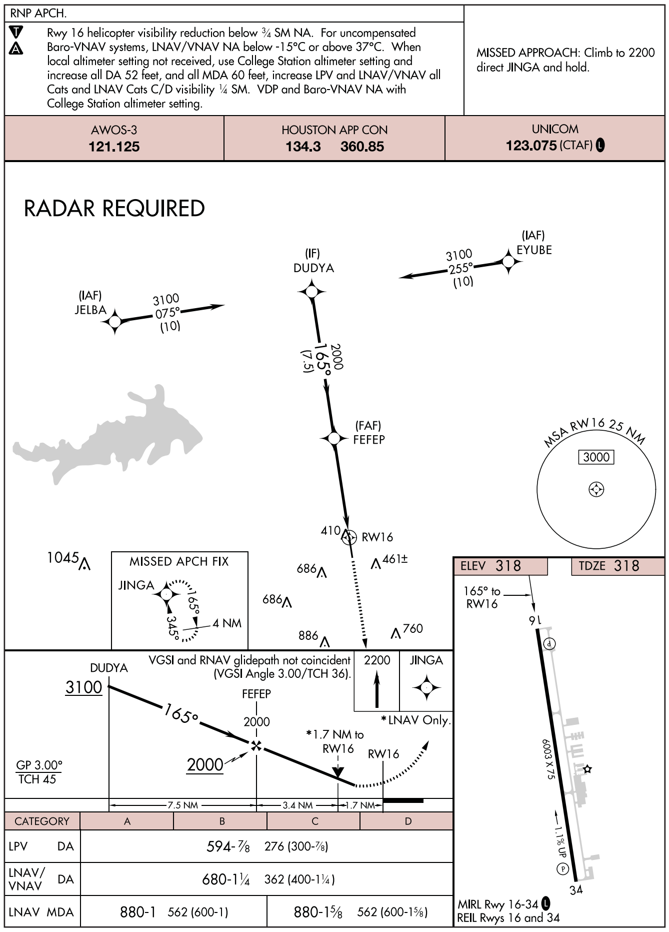
Brenham Municipal Airport is currently equipped with two published instrument GPS approaches. Instrument approaches based on GPS have become very common across the country. GPS is inexpensive, as it does not require a significant investment in ground-based systems by an airport or FAA. Both runway ends are served by GPS localizer performance with vertical guidance (LPV) approaches. GPS LPV approaches provide both horizontal and vertical guidance information to pilots but are not considered precision approaches. A RNAV (GPS) LPV approach is available to Runway 16, which provides a HAT of 276 feet above ground level (AGL) with visibility minimums down to ⅞-mile. An RNAV (GPS) LPV approach is also available to Runway 34, offering a HAT of 250 feet and ¾-mile visibility minimums. Instrument approach procedures at Brenham Municipal Airport are depicted on **Exhibit 1E**.

AWOS-3

WEATHER AND COMMUNICATION

Brenham Municipal Airport is served by an automated weather observation station (AWOS-3). The system updates weather observations every minute, continuously

RNAV (GPS) Runway 16



RNAV (GPS) Runway 34

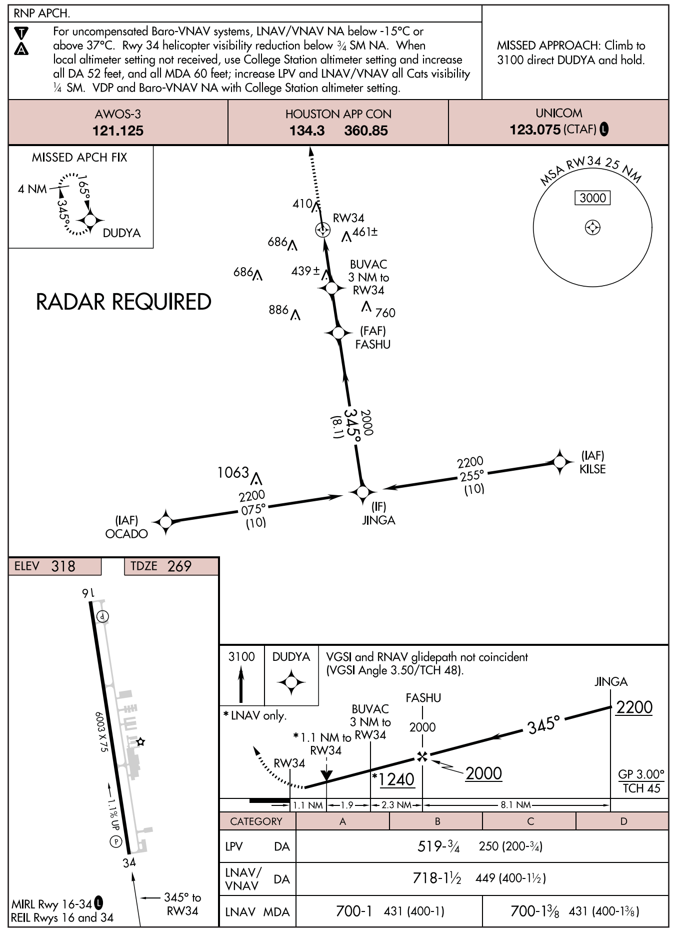


Exhibit 1E
INSTRUMENT APPROACH PROCEDURES

reporting changes that can be accessed via radio frequency 121.125 MHz or by calling (979) 836-2303. 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 currently located on the east side of the runway near Taxiway A3. The AWOS is situated approximately 500 feet from the Runway 16-34 centerline.

ASR-11 Antenna

The airport also has an airport surveillance radar (ASR-11) on-site. The ASR-11 antenna is located on the north side of the airport, west of the Runway 16 threshold, while the repeater equipment is located on the south side of the field. The ASR-11 is a digital radar system that detects aircraft position and provides enhanced weather-reporting capability.

The airport also has a lighted wind cone and segmented circle located at midfield on the west side of the runway near Taxiway A4. The wind cone informs pilots of the wind direction and speed, while the segmented circle indicates aircraft traffic pattern information. A supplemental wind cone is located at the approach end of Runway 16.

Terminal Building

LANDSIDE FACILITIES

TERMINAL BUILDING

Constructed in 2001, the general aviation terminal building at Brenham Municipal is approximately 4,700 square feet (sf) and includes a lobby, offices, a pilot briefing and flight planning area, a pilot's lounge, and showers and restrooms. As depicted on **Exhibit 1F**, the terminal is located adjacent to the terminal apron and is accessible via Aviation Way.

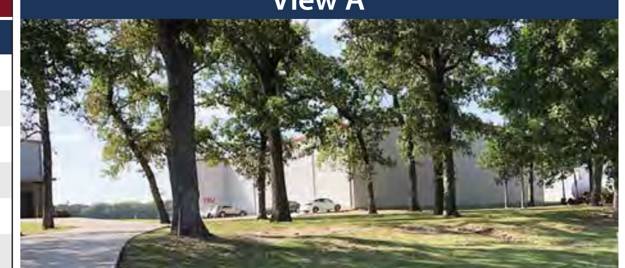
Executive Hangars

AIRCRAFT HANGAR FACILITIES

Hangar facilities at Brenham Municipal Airport include T-hangars, executive box hangars, and conventional hangars, which are shown on **Exhibit 1F**. There are five T-hangar facilities offering 46 individual storage units and comprising approximately 56,600 sf of storage space. These hangars are used primarily for small piston aircraft. Executive box hangars also offer individual storage space for tenants and typically vary in size between 1,500 and

EXISTING LANDSIDE FACILITIES					
Building #	Description	Size (sf)	Building #	Description	Size (sf)
1	Terminal	4,700	16	T-hangar (10-unit)	12,300
2	Fuel Farm	NA	17	T-hangar (10-unit)	12,000
3	T-hangar (10-unit)	12,400	18	Conventional Hangar	10,000
4	Executive Hangar	3,600	19	Executive Hangar	3,800
5	Executive Hangar	3,700	20	Executive Hangar	4,400
6	Executive Hangar	7,200	21	T-hangar (6-unit)	7,500
7	Executive Hangar	3,000	22	T-hangar (10-unit)	12,400
8	Executive Hangar	3,000	23	Airport Maintenance Hangar	8,100
9	Executive Hangar	3,000	24	Conventional Hangar	10,300
10	Executive Hangar	3,900	25	Executive Hangar	4,100
11	Executive Hangar	5,100	26	Conventional Hangar	10,000
12	Executive Hangar	3,000	27	Conventional Hangar	12,900
13	Executive Hangar	3,000	28	Fuel Farm (FBO)	NA
14	Executive Hangar	3,800	29	Conventional Hangar	12,200
15	Executive Hangar	3,700	30	Executive Hangar	6,500

View A



View B

View C

View D

View E

View F

2,500 sf, with some approaching 10,000 sf. They are able to house single engine, multi-engine, turbo-prop, and jet aircraft, as well as helicopters. There are 17 executive box hangars on the airfield comprising approximately 72,900 sf of space. Conventional hangars, which are typically greater than 10,000 sf in size and are used to store larger aircraft, including jets, are also present at Brenham Municipal Airport. As of this writing (July 2022), there are four conventional hangars offering approximately 45,400 sf. A fifth conventional hangar, 10,000 sf in size, is currently under construction. Including the hangar under construction, there is approximately 184,900 sf of aircraft storage space at the airport.

All hangar spaces are currently occupied, and there are 14 individuals on a waiting list for T-hangar space. Additionally, other individuals have expressed interest in securing land leases on which to construct private hangars.

AIRCRAFT PARKING APRONS

A 15,500 square yard (sy) apron located adjacent to the terminal building serves as the primary aircraft parking area. There are 29 marked tiedowns on this apron, and the airport's fueling facilities are located here as well. Secondary apron areas are located on the south side of the airport. These aprons are approximately 1,400 sy and 2,200 sy. Aircraft parking aprons are identified on **Exhibit 1F**.

VEHICLE PARKING

A vehicle parking lot is available at the front of the terminal building and is accessible via Aviation Way. The parking lot has 45 marked vehicle parking spaces, including two handicapped spaces. Tenants of the hangar facilities on the airport typically park their vehicles near their hangars as most of these facilities do not have separate vehicle parking areas.

SUPPORT FACILITIES

FIREFIGHTING SERVICES

As a general aviation airport, Brenham Municipal Airport is not required to maintain on-site aircraft rescue and firefighting (ARFF) equipment or services. Firefighting services are provided by the City of Brenham Fire Department, which operates from a station centrally located within the city. The station, which is located at 101 N. Chappell Hill Street, is approximately four miles south of the airport. The Brenham Fire Department maintains an Airport Response Plan which includes response guidelines and staging instructions for emergency personnel. The plan adheres to FAA AC 150/5200-12C, *First Responders' Responsibility for Protecting Evidence at the Scene of an Aircraft Accident/Incident* and FAA AC 150/5210-7D, *Aircraft Rescue and Fire Fighting Communications*.

FUEL STORAGE

Fuel storage facilities at Brenham Municipal Airport are located north of the terminal building, as shown on **Exhibit 1F**. There are two aboveground storage tanks (AST), one containing 100LL fuel and one for Jet A storage. Both tanks have a 12,000-gallon capacity and are owned by the city. The 100LL fuel is dispensed via a self-service fuel island on the main ramp equipped with a credit card reader, while Jet A fuel is distributed by on-site staff and a refueling vehicle. Secondary fuel tanks owned by an on-airport business are located on the south side of the airport and include a 16,000-gallon Jet A tank, a 3,000-gallon Jet A tank, and a 6,000-gallon 100LL tank. There are also five privately owned fuel trucks located on the airport, one of which is used by a private entity for self-fueling their own aircraft.

Fuel Tanks

Historic fuel flowage data is summarized in **Exhibit 1G**. The most recent full year of available data, 2021, shows that 46,607 gallons of 100LL and 156,315 gallons of Jet A fuel were delivered to the airport. Since 2015, the airport has averaged 37,531 gallons of 100LL and 121,174 gallons of Jet A. This dataset excludes fuel deliveries to self-fueling entities on the airport.

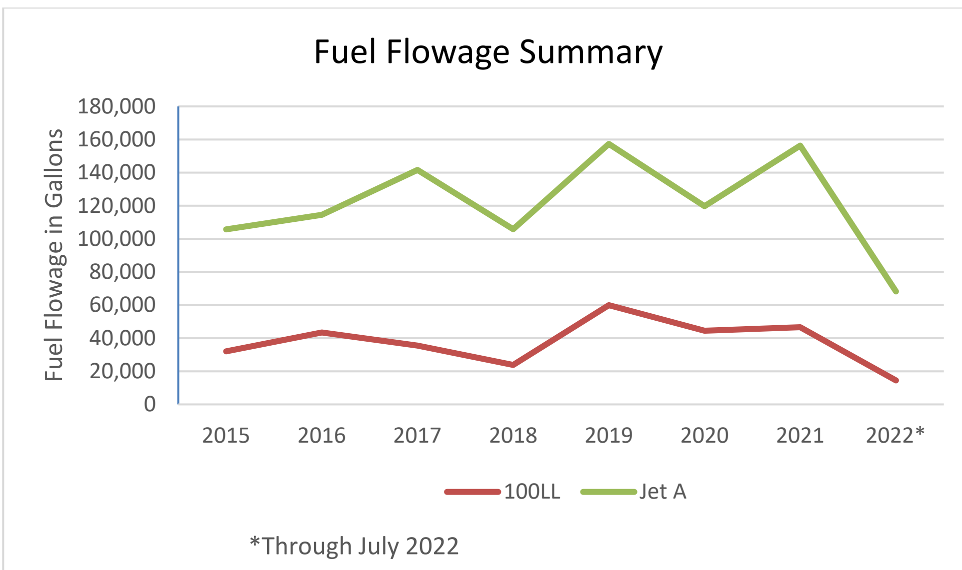


Exhibit 1G – Historic Fuel Flowage

PERIMETER FENCING AND SERVICE ROAD

Airport administrative staff and emergency service vehicles can access the airfield via the terminal apron. There is no service road. The airfield perimeter is equipped with 6-foot-tall wildlife fencing to restrict access to the airfield. Motorized gates are also in place at various points around the perimeter to allow access to authorized personnel only.

UTILITIES

The availability and capacity of the utilities serving the airport are factors in determining the development potential of the airport property, as well as the land immediately adjacent to the facility. Of primary concern in the inventory investigation is the availability of water, gas, sewer, and power sources. Providers are detailed below:

- Energy (Electric and natural gas) – Bluebonnet Electric Cooperative
- Water – Corix Utilities
- Sewer – Septic
- Communication (Phone and internet) – AT&T

AREA AIRSPACE AND AIR TRAFFIC CONTROL

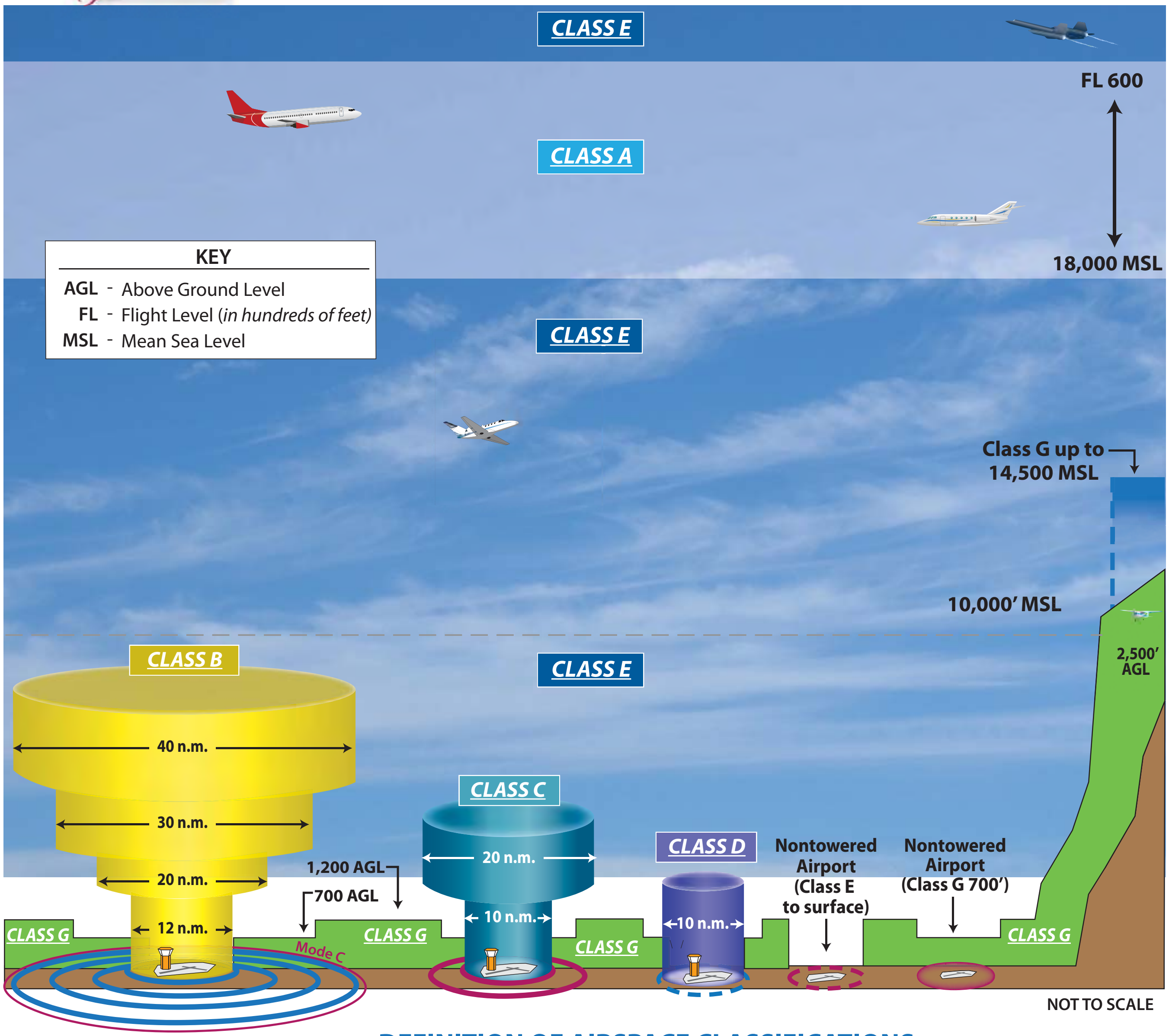
The *FAA Act of 1958* established the FAA as the responsible agency for the control and use of navigable airspace within the U.S. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground, in addition to establishing a safe and efficient airspace environment 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 1H**. 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 Brenham Municipal Airport is depicted on **Exhibit 1J**.

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 14 CFR 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 George Bush Intercontinental Airport (IAH) in Houston, to separate all aircraft within a specified radius of the primary airport. Each Class B airspace is specifically tailored for its primary airport. This airspace is the most restrictive controlled airspace routinely encountered by pilots operating under VFR in an uncontrolled environment. In order to fly within Class B airspace, an aircraft must be equipped with special radio and navigation equipment and must obtain clearance from air traffic control. A pilot is



DEFINITION OF AIRSPACE CLASSIFICATIONS

CLASS A Think A - Altitude. Airspace above 18,000 feet MSL up to and including FL 600. Instrument Flight Rule (IFR) flights only, ADS-B 1090 ES transponder required, ATC clearance required.

CLASS B Think B - Busy. Multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports. ADS-B 1090 ES transponder required, ATC clearance required.

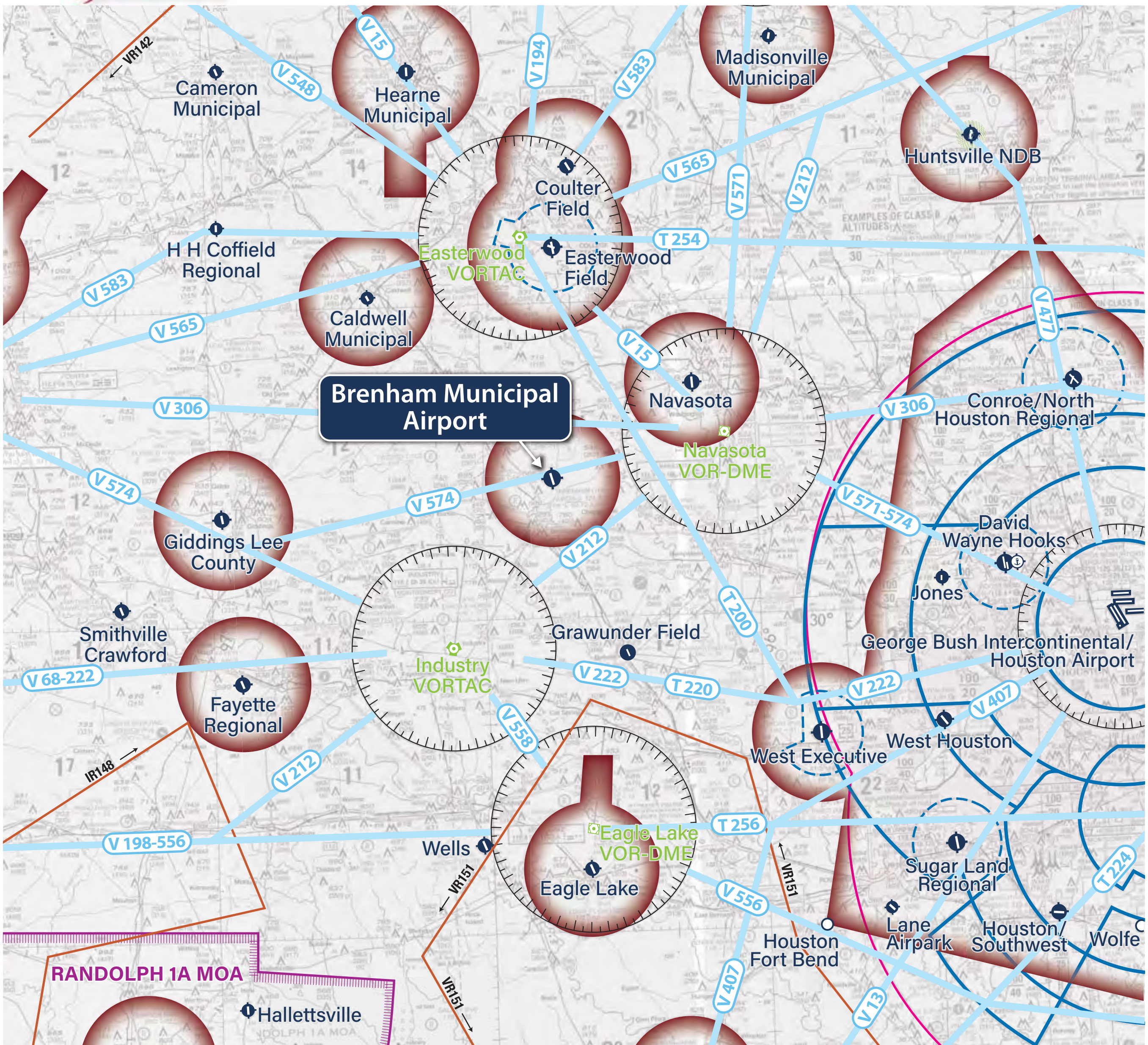
CLASS C Think C - Mode C. Mode C transponder required. ATC communication required. Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.

CLASS D Think D - Dialogue. Pilot must establish dialogue with tower. Generally airspace from the surface to minimum 2,500 feet AGL surrounding towered airports.

CLASS E Think E - Everywhere. Controlled airspace that is not designated as any other Class of airspace.

CLASS G Think G - Ground. Uncontrolled airspace. From surface to a 1,200 AGL (in mountainous areas 2,500 AGL) Exceptions: near airports it lowers to 700' AGL; some airports have Class E to the surface. Visual Flight Rules (VFR) minimums apply.

Source: www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/15_phak_ch15.pdf



LEGEND

- Seaplane Base
- Airport with other than hard-surfaced runway
- 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'
- Compass Rose
- Non-directional Radio Beacon (NDB)
- VORTAC
- VOR-DME
- Military Operations Area (MOA)
- Mode C
- Class B Airspace
- Class D Airspace
- Class E (sfc) Airspace with floor 700 ft. above surface that laterally abuts 1200 ft. or higher Class E airspace
- Victor Airways
- Military Training Routes

NORTH

NOT TO SCALE

Source:
Houston and San Antonio Sectional Chart, US Department of Commerce, National Oceanic and Atmospheric Administration, May 19, 2022

required to have at least a private pilot certificate or be a student pilot who has met the requirements of F.A.R. Part 61.95, which requires special ground and flight training for the Class B airspace. Aircraft are also required to utilize a Mode C transponder within a 30 nautical mile range of the center of the Class B airspace. A mode C transponder allows the airport traffic control tower (ATCT) to track the location and altitude of the aircraft.

Brenham Municipal Airport is located approximately 25 nm from IAH's Class B airspace.

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 Brenham Municipal Airport surrounds Austin-Bergstrom International Airport, approximately 57 nm to the west.

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. Aircraft operators planning to operate within Class D airspace are required to contact air traffic control prior to entering or departing airspace and must maintain contact while within the controlled airspace to land or to transverse the area. The nearest Class D airspace surrounds Easterwood Airport in College Station, approximately 18 nm north of Brenham Municipal Airport.

Class E Airspace | Class E airspace consists of controlled airspace designed to contain IFR operations near an airport and while aircraft are transitioning between the airport and enroute environments. Unless otherwise specified, Class E airspace terminates at the base of the overlying airspace. Only aircraft operating under IFR are required to be in contact with 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. Brenham Municipal Airport is in Class E airspace with the surface beginning at 700 feet above ground level (AGL). Airspace below 700 feet AGL surrounding the airport is Class G airspace.

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 feet AGL).

While aircraft may technically operate within this Class G airspace without any contact with ATC, it is unlikely that many aircraft will operate this low to the ground. Furthermore, 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 Brenham Municipal Airport are identified on **Exhibit 1J**.

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 nearest point of the Randolph 1A MOA is approximately 50 nm southwest of Brenham Municipal Airport. There are no restricted areas in the immediate vicinity of the airport.

AIRSPACE CONTROL

The FAA has established 21 Air Route Traffic Control Centers (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 Houston Center ARTCC controls IFR airspace enroute to and from Brenham Municipal Airport at altitudes greater than 10,000 feet above ground level (AGL).

Flight Service Stations (FSS) 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 Air Mission (NOTAMs), and broadcast aviation meteorological and aeronautical information. The Montgomery County FSS is the nearest to the airport.

LOCAL OPERATING PROCEDURES

The traffic pattern at the airport is maintained to provide the safest and most efficient use of the airspace. At Brenham Municipal Airport, both runway ends have a left-hand traffic pattern, which means aircraft conduct left-hand turns within the traffic pattern when operating on the runway. 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.

REGIONAL AIRPORTS

A review of other public-use airports with at least one paved runway within a 30-nm radius of Brenham Municipal Airport 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 the airport. **Table 1C** provides basic level information on four public-use airports within the vicinity of Brenham Municipal Airport.

Table 1C | Airports Within 30 nm from 11R

Airport	Nautical Miles/ Direction from 11R[1]	FAA Service Level[2]	Based Aircraft[1,3]	Longest Runway (ft.)[1]	Lowest Visibility Minimum[1]
Brenham Municipal	**--**	**GA – Regional**	**48[4]**	**6,003'**	**¾-mile**
Navasota Municipal (60R)	16.2 nm/ENE	NA	45	5,003'	1-mile
Easterwood Field, College Station (CLL)	22.1 nm/N	Primary Commercial Service	40	7,000'	½-mile
Caldwell Municipal (RWV)	24.6 nm/NW	NA	21	3,252'	1-mile
Coulter Field, Bryan (CFD)	29.8 nm/N	GA - Local	47	4,000'	1-mile

Sources: [1]www.airnav.com; [2]NPIAS; [3]basedaircraft.com; [4] Airport records

AVIATION ACTIVITY

AIRCRAFT OPERATIONS

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

Aircraft operations can be separated into four general categories: air carrier, air taxi, general aviation, and military. The following provides a description of the categories of aircraft operations detailed above.

- **Air Taxi** – operations associated with aircraft originally designed to have less than 60 passenger seats or a cargo payload of less than 18,000 pounds and carries cargo or mail on either a scheduled or charter basis, and/or carries passengers on an on-demand basis or limited scheduled basis.
- **Air Carrier** – operations defined as those conducted commercially by aircraft having a seating capacity of 60 or more seats and a cargo payload capacity of more than 18,000 pounds. There are currently no air carriers operating at the airport by definition of an air carrier operation.
- **General Aviation** – civil aviation operations other than scheduled air services and nonscheduled air transport operations for hire. Brenham Municipal Airport caters to general aviation activities, and the majority of its operations fall in this category.
- **Military** – operations conducted by aircraft and helicopters with a military designation.

Due to the absence of an ATCT at the airport, it can be difficult to maintain an accurate count of the airport's operations. An estimated account of annual activity is available via the FAA Form 5010, *Airport Master Record*. The most current data estimates that Brenham Municipal Airport has approximately 27,650 operations per year. The *Airport Master Record* provides a breakdown of estimated operation totals for the airport by type, as detailed in **Table 1D**. It should be noted that, in spite what is reported in the 5010, the airport does experience air taxi operations. These are accounted for in Airport IQ, an aviation data collection service, and have been confirmed by airport staff. This will be discussed in greater detail in the next chapter.

Table 1D | Aircraft Operations

Type of Operation	Annual Operations
Air Taxi	0
Air Carrier	0
GA – Itinerant	6,900
GA – Local	20,700
Military	50
Total	**27,650**

Source: FAA Form 5010, Airport Master Record

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. Brenham Municipal Airport maintains a recent record (December 2022) of based aircraft, which includes a total of 58 aircraft that are based at the airport. Of this total, 46 are single-engine piston aircraft, four are multi-engine, and eight are jets. There are no based turboprops or helicopters reported at the airport.

COMMUNITY PROFILE

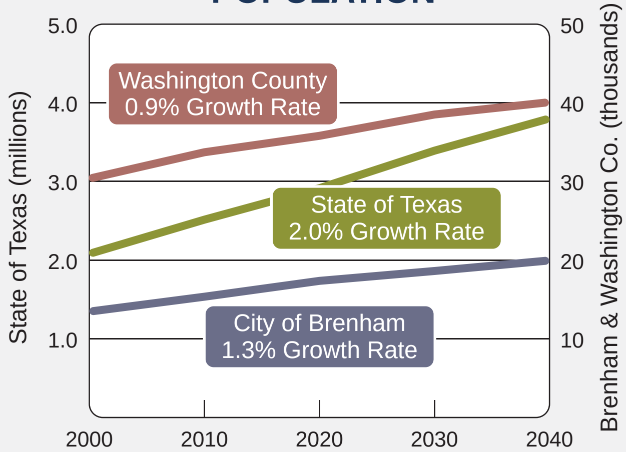
For an airport planning study, a profile of the local community including its socioeconomic characteristics is collected and examined to derive an understanding of the dynamics of growth within the study area. Socioeconomic information related to the local area is an important consideration in the master planning process. The community profile for the City of Brenham on **Exhibit 1K** is derived from the city's Comprehensive Plan that was adopted in September 2019, as well as information sourced from the city's economic development department, the Texas Water Development Board, and the U.S. Census Bureau. From a population perspective, the city is projected to add to its population at a 0.5 percent compound annual growth rate (CAGR)[5], with approximately 2,700 more residents expected over the next 20 years. Key industries in Brenham include education, health care, social assistance, and retail trade, and these, along with others, support a labor force of about 7,000 people.

ENVIRONMENTAL INVENTORY

The purpose of the following environmental inventory is to identify potential environmental sensitivities that should be considered when planning future improvements at the airport. Research was performed for each of the 14 environmental impact categories described within the FAA's Order 1050.1F *Environmental Impacts: Policies and Procedures*. **Exhibit 1L** identifies the environmental sensitivities on and near the airport.

[5] City of Brenham Comprehensive Plan

POPULATION



BRENHAM EMPLOYMENT

2000	5,733
2010	5,708
2020	7,075

2020 Unemployment Rate - 2.5%

MAJOR EMPLOYERS

- Blue Bell Creameries
- Blinn College
- Brenham State Supported Living Center
- Brenham ISD
- Germania Insurance
- Wal-Mart
- Baylor Scott and White Medical Center
- Brenham Clinic

POPULATION BY AGE

- 18% AGES <14
- 12% AGES 15-19
- 8% AGES 20-24
- 42% AGES 25-64
- 20% AGES 65+

HOUSEHOLDS

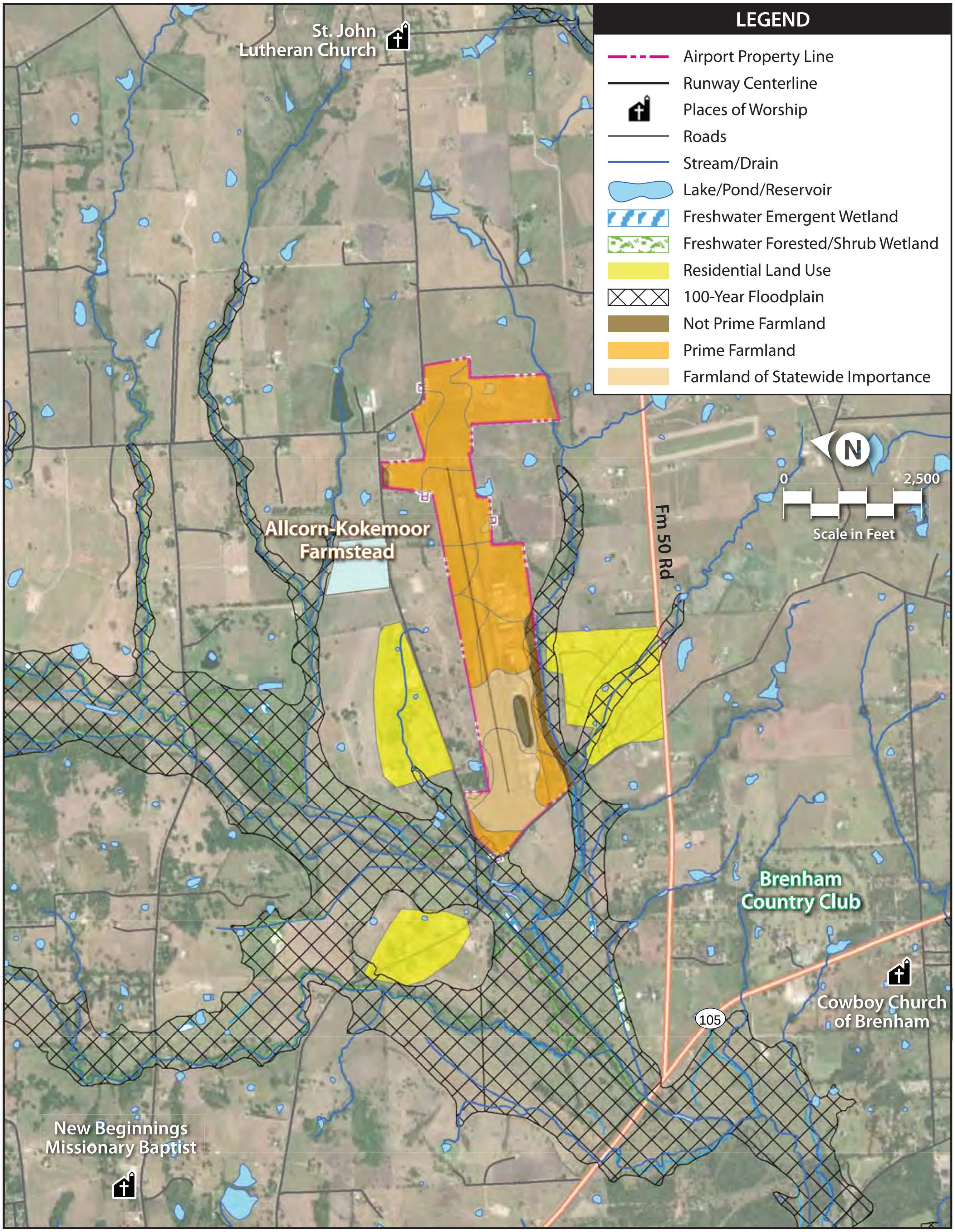
$49,147
MEDIAN HOUSEHOLD INCOME (2020)

$172,600
MEDIAN HOME VALUE (2020)

EMPLOYMENT BY SECTOR

- **29%** Education, healthcare, and social services
- **16%** Retail trade
- **11%** Manufacturing
- **8%** Construction
- **7%** Arts, entertainment, food and recreation
- **6%** Professional, scientific, and administrative services
- **6%** Finance, insurance, and real estate
- **4%** Other services
- **4%** Public administration
- **3%** Agriculture, forestry, and mining
- **2%** Wholesale trade
- **2%** Information
- **1%** Transportation, warehousing, and utilities

Sources: City of Brenham Comprehensive Plan, Texas Water Development Board, U.S. Census Bureau



Sources: ESRI Basemap Imagery, USDA, FEMA, FWS

- Air Quality
- Biological Resources (including fish, wildlife, and plants)
- Climate
- Coastal Resources
- *Department of Transportation Act*, Section 4(f)
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Compatible Land Use
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (including light emissions)
- Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

AIR QUALITY

The concentration of various pollutants in the atmosphere describes the local air quality. The significance of a pollutant's 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.

The airport is in Washington County, Texas which is in attainment for all criteria pollutants.[6]

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 provides a framework to conserve and protect animal or plant species whose populations are threatened by human activities. The FAA and USFWS review projects to determine if a significant impact to protected species will result in the implementation of a

[6] Texas Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants | Green Book | US EPA https://www3.epa.gov/airquality/greenbook/anayo_tx.html

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. The USFWS's Information for Planning and Consultation (IPaC) resource list describes species and habitat protected under ESA within the vicinity of the airport (**Table 1E**).

There is potential for migratory birds at the airport as noted in the IPaC report. Habitat for migratory birds may occur if bushes or other ground nesting substrate is present.

Section 3 of the ESA is used to protect critical habitat areas. Designated critical habitat areas are geographically defined and have been determined to be essential to the recovery of a specific species. There is no federally designated critical habitat at the airport.

Table 1E | Species Protected Under ESA Section 7 with Potential to Occur at the Airport

Common Name (*Scientific Name*)	Federal Status	Habitat and Range	Potential for Occurrence
Piping Plover (*Charadrius melodus*)	Threatened	These shorebirds live on sandy beaches and lakeshores.	Not Likely. Suitable habitat does not appear to be on the airport.
Red Knot (*Calidirs canutus rufa*)	Threatened	The red knot prefers sandy beaches and mud flats. In general, nests are found on sparsely vegetated, dry, sunny, slightly elevated tundra locations, often on windswept ridges or slopes with low cover.	Not Likely. Suitable habitat does not appear to be on the airport.
Whooping Crane (*Grus americana*)	Threatened	Whooping cranes reside in wetlands, marshes, mudflats, wet prairies, and fields. There are currently two migratory populations and one non-migratory population of whooping cranes, one of which spends winters in Aransas National Wildlife Refuge in Texas.	Not Likely. Suitable habitat does not appear to be on the airport.
Texas Fawnsfoot (*Truncilla macrodon*)	Proposed Threatened	The Texas fawnsfoot is most commonly observed in riffles within streams and rivers but has been identified in a variety of habitats. Within the Brazos River basin, the Texas fawnsfoot has been found in multiple locations, including the Clear Fork of the Brazos River, the Brazos River between Possum Kingdom Lake and Lake Granbury, the Brazos River below Waco, the Navasota River, and the Little River.	Unknown. Development near or within on-airport water sources should be reviewed.
Monarch Butterfly (*Danaus plexippus*)	Candidate	Generally, breeding areas are on the leaves of milkweed (*Asclepias* sp.).	Individuals may occur seasonally as a potential migratory stopover.
Navasota Ladies-tresses (*Spiranthes parksii*)	Endangered	Occurs primarily in openings of post oak woodlands in sandy loam soils, often over an impermeable clay layer, adjacent to drainages and seasonal streams.	Not Likely. Suitable habitat does not appear to be on the airport.

Source: USFWS IPaC (https://ipac.ecosphere.fws.gov/, U.S. Fish and Wildlife Service (https://www.fws.gov/)

CLIMATE

Increasing concentrations of greenhouse gases (GHG) can affect global climate by trapping heat in 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. GHGs, such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (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, hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF6). 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.[7]

The U.S. EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020* shows total transportation emissions, including aviation, decreased largely due to coronavirus (COVID-19) and the combined impacts of long-term trends in population, economic growth, energy markets, technological changes, and changes in energy efficiency. The inventory included aviation as a part of the 13.3 percent decrease in transportation sector GHG emissions leading up to 2020.[8]

Information regarding the climate for the airport and surrounding environments, including wind, temperature, and precipitation, are found earlier in this master plan.

COASTAL RESOURCES

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

The airport is not located within a coastal zone. The closest National Marine Sanctuary is Flower Garden Bank National Marine Sanctuary, located 188 miles away.[9]

DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Section 4(f) of the *Department of Transportation Act,* which was recodified and renumbered as Section 303(c) of 49 United States Code, 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.[10]

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7 Intergovernmental Panel on Climate Change AR5 Synthesis Report: Climate Change 2014 (http://www.ipcc.ch/)
8 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020 https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf
9 Google Earth Aerial Imagery (May 2022)
10 49 U.S. Code § 303 - Policy on lands, wildlife and waterfowl refuges, and historic sites

School playgrounds may be considered a Section 4(f) resource if the recreational facilities at the school are readily available to the public. There are no schools located within two miles of the airport. There are no public parks or nature reserves located within two miles of the airport. The nearest public park, Hohlt Park, is located 2.5 miles southwest of the airport.

Significant historic resources are also protected under Section 4(f). There is one known historic structure listed on the National Register of Historic Places within two miles of the airport, the Allcorn-Kokemoor Farmstead.

The nearest wilderness and national recreation areas are listed below:

- Wilderness Area: Little Lake Creek Wilderness (42 miles northeast from the airport)
- National Recreation Area: Amistad National Recreation Area (274 miles southwest from the airport)

FARMLANDS

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and consider 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, unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

Table 1G lists each soil type in the airport area based on information obtained from the USDA Natural Resources Conservation Service's (NRCS) Web Soil Survey (WSS). The survey identifies "All areas are prime farmland," "Farmland of statewide importance," and "Not prime farmland" on the airport (**Exhibit 1M**).

Table 1G| Farmland Classification – Summary by Map Unit Washington County, Texas

Map unit symbol	Map unit name	Rating
6	Bleiblerville clay, 1 to 3 percent slopes	All areas are prime farmland
7	Bleiblerville clay, 3 to 5 percent slopes	All areas are prime farmland
8	Bosque clay loam, frequently flooded	Not prime farmland
11	Brenham clay loam, 3 to8 percent slopes	Not prime farmland
21	Chazos loamy fine sand, 1 to 5 percent slopes	All areas are prime farmland
31	Frelsburg clay, 1 to 3 percent slopes	All areas are prime farmland
32	Frelsburg clay, 3 to 5 percent slopes	All areas are prime farmland
48	Mabank fine sandy loam, 1 to 3 percent slopes	Farmland of statewide importance
61	Silawa loamy fine sand, 1 to 5 percent slopes	All areas are prime farmland
64	Tabor fine sandy loam, 1 to 5 percent slopes	Farmland of statewide importance
69	Trinity clay, 0 to 1 percent slopes, frequently flooded	Not prime farmland
72	Wilson clay loam, 1 to 3 percent slopes	Farmland of statewide importance
W	Water	Not prime farmland

Source: USDA Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx)

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 U.S. EPA's *EJSCREEN*, there are no Superfund or brownfields sites within three miles of the airport.

National Pollutant Discharge Elimination System (NPDES) permits outline the regulatory requirements of municipal storm water management programs and establish requirements to help protect the beneficial uses of the receiving waters. They require permittees to develop and implement Best Management Practices (BMPs) to control/reduce the discharge of pollutants to waters of the United States to the maximum extent practicable (MEP). In Texas, EPA issues NPDES permits on tribal lands and in federal waters off the coast in the Gulf of Mexico. All other permits are issued by the Texas Commission on Environmental Quality.

Texas Commission on Environmental Quality administered the *Texas Administrative Code Title 30 Part 1 Chapter 330: Municipal Solid Waste*, adopted to regulate waste management. General goals of the state municipal solid waste chapter include:

- Instruct sound methods of solid waste management and disposal; and
- Provide policy and procedural guidance to state, substate, and local agencies in the proper management of solid waste.

There is a solid waste landfill within two miles of the airport (City of Brenham Landfill Facility).

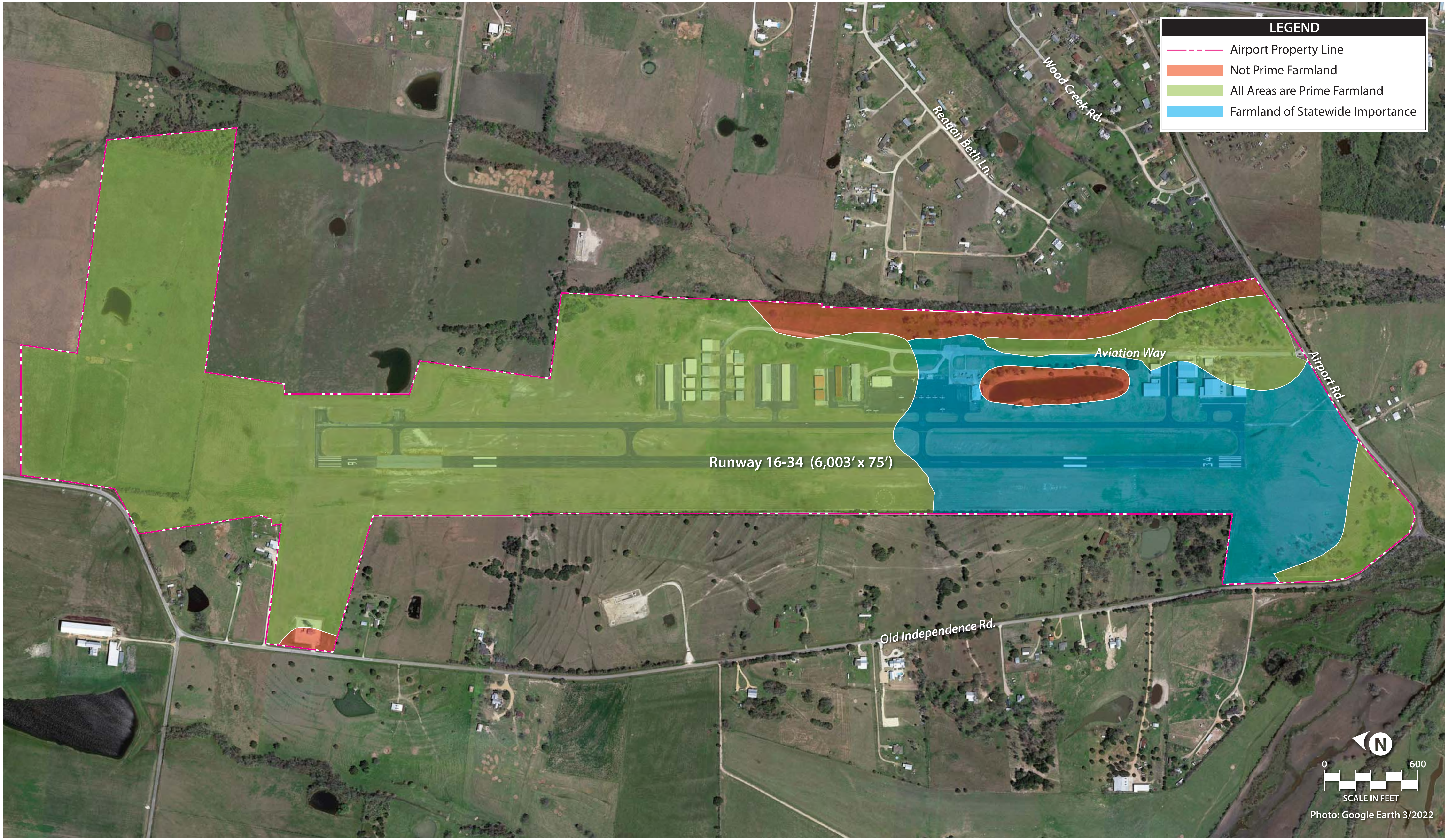
HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources. Impacts may occur when 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.

There are no survey reports for cultural resources at the airport, and the presence of buried cultural resources is not known.

LAND USE

Land use regulations near airports are achieved through local government codes, city policies, and plans that include airport districts and planning areas. Regulations are used to avoid land use compatibility conflict around airports.


LEGEND
Airport Property Line
Not Prime Farmland
All Areas are Prime Farmland
Farmland of Statewide Importance
Wood Creek Rd.
Reagan Beth Ln.
Aviation Way
Airport Rd.
Runway 16-34 (6,003' x 75')
Old Independence Rd.
N
0
600
SCALE IN FEET
Photo: Google Earth 3/2022

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Land use classifications within one mile of the airport consists of airport property (281 acres), agriculture (2,094 acres), commercial (94 acres), open space (93 acres), public (64 acres), residential (809 acres), and right-of-way (81 acres).

NATURAL RESOURCES AND ENERGY SUPPLY

Natural resources and energy supply provide an evaluation of a project's consumption of natural resources. It is the policy of FAA Order 1053.1C, *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.

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 and schools are noise-sensitive land uses that are not considered compatible with a 65 decibel (dB) Day-Night Average Sound Level (Ldn or DNL)[11]. Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB DNL contour, are generally compatible when an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure. Special consideration 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.[12]

Table 1H shows noise-sensitive land uses within two miles of the airport. The closest residential area is 0.04 miles east from the airport (**Exhibit 1L**).

Table 1H | Noise-Sensitive Institutions within Two Miles of the Airport

Facility	Distance/Directions from the Airport
Cowboy Church of Brenham, Texas	1.4 miles southwest
St. John Lutheran Church	1.6 miles north
New Beginnings Missionary Baptist	1.9 miles southeast

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

Socioeconomics | *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).

[11] The DNL accounts for the increased sensitivity to noise at night (10:00 PM to 7:00 AM) and is the metric preferred by FAA, the U.S. EPA, and the U.S. Department of Housing and Urban Development as an appropriate measure of cumulative noise exposure.

[12] 49 U.S. Code § 47141 – Compatible land use planning and projects by State and Local Governments

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 FAA has identified factors to consider when evaluating the context and intensity of potential environmental impacts.

Would the proposed action:

- Induce substantial economic growth in an area, either directly or indirectly?
- Disrupt or divide the physical arrangement of an established community?
- Cause extensive relocation when sufficient replacement housing is unavailable?
- Cause extensive relocation of community business which would cause severe economic hardship for affected communities?
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities?
- Produce a substantial change in the community tax base?

Environmental Justice | *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 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.
- The decision-makers seek out and facilitate the involvement of those potentially affected.[13]

The closest residential area is 0.04 miles east from the airport. According to 2019 American Community survey estimates, the population within one mile of the airport is 878 persons, of which 13 percent of the population is considered low-income and 36 percent is considered a minority population. Indicated in **Table 1J**, approximately 19 percent of the population has identified as Hispanic or Latino.

Table 1J | Population Characteristics Within One Mile of the Airport	
Total Population	878
Population by Race	
White	83%
Black	17%
American Indian	0%
Asian	0%
Pacific Islander	0%
Some Other Race	0%
Population Reporting Two or More Races	0%
Total Hispanic population (ethnicity)	19%

Source: U.S. EPA EJSCREEN ACS Summary Report (2022)

[13] Environmental Justice EPA https://www.epa.gov/environmentaljustice

Children's Environmental Health and Safety | Federal agencies are directed, per E.O. 13045, Protection of Children from Environmental Health Risks and Safety Risks, to make it a high priority to identify and assess the environmental health and safety risks that may disproportionately impact children. Such risks include those that are attributable to products or substances that a child is likely to encounter or ingest (air, food, water – including drinking water) or to which they may be exposed.

According to the U.S. EPA EJSCREEN report of 2019 data, approximately 20 percent of the population within the one-mile study area previously identified is under the age of 17, which equates to 173 children.

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 | 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.

Visual Resources and Visual Character | *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).

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, deserts, etc.

There are no designated scenic byways within the vicinity of the airport listed by the National Scenic Byways Program.

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 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).

USFWS manages the National Wetlands Inventory (NWI) on behalf of all federal agencies. The National Wetlands Inventory identifies surface waters and wetlands in the nation. The NWI information presented on the environmental sensitives exhibit (**Exhibit 1L)** indicates there are two freshwater ponds in the northwest portion of the airport and one freshwater pond on the eastern side of the airport.

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 Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panel number 48477C0325D, effective 05/16/2019 indicates the airport is primarily Zone X, an Area of Minimal Flood Hazard. However, a small area on the eastern portion of the airport lies within Zone A, an Area of Special Flood Hazards (Without Base Flood Elevation [BFE]). There are no 500-year floodplains mapped for the airport. (**Exhibit 1L**).[14]

Surface Waters | The CWA establishes water quality standards, controls discharges, develops waste treatment management plans, and practices, prevents or minimizes the loss of wetlands, and regulates 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 NPDES.

The airport is located within Big Sandy Creek-New Year Creek watershed. There are no monitored impairments under Section 303 of the Clean Water Act within the airport's defined watershed.

The airport has a Stormwater Pollution Prevention Plan in place for *Industrial Activities from Air Transportation Facilities*.[15]

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.[16]

The EPA's Sole Source Aquifer (SSA) Program was established under Section 1424(e) of the Safe Drinking Water Act (SDWA). Since 1977, it has been used by communities to help prevent contamination of groundwater from federally funded projects. It has increased public awareness of the vulnerability of groundwater resources. The SSA program is authorized by Section 1424(e) of the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 U.S.C. 300 et. seq), which states:

[14] Federal Emergency Management Agency *Flood Map Service Center* https://msc.fema.gov/portal/home
[15] AARC Environmental Inc. Multi-Sector General permit MSGP No.TX0500000 Effective August 4, 2016
[16] United States Geological Survey - What is Groundwater? https://www.usgs.gov/faqs/what-groundwater

"*If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register.*"[17]

According to the U.S. EPA Sole Source Aquifer for Drinking Water website, there are no sole source aquifers located within airport boundaries. The nearest sole source aquifer is 84 miles from the airport, Edwards Aquifer II (Austin Area) SSA. [18]

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 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.

The closest designated wild and scenic river identified is Saline Bayou River, located 239 miles from the airport.[19] The nearest National River Inventory feature is Pedernales River, located 102 miles from the airport.

[17] Overview of the Drinking Water Sole Source Aquifer Program | US EPA https://www.epa.gov/dwssa/overview-drinking-water-sole-source-aquifer-program#Authority

[18] Interactive Map for Sole Source Aquifers https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=9ebb047ba3ec41ada1877155fe31356b

[19] Nationwide Rivers Inventory – Rivers https://www.rivers.gov/texas.php

Chapter Two

FORECASTS

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 Brenham Municipal Airport will primarily consider based aircraft, aircraft operations, and peak activity periods.

The Texas Department of Transportation (TxDOT) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. TxDOT will review individual airport forecasts with the objective of comparing them to the *Terminal Area Forecasts* (TAF) for the airport, which is issued by the Federal Aviation Administration (FAA), as well as 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.

When reviewing a sponsor's forecast (from the master plan), TxDOT 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 5090.5, *Formulation of the National Plan of Integrated Airport Systems (NPIAS) and Airports Capital Improvement Plan (ACIP)*, 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 2022 with a long-range forecast out to 2042.

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 2022-2042*, published in June 2022. 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 were impressive: 2019 marked the eleventh consecutive year of profitability for the U.S. airline industry.

The COVID-19 pandemic in 2020 effectively ended those boom years, with airline activity and profitability plummeting almost overnight. In response, airlines cut capacity and costs, and most were able to weather the storm. Some small regional carriers ceased operations as a result of the pandemic, but no mainline carriers did. Some segments of aviation were less impacted. Cargo activity surged, boosted by consumer purchases, and general aviation generally maintained pre-pandemic levels of activity. By the middle of 2021, with the introduction of vaccines and the lifting of some local restrictions, leisure travel began to rebound. Two new low-cost carriers were formed, and one regional carrier that ceased operations in 2020 was revived. By the third quarter of 2021, industry profitability was nearing the breakeven point. There is confidence that U.S. airlines have transformed from a capital intensive, highly cyclical industry to an industry that can generate sustained profits.

ECONOMIC ENVIRONMENT

According to the FAA forecast, over the next 20 years, the annual gross domestic product (GDP) of the U.S. is expected to increase by 2.3 percent. U.S. carrier profitability is projected to remain under pressure for several years due to depressed demand and competitive fare pressures. As carriers return to levels of capacity consistent with their fixed costs, shed excess debt, and see rising yields, profitability should gradually return. Over the long term, a competitive and profitable aviation industry should emerge, characterized by increasing demand for air travel, with airfares growing more slowly than overall inflation, reflective of growing U.S. and global economies.

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 4.7 percent annually, which includes double-digit growth years in 2022 and 2023 as activity climbs out from a very low base. Oil prices averaged $60 per barrel in 2021 and are forecast to rise to $75 in 2022; however, this projection does not take into account Russia's invasion of Ukraine, which will likely push prices even higher in 2022. By the end of the forecast period in 2042, oil is projected to average $87 per barrel.

FAA GENERAL AVIATION FORECASTS

The long-term outlook for general aviation is promising, 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 2022 and 2024, increasing by just 0.1 percent. 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 period.

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.

Table 2A | FAA General Aviation Forecast

Demand Indicator	2022	2042	CAGR
General Aviation (GA) Fleet			
Total Fixed Wing Piston	133,815	112,915	-0.8%
Total Fixed Wing Turbine	26,480	38,455	1.9%
Total Helicopters	9,955	13,530	1.5%
Total Other (experimental, light sport, etc.)	34,340	44,005	1.2%
Total GA Fleet	**204,590**	**208,905**	**0.1%**
General Aviation Operations			
Local	13,731,399	15,767,539	0.7%
Itinerant	14,569,014	16,259,605	0.6%
Total GA Operations	**28,300,413**	**32,027,144**	**0.6%**

CAGR: compound annual growth rate (2022-2042)

Source: FAA Aerospace Forecast - Fiscal Years 2022-2042

General Aviation Aircraft Fleet Mix

For 2022, the FAA estimates there are 133,815 piston-powered, fixed-wing aircraft in the national fleet. That number is forecast to decline by 0.8 percent by 2042, resulting in 112,915 aircraft. This includes a decline of 0.9 percent of single engine aircraft and a decline of 0.3 percent in multi-engine piston aircraft.

Total turbine aircraft are forecast to grow at an annual rate of 1.9 percent through 2042. The FAA estimates there are 26,480 fixed-wing turbine-powered aircraft in the national fleet in 2022, and there will be 38,455 by 2042. Turboprops are forecast to grow by 0.6 percent annually, while business jets are projected to grow by 2.6 percent annually through 2042.

Total helicopters are projected to grow by 1.5 percent annually in the forecast period. There are an estimated 9,955 total helicopters in the national fleet in 2022, and that number is expected to grow to a total of 13,530 by 2042. This includes annual growth rates of 0.6 percent for piston helicopters and 1.9 percent for turbine helicopters.

The FAA also forecasts experimental aircraft, light sport aircraft, and others. Combined, there are an estimated 34,340 other aircraft in 2022 that are forecast to grow to 44,005 by 2042, for an annual growth rate of 1.2 percent.

General Aviation Operations

The FAA also forecasts total operations based upon activity at control towers across the United States. Operations are categorized as air carrier, air taxi/commuter, general aviation, and military. While the fleet size remains relatively level, the number of general aviation operations at towered airports is projected to increase from 28.3 million in 2022 to 32.0 million in 2042, with an average increase of 0.6 percent per year as growth in turbine, rotorcraft, and experimental hours offset a decline in fixed-wing piston hours. This includes annual growth rates of 0.7 percent for local general aviation operations and 0.6 percent for itinerant general aviation operations.

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

General Aviation Aircraft Shipments and Revenue

On an annual basis the General Aviation Manufacturers Association (GAMA) publishes an aviation industry outlook that documents past and current trends and provides an assessment of the future condition of the general aviation industry. **Table 2B** presents historical data related to general aviation aircraft shipments.

Worldwide shipments of general aviation airplanes increased in the year 2021 with a total of 2,646 units delivered around the globe, compared to 2,408 units in 2020, but not quite reaching the 2,658 units delivered in 2019. Worldwide general aviation billings were the highest in 2014. In 2021, there was an increase of new aircraft shipments with more than $21 billion compared to the previous year's $20.0 billion. North America continues to be the largest market for general aviation aircraft and leads the way in the manufacturing of piston, turboprop, and jet aircraft. The Asia-Pacific region is the second largest market for piston-powered, while Latin America is the second leading in the turboprop market, and Europe leads in business jet deliveries.

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

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,962	1,999	52	319	592	12,093
2005	3,590	2,326	139	375	750	15,156
2006	4,054	2,513	242	412	887	18,815
2007	4,277	2,417	258	465	1,137	21,837
2008	3,974	1,943	176	538	1,317	24,846
2009	2,283	893	70	446	874	19,474
2010	2,024	781	108	368	767	19,715
2011	2,120	761	137	526	696	19,042
2012	2,164	817	91	584	672	18,895
2013	2,353	908	122	645	678	23,450
2014	2,454	986	143	603	722	24,499
2015	2,331	946	110	557	718	24,129
2016	2,268	890	129	582	667	21,092
2017	2,324	936	149	563	676	20,197
2018	2,441	952	185	601	703	20,515
2019	2,658	1,111	213	525	809	23,515
2020	2,408	1,164	157	443	644	20,048
2021	2,646	1,261	148	527	710	21,603

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

Source: General Aviation Manufacturers Association, 2020 Annual Report

Business Jets: Business jet deliveries increased from 644 units in 2020 to 710 units in 2021, rebounding from the previous year's drop from 809. The North American market accounted for 66 percent of business jet deliveries, which is a 0.1 percent decrease in market share compared to 2020.

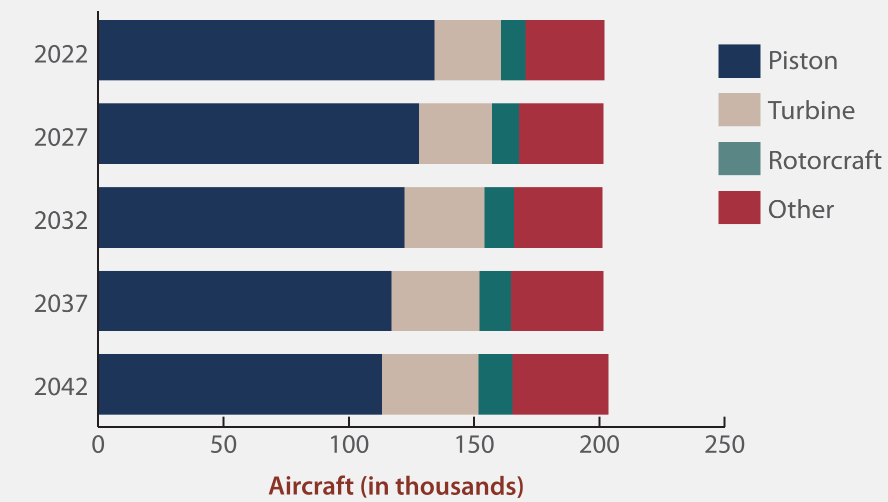
Turboprops: Turboprop shipments were up from 443 in 2020 to 527 in 2021. North America's market share of turboprop aircraft, however, decreased by 2.3 percent in the last year. The European and Asia-Pacific markets also decreased, while Latin America and Middle East & Africa markets increased their market share.

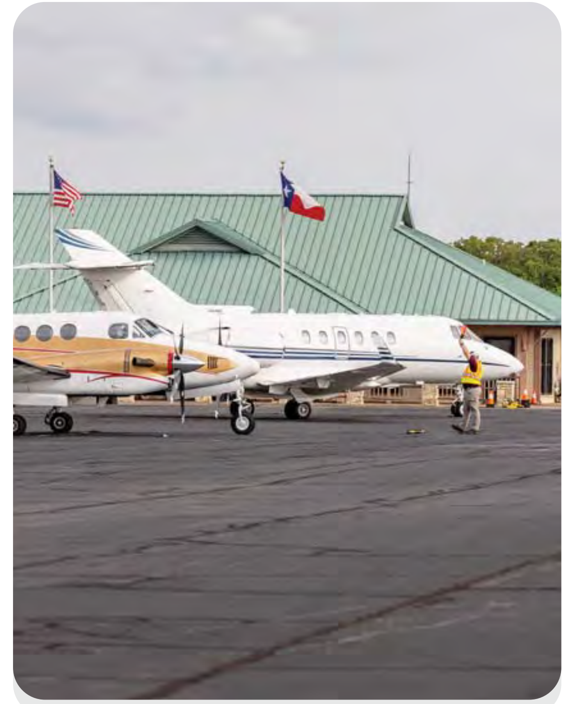
Pistons: In 2021, piston airplane shipments increased to 1,409 units compared to 1,321 units in the prior year. North America's market share of piston aircraft deliveries rose 0.8 percent from the year 2020. The Europe, Latin America, and Middle East & Africa markets experienced a positive rate in market share during the past year, while Asia-Pacific saw a decline.

U.S. PILOT POPULATION

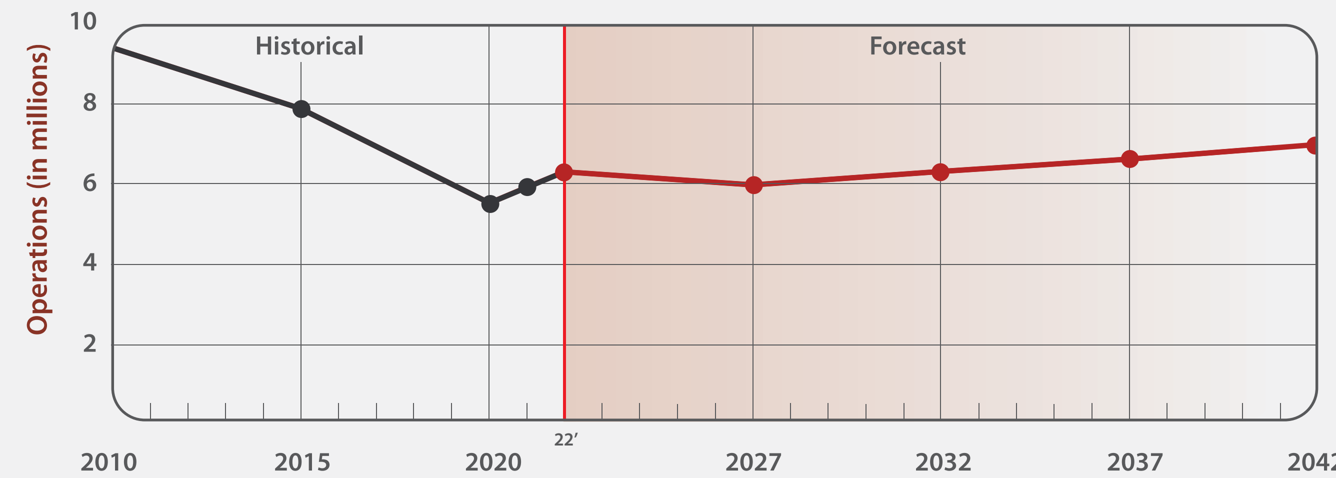
There were 470,408 active pilots certificated by the FAA at the end of 2021, with 474,450 active pilots projected in 2022. All pilot categories, except for private and recreational-only certificates, are expected to continue to increase. Excluding student pilots, the number of active general aviation pilots is projected

U.S. Active General Aviation Aircraft

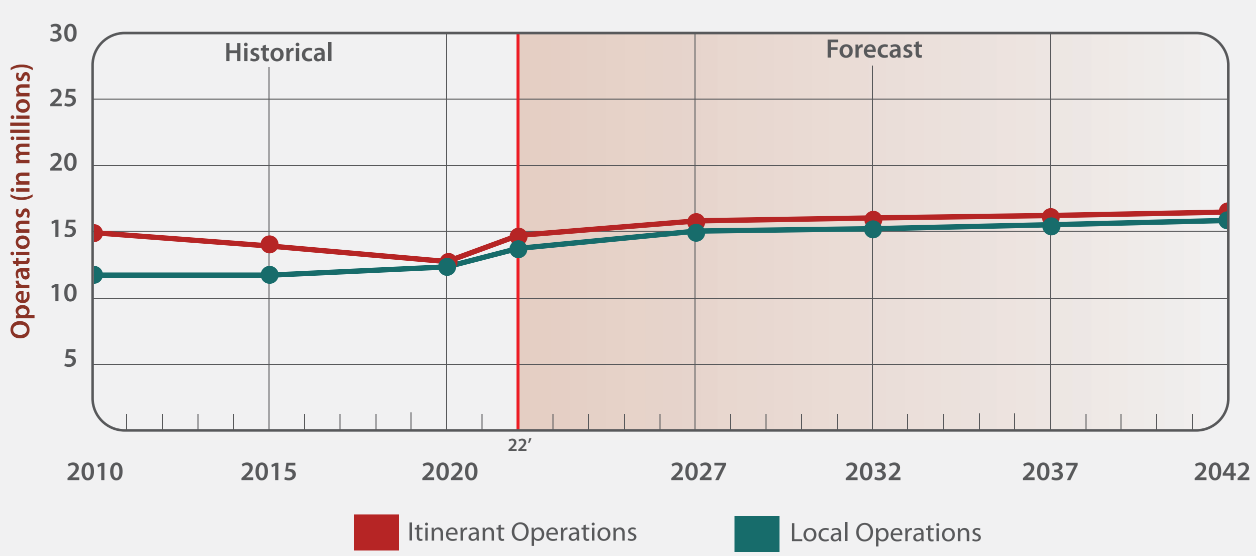




U.S. Air Taxi Operations



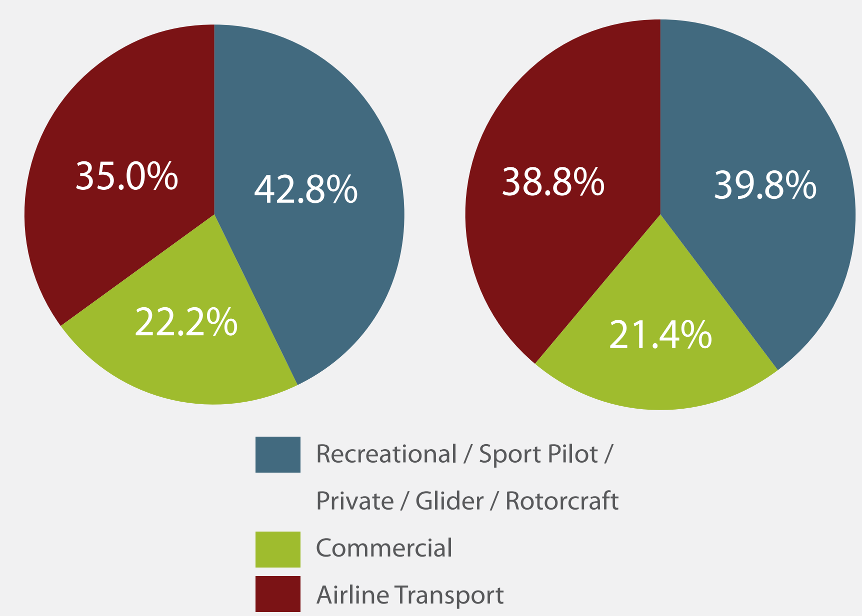
U.S. General Aviation Operations



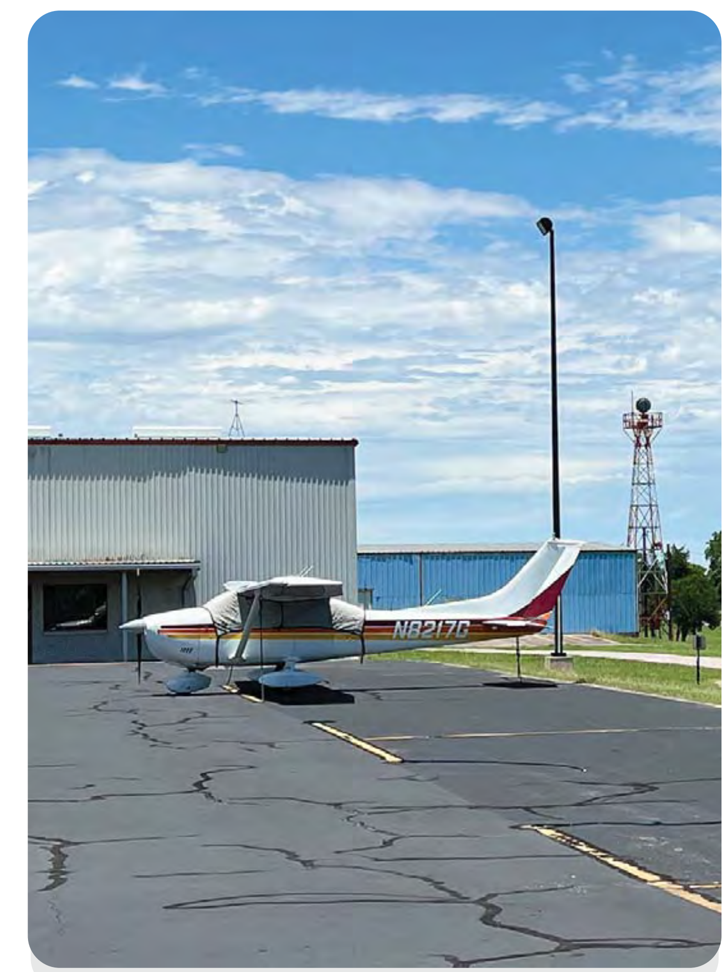
Active Pilots By Certificate

2022
Total Active Pilots: **474,450***

2042
Total Active Pilots: **500,720**



**Excludes Student Pilot Certificates*



Source: FAA Aerospace Forecasts FY2022-2042

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to increase by about 26,270 (up 0.3 percent annually) between 2022 and 2042. The ATP category is forecast to increase by 28,300 (up 0.8 percent annually). Sport pilots and commercial pilots are predicted to increase by 2.7 percent and 0.1 percent annually, respectively, over the forecast period, while private pilot certificates are projected to decrease at an average annual rate of 0.5 percent through 2042. The FAA has currently suspended the student pilot forecast.

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. The COVID-19 pandemic introduced a new risk, and though the industry has rebounded, the threat of future global health pandemics and potential economic fallout remain.

AIRPORT SERVICE AREA

The initial step in determining the aviation demand for an airport is to define its generalized service area for various segments of aviation. The service area is determined primarily by evaluating the location of competing airports, their capabilities, their services, and their relative attraction and convenience. In determining the aviation demand for an airport, it is necessary to identify the role of the airport, as well as the specific areas of aviation demand the airport is intended to serve. Brenham Municipal is classified as a Regional General Aviation (GA) airport within the NPIAS, meaning that its primary role is to support regional economies with interstate and some long-distance flying. General aviation, which includes all segments of the aviation industry except commercial air carriers and the military, is the largest component of the national aviation system. It includes activities such as pilot training, recreational flying, and the use of sophisticated turboprop and jet aircraft for business and corporate use.

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

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

As a Regional GA airport, Brenham Municipal Airport's service area is driven by aircraft owners/operators and where they choose to base their aircraft. The primary consideration of aircraft owners/operators when choosing where to base their aircraft is convenience (i.e., easy access and proximity to the airport). As a general rule, an airport's service area can extend up to and beyond 30 miles. The proximity and level of general aviation services are largely a defining factor when describing the general aviation service area. A description of nearby airports was previously completed in Chapter One, as presented on **Table 1C**. There are four public-use airports within 30 nautical miles (nm) of Brenham Municipal, with varying levels of services and amenities.

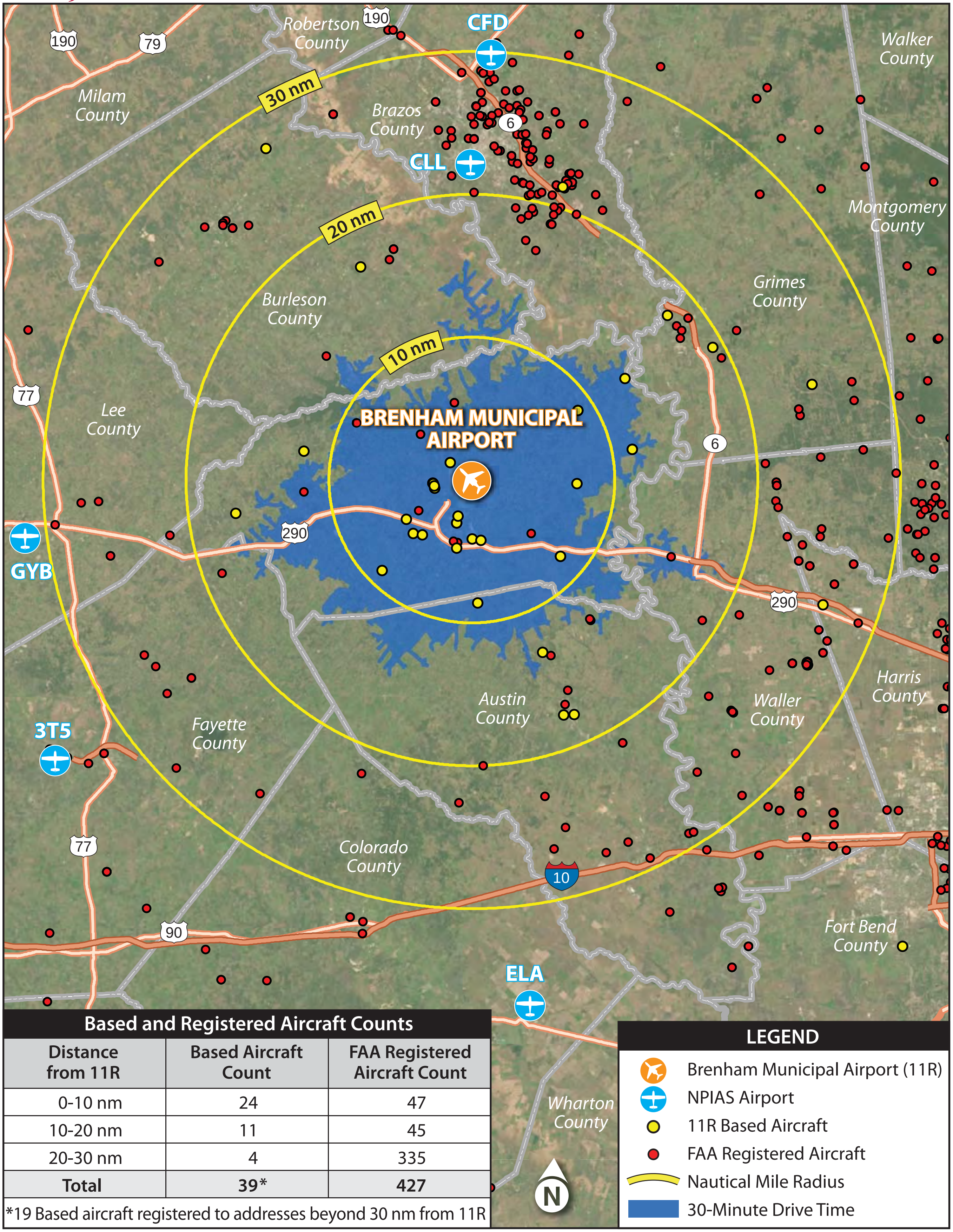
When discussing the general aviation service area, two primary demand segments need to be addressed. The first component is the airport's ability to attract based aircraft. Under this circumstance, the most effective method of defining the airport's service area is by examining the number of registered aircraft owners in proximity to the airport. As previously mentioned, aircraft owners typically choose to base at an airport near their home or business. Based on the current registered aircraft data, presented on **Exhibit 2B**, there are 427 registered aircraft within 30 nm of Brenham Municipal Airport. Of these, 39 are based at the airport, with an additional 19 aircraft registered to addresses beyond 30 nm. The majority of based aircraft at Brenham Municipal are located within 10 nm of the airport. The exhibit also depicts a 30-minute drive time isochrone, which is centered on Washington County.

The second demand segment to consider is itinerant aircraft operations. In most instances, pilots will opt to utilize airports nearer their intended destination; however, this is also dependent on the airport's capabilities in accommodating the aircraft operator. As a result, airports offering better services and facilities are more likely to attract itinerant operators in the region.

With several competing airports in the region, Brenham Municipal Airport's primary service area is defined by its convenience to its users and its ability to compete for based aircraft. Of the four other public-use airports within 30 nm of Brenham, only two are included in the NPIAS – Easterwood Field, a primary commercial service airport, and Coulter Field, a Local GA airport. Both offer attractive amenities to users; however, both are located in Brazos County on the northern edge of the 30-nm radius, and well outside of the 30-minute drive time isochrone. The airport and its 30-minute drive time isochrone are centrally located within Washington County, making it most accessible to users within the county. Brenham Municipal Airport also offers a number of amenities desired by aviation users, including 6,003-foot runway that can accommodate many of the business jets in the national fleet, instrument approach capability, fueling and aircraft maintenance services, and a fully equipped terminal building with a restaurant. As such, Washington County is defined as the airport's primary service area with secondary service areas extending into other contiguous counties.

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 not to use certain techniques depending on the reasonableness of the forecasts produced using other techniques.



Based and Registered Aircraft Counts		
Distance from 11R	Based Aircraft Count	FAA Registered Aircraft Count
0-10 nm	24	47
10-20 nm	11	45
20-30 nm	4	335
Total	**39***	**427**

*19 Based aircraft registered to addresses beyond 30 nm from 11R

LEGEND

- Brenham Municipal Airport (11R)
- NPIAS Airport
- 11R Based Aircraft
- FAA Registered Aircraft
- Nautical Mile Radius
- 30-Minute Drive Time

AIRPORT SERVICE AREA

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 Brenham Municipal Airport, the previous forecasts reviewed are those in the FAA *Terminal Area Forecast* (TAF), the 2010 Texas Airport System Plan (TASP) Update, and the 2005 Airport Development Plan.

FAA *TERMINAL AREA FORECAST*

The FAA develops and publishes the TAF annually 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 also available to airports and consultants for use as a baseline projection and important point of comparison while developing local forecasts. The current TAF was published in March 2022 and is based on the federal fiscal year (October-September).

As presented in **Table 2C**, the TAF projects general aviation activity at the airport to remain static over the next 20 years. A static projection is not an indicator of FAA's true value of future activity at Brenham; instead, it is the common practice by the FAA forecasters for airports without an airport traffic control tower (ATCT). Given that there is currently no commercial service activity at Brenham Municipal Airport, the TAF does not reflect any existing and/or forecast air carrier operations, nor does it reflect any air taxi operations over the forecast period. The TAF estimates that local and itinerant GA operations comprise nearly all of the operational activity at the airport and are estimated to account for approximately 25.0 percent and 74.9 percent of operations, respectively, over the planning period. Military operations are projected to account for less than one percent of total operations, with 50 projected for each of the plan years. Based aircraft are also projected to remain flat over the next 20 years, at 42. As noted previously, TxDOT will compare the new forecasts developed for this master plan to the TAF.

Table 2C | 2022 FAA Terminal Area Forecast – Brenham Municipal Airport

	2022	2027	2032	2042	CAGR 2022-2042
ANNUAL OPERATIONS					
Itinerant					
Air Carrier	0	0	0	0	0.0%
Air Taxi	0	0	0	0	0.0%
General Aviation	6,900	6,900	6,900	6,900	0.0%
Military	50	50	50	50	0.0%
Total Itinerant	*6,950*	*6,950*	*6,950*	*6,950*	*0.0%*
Local					
General Aviation	20,700	20,700	20,700	20,700	0.0%
Military	0	0	0	0	0.0%
Total Local	*20,700*	*20,700*	*20,700*	*20,700*	*0.0%*
Total Operations	***27,650***	***27,650***	***27,650***	***27,650***	0.0%
BASED AIRCRAFT					
Total Based Aircraft	***42***	***42***	***42***	***42***	**0.0%**

Source: FAA Terminal Area Forecast (TAF), March 2022

2010 TASP FORECASTS

The 2010 Texas State Airport System Plan Update prepared forecasts specifically for commercial airport enplanement numbers only; an individual forecast for Brenham Municipal Airport was not prepared. While the System Plan provides adequate background information on socioeconomic and aviation activity trends in the state, references to specific GA airports are not included and therefore are not used for this master plan.

2005 AIRPORT DEVELOPMENT PLAN

A forecast for aviation activity at Brenham Municipal Airport was previously prepared with the 2005 Airport Development Plan. The previous planning study utilized a base year of 2004 to develop forecasts for based aircraft and annual operations. In 2004, there were 40 aircraft based at Brenham Municipal Airport and an estimated 12,000 annual GA operations. The Airport Development Plan projected activity 10 years into the future, with growth anticipated in both based aircraft and total annual operations. **Table 2D** summarizes the forecasts for both based aircraft and total civilian operations at the airport. Based on updated aviation industry trends and activity at the airport, it is necessary to develop new forecasts using the most current information available.

Table 2D | 2005 Airport Development Plan Forecasts

	2004 (Base Year)	2014
Based Aircraft	40	57
Total GA Operations[1]	12,000	17,100

[1] GA does not include military or commercial service activity.

Source: 2005 Airport Development Plan

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.

Registered Aircraft Forecast

Historical registered aircraft in Washington County since 2003 are included in **Table 2E**. Aircraft registrations have grown from a low of 33 in 2005-2006 to 49 registrations reported in 2022 (as of July 2022). The historic peak over this period was reached in 2021, when there were 54 aircraft registered in the county, a notable uptick from the 39 registered aircraft in 2020.

Most registered aircraft in the county fall within the single-engine piston category. In 2022, 38 of the 49 county-registered aircraft were single-engine piston, accounting for 78 percent. Jets made up the next largest segment with four registrations, or eight percent of the fleet mix. There were also two multi-engine aircraft, two helicopters, and two “other” which includes gliders, balloons, and experimental aircraft. Turboprops represent the smallest segment of the county’s fleet mix, with just one reported in 2022.

Different forecasting strategies were used to determine registered aircraft projections, including market share analysis and ratio projection methods. Several regression forecasts were considered as well, including single- and multi-variable regressions examining registered aircraft’s correlation with the service area population, employment, income, and gross regional product, and with U.S. active general aviation aircraft. None of the regressions produced a strong correlation (r^2 value over 0.95); therefore, the regression forecasts were not considered further.

Table 2E | Washington County Registered Aircraft								
Year	Single Engine Piston	Multi Engine Piston	Turbo Prop	Jet	Helicopter	UAV	Other	Total
2003	33	1	2	0	0	0	0	36
2004	33	1	3	0	0	0	0	37
2005	29	1	3	0	0	0	0	33
2006	31	1	1	0	0	0	0	33
2007	37	2	1	0	0	0	1	41
2008	37	3	1	0	0	0	1	42
2009	37	3	1	0	2	0	1	44
2010	40	4	1	0	0	0	1	46
2011	39	4	3	0	0	0	1	47
2012	43	4	2	0	0	0	0	49
2013	46	4	2	0	1	0	0	53
2014	41	4	1	0	1	0	0	47
2015	42	4	1	0	1	0	0	48
2016	37	5	1	0	3	0	0	46
2017	43	4	0	0	3	0	0	50
2018	35	3	0	0	3	0	0	41
2019	36	2	0	0	2	0	0	40
2020	35	2	0	0	2	0	0	39
2021	38	2	1	6	3	2	2	54
2022	38	2	1	4	2	0	2	49

Source: FAA Registered Aircraft

Table 2F shows several projections of registered aircraft for the service area, with a goal of presenting a planning envelope that shows a range of projections based on historic trends. The first set of forecasts are based on market share, which considers the relationship between registered aircraft located in Washington County and active aircraft within the United States. The next set of projections are based on a ratio of the number of aircraft per 1,000 county residents, and a final forecast is based on the historic growth rate of county-registered aircraft.

Market Share Projections

- ***Constant Market Share*** – The low-range market share forecast maintains the 2022 market share of county residents (0.0240%) at a constant throughout the planning period. The result is near stagnant growth in registrations over the 20-year planning period, with just one additional aircraft registration in the county by 2042, reflective of a 0.10 percent compound annual growth rate (CAGR).

- ***Increasing Market Share*** – Two increasing market share forecasts were also considered. The first evaluated a mid-range scenario based on the county's historic high market share, which was 0.0265 percent in 2013. A return to this produces slightly more growth, with 55 aircraft projected by the end of the planning period (0.61 percent CAGR). The high-range market share forecast considered a more aggressive growth rate of 1.25 percent, which produced a forecast of 63 registered aircraft in the county by 2042.

Table 2F | Registered Aircraft Projections for Washington County					
Year	Service Area Registrations[1]	U.S. Active Aircraft[2]	Market Share of U.S. Aircraft	Service Area Population[3]	Aircraft per 1,000 Residents
2003	36	209,606	0.0172%	30,995	1.16
2004	37	219,319	0.0169%	31,330	1.18
2005	33	224,257	0.0147%	31,710	1.04
2006	33	221,942	0.0149%	32,199	1.02
2007	41	231,606	0.0177%	32,434	1.26
2008	42	228,664	0.0184%	32,869	1.28
2009	44	223,876	0.0197%	33,459	1.32
2010	46	223,370	0.0206%	33,695	1.37
2011	47	220,453	0.0213%	33,959	1.38
2012	49	209,034	0.0234%	33,929	1.44
2013	53	199,927	0.0265%	34,207	1.55
2014	47	204,408	0.0230%	34,410	1.37
2015	48	210,031	0.0229%	34,853	1.38
2016	46	211,794	0.0217%	34,728	1.32
2017	50	211,757	0.0236%	34,850	1.43
2018	41	211,749	0.0194%	35,538	1.15
2019	40	210,981	0.0190%	35,685	1.12
2020	39	204,140	0.0191%	35,837	1.09
2021	54	204,405	0.0264%	35,891	1.50
2022	49	204,590	0.0240%	36,112	1.36
Constant Market Share of U.S. Active Aircraft (Low Range) – CAGR 0.10%					
2027	49	204,905	0.0240%	37,239	1.32
2032	49	205,195	0.0240%	38,402	1.28
2042	50	208,905	0.0240%	40,836	1.23
Increasing Market Share of U.S. Active Aircraft (Mid-Range) – CAGR 0.61%					
2027	50	204,905	0.0246%	37,239	1.35
2032	52	205,195	0.0252%	38,402	1.35
2042	55	208,905	0.0265%	40,836	1.36
Increasing Market Share of U.S. Active Aircraft (High Range) – CAGR 1.25%					
2027	52	204,905	0.0254%	37,239	1.40
2032	55	205,195	0.0270%	38,402	1.44
2042	63	208,905	0.0301%	40,836	1.54
Constant Ratio Projection per 1,000 County Residents (Low Range) – CAGR 0.62%					
2027	51	204,905	0.0247%	37,239	1.36
2032	52	205,195	0.0254%	38,402	1.36
2042	55	208,905	0.0265%	40,836	1.36
Increasing Ratio Projection per 1,000 County Residents (Mid Range) – CAGR 1.10% - Selected Forecast					
2027	52	204,905	0.0253%	37,239	1.39
2032	55	205,195	0.0266%	38,402	1.42
2042	61	208,905	0.0292%	40,836	1.49
Increasing Ratio Projection per 1,000 County Residents (High Range) – CAGR 1.29%					
2027	52	204,905	0.0255%	37,239	1.41
2032	56	205,195	0.0272%	38,402	1.45
2042	63	208,905	0.0303%	40,836	1.55
Historic Registered Aircraft Growth Rate – CAGR 1.55%					
2027	53	204,905	0.0258%	37,239	1.42
2032	57	205,195	0.0279%	38,402	1.49
2042	67	208,905	0.0319%	40,836	1.63

Sources:
1 FAA Aircraft Registration Database
2 FAA Aerospace Forecast - Fiscal Years 2022-2042
3 Woods & Poole 2022

Population Ratio Projections

- ***Constant Ratio*** – In 2022, there were 1.36 registered aircraft per 1,000 county residents. Carrying this ratio forward through the plan years results in a CAGR of 0.62 percent, or 55 aircraft by 2042, as the county's population is expected to grow steadily over the next 20 years.

- ***Increasing Ratio*** – Like the market share analysis, two increasing ratio projections were also developed. The first evaluated a mid-range option based on a 1.10 percent CAGR. This resulted in steady growth, with 61 registered aircraft in the county by the end of the planning period. A second increasing ratio forecast considered a return to the historic high ratio of registered aircraft per 1,000 county residents, which was 1.55 in 2013. Applying this ratio to the end of the planning period results in faster growth, with 63 registered aircraft by 2042 (1.29 percent CAGR).

Historic Registered Aircraft Growth Rate

- Since 2003, county-registered aircraft have grown from 36 to 49, which is reflective of a 1.55 percent CAGR. This forecast considers registered aircraft in Washington County maintaining this same growth rate over the next 20 years, which would result in 67 aircraft in the county by 2042.

A graph comparison of each projection is shown in **Exhibit 2C**. The registered aircraft projections result in a range between 50 and 67 registered aircraft in Washington County by 2042, with the constant market share representing the low end and the historic registered aircraft growth rate the high end. Each of the forecasts has been evaluated for reasonableness. The low-range market share forecast shows virtually no growth in county-registered aircraft, while the mid-range market share projection resulted in slow growth, with just one additional aircraft in the next five years and six over the next 20 years. Similarly, the constant ratio projection also appears to underestimate the county's long-term potential to capture more of the market, again with just six aircraft projected over the next 20 years. Based on the county's historical registered aircraft history and growth trends, each of these forecasts likely understate the growth potential over the next 20 years and will not be carried forward in this study.

The remaining forecasts all produced CAGRs greater than 1.00 percent, which is a more likely scenario for Washington County. The county is well-positioned for growth, in part due to its prime location between two of Texas' largest and fastest growing metropolitan areas. Over the next 20 years, the county is anticipated to add to its population at a 0.62 percent CAGR. Population growth typically means an increase in active aircraft, and this will likely be the case for Washington County. That said, the national FAA forecasts for active aircraft must also be considered. The FAA projects the national fleet to grow at a 0.10 percent CAGR, with just 315 aircraft added nationally over the next five years and just over 4,300 over the next 20 years. It is therefore reasonable to select a forecast showing a moderate level of growth throughout the planning period. The mid-range increasing ratio projection, with a CAGR of 1.10, will be carried forward as the selected forecast for service area (Washington County) registered aircraft. This projection shows an increase from 49 registered aircraft in 2022 to 52 in 2027, 55 in 2032, and 61 in 2042.

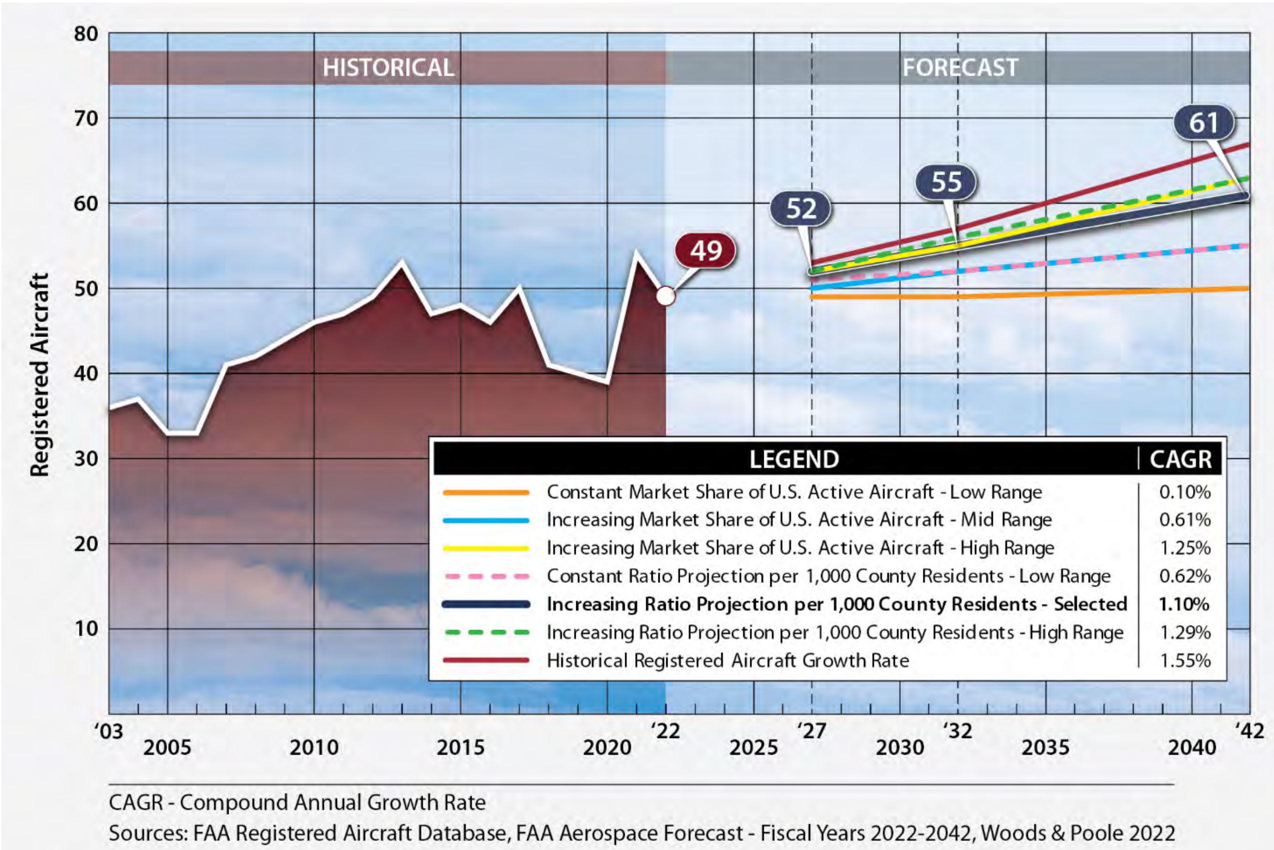


Exhibit 2C – Registered Aircraft Projections

Based Aircraft Forecast

Determining the number of based aircraft at an airport can be a challenging task. Aircraft storage can be somewhat transient in nature, meaning aircraft owners can and do move their aircraft. Some aircraft owners may store their aircraft at an airport for only part of the year. The FAA did not historically require airports to report their based aircraft counts, nor did they validate based aircraft at airports. This has changed in recent years, and now the FAA mandates that airports report their based aircraft levels. These counts are recorded in the National Based Aircraft Inventory program and maintained and validated by the FAA to ensure accuracy.

According to the FAA's database, Brenham Municipal Airport has 58 based aircraft, a count which was last validated on December 20, 2022. This figure will serve as the base year count for forecasting purposes.

Like the registered aircraft forecasts, market share and ratio projections have been made for based aircraft at Brenham Municipal Airport. The market share is based on the airport's percentage of based aircraft as compared to registered aircraft in the service area, while the ratio projection is based on the number of based aircraft per 1,000 county residents.

As a point of comparison, the FAA TAF projections for based aircraft at the airport (detailed previously on **Table 2C**) are flatlined at 42 throughout the planning period, with no growth projected from the base year estimate. However, a forecast was developed based on the statewide growth rate projected in the TAF. The results of these analyses are detailed in **Table 2G** and depicted graphically in **Exhibit 2D**.

Market Share Projections

- ***Constant Market Share*** – In 2022, the airport had 58 based aircraft, which equates to 118.4 percent of the market share of registered aircraft in Washington County. Carrying this percentage throughout the plan years results in a steady increase in based aircraft, reflective of a 1.10 percent CAGR. This projection yielded 72 based aircraft by 2042, which serves as the low-range market share projection.

- ***Increasing Market Share*** – An increasing market share forecast was also evaluated. The high-range market share forecast evaluated a scenario in which the airport holds a greater percentage of the market share, at 128.0 percent, which results in a CAGR of 1.50 percent or 78 based aircraft by the end of the planning period.

Ratio Projections

- ***Constant Ratio*** – In 2022, the ratio of based aircraft per 1,000 county residents stood at 1.61. Maintaining this at a constant through 2042 resulted in a growth rate of 0.62 percent, or 66 based aircraft.

- ***Increasing Ratio*** – Mid- and high-range growth scenarios were also evaluated. The mid-range scenario is based on an increase to 1.75 based aircraft per 1,000 residents. Applying this figure to the end of the planning period results in 71 based aircraft at the airport by 2042, at a CAGR of 1.05 percent. The high-range scenario considers a more aggressive long-range ratio of 2.00. With the estimated growth in county population, applying this ratio produces faster growth over the plan years, with 82 based aircraft forecast by 2042.

FAA TAF Projections

- ***FAA TAF Projection*** – As mentioned, the FAA TAF shows no growth in aviation activity at Brenham Municipal Airport and has flatlined based aircraft at 42 for the duration of the planning period.

- ***Statewide Growth Rate Projection*** – In addition to producing forecasts for individual airports, the FAA also forecasts aviation activity for each state. The FAA projects that based aircraft in Texas will grow at a rate of 1.04 percent. When this figure is applied to the base year count of 58 based aircraft, the result is 71 based aircraft at Brenham Municipal by the end of the planning period.

Table 2G | Based Aircraft Forecasts – Brenham Municipal Airport					
Year	Based Aircraft	Service Area Registrations	Market Share	Service Area Population	Aircraft Per 1,000 Residents
2022	58	49	118.4%	36,112	1.61
Constant Market Share (Low Range) – CAGR 1.10%					
2027	61	52	118.4%	37,239	1.65
2032	65	55	118.4%	38,402	1.68
2042	72	61	118.4%	40,836	1.77
Increasing Market Share (High Range) – CAGR 1.50% – Selected Forecast					
2027	63	52	120.8%	37,239	1.68
2032	67	55	123.2%	38,402	1.75
2042	78	61	128.0%	40,836	1.91
Constant Ratio per 1,000 Residents (Low Range) – CAGR 0.62%					
2027	60	52	115.6%	37,239	1.61
2032	62	55	112.8%	38,402	1.61
2042	66	61	107.5%	40,836	1.61
Increasing Ratio per 1,000 Residents (Mid-Range) – CAGR 1.05%					
2027	61	52	118.2%	37,239	1.64
2032	64	55	117.9%	38,402	1.68
2042	71	61	117.2%	40,836	1.75
Increasing Ratio per 1,000 Residents (High Range) – CAGR 1.73%					
2027	63	52	122.6%	37,239	1.70
2032	69	55	126.7%	38,402	1.80
2042	82	61	133.9%	40,836	2.00
FAA TAF – CAGR -1.60%					
2027	42	52	81.2%	37,239	1.13
2032	42	55	76.8%	38,402	1.09
2042	42	61	68.9%	40,836	1.03
FAA TAF Statewide Growth Rate – CAGR 1.04%					
2027	61	52	118.0%	37,239	1.64
2032	64	55	117.7%	38,402	1.67
2042	71	61	117.0%	40,836	1.75

Sources: FAA records; State System Plan; Previous Planning Studies, 2022 FAA TAF; Woods & Poole CEDDS 2022

The forecasts produce a planning envelope ranging from 42 to 82 based aircraft at the airport by 2042. As of December 2021, there are no hangar vacancies. Fourteen individuals are on a wait list for T-hangar space, and the airport has been contacted by several individuals interested in ground leases in order to construct box hangars, indicating strong demand for based aircraft at the airport. This, combined with the increase in county population and registered aircraft projected over the next 20 years, justifies a more aggressive projection for based aircraft. Therefore, the high-range increasing market share forecast has been selected as the preferred projection. With a CAGR of 1.50 percent, this forecast projects an increase from 58 to 78 based aircraft by the end of the planning period in 2042.

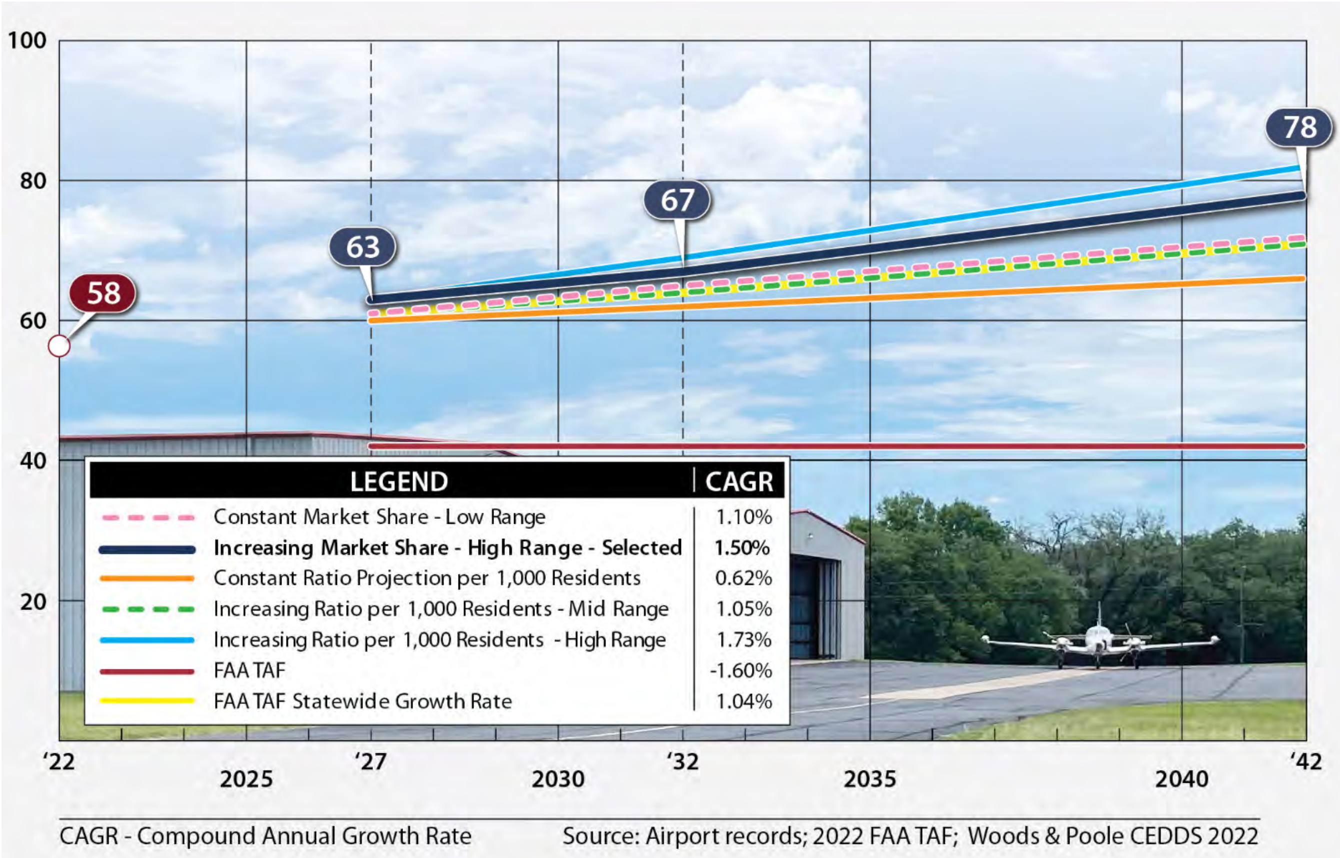


Exhibit 2D – Based Aircraft Projections

Based Aircraft Fleet Mix Forecast

The fleet mix of based aircraft is very important for airport planning and design, sometimes more so than the total number of aircraft. For example, the presence of one or a few large business jets can have a greater impact on design standards for the runway and taxiway system compared to a greater number of smaller, single-engine piston-powered aircraft.

The based aircraft fleet mix forecast for Brenham Municipal Airport is presented in **Table 2H**. Fleet mix projections have been developed based upon the FAA's estimates of how the national fleet mix will evolve over the same period. Local factors, such as the potential for increased turboprop and jet operations due to the presence of manufacturers such as Bluebell Creameries, have also been considered.

Table 2H | Based Aircraft Fleet Mix – Brenham Municipal Airport

	EXISTING		FORECAST					
Aircraft Type	2022	%	2027	%	2032	%	2042	%
Single-Engine Piston	46	79%	49	78%	51	76%	57	73%
Multi-Engine Piston	4	7%	4	6%	2	3%	0	0%
Turboprop	0	0%	1	2%	2	3%	4	5%
Jet	8	14%	9	14%	11	16%	15	19%
Helicopter	0	0%	0	0%	1	1%	2	3%
Totals	**58**	**100%**	**63**	**100%**	**67**	**100%**	**78**	**100%**

Source: Airport records; Coffman Associates analysis

In 2022, most based aircraft (79 percent) at the airport fell into the single-engine piston category. This is projected to remain the majority category over the planning period, with steady growth in the number of single-engine piston aircraft based at the airport by 2042. The next largest aircraft type is jets, with eight of these aircraft based at Brenham Municipal Airport in 2022. This segment, which comprised 14 percent of the fleet mix in 2022, is expected to increase over the planning years, in line with the FAA's national fleet mix projection, and will comprise 19 percent of the local fleet by the end of the planning period. Turboprops and helicopters are also projected to increase, while multi-engine pistons will eventually phase out, both locally and nationally.

OPERATIONS FORECASTS

Operations at Brenham Municipal Airport 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 14 Code of Federal Regulations (CFR) Part 135, otherwise known as "for-hire" or "on-demand" activity. Military operations include those operations conducted by various branches of the U.S. military.

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. 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. 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.

Because Brenham Municipal Airport is not equipped with an airport traffic control tower (ATCT), precise operational (takeoff and landing) counts are not available. Sources for estimated operational activity at the airport include the FAA Form 5010 Airport Master Record and the FAA TAF. Form 5010 indicates a total of 27,650 operations for the 12-month period ending September 29, 2016, as does the 2022 FAA TAF. In both estimates, the majority of operations (74.9 percent) are local GA, with 25.0 percent recorded as itinerant operations. There are no air taxi operations, and military operations are estimated at 0.2 percent of the total. Total operations at the airport are broken down as:

- 20,700 annual local GA operations
- 6,900 annual itinerant GA operations
- 0 annual air taxi operations
- 50 annual military operations

Additional calculations to estimate annual operations were also conducted for comparison purposes. The first, Equation 15 in FAA's "Model for Estimating General Aviation Operations at Non-towered Airports Using Towered and Non-towered Airport Data," factors in regional population and based aircraft data to develop a baseline operational count. When this data was input, the result was 23,363 annual operations.

The second calculation multiplies validated based aircraft by an estimated number of operations per based aircraft (OPBA), as outlined in Airport Cooperative Research Program (ACRP) Report 129, *Evaluating Methods for Counting Aircraft Operations at Non-Towered Airports*. In FAA Order 5090.5, the FAA recommends using a multiplier of 350 OPBA for local GA airports; however, there is no recommended multiplier for regional GA airports such as Brenham. As such, two calculations were prepared, one using 350 as the multiplier and one using 400 as a multiplier to account for the increased operations that a regional GA airport likely experiences. The results were an estimated 15,750 total annual operations using 350 OPBA and 18,000 annual operations using 400 OPBA.

In summary, the following estimates of annual operations as derived from various sources are:

- FAA Form 5010 - 27,650 annual operations
- FAA TAF – 27,650 annual operations
- FAA Equation 15 – 23,363 annual operations
- OPBA with 350 multiplier – 15,750 annual operations
- OPBA with 400 multiplier – 18,000 annual operations

Based on activity levels in the region and at similar airports, it is likely that the FAA Equation and OPBA calculations underestimate annual operations at Brenham Municipal Airport. Therefore, the total of 27,650 as derived from the FAA Form 5010 and TAF will be carried forward as the baseline count of annual GA operations.

Itinerant General Aviation Operations Forecast

Table 2J presents several forecasts for itinerant GA operations. Three forecasts are based on the airport's market share of total U.S. itinerant GA operations, and the FAA TAF is also included for comparison purposes. An additional forecast based on the projected statewide TAF growth rate is also detailed.

Market Share Projections

- ***Constant Market Share*** – In 2022, the airport held 0.0474 percent of the market share of national itinerant operations. The first forecast carries this figure forward as a constant through the planning period, resulting in 7,700 operations by 2042 and a CAGR of 0.55 percent.

- ***Increasing Market Share*** – Two increasing market share forecasts were also evaluated. The mid-range projection assumed an increase to 0.0560 percent of the market share by the end of the planning period, which equated to 9,100 itinerant operations in 2042 reflective of a 1.39 percent CAGR. The high-range market share forecast evaluated a scenario in which the airport captures more of the market share at 0.0625 percent. This produced a CAGR of 1.97 percent or 10,200 annual itinerant operations by the end of the planning period.

Table 2J | Itinerant General Aviation Operations Forecasts			
Year	**Itinerant GA Operations**	**U.S. ATCT Itinerant GA Operations**	**Share %**
2022	6,900	14,569,014	0.0474%
Constant Market Share (Low Range) – CAGR 0.55%			
2027	7,400	15,636,300	0.0474%
2032	7,500	15,838,715	0.0474%
2042	7,700	16,259,605	0.0474%
Increasing Market Share (Mid-Range) – CAGR 1.39% – Selected Forecast			
2027	7,700	15,636,300	0.0495%
2032	8,200	15,838,715	0.0517%
2042	9,100	16,259,605	0.0560%
Increasing Market Share (High Range) – CAGR 1.97%			
2027	8,000	15,636,300	0.0511%
2032	8,700	15,838,715	0.0549%
2042	10,200	16,259,605	0.0625%
FAA TAF – CAGR 0.00%			
2027	6,900	15,636,300	0.0441%
2032	6,900	15,838,715	0.0436%
2042	6,900	16,259,605	0.0424%
FAA State TAF Growth Rate – CAGR 0.55%			
2027	7,100	15,636,300	0.0454%
2032	7,300	15,838,715	0.0461%
2042	7,700	16,259,605	0.0474%

Sources: FAA Aerospace Forecast 2022-2042; FAA Form 5010; 2022 FAA TAF

FAA TAF Projections

- ***FAA TAF Projection*** – Like the based aircraft projection, the FAA TAF shows no growth in annual operations over the next 20 years at Brenham Municipal Airport, with 6,900 itinerant operations forecast for each year of the planning period.

- ***Statewide Growth Rate Projection*** – The TAF anticipates itinerant operations in Texas to grow at a CAGR of 0.55 percent between 2022 and 2042. When this growth rate is applied to the base year itinerant operations at Brenham Municipal Airport, the result is very similar to the constant market share forecast, with 7,700 annual itinerant operations in 2042, but with slower growth in the intervening years.

Exhibit 2E presents a graph of the itinerant GA operation projections. Combined, the forecasts present a planning envelope ranging from 6,900 (TAF forecast) to 10,200 itinerant operations (high-range market share). Neither of these forecasts are considered reasonable, as the TAF figures are flatlined and show no growth, while the 1.97 percent CAGR associated with the high-range market share forecast likely overestimates the growth potential the airport is likely to experience. However, moderate growth in itinerant operations is anticipated as the area continues to grow and as itinerant operations increase nationally over the next 20 years. Therefore, the mid-range market share forecast is the selected projection. This forecast predicts steady growth at 1.39 percent over the planning period, with itinerant operations reaching 9,100 in 2042.

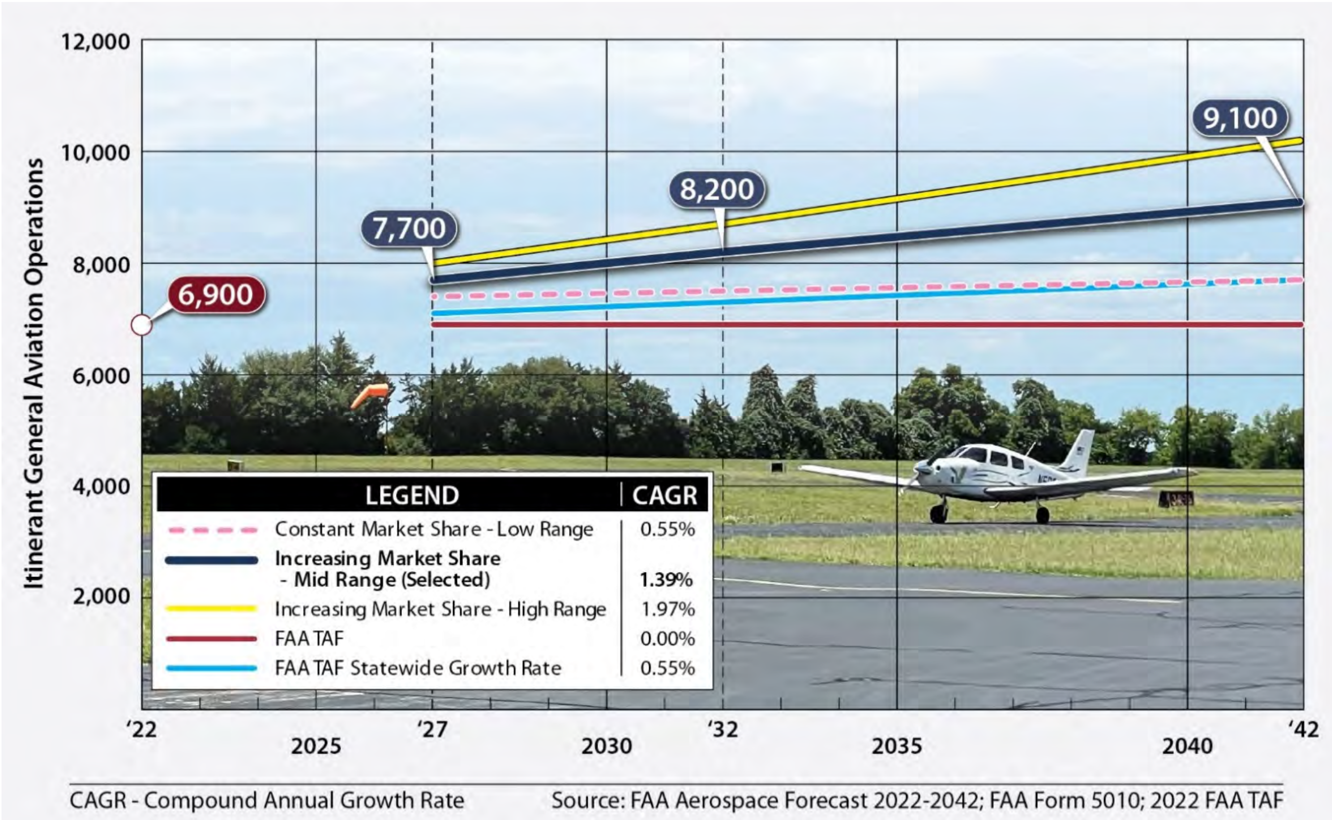


Exhibit 2E – Itinerant GA Operations Projections

Local General Aviation Operations Forecast

Local operations, or those that stay within the traffic pattern or are executing touch-and-go operations, have also been forecast. This type of operation comprises the largest share of the total operations occurring at Brenham Municipal Airport, with 20,700 local operations estimated in 2022. The base year represents a market share of 0.1507 percent when compared to total U.S. local operations. Like the itinerant forecasts, several market share projections were made, as well as a forecast based on the FAA TAF statewide growth rate for the airport. The TAF projections have also been included for comparison purposes. **Table 2K** details each of the projections for local operations during the planning period.

Market Share Projections

- ***Constant Market Share*** – The first forecast maintains the airport's 2022 market share and represents the low-range market share forecast. Carrying this figure into the future results in 23,800 local annual operations at the airport by 2042, reflective of a 0.70 percent CAGR.

- ***Increasing Market Share*** – The next two forecasts evaluated increasing market share scenarios, with the mid-range projection considering an increase to 0.1750 percent of the market share. This resulted in a 1.45 percent CAGR, or 27,600 local operations by 2042. A second increasing market share forecast considered a greater increase to the market share estimate, producing the high end of the planning envelope. In this scenario, 31,500 local operations are forecast by 2042, equating to a 2.12 percent CAGR.

Table 2K | Local General Aviation Operations Forecasts			
Year	Local GA Operations	U.S. ATCT Local GA Operations	Share %
2022	20,700	13,731,399	0.1507%
Constant Market Share (Low Range) – CAGR 0.70%			
2027	22,500	14,950,786	0.1507%
2032	22,900	15,214,104	0.1507%
2042	23,800	15,767,539	0.1507%
Increasing Market Share (Mid-Range) – CAGR 1.45% – Selected Forecast			
2027	23,400	14,950,786	0.1568%
2032	24,800	15,214,104	0.1629%
2042	27,600	15,767,539	0.1750%
Increasing Market Share (High Range) – CAGR 2.12%			
2027	24,400	14,950,786	0.1631%
2032	26,700	15,214,104	0.1754%
2042	31,500	15,767,539	0.2000%
FAA TAF – CAGR 0.00%			
2027	20,700	14,950,786	0.1385%
2032	20,700	15,214,104	0.1361%
2042	20,700	15,767,539	0.1313%
FAA State TAF Growth Rate – CAGR 0.70%			
2027	21,400	14,950,786	0.1431%
2032	22,200	15,214,104	0.1459%
2042	23,800	15,767,539	0.1509%

Sources: FAA Aerospace Forecast 2022-204s; FAA Form 5010; 2022 FAA TAF

FAA TAF Projections

- ***FAA TAF Projection*** – The FAA TAF estimates local operations at Brenham Municipal Airport to remain stagnant at 20,700 over the next 20 years.

- ***Statewide Growth Rate Projection*** – Local operations on a statewide level are anticipated to grow faster than itinerant operations, at CAGR of 0.70 percent. Applied to the forecast years, the result is 23,800 local operations occurring annually at Brenham Municipal by 2042.

Exhibit 2F presents a graph of the local GA operation projections that have been developed. The planning envelope that results from these forecasts ranges from 20,700 to 31,500 local operations. Like the itinerant forecasts, the most reasonable forecast lies between the two extremes, with the mid-range market share forecast carried forward as the selected projection. This forecast results in 27,600 local GA operations by 2042—an increase of approximately 7,000 local operations over the next 20 years. Nationally and statewide, local GA operations are anticipated to grow at about 0.70 percent. While the selected forecast predicts a stronger growth rate for Brenham Municipal Airport, the projection is reasonable due to local and regional trends in this type of operation and is also supported by the increase in based aircraft forecast for the airport.

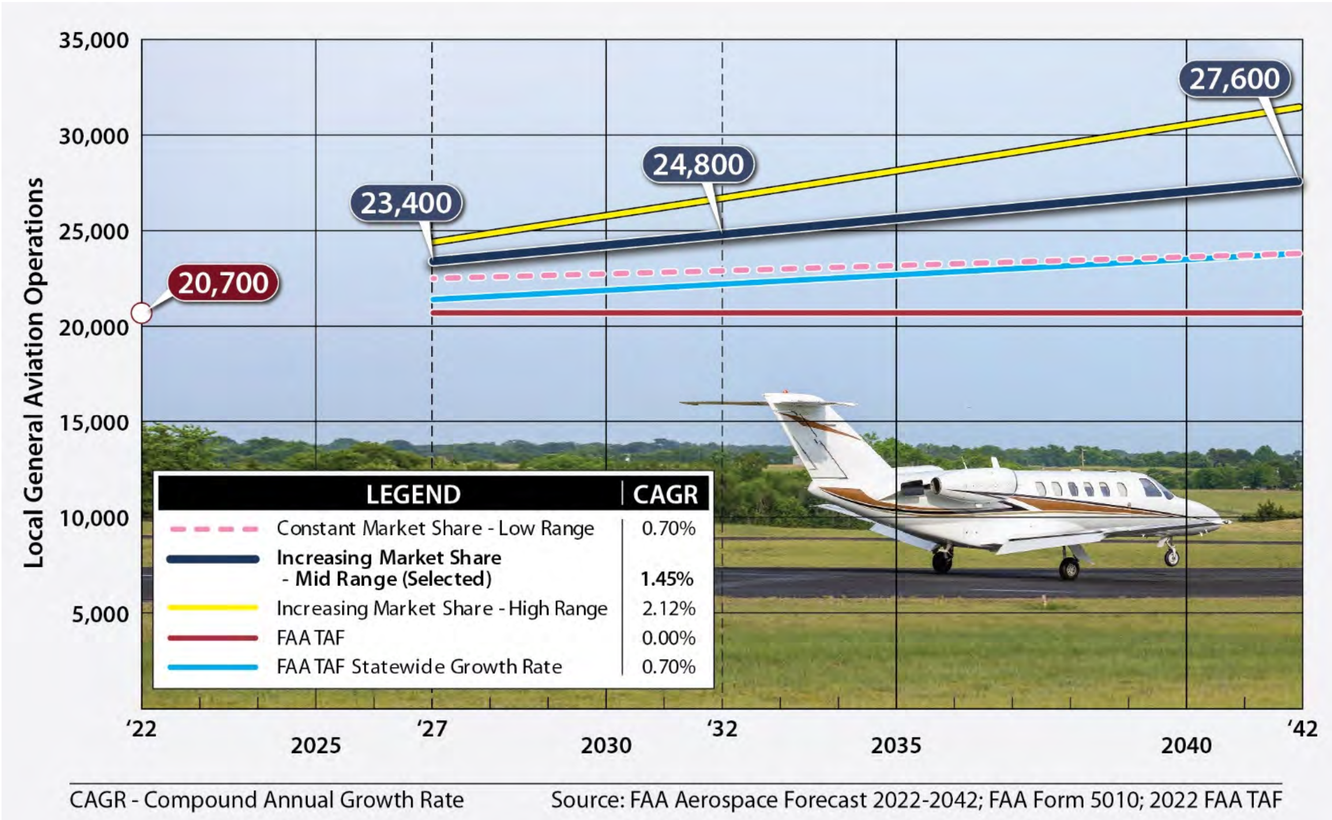


Exhibit 2F – Local GA Operations Projections

Air Taxi Operations Forecast

The air taxi category, which is a subset of the itinerant operations category, is comprised of operations that are conducted by aircraft operating under 14 CFR Part 135. Part 135 operations are "for-hire" or "on-demand" and include charter and commuter flights, air ambulance, or fractional ownership aircraft operations. The FAA Form 5010 and FAA TAF do not account for any air taxi operations at Brenham Municipal Airport. However, information obtained from Airport IQ, a data collection service that contains archived aviation data on U.S. airports, indicates otherwise. For a 12-month period ending in August 2022, Airport IQ recorded 194 air taxi operations at the airport. This figure will thus be carried forward as a more accurate reflection of the air taxi activity occurring at Brenham Municipal Airport.

Nationally, the airport holds 0.0031 percent of the market share of air taxi operations. Like the previous operations forecasts, market share and growth rate projections based on the state TAF have been prepared, with the FAA TAF estimate included for comparison, and are shown in **Table 2L**.

Table 2L | Air Taxi Operations			
Year	Air Taxi Operations	U.S. ATCT Air Taxi Operations	Share %
2022	194	6,284,713	0.0031%
Constant Market Share (Low Range) – CAGR 0.52%			
2027	184	5,962,583	0.0031%
2032	194	6,285,528	0.0031%
2042	215	6,966,613	0.0031%
Increasing Market Share (Mid-Range) – CAGR 2.42%			
2027	205	5,962,583	0.0034%
2032	238	6,285,528	0.0038%
2042	313	6,966,613	0.0045%
Increasing Market Share (High Range) – CAGR 4.33% – Selected Forecast			
2027	235	5,962,583	0.0039%
2032	301	6,285,528	0.0048%
2042	453	6,966,613	0.0065%
FAA TAF – CAGR -100.00%			
2027	0	5,962,583	0.0000%
2032	0	6,285,528	0.0000%
2042	0	6,966,613	0.0000%
FAA State TAF Growth Rate – CAGR -0.43%			
2027	190	5,962,583	0.0032%
2032	186	6,285,528	0.0030%
2042	178	6,966,613	0.0026%

Sources: FAA Aerospace Forecast 2022-2042; 2022 FAA TAF; Airport IQ

Market Share Projections

- ***Constant Market Share*** – Carrying the base year's market share of 0.0031 percent results in a decline in air taxi operations through 2032, before slow growth occurs by the end of the planning period. This is due to the FAA's projection that air taxi operations will decline nationally over the next 10 years, before an increasing trend begins. Locally, the resulting CAGR over the 20-year period is 0.52 percent, with 215 air taxi operations projected by 2042.

- ***Increasing Market Share*** – Stronger growth scenarios based on market share were also evaluated. The mid-range scenario considered Brenham Municipal holding 0.0045 percent of the national market share by 2042, which translated to 313 air taxi operations by the end of the planning period. This is reflective of a 2.42 percent CAGR. A high-range projection was also prepared which assessed a 0.0065 percent market share by 2042 and produced a CAGR of 4.33 percent, or 453 air taxi operations.

FAA TAF Projections

- ***FAA TAF Projection*** – The FAA TAF shows no growth in air taxi operations at the airport, with the count remaining at zero over the next 20 years.

- ***Statewide Growth Rate Projection*** – Similar to national projections, the FAA estimates air taxi operations at the state level to decline at a CAGR of -0.43 percent. Applying this negative growth rate results in a decrease of air taxi operations at Brenham Municipal, down from 194 in 2022 to 178 by the end of the planning period.

Exhibit 2G presents a graph of the new air taxi operation projections. The air taxi forecasts range between a low of zero operations, based on the TAF, and a peak of 453 operations based on a high-range, increasing market share. As mentioned previously, Brenham is a growing community with an ideal location between Austin and Houston. Large-scale manufacturers are already established in the area, with evident growth potential for more. Therefore, a higher level of growth is anticipated for this operational segment, and the high range, increasing market share will be carried forward as the selected forecast, with 453 air taxi operations projected by 2042.

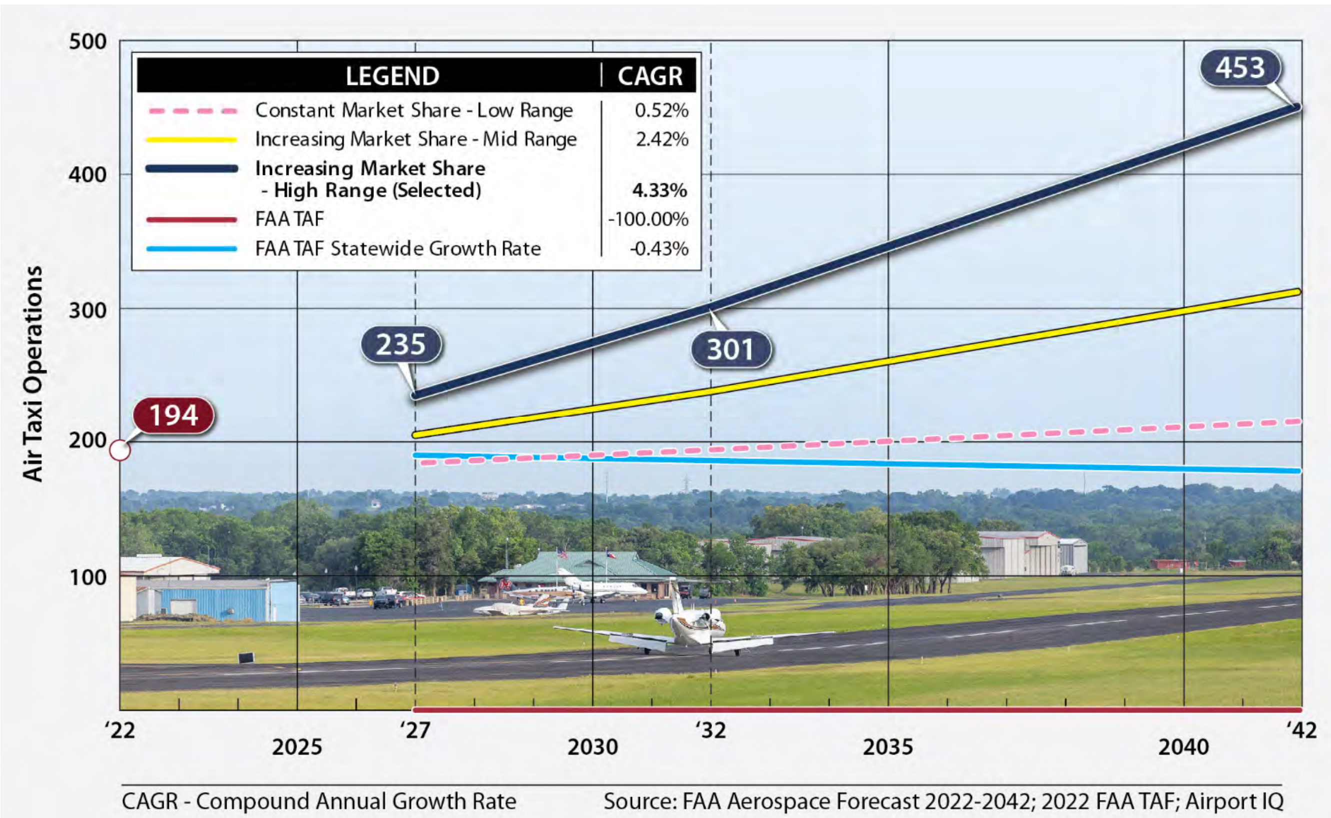


Exhibit 2G – Air Taxi Operations Projections

Military Operations Forecast

Military aircraft can and do utilize civilian airports across the country, including Brenham Municipal Airport. However, it is inherently difficult to project future military operations due to their national security nature and the fact that missions can change without notice. Thus, it is typical for the FAA to use a flat-line number for military operations. For this planning study, military operations at the airport are projected to stay constant through the plan years at 50 itinerant operations.

PEAK PERIOD FORECASTS

Peaking characteristics play an important role in determining airport capacity and facility requirements. Because Brenham Municipal Airport does not have a control tower, the generalized peaking characteristics of other non-towered general aviation airports have been used for the purposes of this study. The peaking periods used to develop the capacity analysis and facility requirements are described below.

- Peak month – the calendar month in which traffic activity is the highest
- Design day – the average day in the peak month, derived by dividing the peak month by the number of days in the month
- Design hour – the average hour within the design day
- Busy day – the busiest day of a typical week in the peak month

For the purposes of this study, the peak month for total operations was estimated at 10 percent of the annual operations. By 2042, the estimated peak month is projected to reach 2,784 operations. The design day is estimated by dividing the peak month by the number of days in month (31), and the busy day is calculated at 1.25 times the design day. The design hour is then calculated at 15 percent of the design day. These projections are included in **Table 2M**.

Table 2M | Peak Period Forecasts

	2022	2027	2032	2042
Annual	27,844*	31,400	33,400	37,200
Peak Month	2,784	3,140	3,340	3,720
Design Day	90	101	108	120
Design Hour	13	15	16	18
Busy Day	112	126	133	145

*Includes air taxi operations sourced from Airport IQ

Source: Coffman Associates analysis

Forecast Summary and Comparison to the FAA TAF

Demand-based forecasts of aviation activity at the airport over the next 20 years have been developed. An attempt has been made to define the projections in terms of short (1-5 years), intermediate (6-10 years), and long (11-20 years) term planning horizons. Elements such as local socioeconomic indicators, anticipated regional development, historical aviation data, and national aviation trends were all considered when determining future conditions. **Exhibit 2H** presents a 20-year forecast summary. The base year for these forecasts is 2022, with a 20-year planning horizon to 2042. The primary aviation demand indicators are based aircraft and operations. Based aircraft are forecast to increase from 58 in 2022 to 78 by 2042 (1.50 percent CAGR). Total operations are forecast to increase from 27,844 (includes air taxi operations derived from Airport IQ) in 2022 to 37,200 by 2042 (1.46 percent CAGR).

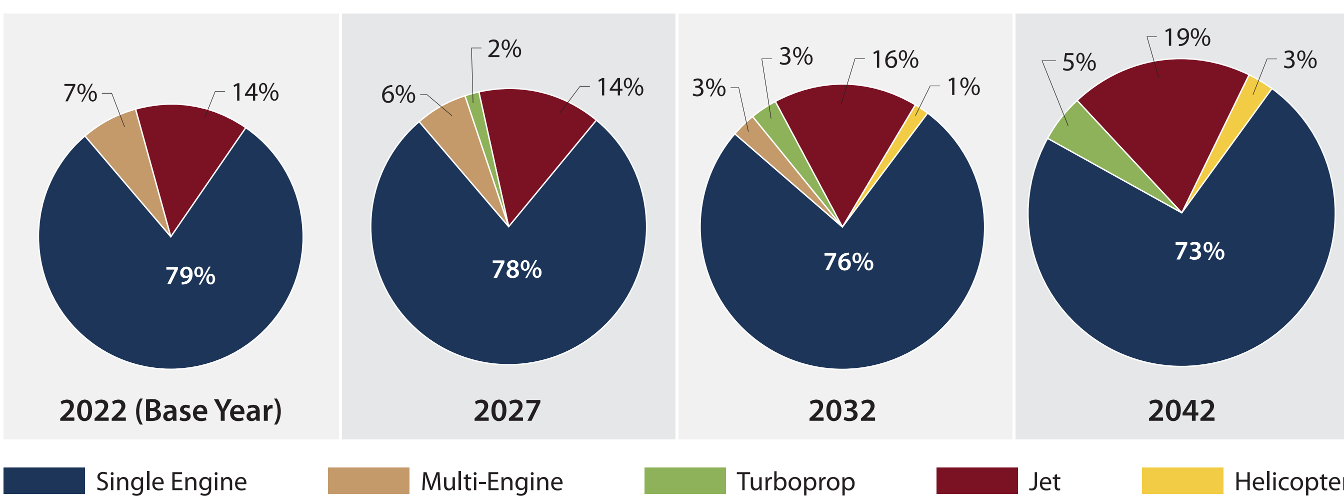
Projections of aviation demand will be influenced by unforeseen factors and events in the future. Therefore, it is not reasonable to assume that future demand will follow the exact projection line, but over time, forecasts of aviation demand tend to fall within the planning envelope. The forecasts developed 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 slower. Likewise, if demand exceeds these forecasts, the airport may accelerate construction of new facilities.

TxDOT reviews the forecasts presented in this airport 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 5090.5, *Formulation of the NPIAS and ACIP*.

	BASE YEAR	2027	2032	2042
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	0	0	0	0
Other Air Taxi	194	235	301	453
General Aviation	6,900	7,700	8,200	9,100
Military	50	50	50	50
Total Itinerant Operations	***7,144***	***8,000***	***8,600***	***9,600***
Local				
General Aviation	20,700	23,400	24,800	27,600
Military	0	0	0	0
Total Local Operations	***20,700***	***23,400***	***24,800***	***27,600***
Total Annual Operations	***27,844***	***31,400***	***33,400***	***37,200***
PEAKING				
Total Annual Operations	27,844	31,400	33,400	37,200
Peak Month	2,784	3,140	3,340	3,720
Design Day	90	101	108	120
Design Hour	13	15	16	18
Busy Day	112	126	133	145
BASED AIRCRAFT				
Single Engine	46	49	51	57
Multi-Engine	4	4	2	0
Turboprop	0	1	2	4
Jet	8	9	11	15
Helicopter	0	0	1	2
Total Based Aircraft	***58***	***63***	***67***	***78***

Based Aircraft Fleet Mix



If the forecasts exceed these parameters, additional review and justification may be required. **Table 2N** presents the direct comparison of this master planning forecast with the TAF published in March 2022.

Table 2N | Comparison of Master Plan Forecasts to FAA TAF					
	2022	2027	2032	2042	CAGR
Total Operations					
Master Plan Forecast	27,844*	31,400	33,400	37,200	1.46%
TAF	27,650	27,650	27,650	27,650	0.00%
% Difference	0.70%	12.70%	18.84%	29.45%	
Based Aircraft					
Master Plan Forecast	58	63	67	78	1.50%
TAF	42	42	42	42	0.00%
% Difference	32.00%	40.00%	45.87%	60.00%	
*Includes air taxi operations sourced from Airport IQ					

The operations forecast is slightly outside the TAF tolerance for the 5- and 10-year periods, at 12.70 percent and 18.84 percent, respectively. This is due to operations being flatlined over the planning period, whereas the master plan predicts some level of growth in operations. A similar condition exists for the based aircraft forecast comparison between this master plan and the TAF. In the 5-year period, the difference is 40.00 percent, and it is 45.87 percent in the 10-year period. Again, this is due to the TAF projecting no growth in based aircraft at the airport over the next 20 years, at least in part. The difference can also be credited to the discrepancy in the 2022 count of based aircraft between the master plan and the TAF. While airport records maintained by staff and validated by the FAA indicate 58 based aircraft, the TAF only reports 42, further contributing to the larger percentage outside tolerance.

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 aircraft is used to define the design parameters for an airport. The critical aircraft may be a single aircraft type or a composite aircraft representing a collection of aircraft with similar characteristics. The critical aircraft is classified by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). FAA AC 150/5300-13B, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2J**.

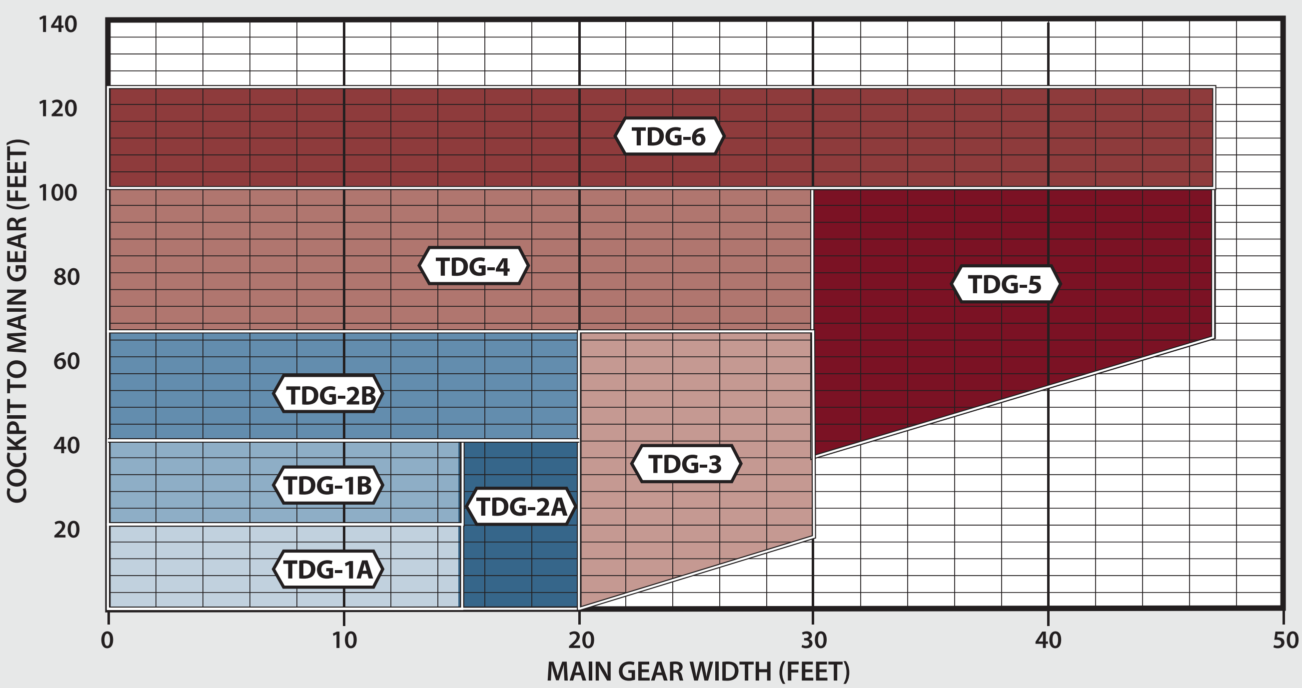
AIRCRAFT APPROACH CATEGORY (AAC)	
Category	**Approach Speed**
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

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

VISIBILITY MINIMUMS	
RVR* (ft)	**Flight Visibility Category (statute miles)**
VIS	3-mile or greater visibility minimums
5,000	Not lower than 1-mile
4,000	Lower than 1-mile but not lower than ¾-mile
2,400	Lower than ¾-mile but not lower than ½-mile
1,600	Lower than ½-mile but not lower than ¼-mile
1,200	Lower than ¼-mile

***RVR**: Runway Visual Range

TAXIWAY DESIGN GROUP (TDG)

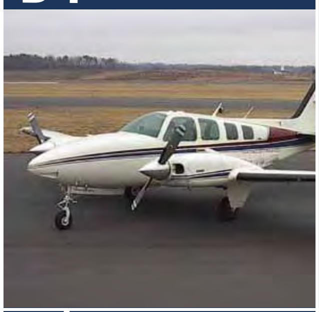


Source: FAA AC 150/5300-13B, Airport Design

A-I

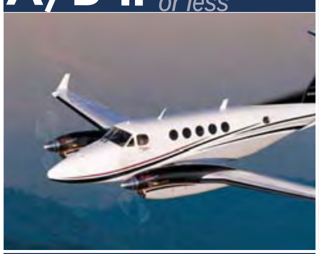
Aircraft	TDG
Beech Baron 55	1A
Beech Bonanza	**1A**
Cessna 150, 172	1A
Eclipse 500	1A
Piper Archer, Seneca	1A

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)	2A
Embraer Phenom 100	1B

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

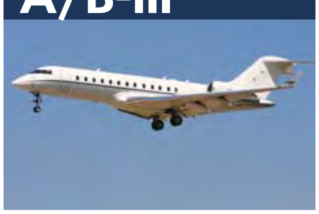


Aircraft	TDG
Beech Super King Air 200	**2A**
Cessna 441 Conquest	1A
Cessna Citation CJ2 (525A)	2A
Pilatus PC-12	1A

B-II over 12,500 lbs.

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

A/B-III

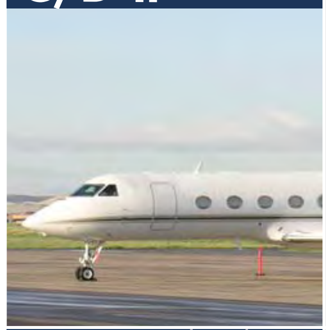


Aircraft	TDG
Bombardier Dash 8	3
Bombardier Global 5000, 6000, 7000, 8000	**2B**
Falcon 6X, 7X, 8X	2B

C/D-I

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

C/D-II

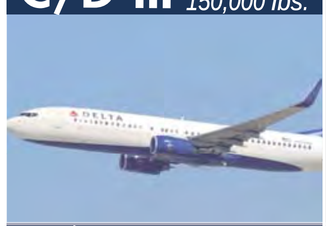


Aircraft	TDG
Challenger 600/604/ 800/850	1B
Cessna Citation VII, X+	1B
Embraer Legacy 450/500	1B
Gulfstream IV, 350, 450 (D-II)	2A
Gulfstream G200/G280	1B
Lear 70, 75	1B

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

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

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**

TDG - Taxiway Design Group

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 area (TOFA), taxilane object free area, apron wingtip clearance, and various separation distances.

Taxiway Design Group (TDG): A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the critical aircraft. The TDG is classified by an alphanumeric system: 1A, 1B, 2A, 2B, 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 critical 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 2J** 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 take off from a runway while any aircraft are present on adjacent taxiways, under particular meteorological conditions with no special operating conditions. The DPRC is similar to the APRC but is composed of two components: 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 Brenham Municipal Airport identifies the ARC as B-II.

CRITICAL 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 aircraft is used to define the design parameters for an airport. The critical 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 critical 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 150/5300-13B, *Airport Design*, "airport designs based only on aircraft currently using the airport can severely limit the airport's ability to accommodate future operations of more demanding aircraft. Conversely, it is not practical or economical to base airport design on aircraft that will not realistically use the airport." Selection of the current and future critical aircraft must be realistic in nature and supported by current data and realistic projections.

AIRPORT CRITICAL AIRCRAFT

There are three elements for classifying the airport critical 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 certain 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.

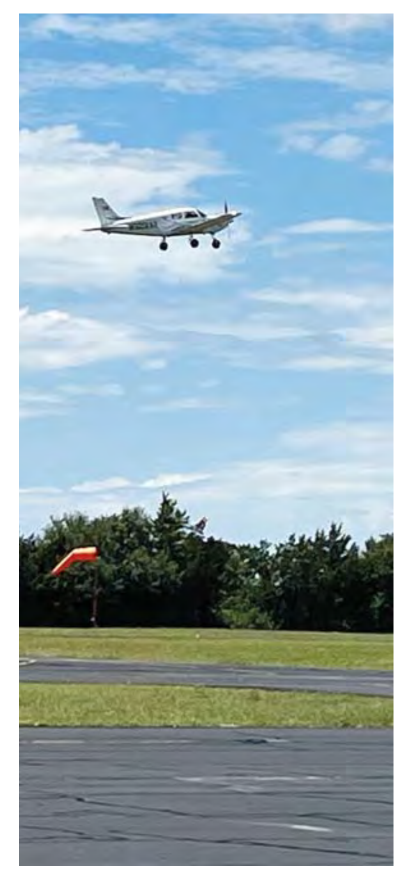
Exhibit 2K presents the TFMSC operational mix at the airport for turbine aircraft operations for the last 10 years. As can be seen, the airport experiences activity by a full range of business jets, but only one category of aircraft conducts more than 500 annual operations. In 2021, the greatest number of operations in any single design family was 754 in B-II, which accounted for approximately 62 percent of logged turbine aircraft activity. Over the 10-year period, the B-II design category has averaged approximately 531 annual operations, as reported by the TFMSC. Representative aircraft in this category include the Citation II/SP/Latitude and the Beechcraft King Air 200/300/350.

In the future, larger and more sophisticated jets are anticipated to operate more frequently at the airport. Nationally, the aircraft fleet is shifting to include more of this type of aircraft and fewer piston-powered aircraft. While single-engine pistons will likely continue to dominate in terms of operations at the airport over the short and intermediate terms, it is important to plan for increased operations from larger jet aircraft over the long-term. According to TFMSC data, ARC C-II aircraft operate regularly at the airport. While recent years do show a decline in activity for this operational category, historical data indicates that C-II aircraft have been a strong presence at the airport in the past. As such, it is not unreasonable to anticipate a return to higher activity levels by these aircraft, especially when national trends are considered along with the strong growth potential for more industrial/manufacturing growth locally. Planning facilities to accommodate this type of aircraft is prudent; therefore, the ultimate critical aircraft for Brenham Municipal Airport has been determined to fall within ARC C-II, with the Challenger 600/604 serving as a representative aircraft for this category.

ARC	AIRCRAFT	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A-I	A36 Bonanza	2	0	4	0	0	0	0	0	2	2
	Cessna 206/207/210	0	0	0	0	0	0	0	2	0	0
	Cirrus Vision Jet	0	0	0	0	0	0	0	0	2	0
	Eclipse 400/500	0	8	6	4	12	8	12	20	4	0
	Epic Dynasty	0	0	0	0	0	0	2	0	0	0
	Kodiak Quest	0	0	0	0	0	0	0	0	0	2
	Lancair Evolution/Legacy	0	0	4	2	2	0	0	0	0	0
	Piper Malibu/Meridian	10	20	14	12	4	6	2	4	8	12
	Socata TBM 7/850/900	2	10	4	6	12	22	8	6	2	14
	Total	**14**	**38**	**32**	**24**	**30**	**36**	**24**	**32**	**18**	**30**
A-II	Cessna Caravan	8	10	4	6	2	2	6	2	4	8
	De Havilland Twin Otter	0	0	0	2	0	0	2	0	0	0
	Pilatus PC-12	14	20	34	48	14	12	14	54	14	24
	Total	**22**	**30**	**38**	**56**	**16**	**14**	**22**	**56**	**18**	**32**
B-I	Beechjet 400	86	18	14	8	4	2	0	4	2	24
	Cessna 425 Corsair	20	4	8	0	6	4	10	2	6	2
	Citation CJ1	20	18	14	14	32	32	10	18	18	6
	Citation I/SP	0	6	8	2	0	0	10	56	22	28
	Citation M2	0	0	0	0	0	0	6	4	2	0
	Citation Mustang	12	10	8	6	4	4	0	2	2	4
	Falcon 10	6	10	20	4	0	0	0	0	6	22
	Hawker 1000	0	0	0	0	0	2	0	0	0	0
	Honda Jet	0	0	0	0	0	0	0	0	2	6
	King Air 90/100	60	68	84	80	70	80	62	76	38	54
	L-39 Albatross	0	0	2	4	0	0	0	0	0	12
	Mitsubishi MU-2	32	40	96	134	148	92	120	104	86	44
	Phenom 100	14	4	0	2	8	2	2	6	14	6
	Piaggio Avanti	2	2	2	0	6	0	0	0	0	2
	Piper Cheyenne	2	0	6	2	0	4	20	10	2	4
	Premier 1	38	84	100	48	62	92	80	6	14	20
	Rockwell Sabre 40/60	0	2	0	0	0	0	0	0	0	0
	T-6 Texan	0	0	2	0	0	0	2	0	4	4
	Total	**292**	**266**	**364**	**304**	**340**	**314**	**322**	**288**	**218**	**238**
B-II	Aero Commander 690	2	0	2	0	0	2	0	2	4	0
	BAe Jetstream	0	4	0	2	0	0	0	0	0	0
	Cessna Conquest	0	4	26	26	26	4	6	0	0	6
	Challenger 300	2	2	10	12	14	48	42	64	40	56
	Citation CJ2/CJ3/CJ4	6	10	6	12	12	8	10	12	18	18
	Citation II/SP/Latitude	62	44	32	22	46	50	128	140	110	248
	Citation Longitude	0	0	0	0	0	0	0	0	4	2
	Citation V/Sovereign	36	42	58	54	60	42	34	30	30	62
	Citation X	14	12	18	22	26	28	16	22	2	18
	Citation XLS	22	22	12	16	22	44	28	54	26	72
	Falcon 20/50	4	42	68	54	56	92	66	122	58	92
	Falcon 2000	4	4	4	16	2	16	10	10	0	10
	Falcon 900	2	0	0	0	8	2	0	10	0	4
	Hawker 4000	2	0	0	2	0	0	2	0	0	0
	King Air 200/300/350	250	288	292	178	164	94	144	220	234	128
	King Air F90	2	2	2	8	4	0	2	2	2	8
	Phenom 300	4	0	10	8	22	24	14	22	18	30
	Shorts C-23	2	0	0	0	0	0	0	0	0	0
	Swearingen Merlin	0	6	2	6	2	0	4	0	0	0
	Total	**414**	**482**	**542**	**438**	**464**	**454**	**506**	**710**	**546**	**754**

Source: TFMSC 2012-2021; data normalized annually

ARC	AIRCRAFT	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
B-III	Aerospatiale ATR 42/72	2	0	0	0	0	0	0	0	0	0
	Bombardier Global 5000	0	0	2	0	0	0	0	0	0	0
	Bombardier Global Express	0	0	0	0	0	0	0	0	0	4
	CASA 235	0	0	0	0	8	0	0	0	0	0
	Falcon 7X/8X	0	0	0	0	2	0	0	0	0	0
	Total	**2**	**0**	**2**	**0**	**10**	**0**	**0**	**0**	**0**	**4**
C-I	BAe HS 125 Series	0	0	2	2	0	0	0	0	0	0
	Learjet 20 Series	0	0	2	0	0	0	0	0	0	0
	Learjet 31	156	98	38	42	24	4	0	0	2	22
	Learjet 40 Series	14	26	28	20	8	14	2	8	4	6
	Learjet 50 Series	2	0	0	0	0	0	2	2	4	2
	Learjet 60 Series	6	6	0	0	4	0	6	4	4	2
	Westwind II	16	10	0	4	4	6	0	0	0	2
	Total	**194**	**140**	**70**	**68**	**40**	**24**	**10**	**14**	**14**	**34**
C-II	Challenger 600/604	16	10	14	14	6	8	4	6	16	36
	Citation III/VI	10	24	16	4	4	2	8	28	18	20
	Embraer 500/450 Legacy	0	0	0	0	0	0	4	0	6	2
	Embraer ERJ-135/140/145	2	4	0	0	0	0	2	0	0	0
	Gulfstream 100/150	10	10	0	66	72	52	40	30	26	2
	Gulfstream 280	0	0	0	0	14	12	18	2	2	0
	Gulfstream G-III	0	0	10	14	4	0	0	0	0	0
	Hawker 800 (Formerly Bae-125-800)	44	116	106	134	50	4	4	4	6	16
	Learjet 70 Series	0	0	0	4	2	0	2	2	0	2
	Total	**82**	**164**	**146**	**236**	**152**	**78**	**82**	**72**	**74**	**78**
C-III	Embraer EMB 170/175/190	0	0	0	2	0	0	0	0	0	0



AIRCRAFT REFERENCE CODE (ARC) SUMMARY

ARC	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A-I	14	38	32	24	30	36	24	32	18	30
A-II	22	30	38	56	16	14	22	56	18	32
B-I	292	266	364	304	340	314	322	288	218	238
B-II	414	482	542	438	464	454	506	710	546	754
B-III	2	0	2	0	10	0	0	0	0	4
C-I	194	140	70	68	40	24	10	14	14	34
C-II	82	164	146	236	152	78	82	72	74	78
C-III	0	0	0	2	0	0	0	0	0	0
D-I	2	2	2	4	0	2	0	0	0	6
D-II	12	26	24	12	8	14	6	6	6	14
D-III	0	4	0	2	0	2	0	8	6	18
Total	**1,034**	**1,152**	**1,220**	**1,146**	**1,060**	**938**	**972**	**1,186**	**900**	**1,208**

APPROACH CATEGORY (AC)

AC	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A	36	68	70	80	46	50	46	88	36	62
B	708	748	908	742	814	768	828	998	764	996
C	276	304	216	306	192	102	92	86	88	112
D	14	32	26	18	8	18	6	14	12	38
Total	**1,034**	**1,152**	**1,220**	**1,146**	**1,060**	**938**	**972**	**1,186**	**900**	**1,208**

DESIGN GROUP (DG)

DG	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I	502	446	468	400	410	376	356	334	250	308
II	530	702	750	742	640	560	616	844	644	878
III	2	4	2	4	10	2	0	8	6	22
Total	**1,034**	**1,152**	**1,220**	**1,146**	**1,060**	**938**	**972**	**1,186**	**900**	**1,208**

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Airport Critical Aircraft Summary

The current aircraft approach category is “B,” and the current airplane design group is “II.” Over the last 10 years, the most active B-II airplane at the airport has been the Citation II/SP/Latitude, which is a TDG 2A aircraft. Therefore, the current airport critical aircraft is classified as B-II-2A. The future airport critical aircraft is planned to transition to C-II-2A, represented by mid-sized and larger business jet aircraft such as the Challenger 600/604 and Citation III/VI.

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 aircraft will also be the RDC for the primary runway.

Runway 16-34 should be designed to accommodate the overall airport critical aircraft, which has been identified as B-II-2A. The primary runway is 6,003 feet long and 75 feet wide. Runway 16 has a non-precision instrument approach with visibility minimums as low as ⅞-mile, and Runway 34 has a non-precision approach with visibility minimums down to ¾-mile. Based on the current activity, the existing RDC is B-II-4000. Since the airport is anticipated to transition to serve ARC C-II aircraft in the future, the ultimate RDC for Runway 16-34 is planned to transition to C-II-4000.

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 16-34 is located 240 feet from the runway (centerline to centerline). Based on this separation distance and the lowest visibility minimums associated with the runway, the APRC for Runway 16-34 is B/II/4000 and its DPRC is B/II.

AIRPORT AND RUNWAY CLASSIFICATION SUMMARY

Table 2P 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 transition to C-II in the future.

Table 2P | Airport and Runway Classifications

	Runway 16-34 Existing	Runway 16-34 Ultimate
Airport Reference Code (ARC)	B-II	C-II
Airport Critical Aircraft	B-II-2A	C-II-2A
Critical Aircraft (Typ.)	Citation II/SP/Latitude	Challenger 600/604
Runway Design Code (RDC)	B-II-4000	C-II-4000
Approach Reference Code (APRC)	B/II/4000	B/III/4000 & D/II/4000
Departure Reference Code (DPRC)	B/II	B/III & D/II
Taxiway Design Group (TDG)	2A	2A*

*Based on the Citation II/SP/Latitude

Source: FAA AC 150/5300-13B, 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 aircraft for the airport. Based aircraft are forecast to grow from 58 currently to 78 by 2042. Operations are forecast to grow from 27,844 in 2022 to 37,200 by 2042. The projected growth is driven by FAA's positive outlook for general activity nationwide, as well as projected socioeconomic growth (population, employment, and income/GRP) in Brenham and the region.

The critical aircraft for the airport was determined by examining the FAA TFMSC database of flight plans. The current critical aircraft is described as B-II-2A and is best represented by a Citation II/SP/Latitude, a small business jet typically used for corporate operations or air charters. The future critical aircraft is projected to transition to C-II-2A, with the Challenger 600/604 serving as the representative aircraft.

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

AIRPORT FACILITY REQUIREMENTS

City of BRENHAM

Chapter Three

AIRPORT 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 Brenham Municipal Airport facilities. The existing capacities will then be compared to the forecast activity levels prepared in Chapter Two to determine the adequacy of existing facilities, as well as to identify if deficiencies currently exist or may be expected to materialize in the future. The chapter will present the following elements:

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

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.

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

- Advisory Circular (AC) 150/5300-13B, *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 Brenham Municipal Airport has been established and was detailed in Chapter Two. These activity forecasts include annual aircraft operations, based aircraft, aircraft fleet mix, and peaking characteristics. With this information, specific components of the airfield and land-side 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 has been established that takes 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, rather than dates in time. 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.

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*.

Table 3A | Aviation Demand Planning Horizons	Base Year (2022)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single Engine	46	49	51	57
Multi-Engine	4	4	2	0
Turboprop	0	1	2	4
Jet	8	9	11	15
Helicopter	0	0	1	2
TOTAL BASED AIRCRAFT	**58**	**63**	**67**	**78**
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	0	0	0	0
Air Taxi	194	235	301	453
General Aviation	6,900	7,700	8,200	9,100
Military	50	50	50	50
Total Itinerant	***7,144***	***8,000***	***8,600***	***9,600***
Local				
General Aviation	20,700	23,400	24,800	27,600
Military	0	0	0	0
Total Local	***20,700***	***23,400***	***24,800***	***27,600***
TOTAL OPERATIONS	**27,844**	**31,400**	**33,400**	**37,200**

Source: Coffman Associates analysis

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 Brenham Municipal Airport and include airfield layout, weather conditions, aircraft mix, and operations.

- **Runway Configuration** – The existing airfield configuration consists of a single runway supported by a full-length parallel taxiway. Runway 16-34 is 6,003 feet long and 75 feet wide, oriented north/south.

- **Runway Use** – Runway use in capacity conditions is controlled by wind and/or airspace conditions. For Brenham Municipal, the direction of takeoffs and landings is typically determined by the speed and direction of the wind. It is generally safest for aircraft to take off 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. Wind conditions dictate the use of Runway 16 approximately 49 percent of the time, and Runway 34 approximately 26 percent of the time. Calm wind conditions are present approximately 25 percent of the time.

- **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 Brenham Municipal. The exits must be at least 750 feet apart to count as

AIRFIELD LAYOUT

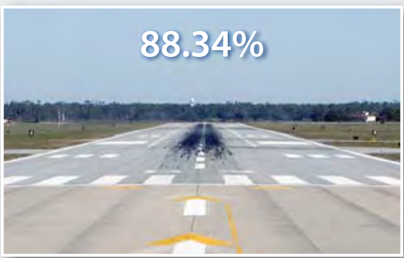
Runway Configuration

Runway Use

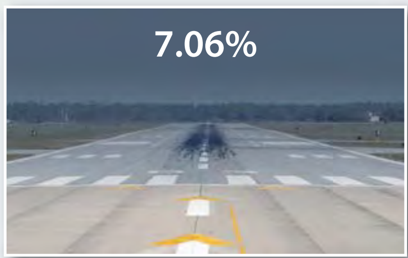
Number of Exits

WEATHER CONDITIONS

VMC (VFR)
Visual Meteorological Conditions



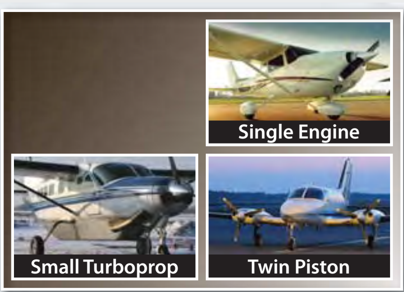
IMC (IFR)
Instrument Meteorological Conditions



PVC
Poor Visibility Conditions

AIRCRAFT MIX

Category A & B Aircraft

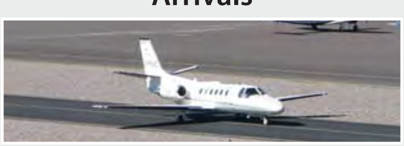


Category C Aircraft

Category D Aircraft

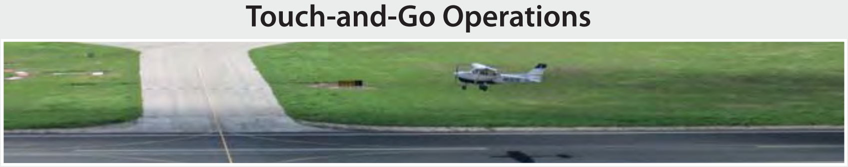
OPERATIONS

Arrivals



Departures

Touch-and-Go Operations



Total Annual Operations

Exhibit 3A
AIRFIELD CAPACITY FACTORS

separate exit taxiways. Utilizing these criteria, Runways 16 and 34 are credited with two exit taxiways (Taxiways C and D). Taxiway A4 is not counted as an exit taxiway in the capacity analysis as it is less than 2,000 feet from the Runway 16 threshold, and it exceeds the allowable range for aircraft landing on Runway 34.

- **Weather Conditions** – Weather conditions can have a significant impact on airfield capacity. Airfield capacity is usually highest in clear weather when flight visibility is at its best and 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 88.34 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. **Table 3B** summarizes the weather conditions experienced at the airport over a 10-year period of time.

Table 3B | Weather Conditions

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1,000’ AGL	≥ 3 statute miles	88.34%
IMC	≥ 500’ AGL and < 1,000’ AGL	≥ 1 to < 3 statute miles	7.06%
PVC	< 500’ AGL	< 1 statute mile	4.60%

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

Source: Station - Brenham Municipal Airport – A0000253928, Observations from 1/1/2012 thru 12/31/2021

- **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. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft which utilize the airport on a regular basis. Class D aircraft consist of aircraft weighing more than 300,000 pounds.

  Most operations at Brenham Municipal Airport are by Classes A and B aircraft. According to the FAA’s Traffic Flow Management System Count (TFMSC) data for 2021, there were approximately 942 total operations by Class C aircraft at Brenham Municipal Airport, which represents approximately 3.4 percent of all operations. There were no operations by Class D aircraft reported in the TFMSC.

- **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 Brenham Municipal Airport.

- **Touch-and-Go Activity** – A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and classified as local operations. 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 Brenham Municipal Airport have historically been estimated to account for approximately 74 percent of total annual operations.

- **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.

AIRFIELD CAPACITY SUMMARY

Given the factors outlined above, the airfield's ASV will range between 200,000 and 230,000 annual operations. The ASV does not indicate a point of absolute gridlock for the airfield; however, it does represent the point at which operational delay for each aircraft operation will increase exponentially.

Current operational estimates for the airport represent just under 14 percent of the airfield's ASV, if the ASV is considered at the low end of the typical range of 200,000 annual operations. By the end of the long-term planning period, total annual operations are expected to represent about 19 percent of the airfield's ASV.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This is an approximate level to begin the detailed planning of capacity improvements. At the 80 percent level, the planned improvements should be made. No significant capacity improvements will be necessary as the existing and forecast operations do not exceed even 25 percent of the ASV; however, options to improve airfield efficiency will still be considered in the upcoming sections.

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 RDC as B-II-4000 for Runway 16-34 and RDC C-II-4000 as the ultimate RDC.

RUNWAYS

Runway conditions, such as orientation, length, width, and pavement strength, were analyzed at Brenham Municipal Airport. 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 150/5300-13B, *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. **Table 3C** details the allowable crosswind component for each RDC.

Table 3C | Allowable Crosswind Component by RDC

RDC	Allowable Crosswind Component
A-I and B-I (includes small aircraft)	10.5 knots
A-II and B-II	13 knots
A-III and B-III C-I through D-III	16 knots
A-IV and B-IV C-IV through C-VI D-IV through D-VI E-I through E-VI	20 knots

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

Exhibit 3B presents the all-weather and instrument flight rule (IFR) wind roses for the airport. The previous 10 years of wind data[1] was obtained from the on-airport automated weather observation station (AWOS) and has been analyzed to identify wind coverage provided by the existing runway orientations. At Brenham Municipal, the orientation of the runway provides greater than 99 percent coverage for each of the crosswind components. Thus, the current runway orientation at the airport provides adequate wind coverage for all-weather conditions, and a crosswind runway would not be eligible for or supported by state or federal funding programs. Therefore, a crosswind runway will not be planned for the future.

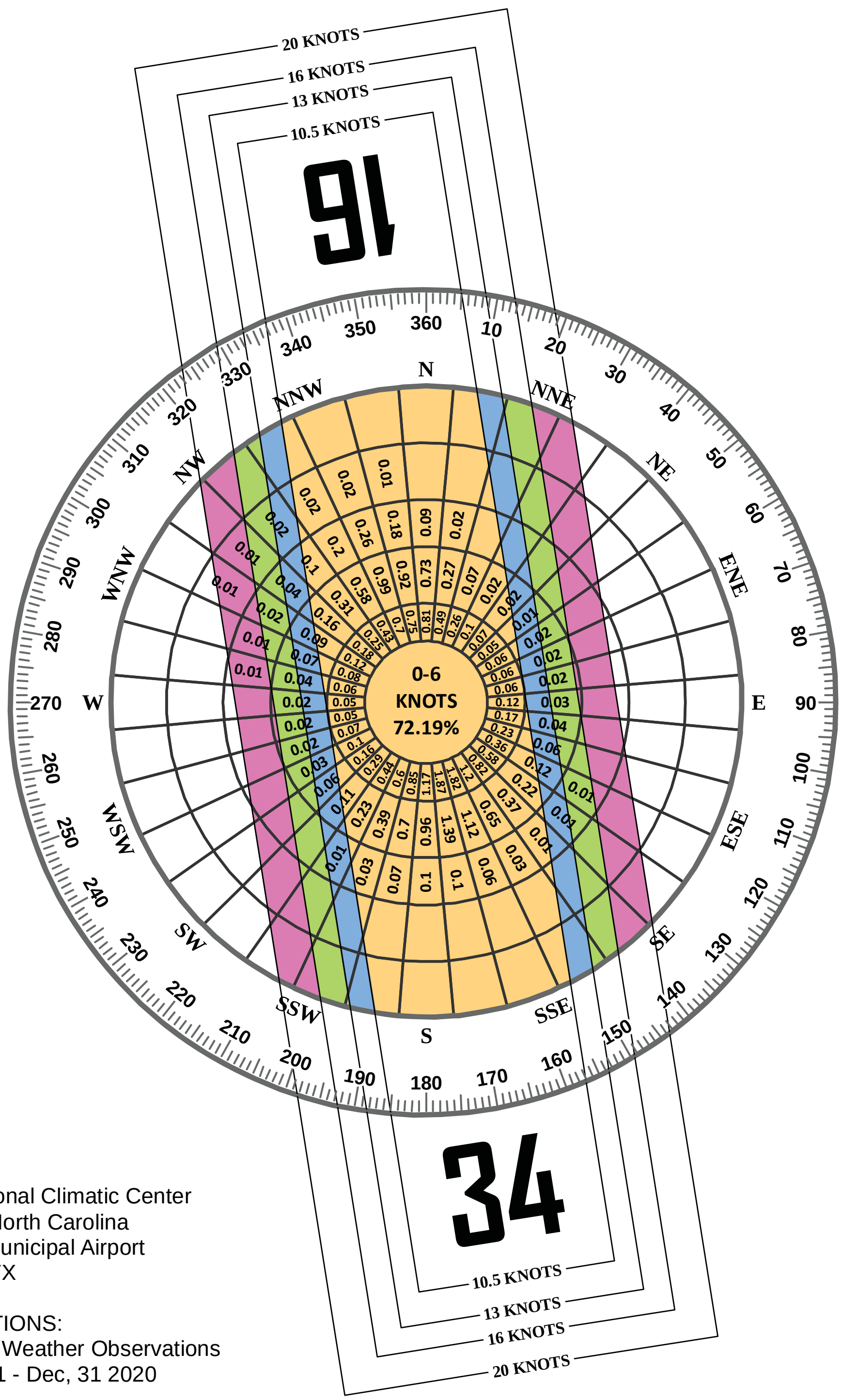
Runway Designations

A runway's designation is based upon its magnetic headings, which are determined by the magnetic declination for the area. The magnetic declination near Brenham Municipal Airport is 2° 33' E ± 0° 21' W per year. The runway has a true heading of 171°/351°. Adjusting for the magnetic declination, the current magnetic heading of the runway is 169°/349°. As a result, consideration should be given to redesignating the runway as Runway 17-35. Any re-designation should be coordinated with TxDOT/FAA to ensure its

[1] 251,180 all-weather observations and 30,502 IFR observations were collected for the period January 1, 2011, through December 31, 2020.

ALL WEATHER WIND COVERAGE

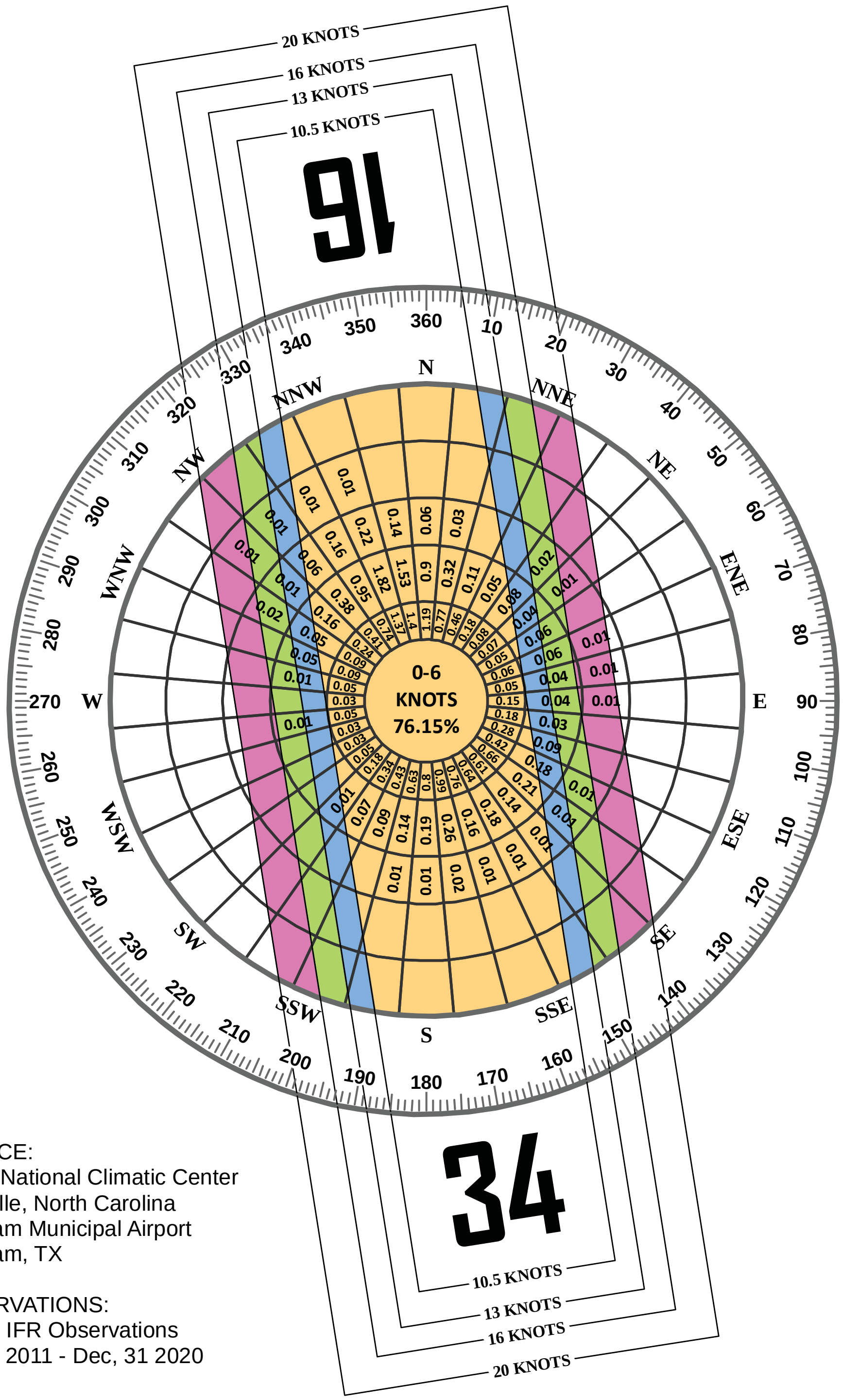
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16/34	99.17%	99.69%	99.94%	99.99%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Brenham Municipal Airport
Brenham, TX

OBSERVATIONS:
251,180 All Weather Observations
Jan. 1, 2011 - Dec, 31 2020

IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16/34	99.26%	99.69%	99.94%	99.99%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Brenham Municipal Airport
Brenham, TX

OBSERVATIONS:
30,502 IFR Observations
Jan. 1, 2011 - Dec, 31 2020

necessity and that all appropriate publications are updated. If it is confirmed that the runway should be re-designated, new runway end designation markings can be incorporated concurrent with a future pavement rehabilitation project.

Runway Length

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. The determination of runway length requirements for the airport is based on five primary factors:

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

The mean maximum daily temperature of the hottest month for Brenham Municipal Airport is 95.0 degrees Fahrenheit (F), which occurs in August. The airport elevation is 317.7 feet mean sea level (MSL). Runway 16-34 has an average gradient of 1.12 percent, which conforms 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. Runway planning should always include an evaluation of aircraft types currently using and/or expected to use the airport in the future. This analysis is primarily based on the approved critical aircraft (or family of aircraft) as outlined in a realistic forecasting exercise (provided in the previous chapter).

General Aviation Aircraft

Most operations occurring at Brenham Municipal Airport are conducted using smaller GA 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 3,200 feet is recommended. For 100 percent of these small aircraft, a runway length of 3,800 feet is recommended. For small aircraft with 10 or more passenger seats, 4,300 feet of runway length is recommended.

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

Table 3D | Business Jet Categories for Runway Length Determination

Aircraft	MTOW (lbs.)
75 Percent of the National Fleet	
Lear 35	20,350
Lear 45	20,500
Cessna 550	14,100
Cessna 560XL	20,000
Cessna 650 (VII)	22,000
IAI Westwind	23,500
Beechjet 400	15,800
Falcon 50	18,500
75-100 Percent of the National Fleet	
Lear 55	21,500
Lear 60	23,500
Hawker 800XP	28,000
Hawker 1000	31,000
Cessna 650 (III/IV)	22,000
Cessna 750 (X)	36,100
Challenger 604	47,600
IAI Astra	23,500
Greater than 60,000 Pounds	
Gulfstream II	65,500
Gulfstream IV	73,200
Gulfstream V	90,500
Global Express	98,000
Gulfstream 650	99,600
MTOW: Maximum Takeoff Weight	

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

Table 3E presents the results of the runway length analysis for business jets developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. This length is derived from a raw length of 4,771 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 6,400 feet is recommended.

Table 3E | Runway Length Requirements

Fleet Mix Category	TAKEOFF LENGTHS		LANDING LENGTHS	Final Runway Length
	Raw Runway Length from FAA AC	Runway Length with Gradient Adjustment (+360')	Wet Surface Landing Length for Jets (+15%)*	
75% of fleet at 60% useful load	4,711	5,444	5,486	5,500
100% of fleet at 60% useful load	5,719	6,392	5,500	6,400
75% of fleet at 90% useful load	7,069	7,742	7,000	7,800
100% of fleet at 90% useful load	9,154	9,827	7,000	9,800
*Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet condition.				

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

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at an airport. This could be documented activity by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,800 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 9,800 feet is recommended.

Another method to determine runway length requirements for aircraft at Brenham Municipal Airport is to examine aircraft flight planning manuals under conditions specific to the airport. Several aircraft were analyzed for takeoff length requirements at a design temperature of 95.0 degrees F at a field elevation of 317.7 feet MSL with a 1.12 percent runway grade. **Table 3F** 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.

Table 3F | Business Aircraft Takeoff Length Requirements – Runway 16-34

		TAKEOFF LENGTH REQUIREMENTS (FEET)				
		Useful load				
Aircraft Name	**MTOW (lbs)**	**60%**	**70%**	**80%**	**90%**	**100%**
Pilatus PC-12	9,921	2,135	2,309	2,492	2,683	2,882
King Air C90GTi	10,100	2,592	2,278	2,979	3,180	3,381
King Air 200 GT	12,500	3,381	3,488	3,599	3,715	3,835
Citation I/SP	11,850	3,091	3,353	3,633	3,929	4,240
Citation CJ3	13,870	3,251	3,539	3,835	4,187	4,529
King Air 350	15,000	3,633	3,783	3,981	4,314	4,735
Citation (525A) CJ2	12,375	3,533	3,812	4,169	4,486	4,839
Citation Sovereign	30,300	3,908	3,979	4,180	4,507	4,915
Citation 560 XLS	20,200	3,836	4,158	4,500	4,874	5,262
Beechjet 400A	16,300	4,267	4,623	5,008	5,449	5,935
Falcon 50 EX	41,000	4,638	5,147	5,687	6,257	6,784
Lear 40	21,000	4,826	5,293	5,788	6,012	6,802
Gulfstream 450	74,600	4,662	5,138	5,671	6,242	6,900
Challenger 300	38,850	4,999	5,488	5,995	6,523	7,073
Citation II (550)	13,300	3,575	3,931	4,308	4,703	7,109
Challenger 604/605	48,200	5,150	5,716	6,354	7,033	7,723
Gulfstream 650	99,600	5,129	5,665	6,259	6,967	7,759
Gulfstream 550	91,000	4,800	5,498	6,207	7,013	8,070
Citation X	35,700	5,642	6,180	6,833	7,524	8,258
Lear 60	23,500	5,696	6,315	7,061	7,824	8,788
Falcon 2000	35,800	5,112	5,788	6,900	7,826	8,798
Citation III	21,500	5,648	6,326	7,078	7,906	Climb Limited
Citation (525) CJ1	10,600	5,304	6,862	Climb Limited	Climb Limited	Climb Limited

Green figures are less than or equal to the length of the runway at 11R; orange figures are greater than the length of the runway at 11R. 'Climb Limited' indicates the input data is outside the operating limits of the aircraft planning manual.
MTOW - Maximum Takeoff Weight

Source: Ultranav software

The analysis shows that the current length of 6,003 feet available on Runway 16-34 is adequate for most of the business jets analyzed until they reach 90 percent useful load. At 90 percent and greater useful loads, about half become weight-restricted or climb limited.

Table 3G 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.

Table 3G | Business Aircraft Landing Length Requirements – Runway 16-34

		LANDING LENGTH REQUIREMENTS (FEET)					
		Dry Runway Condition			Wet Runway Condition		
Aircraft Name	MLW	Part 25	80% Rule	60% Rule	Part 25	80% Rule	60% Rule
Citation I/SP	11,350	2,472	3,090	4,120	2,843	3,554	4,738
Falcon 50 EX	35,715	2,945	3,681	4,908	3,386	4,233	5,643
King Air 350	15,000	3,137	3,921	5,228	3,607	4,509	6,012
Falcon 2000	33,000	3,144	3,930	5,240	3,616	4,520	6,027
Lear 40	19,200	2,895	3,619	4,825	3,740	4,675	6,233
Challenger 604/605	38,000	2,803	3,504	4,672	4,344	5,430	7,240
Citation Sovereign	27,100	3,605	4,506	6,008	4,860	6,075	8,100
Lear 60	19,500	3,659	4,574	6,098	5,018	6,273	8,363
Challenger 300	33,750	2,622	3,278	4,370	5,026	6,283	8,377
Citation CJ3	12,750	3,715	4,644	6,192	5,122	6,403	8,537
Citation (525) CJ1	9,800	3,922	4,903	6,537	5,377	6,721	8,962
Gulfstream 650	83,500	4,220	5,275	7,033	5,420	6,775	9,033
Citation (525A) CJ2	11,500	3,863	4,829	6,438	5,594	6,993	9,323
Gulfstream 550	75,300	2,790	3,488	4,650	5,604	7,005	9,340
Beechjet 400A	15,700	3,811	4,764	6,352	5,882	7,353	9,803
Gulfstream 450	66,000	3,280	4,100	5,467	6,192	7,740	10,320
Citation 560 XLS	18,700	3,961	4,951	6,602	6,252	7,815	10,420
Citation X	31,800	4,851	6,064	8,085	7,089	8,861	11,815
Citation III	19,000	5,039	6,299	8,398	7,411	9,264	12,352
King Air C90GTi	9,600	1,514	1,893	2,523	No Data	No Data	No Data
Citation II (550)	12,700	2,470	3,088	4,117	No Data	No Data	No Data
King Air 200 GT	12,500	2,274	2,843	3,790	No Data	No Data	No Data
Pilatus PC-12	9,921	2,237	2,796	3,728	No Data	No Data	No Data

Green figures are less than or equal to the length of the runway at 11R; orange figures are greater than the length of the runway at 11R.
MLW – Maximum Landing Weight
N/A – Not Applicable. Turboprop aircraft landing lengths are not adjusted for wet runway conditions.

Source: Ultranav software

The landing length analysis shows that all Part 25 operations and most aircraft operating under Part 91k can land on the available runway length during dry runway conditions. Approximately half of the aircraft analyzed can safely operate on a dry runway under Part 135 conditions. During wet or contaminated runway conditions, fewer aircraft are able to operate, and only two meet the landing length requirements under Part 135.

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at Brenham Municipal Airport. The airport should strive to accommodate business jets and turboprop aircraft to the greatest extent possible as demand would dictate. Runway 16-34 is currently 6,003 feet long and can accommodate many of these aircraft under moderate loading conditions, even during hot temperatures and at high percentage useful loads. At near maximum takeoff weights (MTOWs), some aircraft do have runway length requirements that exceed the available length on Runway 16-34 or are climb limited.

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 existing critical aircraft, the Citation II/SP/Latitude, can operate at up to 90 percent useful load. The ultimate critical aircraft, the Challenger 600/604, requires a longer runway than what is currently available when operating at 80 percent and greater useful loads.

According to criteria outlined in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design,* to accommodate 100 percent of the general aviation business jet fleet at 60 percent useful load, the runway should be 6,400 feet long. Additional analysis using aircraft flight planning manuals determined that several of the turbine aircraft currently using and anticipated to use the runway at Brenham Municipal Airport are unable to operate when taking on more than 80 percent useful loads. Therefore, runway extension options should be considered. While the airport may not be able to justify an extension with 500 annual itinerant operations at present, planning should consider the potential for this threshold to be met at some point in the future. Analysis in the next chapter will examine potential extensions up to at least 6,400 feet to Runway 16-34, while considering appropriate safety design standards (these standards will be detailed later in this chapter).

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 16-34, existing RDC B-II-4000 design criteria stipulate a runway width of 75 feet, while ultimate RDC C-II-2400 standards call for a width of 100 feet. Runway 16-34 is currently 75 feet wide. As such, development alternatives in the next chapter will consider a width increase to 100 feet to meet ultimate design standards.

Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft of varying weights. 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. Regular usage by heavier aircraft can deteriorate the pavement quicker, thus shortening the lifespan of the airfield pavement.

At Brenham Municipal Airport, the pavement for Runway 16-34 should be able to accommodate regular usage by the largest business jet aircraft using and planned to use the airport. The current strength rating on Runway 16-34 is 30,000 pounds single wheel loading (SWL). This is adequate for many of the business jet fleet, including the smaller Cessna Citation jets and Embraer Phenom 300, and the Dassault Falcon F20-F5, which is based at Brenham. The runway currently does not have a dual wheel loading (DWL) rating.

The future critical design aircraft grouping includes aircraft like the Bombardier Challenger 600/604, which have MTOWs of 41,100 pounds and 48,200 pounds, respectively, on dual wheel configurations. According to the FAA's Aircraft Characteristics Database, the heaviest C-II aircraft is the Bombardier CRJ 700/701/702 which has an MTOW of 77,000 pounds DWL. The runway's strength rating should be tied to reasonable usage by the heaviest aircraft operating at the airport on a regular basis.

Runway Line-of-Sight and Gradient

The FAA has instituted various line-of-sight requirements to facilitate coordination among aircraft and between aircraft and vehicles that are operating on active runways. This allows departing and arriving aircraft to verify the location and actions of other aircraft and vehicles on the ground that could create a conflict.

Line-of-sight standards for an individual runway are based on whether there is a parallel taxiway available. When a full-length parallel taxiway is available, thus facilitating faster runway exit times, then any point five feet above the runway centerline must be mutually visible with any other point five feet above the runway centerline that is located at less than half the length of the runway. Runway 16-34 meets the line-of-sight standard.

The surface gradient of a runway affects aircraft performance and pilot perception. The surface gradient is the maximum allowable slope for a runway. For runways designated for approach categories A and B, the maximum longitudinal grade is 2.0 percent. The maximum longitudinal grade for runways in approach category C, D, and E is 1.5 percent; however, longitudinal grades exceeding 0.8 percent are not acceptable within the lesser of the following criteria:

- In the first and last quarter of the runway length; or
- The first and last 2,500 feet of the runway length.

The Runway 16 end is 67.3 feet higher than the Runway 34 end which results in a longitudinal runway gradient of 1.12 percent, which is within standard in both the existing and ultimate conditions. In the future, when the runway transitions to aircraft design group C, stricter standards will apply, and the longitudinal gradient will no longer be within standard for the first quarter section of the runway. Using survey data collected from the United States Geological Survey (USGS),[2] when measuring 1,500 feet from the Runway 16 threshold, there is a gradient of 2.01 percent, which exceeds the allowable grade. At 0.61 percent, the last quarter of the runway (measuring 1,500 feet from the Runway 34 threshold) does meet gradient standards.

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), obstacle free zone (OFZ), and runway protection zone (RPZ).

The entire RSA, ROFA, and runway obstacle free zone (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 graphically on **Exhibit 3C**, and **Table 3H** presents the FAA design standards as they apply to Runway 16-34 at Brenham Municipal Airport.

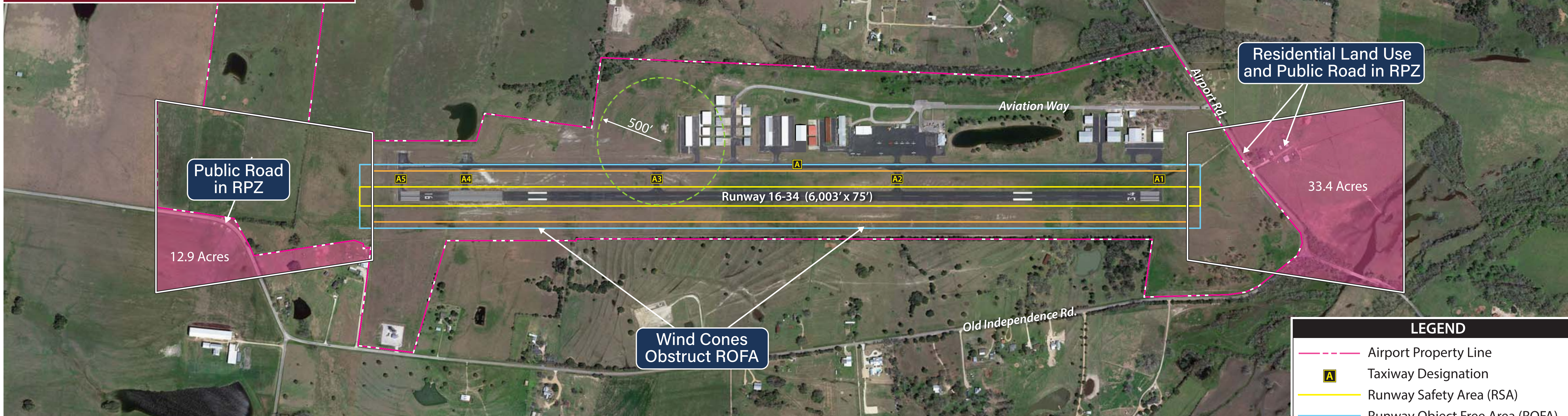
Runway Safety Area

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

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in 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.

[2] Lidar data from USGS was analyzed to determine ground elevation along Runway 16-34 with a variance allowance of one meter. An 18b ground survey should be conducted to more accurately determine longitudinal gradient for the runway.

Existing Runway Design Code: B-II-4000



Ultimate Runway Design Code: C-II-4000

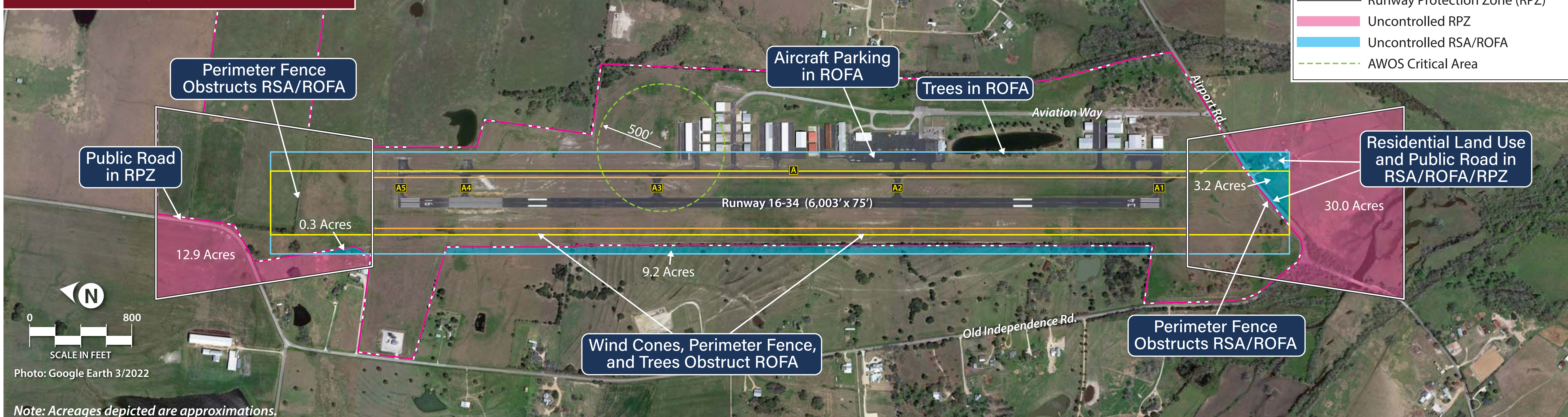


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Table 3H | Runway Design Standards

	Runway 16-34 (Existing)		Runway 16-34 (Ultimate)	
Runway Design Code	B-II-4000		C-II-4000	
Visibility Minimums	⅞ mile (16) | ¾-mile (34)		¾-mile (16) | ¾-mile (34)	
RUNWAY DESIGN				
Runway Width	75′		100′	
RUNWAY PROTECTION				
Runway Safety Area				
Width	150′		500′	
Length Beyond Departure End	300′		1,000′	
Length Prior to Threshold	300′		600′	
Runway Object Free Area				
Width	500′		800′	
Length Beyond Departure End	300′		1,000′	
Length Prior to Threshold	300′		600′	
Runway Obstacle Free Zone				
Width	400′		400′	
Length Beyond Runway End	200′		200′	
Approach Runway Protection Zone				
Runway End	**16**	**34**	**16**	**34**
Length	1,700′	1,700′	1,700′	1,700′
Inner Width	1,000′	1,000′	1,000′	1,000′
Outer Width	1,510′	1,510′	1,510′	1,510′
Departure Runway Protection Zone				
Runway End	**16**	**34**	**16**	**34**
Length	1,000′	1,000′	1,700′	1,700′
Inner Width	500′	500′	500′	500′
Outer Width	700′	700′	1,010′	1,010′
RUNWAY SEPARATION				
Runway Centerline to:				
Hold Line Position	200′		250′	
Parallel Taxiway	240′		300′	
Note: All dimensions in feet unless otherwise noted.				

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

For existing RDC B-II-4000 design standards on Runway 16-34, the FAA calls for the RSA to be 150 feet wide and extend 300 feet beyond the runway ends. At these dimensions, the RSA is fully contained within existing airport property and does not include any obstructions. However, for ultimate RDC C-II-4000 design standards, the dimensions of the RSA increase to 500 feet wide and 1,000 feet beyond the runway ends. As depicted on **Exhibit 3C**, the ultimate RSA extends south beyond airport property and across Airport Road, which would not be a permissible condition. The perimeter fence would also obstruct the ultimate RSA on both the north and south ends. The alternatives chapter will consider options to mitigate this non-standard condition.

Runway Object Free Area

The ROFA is "a clear area limited to equipment necessary for air and ground navigation, and provides wingtip protection in the event of an aircraft excursion from the runway." It 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 aircraft utilizing the runway.

For existing RDC B-II-4000 design standards on Runway 16-34, the FAA calls for the ROFA to be 500 feet wide, extending 300 feet beyond each runway end. In the existing condition, the ROFA is fully contained within airport property; however, the lighted wind cone and supplemental wind cone located on the west side of the runway (approximately 245 feet west of the centerline) are obstructions and should be relocated outside of the ROFA.

In the ultimate RDC C-II-4000 condition, the ROFA dimensions increase to 800 feet wide and 1,000 feet beyond the runway ends. Like the ultimate RSA, the ultimate ROFA south of the Runway 34 threshold extends beyond airport property and encompasses Airport Road. The larger width of the ultimate ROFA also results in uncontrolled property on the west side, as shown in blue shading on **Exhibit 3C**. Aside from Airport Road, there are other obstructions to the ROFA in the ultimate condition, including residential land uses on the south end; the wind cone at midfield and the supplemental wind cone near the Runway 16 threshold; trees near the pond on the east side and along the fence on the west side; perimeter fencing along the north, south, and west sides; and the marked aircraft parking on the terminal apron. The next chapter will evaluate options to correct these non-standard conditions for the long-term shift to RDC C-II design.

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 16-34 at Brenham Municipal Airport. Under current evaluation with available data, there are no ROFZ obstructions at the airport.

A precision obstacle free zone (POFZ) is further defined for runway ends with a ½-mile visibility precision approach. The POFZ is 800 feet wide, centered on the runway, and extends from the runway's threshold for 200 feet. The POFZ is in effect when the following conditions are met:

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

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. POFZ standards do not currently apply to Runway 16-34 as it is not equipped with vertically guided approaches with instrument approach minimums below ¾-mile. The alternatives in the next section will evaluate the potential for an instrument approach with visibility minimums below ¾-mile, which would trigger the implementation of a POFZ when the above conditions are present.

Runway Protection Zone

An RPZ is a trapezoidal area centered on the extended runway centerline beginning 200 feet from the end of the runway. This safety area has been established to protect the end of the runway from airspace penetrations and incompatible land uses. The RPZ dimensions are based upon the established RDC and the approach visibility minimums serving 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 150/5300-13B, the following land uses are permissible within the RPZ:

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

In September 2022, the FAA published AC 150/5190-4B, *Airport Land Use Compatibility Planning*, which states that airport owner control over RPZs is preferred. Airport owner control over RPZs may be achieved through:

- Ownership of the RPZ property in fee simple;
- Possessing sufficient interest in the RPZ property through easements, deed restrictions, etc.;
- Possessing sufficient land use control authority to regulate land use in the jurisdiction containing the RPZ;
- Possessing and exercising the power of eminent domain over the property; or
- Possessing and exercising permitting authority over proponents of development within the RPZ (e.g., where the sponsor is a State).

AC 150/5190-4B further states that "control is preferably exercised through acquisition of sufficient property interest and includes clearing RPZ areas (and keeping them clear) of objects and activities that would impact the safety of people and property on the ground." The FAA does recognize that land ownership, environmental, geographical, and other considerations can complicate land use compatibility within RPZs. Regardless, airport sponsors are to comply with FAA Grant Assurances, including but not limited to Grant Assurance 21, Compatible Land Use. Sponsors are expected to take appropriate measures to "protect against, remove, or mitigate land uses that introduce incompatible development within RPZs." For proposed projects that would shift an RPZ into an area with existing incompatible land uses, such as a runway extension or construction of a new runway, the sponsor is expected to have or secure sufficient control of the RPZ, ideally through fee simple ownership. Where existing incompatible land uses are present, the FAA expects sponsors to "seek all possible opportunities to eliminate, reduce, or mitigate existing incompatible land uses" through acquisition, land exchanges, right-of-first-refusal to purchase, agreement with property owners on land uses, easements, or other such measures. These efforts should be revisited during master plan or ALP updates, and periodically thereafter, and documented to demonstrate compliance with FAA Grant Assurances. If new or proposed incompatible land uses impact an RPZ, the FAA expects the airport to take the above actions to control the property within the RPZ, along with adopting a strong public stance opposing the incompatible land uses.

For new incompatible land uses that result from a sponsor-proposed action (i.e., an airfield project such as a runway extension, a change in the critical aircraft that increases the RPZ dimension, or lower minimums that increase the RPZ dimension), The airport sponsor is expected to conduct an Alternatives Evaluation. The intent of the Alternatives Evaluation is to "proactively identify a full range of alternatives and prepare a sufficient evaluation to be able to draw a conclusion about what is 'appropriate and reasonable.'" For incompatible development off-airport, the sponsor should coordinate with the Airports District Office (ADO) as soon as they are aware of the development, with the alternatives evaluation conducted within 30 days of becoming aware of the development within the RPZ. The following items are typically necessary in an Alternatives Evaluation:

- Sponsor's statement of the purpose and need of the proposed action (airport project, land use change or development)
- Identification of any other interested parties and proponents
- Identification of any federal, state, and local transportation agencies involved
- Analysis of sponsor control of the land within the RPZ
- Summary of all alternatives considered including:
    - Alternatives that preclude introducing the incompatible land use within the RPZ (e.g., zoning action, purchase, and design alternatives such as implementation of declared distances, displaced thresholds, runway shift or shortening, raising minimums)
    - Alternatives that minimize the impact of the land use in the RPZ (e.g., rerouting a new roadway through less of the RPZ, etc.)
    - Alternatives that mitigate risk to people and property on the ground (e.g., tunnelling, depressing and/or protecting a roadway through the RPZ, implementing operational measures to mitigate any risks, etc.)
- Narrative discussion and exhibits or figures depicting the alternative
- Rough order of magnitude cost estimates associated with each alternative, regardless of potential funding sources
- A practicability assessment based on the feasibility of the alternative in terms of cost, constructability, operational impacts, and other factors.

Once the Alternatives Evaluation has been submitted to the ADO, the FAA will determine whether or not the sponsor has made an adequate effort to pursue and give full consideration to appropriate and reasonable alternatives. **The FAA will not approve or disapprove the airport sponsor's preferred alternative; rather, the FAA will only evaluate whether an acceptable level of alternatives analysis has been completed before the sponsor makes the decision to allow or not allow the proposed land use within the RPZ.**

In summary, the RPZ guidance published in September 2022 shifts the responsibility of protecting the RPZ to the airport sponsor. The airport sponsor is expected to take action to control the RPZ or to demonstrate that appropriate actions have been taken. It is ultimately up to the airport sponsor on whether or not to permit existing or new incompatible land uses within an RPZ, with the understanding that they still have grant assurance obligations, and the FAA retains the authority to review and approve or disapprove portions of the ALP that would adversely impact the safety of people and property within the RPZ.

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**, portions of both RPZs extend beyond current airport property bounds in the existing and ultimate conditions. In addition to portions being uncontrolled, the Runway 34 RPZ contains residential land uses in both the existing and ultimate conditions. Moreover, public roads pass through both RPZs. As mentioned previously, public roadways are considered incompatible uses within an RPZ; however, the FAA generally opts to "grandfather" the condition so that no corrective action is necessary. It should be noted that a change to the runway environment that alters the size of the RPZ negates the "grandfathered" condition and the FAA must approve the condition to continue and could disapprove of the condition. The alternatives discussion in the next chapter will explore options for the airport to gain control over each of the RPZs and mitigate incompatibilities.

SEPARATION STANDARDS

There are several other standards related to separation distances from runways and taxiways. 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 aircraft and the instrument approach visibility minimum. The separation standard for Runway 16-34 in the existing condition (RDC B-II-4000) is 240 feet from the runway centerline to the parallel taxiway centerline. Parallel Taxiway A is separated from the runway by 240 feet, meeting FAA design standards in the existing condition. In the ultimate condition (C-II-4000), the separation standard increases to 300 feet. Thus, maintaining Taxiway A in its current location would not meet the design standard if/when the runway shifts to an RDC of C-II-4000. The alternatives in the next chapter will examine various options to meet this standard.

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. The existing standard calls for holding positions to be separated from the runway centerline by 200 feet, which is the case currently at Brenham Municipal.

However, the standard for hold line separation increases to 250 feet in the ultimate condition. As such, options to meet the ultimate design standard for holding positions will be explored in the next chapter.

Aircraft Parking Area Separation

According to FAA AC 150/5300-13B, aircraft parking positions should be located to ensure that aircraft components (wings, tail, and fuselage) do not:

1. Conflict with the object free area for adjacent runway or taxiways:
   a. Runway Object Free Area (ROFA)
   b. Taxiway Object Free Area (TOFA)
   c. Taxilane Object Free Area (TLOFA)

2. Violate any of the following aeronautical surfaces and areas:
   a. Runway approach or departure surface
   b. Runway Visibility Zone (RVZ)
   c. Runway Obstacle Free Zone (ROFZ)
   d. Navigational aid equipment critical areas

Existing aircraft parking positions at Brenham Municipal Airport are located on the terminal apron. **Figure 3A** depicts this area, along with the existing/ultimate ROFA and TOFA (TOFA standards are described in greater detail in the next section). As detailed in the graphic, the existing parking positions are clear of the existing ROFA and TOFA; however, the 10 aircraft parking positions on the west side of the terminal apron are located within the ultimate ROFA and will need to be removed/relocated when the airport transitions to ARC C-II.

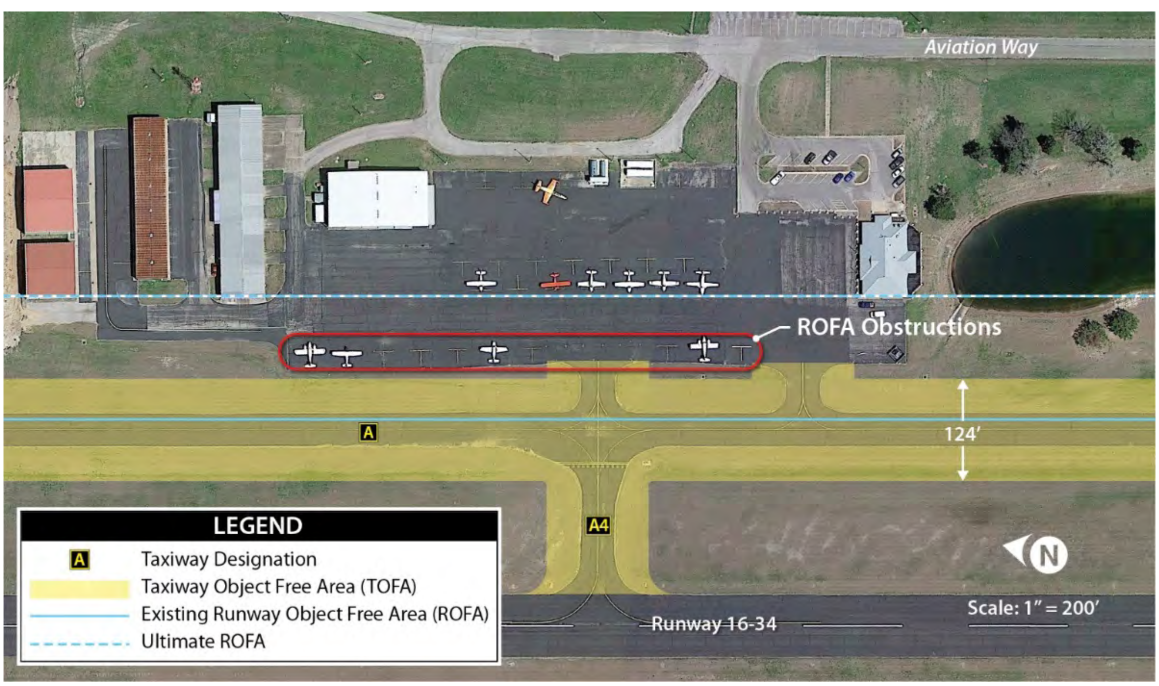


Figure 3A – Aircraft Parking Area Separation

TAXIWAYS

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the ADG of the critical aircraft. As determined previously, the applicable ADG for Runway 16-34 is ADG II. **Table 3J** presents the various taxiway design standards related to ADG II. 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 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.

Table 3J | Taxiway Dimensions and Standards

STANDARDS BASED ON WINGSPAN	ADG I	ADG II
Taxiway and Taxilane Protection		
Taxiway Safety Area width (TSA)	49’	79’
Taxiway Object Free Area width (TOFA)	89’	124’
Taxilane Object Free Area width (TLOFA)	79’	110’
Taxiway and Taxilane Separation		
Taxiway Centerline to Parallel Taxiway Centerline	70’	102’
Taxiway Centerline to Fixed or Moveable Object	44.5’	62’
Taxilane Centerline to Parallel Taxilane Centerline	64’	94’
Taxilane Centerline to Fixed or Moveable Object	39.5’	55’
Wingtip Clearance		
Taxiway Wingtip Clearance (feet)	20’	23’
Taxilane Wingtip Clearance (feet)	15’	16’
STANDARDS BASED ON TDG	**TDG 1A/B**	**TDG 2A/B**
Taxiway Width Standard	25’	35’
Taxiway Edge Safety Margin	5’	7.5’
Taxiway Shoulder Width	10’	15’
ADG: Airplane Design Group; TDG: Taxiway Design Group; Note: All dimensions in feet		

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

The current design for taxiways serving the runways is TDG 2A, based upon the Citation II/SP/Latitude, which dictates a width of 35 feet. The entire taxiway system at Brenham Municipal Airport is 40 feet wide. While the greater width provides an added safety margin for aircraft operating at the airport, the FAA may elect not to fund regular pavement maintenance for the portions of taxiway pavement that exceed the standard. If the airport chooses to maintain the taxiways at their current widths, the costs may need to come from a local funding source rather than federal or state grant monies. 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.

Figure 3B depicts the taxiway object free area (TOFA) and taxilane object free area (TLOFA) for the taxiways and taxilanes at Brenham Municipal. The TOFA is based upon ADG II standards for the entire airfield. The TLOFA, which is centered on taxilanes serving hangar areas, is also based upon ADG standards; however, these standards are variable based on the type of aircraft using the taxilanes, as illustrated in the graphic. The TOFA for taxiways serving Runway 16-34 is 124 feet wide, while the TLOFA for taxilanes serving T-hangar areas is 79 feet wide and is 110’ feet wide for taxilanes serving executive and conventional hangars. Like the ROFA, these areas should be cleared of objects and parked aircraft except for objects needed for air navigation or aircraft ground maneuvering purposes. The TOFAs associated with taxiway pavement is clear of obstructions, but the portions of the TLOFAs associated with taxilane pavement are obstructed by hangars, as illustrated on the graphic. The alternatives in the next chapter will examine mitigative measures for this non-standard condition.

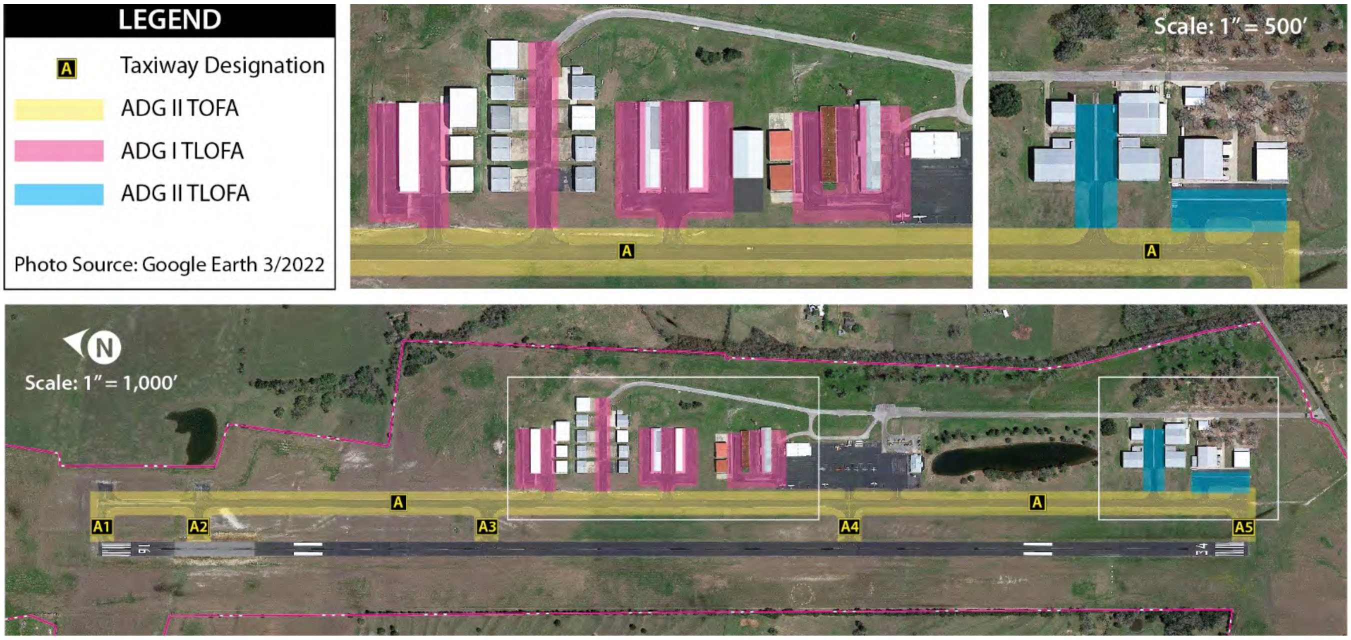


Figure 3B – TOFA and TLOFA

Taxiway and Taxilane Design Considerations

FAA AC 150/5300-13B, *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 following is a list of the taxiway design guidelines and the basic rationale behind each recommendation included in the current AC as well as previous FAA safety and design recommendations.

1. **Taxiing Method**: Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate "judgmental oversteering," which is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.
2. **Curve Design**: 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-Path Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot with a maximum of three choices of travel. Ideally, these are right, left, and a continuation straight ahead.
4. **Channelized Taxiing**: To support visibility of airfield signage, taxiway intersections should be designed to meet standard taxiway width and fillet geometry.
5. **Designated Hot Spots and Runway Incursion Mitigation (RIM) Locations**: A hot spot is a location on the airfield with elevated risk of a collision or runway incursion. For areas the FAA designates as a hot spot or RIM location, mitigation measures should be prioritized.

6. **Intersection Angles**: Design turns to be 90 degrees wherever possible. For acute-angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

7. **Runway Incursions**: Design taxiways to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three-path" 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 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.
   - *Direct 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.

8. **Runway/Taxiway Intersections**
   - *Right Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for an acute-angled 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. The construction of high-speed exits is typically only justified for runways with regular use by jet aircraft in approach categories C and above.
   - *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.

9. **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 make 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 or no-taxi island 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.

The taxiway system at Brenham Municipal Airport generally provides for the efficient movement of aircraft, and there are no FAA-designated hot spots at the airport. However, there are several non-standard taxiway geometry conditions, as detailed on **Figure 3C**, including:

- Taxiways A1 and A2 provide direct access to a runway from an apron area.
- The holding bays at the north end of Taxiway A are of a non-standard design. The FAA now considers these designs to be wide expanses of pavement and has set new standards for holding bay design.

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.

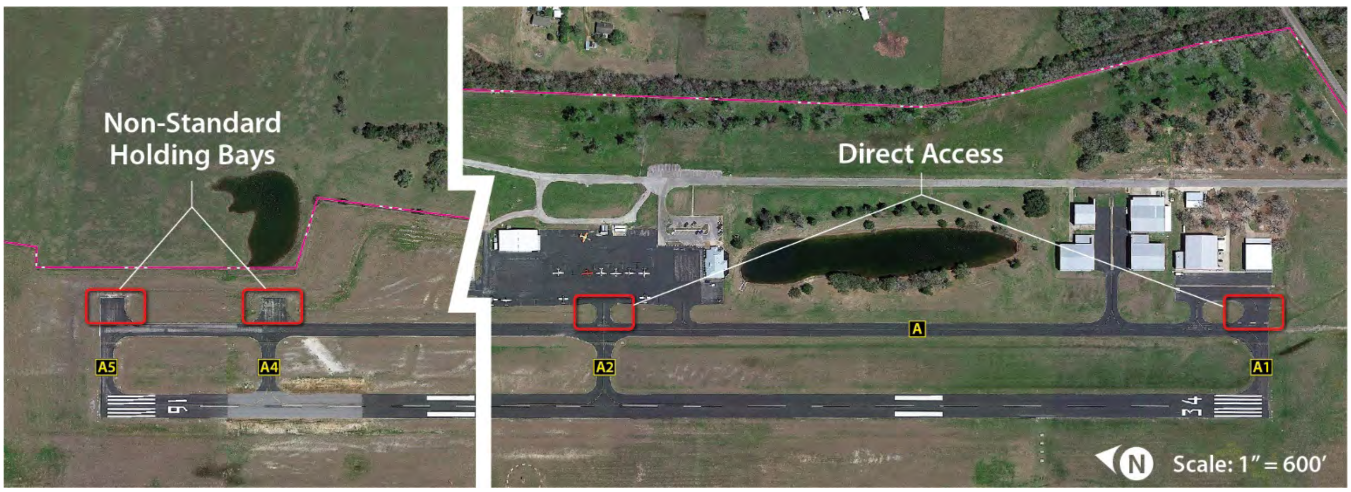


Figure 3C – Non-standard Conditions on Taxiways

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 pilots and 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

Brenham Municipal Airport has two published instrument approach procedures to Runway 16-34. Both runway ends are served by GPS localizer performance with vertical guidance (LPV) approaches, with visibility minimums down to ⅞-mile on Runway 16 and ¾-mile on Runway 34. An instrument approach with visibility minimums below ¾-mile for either runway end would result in the need for a 400-foot runway to taxiway separation as well as additional infrastructure including a medium intensity approach lighting system with runway alignment indicator lights (MALSR) to support the approach. Analysis in the next chapter will consider improvements necessary for enhancing instrument approach capabilities to Runway 16 (i.e., visibility minimums down to ¾-mile vs. visibility minimums below ¾-mile).

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Currently, Runway 16 is equipped with a two-box precision approach path indicator (PAPI-2) and Runway 34 is equipped with a four-box system (PAPI-4). As more turbine aircraft begin to operate at the airport, consideration should be given to upgrading the PAPI-2 on Runway 16 to a PAPI-4.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from the other lighting on the airport and in the approach areas. Both runway ends are equipped with REILs, which should be maintained through the long-term planning period.

Weather Reporting Aids

Brenham Municipal Airport has a lighted wind cone and segmented circle located at midfield, as well as a supplemental wind cone near the Runway 16 threshold. The wind cones provide information to pilots regarding wind speed and direction. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots.

The airport is also 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. FAA siting criteria indicate that the AWOS should be located between 1,000 and 3,000 feet from the runway threshold and between 500 to 1,000 feet perpendicular to the runway centerline. The AWOS also has a 500-foot radius critical area that must be kept free of obstructions that could interfere with its sensors.

The wind cones and AWOS should be maintained through the planning period; however, as noted previously, the wind cones' locations within the ROFA are a non-standard condition and consideration should be given to relocating this equipment outside of this safety area. It should also be noted that the AWOS is planned to be relocated in fiscal year 2022 in order to maintain an obstruction-free critical area and to allow for landside facility expansion to the north. At the time of this writing (August 2022), a separate study is undergoing FAA review to obtain site approval for the relocation of the AWOS equipment.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

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

Airport Identification Lighting | The airport's rotating beacon is located on the east side of the field, northeast of the terminal apron. The beacon is in good working order and should be maintained through the planning period.

Runway and Taxiway Lighting | Runway 16-34 is equipped with a medium intensity runway lighting (MIRL) system. This system is adequate and should be maintained. The taxiway system is equipped with green centerline reflectors. Planning should consider the installation of medium intensity taxiway lighting (MITL) on all current and future taxiway pavement, in accordance with FAA recommendations to include MITL on taxiways and aprons at airports where runway lighting systems are installed and where nighttime instrument approach procedures are conducted.

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 systems on the airfield. The signage system includes runway and taxiway designations and routing/directional signs. All these signs should be maintained throughout the planning period.

It should be noted that many airports are transitioning to light emitting diode (LED) 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. All lighting on the airfield is LED, including the MIRL, PAPIs, and REILs. If and when new lighting systems are added, such as MITL, they should also be LED.

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. Both runway ends are equipped with non-precision markings in accordance with the non-precision instrument approaches to both ends. These markings should be maintained through the long-term planning horizon.

A summary of the airside facilities at Brenham Municipal Airport 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 Brenham Municipal Airport, this includes components for general aviation needs such as:

- General Aviation Terminal Facilities and Auto Parking
- Aircraft Storage Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

In addition to landside facility requirements, potential non-aeronautical land uses will also be evaluated. These are portions of airport property that are suitable for non-aviation purposes and can generate revenue for the airport, such as agriculture or industrial. While airport property is generally subject to Airport Improvements Program (AIP) grant assurances, airports can request a release of aeronautical federal obligations for certain areas of property that are not necessary for aviation uses. These requests are facilitated under the *FAA Reauthorization Act of 2018*, Section 163, which governs the FAA's authority over non-aeronautical development.

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, pilots' 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 Brenham Municipal Airport, all public-use general aviation terminal services are provided in the terminal building, which includes a lobby, offices, a pilot briefing and flight planning area, pilots' lounge, showers, and restrooms. Supplemental terminal services are also provided in facilities owned and operated by private entities.

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 (sf) per design hour passenger, which includes

CATEGORY	EXISTING	ULTIMATE

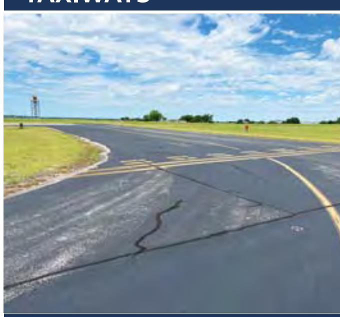
RUNWAYS

CATEGORY	EXISTING	ULTIMATE
Runway Designation	16-34	17-35
Runway Design Code (RDC)	B-II-4000	C-II-4000
Dimensions	6,003' x 75'	Consider extension; increase width to 100'
Pavement Strength	30,000 lbs SWL	Consider increase

SAFETY AREAS

CATEGORY	EXISTING	ULTIMATE
RSA	Standard RSA	1.7 acres uncontrolled; fence and public road obstruct RSA - mitigation measures required
ROFA	Obstructions present (windcones) - mitigation measures required	10.8 acres uncontrolled; obstructions present (residential use, trees, aircraft parking, fence, windcones & public road) - mitigation measures required
ROFZ	Standard ROFZ	Maintain
RPZ	Portions of both RPZs uncontrolled; residential use in Runway 34 RPZ and public roads in both RPZs - mitigation measures may be necessary	Mitigate per FAA direction and maintain

TAXIWAYS



CATEGORY	EXISTING	ULTIMATE
Design Group	2A	Maintain
Parallel Taxiway	Taxiway A	Maintain
Parallel Taxiway Separation from Runway	240'	300'
Widths	40'	Maintain
Holding Position Separation	200'	250'
Notable Conditions	Direct access from apron via Taxiways A1 and A2; non-standard holding bays	Consider corrective measures

NAVIGATIONAL AND WEATHER AIDS

CATEGORY	EXISTING	ULTIMATE
Instrument Approaches	GPS LPV	Maintain
Weather Aids	AWOS, wind cones, rotating beacon, ASR-11	Maintain equipment; relocate wind cones outside ROFA; relocate AWOS based on current siting study
Approach Aids	PAPI-2 (Runway 16); PAPI-4 (Runway 34); REILs	Consider upgrade to PAPI-4 on Runway 16; Maintain REILs

LIGHTING AND MARKING

CATEGORY	EXISTING	ULTIMATE
Runway Lighting	MIRL	Maintain
Runway Marking	Non-precision	Maintain
Taxiway Lighting	Green centerline reflectors	MITL

KEY:

AWOS - Automated Weather Observing System
DWL - Dual Wheel Landing Gear Type
GPS - Global Positioning System
LPV - Localizer Performance Vertical Guidance
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
REILs - Runway End Identifier Lights
ROFZ - Runway Obstacle Free Zone
ROFA - Runway Object Free Area
RPZ - Runway Protection Zone
RSA - Runway Safety Area
PAPI - Precision Approach Path Indicator
SWL - Single Wheel Landing Gear Type

a mix of itinerant passengers as well as local operators. A multiplier of 3.0 in the short term, increasing to 4.8 in the long term, was also applied to terminal facility needs to better determine the number of passengers associated with each 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 Brenham Municipal Airport, where an increasing number of turbine operations are anticipated.

Table 3K outlines the space requirements for general aviation terminal services at the airport through the long-term planning period. The amount of space currently offered in the terminal is approximately 3,400 sf (this figure excludes the 1,300-sf restaurant/kitchen space). As shown in the table, the terminal is adequately sized through the intermediate period, but by the long term, approximately 4,100 sf may be necessary to support increased traffic.

Table 3K | General Aviation Terminal Area Facilities

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need
Terminal Services Building (sf)	3,400*	1,800	2,600	4,100
General Aviation Design Hour Passengers		14	21	33
Passenger Multiplier		3.0	3.7	4.8
Visitor/Tenant Vehicle Parking	45	23	34	56

* Excludes restaurant area

Source: Coffman Associates analysis

General aviation vehicle parking demands have also been determined for the airport. 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 45 individual spaces provided at the terminal building, which can also serve some general aviation vehicle parking needs. However, most based aircraft owners prefer to park near their hangars. As can be seen in the table, vehicle parking needs is another segment that is anticipated to grow over the course of the planning period, with 56 spaces estimated to be needed by the end of the long term. This includes spaces for itinerant passengers, based aircraft owners, and other visitors to the airport.

AIRCRAFT HANGARS

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

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, hangar development should be based upon actual demand trends and financial investment conditions.

While most aircraft owners prefer enclosed aircraft storage, 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.

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 a combined 56,600 sf of T-hangar storage space at the airport. For determining future aircraft storage needs, a planning standard of 1,200 sf 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 sf, with some approaching 10,000 sf. They are typically able to house single engine, multi-engine, turboprop, and jet aircraft, as well as helicopters. Executive box hangar space at Brenham Municipal Airport is estimated at 64,800 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 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 sf to more than 20,000 sf. Often, a portion of a conventional hangar is utilized for non-aircraft storage needs, such as maintenance or office space. There are three conventional hangars at Brenham Municipal Airport currently, with a fourth conventional hangar under construction as of September 2022. For planning purposes, the same aircraft sizing standards utilized for executive hangars is also utilized for conventional hangars.

Requirements for maintenance/service hangar area have also been calculated. The airport currently has maintenance providers operating out of two hangars that offer a combined 21,000 sf of space. To determine service hangar needs, a planning standard of 250 sf per based aircraft has been calculated.

Future hangar requirements for the airport are summarized in **Table 3L**. Currently, all based aircraft occupy hangars; however, future planning will assume that some based aircraft may utilize aircraft parking apron space as opposed to enclosed hangar space. For planning purposes, it is estimated that five percent of future based aircraft may tie down on the apron.

Table 3L | Aircraft Hangar Requirements

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Total Based Aircraft	58	63	67	78	+20
Aircraft to be Hangared	58	60	64	74	
Hangar Area Requirements					
T-Hangar (sf)	56,600	57,200	56,600	60,600	+4,000
Executive Box/Conventional Hangar Area (sf)	107,300	115,300	129,800	157,300	+50,000
Service Hangar Area (sf)	21,000	15,800	16,800	19,500	-1-500
Total Hangar Area (sf)	**184,900**	**188,300**	**203,200**	**237,400**	**+52,500**

Source: Coffman Associates analysis

The analysis shows that future hangar requirements indicate a potential need for more than 52,000 sf of new hangar storage capacity through the long-term planning period. This includes a mixture of hangar types, with the largest need projected in the executive and conventional hangar categories. Due to the projected increase in based aircraft, annual general aviation operations, and hangar storage needs, facility planning will consider additional hangars at the airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types. While the service hangar needs presented in the table are adequate through the long-term horizon, airport staff has indicated a need for an additional maintenance hangar that could attract a specialized aviation service operator (SASO), and particularly an operator providing avionics services. Future planning will include the potential for this type of hangar/operator at the airport.

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. Typically, a main apron is centrally located near the airside entry point, such as the terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users as well as a portion of locally based aircraft. Often, smaller aprons are available adjacent to FBO or SASO hangars and at other locations around the airport. The apron layout at Brenham Municipal Airport follows this typical pattern, with a terminal apron that serves both local and transient users and secondary aprons that support the executive/conventional hangars on the south side of the field. For planning purposes, only aprons that are available for public use/aircraft parking are included in the in the calculation for parking apron needs.

To determine future apron needs, a planning criterion of 800 square yards (sy) was used for single and multi-engine itinerant aircraft, while a planning criterion of 1,600 sy was used to determine the area for transient turboprop and jet aircraft. A parking apron should also provide space for locally based aircraft that require temporary tiedown storage. Locally based tiedowns typically will be utilized by smaller single engine aircraft; thus, a planning standard of 650 sy per position is utilized.

The total apron parking requirements are presented in **Table 3M**. Currently, the existing parking aprons at Brenham Municipal Airport encompass approximately 16,900 sy of space. This is divided among the terminal apron (15,500 sy) and a public-use secondary apron (1,400 sy). Using the planning standards described above and factoring in assumptions regarding operational and based aircraft growth, additional apron space is projected to be needed beginning in the short term. By the long term, approximately 39,600 sy of aircraft parking apron pavement is needed.

There are currently 29 marked parking positions available for based and itinerant aircraft at the airport, all of which are located on the terminal apron. As shown in the table, approximately 42 marked tiedown positions could be needed by the end of the planning period of this study, including four helicopter parking areas. It should be noted that, of the 29 existing aircraft parking positions, 10 are located within the ultimate ROFA and will need to be removed when the airport transitions to ARC C-II, as detailed previously. Based on input from airport staff, city officials, and local pilots, the existing parking apron at Brenham Municipal Airport can become very constrained during peak periods. As such, additional consideration has been given to increasing transient aircraft parking at the airport.

Table 3M | Aircraft Parking Apron Requirements				
	Available	Short Term	Intermediate Term	Long Term
Aircraft Parking Positions				
Based/Local GA Aircraft	[redacted]	3	3	4
Transient GA Aircraft		21	22	25
Corporate Jet Aircraft		5	6	9
Helicopter		2	2	4
Total Parking Positions	**29**	**31**	**33**	**42**
Total Apron Area	**16,900***	**27,900**	**30,600**	**39,600**
*Public-use aprons				

Source: Coffman Associates analysis

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

The City of Brenham owns the 12,000-gallon Jet A and 12,000-gallon 100LL fuel tanks located north of the terminal building. Three secondary tanks are owned by an on-airport business and have capacities of 16,000 gallons (Jet A), 3,000 gallons (Jet A), and 6,000 gallons (100LL). Based on historic fuel records from the last three years, an average of 144,462 gallons of Jet A and 50,340 gallons of 100LL were delivered to the airport. Dividing the total fuel flowage by the total number of operations provides a ratio of fuel flowage per operation. Between 2019 and 2021, the airport pumped approximately 5.19 gallons of Jet A per turbine operation and 1.81 gallons of 100LL per piston 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 both Jet A and 100LL fuel. Based on these usage assumptions and projected design day operations, no additional storage for either Jet A or 100LL is projected to be needed. **Table 3N** summarizes the forecasted fuel storage requirements through the planning period.

Table 3N | Fuel Storage Requirements					
			PLANNING HORIZON		
	Capacity	2021 Need	Short-Term	Intermediate-Term	Long-Term
Jet A					
Daily Usage (gal.)	31,000	466	526	559	623
14-Day Supply (gal.)		6,524	7,357	7,826	8,716
Annual Usage (gal.)		169,600	191,300	203,500	226,600
AvGas (100LL)					
Daily Usage (gal.)	18,000	162	183	195	217
14-Day Supply (gal.)		2,273	2,564	2,727	3,037
Annual Usage (gal.)		59,100	66,700	70,900	79,000

Sources: Historic fuel delivery 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 at the airport will determine the need for additional fuel storage capacity. It is important that airport personnel work with the city to plan for adequate levels of fuel storage capacity through the long-term planning period of this study. Planning should also consider an additional tank to store unleaded aviation fuel (100UL). The FAA has recently approved the use of 100UL in piston-powered aircraft, although unknowns regarding infrastructure and distribution remain. Nevertheless, the alternatives will include placeholders for these facilities.

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 areas;
- 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.

As detailed in Chapter One, the airport's perimeter is completely enclosed by fencing, including 6-foot-tall wildlife fencing. Additional fencing was installed in July 2022 to prevent unauthorized access to hangar facilities on the north side of the airport. Controlled access gates are also available for use at the airport. All existing fencing and gates should be maintained throughout the planning period and should be regularly inspected to ensure they are functioning property and are undamaged. It could be desirable for the City of Brenham to consider additional fencing on the south side of the airport to assist in controlling access to the Air Operations Area (AOA).

A summary of the overall general aviation landside facilities is presented in **Exhibit 3E**.

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at Brenham Municipal Airport for the next 20 years. In an effort to provide a more flexible master plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a 5-year timeframe, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

	AVAILABLE	SHORT-TERM	INTERMEDIATE-TERM	LONG-TERM
AIRCRAFT STORAGE HANGAR REQUIREMENTS				
Aircraft to be Hangared		60	64	74
T-Hangar Area (sf)	56,600	57,200	56,600	60,600
Executive/Conventional Hangar Area (sf)	107,300	115,300	129,800	157,300
Service/Maintenance Area (sf)	21,000	15,800	16,800	19,500
Total Hangar Storage Area (sf)	184,900	188,300	203,200	237,400

	AVAILABLE	SHORT-TERM	INTERMEDIATE-TERM	LONG-TERM
AIRCRAFT PARKING APRON				
Aircraft Parking Positions	29	31	33	42
Total Public Apron Area (sy)	16,900	27,900	30,600	39,600

	AVAILABLE	SHORT-TERM	INTERMEDIATE-TERM	LONG-TERM
GENERAL AVIATION TERMINAL FACILITIES AND PARKING				
Building Space (sf) (Excludes Restaurant Area)	3,400	1,800	2,600	4,100
Total GA Parking Spaces	45	23	34	56

	AVAILABLE	SHORT-TERM	INTERMEDIATE-TERM	LONG-TERM
SUPPORT FACILITIES				
14-Day Fuel Storage - 100LL	18,000	2,564	2,727	3,037
14-Day Fuel Storage - Jet A	31,000	7,357	7,826	8,716

(sf) - square feet (sy) - square yards

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 Brenham Municipal Airport.

Chapter Four

AIRPORT DEVELOPMENT ALTERNATIVES

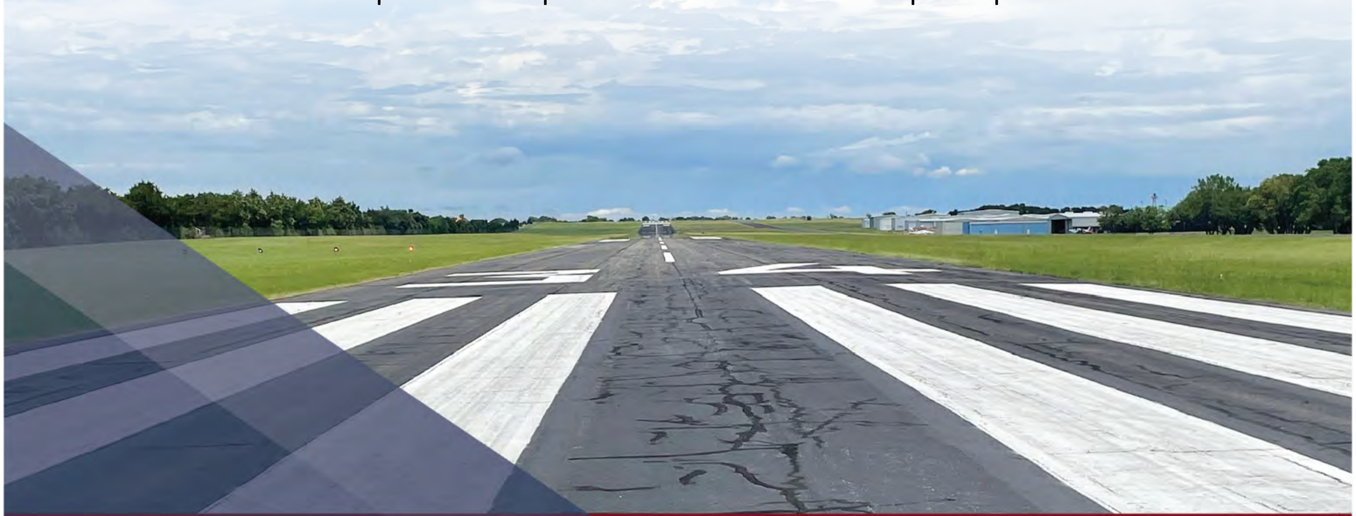
Chapter Four

AIRPORT DEVELOPMENT 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 or geographical features. Careful consideration should be given to the layout of future facilities and impacts to potential airfield improvements at Brenham Municipal Airport (11R). 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 applicable safety design standards and 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 Brenham, airport users, the local community, and the surrounding region, all of which have a vested interest in the development and operation of Brenham Municipal Airport.



The goal of this stage in the process 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 Brenham, airport management, the Airport Master Plan Committee (AMPC), 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 Brenham Municipal Airport.

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 Brenham provides the overall guidance for the operation and development of the airport. It is of primary concern that Brenham Municipal Airport 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 Brenham Municipal Airport was completed in 1986. More recently, the Airport Layout Plan (ALP) was updated as part of an Airport Development Plan in 2005. That ALP, which was approved in 2007, includes the following primary recommendations:

- Extend Runway 16-34 from 5,498 feet to 6,000 feet (accomplished in 2008)
- Maintain the width of Runway 16-34 at 75 feet
- Improved instrument approach procedures with lower visibility minimums
- Upgrade the PAPI-2 on Runway 16 to a PAPI-4 system.
- Construct a partial parallel taxiway on the west side to support new landside development
- Additional landside development in the form of apron pavement and hangars on both the east and west sides of the airport

The analysis presented in this chapter will revisit the recommendations presented in the planning study. 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 while others may be changed and/or removed from further consideration.

NO ACTION/NON-DEVELOPMENT ALTERNATIVES

The City of Brenham 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 Brenham Municipal Airport, 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 impact 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 2018 found that Brenham Municipal Airport generates $5.8 million dollars in total economic impact and supports more than 40 jobs. If facilities are not maintained and improved so 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 Texas Department of Transportation (TxDOT) – Aviation Division, 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 Brenham Municipal Airport 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 Brenham Municipal Airport 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 Brenham, TxDOT, 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.

AIRSIDE ALTERNATIVES

The development alternatives are categorized into two functional areas: airside and landside. The airside 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 Brenham Municipal Airport 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 region.

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

AIRSIDE CONSIDERATIONS

Airside planning considerations generally relate to those airport elements that contribute to the safe and efficient transition of aircraft and passengers from air transportation to the landside facilities at the airport. Planning must factor and balance many airside items, including meeting FAA design parameters of the established design aircraft, instrument approach capability, airfield capacity, runway length and width, taxiway layouts, and pavement strengths. Each of these elements for Brenham Municipal Airport was analyzed in the previous chapter. The alternatives to follow will examine airside improvement opportunities to meet design standards and/or capacity constraints. A summary of the primary airside planning issues to be considered in this alternatives analysis is listed below.

Airside Planning Considerations
1. Meet ultimate Runway Design Code (RDC) C-II-4000 standards on Runway 16-34 2. Analyze extension of Runway 16-34 to better accommodate turbine aircraft 3. Mitigate non-standard conditions in safety areas (RSA, ROFA, RPZ) 4. Corrective measures for non-standard taxiway geometry (direct access via Taxiways A1 and A2; non-standard holding bays) 5. Meet C-II-4000 standards for separation between Runway 16-34 and parallel Taxiway A and holding positions 6. Upgrade to PAPI-4 on Runway 16 7. Lower visibility minimums on Runway 16 8. Potential for an additional turf runway

Consideration #1 – Meet Ultimate RDC C-II-4000 Design Standards on Runway 16-34

As detailed in Chapter Two, the critical aircraft analysis concluded that Runway 16-34 should meet Runway Design Code (RDC) C-II-4000 design standards in the ultimate condition. Currently, the runway is categorized as B-II-4000; however, due to anticipated growth in operations and based aircraft by larger, more demanding aircraft, including turboprops and jets, it is prudent to plan facilities to accommodate these users. With a transition to the ultimate RDC, the runway width standard increases from 75 feet to 100 feet. As such, alternatives will consider widening Runway 16-34 to meet ultimate C-II-4000 design standards.

Consideration #2 – Runway 16-34 Extension

Runway 16-34 is currently 6,003 feet long, which is capable of accommodating all small aircraft in the national fleet. Many turbine aircraft can also comfortably operate on the existing runway length; however, the runway length analysis in the previous chapter illustrated that some turbine operators are weight-restricted or unable to operate on the existing runway length, especially during hot weather. To accommodate 100 percent of the business jet fleet at 60 percent useful load, a runway length of 6,400 feet is recommended. As such, the alternatives to follow will include an evaluation of extending Runway 16 by 400 feet as there are fewer constraining factors to the north.

Consideration #3 – Mitigate Non-standard Conditions in Safety Areas

The existing and ultimate runway object free areas (ROFA) are non-standard and contain obstructions. In the existing B-II-4000 condition, the wind cones located at midfield and near the Runway 16 end obstruct the ROFA. In the ultimate condition, these safety areas increase in size and additional obstructions are introduced in both the ROFA and the runway safety area (RSA). This includes portions of the airport's perimeter fence and trees, as well as Airport Road and residential uses south of Runway 34.

Additional guidance from the FAA regarding runway protection zones (RPZs) was published in September 2022. The new guidance can be found in FAA Advisory Circular (AC) 150/5190-4B, Airport Land Use Compatibility Planning[1] and outlines specific expectations the FAA has of airport sponsors regarding existing or new incompatible land uses in RPZs. Ownership or land use control authority is preferred over property within RPZs, and sponsors are expected to take measures to secure this or remove/mitigate incompatible land uses. These efforts should be revisited during planning studies, or periodically, to demonstrate compliance with FAA grant assurances. In instances where new incompatible land uses are introduced into an RPZ as a result of a sponsor-proposed project (i.e., runway extension, an increase in RPZ dimension due to lower visibility minimums, etc.), the sponsor is to submit an Alternatives Evaluation to the FAA detailing various alternatives that have been examined and/or pursued to mitigate the incompatibility. The FAA will then determine whether or not an acceptable level of analysis has been completed; however, the FAA will not approve or disapprove the sponsor's preferred alternative. In summary, the airport sponsor is expected to take action to control the RPZ or to demonstrate that appropriate actions have been evaluated and pursued. It is ultimately up to the airport sponsor whether or not to permit existing or new incompatible land uses within an RPZ, with the understanding that the sponsor still has grant assurance obligations, and the FAA retains the authority to review and approve or disapprove portions of the ALP that would adversely impact the safety of people and property within the RPZ.

1 FAA AC 150/5190-4B, Airport Land Use Compatibility Planning. https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5190-4

As illustrated previously on Exhibit 3C, there are incompatible land uses located within both RPZs that extend off the runway ends in the existing and ultimate conditions. These include a barn and Old Independence Road located within the Runway 16 RPZ, and portions of Old Independence Road, Airport Road, and residential land uses located within the Runway 34 RPZ. The airside alternatives will examine various options to mitigate these incompatibilities, including acquisition of property, removal of structures, rerouting roads, and implementation of declared distances.[2]

Consideration #4 – Corrective Measures for Non-standard Taxiway Geometry

Direct Access

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, potentially resulting in a runway incursion. Taxiways A1 and A2 allow for direct access to the runway and are, therefore, a non-standard design. The airside alternatives present different options for eliminating these direct access points.

Non-standard Holding Bays

The airport has two holding bays located at the Runway 16 end. These holding aprons are a traditional design consisting of a wide, unmarked pavement area that allows aircraft to pull aside and perform pre-flight engine checks. New holding bay design standards incorporate clearly marked entrance/exits with independent parking areas that are either separated by islands or are clearly marked with centerlines to allow aircraft to safely bypass each other. The airside alternatives consider reconstructing the holding bays to meet current design standards.

Consideration #5 – Meet Separation Standards Between Runway/Taxiway and Runway/Holding Positions

Taxiway A is currently separated from Runway 16-34 by 240 feet, centerline to centerline. This meets the separation standards for the existing B-II-4000 condition but falls 60 feet short of the 300-foot separation standard for a C-II-4000 design. Similarly, the hold position separation standards increase from 200 feet to 250 feet in the ultimate condition. Currently, all holding positions are separated from the runway centerline by 200 feet. Airside Alternatives 2 and 3 illustrate different relocation options to adhere to the more stringent runway-taxiway separation standards that will need to be met if, and when, the airport transitions to C-II.

Consideration #6 – Visual Aids and Airfield Lighting

Runway 34 is equipped with a four-light precision approach path indicator (PAPI-4) system, while Runway 16 has a two-light PAPI. A four-light PAPI is recommended for airports serving jet aircraft operations. As Brenham Municipal Airport currently serves, and is anticipated to be utilized more frequently by, jet aircraft, PAPI-4s are recommended for each runway end. The taxiway system at the airport is currently

[2] The declared distances and their application will be defined in the Airside Alternative 2 section of this chapter.

equipped with centerline reflectors, which should be upgraded to medium intensity taxiway lighting (MITL). The alternative exhibits to follow each reflect upgrading the PAPI-2 on Runway 16 to a PAPI-4 and the installation of MITL.

Consideration #7 – Instrument Approach Procedures

Brenham Municipal Airport is currently equipped with GPS localizer performance with vertical guidance (LPV) instrument approach procedures to each runway end. The lowest visibility minimums are on the approach to Runway 34, which provides for a 250-foot height above threshold (HAT) and ¾-mile visibility minimums. The approach to Runway 16 has a 276-foot HAT and ⅞-mile visibility minimums. Consideration has been given to the potential for improved instrument approach capability to Runway 16, with visibility minimums not lower than ¾-mile. To achieve this, additional analysis would need to be conducted by the FAA to ensure there are no penetrations to the approach and transitional surfaces. Implementation of a not lower than ¾-mile approach would not result in a change to the size of the RPZ serving Runway 16.

Consideration has also been given to the potential for an instrument approach procedure offering lower than ¾-mile instrument approach to either runway end. If lower visibility minimums are pursued, the dimensions of the RPZ associated with the approach will increase. **Figure 4A** presents a comparison of the RPZs serving Runways 16 and 34 currently versus what they would be if visibility minimums lower than ¾-mile are implemented. As can be seen in the graphic, the RPZs would increase significantly in size if an instrument approach with visibility minimums lower than ¾-mile were to be implemented. This would result in a larger area of uncontrolled property containing potentially incompatible land uses.

Figure 4A – RPZ Comparison

In addition to the larger RPZ, an additional challenge is presented if minimums below ¾-mile were provided in the ultimate C-II condition. To meet a C-II-2400 standard, the runway to taxiway separation standard would increase to 400 feet, as compared to the 300-foot separation standard required in the ultimate C-II-4000 condition.[3] Relocating Taxiway A farther east to provide a 400-foot separation from the existing runway centerline would negatively impact all of the landside facilities except for the airport maintenance hangar located on the northeast corner of the apron. Each of the other buildings east of the runway would be located within the taxiway object free area (TOFA), which is a non-standard condition. As such, the only reasonable option to provide for a 400-foot separation would be to shift the runway centerline 160 feet to the west, which would be a significant undertaking in terms of property acquisition, potential environmental impacts, and cost. Additionally, the existing runway would be inoperable during the construction of the relocated runway.

Finally, an approach lighting system (ALS) is necessary to achieve an instrument approach with lower than ¾-mile visibility minimums. For a ½-mile LPV (GPS) approach, a medium-intensity approach lighting system (MALSR) is required. A MALSR system is installed in the runway approach along the extended centerline of the runway, typically extending 2,400 feet beyond the runway threshold. MALSRs consist of a combination of steady burning light bars and flashers that provide pilots with visual information on runway alignment, height perception, roll guidance, and horizontal references to support the visual portion of an instrument approach. The property on which the MALSR equipment is located should be owned by the airport. For these reasons, each of the airside alternatives to follow are based upon an RDC C-II-4000 scenario and consider visibility minimums lower than 1-mile but not lower than ¾-mile.

Consideration #8 – Potential Turf Runway

Airport staff members have received requests from airport users regarding the potential construction of a turf runway on the airport. A turf runway provides an alternative to the paved runway surface, which can be attractive to small aircraft users, particularly those with tailwheel-type landing gear. Turf runways must meet the same safety area design standards as paved runways, with maintenance requirements that include grading, mowing, and seeding as necessary.

At Brenham Municipal Airport, construction of a turf runway would require some level of property acquisition. The least impactful scenario in terms of land acquisition and negative effects on surrounding land uses would involve the construction of a parallel turf runway west of Runway 16-34. To avoid operating inside the ultimate Runway 16-34 RSA, which measures 500 feet wide (250 feet on either side of centerline), the turf runway would need to be constructed at least 300 feet west of the existing paved runway. This is also the minimum separation configuration suitable for a paved runway paired with a turf runway. However, at this distance, the runways would not be able to be used simultaneously. Significant grading and tree removal would be necessary in order to support a turf runway and its safety areas in this location.

[3] C-II-2400 is reflective of a RDC that includes visibility minimums lower than ¾-mile but not lower than ½-mile, while RDC C-II-4000 includes visibility minimums below 1-mile but not lower than ¾-mile.

As part of this evaluation, a benefit-cost comparison is necessary to determine if the inclusion of a turf runway at the airport makes financial sense. As mentioned, there would be costs associated with property acquisition, construction, and maintenance of the turf runway and its safety areas. While grant funding assistance may be available for projects associated with turf runways, runway justification conditions and regular-use criteria would apply (i.e., 500 annual operations by users requiring a turf surface), and it is unlikely this justification would be met. Additionally, because the runways could not be used simultaneously, there may be periods when Runway 16-34 is unusable because a small aircraft is operating on the turf runway. For an airport that experiences frequent jet operations, such as Brenham Municipal Airport, this is not a desirable outcome. For these reasons, the inclusion of a turf runway will not be considered further.

Other Considerations

Other airside considerations identified in the previous chapter are related to the runway's pavement strength and the runway gradient. The pavement strength of Runway 16-34 is currently rated at 30,000 pounds single wheel loading (SWL), which is adequate for most of the aircraft currently operating at Brenham Municipal Airport. However, as detailed in the Facility Requirements chapter, future planning should consider the potential to increase the pavement strength to better accommodate larger, heavier aircraft, particularly those within the C-II family of aircraft which are anticipated to operate more frequently in the future. The next chapter will identify a specific runway pavement strength which will also be included on the Airport Layout Plan (ALP).

The runway's longitudinal gradient was also examined and found to be within the allowable standard in the existing B-II condition (2.0 percent). However, when the airport transitions to C-II, the allowable gradient standards become more stringent (1.5 percent), particularly for the runway ends (cannot exceed 0.8 percent in the first and last quarter of the runway). Survey data sourced from the United States Geological Survey (USGS) indicates that Runway 16 does not meet the gradient standard when measuring 1,500 feet from the Runway 16 threshold. An airfield survey should be conducted to determine more precise topographical conditions, thus determining the scope of work necessary to meet ultimate C-II runway gradient requirements.

AIRSIDE ALTERNATIVE 1

Depicted on **Exhibit 4A**, Airside Alternative 1 focuses primarily on bringing the safety areas associated with Runway 16-34 into compliance with FAA standards in the existing condition (B-II-4000). While Runway 16-34 is projected to experience an increase in C-II operations and subsequently move to a design of C-II-4000 in the ultimate condition, consideration should also be given to correcting non-standard safety area conditions for the existing B-II condition. Airside Alternative 1 also maintains Runway 16-34 at its current length of 6,003 feet and width of 75 feet. This is an important scenario to consider because an extension to the runway is not a certainty. 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 public outreach. If justification for a runway extension is not achieved for several years, or ever, a contingency airfield plan should be available.

Airside Alternative 1 illustrates an option that would bring Runway 16-34 into compliance with FAA design standards as they relate to existing ROFA obstructions and RPZ incompatibilities. As detailed previously, the wind cones on the west side of the runway obstruct the ROFA in the existing condition. FAA design standards call for the ROFA to be clear of objects not fixed by function (i.e., navigational aids, lighting, etc.) As such, Airside Alternative 1 proposes relocation of both wind cones outside of this safety area.

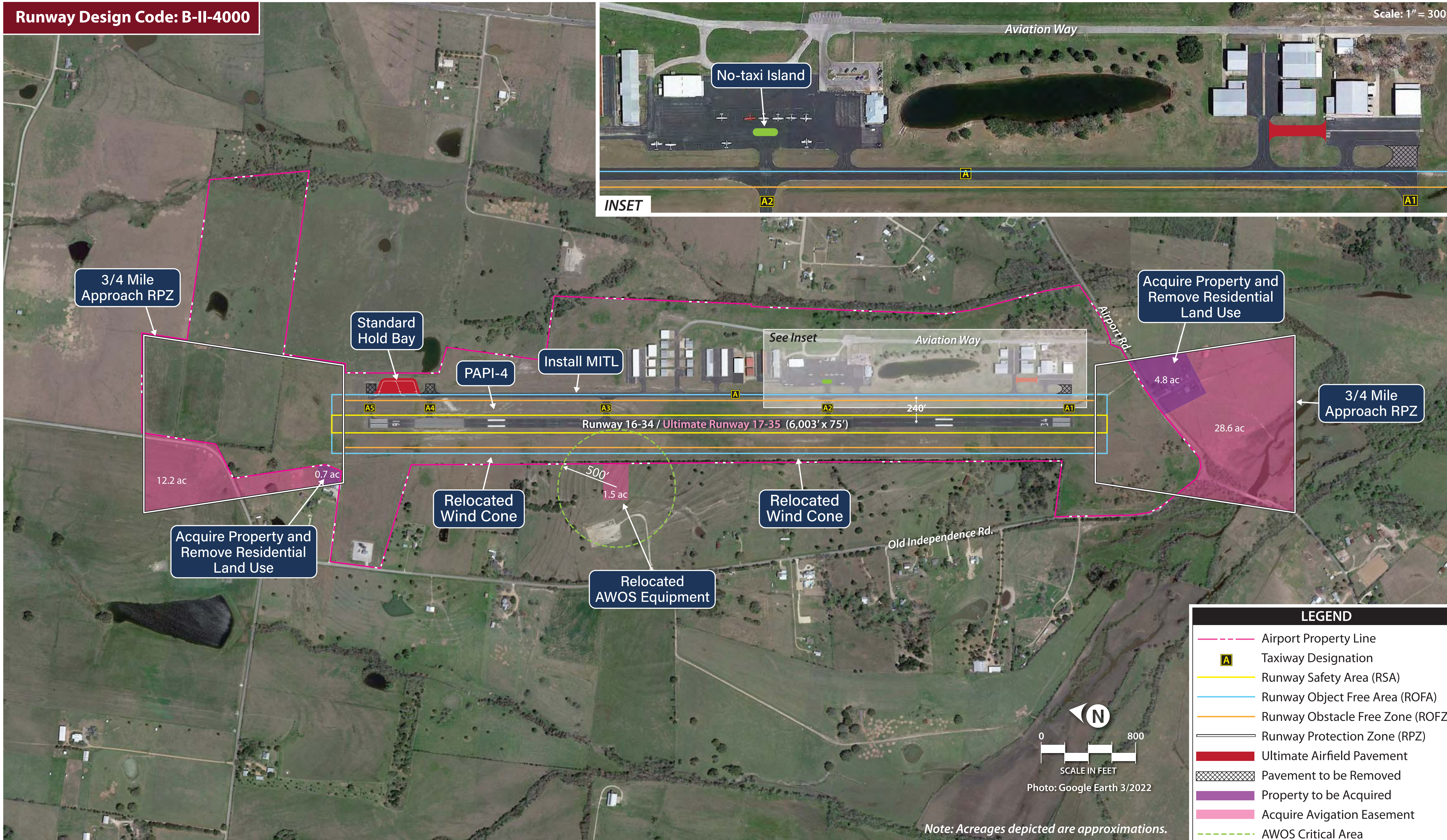
Both RPZs also contain incompatible uses, as described previously. Based on the updated FAA guidance for RPZs summarized above, Airside Alternative 1 proposes a plan to acquire approximately 0.7 acres of the Runway 16 RPZ and approximately 4.8 acres of the Runway 34 RPZ[4] in fee. While this alternative does not propose an action that would constitute a significant change to the runway environment that would introduce new incompatible land uses in an RPZ, it is still desirable for the airport sponsor to eliminate land uses that attract people, such as the residential structures located in these RPZs. The remaining 12.2 acres of the Runway 16 RPZ is proposed to be controlled via an avigation easement, as are the 28.6 acres of the Runway 34 RPZ that extend beyond airport property.

Other features of Airside Alternative 1 include:

1. A no-taxi island is proposed at the entrance to Taxiway A2 to eliminate the direct access from the aircraft parking apron to Runway 16-34. A no-taxi island is an area of either natural turf or artificial turf/paint that functions to force pilots to make a turn prior to entering the runway environment, thereby improving pilot situational awareness and reducing the risk of a runway incursion.
2. The pavement that connects the south apron to Taxiway A1 is proposed to be removed to eliminate the second direct access point at the airport. New pavement is planned to be constructed to connect the taxilanes to allow adequate space for aircraft accessing this apron to turn around.
3. A standard aircraft hold bay is proposed at the Runway 16 runway end. The hold bays that currently exist at the north end are a non-standard design. This alternative proposes a modification in design to one of the FAA's preferred hold bay configurations which includes centerline markings to allow for independent aircraft maneuvering. This marking also provides a visual cue to pilots to assist in situational awareness. Hold bays are considered for each of the airside alternatives, rather than bypass taxiways, as hold bays better enhance capacity and are especially beneficial at busier airports, including those that experience high levels of local operations like Brenham Municipal Airport.
4. The PAPI-2 serving Runway 16 is planned to be upgraded to a PAPI-4.
5. A ¾-mile LPV GPS approach is proposed for Runway 16. Currently, this runway offers a LPV GPS approach with visibility minimums of ⅞-mile. Pursuing the lower approach does not require any ground-based equipment and would not change the size of the Runway 16 RPZ.

This alternative and the two to follow also show an update to the runway designation. As described in Chapter Three, it is recommended that Runway 16-34 be re-designated as Runway 17-35 due to the magnetic declination in the area. This project can be planned to coincide with another runway project,

[4] The departure RPZ for each runway end is not depicted as its dimensions are smaller than the approach RPZ and it is fully contained within the approach RPZ.



Runway Design Code: B-II-4000
Scale: 1″ = 300′
Aviation Way
No-taxi Island
INSET
A
A2
A1
3/4 Mile Approach RPZ
Standard Hold Bay
PAPI-4
Install MITL
See Inset
Aviation Way
Airport Rd.
Acquire Property and Remove Residential Land Use
4.8 ac
28.6 ac
3/4 Mile Approach RPZ
A5
A4
A3
A2
A1
240′
Runway 16-34 / Ultimate Runway 17-35 (6,003′ x 75′)
12.2 ac
0.7 ac
500′
1.5 ac
Relocated Wind Cone
Relocated Wind Cone
Old Independence Rd.
Acquire Property and Remove Residential Land Use
Relocated AWOS Equipment
N
0
800
SCALE IN FEET
Photo: Google Earth 3/2022
Note: Acreages depicted are approximations.
LEGEND
Airport Property Line
Taxiway Designation
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
Ultimate Airfield Pavement
Pavement to be Removed
Property to be Acquired
Acquire Avigation Easement
AWOS Critical Area

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such as pavement rehabilitation or reconstruction, which would necessitate re-marking of the runway. While updating the designation is recommended in this master plan and presented on each of the alternatives, the runway will continue to be referred to as Runway 16-34 to maintain consistency in discussion and eliminate potential confusion.

Finally, this alternative also depicts a relocation of the AWOS equipment currently located on the east side of the runway. The FAA recommends that an AWOS be located between 1,000 feet and 3,000 feet down runways, and at least 500 feet from the primary runway's centerline, unless this location is unnecessarily restrictive. The AWOS also has a 500-foot radius critical area, which should be kept free of any obstructions that could interfere with the sensors. As discussed in previous chapters, an AWOS siting study was conducted and included an option to relocate the AWOS equipment west of the runway to maximize landside development potential on the east side. **Exhibit 4A** depicts the preferred site for the relocated AWOS equipment, as illustrated in the siting study. This project was approved and funded for fiscal year (FY) 2022; however, as of October 2022, it has not yet begun.

AIRSIDE ALTERNATIVE 2

Depicted on **Exhibit 4B**, Airside Alternative 2 is based on ultimate RDC C-II-4000 design standards. These design standards call for both an increase in runway width and a greater separation between the runway and parallel taxiway. The alternative proposes relocating Runway 16-34 60 feet to the west to provide the standard 300 feet of separation between it and Taxiway A. The runway is also planned for a 25-foot width increase, bringing the new runway width to 100 feet to meet ultimate design standards.

As detailed previously, the RSA and ROFA would expand in size when the airport transitions from B-II to C-II, and new obstructions would be introduced to these safety areas. Beginning on the north side, the ultimate RSA is fully contained on existing airport property, but approximately 1.3 acres of the ultimate ROFA near the Runway 16 end would be outside of airport property. The airport's perimeter fence and vegetation are also present in the RSA and ROFA is this area and are proposed to be removed/relocated outside of these safety areas. Similarly, approximately 17.0 acres of the ultimate ROFA on the west side of the runway is unowned and contains obstructions. This property is proposed to be acquired fee simple, cleared of vegetation, and the wind cones and perimeter fence relocated outside of the ultimate ROFA.

On the south side, a portion of the expanded RSA/ROFA in the ultimate condition extends off airport property and across Airport Road, encompassing residential land uses (depicted previously on Exhibit 3C). There are several options for mitigating this non-standard condition, but the least impactful to the surrounding road network or to the runway itself (i.e., pavement removal to physically shorten the runway), is the application of declared distances, which are illustrated on the bottom half of **Exhibit 4B**. Declared distances are used to define the effective runway length for landing and takeoff when a standard safety area cannot be achieved. The declared distances include:

- Takeoff Run Available (TORA) – the runway length declared available and suitable for the ground run of an aircraft taking off (factors in the positioning of the departure RPZ);
- Takeoff Distance Available (TODA) – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA; the full length of the TODA may need to be reduced because of obstacles in the departure area;

- Accelerate-Stop Distance Available (ASDA) – the runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff (factors in the length of RSA/ROFA beyond the runway end); and
- Landing Distance Available (LDA) – the runway length declared available and suitable for landing an aircraft (factors in the length of RSA/ROFA beyond the runway end and the positioning of the approach RPZ).

Measuring from the end of the ultimate C-II-4000 ROFA to the perimeter fence results in 474 feet necessary to achieve the full C-II RSA and ROFA (1,000 feet beyond the runway end), which impacts the ASDA and LDA for Runway 16. The RSA and ROFA can be shifted north off Airport Road and entirely onto airport property by displacing the Runway 34 threshold. While the ultimate RSA and ROFA extend 1,000 feet beyond the end of the runway, only 600 feet of RSA/ROFA are needed prior to the threshold. With 526 feet of RSA/ROFA available, the Runway 34 threshold only needs to be displaced by 74 feet to meet the standard. With a 74-foot displaced threshold on Runway 34, the resulting declared distances are:

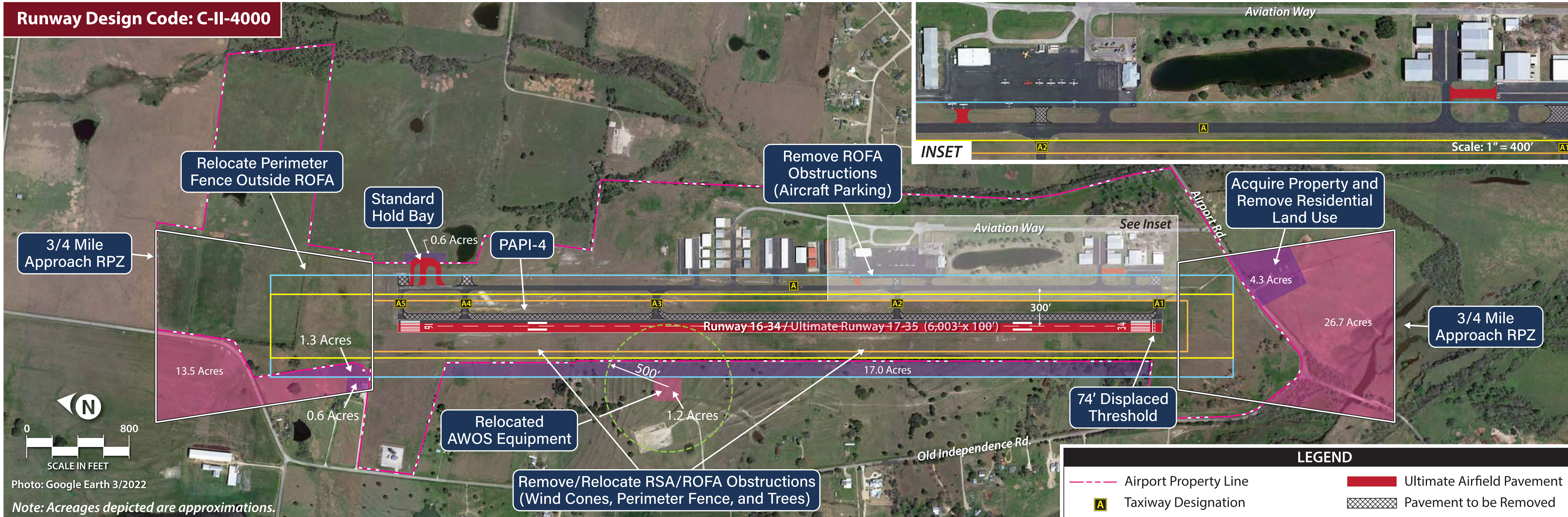
	Runway 16	Runway 34
TORA	6,003’	6,003’
TODA	6,003’	6,003’
ASDA	5,529’	6,003’
LDA	5,529’	5,929’

As seen above, the usable length of the runway would be lessened for some operations due to the implementation of declared distances. While all takeoff operations (with the exception of a rejected takeoff from Runway 16) would have the full 6,003 feet of pavement available, landing operations to both runway ends are impacted, with 5,529 feet of available pavement for pilots landing on Runway 16 and 5,929 feet for landing operations on Runway 34. Airside Alternative 2 poses minimal impact in terms of earthwork and construction and fully meets FAA design standards for RSA and ROFA; however, the obvious drawback is that it reduces usable runway length during certain operations, potentially making it more restrictive to business jets.

The RPZs off each end of the runway also contain potential incompatibilities. Like Airside Alternative 1, this alternative proposes acquisition of the property containing residential land uses and removal of the structures, with the remaining RPZ property protected via an avigation easement. Both RPZs would still contain public roadways, and while roads are not preferrable inside an RPZ, the airport sponsor may elect to allow them to remain.

A secondary option for clearing RPZs that an airport sponsor may consider is displacing the runway threshold and using declared distances to shift the RPZs off incompatible land uses. This relies on the same principles described above; however, a greater displacement would be necessary to fully contain the RPZ on airport property and eliminate incompatible land uses. At Brenham Municipal Airport, this is feasible for Runway 16, though a displacement of approximately 1,700 feet would be necessary, resulting in even less usable pavement for aircraft taking off from Runway 34 and landing on Runway 16. On the Runway 34 end, displacing the threshold to shift the RPZ off Airport Road is impractical due to the airport’s landside facilities (i.e., hangars) on the south side, which would be contained within the RPZ if the threshold were displaced. Like other buildings, aircraft storage hangars are considered incompatible uses within RPZ.

Runway Design Code: C-II-4000

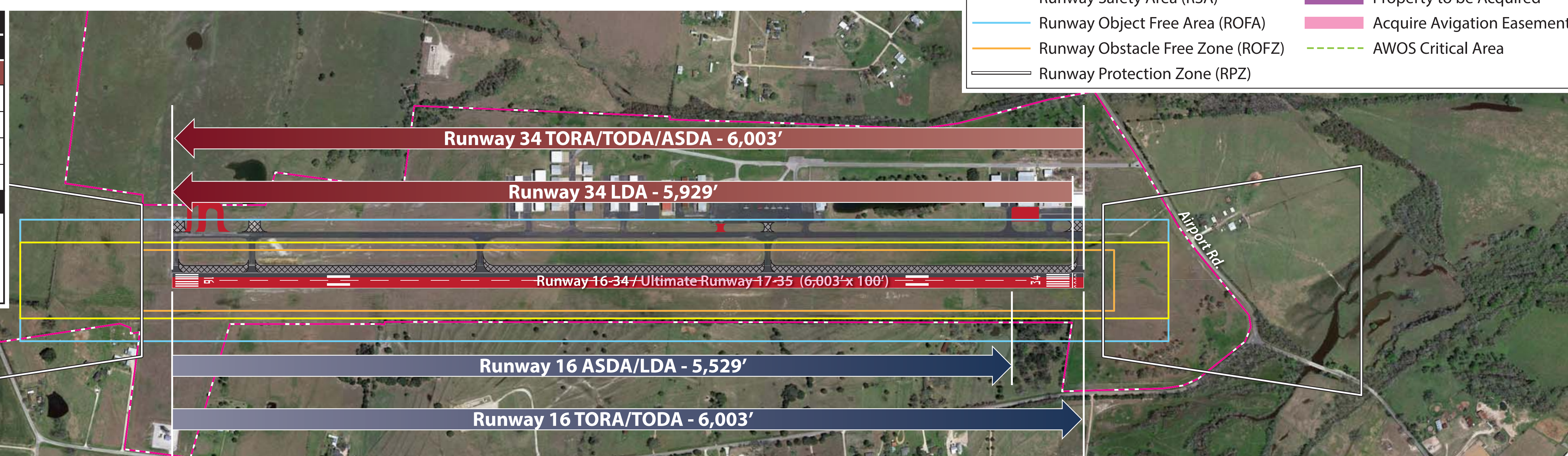


RUNWAY 16-34 DECLARED DISTANCES

	Runway 16	Runway 34
TORA	6,003′	6,003′
TODA	6,003′	6,003′
ASDA	5,529′	6,003′
LDA	5,529′	5,929′

KEY

TORA - Take Off Run Available
ASDA - Accelerate Stop Distance Available
TODA - Take Off Distance Available
LDA - Landing Distance Available



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Additional features of Airside Alternative 2 include:

1. To eliminate the direct access from the aircraft parking apron to Runway 16-34, Taxiway A2 is proposed to be demolished and a new connector taxiway constructed to the north. Offsetting this connection to the runway forces pilots to make a turn onto Taxiway A when exiting the apron, reducing the risk of inadvertent runway access and enhancing safety.
2. Like the previous alternative, the pavement that connects the south apron to Taxiway A1 is proposed to be removed to eliminate the second direct access point at the airport, with new pavement constructed to allow for aircraft turnaround.
3. A standard aircraft hold bay is planned at the Runway 16 runway end. This alternative presents an alternate FAA-preferred design that includes grass or painted islands to provide an enhanced visual cue to pilots in holding aircraft. Approximately 0.6 acres would need to be acquired in order to construct the hold bay and maintain a standard TOFA.
4. The PAPI-2 serving Runway 16 is planned to be upgraded to a PAPI-4.
5. A ¾-mile LPV GPS approach is proposed for Runway 16.
6. Relocation of the AWOS equipment.

AIRSIDE ALTERNATIVE 3

Airside Alternative 3 is presented on **Exhibit 4C**. Like the previous alternative, this option also evaluates the ultimate C-II-4000 scenario; however, there are three primary differences. The first is the inclusion of a runway extension. The second is the proposed relocation of Taxiway A rather than Runway 16-34 to meet the increased runway-taxiway separation standards that are called for in a C-II design. Lastly, an alternate option for meeting FAA design standards for the expanded C-II safety areas (RSA and ROFA) as well as a different strategy for mitigating RPZ incompatibilities are presented in this alternative.

As outlined in Chapter Three, Facility Requirements, the current length of Runway 16-34 (6,003 feet) is adequate for most operations occurring at Brenham Municipal Airport now and in the future. However, some business jets may be weight-restricted or unable to operate on the existing runway length, particularly during hot weather. As such, an option to extend the runway to 6,400 feet, which would accommodate 100 percent of the business jet fleet at 60 percent useful load, is illustrated on **Exhibit 4C**. Airside Alternative 3 proposes a 400-foot extension to Runway 16, bringing the total runway length to 6,403 feet. The runway is also proposed to be widened to 100 feet, in accordance with C-II design standards, with the additional 25 feet of pavement added to the west side of the runway. Adding all of the additional width on this side of the runway, rather than 12.5 feet on each side, is proposed to lessen the impact of relocating Taxiway A to meet the increased runway-taxiway separation required for a C-II-4000 scenario. This will also serve to shift the ultimate ROFA farther away from the landside facilities.

As mentioned, in order to meet the 300-foot runway to taxiway separation standard, Airside Alternative 3 proposes the relocation of Taxiway A, rather than shifting Runway 16-34 to the west, as was illustrated in Alternative 2. New parallel taxiway pavement is proposed to replace the existing Taxiway A pavement, which is planned to be demolished under this alternative. The relocated Taxiway A would be located 300 feet from Runway 16-34, centerline to centerline, meeting the C-II-4000 standard. In this location, a segment of the taxiway would abut the aircraft parking apron, necessitating the re-marking of the apron pavement. Aircraft parking on the west side of the apron is planned to be removed. With Taxiway A shifted west, closer to existing landside facilities, additional taxilane pavement is proposed at various points along Taxiway A in order for aircraft to access hangars and maintain wingtip clearance. Finally, relocating Taxiway A would also result in a reduction of aircraft parking area on the south apron as both the ROFA and the TOFA would encroach farther onto apron pavement. To compensate for this loss, new apron pavement is proposed to the south and east to allow for aircraft parking and turnaround. **Figure 4B** depicts a closer view of these proposed changes to the taxiway/taxilane system under this alternative.

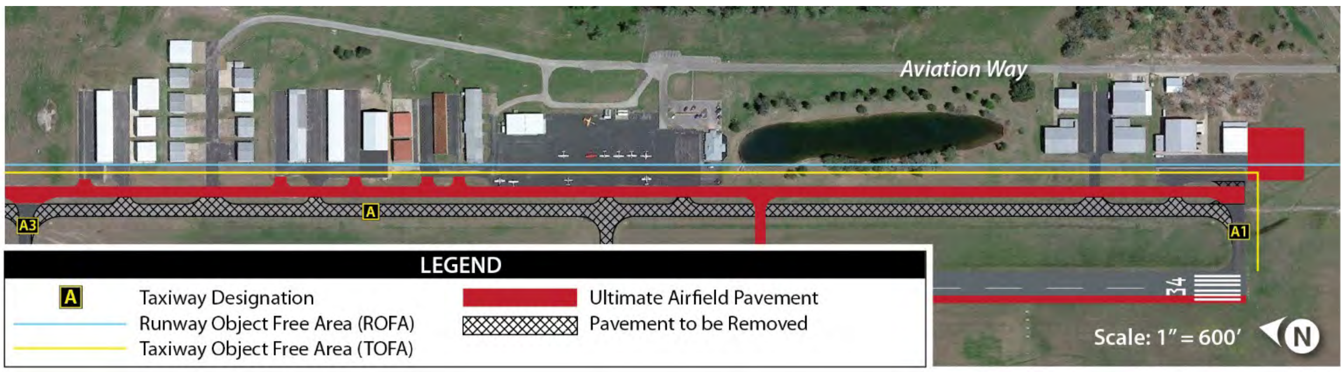


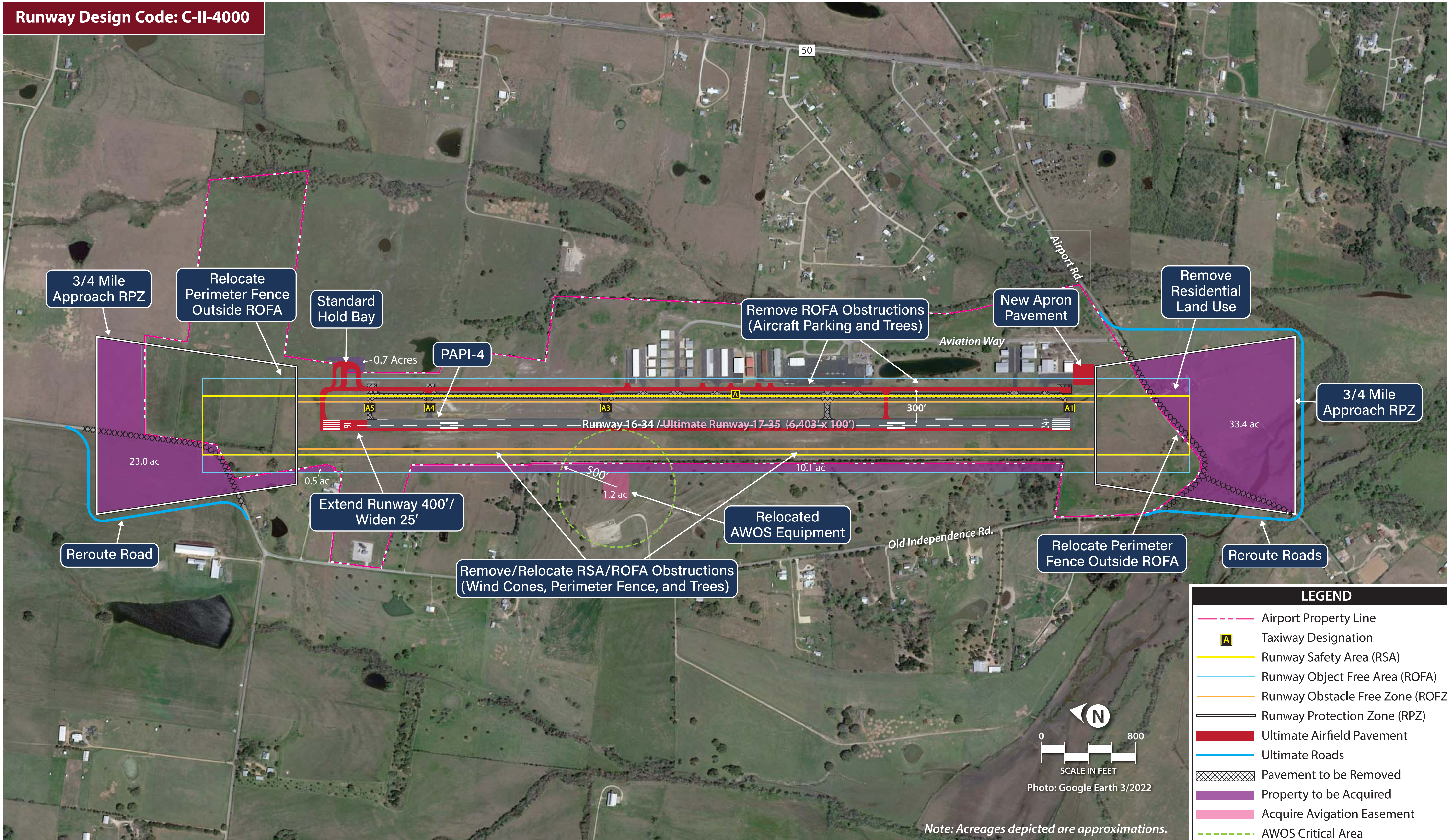
Figure 4B – Proposed Taxiway A Relocation

The last major difference illustrated on Airside Alternative 3 is a new potential strategy for maintaining standard C-II safety areas. As outlined previously, the RSA and ROFA dimensions increase in size in the ultimate condition. With the proposed extension to Runway 16-34, these safety areas are pushed farther outside airport property on the north end and extend over Old Independence Road. A similar condition is present on the south end, where these safety areas extend across Airport Road. The RPZs are also partially located off airport property and contain incompatible land uses. Rather than displace the threshold at each runway end and implement declared distances, as described in the previous alternative, this alternative proposes to acquire property on each runway end and reroute roadways around the ultimate RPZs. On the north end, approximately 23.5 acres of the ultimate RSA/ROFA/RPZ are proposed to be acquired fee simple. The portion of Old Independence Road that traverses the safety areas on this end is planned to be closed, with new pavement rerouted around the RPZ. On the south end, approximately 33.4 acres within the ultimate RSA, ROFA, and Runway 34 RPZ are proposed to be acquired in fee, with the residence and associated structures removed. Portions of Airport Road and Old Independence Road are proposed to be closed and rerouted around the Runway 34 RPZ.

Additional features of Airside Alternative 3 include:

1. Acquire approximately 10.1 acres of property within the ultimate ROFA on the west side of Runway 16-34.
2. Removal and/or relocation of obstructions in the ultimate RSA and ROFA, including aircraft parking positions and trees near the pond on the east side of the runway; the perimeter fence on the north, west, and south sides of the runway; and the wind cones west of the runway.

Runway Design Code: C-II-4000



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3. Relocated Taxiway A is proposed to be extended 400 feet to the north to match the runway extension. A new connector taxiway is proposed at the Runway 16 end.
4. Taxiway A2 is proposed to be closed/removed to eliminate the direct access from the aircraft parking apron to Runway 16-34. A new connector taxiway is proposed approximately 500 feet south of Taxiway A2.
5. The pavement that connects the south apron to Taxiway A1 is proposed to be removed to eliminate the second direct access point at the airport. Previous alternatives considered construction of new connecting taxilane pavement to provide adequate space for aircraft to turn around when utilizing this apron; however, due to the proposed relocation of Taxiway A in this alternative, this option is not feasible. Rather, this alternative proposes construction of a new apron area to the south where aircraft can conduct pre-flight engine checks and turnaround.
6. A standard aircraft hold bay with grass islands is planned at the Runway 16 runway end. Approximately 0.7 acres would need to be acquired in order to construct the hold bay and maintain a standard TOFA.
7. The PAPI-2 serving Runway 16 is planned to be upgraded to a PAPI-4.
8. A ¾-mile LPV GPS approach is proposed for Runway 16.
9. Relocation of the AWOS equipment.

AIRSIDE SUMMARY

The sections above outlined three planning considerations for the airfield at Brenham Municipal Airport. The primary issues on the airside are mitigating non-standard safety areas at both runway ends, removing obstructions from the RSA and ROFA, addressing non-standard taxiway geometry, and evaluating options for meeting runway to taxiway separation standards. Increases in runway length and width were also examined. Mitigating non-standard safety area conditions and the potential for a runway extension and/or displaced threshold will potentially be the most impactful to both the public and the aviation community. For this reason, it is vitally important that the AMPC, 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 below, will focus on strategies following a philosophy of separating activity levels. Landside facility development at Brenham Municipal Airport is focused primarily on the east side of airport property where the terminal and hangars are already located; however, consideration will also be given to the potential for property acquisition to develop west of the runway. Other undeveloped portions of airport property, such as the approximately 28-acre parcel northeast of the Runway 16 threshold, will also be evaluated for development potential (aeronautical or non-aeronautical).

Landside Planning Considerations
1. Consider the Building Restriction Line (BRL) when planning vertical infrastructure
2. Consider the topographical constraints on and around airport property
3. Increase aircraft storage capacity
4. Expand aircraft parking apron and add additional marked aircraft parking
5. Expand terminal capacity
6. Consider appropriate aviation and non-aviation-related uses for the future development of vacant property, or release of property

Consideration #1 – Building Restriction Line (BRL)

The BRL identifies suitable building area locations on the airport. It encompasses the RPZs, the OFA, navigational aid critical areas, areas required for terminal instrument procedures, and other areas necessary for meeting airport line-of-sight criteria. Two primary factors contribute to the determination of the BRL: type of runway ("utility" or "other-than-utility") and the capability of the instrument approaches. Runway 16-34 is considered an other-than-utility, nonprecision instrument runway with visibility minimums not lower than ¾-mile. The BRL is the product of CFR Part 77 transitional surface clearance requirements. These requirements stipulate that no object be located in the primary surface, defined as being 1,000 feet wide for nonprecision instrument runways with visibility minimums ¾-mile and lower. From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizontal feet.

At Brenham Municipal Airport, the 35-foot BRL for Runway 16-34 is set at 745 feet from the runway centerline, and the 25-foot BRL is set at 675 feet from centerline. Presently, all landside facilities are located within the BRL, with the nearest structure located approximately 400 feet from the runway centerline. While these buildings are located within the BRL, this does not necessarily mean there are penetrations to Part 77 surfaces. **It should be clearly stated that the BRL is not a standard, but rather a guideline to use when planning vertical infrastructure on the airport.** The FAA may require structures inside the BRL to be equipped with obstruction lights.

Consideration #2 – Airport Topography

As shown on **Exhibit 4D**, airport property slopes down from the north to the south by approximately 70 feet. There is also a notable grade change on the east side, where airport property slopes down from the airfield to the eastern property line, by as much as 30 to 40 feet in some areas. A portion of airport property is also located within a 100-year floodplain. When considering the construction of new pavement and

Exhibit 4D
AIRPORT TOPOGRAPHY

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buildings on the landside, it is important to factor in these topographical constraints that may impact the feasibility of construction (i.e., environmental factors; additional costs associated with earthwork, drainage, etc.). The alternatives to follow consider unconstrained growth/construction scenarios that maximize the use of existing airport property as much as possible, with the understanding that some projects may be deemed infeasible due to engineering challenges owing to topographical constraints.

Consideration #3 – Hangars

Hangar occupancy at Brenham Municipal Airport stands at 100 percent, with 14 individuals on a waiting list for T-hangar space and several others interested in land leases on which to construct box hangars. With clear demand for additional hangar capacity at the airport, the landside alternatives will consider areas for the development of various hangar styles, including small aircraft facilities, executive/conventional hangars, and service/maintenance 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. The airport currently has approximately 56,600 sf of T-hangar storage space, with an additional 4,000 sf projected to be needed by the end of the 20-year planning period.

- **Executive/conventional hangars** consist primarily of clear span hangars with no interior supporting structure. Executive hangars are typically less than 10,000 sf and can accommodate small aviation businesses, one larger aircraft, or multiple smaller aircraft, while conventional hangars can range in size from 10,000 sf to 20,000 sf. Both of these hangar types typically require all utilities and segregated roadway access. The airport has approximately 107,300 sf of combined executive/conventional hangar space, with an additional 50,000 sf estimated to be needed by the end of the planning period.

- **Service/maintenance hangars** house businesses that offer services such as aircraft maintenance, line service, aircraft manufacturing, and aircraft fueling. High levels of activity can be concentrated around these hangars, necessitating adequate 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. Currently, Brenham Municipal Airport has about 21,000 sf of service hangar space available, which is adequate through the end of the planning period.

The alternatives to follow show various hangar layouts that airport/city staff and the AMPC may consider. In each, the overall capacity for the proposed hangars exceeds the need determined in the previous chapter as the scenarios presented are based upon a conceptual, built-out condition.

Consideration #4 – Aprons and Marked Aircraft Parking

Brenham Municipal Airport has approximately 16,900 sy of apron space for public aircraft parking and circulation, with 29 marked parking positions for fixed wing aircraft. Based on projected growth in based aircraft and transient operations, an additional 22,700 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 and/or taxilane pavement. As outlined in Chapter Three, taxilane pavement should be designed to meet the Aircraft Design Group (ADG) standards for the aircraft utilizing the pavement. In instances where the TLOFA is obstructed by an existing hangar, as is the case at Brenham Municipal Airport[5], it is acceptable to base the TLOFA on the largest wingspan of the aircraft using the taxilane, which may be less than the standard TLOFA width. For planning purposes, the alternatives to follow consider proposed taxilane pavement to meet the TLOFA standards as outlined by FAA.

In terms of marked aircraft parking, 13 additional parking spaces are projected to be needed, including four helicopter parking positions.

Consideration #5 – Terminal Building

Operations at the airport 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 areas, concessions, airport management offices, and storage space. The existing 3,400 square foot (sf) terminal building[6], constructed in 2001, will become undersized and outdated over time. The Facility Requirements projected a need for an additional 700 sf by the end of the planning period. In order to accommodate anticipated growth and remain competitive with other general aviation airports in the region, consideration should be given to expanding/updating the existing terminal building or developing a new, modern terminal building with all appropriate amenities. 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.

Consideration #6 – Land Development/Release

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.

[5] Refer to Figure 3B in Chapter Three, Facility Requirements.
[6] Excludes restaurant area.

The following sections describe a series of landside alternatives as they relate to the considerations detailed above. Three alternatives have been prepared to illustrate potential development plans aimed at meeting the needs of general aviation through the long-term planning period and, in some cases, beyond. The alternatives are based upon an unconstrained growth scenario, with expanded landside facilities that may exceed the need determined in the Facility Requirements. It should be noted that 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 Brenham 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.

LANDSIDE ALTERNATIVE 1

Depicted on **Exhibit 4E**, Landside Alternative 1 considers options for additional landside development on the east side of airport property. This alternative considers an environment in which the centerline of Runway 16-34 is shifted to the west to meet ultimate C-II-4000 design standards, which affects the placement of the BRL and the outer boundary of the ROFA. The primary features of Landside Alternative 1 include construction of additional apron and taxilane pavement to support future hangar development, as well as expanded vehicle parking. Portions of airport property are also proposed for future aeronautical or non-aeronautical development. The following sections describe the attributes of Landside Alternative 1 in greater detail.

Hangar Development

A variety of hangar types and sizes are proposed in this alternative to meet the various needs of based aircraft owners, with development concentrated north of the terminal building, where most existing hangars facilities are already located. Two conventional hangars are shown on the south side of the airport, accessible via a proposed taxilane extending from the south ramp area. As shown on the exhibit, a mix of conventional and executive box hangars are depicted, along with T-hangars. In total, this alternative includes approximately 90,000 sf of new T-hangar space and approximately 123,700 sf of new executive box/conventional hangar space.

Apron/Taxilane Expansion and Marked Aircraft Parking

This alternative proposes an expansion of the terminal apron to the east. This expansion would allow for additional marked parking for both fixed wing aircraft and helicopters, reconfigured to account for a potential no-taxi island and to allow for adequate taxilane areas. Helicopter parking is proposed north of the terminal building. The existing aircraft parking on the west side of the apron is proposed to be removed as these positions are located within the ultimate ROFA, and any aircraft parked in this area would become an obstruction to this safety area. With the terminal apron expansion, 16 additional fixed wing aircraft parking positions are proposed, along with two helicopter parking positions.

A new apron area is also proposed north of the expanded terminal apron. This area is proposed to serve a large conventional hangar that could be used to accommodate transient operators or a SASO. In all, approximately 6,000 square yards (sy) of new apron pavement is proposed under this alternative.

New taxilane pavement leading to proposed hangars is also planned, with pavement widths determined by the appropriate taxilane design group. FAA design standards call for taxilane object free area (TLOFA) for aircraft in Airplane Design Group (ADG) I to be 79 feet wide, while the TLOFA for ADG II is 110 feet wide, as centered on the taxilane. New taxilane pavement is proposed to meet the appropriate standard for the aircraft utilizing that pavement section to access hangar facilities.

Vehicle Access and Parking

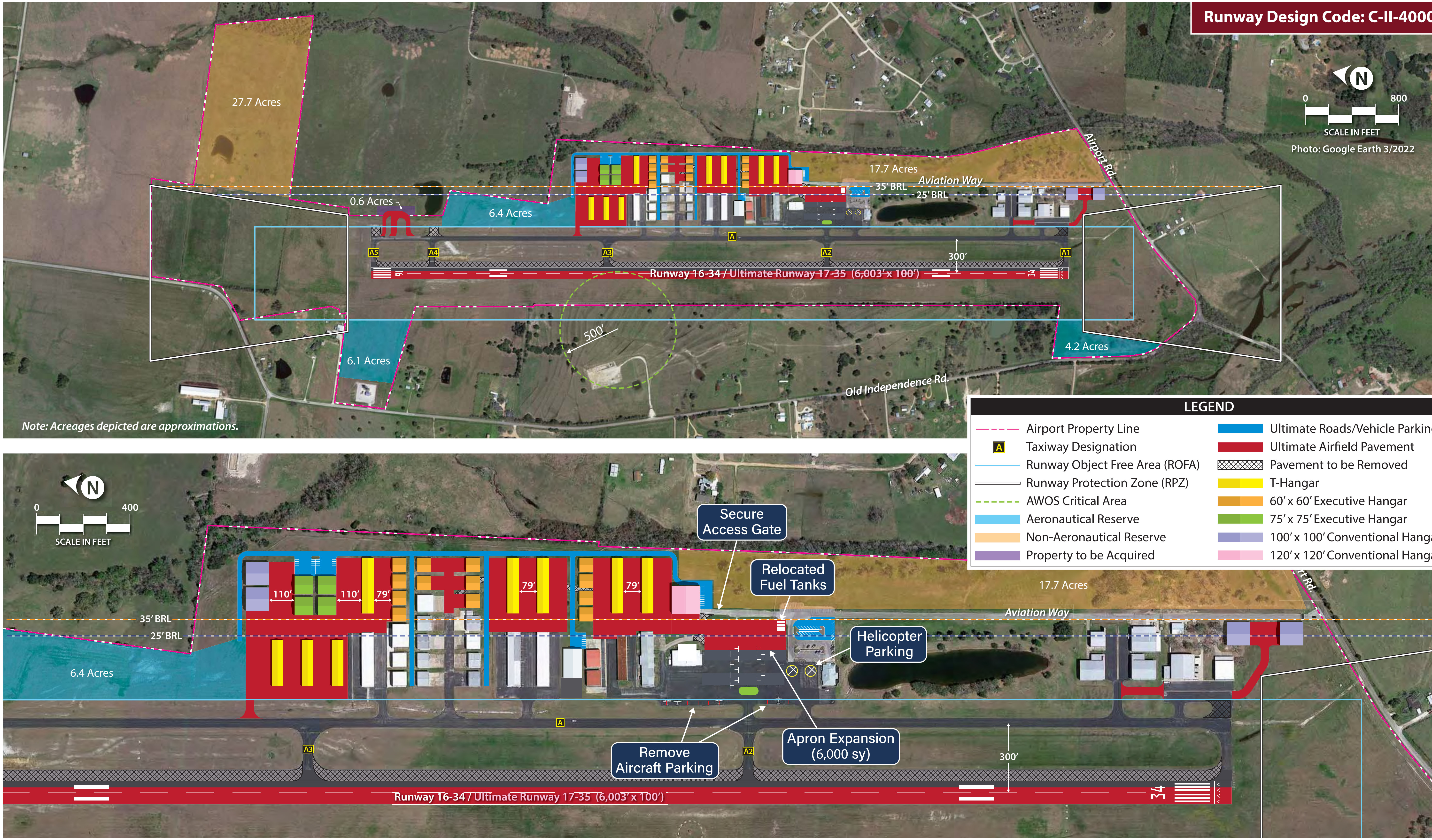
Consideration has also been given to expanded vehicle parking and access roads. Near the terminal building, the existing vehicle lot is proposed for expansion to meet projected demand over the next 20 years. Dedicated vehicle parking is also proposed for various other areas on the landside, with lots planned to serve proposed hangars on the north end, another planned at the rear of the box hangar currently under construction (2022), and third proposed adjacent to Aviation Way at midfield. The alternative also considers the extension of Aviation Way to the north to provide access to proposed hangars, with tenant access roads planned to extend from Aviation Way.

Ancillary

The proposed expansion of the terminal apron would necessitate the relocation of the fuel farm currently located on the eastern edge of the apron. This alternative proposes relocating these facilities to the southeastern corner of the expanded apron, with fuel trucks using existing Aviation Way to access the tanks. The alternative also includes the addition of a fourth fuel tank, intended for the storage of unleaded aviation fuel (100UL). Immediately north of the relocated fuel tanks, a secure access gate is proposed to prevent unauthorized access to landside facilities and enhance security at the airport.

Reserve Property

Portions of airport property have also been identified for either aeronautical or non-aeronautical reserves. These are areas of airport property that may be inaccessible to the airfield or otherwise offer limited development potential due to lack of infrastructure or other constraining factors.


Runway Design Code: C-II-4000
N
0
800
SCALE IN FEET
Photo: Google Earth 3/2022
27.7 Acres
17.7 Acres
0.6 Acres
6.4 Acres
6.1 Acres
4.2 Acres
35' BRL
25' BRL
Aviation Way
Airport Rd.
A
A1
A2
A3
A4
A5
300'
500'
Runway 16-34 / Ultimate Runway 17-35 (6,003' x 100')
Old Independence Rd.
Note: Acreages depicted are approximations.
LEGEND
Airport Property Line
Taxiway Designation
Runway Object Free Area (ROFA)
Runway Protection Zone (RPZ)
AWOS Critical Area
Aeronautical Reserve
Non-Aeronautical Reserve
Property to be Acquired
Ultimate Roads/Vehicle Parking
Ultimate Airfield Pavement
Pavement to be Removed
T-Hangar
60' x 60' Executive Hangar
75' x 75' Executive Hangar
100' x 100' Conventional Hangar
120' x 120' Conventional Hangar
0
400
SCALE IN FEET
Secure Access Gate
Relocated Fuel Tanks
Helicopter Parking
Remove Aircraft Parking
Apron Expansion (6,000 sy)
110'
79'

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Landside Alternative 1 highlights three areas of aviation reserve property (shaded in blue) and two areas of non-aeronautical reserve property (shaded in yellow). On the west side of the runway, a 6.1-acre parcel on the north end near the airport surveillance radar (ASR-11) tower is proposed to be held in reserve for future aviation use, as is a 4.2-acre parcel west of the Runway 34 threshold. A 6.4-acre parcel east of the runway and north of landside development is also proposed to be held in reserve for aviation use. All of these areas offer potential for aeronautical development if the city decides to pursue additional development at some point in the future. On the east side, a 27.7-acre and a 17.7-acre parcel are proposed to be used for non-aeronautical development. Neither area has access to the airfield, and, in the case of the 27.7-acre parcel, is not equipped with access roads or other infrastructure that could support aviation development.

LANDSIDE ALTERNATIVE 2

Landside Alternative 2 is shown on **Exhibit 4F**. This option evaluates greater development potential on the east side of the airfield but considers a relocated Taxiway A in accordance with ultimate C-II-2400 design standards. Like the first alternative, this shift also impacts the location of the BRL and ultimate ROFA, resulting in a greater portion of the terminal apron being unusable for aircraft parking. In addition to featuring a different conceptual layout for future hangar construction, Landside Alternative 2 also considers development in the area of the pond that is located immediately south of the terminal.

Terminal Building

The Facility Requirements indicated a potential need for expanded terminal facilities, which may be necessary by the end of the intermediate planning period. Landside Alternative 2 illustrates an expansion of 1,225 sf on the north side of the existing building, which would provide needed space to accommodate the projected increase in transient pilots and passengers.

Hangar Development

Like the first landside alternative, a variety of hangar types and sizes are proposed, but with a different layout concept. Landside Alternative 2 depicts a large T-hangar complex to the north of existing landside facilities, with executive hangars proposed to complete the build-out of the midportion of the landside area. Executive hangars are also proposed along an expanded terminal apron.

Conventional hangars are proposed on a new apron area that would be constructed on the pond site. To accomplish this, extensive earthwork would be necessary to drain the pond and add enough fill to stabilize the area for future pavement and hangar construction. However, this is a prime location along the flight line and near the terminal building that would be well-suited for a specialized aviation service operator (SASO) or other aviation-related business.

In total, this alternative includes approximately 180,050 sf of new T-hangar space and approximately 179,825 sf of new executive box/conventional hangar space.

Apron/Taxilane Expansion and Marked Aircraft Parking

Like the previous alternative, Landside Alternative 2 proposes an easterly expansion of the terminal apron, with approximately 8,900 sy of new pavement that could support executive box hangars and additional aircraft parking. As illustrated on **Exhibit 4F**, marked parking for fixed wing aircraft is proposed, with 10 new tiedowns on the expanded apron and a new helicopter parking position. The existing aircraft parking on the west side of the apron is proposed to be removed as these positions are located within the ultimate ROFA.

A new apron area is also proposed south of the terminal on the pond site, as mentioned in the previous section. This 32,500 sy apron could provide for both fixed wing and helicopter parking positions.

New taxilane pavement is proposed north of existing landside facilities, with ADG I taxilanes providing access to the proposed T-hangar complex. A mix of ADG I and ADG II taxilanes are proposed leading to various new hangars east of existing box and T-hangars.

Vehicle Access and Parking

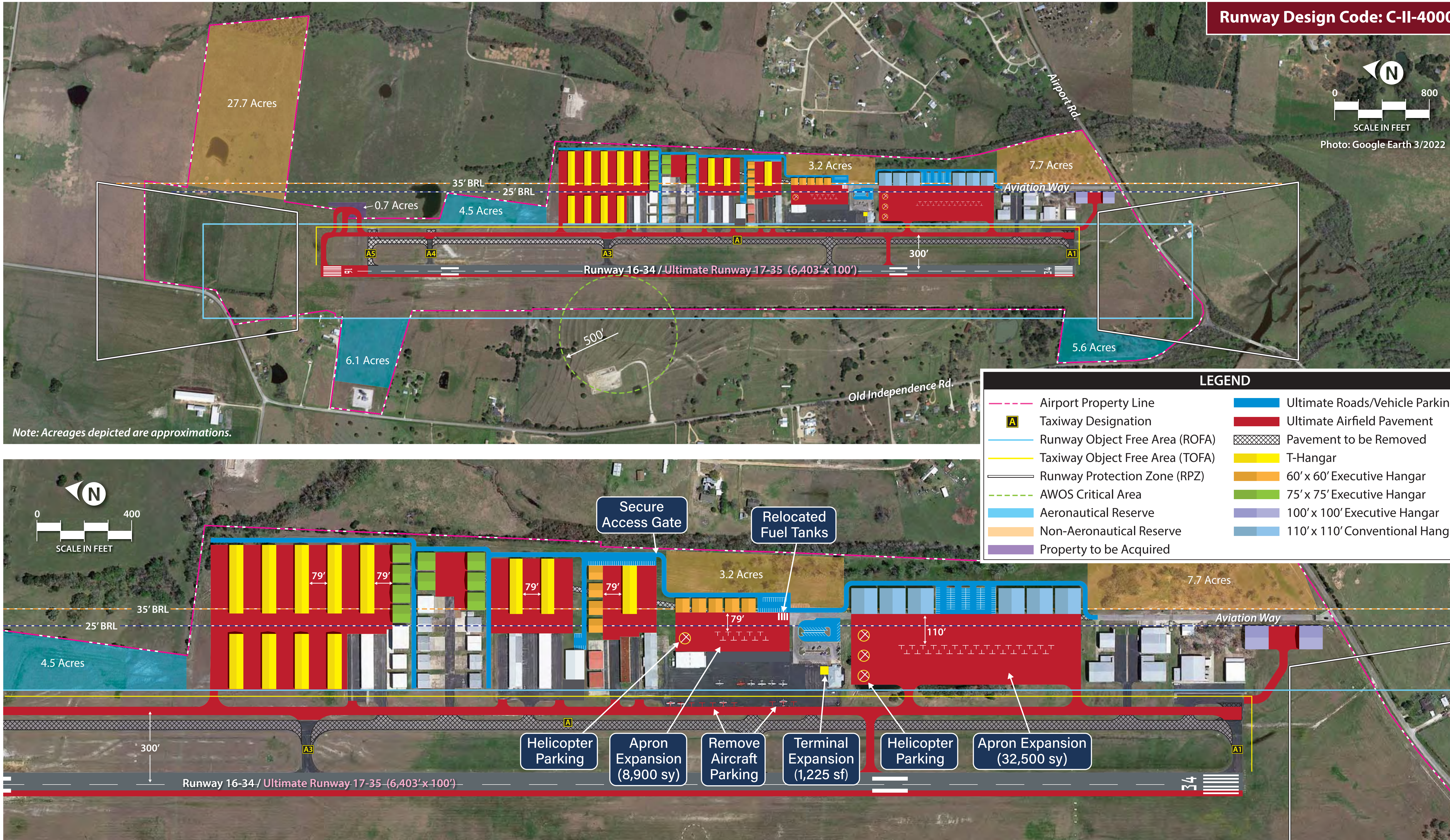
The majority of Aviation Way is proposed to be reconstructed to allow for expanded landside development. South of the pond, the road is planned to be rerouted to the east to allow for construction of the proposed new apron and conventional hangars, before continuing north to provide access to existing and proposed box and T-hangars north of the terminal. The vehicle parking lot adjacent to the terminal is planned to be expanded, and new parking lots and access roads are proposed to serve existing and proposed box and T-hangars.

Ancillary

The fuel farm is proposed to be relocated to accommodate the planned terminal apron expansion depicted in this alternative, with the fuel tanks relocated to the southeast corner of the new apron area. A secure access gate is proposed on Aviation Way north of the expanded terminal apron to prevent unauthorized access to private hangar facilities and enhance security at the airport.

Reserve Property

Similar to the first landside alternative, portions of existing airport property are being proposed for aeronautical and non-aeronautical reserve. West of Runway 16-34, the 6.1 acres near the ASR-11 tower are proposed for aviation reserve, as is a 5.6-acre area on the south end of the airfield. On the east side, a 4.5-acre area is also proposed for aeronautical reserve, while the 27.7-acre parcel northeast of the Runway 16 threshold is planned for non-aeronautical reserve. Two parcels east of Aviation Drive are also proposed for potential non-aeronautical developments.


Runway Design Code: C-II-4000
0
800
SCALE IN FEET
Photo: Google Earth 3/2022
27.7 Acres
3.2 Acres
7.7 Acres
Airport Rd.
Aviation Way
35' BRL
25' BRL
0.7 Acres
4.5 Acres
A
A5
A4
A3
A1
300'
Runway 16-34 / Ultimate Runway 17-35 (6,403' x 100')
500'
6.1 Acres
5.6 Acres
Old Independence Rd.
Note: Acreages depicted are approximations.
LEGEND
Airport Property Line
Taxiway Designation
Runway Object Free Area (ROFA)
Taxiway Object Free Area (TOFA)
Runway Protection Zone (RPZ)
AWOS Critical Area
Aeronautical Reserve
Non-Aeronautical Reserve
Property to be Acquired
Ultimate Roads/Vehicle Parking
Ultimate Airfield Pavement
Pavement to be Removed
T-Hangar
60' x 60' Executive Hangar
75' x 75' Executive Hangar
100' x 100' Executive Hangar
110' x 110' Conventional Hangar
0
400
SCALE IN FEET
Secure Access Gate
Relocated Fuel Tanks
79'
79'
79'
79'
79'
110'
3.2 Acres
7.7 Acres
Aviation Way
35' BRL
25' BRL
4.5 Acres
300'
A
A3
A1
Helicopter Parking
Apron Expansion (8,900 sy)
Remove Aircraft Parking
Terminal Expansion (1,225 sf)
Helicopter Parking
Apron Expansion (32,500 sy)
Runway 16-34 / Ultimate Runway 17-35 (6,403' x 100')

LANDSIDE ALTERNATIVE 3

Depicted on **Exhibit 4G**, Landside Alternative 3 considers expanded development potential on both sides of the airfield. This alternative does not include development on the pond site, and instead evaluates the potential for property acquisition west of the runway. Proposed west side development is concentrated near the Runway 34 end, staying clear of the AWOS critical area and homes located to the north, while also ensuring adequate space is available for hangar development based on the location of the BRL. This and other features of Landside Alternative 3 are detailed below.

Terminal Building

Two terminal building options are considered under this landside alternative. The first, Option #1, illustrates a 1,000-sf expansion on the west side of the existing terminal building. The second option considers construction of a new, modern terminal building, 5,625 sf in size, east of the expanded terminal apron. If Option #2 were pursued, the existing terminal building could be demolished, and the site developed as additional apron area.

Hangar Development

Landside Alternative 3 proposes a similar development plan as previous alternatives, with continued build-out of existing taxilanes and hangar areas on the east side, along with new conventional hangars fronting an expanded terminal apron. The pond is maintained as-is. As mentioned, a new development area is also considered on the west side of the runway. Currently, the airport's property line does not extend to Old Independence Road for most of the area west of the runway. Some level of property acquisition will be necessary when the airport transitions to C-II as the ROFA dimensions increase and encompass portion of property outside the airport's existing western boundary, as discussed in the airside alternatives section. In order to develop new landside facilities west of the runway, additional property acquisition would be necessary to construct new airfield pavement to access these facilities, protect runway and taxiway safety areas, and develop new apron and hangar facilities. Landside Alternative 3 assumes approximately 29.5 acres of property would be needed in total to construct the facility layout pictured on the exhibit. This includes property within the C-II ROFA as well as land that would be necessary for construction of associated airside and landside facilities.

If the west side were to be developed as pictured in **Exhibit 4G**, a partial-parallel taxiway would need to be constructed, at a minimum, to provide access to proposed landside facilities. The apron depicted on the exhibit is sited to allow for the construction of conventional hangars beyond the 35-foot BRL. As previously discussed, the BRL is used as a planning guideline, not a rule. If the city decides to develop west of the runway, the FAA will make the final determination on proposed structure heights to ensure there are no penetrations to Part 77 surfaces. Access to proposed west side development is available via Old Independence Road; however, utilities would need to be extended to the new development area.

In total, this alternative proposes approximately 103,600 sf of new T-hangar space and approximately 170,350 sf of new executive box/conventional hangar space.

Apron/Taxilane Expansion and Marked Aircraft Parking

Like each of the previous alternatives, an expansion of the existing terminal apron is proposed, with approximately 15,000 sy of new pavement. This pavement could support hangars and additional aircraft parking, with 11 fixed wing positions and four helicopter positions shown. Aircraft parking on the western edge of the terminal apron within the ultimate ROFA is proposed to be removed.

A second apron area on the east side of the airfield is also planned, featuring approximately 7,000 sy of new pavement. Marked aircraft parking is proposed along the western edge of this apron.

New taxilane pavement is proposed north of existing landside facilities, with ADG I taxilanes providing access to proposed T-hangars and executive hangars. A mix of ADG I and ADG II taxilanes are included under this alternative, leading to various new hangars east of existing box and T-hangars.

As described above, a new apron on the west side of the runway is also included as part of this alternative. This 19,300 sy apron is sized to include 23 fixed wing aircraft parking positions and two helicopter positions, as depicted.

Vehicle Access and Parking

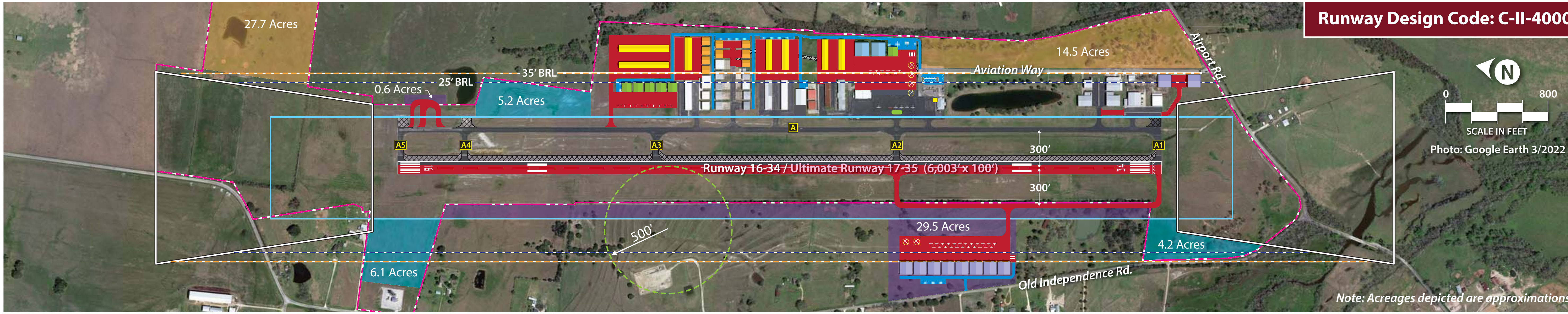
Aviation Way is proposed to be realigned and extended to the north to provide tenant access to hangar facilities north of the terminal. Several areas of dedicated vehicle parking for tenants are planned, along with an expansion of the public parking lot east of the terminal building (assumes the existing terminal building will remain and a new terminal would not be constructed).

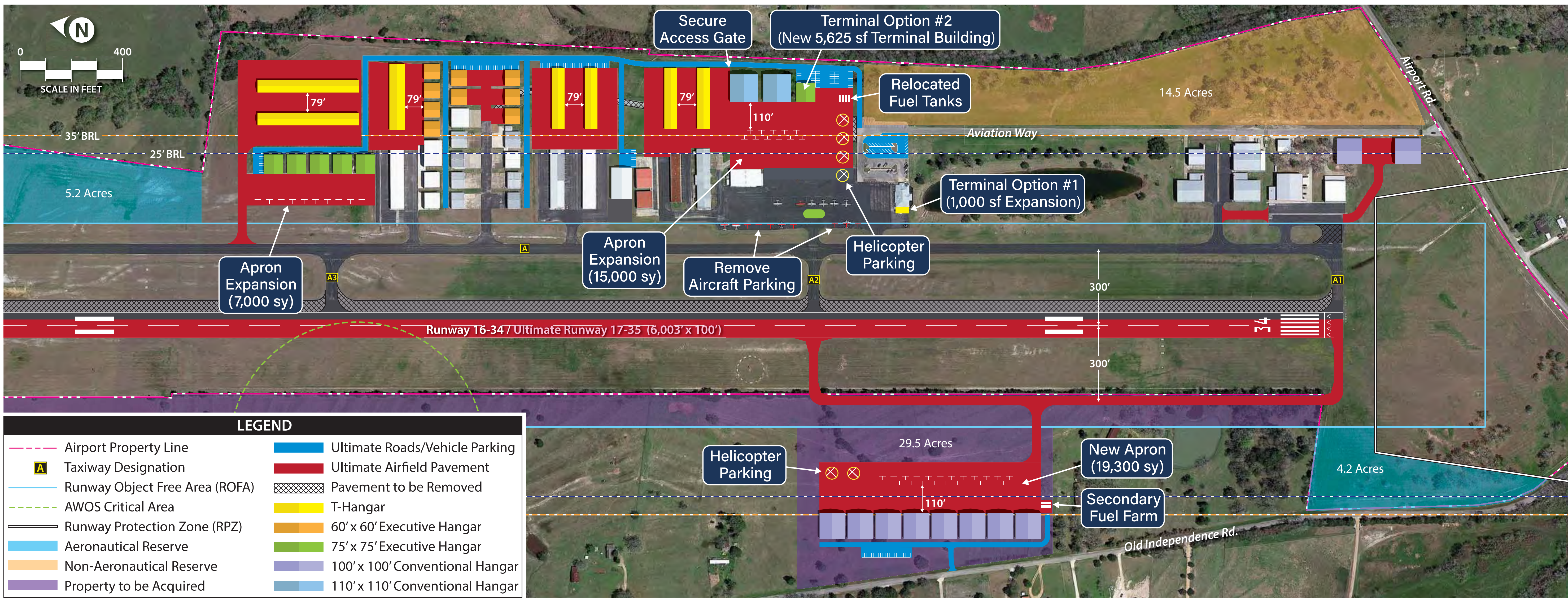
Ancillary

The existing fuel farm is proposed to be relocated to accommodate the planned terminal apron expansion, with the fuel tanks relocated to the southeast corner of the new apron area (including an additional tank for 100UL). On the proposed west apron, a secondary fuel farm is planned. Having a second aviation fueling area eliminates the need for pilots and fuel trucks to travel from one side of the airport to the other. A secure access gate is also proposed on the east side to enhance the security of private landside facilities.

Reserve Property

Like the previous alternatives, aeronautical reserve property is depicted east and west of the runway (5.2=, 6.1- and 4.2-acre parcels), while areas better suited for non-aeronautical development are shown on the east side. This includes the 27.7-acre parcel northeast of Runway 16 as well as a 14.5-acre area west of Aviation Way.





LANDSIDE ALTERNATIVE 3

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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 Brenham Municipal Airport in the future. There is demand for new facilities at the airport, and with a changing fleet mix of aircraft that includes more sophisticated aircraft, airport and city leaders 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 an 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 the changes necessary for the airport to meet ultimate C-II-4000 design standards, resolving non-standard safety area conditions in both the existing and ultimate conditions, and the potential for extending Runway 16-34. For the landside, alternatives were presented to consider additional aviation development on the east side of the airport. West side development, which would require property acquisition and new airfield pavement, has also been considered. 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 AMPC and the public will be important considerations. Additional consultation with TxDOT 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.

Chapter Five

RECOMMENDED MASTER PLAN CONCEPT

Chapter Five

RECOMMENDED MASTER PLAN CONCEPT

The airport master plan for Brenham Municipal Airport 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 Airport Master Plan Committee (AMPC) meetings and were available on the project website. A public workshop at the conclusion of the process will be held to familiarize the public with the master plan and provide the opportunity for comment. A second workshop will be held when the Draft Master Plan is presented to the Brenham City Council for approval and adoption.

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

The recommended concept provides the ability to meet the disparate needs of an 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 activities in and around the City of Brenham and regional 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 two-phased implementation of the recommended development concept includes a "future" plan and an "ultimate" plan. The future plan roughly corresponds to a period of time between now and 20 years, while the ultimate plan has been established as a point in time that could exceed 20 years, unless aviation demand dictates the need for development associated with the ultimate plan sooner. Development staging for both scenarios will be presented in Chapter Six. The following sections describe the key details of the recommended master plan concept.

AIRSIDE DEVELOPMENT

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

DESIGN STANDARDS

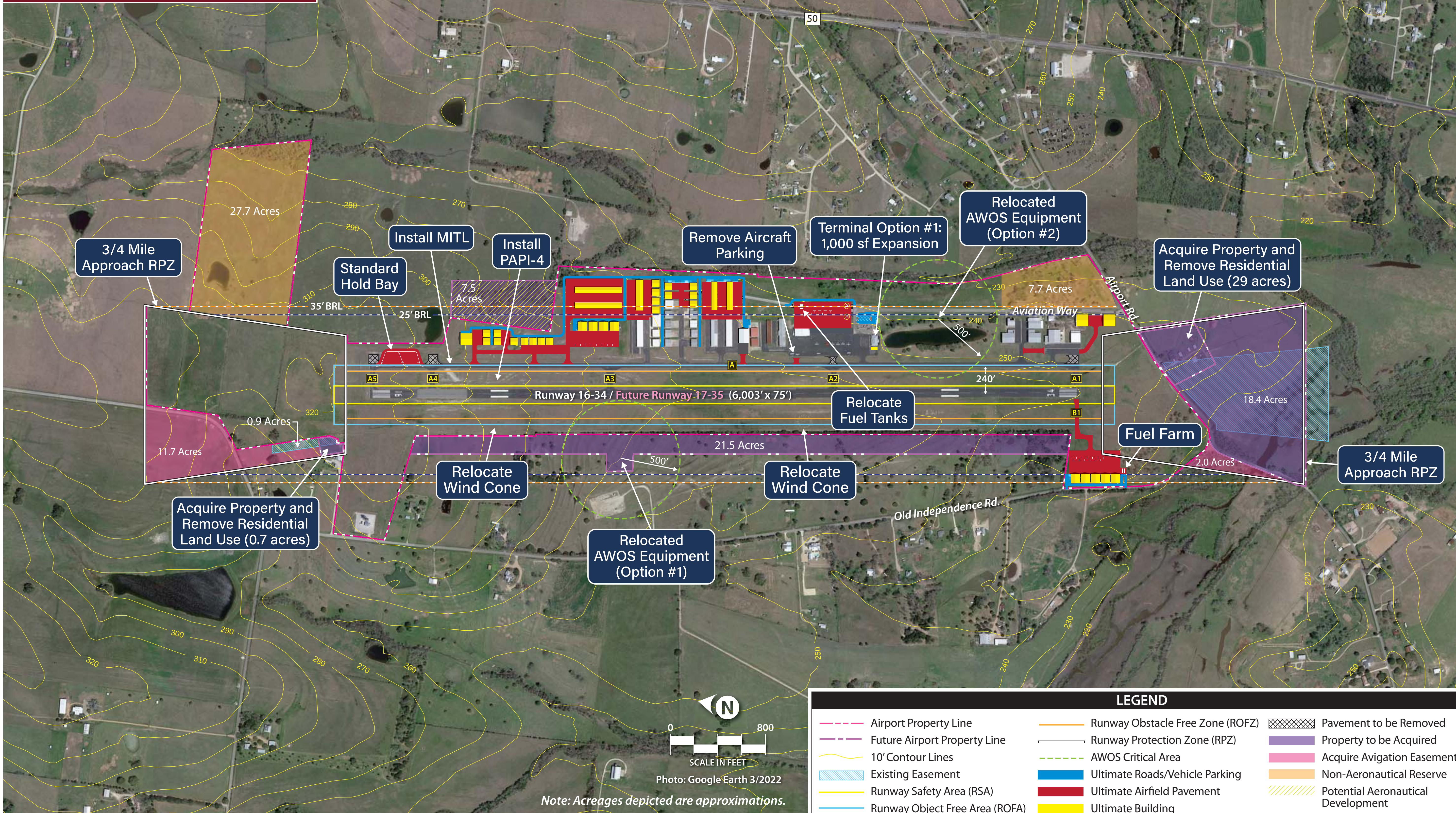
The FAA has established design criteria to define the physical dimensions of runways and taxiways, as well as the imaginary surfaces surrounding them, to enhance the safe operation of aircraft at airports. These design standards also define the separation criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on the airport's critical 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). In the case of Brenham Municipal Airport, which has only one runway, the RDC for Runway 16-34 also serves as the ARC.

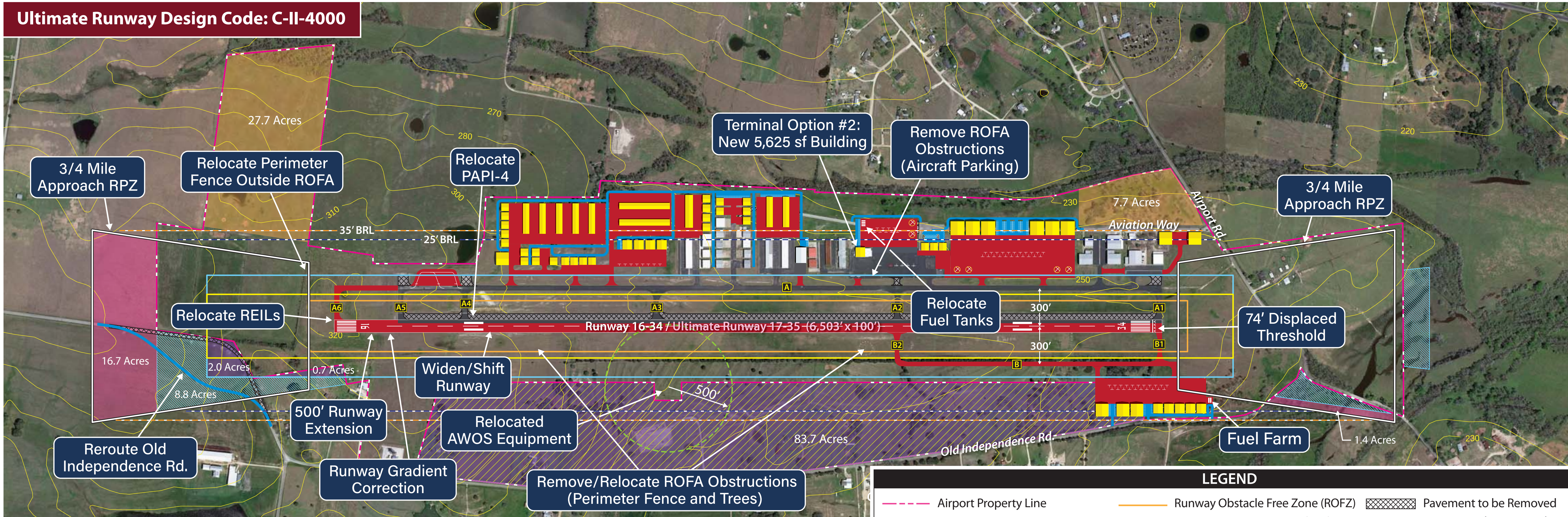
While airfield elements, such as safety areas, must meet design standards associated with the applicable RDC, landside elements can be designed to accommodate specific categories of aircraft. For example, an airside taxiway must meet taxiway object free area (TOFA) standards for all aircraft types using 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.

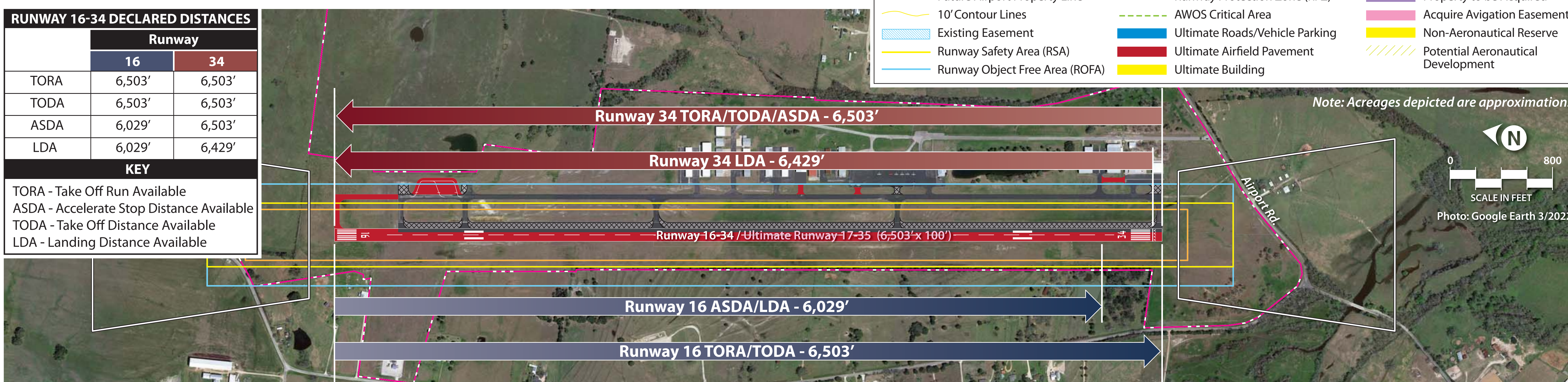
The applicable RDC and critical design aircraft for Runway 16-34 in the existing/future and ultimate conditions are summarized in **Table 5A**.

Future Runway Design Code: B-II-4000



Ultimate Runway Design Code: C-II-4000





RUNWAY 16-34 DECLARED DISTANCES

	Runway 16	Runway 34
TORA	6,503'	6,503'
TODA	6,503'	6,503'
ASDA	6,029'	6,503'
LDA	6,029'	6,429'

KEY

TORA - Take Off Run Available
ASDA - Accelerate Stop Distance Available
TODA - Take Off Distance Available
LDA - Landing Distance Available

Table 5A | Airport and Runway Classifications		
	Runway 16-34 Existing/Future	**Runway 16-34 Ultimate**
Airport Reference Code (ARC)	B-II	C-II
Airport Critical Aircraft	B-II-2A	C-II-2A
Critical Aircraft (Typ.)	Citation II/SP/Latitude	Challenger 600/604
Runway Design Code (RDC)	B-II-4000	C-II-4000
Approach Reference Code (APRC)	B/II/4000	B/II/4000
Departure Reference Code (DPRC)	B/II	B/II
Taxiway Design Group (TDG)	2A	2A*
*Based on the Citation II/SP/Latitude		
Source: FAA AC 150/5300-13B, Airport Design		

RUNWAY 16-34

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 Brenham Municipal Airport is 2° 33' E ± 0° 21' W. The runway is oriented north/south with a true heading of 171°/351°. Adjusting for the magnetic declination, the current magnetic heading of the runway is 169°/349°. As detailed previously in Chapter Three, consideration should be given to redesignating Runway 16-34 as Runway 17-35 when the next runway painting project is to be undertaken. The airport sponsor should coordinate with the Texas Department of Transportation (TxDOT) Aviation Division and the FAA prior to redesignating the runway. If these entities confirm that redesignation is necessary, this project can be incorporated into a pavement rehabilitation project.

Runway Dimensions | Runway 16-34 is currently 6,003 feet long and 75 feet wide, meeting RDC B-II-4000 design standards for runway width. 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 can limit business jet capabilities. As a general aviation airport, Brenham Municipal Airport serves a wide array of piston and turbine aircraft, with operations by both aircraft types expected to increase over the planning period. The City of Brenham is also a growing community, and its location halfway between two of Texas' largest and steadily growing cities, Austin and Houston, results in significant growth potential for new residents and businesses basing in the area. These local factors, combined with a projected shift in the national fleet mix to include more turbine aircraft, support a need to plan for a longer runway. Increasing the utility of the runway to safely accommodate business jets will also expand Brenham Municipal Airport's market potential, attracting new itinerant operators, based aircraft, and businesses that provide services to business jet clients.

The future recommended development concept includes a plan to maintain the runway's current dimensions; however, the ultimate plan recommends an increase in the runway width to 100 feet in order to meet an expected transition to C-II-4000 design standards. Additionally, the separation standard between the runway and the parallel taxiway increases to 300 feet in the ultimate C-II-4000 condition. Currently, the runway and taxiway are separated by 240 feet in accordance with B-II-4000 design criteria.

In the previous chapter, various options were examined on ways to achieve the C-II design standards for increased runway width and runway to taxiway separation. The ultimate term plan considers improving the runway to taxiway distance by reconstructing the entire runway pavement 60 feet to the west, which will then offer a 300-foot runway/taxiway separation. This plan preserves the parallel taxiway in its current location and will not encroach or negatively impact existing eastside landside facilities. It should be stated clearly that this project is recommended with the understanding that it would be completed when a) justification arises in the form of 500 or more annual itinerant operations by C-II aircraft and b) a runway reconstruction project is necessary. The relocation of the Runway 16-34 centerline will require the removal of existing runway pavement on the east side, as illustrated on the back side of **Exhibit 5A**. New runway pavement is planned on the west side to achieve a 100-foot-wide surface, in accordance with runway width standards for C-II-4000.

Significant earthwork will be necessary to shift the runway as previous projects have demonstrated that the existing runway profile has poor basic materials and waning subgrades. However, following discussions with airport and city staff and the engineer providing support on this master plan, shifting the runway centerline has been deemed a more prudent plan than shifting the taxiway to meet the separation standard and adding the runway width increase to either side (12.5 feet of pavement on either side of the runway). It should be noted that this determination was based on limited available information, and the plan is subject to change if future information warrants.

A 500-foot extension to Runway 16 (north end) is also planned in the ultimate timeframe to achieve a pavement length of 6,503 feet. At this length, 100 percent of the small to mid-sized business jet fleet could safely operate at 60 percent useful load.[1] The plan will require a 74-foot displacement of the Runway 34 threshold (south end), which is necessary to provide the full runway safety area (RSA) and runway object free area (ROFA) beyond the runway end in the ultimate C-II-4000 environment. If, and when, the airport transitions to C-II, these safety area dimensions will increase in size, and as discussed in the previous chapter, displacing the threshold is a minimally impactful solution to achieve standard safety areas. This will be discussed in greater detail in the next section.

Connected actions to the 500-foot extension of Runway 16-34 and transition to ultimate C-II-4000 include the following:

- Environmental analysis to determine the potential for environmental impacts to occur, likely in the form of an Environmental Assessment (EA).
- Acquisition of property interests (fee simple or avigation easement) to protect safety areas (to be discussed).
- Rerouting of Old Independence Road around the ultimate ROFA at the Runway 16 end.
- Extension of Taxiway A to the ultimate Runway 16 end.
- Clearing and grading of the ultimate RSA and clearing within the ultimate ROFA.
- Displacement of the Runway 34 threshold (to be discussed).
- Relocation of the runway end identifier lights (REILs) and precision approach path indicator (PAPI) equipment.

[1] Refer to Table 3E.

- All new runway pavement would be equipped with medium intensity runway edge lighting (MIRL) and new taxiway pavement would be equipped with medium intensity taxiway edge lighting (MITL).
- Re-marking of runway pavement with non-precision markings.

It should be again noted that the runway extension, width increase, and relocation is included for planning purposes only and is not currently justified. An extension project would require additional aircraft operations that demonstrate the need for increased runway length before the FAA will offer grant funding assistance for its construction.

Runway Safety Areas | In the existing/future condition, the RSA and ROFA are fully contained on airport property, while portions of each runway protection zone (RPZ) extend beyond airport property and contain potentially incompatible land uses. As such, the existing/future plan includes a recommendation for the airport to acquire fee simple the portions of the RPZs that contain residential uses and remove these structures. On the Runway 16 end, this includes an area encompassing approximately 0.7 acres, depicted in purple shading on **Exhibit 5A**. On the Runway 34 end, the residential uses are located on a parcel of land adjacent to Airport Road. Both of these areas, along with the majority of the Runway 34 RPZ, are recommended to be acquired in fee. It is further recommended that the airport obtain property interest, in the form of an avigation easement, at a minimum, with fee simple as the preferred, over the remaining uncontrolled portions of the RPZs. It should be noted that portions of both RPZs are currently protected by easements. The airspace above part of the property within the current Runway 34 RPZ is protected via a clear zone easement acquired in 1971. Since that time, the dimensions of the RPZ have increased, due to the implementation of the RNAV (GPS) approach, leaving a portion of the current Runway 34 RPZ uncontrolled. In addition to the plan to acquire fee simple approximately 29.0 acres of the Runway 34, it is recommended that the airport sponsor acquire an avigation easement over the remaining 2.0 acres of the Runway 34 RPZ. On the Runway 16 end, a 0.9-acre portion of the RPZ is protected by an avigation easement; however, the remaining property within the RPZ is unprotected and an avigation easement over this area is recommended. It is important to note that avigation easements generally only offer the rights of airspace and do not limit real land uses, such as residential development. As such, fee simple acquisition is the ideal land use protection instrument.

In the ultimate C-II environment, additional property acquisition would be necessary due to the increased dimensions of the RSA and ROFA, the planned runway extension, and shifting the runway centerline. To prepare for this ultimate scenario, the future plan includes a recommendation for the airport sponsor to acquire approximately 21.5 acres of property on the west side of the runway. This includes property within the ultimate ROFA as well as the property on which the AWOS equipment could be located (to be discussed further in a later section). The remainder of the property within the C-II RSA and ROFA (2.7 acres) off the Runway 16 end is planned to be acquired to support the ultimate concept. This property includes a portion of Old Independence Road, which is planned to be rerouted around the ultimate ROFA. On the Runway 34 end, the ultimate RSA/ROFA extends beyond the airport's property line and over Airport Road. Rather than close or reroute Airport Road, the ultimate plan recommends displacing the Runway 34 threshold. This will be discussed further in the next section.

The Runway 16 RPZ will also shift due to the planned runway extension and centerline relocation, leaving approximately 16.7 acres of RPZ property unprotected. As such, the ultimate development concept depicts a plan to protect this area via avigation easement (while fee simple would be preferred), along with a 3.8-acre portion of property within the ultimate Runway 34 RPZ.

It should be noted that public roadways currently traverse the RPZs at both runway ends. Old Independence Road passes through the Runway 16 RPZ (north end), while Airport Road passes through the Runway 34 RPZ (south end). As mentioned, Old Independence Road is proposed to be rerouted, pending further evaluation, to avoid the ultimate RSA and ROFA off the Runway 16 end, but is planned to traverse the ultimate RPZ. It should be noted that a potential rerouting of Old Independence Road would only occur if and when Runway 16-34 is extended. Airport Road is also planned to remain within the Runway 34 RPZ. Following discussion with the airport sponsor and considering guidance from FAA AC 150/5190-4B, *Airport Land Use Compatibility Planning*, including an alternatives evaluation of various mitigative scenarios, it was deemed least impactful to the operation of the airport and the community to allow these roads to remain within the RPZs.

In terms of safety area obstructions in the existing/future condition, the airport's lighted wind cone located at midfield and the supplemental wind cone located near the existing Runway 16 end obstruct the ROFA in the future and ultimate conditions. As such, both wind cones are planned to be relocated. Additional ROFA obstructions are also present in the ultimate C-II condition, including portions of the airport's perimeter fence, aircraft parking on the west side of the terminal apron, and vegetation. The ultimate recommended plan calls for these obstructions to be removed and the fencing to be relocated outside the ROFA.

Runway 34 Threshold Displacement | The ultimate recommended development concept also includes a plan to displace the Runway 34 threshold by 74 feet, which will allow the airport to meet C-II standards for RSA and ROFA. The displacement artificially relocates the RSA and OFA without having to modify the current location of Airport Road. Displacing the threshold results in a reduction of available runway length during certain operations and necessitates the implementation of declared distances. As described previously in Chapter Four, the declared distances are:

- Takeoff Run Available (TORA) – the runway length declared available and suitable for the ground run of an aircraft taking off (factors in the positioning of the departure RPZ);
- Takeoff Distance Available (TODA) – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA; the full length of the TODA may need to be reduced because of obstacles in the departure surface;
- Accelerate-Stop Distance Available (ASDA) – the runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff (factors in the length of RSA/ROFA beyond the runway end); and
- Landing Distance Available (LDA) – the runway length declared available and suitable for landing an aircraft (factors in the length of RSA/ROFA beyond the runway end and the positioning of the approach RPZ).

As depicted on the second page of **Exhibit 5A**, at the ultimate length of 6,503 feet, the LDA for landing operations to either end of Runway 16-34 is impacted, with 6,029 feet of usable runway pavement for aircraft landing on Runway 16 and 6,429 feet of available runway for aircraft landing on Runway 34. Takeoff operations from either runway have the full 6,503 feet of pavement available, with the exception of the ASDA for operations on Runway 16. **Table 5B** details the declared distances for operations on Runway 16-34.

Table 5B | Declared Distances			
	Affected Runway Design Standard	**Runway 16**	**Runway 34**
TORA	Departure RPZ	6,503'	6,503'
TODA*	Departure Surface	6,503'	6,503'
ASDA	RSA, ROFA	6,029'	6,503'
LDA	RSA, ROFA, Approach RPZ, Approach Surface	6,029'	6,429'
*TODA may be impacted by penetrations to the departure surface; analysis pending			
Source: Coffman Associates analysis			

Pavement Strength | Runway 16-34 is currently strength-rated for up to 30,000 pounds for single wheel loading aircraft (SWL), which is adequate for all small aircraft and many aircraft within the business jet fleet. The ultimate critical aircraft (Challenger 600/604) has a maximum takeoff weight (MTOW) of 48,200 pounds or less, on dual wheel landing gear. In the future, the runway at Brenham Municipal Airport should be planned for an ultimate pavement strength of 60,000 pounds dual wheel loading (DWL).

Instrument Approach Procedures | Both runway ends offer published instrument approach procedures. Runway 16 is equipped with an LPV (GPS) approach with visibility minimums down to ⅞-mile, while Runway 34 offers an LPV (GPS) approach with visibility minimums down to ¾-mile. Consideration was given to the potential for an instrument approach with visibility minimums below ¾-mile but was ultimately rejected due to the challenges that would result (i.e., larger RPZs requiring additional property acquisition, 400-foot runway to taxiway separation requirement, and installation of an approach lighting system). The benefit of providing the lower approach minimums was marginal compared to these obstacles, which would require significant and costly modifications unlikely to garner local support. As such, the plan includes the potential for lower approach minimums to Runway 16 (not lower than ¾-mile) and maintaining current instrument approach capabilities to Runway 34. This would not alter the size of the RPZs serving each runway end.

Visual Approach Aids | Runway 16-34 is currently equipped with a PAPI-2 at the Runway 16 end and a PAPI-4 at the Runway 34 end. Both runway ends are equipped with REILs. The plan includes upgrading to a PAPI-4 system at the Runway 16 end and maintaining the existing PAPI-4 on Runway 34 and the REILs at both runway ends. If, and when, the airport transitions to C-II-4000 and the runway is widened and relocated, these visual approach aids are planned to be relocated accordingly.

Runway Line-of-Sight and Gradient | As discussed in Chapter Three, Runway 16-34 has a longitudinal gradient of 1.12 percent, which meets the FAA's standard for runway gradient of 2.0 percent for the existing and future B-II-4000 environment. For aircraft design group C, the gradient standards become more restrictive decreasing to 1.5 percent, and include additional standards for the first and last quarter of the runway length which cannot exceed 0.8 percent. In the ultimate C-II-4000 condition, Runway 16-34 meets the longitudinal gradient standard but, based on United States Geological Survey (USGS) data, exceeds the gradient standard at the Runway 16 end. Based on limited available data from the USGS, the first quarter gradient for Runway 16 is 2.01 percent, exceeding the C-II standard. As such, the ultimate plan includes a recommendation for an engineering analysis and earthwork to correct the grade at the Runway 16 end, so it is within the FAA's tolerance of 0.8 percent or less.

Weather Reporting Equipment | As discussed in previous chapters, the existing AWOS equipment at the airport is planned to be replaced and moved to a new location. The future recommended development concept depicts two options for relocating the AWOS. The first option is on the west side of the airport, approximately 2,100 feet from the existing Runway 16 threshold and approximately 500 feet from the runway centerline. As noted previously, siting the AWOS in this location would require the acquisition of private property. The second option for relocating the AWOS is on the east side of the airport near the pond. This location, approximately 1,250 feet from the Runway 34 threshold and approximately 650 feet east of the runway centerline, is on airport property and would not necessitate any property acquisition. It would, however, require the removal of trees and vegetation within the AWOS's 500-foot critical area to ensure the sensors remain free of any signal interference.

As shown on the ultimate recommended development concept, the pond area is planned to be developed if/when demand dictates. If the City of Brenham and TxDOT opt to relocate the AWOS equipment to this site, and apron/hangar development occur in this area, the equipment would again need to be moved. It is assumed that this development would not occur during the AWOS's useful lifespan (approximately 20 years), and as such, it would be necessary to replace/upgrade the equipment and a new site would again be evaluated at that time.

TAXIWAY IMPROVEMENTS

Taxiway Design | The entirety of the Brenham Municipal Airport taxiway system is planned to meet Taxiway Design Group (TDG) 2A standards, which call for a width of 35 feet. All taxiways are currently 40 feet wide. The future and ultimate recommended development concept includes a plan for all taxiways – existing and ultimate – to be at least 35 feet wide. *If the airport sponsor wishes to maintain existing taxiway pavement at 40 feet wide, it should be with the understanding that the costs to rehabilitate the additional width may be the sponsor's responsibility.*

Taxiway A | Taxiway A, the full-length parallel taxiway supporting Runway 16-34, is separated from the runway by 240 feet, centerline to centerline. While this meets the existing and future B-II-4000 design standards for runway to taxiway separation, it does not meet ultimate C-II-4000 standards, which call for 300 feet of separation. As such, the ultimate recommended development concept includes a plan to relocate the Runway 16-34 centerline 60 feet to the west to provide for a 300-foot separation from the taxiway, as discussed previously. Taxiway A is planned to remain in its current location throughout the planning period. In the ultimate plan, Taxiway A is planned to be extended 500 feet north to the ultimate Runway 16 threshold. Existing taxiway connectors are planned to be maintained, with a new connector (ultimate Taxiway A6) planned to provide access to the extended Runway 16 threshold. Taxiway A is also recommended to be equipped with MITL on all existing and proposed new pavement.

Taxiway B | In the future recommended development concept, Taxiway B1 is planned to extend from the Runway 34 threshold to provide access to a proposed hangar development area. In the ultimate recommended development plan, additional taxiway pavement (ultimate Taxiway B) is planned to be constructed to serve as a 35-foot-wide partial parallel taxiway to Runway 16-34. An additional connector, Taxiway B2, is planned to provide another access point from the runway. Ultimate Taxiway B and connectors are planned to be equipped with MITL.

Taxiway Geometry Improvements | Previous chapters have discussed non-standard taxiway geometry issues at Brenham Municipal Airport, including where existing Taxiways A1 and A2 provide direct access from the apron area to the runway. Consideration was given to the inclusion of a no-taxi island on the terminal apron to eliminate the direct access via Taxiway A2, as well as removal of existing taxiway pavement and construction of new pavement to offset the connecting taxiway pavement. Ultimately, the no-taxi island option was discarded, and preference was given to removal of portions of Taxiways A1 and A2 east of Taxiway A. As shown on **Exhibit 5A** and **Figure 5A**, new taxiway connector pavement is planned leading from Taxiway A to the north side of the terminal apron. Construction of this new connector would necessitate the removal of four aircraft parking positions in the future term, as shown on the future development plan. On the south end of the airport, the pavement that connects Taxiway A1 to the apron is planned to be removed, and new taxilane pavement constructed between the two apron areas. This eliminates the direct access point and allows ingress/egress from this apron area.

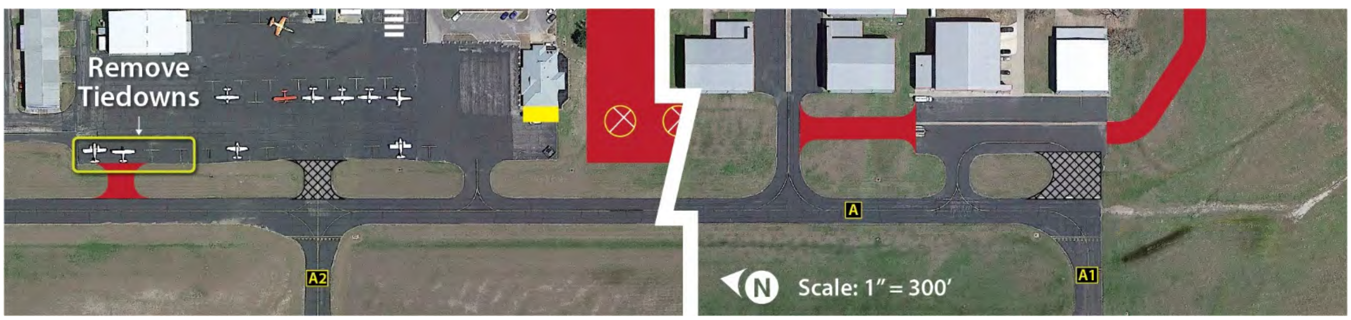


Figure 5A – Direct Access Mitigation

Holding Bays | The traditional holding aprons at the end of existing Taxiway A near the Runway 16 threshold are now considered non-standard per FAA airfield design. Therefore, the future plan includes eliminating the existing holding aprons and replacing them with a single taxiway holding bay that can accommodate multiple aircraft. The planned holding bay has clear entrance/exit points and independent parking areas denoted by centerline markings. Each holding bay is designed to accommodate airplane design group (ADG) II aircraft.

Holding Position Markings | The holding positions at Brenham Municipal Airport are currently separated from the Runway 16-34 centerline by 200 feet, meeting B-II-4000 standards. These markings are planned to remain in the future recommended development concept; however, in the ultimate recommended concept, taxiways are planned to be re-marked with hold lines separated by 250 feet from the runway centerline, in accordance with ultimate C-II-4000 design standards.

LANDSIDE CONCEPT

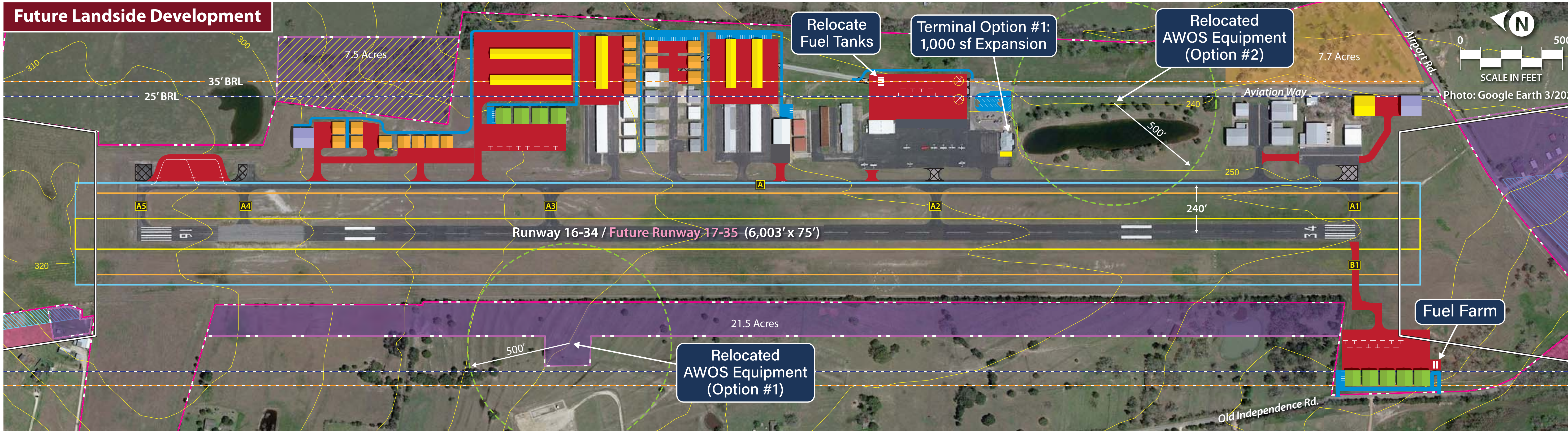
The primary goal of landside facility planning is to provide adequate space to meet reasonably anticipated general aviation needs, while also optimizing operational efficiency and land use. Achieving these goals yields a development scheme that segregates functional uses, while maximizing the airport's revenue potential. The key issues to be addressed in the landside areas at Brenham Municipal Airport are typical of most general aviation airports and include providing an expanded terminal services facility, increasing hangar and apron capacities, and adding amenities to accommodate existing users and attract new users. It should be clearly stated that 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 Brenham Municipal Airport staff when considering new developments.

Exhibit 5B depicts a close-in view of proposed landside facilities on both the east and west sides of the airport. A 25-foot and 35-foot building restriction line (BRL) is also included on the graphic. As discussed in the previous chapter, the BRL serves strictly as a planning guide for vertical construction on the airport by factoring in Code of Federal Regulations (CFR) Part 77 surfaces. Structures should generally be planned beyond the BRL, farther from the runway, to ensure clearance of safety areas and imaginary surfaces. However, as is the case at Brenham Municipal Airport, it is not uncommon for airports to have development inside the BRL. The FAA may require structures to be equipped with obstruction lighting, and all proposed structures should undergo airspace analysis prior to development to ensure there are no penetrations to Part 77 surfaces.

All of Brenham Municipal Airport's existing landside facilities are located east of Runway 16-34. This includes the terminal building, aircraft parking aprons, and aircraft storage hangars. The Facility Requirements chapter determined that additional capacity may be needed in each of these areas by the end of the planning period, and the Alternatives chapter considered several facility layout concepts. The preferred development concept for landside facilities is depicted on **Exhibit 5B**. It should be noted that, like the airside concept, future and ultimate plans are presented, with the top half of the exhibit illustrating potential future development and the bottom half showing additional potential development in the ultimate scenario. While a significant portion of these two plans is similar, especially on the east side, there are a few primary differences between the two layouts. These are listed below and will be described in greater detail in upcoming sections:

1. Two options for the terminal building are presented, with the future plan retaining the terminal in its existing location and the ultimate plan reflecting a new, relocated terminal building.
2. On the northeast side of the airfield, property is proposed for acquisition to support expanded development of landside facilities in the ultimate term.
3. On the southwest side of the airfield, property is proposed for acquisition to support expanded development of landside facilities in the ultimate term.
4. The ultimate plan depicts expansion of facilities (hangars, aprons/taxilanes, and access roads) proposed in the future plan on both the east and west sides of the field. This includes ultimate proposed development on the pond site.

Future Landside Development



Ultimate Landside Development

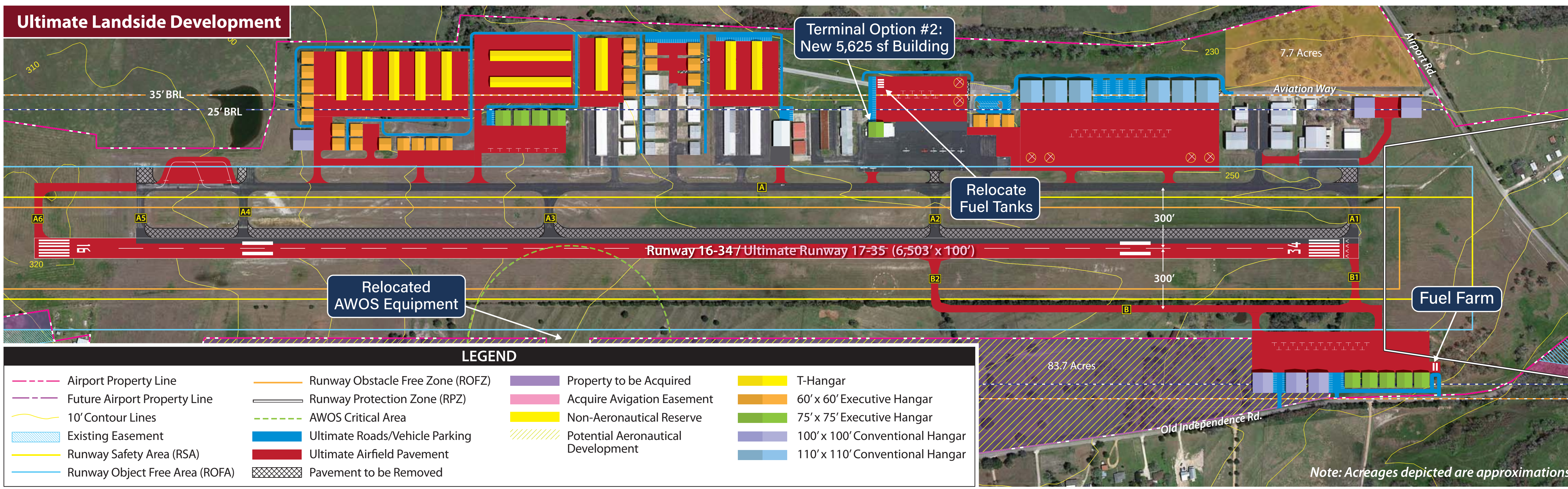


Exhibit 5B
RECOMMENDED LANDSIDE DEVELOPMENT

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The future and ultimate landside plans depict almost a full build-out of the airport's property on the east side. However, as described in previous chapters, there are significant terrain and floodplain challenges on this side of the airport that could limit development potential when the cost-benefit is considered. Nonetheless, it is important to plan for potential development of existing airport property so decision-makers can carefully weigh all options (i.e., costs to develop in more challenging areas vs. costs to acquire new property to develop).

Terminal Building and Vehicle Parking| The alternatives analysis considered different options for expansion of the existing terminal building, as well as the possibility to develop a new terminal building. The recommended development concept has included both options, which affords the City of Brenham greater flexibility in planning when capacity reaches a point where expansion is needed, or the existing terminal has reached an age that the benefits of constructing a new building outweigh the costs of maintaining the existing building. The future development concept illustrates a 1,000-square-foot (sf) expansion of the existing terminal building. This expansion is intended to accommodate additional transient operators accessing terminal services, while maintaining airport staff offices in the same location. The vehicle parking lot on the east side of the building is also planned to be expanded to provide additional parking for airport users and visitors.

In the ultimate scenario, a second option is presented that relocates the terminal building to the north side of the apron. The new terminal would be located on the site of the existing maintenance hangar, which would be redeveloped to operate as the terminal building. This location was the site of the original terminal building prior to construction of the existing structure. Option #2 plans for a 5,625-sf building that could include the amenities pilots expect from a facility like Brenham Municipal Airport, such as a lobby, pilots' lounge, flight planning area, and restrooms and showers, along with dedicated space for airport staff. If the airport sponsor desires a restaurant area as is currently available in the existing terminal building, space could be set aside for that use on the proposed 5,625-sf footprint.

Expanded vehicle parking facilities are also depicted for both scenarios. If the City of Brenham elects to retain the existing terminal building on the south side of the apron, additional parking is proposed east of the current parking lot. If the second terminal option is pursued, a new parking area is planned at the rear of the proposed terminal, with access provided from Aviation Way.

Aircraft Storage Facilities | As mentioned, all of Brenham Municipal Airport's existing facilities are concentrated on the east side. Currently, there is a mix of T-hangars, executive box, and conventional hangars at the airport. The recommended plan includes additional development of each of these hangar types on both the east and west sides of the airfield, with the understanding that some of these hangars will likely be used to support specialized aviation service operators (SASOs) offering aircraft maintenance and other services. The following hangar development areas are planned for the airport:

- **T-hangars** – The future plan includes the addition of five T-hangars along the eastern boundary of the airport. These hangars are planned to be accessed via Aviation Way, which is proposed to be realigned to allow access to the new landside facilities on this side of the airfield. The ultimate scenario adds five more T-hangars and a greater extension of Aviation Way to access these units.

- **Executive Hangars** – Several areas on the east side of the airport are planned for new executive hangars. In the future development concept, this includes eighteen 60' by 60' hangars, depicted in orange on **Exhibit 5B**. Four 75' by 75' hangars are also planned, as shown in green. The ultimate development concept includes eight additional 60' by 60' executive hangars on the east side. Three of these are located near the existing terminal building, and development of these hangars would be contingent upon relocation of the terminal to the north side of the apron (Terminal Option #2). Each proposed hangar is served by apron and/or taxilane pavement and can be accessed by vehicles from Aviation Way. On the west side, five 75' by 75' executive hangars are proposed on existing airport property in the future term, with a new vehicle access road and parking for tenants. As described in the Taxiway section previously, a new taxiway extending from the Runway 34 threshold to the southwest apron is proposed in the future term, with expansion of the taxiway system in this area planned for the ultimate scenario.

- **Conventional Hangars** – The future and ultimate recommended plan includes proposed conventional hangars on both the east and west sides of the airport. On the southeast side, two 100' by 100' hangars are planned near the intersection of Airport Road and Aviation Way. These hangars would be accessed from a new taxilane extending from the south apron area. On the northeast side, a single 100' by 100' conventional hangar is also proposed. Again, vehicle access to each of these is provided from existing and new portions of Aviation Way, which is proposed to be realigned and extended to accommodate planned development. In the ultimate plan, the pond is proposed to be filled, allowing for additional development along the flightline. During the planning process, various options were considered for the future of this site. While the pond is an attractive natural feature at the airport, it also occupies a prime location on the flightline that would potentially be better served for aviation uses. Additionally, the pond is an attractant for birds and other wildlife which pose a safety hazard at the airport. The ultimate plan depicts six 110' by 110' conventional hangars, fronted by a large apron with parking for both fixed wing aircraft and rotorcraft. These hangars are envisioned to be used by SASOs as well as the potential for a community hangar to house transient aircraft.

  On the west side of Runway 34, additional conventional hangars are proposed for the ultimate term, pending property acquisition. As shown on the bottom half of **Exhibit 5B**, the plan accounts for expanded development, with three new conventional hangars proposed north of the planned executive hangars.

Aircraft Parking Apron | Currently, Brenham Municipal Airport offers marked aircraft parking on a 15,500-square-yard (sy) apron adjacent to the terminal. Two smaller apron areas are located on the south side of the field. The Facility Requirements chapter identified a need for additional apron area and aircraft parking. The future recommended development concept includes two additional apron areas on the east side. The first is an eastward expansion of the existing terminal apron, which would require relocation of the fuel tanks that are currently located on the eastern edge of the apron (to be discussed in greater detail below). Expansion of the terminal apron would allow for additional tiedowns for fixed-wing aircraft and dedicated helicopter parking. A second apron area is located farther north, near Taxiway A3. This apron is planned to support a complex of smaller, executive box hangars and includes additional tiedowns for fixed-wing aircraft. In the ultimate recommended plan, a third apron is proposed to be constructed on the existing pond site, which, if pursued, would be filled and graded to support new pavement and ultimate facilities. The proposed apron on this site would also be planned to provide additional parking for both fixed-wing aircraft and helicopters.

On the west side, a new apron is proposed to support future hangar development/aviation businesses and includes marked aircraft parking. Ultimately, this apron could be expanded farther north to support additional hangars and tiedowns. All aprons are planned to include taxilanes that meet ADG II standards, with the exception of the terminal apron expansion. The marked aircraft parking in this area is designed to accommodate smaller Group I aircraft, with parking for larger Group II aircraft provided on existing terminal apron pavement.

Fuel Facilities | Fueling facilities at Brenham Municipal Airport are currently centrally located on the eastern edge of the terminal apron. In order to expand this apron as proposed, the fuel tanks would need to be relocated. Several sites were considered, but the future and ultimate recommendation is to locate the tanks on the northeastern corner of the expanded terminal apron. In this location, the tanks do not impede aircraft movements or potential parking and could be easily accessed by both fuel trucks and aircraft.

Vehicle Access and Parking | Consideration has been given to ensuring that vehicular traffic remains segregated from areas where aircraft are operating. As such, the recommended plan includes new access roads and parking areas to hangar developments to prevent aircraft and vehicles from using the same pavement. Each of these areas is accessible from Aviation Way on the east side and Old Independence Road on the west side, with secure access gates and dedicated parking areas for tenants and airport staff.

Property Acquisition for Aeronautical Reserve | As shown on the future recommended development plan, a 7.5-acre tract is proposed for acquisition to support landside development depicted on the ultimate concept. This property is proposed to be acquired at some point in the future term in order to preserve the potential for development at a later date. Significant development potential also exists west of the airport's current boundary. Approximately 83.7 acres of property between the ultimate ROFA and Old Independence Road is proposed for acquisition for the purpose of ultimately being developed for aviation uses. This could include an expansion of Ultimate Taxiway B to serve as a full-length parallel taxiway, as well as additional landside facilities.

Non-Aeronautical Development/Potential Release | As depicted on the development concept, there are two areas on airport property that are earmarked for non-aeronautical development. Both are inaccessible to the airfield and, therefore, cannot be developed for aviation-related uses. The first, a 7.7-acre parcel, is located on the southeast side, east of Aviation Way, while the second area, a 27.7-acre parcel, is located on the northeast side. Currently, the 27.7-acre parcel is leased for agricultural use. The plan reserves both parcels for non-aeronautical development to include compatible commercial, industrial, or agricultural developments.

A secondary option that the airport sponsor may consider is to release the property from aviation use obligation (land use release). Generally, airport property is subject to Airport Improvement Program (AIP) grant assurances; therefore, if the sponsor were to opt to release the property, they would 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, the city would be able to lease 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.

It should also be noted that, if release of all or a portion of the 27.7 acres is pursued, one option the airport may consider is a land swap for the 7.5-acre parcel that is proposed for acquisition on the future recommended development concept. Further coordination with TxDOT, FAA, and local property owners would be necessary if a land swap is pursued.

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 Texas Solid Waste Management

The *Texas Administrative Code Title 30 Part 1 Chapter 330: Municipal Solid Waste* [2] was adopted to regulate waste management. The code states to:

[2] Texas Administrative Code - https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=330&rl=103

- Instruct sound methods of solid waste management and disposal; and
- Provide policy and procedural guidance to state, substate, and local agencies in the proper management of solid waste.

SOLID WASTE

Typically, airport sponsors have purview over waste handling services in facilities owned and operated, such as the passenger terminal building, airport 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 services.

For airports, waste can generally be divided into eight categories:[3]

- **Municipal Solid Waste** (MSW) is more commonly known as trash or garbage consisting of everyday items that are used and then discarded, such as product packaging.

- **Construction and Demolition Waste** (C&D) is considered non-hazardous trash resulting from land clearing, excavation, demolition, renovation or repair of structures, roads, and utilities, including concrete, wood, metals, drywall, carpet, plastic, pipe, cardboard, and salvaged building components. C&D is also generally labeled 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 aircraft. 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[4] 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 into the public sanitary sewage 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.

3 Recycling, Reuse and Waste Reduction at Airports, FAA (April 24, 2013)

4 A triturator facility turns lavatory waste into fine particulates for further processing.

- **Hazardous Wastes** are governed by the *Resource Conservation and Recovery Act* (RCRA), as well as the regulations in 40 Code of Federal Regulations (CFR) Subtitle C, Parts 260 to 270. The 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 5C**, there are multiple areas where the airport potentially contributes to the waste stream, including the terminal building, on-airport tenants, hangars, and airport construction projects. To create a comprehensive waste reduction and recycling plan for the airport, all potential inputs must be considered.

EXISTING SERVICES

Brenham Municipal Airport does not have an existing recycling program in place. The airport's current solid waste provider is the City of Brenham, which uses a third party contractor for this service. There are two to three solid waste bins that are secured by and paid for by the airport's tenants.

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 receptacles for the collection of waste, recyclables, or compostable materials and contracts for the removal by a single local provider.[5] 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 it has fewer 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. However, airport tenants, such as fixed base operators, retail shops, and others 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.

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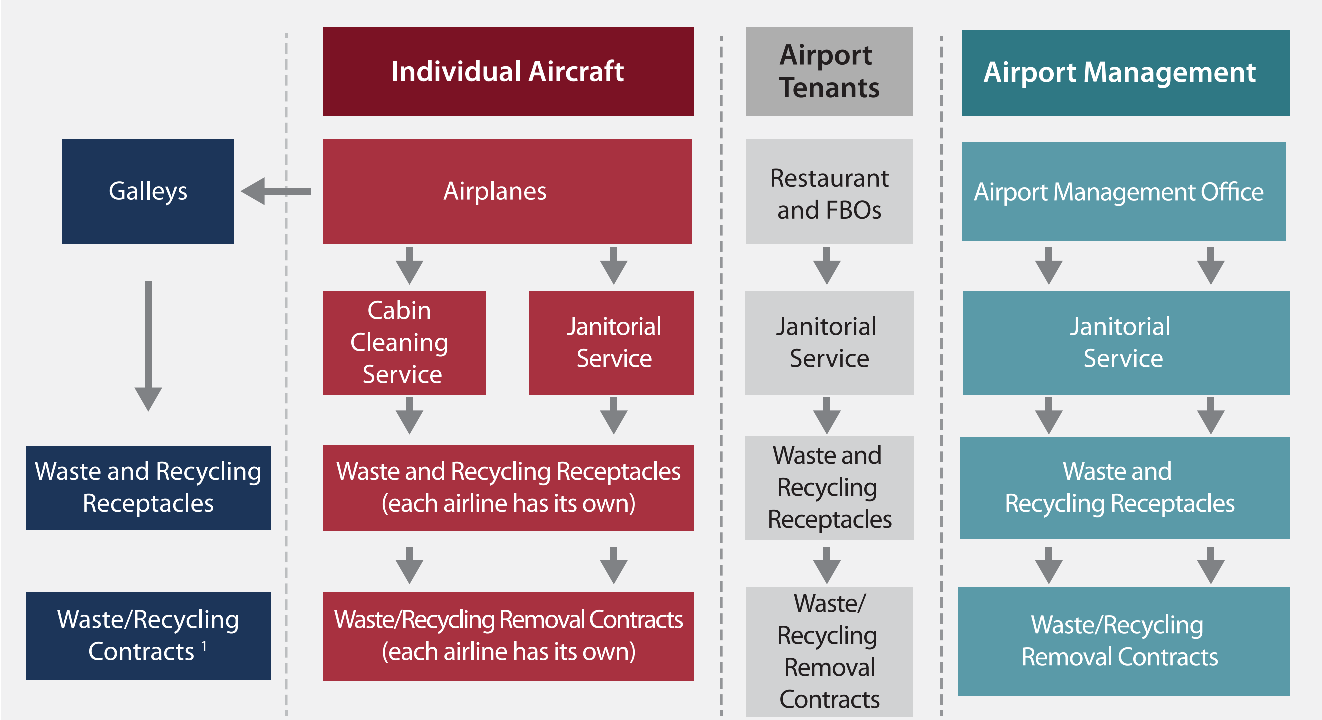
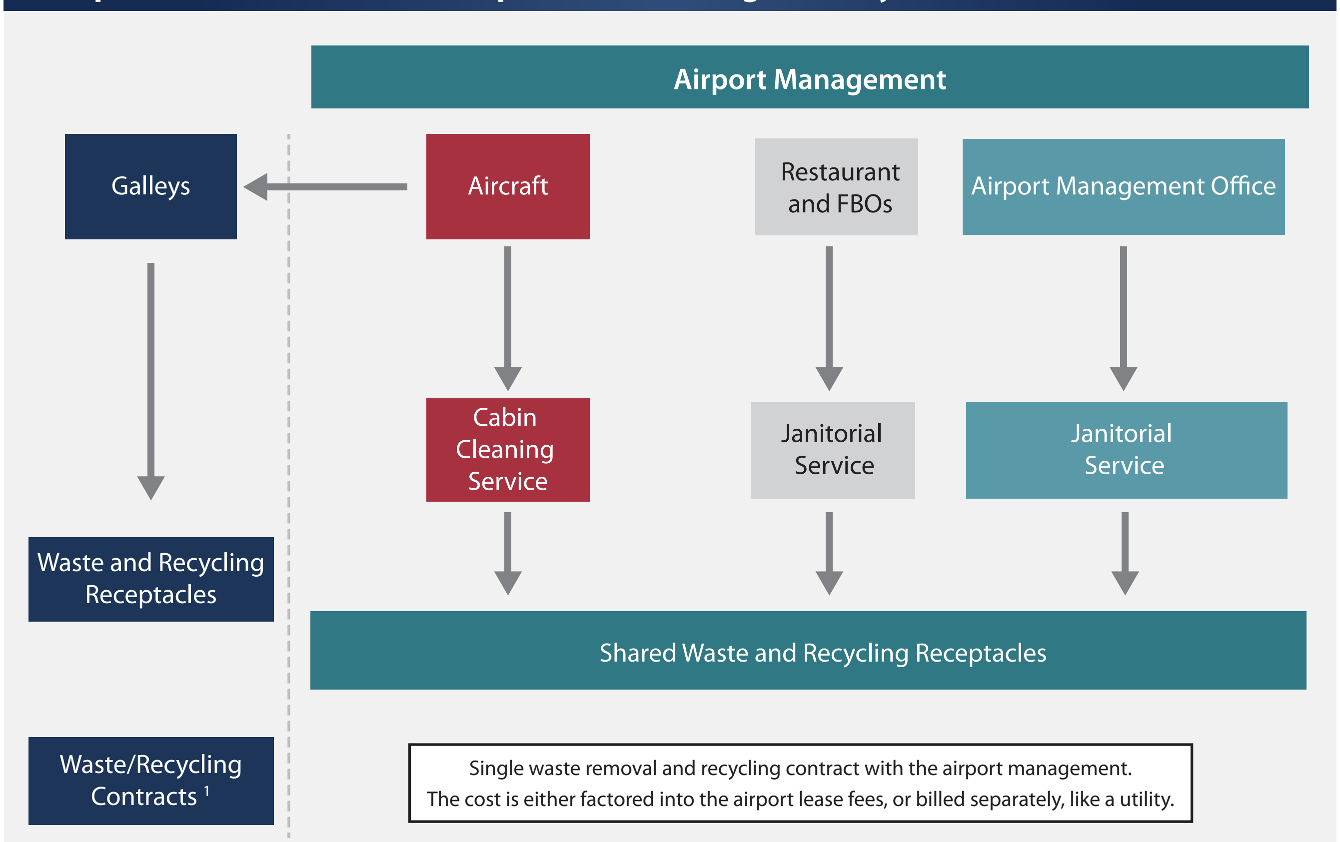
[5] *Airport Waste Management and Recycling Practices* (2018) The National Academies of Sciences, Engineering, and Medicine Airport Cooperative Research Program, Synthesis 92.

Components of a Decentralized Airport Waste Management System



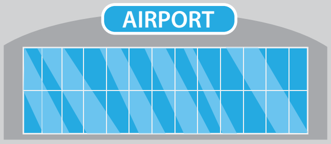
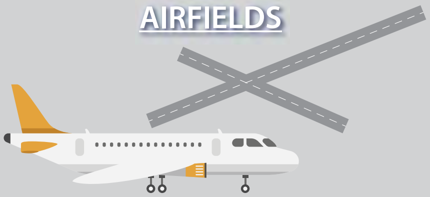
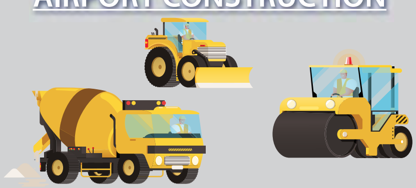
Components of a Centralized Airport Waste Management System



[1] Galleys usually 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.

AIRPORT WASTE STREAMS

AIRPORT AREA	POTENTIAL INPUTS	POTENTIAL OUTPUTS
	Restaurants Shops Passengers Employees	Food Waste, Paper Plastic, Aluminum Cans Trash, Grease & Oil Green Waste Deplaned Waste
AIRFIELDS 	Aircraft Operations	Runway Rubber Green Waste
AIRCRAFT 	Aircraft Ground Support Equipment (GSE)	Vehicle Waste Plastic Wastewater Hazmat
AIRPORT CONSTRUCTION 	Construction Re-Construction Demolition	Reused Concrete Reused Asphalt Vehicle Waste Soils, Building Materials Wood, General Waste
FLIGHT KITCHENS 	Aircraft Food Services	Food Waste Waste Water Plastic Wood
ADMINISTRATIVE OFFICES 	Employees	Food Waste Paper, Plastic Aluminum Cans Trash

Source: Recycling, Reuse, and Waste Reduction at Airports, FAA (April 24, 2013)

Currently, Brenham Municipal Airport uses a decentralized waste management system since airport tenants manage and pay for their respective waste services.

GOALS AND RECOMMENDATIONS

Solid Waste and Recycling Goals

Table 5C 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.

Table 5C | Waste Management and Recycling Goals

Goals	Objectives
Reduce amount of solid waste generated	Switch to online bill pay to eliminate monthly paper bills
	Conduct a waste audit to ide`ntify the most common types of waste
	Eliminate purchase of items that are not recyclable (i.e., Styrofoam, plastic bags)
Increase amount of materials recycled	Implement recycling services at 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, and recycle construction and demolition waste

Source: Coffman Associates

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 rates. There are several ways an airport can gain insight into their waste stream, such as requesting weights from the hauler or tracking the volume. 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
  - Establish 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
  - Understand 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 solid waste 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.

- **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.

- **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 Brenham Municipal Airport.

- **Create a recycling program at the airport.** 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.

ENVIRONMENTAL OVERVIEW

An analysis of potential environmental impacts associated with proposed airport projects is an essential consideration in the airport master plan process. The primary purpose of this discussion is to review the recommended development concept (**Exhibit 5A**) and associated capital improvement program at the airport to determine whether projects identified in the airport master plan could, individually or collectively, significantly impact existing environmental resources. Information contained in this section was obtained from previous studies, official internet websites, and analysis by the consultant.

The FAA *Reauthorization Act of 2018* (Act) changed how the FAA historically operates with respect to airport oversight. Section 163 of the Act limits the FAA's approval authority over certain projects. Pursuant to Section 163, when a sponsor submits a change to the airport layout plan (ALP) for a project that would not be federally funded, requests a change in land use from aeronautical to non-aeronautical use, or requests to dispose of airport-owned land, the FAA would need to determine if the proposal would be subject to the agency's approval authority. This approval is a two-step process. The FAA exercises its regulatory authority consistent with the Act and separately examines and reaches a determination regarding its authority under both of the following steps. First, the FAA determines if they have ALP approval authority under Section 163 of the Act. The second step is to determine how the land was acquired and if land release obligations are required. Projects depicted on the ALP that were approved prior to the Act must be evaluated to determine whether FAA retains their approval authority.

If FAA retains approval authority over a project, then the project is typically subject to the *National Environmental Policy Act* (NEPA). 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, an environmental impact statement (EIS) may be required.

The following portion of the airport master plan is not designed to satisfy the NEPA requirements for a specific development project, but 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 the first chapter of this master plan 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 on the recommended development concept.

Table 5D summarizes potential environmental concerns associated with implementation of the recommended development concept for Brenham Municipal Airport. Analysis under NEPA includes effects or impacts a proposed action or alternative may have on the human environment (see 40 Code of Federal Regulations [CFR] §1508.1). Effects have been recently defined in the Council of Environmental Quality guidelines as changes that are not only reasonably foreseeable but those that have a close causal relationship to the proposed action or alternatives.

Table 5D | Summary of Potential Environmental Concerns	
AIR QUALITY	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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 Environmental Concerns	**Potential Impact.** An increase in operations could occur over the 21+ year planning horizon of the development concept (**Exhibit 5A**) that would likely result in additional emissions. Washington County currently complies with federal NAAQS requirements; therefore, general conformity review per the *Clean Air Act* is not required. According to the most recent FAA *Aviation Emissions and Air Quality Handbook* (2015), an emissions inventory under NEPA may be necessary for any proposed action that would result in a reasonably foreseeable increase in emissions due to plan implementation. For construction emissions, a qualitative or quantitative emissions inventory under NEPA may be required, depending on the type of environmental review needed for projects defined on the development plan concept.
BIOLOGICAL RESOURCES	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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.
Potential Environmental Concerns	**Federally Protected Species** **Potential Impact.** According to the USFWS Information for Planning and Consultation (IPaC) report, there is the potential for six candidate, threatened, proposed threatened or endangered species within the vicinity of the airport: piper plover (bird), red knot (bird), whooping crane (bird), Texas fawnsfoot (clam), monarch butterfly (insect), and navasota ladies-tresses (plant). Of the six species listed above, three of them have potential habitat at the airport (whooping crane, monarch butterfly, and navasota ladies-tresses). These species may inhabit areas of the airport that contain trees or shrubs. In addition to this, monarch butterflies inhabit areas that contain milkweed (*Asclepias* sp.) and other types of vegetation. Proposed future development in the eastern portion of the airport related to new hangars and associated infrastructure (i.e., ultimate roads/vehicle parking and ultimate airfield pavement), aviation easements in the northern and southern portions of the airport, the fuel farm in the southwestern portion of the airport, and the removal/relocation of ROFA obstructions in the eastern portion of the airport are in areas inhabited by vegetation and may be areas of concern. Thus, if trees or other vegetation are removed in these areas, a bird survey may be warranted prior to project development in vegetated areas. Furthermore, habitat surveys (i.e., botanical surveys) may be necessary prior to development in vegetated areas. **Designated Critical Habitat** **No Impact.** There are no designated critical habitats within airport boundaries. **Non-Listed Species** **Potential Impact.** Non-listed species of concern include those protected by the *Migratory Bird Treaty Act* (MBTA) and the *Bald and Golden Eagle Protection Act.* No eagles are expected to use the airport environs. Bird species protected by the MBTA could be adversely affected if construction occurs during the nesting and breeding seasons (typically May through September). Pre-construction surveys of vegetated areas at the airport are recommended for projects where ground clearing would occur

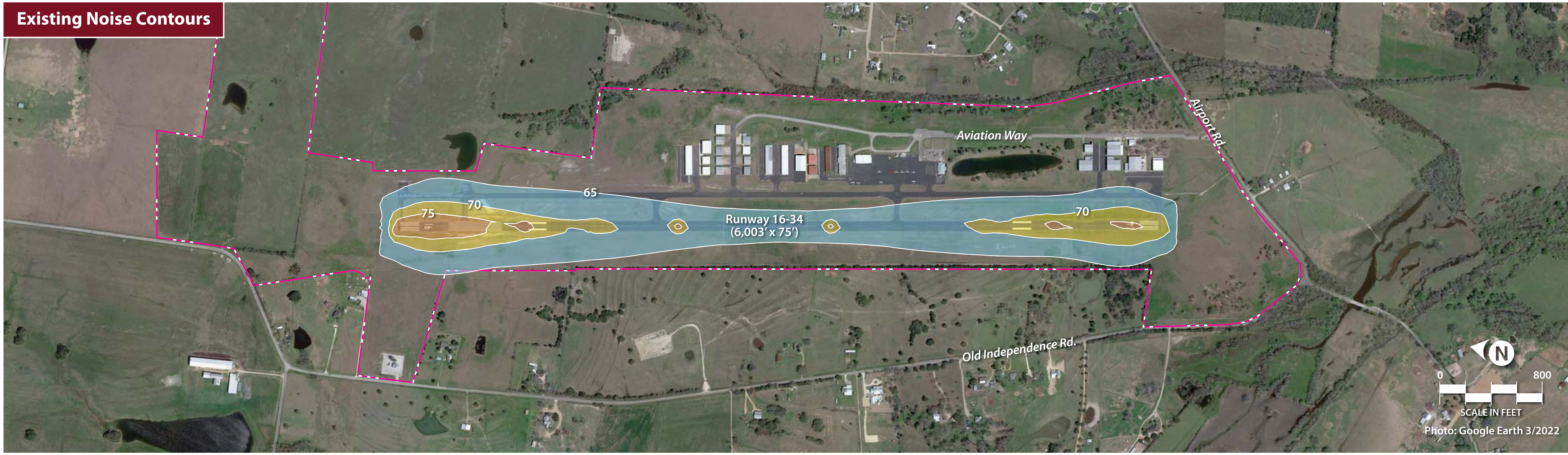
	unless happening outside the nesting and breeding seasons. Projects related to the construction of the fuel farm in the southwestern portion of the airport and proposed hangar development in the eastern portion of the airport contain vegetation and may be areas of concern.
CLIMATE	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	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 Environmental Concerns	**Unknown.** An increase in greenhouse gas (GHG) emissions could occur over the 21+ year planning horizon of the airport master plan. A project-specific analysis may be required per FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, based on the parameters of the individual projects; however, at this time, FAA does not have an impact threshold to use to determine significance under NEPA.
COASTAL RESOURCES	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	FAA has not established a significance threshold for Coastal Resources.
Potential Environmental Concerns	**No Impact.** The airport is not located within a coastal zone. The closest National Marine Sanctuary is Flower Garden Bank National Marine Sanctuary, located 188 miles away.
***DEPARTMENT OF TRANSPORTATION ACT*, SECTION 4(f)**	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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 Environmental Concerns	**Potential Impact.** There are no wilderness areas, public recreational facilities, or National Register of Historic Places (NRHP)-listed resources that would be impacted by proposed development at the airport. The closest known potential Section 4(f) resource is the Allcorn-Kokemoor Farmstead, located 0.4-mile to the west, which is listed on the National Register of Historic Places (NRHP); however, any airport structures 50 years or older should be evaluated for historic significance prior to alteration or demolition. If determined to be a significant historic resource, they would likely qualify as a Section 4(f) resource.
FARMLANDS	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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.
Potential Environmental Concerns	**Potential Impact.** According to the NRCS Web Soil Survey (WSS), the airport is primarily designated as "all areas are prime farmland" and "farmland of statewide importance." The remaining portion of land is designated as "not prime farmland." Currently, the airport leases land north of the runway for hay production and livestock grazing. In the past, this area has been utilized for similar purposes. The closest proposed development to this area is the potential for non-aeronautical uses to be developed on the 27.7 acres of land northeast of the runway. This area has been identified in the master plan as "non-aeronautical reserve" and is currently leased for agricultural use. Future airport improvements to airside and landside areas of the airport within designated areas of "all areas are prime farmland" and "farmland of statewide importance" include (**Exhibit 5A**):

	• Construction of standard holding bay near the end approach of future Runway 16. • Installation of PAPI-4 at Runway 16 end. • Construction of new hangars on the east and west sides of the airport. • Expansion of the terminal building. • Relocation of wind cones. • Installation of MITL along Taxiway A. • Acquisition of 21.5 acres of land for future development on the western portion of the airport. • 27.7 acres of land reserved for future non-aeronautical development on the northeastern portion of the airport. • 7.7 acres of land reserved for future non-aeronautical development on the southeastern portion of the airport. • Construction of a new fuel farm facility on the southwestern portion of the airport. Ultimate airport improvements to airside and landside areas of the airport within designated area of "all areas are prime farmland" and "farmland of statewide importance" include (**Exhibit 5A**): • 500-foot-runway extension to Runway 16. • Runway gradient correction on the extended Runway 16 end. • Relocation of REILs on Runway 16. • Relocation of PAPI-4 on Runway 16. • Construction of new hangars on the east and west sides of the airport. • Acquisition of 83.7 acres of land for future development on the western portion of the airport. • Removal/relocation of ROFA obstructions including the perimeter fence and trees. • Reroute Old Independence Road near the north portion of the airport. • 27.7 acres of land reserved for future non-aeronautical development on the northeastern portion of the airport. • 7.7 acres of land reserved for future non-aeronautical development on the southeastern portion of the airport. Since proposed airport development is in non-urbanized areas, important farmlands are identified, and agricultural uses are present, FPPA may apply. As part of the NEPA process associated with airport projects, coordination with the NRCS on the completion of Form AD-1006 may be required.
HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	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 Environmental Concerns	**No Impact**. There are no identified brownfields or Superfund sites located within a one-mile buffer of the airport. Because of the existing regulatory environment regarding hazardous materials and waste and stormwater management, no impacts related to future and ultimate airport development are anticipated. There are two aboveground storage tanks (AST) located north of the terminal building that offer fuel services at the airport. One tank is dispensed via a self-service fuel island, while the other tank distributes fuel by on-site staff and a refueling vehicle. The ASTs are required to maintain spill response procedures to minimize non-stormwater discharges from contaminating waterways under federal regulations. Proposed landside ultimate and future development southwest of future Runway 16-34 includes a fuel facility. Similar to the ASTs, the proposed fuel facility will be required to manage and maintain spill response procedures (i.e., a Spill Prevention Control and Countermeasure Plan (SPCC). The construction of the planned developments would temporarily increase solid waste. In addition, an expanded terminal building and the use of new hangars would increase solid waste in the long term. See the Recycling Plan contained later in this chapter for recommendations to reduce solid

	waste produced by the airport. The closest landfill is located 1.8-mile from the airport. No impacts related to solid waste disposal are expected. See discussion on Surface Water for information on water quality pollution prevention.
HISTORIC, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	FAA has not established a significance threshold for Historical, Architectural, Archaeological, and Cultural Resources. Factors to consider are if an action would result in a finding of "adverse effect" through the Section 106 process. However, an adverse effect finding does not automatically trigger preparation of an EIS (i.e., a significant impact).
Potential Environmental Concerns	**Potential Impact.** The closest resource listed on the NRHP is the Allcorn-Kokemoor Farmstead, located 0.4-mile west; however, Allcorn-Kokemoor Farmstead is not located near any proposed airfield improvements, as it is located outside airport property boundaries. An airport-wide cultural resources survey should be completed to document any other resources at the airport. The FAA would then determine the level of effect airport projects would have on these historic properties under NEPA and through the *National Historic Preservation Act's* Section 106 process. If previously undocumented buried cultural resources are identified during ground-disturbing activities for future or ultimate airport development, all work must immediately cease within 30 meters (100 feet) until a qualified archaeologist has documented the discovery and evaluated its eligibility for the NRHP, as appropriate. Work must not resume in the area without approval of FAA.
LAND USE	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	FAA has not established a significance threshold for Land Use. There are also no specific independent factors to consider. The determination that significant impacts exist is normally dependent on the significance of other impacts.
Potential Environmental Concerns	**Potential Impact**. There are two scattered residential areas that surround the airport. The first residential community is located near the western portion of the airport, west of Old Independence Road. The nearest proposed airport development would be the construction of the proposed fuel farm; however, this proposed development would be contained to the airport and would not relocate any nearby residential areas. The second residential community is located near the eastern portion of the airport, east of Aviation Way. The closest proposed airport development would be the construction of the new hangars and associated infrastructure. However, this proposed development is located 0.5-mile away from the nearest residences. Most proposed future and ultimate development would occur within airport boundaries and are typical land uses occurring at an airport (**Exhibit 5A**). The properties to be designated as an avigation easement for future development are located in the Runway Protection Zone (RPZ). As a result of the RPZ, a 0.7-acre property northwest of existing Runway 16-34 and a 4.8-acre property southeast of existing Runway 16-34 will be obtained via fee simple acquisition. These properties contain existing residential land uses that will be removed for the RPZ. As a result, the *Uniform Relocation Assistance and Real Property Acquisition Act* (URA) will need to be enacted. See discussion on Socioeconomic for more information on the URA. In addition to this, ultimate development will include an 83.7-acre parcel of land to be acquired via fee simple on the western portion of the airport. This land will be reserved for future aviation development (i.e., hangars, apron/taxilane pavement, etc.). Furthermore, future and ultimate development will include two non-aeronautical reserves on the eastern portion of the airport. These reserves may be used for non-aviation-related development in the future. Future land use incompatibilities, if any, would need to be evaluated when development is proposed.
NATURAL RESOURCES AND ENERGY SUPPLY	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	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 Environmental Concerns	**No Impact**. Planned development projects at the airport could increase demands on energy utilities, water supplies and treatment, and other natural resources during construction; however, significant long-term impacts are not anticipated. Should long-term impacts be a concern, coordination with local service providers is recommended.

NOISE AND NOISE-SENSITIVE LAND USE	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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 noise level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe.** Another factor to consider is that special consideration needs to be given to the evaluation of the significance of noise impacts on noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in Title 14 CFR Part 150 are not relevant to the value, significance, and enjoyment of the area in question.
Potential Environmental Concerns	**No Impact.** Scattered residences are located within the vicinity of all four airport property boundaries. The ultimate development at the airport is not expected to change the overall noise environment by more than the 1.5 dB threshold; however, this should be confirmed prior to implementing a runway extension/widening along proposed ultimate Runway 16-34. **Exhibit 5E** shows existing and anticipated noise contours for the airport. As shown on the exhibit, for existing conditions, the DNL 65 dB noise exposure contour remains on airport property. In the ultimate noise contours shown on the bottom half of the exhibit, the DNL 65 dB noise exposure contour expands around the runways, and slightly outside the airport on the western boundary. Operation growth will not result in noise impacts under FAA 1050.1F. Impacts to noise-sensitive land uses are only identified through NEPA documentation for specific projects or through the voluntary Part 150 process.
SOCIOECONOMIC, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH AND SAFETY RISKS	
Socioeconomic	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	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 Environmental Concerns	**Potential Impact.** Proposed development would not relocate or disrupt current businesses. However, there are planned future relocations of two separate residences located northwest and southeast of ultimate Runway 16-34, as these properties are located within the RPZ. Under the *Uniform Relocation Assistance and Real Property Acquisition Act* (URA)[1], coordination between the property owners and the airport is required to provide equitable treatment and assistance to the persons displaced due to the RPZ. Ultimate airport development would not relocate or disrupt current businesses or residents. However, Old Independence Road, which acts as an access road for the scattered residences along the west of U.S. Highway 60, is proposed to be rerouted near the end approach of ultimate Runway 16. This proposed development would reroute Old Independence Road farther west of the existing route. Both future and ultimate airport projects would result in temporary disruption of local traffic patterns during construction. Developments that would disrupt local traffic patterns are primarily landside developments, like the proposed construction of a fuel farm and new hangars. As mentioned above, these traffic disruptions will be temporary and will not result in significant impacts. Furthermore, associated infrastructure, such as ultimate roads and vehicle parking, will also be constructed. Once operational, these ultimate roads may alleviate traffic congestion along connecting roadways, like Aviation Way. Significant impacts on traffic are not anticipated as hangars do not generate large volumes of traffic. 1 – *Uniform Relocation Assistance and Real Property Acquisition Act* (URA): a federal law that establishes protections and assistances for federally funded programs and projects that require the acquisition of real property or displaces persons from their respective homes, businesses, or farms.

Existing Noise Contours



Ultimate Noise Contours

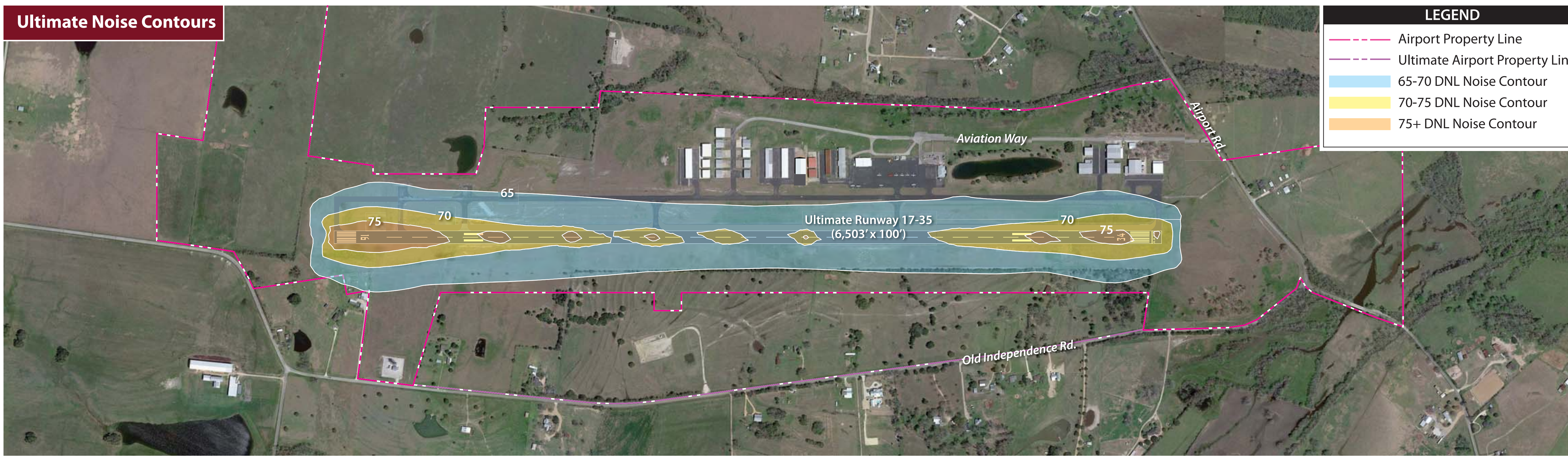


Exhibit 5E
NOISE EXPOSURE CONTOURS

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Environmental Justice	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	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 Environmental Concerns	**No Impact.** Both low-income and minority populations have been identified in the vicinity of the airport. The nearest residential area is 0.04-mile east of the airport. However, it is unlikely that implementation of the proposed improvements outlined in the development concept plan would affect these populations in a disproportionate or adverse manner. Any residences that will be displaced due to the proposed development concept will be acquired to adhere to the URA Act. 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 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; therefore, disclosure of ultimate airport development to potentially affected environmental justice populations near the airport as the projects are proposed is crucial. If disproportionately high or adverse impacts are noted, mitigation and enhancement measures and offsetting benefits should be taken into consideration.
Children's Health and Safety Risks	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	FAA has not established a significance threshold for Children's Environmental Health and Safety Risks. However, factors to consider are whether an action would have the potential to lead to a disproportionate health or safety risk to children.
Potential Environmental Concerns	**No Impact**. There are no parks or schools located within one mile of the airport. The airport is an access-controlled facility, and children will not be allowed within the fenced portions of the airport without adult supervision. All construction areas should be controlled to prevent unauthorized access.
VISUAL EFFECTS	
Light Emissions	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	The FAA has not established a significance threshold for light emissions. However, a factor to consider is the degree to which an action would have the potential to: • Create annoyance or interfere with normal activities from light emissions; and • Affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resource.
Potential Environmental Concerns	**No Impact.** The existing lighting at the airport includes a rotating beacon northeast of the terminal apron, pavement edge lighting, MIRL at existing Runway 16-34, threshold lights at the end of each runway, a PAPI-2 at Runway 16, a PAPI-4 at Runway 34, and REILs. In addition to this, there is pilot-controlled lighting (PCL) to activate the MIRL and visual approach aids from their aircraft. There is no taxiway lighting at the airport. New proposed future lighting would be a 4-light PAPI at the end approach of future Runway 16. MITL would be installed along Taxiway A. Ultimate proposed lighting would relocate the 4-light PAPI and REILs at the end approach of future Runway 16. All new airport lighting will be part of the overall airport environment and is not expected to cause significant lighting issues to areas outside the airport property. Night lighting during construction phases within the runway environment is typically directed down to the construction work area to avoid light from spilling outside airport boundaries. Other future and ultimate projects are likely to include additional lighting during operation of the airport's new structures and facilities but would not significantly change the amount of lighting seen from outside the airport.

Visual Resources/Visual Character	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	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 Environmental Concerns	**No Impact.** Future and ultimate airport improvements are likely to be what currently exists at the airport and would not change the overall visual character of the airport.
WATER RESOURCES	
Wetlands	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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 Environmental Concerns	**Potential Impact.** According to USFWS National Wetlands Inventory, there are two freshwater ponds in the northwest portion of the airport, and one freshwater pond on the eastern side of the airport (**Exhibit 1L**). The proposed future 7.5-acres of property to be acquired is located near one of the freshwater ponds in the northwest portion of the airport. The proposed future construction of new hangars and associated infrastructure are located within the second freshwater pond located in the northeast portion of the airport. The freshwater pond on the eastern portion of the airport is located within the proposed future terminal building expansion and proposed ultimate airfield pavement. The proposed ultimate development includes the construction of new hangars and associated infrastructure in the northeastern portion of the airport. The freshwater pond on the eastern portion of the airport is located within the proposed ultimate airfield pavement. If development occurs in these areas involving the relocation or removal of wetlands or impacting other potential waters of the U.S., a delineation of the area should be completed by a qualified wetlands biologist to help determine if the area is protected by the *Clean Water Act*. Based on the results of this study, consultation with the U.S. Army Corps of Engineers may be required to determine if a Section 404 permit under the *Clean Water Act* is warranted. A Section 404 permit regulates the discharge of dredged or fill material into jurisdictional waters and wetlands. Mitigation for impacts to wetlands or other jurisdictional waters may be required.
Floodplains	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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 Environmental Concerns	**Potential Impact.** A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panel 48477C0325D (effective May 16, 2019), indicates the airport is primarily in Zone X, an Area of Minimal Flood Hazard. However, on the eastern portion of the airport, a small portion of the airport lies within Zone A, an Area of Special Flood Hazards (Without Base Flood Elevation [BFE]) (**Exhibit 1L**). Both future and ultimate airport improvements have proposed ultimate airfield pavement located within the floodplain, designated as Zone A. There are no 500-year floodplains mapped for the airport.

	On May 25, 2021, E.O. 14030, Climate-Related Financial Risk was established. Section 5(e) of E.O. 14030 reinstates E.O. 13690[1], amends E.O. 11988[2] and mandates that a Federal Flood Risk Management Standard (FFRMS) be created. One of the primary purposes of FFRMS is to expand the management of floodplains from a "base flood" evaluation to include a higher vertical elevation (and the corresponding floodplain) to protect against future flood risks for federally funded projects. Under E.O. 13690 and its guidelines, one of several approaches should be used to identify floodplains and their risks to critical or non-critical federally funded actions: • Climate-Informed Science Approach (CISA) – the elevation and flood hazard area (i.e., 100-year floodplain) using data that integrates climate science with an emphasis on possible future effects on critical actions. • Freeboard Value Approach – the elevation and flood hazard area and an additional two or three feet above the base flood elevation depending on whether the proposed federal action is critical or non-critical. • 500-year Floodplain Approach – all areas subject to the 0.2 percent annual chance flood. • Other methods resulting from updates to the FFRMS. 1 - *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* (2015) 2- *Floodplain Management,* May 1977 3- Critical action is defined in E.O. 13690 and 2015 Guidelines for Implementing E.O. 11988 as any activity for which even a slight change of flooding is too great. For example, a facility producing and/or storing highly volatile, toxic, or water-reactive materials; structures such as schools where occupants may not be sufficiently mobile or have available transport capability given the flood warning lead times available; or essential or irreplaceable resources, utilities, and other functions that could be damaged beyond repair or otherwise made unavailable.
Surface Waters	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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 Environmental Concerns	**Potential Impact.** The closest natural surface water features are the freshwater ponds located within the airport. There are no impaired waterbodies within and surrounding the airport. Long-term impacts to water quality from the proposed airfield improvements may need to be assessed, depending on how or if stormwater runoff is conveyed to airport stormwater infrastructure. The airport manages its stormwater discharges with a Texas Pollutant Discharge Elimination System (TPDES) permit issued and regulated by the Texas Commission on Environmental Quality (TCEQ). 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. A TPDES General Construction permit would be required for all projects involving ground disturbance over one acre. FAA's Advisory Circular (AC) 150/5370-10G, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control* should also be implemented during construction projects at the airport.
Groundwater	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	**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.
Potential Environmental Concerns	**No Impact**. The airport property is not located near a sole source aquifer. Edwards Aquifer II (Austin Area) is the nearest sole source aquifer and is located approximately 84 miles west of the airport.
Wild and Scenic Rivers	
FAA Order 1050.1F, Significance Threshold/Factors to Consider	FAA has not established a significance threshold for Wild and Scenic Rivers. Factors to consider are when an action would have an adverse impact on the values for which a river was designated (or considered for designation) through: • Destroying or altering a river's free-flowing nature; • A direct and adverse effect on the values for which a river was designated (or under study for designation); • Introducing a visual, audible, or other type of intrusion that is out of character with the river or would alter outstanding features of the river's setting; • Causing the river's water quality to deteriorate; • Allowing the transfer or sale of property interests without restrictions needed to protect the river or the river corridor; or • Any of the above impacts preventing a river on the Nationwide Rivers Inventory (NRI) or a Section 5(d) river that is not included in the NRI from being included in the Wild and Scenic River System or causing a downgrade in its classification (e.g., from wild to recreational).
Potential Environmental Concerns	**No Impact.** The nearest designated Wild and Scenic River, Saline Bayou River, is located approximately 239 miles north of the airport. The closest river on the NRI is a segment of Pedernales River, 102 miles west of the airport. Projects delineated on the future and ultimate development concepts would not have adverse effects on these rivers' outstanding remarkable values (i.e., scenery, recreation, geology, fish, wildlife, and history).

Source: Coffman Associates, Inc. analysis

SUMMARY

This chapter has been prepared to help the City of Brenham make decisions on the future growth and development of Brenham Municipal Airport 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 future and ultimate 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 AMPC, City of Brenham, and the 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.

City of BRENHAM

Chapter Six

FINANCIAL MANAGEMENT PLAN

Chapter Six

FINANCIAL MANAGEMENT PLAN

The recommended master plan concept presented in the previous chapter outlined airside and landside improvements for Brenham Municipal Airport that provide the City of Brenham with a plan to preserve and develop the airport to meet future aviation demands. Using the concept as a guide, the next step is to determine a realistic schedule and the associated costs for implementing the recommended development concept. The capital program considers the interrelationships among the projects to determine an appropriate sequence of development, while remaining within reasonable fiscal constraints.

This section will examine the overall cost of each item in the capital program. The CIP, programmed by years, has been developed to cover the first five years of the plan, which is generally reflective of projects depicted in the existing/future development plan. The remaining existing/future projects are grouped into the intermediate term (years 6-10), while the ultimate term (years 11+) generally represents projects associated with the ultimate development concept. The various landside development projects (i.e., taxilane and apron construction to support hangar development) are programmed throughout the 20+ year period with the understanding that they may be prioritized based on demand.

Generally speaking, more detailed information is provided for the five-year horizon, with less detail provided for the longer planning periods as needs will likely change. By utilizing planning horizons instead of specific years for intermediate- and ultimate-term development, the City of Brenham will have greater flexibility to adjust capital needs as demand dictates. **Table 6A** summarizes the key milestones for each of the three planning horizons. It should be understood that this analysis will serve a very small window of time and should be updated annually with TxDOT/FAA. The annual capital improvement program (ACIP) process is common outside the block grant program but can be a useful tool in ensuring capital needs are met and proper financial resources are targeted and budgeted accordingly.

Table 6A | Aviation Demand Planning Horizons

	Base Year (2022)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single Engine	46	49	51	57
Multi-Engine	4	4	2	0
Turboprop	0	1	2	4
Jet	8	9	11	15
Helicopter	0	0	1	2
TOTAL BASED AIRCRAFT	**58**	**63**	**67**	**78**
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	0	0	0	0
Air Taxi	194	235	301	453
General Aviation	6,900	7,700	8,200	9,100
Military	50	50	50	50
Total Itinerant	***7,144***	***8,000***	***8,600***	***9,600***
Local				
General Aviation	20,700	23,400	24,800	27,600
Military	0	0	0	0
Total Local	***20,700***	***23,400***	***24,800***	***27,600***
TOTAL OPERATIONS	**27,844**	**31,400**	**33,400**	**37,200**

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. 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 ultimate-term activity milestones.

A demand-based master plan does not specifically require the implementation of any of the demand-based improvements. Instead, it is envisioned that implementation of any improvements would be examined against the demand levels prior to implementation. As such, the master plan establishes a plan for the use of airport facilities consistent with the potential aviation needs and capital needs required to support that use. Individual projects in the plan are not implemented until the need is demonstrated and the project is approved for funding.

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 Federal Aviation Administration (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 Brenham Municipal Airport, 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. As revenue-producing facilities, hangar development is not generally eligible for federal AIP funding assistance with the exception of non-primary entitlement (NPE) funds. Even though hangar development is eligible for NPE funds, the FAA requires that all airfield issues be satisfied before the NPE funds could be used for hangars. Moreover, NPE can only provide up to $150,000 per year with banking available for four years. In essence, the maximum funding available for NPE hangar development would be $650,000, which is not nearly enough for most hangar development. If the City of Brenham were to pursue NPE grants for the development of hangars, it should be with the understanding that these grants would only fund a portion of the development, and local funding would also be required.

State funds are also limited for this type of development. The decision to self-fund hangars or allow for private developers to do so rests solely with the City of Brenham. There are some advantages and disadvantages for each option that should be considered. If the city elects to self-fund hangar development, the obvious advantage is that they are able to immediately meet the needs of aircraft owners desiring hangar space. At Brenham Municipal Airport, there is clear demand for additional hangar storage, so it is likely that the city would be able to secure leases and begin generating revenue on these facilities right away; however, the return on investment is generally lengthy (more than likely 15-30 years). On the other hand, private developers may also be able to keep construction costs lower, which, in turn, lowers the monthly lease rates necessary to amortize a loan. Another option could be for the city to front construction and utility costs, readying the available area for development, with the land lessor responsible for a pro-rated portion. Cities can utilize many methods for financing, with one being bond mechanisms, which will be discussed in greater detail in a later section within this chapter. The developer would then have less sunk costs, initially requiring less capital to begin development, and the city can charge a higher lease rate to amortize the investment made in construction and utility improvements. Ultimately, hangar development and the resulting increase in revenue from tenants can help the airport become financially self-sufficient and potentially support the future development of other projects in the CIP. For this master plan, the CIP for Brenham Municipal Airport assumes that site preparation and development for landside facilities will be constructed privately. As such, cost estimates for hangar construction are not included. The City of Brenham 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., earthwork, such as grading/fill, drainage improvements, extension of utilities, etc.) that may increase the estimated cost of the project or increase the timeline for completion.

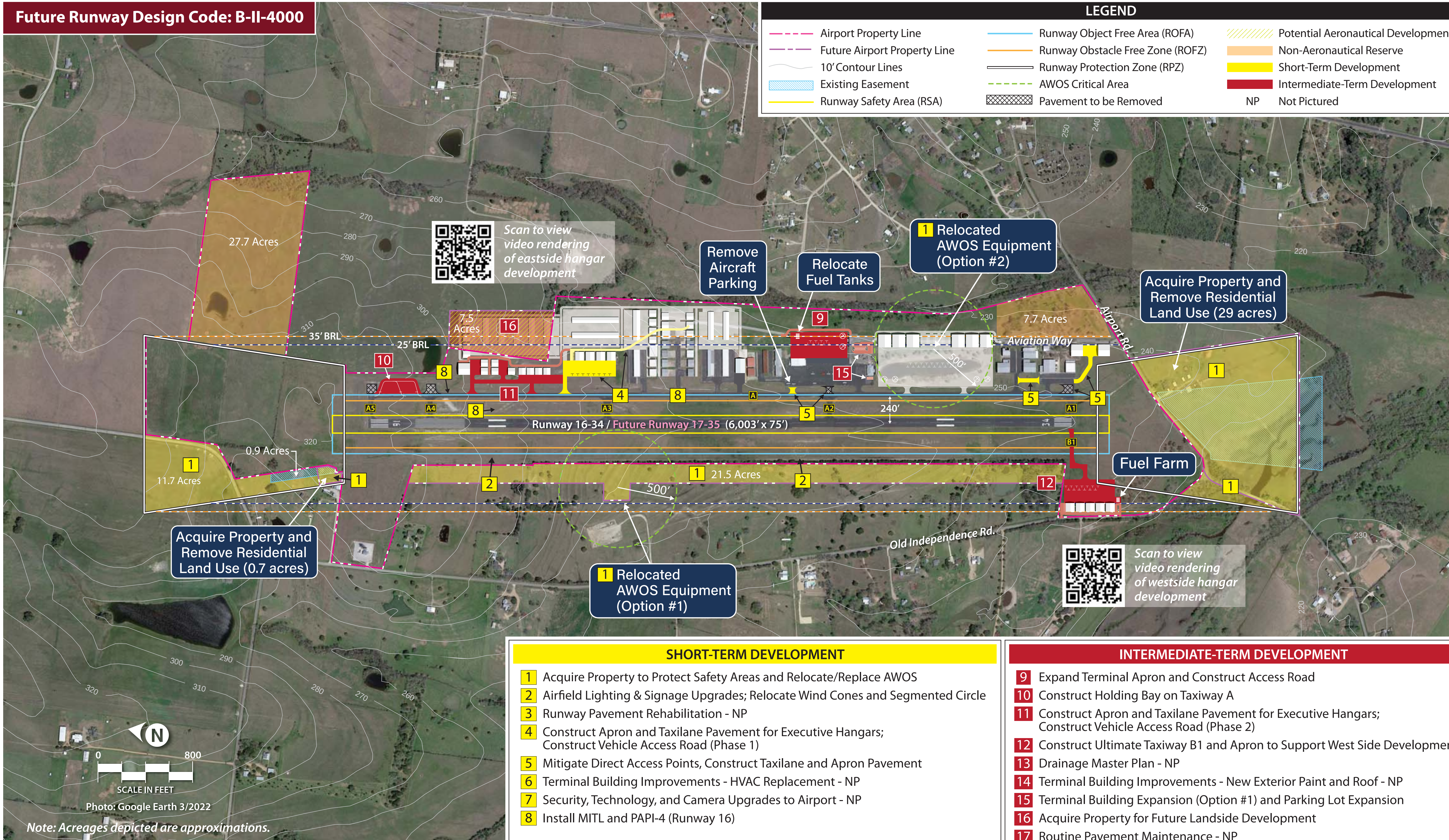
Once a list of necessary projects was identified and refined, project-specific cost estimates were prepared. These estimates include design, construction, administration, and contingency costs that may arise on the project. ***Capital costs presented here should be viewed only as "order-of-magnitude" 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 may 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 Strand Associates, who is providing engineering support for the master plan and is familiar with Brenham Municipal Airport. Cost estimates for each of the development projects in the CIP are in current dollars, with the exception of future property acquisition costs, which assume a three percent annual inflation increase.

Table 6B presents the proposed 20-year CIP for Brenham Municipal Airport. It should be stated clearly that the proposed CIP is a point-in-time analysis that will change annually based on actual demand and changing needs. An estimate of grant (FAA and/or TxDOT) funding eligibility has been included, although actual funding is not guaranteed. For projects that are eligible for federal/state funding, Airport Improvement Program (AIP)/TxDOT grants provide up to 90 percent of the total project cost. The remaining 10 percent, or more, of project costs are funded locally by the City of Brenham. Revenue-generating improvement projects, such as fuel farm development, 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 local funding or funding through specific TxDOT programs.

The FAA and TxDOT each utilize 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. These entities will participate in the highest priority projects before considering lower priority projects, even if a lower priority project is considered a more urgent need by the local sponsor. Nonetheless, the project should remain a priority for the airport, and funding support should continue to be requested in subsequent years.

As detailed in the CIP, many of the projects listed are eligible for federal or state funding. Obviously, demand and justification for these projects must be provided prior to a grant being issued. **Exhibit 6A** graphically depicts the development staging by overlaying each project onto the aerial photograph of Brenham Municipal Airport.

Future Runway Design Code: B-II-4000



LEGEND

- Airport Property Line
- Future Airport Property Line
- 10' Contour Lines
- Existing Easement
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- AWOS Critical Area
- Pavement to be Removed
- Potential Aeronautical Development
- Non-Aeronautical Reserve
- Short-Term Development
- Intermediate-Term Development
- NP Not Pictured

SHORT-TERM DEVELOPMENT

1. Acquire Property to Protect Safety Areas and Relocate/Replace AWOS
2. Airfield Lighting & Signage Upgrades; Relocate Wind Cones and Segmented Circle
3. Runway Pavement Rehabilitation - NP
4. Construct Apron and Taxilane Pavement for Executive Hangars; Construct Vehicle Access Road (Phase 1)
5. Mitigate Direct Access Points, Construct Taxilane and Apron Pavement
6. Terminal Building Improvements - HVAC Replacement - NP
7. Security, Technology, and Camera Upgrades to Airport - NP
8. Install MITL and PAPI-4 (Runway 16)

INTERMEDIATE-TERM DEVELOPMENT

9. Expand Terminal Apron and Construct Access Road
10. Construct Holding Bay on Taxiway A
11. Construct Apron and Taxilane Pavement for Executive Hangars; Construct Vehicle Access Road (Phase 2)
12. Construct Ultimate Taxiway B1 and Apron to Support West Side Development
13. Drainage Master Plan - NP
14. Terminal Building Improvements - New Exterior Paint and Roof - NP
15. Terminal Building Expansion (Option #1) and Parking Lot Expansion
16. Acquire Property for Future Landside Development
17. Routine Pavement Maintenance - NP

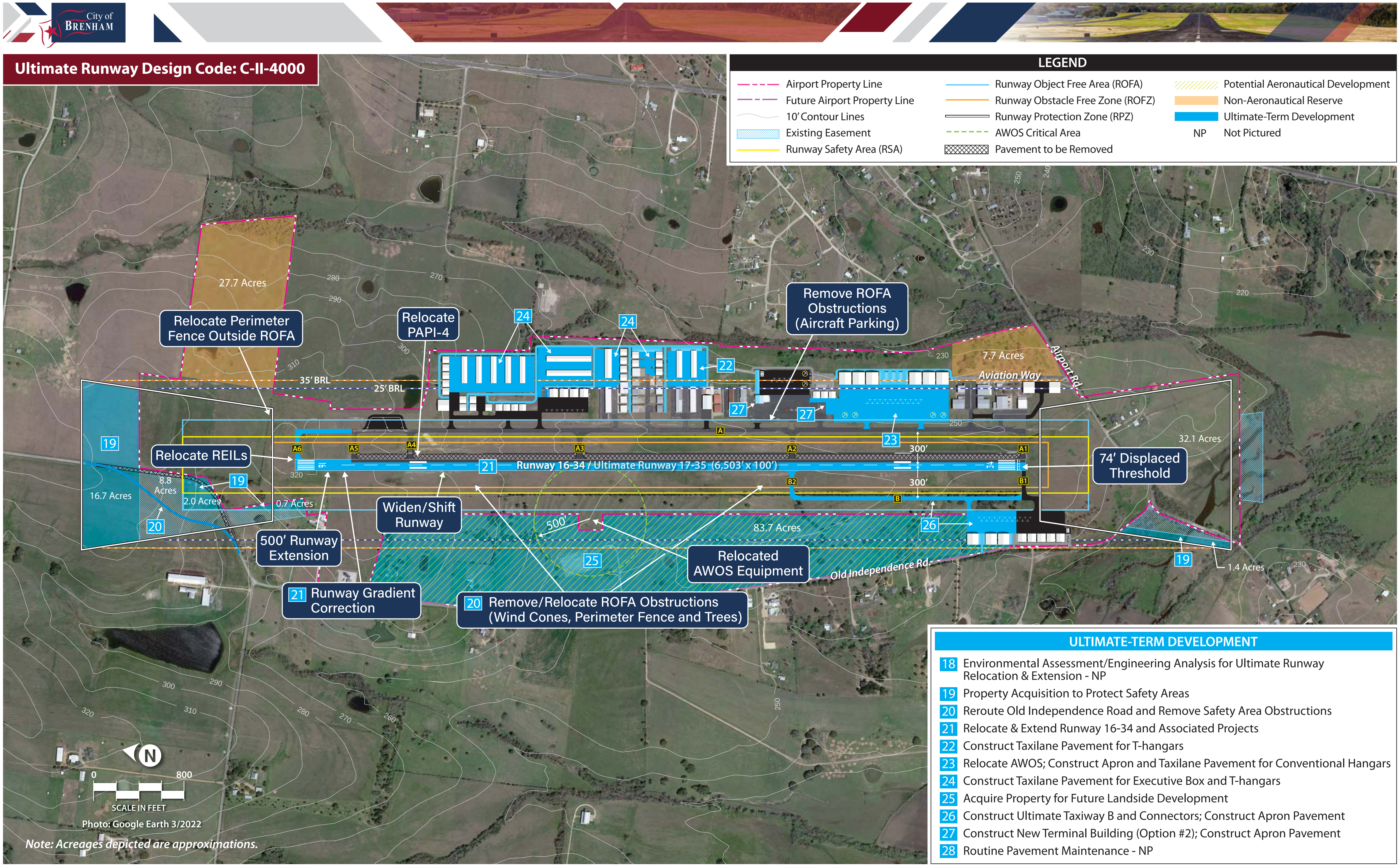

City of Brenham
Ultimate Runway Design Code: C-II-4000
LEGEND
Airport Property Line
Future Airport Property Line
10' Contour Lines
Existing Easement
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
AWOS Critical Area
Pavement to be Removed
Potential Aeronautical Development
Non-Aeronautical Reserve
Ultimate-Term Development
NP Not Pictured
27.7 Acres
Relocate Perimeter Fence Outside ROFA
Relocate PAPI-4
24
24
Remove ROFA Obstructions (Aircraft Parking)
22
27
27
23
7.7 Acres
Aviation Way
Airport Rd
35' BRL
25' BRL
19
Relocate REILs
8.8 Acres
16.7 Acres
2.0 Acres
0.7 Acres
19
20
21
Runway 16-34 / Ultimate Runway 17-35 (6,503' x 100')
300'
300'
500'
32.1 Acres
74' Displaced Threshold
Widen/Shift Runway
500' Runway Extension
83.7 Acres
26
25
Relocated AWOS Equipment
Old Independence Rd
19
1.4 Acres
21 Runway Gradient Correction
20 Remove/Relocate ROFA Obstructions (Wind Cones, Perimeter Fence and Trees)
N
0
800
SCALE IN FEET
Photo: Google Earth 3/2022
Note: Acreages depicted are approximations.
ULTIMATE-TERM DEVELOPMENT
18 Environmental Assessment/Engineering Analysis for Ultimate Runway Relocation & Extension - NP
19 Property Acquisition to Protect Safety Areas
20 Reroute Old Independence Road and Remove Safety Area Obstructions
21 Relocate & Extend Runway 16-34 and Associated Projects
22 Construct Taxilane Pavement for T-hangars
23 Relocate AWOS; Construct Apron and Taxilane Pavement for Conventional Hangars
24 Construct Taxilane Pavement for Executive Box and T-hangars
25 Acquire Property for Future Landside Development
26 Construct Ultimate Taxiway B and Connectors; Construct Apron Pavement
27 Construct New Terminal Building (Option #2); Construct Apron Pavement
28 Routine Pavement Maintenance - NP

Table 6B | Capital Improvement Program

FY	PROJECT #	PROJECT DESCRIPTION	ESTIMATED COST	FUNDING PLAN: AIP/TXDOT	FUNDING PLAN: AIRPORT SPONSOR
SHORT-TERM PROJECTS					
2024	1	Acquire Property to Protect Safety Areas and Relocate/Replace AWOS	$1,811,200	$1,630,080	$181,120
2024	2	Airfield Lighting & Signage Upgrades; Relocate Wind Cones and Segmented Circle	$1,000,000	$900,000	$100,000
2025	3	Runway Pavement Rehabilitation	$2,000,000	$1,800,000	$200,000
2026	4	Construct Apron and Taxilane Pavement for Executive Hangars; Construct Vehicle Access Road - Phase 1	$1,396,800	$1,257,120	$139,680
2027	5	Mitigate Direct Access Points; Construct Taxilane and Apron Pavement	$428,200	$385,380	$42,820
2027	6	Terminal Building Improvements - HVAC Replacement	$97,098	$48,549	$48,549
2027	7	Security, Technology, and Camera Upgrades to Airport	$79,082	$71,174	$7,908
2028	8	Install MITL and PAPI-4 (Runway 16)	$1,443,800	$1,299,420	$144,380
		Short-Term Subtotal	**$8,296,180**	**$7,391,723**	**$864,457**
INTERMEDIATE-TERM PROJECTS					
FY2028-2042	9	Expand Terminal Apron and Construct Access Road	$1,559,300	$1,403,370	$155,930
FY2028-2042	10	Construct Holding Bay on Taxiway A	$351,300	$316,170	$35,130
FY2028-2042	11	Construct Apron and Taxilane Pavement for Executive Hangars; Construct Vehicle Access Road - Phase 2	$1,682,900	$1,514,610	$168,290
FY2028-2042	12	Construct Future Taxiway B1 and Apron to Support West Side Development	$2,845,300	$2,560,770	$284,530
FY2028-2042	13	Drainage Master Plan	$190,000	$171,000	$19,000
FY2028-2042	14	Terminal Building Improvements - New Exterior Paint and Roof	$217,635	$108,818	$108,818
FY2028-2042	15	Terminal Building Expansion (Option #1) and Parking Lot Expansion	$374,100	$-	$374,100
FY2028-2042	16	Acquire Property for Future Landside Development	$395,000	$-	$395,000
FY2028-2042	17	Routine Pavement Maintenance	$2,000,000	$1,800,000	$200,000
		Intermediate-Term Subtotal	**$9,615,535**	**$7,874,738**	**$1,740,798**
ULTIMATE-TERM PROJECTS					
FY2043+	18	Environmental Assessment / Engineering Analysis for Ultimate Runway Relocation & Extension	$300,000	$270,000	$30,000
FY2043+	19	Acquire Property to Protect Safety Areas	$752,600	$677,340	$75,260
FY2043+	20	Reroute Old Independence Road and Remove Safety Area Obstructions	$863,800	$777,420	$86,380
FY2043+	21	Relocate & Extend Runway 16-34 and Associated Projects	$11,284,800	$10,156,320	$1,128,480
FY2043+	22	Construct Taxilane Pavement for T-hangars	$1,830,700	$1,647,630	$183,070
FY2043+	23	Replace/relocate AWOS; Construct Apron and Taxilane Pavement for Conventional Hangars	$16,174,800	$14,557,320	$1,617,480
FY2043+	24	Construct Taxilane Pavement for Executive Box and T-hangars	$10,622,800	$9,560,520	$1,062,280
FY2043+	25	Acquire Property for Future Landside Development	$3,511,200	$-	$3,511,200
FY2043+	26	Construct Ultimate Taxiway B and Connectors; Construct Apron Pavement	$5,953,200	$5,357,880	$595,320
FY2043+	27	Construct New Terminal Building (Option #2); Construct Apron Pavement	$3,180,800	$-	$3,180,800
FY2043+	28	Routine Pavement Maintenance	$4,000,000	$3,600,000	$400,000
		Ultimate-Term CIP Subtotal	**$58,474,700**	**$46,604,430**	**$11,870,270**
		Total CIP	**$76,386,415**	**$61,870,890**	**$14,475,525**

Some projects identified in the CIP will require environmental documentation. The level of documentation necessary for each project must be determined in consultation with TxDOT. There are three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA) that include Categorical Exclusions (CatExs), Environmental Assessments (EAs), and Environmental Impact Statements (EISs). 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 the previous chapter addresses NEPA and provides an evaluation of various environmental categories for the airport.

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 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 facilities and improving airfield safety. The short-term program considers eight projects for the planning period as presented in **Table 6B** and depicted on **Exhibit 6A**. The following provides a detailed breakdown of each project.

Project #1 – 2024: Acquire Property to Protect Safety Areas and Relocate/Replace AWOS

- *Description:* Portions of the existing/future protection zone (RPZ) at each runway end extend beyond airport property and contain residential land uses, which are considered incompatible by the FAA. This project plans for the fee simple acquisition of approximately 0.7 acres in the Runway 16 RPZ, approximately 29.0 acres of the Runway 34 RPZ, and removal of any residential structures. An additional 13.7 acres of both RPZs are uncontrolled and are planned to be protected by avigation easement as part of this project. Lastly, this project plans for the fee simple acquisition of approximately 21.5 acres of property west of the runway to protect the ultimate runway object free area (ROFA). Environmental documentation is required prior to major airfield projects involving property acquisition. The cost of this project assumes an Environmental Assessment (EA) for planning purposes. The project also includes the replacement of existing automated weather observation system (AWOS) equipment, which is currently out of service, and relocation of the AWOS equipment.
- *Cost Estimate:* $1,811,200
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #2 – 2024: Airfield Lighting and Signage Upgrades; Relocate Wind Cones and Segmented Circle

- *Description:* Many of the lighting systems and airfield signage at the airport are aging or in need of replacement. Project #2 plans for the medium intensity runway lighting (MIRL) on Runway 16-34 to be replaced with new fixtures. This project also plans for the beacon light and systems at the electrical vault to be replaced, along with the runway and taxiway signage. The signs are currently out of service and beyond repair. Lastly, there are two wind cones at Brenham Municipal Airport. A lighted wind cone co-located with a segmented circle is located at midfield, and a supplemental wind cone is located at the Runway 16 end. Both wind cones are obstructions to the existing/future and ultimate runway object free area (ROFA). This project plans for the relocation of the lighted wind cone/segmented circle and the supplemental wind cone outside the future B-II ROFA.

- *Cost Estimate:* $1,000,000
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #3 – 2025: Runway Pavement Rehabilitation

- *Description:* As airfield pavements deteriorate over time, it is necessary to undergo overlay/rehabilitation/reconstruction projects. This project plans for rehabilitation of the existing runway pavement, as well as the redesignation of Runway 16-34 to Runway 17-35, including updating airfield signage to reflect this. Coordination with the FAA and TxDOT should be undertaken prior to redesignation of the runway.
- *Cost Estimate:* $2,000,000
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #4: Construct Apron and Taxilane Pavement for Executive Hangars; Construct Vehicle Access Road – Phase 1

- *Description:* To meet projected demand in hangar storage space, new executive box hangars are planned north of existing landside facilities, near Taxiway A3. This project plans for a new taxilane extending from Taxiway A to connect to a new apron area to support planned executive hangars. Aircraft tiedowns are planned along the western edge of the new apron. To provide vehicle access for future tenants, Aviation Way is planned to be extended to this new development area. Project costs also include the extension of utilities.
- *Cost Estimate:* $1,396,800
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #5 – 2025: Mitigate Direct Access Points; Construct Taxilane and Apron Pavement

- *Description:* Taxiways A1 and A2 provide direct access from the terminal and south aprons to the runway, which is a non-standard condition. This project plans this condition to be mitigated by removing the portions of Taxiways A1 and A2 east of Runway 16-34. A new taxiway connector is planned approximately 300 feet north of existing Taxiway A2, offsetting the taxiways and mitigating the direct access from the terminal apron. This will necessitate the removal of four aircraft parking positions located on the northwestern corner of the apron. On the south end, with a portion of Taxiway A1 removed, new taxilane pavement is planned to connect the two aprons to allow aircraft to maneuver and provide an ingress/egress for pilots. This project also plans for the construction of a new taxilane extending from the south apron to a planned development area. This area is planned to consist of two conventional hangars with a shared apron.
- *Cost Estimate:* $428,200
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #6 – 2026: Terminal Building Improvements – HVAC Replacement

- *Description:* This project includes labor and materials to replace the HVAC units at the terminal building. Funds are anticipated to be sourced through TxDOT's Routine Airport Maintenance Program (RAMP), which provides matching funds of 50 percent of the project cost, up to $50,000.
- *Cost Estimate:* $97,098
- *Funding Breakdown:* AIP/TxDOT - 50 percent | Sponsor/Local - 50 percent

Project #7 – 2027: Security, Technology, and Camera Upgrades to Airport

- *Description:* This project includes technology and security upgrades, including the addition of cameras, door card readers, and other technology improvements.
- *Cost Estimate:* $79,082
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #8 – 2027 Install Medium Intensity Taxiway Lighting (MITL) and Four-Box Precision Approach Path Indicator (PAPI) on Runway 16

- *Description:* Taxiway pavement at Brenham Municipal Airport is currently equipped with green centerline reflectors embedded in the pavement. This project plans for the addition of MITL on Taxiway A and its connectors. A PAPI-4 is also planned to replace the PAPI-2 on the approach to Runway 16.
- *Cost Estimate:* $1,443,800
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

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 $8.3 million as detailed in **Table 6B**. Of the overall short-term CIP total, approximately $7.4 million is eligible for federal and state funding assistance. The approximately $860,000 that remains 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 nine projects for the intermediate timeframe as listed in **Table 6B** and depicted on **Exhibit 6A**. The following section includes a description of each project.

Project #9: Expand Terminal Apron and Construct Access Road

- *Description:* The terminal apron is planned to be expanded to the east to provide additional ramp space and parking for transient aircraft, both fixed-wing aircraft and helicopters. This expansion would require the relocation of the fuel tanks that are currently located centrally on the east side of the apron. Aviation Way is planned to be rerouted around the new apron area.
- *Cost Estimate:* $1,559,300
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #10 – 2027: Construct Holding Bay on Taxiway A

- *Description:* A standard holding bay is planned at the north end of Taxiway A to provide space for queuing aircraft, which will enhance capacity and increase safety. This holding bay will replace the two nonstandard holding bays currently located at this runway end. The new holding bay reflects the design standards detailed in FAA Advisory Circular (AC) 150/5300-13B, *Airport Design*, and includes markings that allow independent movements for aircraft bypassing one another.
- *Cost Estimate:* $351,300
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #11: Construct Apron and Taxilane Pavement for Executive Hangars; Construct Vehicle Access Road – Phase 2

- *Description:* To meet projected demand in hangar storage space, new executive box hangars and a conventional hangar are planned north of the proposed hangar development outlined in Project #4. Project #11 plans for two new taxilanes extending from Taxiway A to connect to new apron areas to support planned executive hangars and a conventional hangar. The access road constructed as part of Project #4 is planned to be extended farther north to allow tenant access to this area. Project costs also include the extension of utilities.
- *Cost Estimate:* $1,682,900
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #12: Construct Future Taxiway B1 and Apron to Support West Side Development

- *Description:* Future Taxiway B1 is a planned new taxiway serving the west side of the airport. Currently, the airport owns property west of the Runway 34 threshold sufficient to support an apron and hangar complex. As no development currently exists in this area, a new taxiway (Taxiway B1) is planned to extend from Runway 34 to a new apron that could support four conventional hangars as well as a new, secondary fuel farm. Included in this project is MITL on new taxiway pavement, airfield signage, extension of utilities to this area, and vehicle parking for future tenants.
- *Cost Estimate:* $2,845,300
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #13: Drainage Master Plan

- *Description:* A drainage master plan is programmed to identify drainage deficiencies on the airport's property and develop solutions to meet the overall master plan goals. With planned development on both the airside and landside, a drainage study will be necessary to accommodate drainage needs associated with planned projects.
- *Cost Estimate:* $190,000
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #14: Terminal Building Improvements – New Exterior Paint and Roof

- *Description:* This project includes labor and materials to repaint the exterior of the terminal building and replace the roof.
- *Cost Estimate:* $217,635
- *Funding Breakdown:* AIP/TxDOT - 50 percent | Sponsor/Local - 50 percent

Project #15: Terminal Building Expansion (Option #1) and Parking Lot Expansion

- *Description:* As detailed in previous chapters, the existing terminal building may become constrained over the planning period as activity at the airport increases. This project plans for a 1,000-sf expansion of the existing building, which could include additional office/conference room space, a larger lobby, or additional pilot amenities. The vehicle parking lot is also planned to be expanded as part of this project. Currently, the public parking lot offers 45 parking spaces; the master plan study plans for an additional 22 spaces in the public parking area.

  Funding for terminal building expansion and construction projects is eligible to be sourced through TxDOT as a one-time occurrence. This is important to note because the existing terminal building at Brenham Municipal Airport was constructed using TxDOT's terminal funds. As such, Project #13 would need to be funded through local funding outlets OR through discretionary funds, which are not guaranteed.
- *Cost Estimate:* $374,100
- *Funding Breakdown:* AIP/TxDOT - 0 percent | Sponsor/Local – 100 percent

Project #16: Acquire Property for Future Landside Development

- *Description:* Approximately 7.5 acres of property east of the Runway 16 end has potential for future landside facility development. This project includes the acquisition of this property for future aviation development, as well as the cost to conduct an EA prior to purchase. It should be noted that, until it can be demonstrated that property is needed for aviation use, TxDOT/FAA will not participate in funding assistance. In these cases, the FAA considers this "land banking" and the airport sponsor is responsible for 100 percent of the upfront purchase, with the option to request reimbursement from TxDOT/FAA at a later date when need can be demonstrated (as long as federal guidelines were followed in purchasing the property).
- *Cost Estimate:* $395,000
- *Funding Breakdown:* AIP/TxDOT - 0 percent | Sponsor/Local - 100 percent

Project #17: Routine Pavement Maintenance

- *Description:* As airfield pavements deteriorate over time, it is necessary to undergo overlay/rehabilitation/reconstruction projects. Similar to the line item in the intermediate term program, it could be anticipated that multiple projects would cover routine pavement maintenance during the ultimate planning period.
- *Cost Estimate:* $2,000,000
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Intermediate-Term Program Summary

The total costs associated with the intermediate term program are estimated at $9.6 million as presented in **Table 6B**. Of this total, approximately $7.9 million could be eligible for federal/state funding, and the airport sponsor share is projected at $1.7 million.

ULTIMATE-TERM PROGRAM

The long-term planning horizon considers 11 projects for the 11-20+ year period that are mainly demand-driven. The projects and their associated costs are listed in **Table 6B** and graphically depicted on **Exhibit 6A** as appropriate.

Project #18: Environmental Assessment / Engineering Analysis for Ultimate Runway Relocation & Extension

- *Description:* Environmental and engineering analysis will need to be conducted prior to relocation, reconstruction, and extension of the runway. Specifically, the runway relocation project will require the acquisition of property in order to control the safety areas associated with the extended runway, thus triggering a need for environmental analysis, likely in the form of an Environmental Assessment. Additionally, engineering analysis will be needed to determine the scope of work necessary to bring the Runway 16 end into tolerance with FAA's gradient standards for a C-II runway environment.
- *Cost Estimate:* $300,000
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #19: Acquire Property to Protect Safety Areas

- *Description:* This project plans for the fee simple acquisition of approximately 2.7 acres of property north of the extended Runway 16 threshold to protect the ultimate ROFA. Additionally, aviation easements are planned to be acquired to protect approximately 16.7 acres of the Runway 16 RPZ and approximately 3.8 acres of the Runway 34 RPZ. Due to the proposed relocation and extension of the runway, the RPZ is consequently shifted, resulting in a need to protect property that has not historically been owned or protected by easement.
- *Cost Estimate:* $752,600
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #20: Reroute Old Independence Road and Remove Safety Area Obstructions

- *Description:* Old Independence Road passes through the ultimate C-II ROFA and RSA northwest of the Runway 16 threshold. If and when the airport transitions to a C-II design, these safety areas must be owned by the airport and free of any obstructions, such as public roadways. This project plans for Old Independence Road to be rerouted around the ultimate ROFA at this runway end when operations at the airport justify a transition to C-II. Objects that will become obstructions if/when the airport transitions to C-II-4000, such as the wind cones, perimeter fence, and vegetation, are planned to be removed or relocated. The remaining aircraft parking positions on the west side of the terminal apron are also planned to be removed.

- *Cost Estimate:* $863,800
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #21: Relocate & Extend Runway 16-34 and Associated Projects

- *Description:* This project plans for Runway 16-34 to be relocated, widened, and extended to meet ultimate C-II-4000 design standards. This includes relocating the runway centerline 60 feet to the west. New pavement is planned to be constructed on the west side, with pavement on the east side demolished, bringing the ultimate runway width to 100 feet and allowing for 300 feet of separation between the runway and Taxiway A. Additionally, the runway is planned to be extended 500 feet to the north, bringing the total length to 6,503 feet. Taxiway A is also planned to be extended to the ultimate Runway 16 end, with a new connector (Taxiway A6) providing access to the threshold. In order to accomplish these projects and meet C-II standards for runway gradient, earthwork that could include fill and grading will need to be performed as part of this project. Navaids and other equipment that will need to be relocated as a result of the runway extension include the PAPI-4 (currently PAPI-2) and the runway end identifier lights (REILs) serving Runway 16. New pavement markings and airfield signage are planned, as well as additional MIRL on the extended runway and MITL on the extended taxiway. Lastly, this project will also include the displacement and re-marking of the Runway 34 threshold to provide standard safety areas on the south end.
- *Cost Estimate:* $11,284,800
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #22: Construct New Taxilane Pavement for T-hangars

- *Description:* New taxilane pavement is planned north of the terminal apron. This pavement is planned to support new T-hangars. Additionally, the access road is planned to be rerouted/extended to provide access to these hangar units as well as existing box hangars.
- *Cost Estimate:* $1,830,700
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #23: Construct New Apron and Taxilane Pavement for Conventional Hangars

- *Description:* The pond site is planned to be developed for revenue-producing aviation use. The costs to undertake this project would be significant, and the cost-benefit of pursuing this project should be carefully weighed, as other options for development may be available (i.e., acquisition of property on the west side of the airport to further development airside and landside facilities [see Project #25]). This project plans for the AWOS equipment to be relocated and the pond filled, with new apron and taxilane pavement constructed on this site. The apron is planned to be marked with dedicated aircraft parking, with vehicle access for tenants via a rerouted Aviation Way. A vehicle parking lot is also planned.
- *Cost Estimate:* $16,174,800
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #24: Construct New Taxilane Pavement for Executive Box and T-hangars

- *Description:* New taxilane pavement is planned north of the terminal apron. This pavement is planned to support new executive box and T-hangars. Additionally, the access road is planned to be rerouted/extended to provide access to these hangar units as well as existing box hangars. Note that this project area and its development potential will be analyzed in the drainage master plan (refer to Project #13).
- *Cost Estimate:* $10,622,800
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #25: Acquire Property for Future Landside Development

- *Description:* Approximately 83.7 acres of property located between Old Independence Road and the west side of Runway 16-34 has potential for aeronautical development. This project includes the cost of an EA and the property acquisition in order to preserve this property for potential future aviation use. A portion of this property would be necessary to construct ultimate Taxiways B and B2, along with the proposed expansion of the west side development. Similar to Project #16, this project would likely need to be funded locally, with reimbursement for all or a portion of the cost requested once the City of Brenham demonstrates an aeronautical need for the property and federal guidelines were followed in the acquisition process.
- *Cost Estimate:* $3,511,200
- *Funding Breakdown:* AIP/TxDOT - 0 percent | Sponsor/Local - 100 percent

Project #26: Construct Ultimate Taxiway B and Connectors; Construct Apron Pavement

- *Description:* Project #12, described previously, detailed the construction of future Taxiway B1 to provide access to a planned landside development area west of Runway 34. Project #26 plans for expansion of this area, with new taxiway pavement constructed (partial parallel Taxiway B and connector B2) along with an expanded apron area to support additional conventional hangars. Additional parking areas are planned for both aircraft and vehicles.
- *Cost Estimate:* $5,953,200
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Project #27: Construct New Terminal Building (Option #2); Construct Apron Pavement

- *Description:* An option to construct a new terminal building on the north side of the apron and demolish the existing terminal structure has been considered. This project outlines the details and cost of this option. As shown on **Exhibit 6A**, terminal option #2 includes construction of a new terminal building on the footprint of the existing maintenance hangar on the north side of the terminal apron. The existing terminal building would be demolished, and new pavement constructed for an expanded apron area which could support executive box hangars. The new terminal, planned at 5,625 sf, could include all the amenities currently offered, with additional space for an expanded lobby or pilot uses, but in a modernized building. Vehicle parking is also planned at the rear of the terminal building. While TxDOT state funds for terminal development have already been used to construct the existing terminal, this could be eligible for federal funding through discretionary grants but is unlikely due to it being considered a low priority project.
- *Cost Estimate:* $3,180,800
- *Funding Breakdown:* AIP/TxDOT - 0 | Sponsor/Local - 100

Project #28: Routine Pavement Maintenance

- *Description:* As airfield pavements deteriorate over time, it is necessary to undergo overlay/rehabilitation/reconstruction projects. Similar to the line item in the intermediate term program, it could be anticipated that multiple projects would cover routine pavement maintenance during the ultimate planning period.
- *Cost Estimate:* $4,000,000
- *Funding Breakdown:* AIP/TxDOT - 90 percent | Sponsor/Local - 10 percent

Ultimate-Term Program Summary

The total investment necessary for the ultimate-term CIP detailed in **Table 6B** is approximately $58.5 million. Approximately $46.6 million is eligible for federal/state funding assistance, once justified. The airport's share of ultimate-term projects is projected at $11.9 million.

CAPITAL IMPROVEMENT PROGRAM SUMMARY

The CIP is intended as a road map of improvements to help guide the City of Brenham and TxDOT. The plan as presented will help accommodate increases in forecast demand at Brenham Municipal Airport 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, TxDOT, and the FAA. Nonetheless, this is a comprehensive list of capital projects the airport should consider in the next 20+ years.

The total CIP proposes approximately $76.4 million in airport development needs. Of this total, approximately $61.9 million could be eligible for federal/state funding assistance. The local funding estimate for the proposed CIP is $14.5 million.

CAPITAL IMPROVEMENT FUNDING SOURCES

There are generally four different 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), generally reserved for commercial service airports

Access to these sources of financing varies widely among airports, with some large airports maintaining substantial cash reserves, while the smaller commercial service and general aviation airports often require subsidies from local governments to fund operating expenses and finance modest improvements.

Financing capital improvements at Brenham Municipal Airport will not rely solely on the financial resources of the City of Brenham. Capital improvement funding is available through various grant-in-aid programs on both the federal and state levels. Historically, the airport has received both federal and state grants. While more funds could be available in 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 the 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 Airport Improvement Program (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 the 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 reauthorized 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. Established in 1970, the Aviation Trust Fund provides 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 Brenham Municipal Airport – may receive AIP funding for eligible projects, as described in FAA's *Airport Improvement Program Handbook*. The airport must fund the remaining projects' costs using a combination of other funding sources, which are discussed in the following sections.

Table 6C presents the approximate distribution of the AIP funds as described in FAA Order 5100.38D, Change 1, *Airport Improvement Program Handbook*, issued February 26, 2019. Brenham Municipal Airport is eligible to apply for grants which may be funded through state apportionments, the small airport fund, discretionary funds, and/or set-aside categories.

Funding for AIP-eligible projects is undertaken through a cost-sharing arrangement in which FAA/TxDOT provides up to 90 percent of the cost and the airport sponsor invests the remaining 10 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.

TABLE 6C | Federal AIP Funding Distribution

Funding Category	Percent of Total	Amount[1]
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
Total	**100.00%**	**$3,350,000,000**

[1]FAA *Modernization and Reform Act of 2018*

Source: FAA Order 5100.38D, Change 1, Airport Improvement Program Handbook

Another source of federal grants is the **Bipartisan Infrastructure Law (BIL), which was signed into law in 2022 and plans for $25 billion to be invested into airports in the United States over the next five years**. BIL funds are sourced from the U.S. Treasury General Fund and are split into two funding buckets: $20 billion for Airport Infrastructure Grants (AIG) and $4.85 billion for Airport Terminal Program (ATP). **Under BIL, Brenham Municipal Airport can receive approximately $295,000 in allocated AIG funding each year through 2026**.[1] Beginning in FY2022, funds were apportioned to the airport, but as of the writing of this document (May 2023), detail of grant fund administration have yet to be provided. Once these funds become available, this money can be used for repair and maintenance of existing infrastructure or construction of new facilities (e.g., airfield pavement, navaids, lighting, terminal buildings, etc.). ATP grants can be used for multi-modal terminal development and relocating, reconstructing, repairing, or improving an airport traffic control tower. The federal share for AIG is the same as an AIP grant – 90 percent with a 10 percent local match – while the federal share for ATP grants is 95 percent for non-primary airports. The same grant assurances that apply to AIP grants will also apply to BIL grants. BIL and AIP grants cannot be combined into a single grant. TxDOT Aviation has recently agreed to administer the program for FAA, so Texas airports, including Brenham Municipal Airport, can expect to receive these funds in the near future, with approximately $295,000 annually allotted to Brenham Municipal Airport for each year of the program.

1 Brenham Municipal Airport was eligible to receive $295,000 in BIL grants for FY2022 and $292,000 in FY2023.

Apportionment (Entitlement) Funds

AIP provides funding for eligible projects at airports through an apportionment (entitlement) program. Non-primary airports that are included in the *National Plan of Integrated Airport Systems* (NPIAS), such as Brenham Municipal Airport, receive a guaranteed minimum level of 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 the completion of a more expensive project.

The FAA also provides a state apportionment based on a federal formula that considers land area and population. For the State of Texas, TxDOT 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 passenger facility charge (PFC), which is a fee of up to $4.50 per 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, Brenham Municipal Airport 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 element of discretionary funds is that they are distributed on a priority basis. The priorities are established by a code system at FAA. 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 design standards, and increasing system capacity.

It is important to note that competition for discretionary funding is not limited to airports within the State of Texas, or those within the FAA Southwest Region. The funds are distributed to all airports in the country and, as such, are more difficult to obtain. High priority projects will often fare favorably, while lower priority projects may not receive discretionary grants.

FAA Facilities and Equipment (F&E) Program

The Airway Facilities Division of the FAA administers the Facilities and Equipment (F&E) Program. This program provides funding for the installation and maintenance of various navigational aids and equipment of the National Airspace System. Under the F&E program, funding is provided for FAA air traffic control towers, 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.[2]

STATE FUNDING PROGRAMS

The State of Texas participates in the federal State Block Grant Program. Under this program, the FAA annually distributes general aviation state apportionment and discretionary funds to TxDOT which, in turn, distributes grants to airports within the state. In compliance with TxDOT's legislative mandate that it "apply for, receive, and disburse" federal funds for general aviation airports, TxDOT acts as the agent of the local airport sponsor. Although these grants are distributed by TxDOT, they contain all federal obligations.

The State of Texas also distributes funding to general aviation airports from the Highway Trust Fund as the Texas Aviation Facilities Development Program. These funds are appropriated each year by the state legislature. Once distributed, these grants contain state obligations only.

The establishment of a CIP for the state entails first identifying the need, then establishing a ranking or priority system. Identifying all state airport project needs allows TxDOT to establish a biennial program and budget for development costs. The currently approved TxDOT CIP, *Aviation Capital Improvement Program 2023-2025*, assumes that approximately $19 million in annual federal AIP grants, plus $24 million earmarked for non-primary entitlement, $12 million in annual federal discretionary funding, and $15 million in state funds, would be available.

The TxDOT biennial program sets a project priority system established by the Texas Transportation Commission in order to make the best use of limited state and federal airport development funds. **Table 6D** presents the priority objectives and their associated description, listed in order of importance.

TABLE 6D | TxDOT Project Priorities

PRIORITY OBJECTIVE	DESCRIPTION
Safety	Projects needed to make the facility safe for aircraft operations.
Preservation	Projects to preserve the functional or structural integrity of the airport.
Standards	Improvements required to bring the airport up to the design standards for current user aircraft.
Upgrade	Improvements required to allow the airport to accommodate larger aircraft or longer stage lengths.
Capacity	Expansion required to accommodate more aircraft or higher activity levels.
New Access	A new airport providing new air access to a previously unserved area.
New Capacity	A new airport needed to add capacity or relieve congestion at other area airports.

Source: TxDOT Aviation Capital Improvement Program, 2023-2025

Each project for the airport must be identified and programmed into the state CIP and will compete with other airport projects in the state for both federal and state funds. In Texas, airport development projects that meet TxDOT's discretionary funds' eligibility requirements can receive 90 percent funding from the AIP State Block Grant Program. Eligible projects include airfield and apron facilities. Historically,

2 Guidance on the eligibility of a project for federal AIP grant funding can be found in FAA Order 5100.38D, *Airport Improvement Program Handbook, Change 1*, effective February 26, 2019.

revenue-generating improvements, such as fuel facilities, utilities, and hangars, have not been eligible for AIP funding. However, FAA funding legislation has historically provided an allowance of NPE funds to be used for hangar or fuel farm construction if all other airfield needs have been addressed.

The availability of grant funds can fluctuate from year to year. Typically, an airport can expect a grant to cover several projects in one grant cycle. The next grant opportunity may not occur for a couple of years after. This cycle occurs because TxDOT must administer grants for more than 300 airports and has relatively limited resources. As a result, local budgeting for future capital improvements should consider sporadic grant availabilities.

Routine Airport Maintenance Program (RAMP)

TxDOT has established the RAMP to help general aviation airports maintain and, in some cases, construct new facilities. The program was initially designed to help airports maintain airside and landside pavements but has since been expanded to include construction of new facilities. RAMP is an annual funding source in which TxDOT will provide a 50 percent funding match for projects up to $100,000. **Table 6E** outlines the projects that are eligible under RAMP. It should be noted that some of the projects listed in the airport's proposed CIP are also eligible for RAMP funding.

TABLE 6E | RAMP Eligible Projects
AIRSIDE MAINTENANCE
Pavement crack seal/Slurry seal/Fog seal/Rejuvenator
Pavement markings
Drainage maintenance
Sweeping
Herbicide application
Replacement bulbs/lamps for airside lights, approach aids
Repair/maintenance of beacon, lighting, approach, and navigational aids
AWOS parts replacement
AFTER AIRSIDE MAINTENANCE IS ADDRESSED
Seal coats/chip seals/crack seal for non-airside pavement
Hangar/terminal painting and repairs (airport-owned only)
Security camera systems
Game-proof or security fencing and gates
Access roads for AWOS installations
AWOS NADIN interface charges
Airport entrance signs
Repair/replacement of fuel systems, including tanks (airport-owned only)
Storm Water Pollution Prevention Plans and Spill Prevention Control & Countermeasure Plans
Airfield FOD sweeper
HVAC repairs in terminal building/tower
CAPITAL IMPROVEMENT PROJECTS (with TxDOT guidance)
New public vehicle parking areas
New entrance roads and hangar access roads
Aircraft wash racks
Aircraft parking aprons
Extension of runway lighting systems
Drainage improvements
Small general aviation terminal buildings
Beacon/tower replacement
Preparation of FAA Form 7460-1 for RAMP projects

Source: TxDOT RAMP (2022)

Other State Airport Programs

TxDOT also provides a funding mechanism for terminal buildings and airport traffic control tower (ATCT) improvements. TxDOT has funded terminal building construction on a 50/50 basis, up to a $1 million total project cost. It should be noted that TxDOT has recently considered upgrading the total cost allowance on a case-by-case basis. However, this program generally allows for a one-time construction aid; thus, any new terminal building construction would be ineligible for this program as these monies were previously used to construct the existing building.

TxDOT also funds the construction of up to two ATCTs statewide each year. TxDOT has improved the program so that ATCT funding could be provided on a 90/10 basis, up to a total construction cost of $1.67 million.

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 money 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 or improvements to airport facilities.

All airports should establish standard base rates for various leases. All lease rates should be set to adjust to a standard index, such as the consumer price index (CPI), to ensure that fair and equitable rates continue to be charged in 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 may 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; 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/Third-Party Financing

Leasehold or third-party financing refers to a developer or tenant financing improvements under a long-term ground lease. The advantage of this arrangement is that it relieves the airport of the responsibility of having to raise capital funds for the improvement. As an example, a hangar developer might consider constructing hangars and charging fair market lease rates, while paying the airport for a ground lease. A fuel farm can be undertaken in the same manner, with the developer of the facility paying the airport a fuel flowage fee.

Many airports use third-party funding when the planned improvements will primarily be used by a private business or other organization. Such projects are not ordinarily eligible for federal funding. Projects of this kind typically include hangars, fixed-base operator facilities, fuel storage, exclusive aircraft parking aprons, industrial aviation-use facilities, non-aviation office/commercial/industrial developments, and other similar projects. Private development proposals are considered on a case-by-case basis. Often, airport funds for infrastructure, preliminary site work, and site access are required to facilitate privately developed projects on airport property.

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. A landing fee (described in greater detail in a later section) is another example where operators of aircraft pay the airport a set amount for using the airfield. Oftentimes, this can be waived with the purchase of aviation fuel, which, in turn, offers another revenue source for the airport.

Non-Aeronautical Development

In addition to generating revenue from traditional aviation sources, airports with excess land can permit compatible non-aeronautical development. Generally, an airport will extend a long-term lease (up to 30 years) for land not anticipated to be needed for aviation purposes in the future. The developer then pays the monthly market defined lease rate, constructs, and uses the compatible facility. Brenham Municipal Airport has approximately 46 acres of property currently being used for non-aeronautical purposes (i.e., agricultural lease), including the 27.7-acre area earmarked for future/ultimate non-aeronautical use as discussed in the previous chapter. An additional 7.7-acre area on the southeast side of the airport is also planned to be reserved for potential non-aeronautical development. As described previously in Chapter Five, it should be noted that any future non-aviation development must be reviewed and approved by both the FAA and TxDOT[3].

Special Events

Another common revenue-generating option is permitted use of airport property for temporary or single events. A pancake "fly-in" or an air show are two popular examples of a special event. It should be noted that air shows require a Certificate of Waiver or Authorization (FAA Form 7711-1) that has been

[3] Refer to the FAA *Reauthorization Act of 2018*, Section 163 for additional information.

approved and issued by the appropriate FAA Flight Standards District Office[4]. Airports can also permit portions of their facilities to be used 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.

AIRPORT RATES AND CHARGES

The FAA places several stipulations on rates and charges establishment and collection; however, two primary considerations need to be addressed. First, the rates and charges must be fair, equally applied, and resemble fair market value. Second, the rates and charges collected must be returned to and used only by and/or for the airport. In other words, the revenues generated by airport operations cannot be diverted to the general use of the City of Brenham. The FAA requires funds to be used at airports, as these funds often need to either support the day-to-day operational costs or offset capital improvement costs.

The following provides several activities that enhance revenue production for an airport, some of which are currently being practiced at Brenham Municipal Airport.

Comparable Airport Rates and Charges

As a point of comparison, **Table 6F** presents published rates and charges imposed by other Texas airports offering general aviation services. This information can serve as a barometer to which the City of Brenham can measure the airport's rates and fees to ensure market rates are being charged. If the city desires a more detailed evaluation, consideration should be given to conducting an Airport Rates and Charges Study to ensure revenues are adequate to cover costs and the airport is compliant with FAA policies for revenue-producing facilities.

A secondary source of information is included in a 2021 *Airport Rates and Charges Survey* conducted by another aviation consultancy. This survey provides rates and fees statistics based on survey respondent answers, with information categorized by state and NPIAS role. For Texas, the overall response rate was 30 percent, with 71 airports providing information. Airports classified as Regional airports within the NPIAS, such as Brenham Municipal Airport, responded at a rate of 35 percent. Using information from this survey, which is included in the following sections, as well as specific information from the airports detailed in **Table 6F**, will enable Brenham Municipal Airport to make better-informed decisions when setting rates and charges for facility use.

[4] Refer to https://www.faa.gov/airports/airport_safety/airshows for additional information on air show requirements.

TABLE 6F | Comparable Airport Statistics – General Aviation

Airport	2022 Est. Operations	Tie-Down	HANGARS Size	HANGARS Monthly Rent	FUEL PRICE/GALLON Type	FUEL PRICE/GALLON 100LL	FUEL PRICE/GALLON Jet A
Terrell Municipal Terrell, TX	33,580	N/A	*T-hangars* - 1,000 sq. ft. - 44' door opening with bi-fold doors - City Hangar @ 6,000 sq. ft.	 $150 $290-420 $1,000	FS	$5.85	$5.40
Granbury Regional Granbury, TX	40,150	$8-12/night NC with Fuel	*T-hangars* - New enclosed hangars - New enclosed end hangars - Older city hangars - Open T-hangars	 $305 $350 $240 $135	SS FS	$5.35 N/A	N/A $4.99
Cleburne Regional Cleburne, TX	33,215	NC	T-hangars – small T-hangars – large	$200 $250	SS FS	$5.24 $5.95	$4.53 $5.53
Mid-Way Regional Airport Midlothian, TX	49,640	N/A	*T-hangars* - 39 x 33 - 47 x 33 - 45 x 39 - Box hangar – 3,111 sq. ft. - Box hangar – 4,620 sq. ft., powered doors - Box hangar – 4,225 sq. ft., power doors/sprinkler	 $308 $363 $470 $935 $1,089 $1,700	SS FS	$5.80 $6.20	N/A $6.85
Burnet Municipal Burnet, TX	20,805	NC overnight $75/month	- T-hangar & Community Hangar - Sun Shelters	$275 $125	SS FS	$5.67 $6.24	$5.80 $5.89
Smithville Crawford Municipal Smithville, TX	16,790	$50-60/month ramp $35-50/month grass	- Single hangar	$375	SS	$6.10	N/A
Gillespie County Fredericksburg, TX	14,965	NC	- T-hangar	$255	SS FS	$6.23 $6.23	$5.30 N/A
Lockhart Municipal Lockhart, TX	15,695	NC	- T-hangar - Clear 45 x 41 - Corner Tee 42 x 30	$250 $350 $275	SS	$5.75	N/A
Lampasas Airport Lampasas, TX	10,950	$30/month	- T-hangar I - T-hangar II - Box Hangar I - Box Hangar II	$125 $160-200 $160 $140	SS	$6.25	N/A
Brownwood Regional Brownwood, TX	7,665	$30/month	- T-hangar - Executive Box Hangar - Shared Corporate Hangar - T-Shelter	$155 $330 $155 $77	SS FS	$4.83 $5.33	$4.85 $5.05

Legend: SS = self-serve, FS = full serve, NC = no charge, N/A = not available, sq. ft. = square feet

Sources: www.airnav.com, and airport websites

Aircraft Parking/Tiedowns

Aircraft parking fees, also referred to as tiedown fees, are typically assessed to those aircraft utilizing a portion of an aircraft parking area that is owned by the airport. These fees are most generally assessed on a daily or monthly basis, depending upon the specific activity of a particular aircraft.

Aircraft parking fees can be established in several different ways. Typically, airports assess aircraft parking fees in accordance with an established schedule in which an aircraft within a designated weight and/or size category pays a similar fee (i.e., small aircraft, single engine aircraft). Aircraft parking fees may also be charged according to a "cents per 1,000 pounds" basis in which larger aircraft with increased weights would obviously pay more for utilizing the aircraft parking apron. There are also instances in which aircraft parking fees are not assessed on an airport.

An airport sponsor may also include in a lease agreement with an aviation-related commercial operator at the airport to collect aircraft parking fees on portions of an aircraft parking apron in which the airport does not own or is leasing to a commercial operator, such as a SASO. As a result, the airport could directly collect parking fees from an aircraft utilizing this space or allow the commercial operator to collect the parking fee, in which the agreement may allow the commercial operator to retain a portion of the parking fee as an administrative or service fee.

As previously discussed, aircraft parking fees can be assessed on a daily or monthly basis. Daily aircraft parking fees are typically assessed to transient aircraft utilizing the airport on a short-term basis, while monthly fees are charged to aircraft that utilize a particular parking area for the permanent storage of their aircraft. Monthly aircraft parking fees are often assessed at airports that contain a waiting list for aircraft hangar storage space. It is also common practice at many airports to waive a daily aircraft parking fee in the event the aircraft purchases fuel prior to departing the airport.

Using the airports detailed in **Table 6F** above for comparison purposes, daily aircraft parking fees can vary depending on the type of aircraft and whether or not fuel was purchased, while monthly aircraft parking fees generally range between $30 to $75 per month depending on the type and size of the aircraft. The 2021 survey did not include information pertaining to tiedown fees.

At present, Brenham Municipal Airport does not charge a daily tiedown fee or have an established monthly tiedown rate. The airport should consider establishing daily and monthly tiedown fees for local and transient aircraft.

Aircraft Storage Hangars

There are several types of aircraft storage hangars that can accommodate aircraft on an airport. In order to establish hangar fees, an airport typically factors in such qualities as hangar size, location, and utilities. Aircraft hangar fees are most often charged on a monthly basis. Hangars are commonly owned both by the airport proprietor or a private entity. If owned by the airport, the tenant is charged a rental fee. If a hangar is constructed and operated by a private entity, a long-term lease, under market rates, is charged not typically longer than 30 years with the attachment of a reversion clause. The reversion clause indicates that the physical structure will “revert” to airport sponsor ownership at a defined future time.

Based on the FAA’s interpretation of Grant Assurance 5 regarding reversionary interests, an airport sponsor’s failure to include or exercise lease agreement reversion clauses contributes to forfeiting its rights and powers. In addition, Grant Assurance 22 regarding economic non-discrimination requires terms, rates and fees to be established without unjust discrimination and applied uniformly to same or similar uses. Also, Grant Assurance 24 regarding fee and rental structure requires the establishment of rates, fees and rents which will make the airport as self-sustaining as possible. Thus, failure to include or exercise reversion clauses in a lease agreement impacts the airport sponsor’s ability to achieve or maintain self-sustainability.

Overall, the FAA has found that failure to exercise reversion clauses in leases has contributed to forfeiting an airport's rights, powers and ability to be self-sustainable. Failure to apply best practices or obligatory requirements places the airport at risk for future FAA grant funding. With that said, an extended lease term should not be an issue if aeronautical rent for land and improvements are at comparable fair market value.

Common aircraft storage hangars are typically categorized as shade hangars, T-hangars, executive box, and conventional hangars. Shade hangars consist of tiedown spaces with a protective roof covering. T-hangars provide separate, single-aircraft storage areas. Executive box and conventional hangars provide a larger enclosed space that can accommodate larger multi-engine piston or turbine aircraft and/or multiple aircraft storage. Conventional hangars can also be utilized by aviation-related commercial operators for their business activities on an airport.

Location can also play a role in determining hangar rates. Aircraft storage hangars with direct access to improved taxiways/taxilanes and adjacent to aviation services being offered at an airport can oftentimes be more expensive to rent. In addition, the type of utility infrastructure being offered to the hangar can also help determine storage fees. Smaller aircraft storage hangars, such as a T-hangar or small box hangar, can either be granted access through a manual sliding door or electric door. It is common for hangars that provide electric doors to have higher rental fees, as the cost associated with constructing these hangars would exceed the cost associated with simpler structures.

As noted above, some airports' hangar facilities are constructed and managed by the airport sponsor, while at other airports, hangars are built by private entities. In some cases, airports have both public and private hangar facilities available. Hangars can be expensive to construct and offer minimal return on investment in the short term. In order to amortize the cost of constructing hangars, lease rates should be developed at a minimum to recover development and finance costs prior to the expiration of the facilities' useful life.

As shown in **Table 6F**, T-hangars often range from approximately $150 to $400 per month depending on several factors previously listed. The 2021 rates and charges survey also included data on average T-hangar rental rates, with smaller hangars, on average, being leased for $275 per month, and medium hangars rented for $375 per month on average. Clearspan hangars leased for $745 per month on average, while community hangars are rented for an average of $320 per month. Larger conventional-style hangars can be leased per aircraft space or for the entire hangar. Monthly rates similar to those for individual T-hangar units often apply to leased aircraft space in a conventional hangar.

At Brenham Municipal Airport, the city charges a lease/rental rate of $280 per month or $3,360 annually on all airport-owned hangars. On average, the T-hangar rental rate presented in **Table 6F** is approximately $270 per month. Based upon this analysis, the City of Brenham could consider increasing the hangar rental rate if they want to be at the top end of the market. However, a rate change such as this should be well thought out and carefully orchestrated as local market conditions will prevail. The airport could potentially lose tenants if hangar rental rates are increased too drastically. Thus, a balance must be struck between what is profitable for the airport and what the local market can support.

Ground Rental/Lease

Ground rentals can be applied to aviation and non-aviation development on an airport. Also known as a land lease, a ground lease can be structured to meet the particular needs of an airport operator in terms of location, terrain features, amount of land needed, and type of facility infrastructure included.

One of the single most valuable assets available to an airport is the leasable land with access to the runway/taxiway system. For aviation-related businesses, it is critical that they be located on an airport. Airport property is available for long-term lease but, in most cases, it cannot be sold. At the expiration of the lease and any extensions, the improvements on the leased land revert back to the airport sponsor. In order for this arrangement to make financial sense, most ground leases are at least 20 years in length and include extension opportunities. Those who lease land on an airport are typically interested in constructing a hangar for their own private use, for sub-lease, or for operation of an airport business. Therefore, the long-term lease arrangement is important in order to obtain capital funding for the construction of a hangar or other type of facility. It should also be noted that ground leases should include the opportunity to periodically review the lease and adjust the rate according to the consumer price index (CPI). Typical lease agreements range from 20 to 30 years with options for extensions.

Ground leases are typically established on a yearly fee schedule based upon the amount of square feet leased. The amount charged can vary greatly depending on the level of improvements to the land. For example, undeveloped land with readily accessible utilities and taxiway access can generate more revenue than unimproved property. According to the 2021 rates and charges survey, aeronautical land lease rates per square foot were $0.27 on average. The current land lease rate at Brenham Municipal Airport is set at $0.10 per square foot per year. Based upon results from surveys outside this study, the airport should consider increasing lease rates, with a greater increase for prime locations. Consideration should also be given to the inclusion of a reversion clause within the ground lease agreement.

Some airports will have other leasable space available. For example, airports with a terminal building may have office or counter space available for aviation and non-aviation related businesses. Some example businesses could include SASOs, aircraft sales, flight instruction, aircraft insurance, and a restaurant.

Under certain circumstances, an airport sponsor may utilize portions of the airport for non-aeronautical purposes, such as commercial and/or industrial development, if certain areas are not needed to satisfy aviation demand or are not accessible to aviation activity. Prior to an airport pursuing a ground lease with a commercial operator for non-aeronautical purposes, the sponsor must formally request that TxDOT and the FAA release the land in question from its federal obligations.

Fuel Sales and Flowage

Fuel sales are typically managed at an airport in one of two ways: the airport sponsor acts as the fuel distributor or fueling operations are sub-contracted to an FBO. If the airport sponsor acts as the fuel distributor, then the airport would receive revenues equal to the difference between wholesale and retail prices. Of course, there are added expenses, such as employing people to fuel the aircraft.

When these services are undertaken by an FBO, the airport sponsor typically receives a fuel flowage fee per gallon of fuel. By way of agreement with the airport sponsor, FBOs would be required to pay a fuel flowage fee for each gallon of fuel received into inventory. In the case of self-fueling entities, a fuel flowage fee could apply for each gallon of fuel dispensed. Fuel flowage fees are typically paid on a "cents per gallon" basis. In some instances, fuel flowage fees will be established based upon the type of aviation activity. For example, commercial airline service operators may be assessed a higher fuel flowage fee than general aviation aircraft, or no fuel flowage fee at all if being assessed a landing fee (to be discussed in the next section). Fuel flowage fees can also be distinguished by type of fuel (100LL or Jet A). At Brenham Municipal Airport, the city currently collects a fuel flowage fee of $0.04 for 100LL and $0.08 for Jet A. Previous surveys conducted by the consultant have determined fuel flowage rates to range from $0.10 per gallon to approximately $0.20 per gallon. As such, the airport should consider imposing a higher fuel flowage fee to match market rates.

The owner of the fuel farm can also be the airport sponsor or an FBO operator. If the airport sponsor owns the fuel farm and the FBO operator undertakes the fueling activities, then a separate fuel storage fee can be charged, or a higher fuel flowage fee may be assessed.

Landing Fees

Landing fees typically only apply to larger aircraft, such as those over 60,000 pounds, for example, and only those involved in commercial airline or air taxi operations. Landing fees are not common on general aviation airports and are generally discouraged due to collection difficulty. Moreover, landing fees are somewhat discouraging to aircraft operators, who will many times elect to utilize a nearby airport that does not collect a landing fee.

When landing fees are assessed, they are most commonly based upon aircraft weight and a "cents per 1,000 pounds" approach. In addition, some airport sponsors may use a flat fee approach wherein aircraft within a specified weight range are charged the same fee.

Landing fees may be collected directly by the airport sponsor, or an airport may have an agreement with a commercial operator to collect landing fees. Similar to what was discussed with aircraft parking fees, under this scenario, the agreement may allow the commercial operator, such as an FBO, to retain a portion of the landing fee as an administrative or service fee.

Similar to most general aviation airports, a landing fee has not been imposed at Brenham Municipal Airport. It is likely not in the best interest of the city to do so as it could act as a deterrent for some operators.

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 Brenham Municipal Airport to best serve the air transportation needs of the region, while achieving economic self-sufficiency.

The CIP and the phasing program presented will change over time. An effort has been made to identify and prioritize all major capital projects that would require TxDOT and FAA grant funding. Nonetheless, the airport and TxDOT 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 seven to 10 years, or sooner if significant changes occur in the interim.

In summary, the planning process requires the City of Brenham 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.

City of BRENHAM

Appendix A

GLOSSARY OF TERMS

GLOSSARY OF TERMS

A

Above Ground Level: The elevation of a point or surface above the ground.

Accelerate-Stop Distance Available (ASDA): See declared distances.

Advisory Circular: External publications issued by the FAA consisting of non-regulatory 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.

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 enroute phase of flight.

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 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.

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.

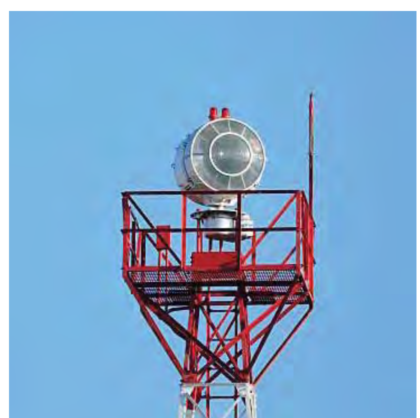
Airline Hub: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

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 Beacon

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: A local planning document that serves as a guide for 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.

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.

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 Lighting System

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.

Automated Weather Observation System (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.

Blast Fence

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.

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.

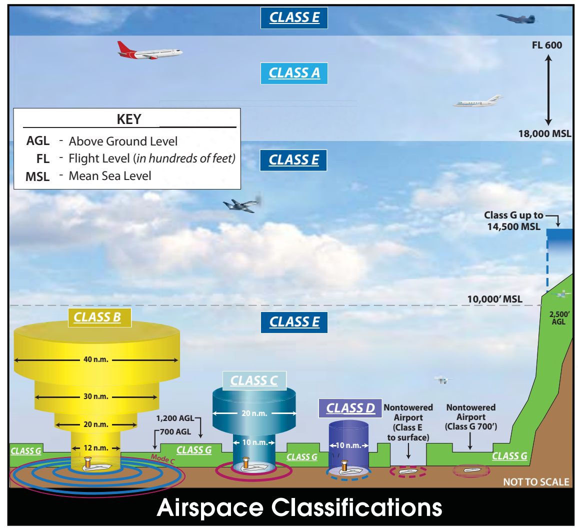
Common Traffic Advisory Frequency (CTAF): A radio frequency identified in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

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:



Airspace Classifications

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 airport 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:

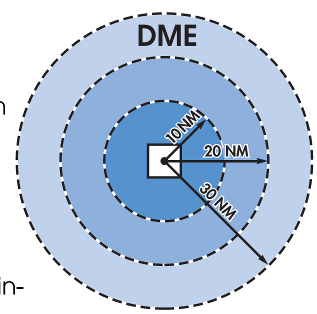
- **Takeoff Run Available (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off.
- **Takeoff Distance Available (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.
- **Accelerate-stop Distance Available (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 or 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 (FSS): 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 preflight 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:

- Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or
- Visual ground aids, such as PAPI, 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 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.

Ground Based Augmentation System (GBAS): A program that augments the existing GPS system by providing corrections to aircraft in the vicinity of an airport in order to improve the accuracy of these aircrafts' GPS navigational position

H

Helipad: A designated area for the takeoff, landing, and parking of helicopters.

High Intensity Runway Lights (HIRL): 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: An acute-angled exit taxiway forming a 30 degree angle with the runway centerline, designed to allow an aircraft to exit a runway without having to decelerate to typical taxi speed.

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.

Hot Spot: A location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary.

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	3. Outer Marker	5. Approach Lights
2. Glide Slope	4. Middle Marker	

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 arriving from outside the traffic pattern or departing the airport traffic pattern.

K

Knots: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

Landside: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

Landing Distance Available (LDA): See declared distances.

Large Airplane: An airplane that has a maximum certified takeoff weight in excess of 12,500 pounds.

Local Operations: Aircraft operations performed by aircraft 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. 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.


Localizer

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.

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:

- When the aircraft has descended to the decision height and has not established visual contact; or
- 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 (NAS): The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

National Plan Of Integrated Airport Systems (NPIAS): 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 non-directional 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 Air Missions (NOTAM): 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.

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 minimal less than Category II.

Precision Approach Path Indicator (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. A PAPI normally consists of four light units but an abbreviated system of two lights is acceptable for some categories of aircraft.

Precision Approach Path Indicator

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 Zone (POFZ): 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 POFZ is a clearing standard which requires the POFZ to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA is only in effect when the approach includes vertical guidance, the reported ceiling is below 250 feet, and an aircraft is on final approach within two miles of the runway threshold.

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 enroute 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 enroute 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 (RAIL): 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 signifying the FAA 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.


REIL

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 minimal.

Runway Reference Code: A code signifying the current operational capabilities of a runway and 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 sight 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, often co-located with a wind cone.

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 enroute 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: A taxiway designed for low speed and precise taxiing. Taxilanes are usually, but not always, located outside the movement area and provide access to from taxiways to aircraft parking positions and other terminal areas.

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 enroute 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.


Tetrahedron

Threshold: The beginning of that portion of the runway available for landing. In some instances, the 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.

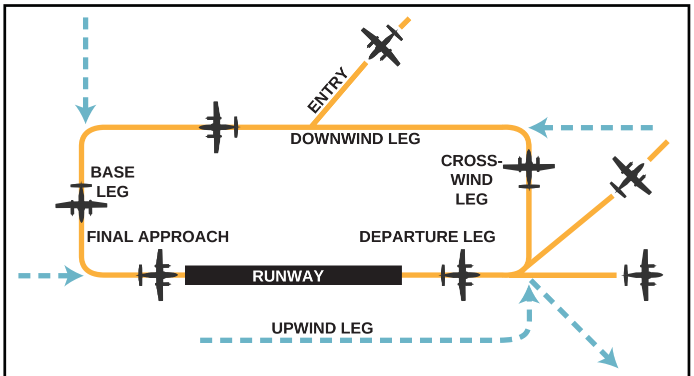
Touchdown and Lift-off Area (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which a helicopter lands or takes off.

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 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.



Traffic Pattern

U

Uncontrolled Airport: An airport without an airport 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 non-government communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOMs 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 Omni-directional 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 system of established routes that run along specified VOR radials, from one VOR station to another.

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. The VASI is now obsolete and is being replaced with the PAPI.

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.

Visual Runway: A runway without an existing or planned instrument approach.

VOR: See "Very High Frequency Omni-directional Range."

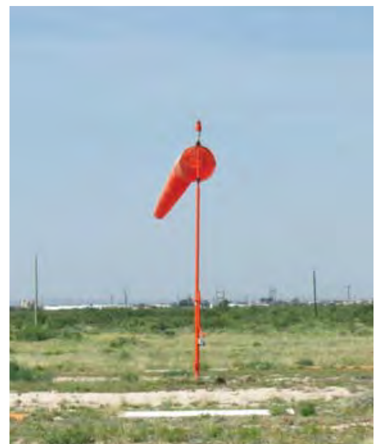
VORTAC: See "Very High Frequency Omni-directional Range/Tactical Air Navigation."

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.


Windsock/Windcone

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

APRC: approach reference code

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

ASV: annual service volume

ATC: airport traffic control

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100LL)

AWOS: automated 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

DPRC: departure reference code

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

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at middle marker

LNAV: lateral navigation

LOC: localizer

LOM: compass locator at outer marker

LP: localizer performance

LPV: localizer performance with vertical guidance

MALS: medium intensity approach lighting system

MALSR: MALS with runway alignment indicator lights

MALSF: MALS with sequenced flashers

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

MTOW: maximum takeoff weight

NAVAID: navigational aid

NDB: non-directional radio beacon

NEPA: National Environmental Policy Act

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: omni-directional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCI: pavement condition index

PCL: pilot-controlled lighting

PIW: public information workshop

POFZ: precision object free zone

PVC: poor visibility and ceiling

RCO: remote communications outlet

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: very high frequency omni-directional range/tactical air navigation

WAAS: wide area augmentation system

City of BRENHAM

Appendix B

AIRPORT LAYOUT PLANS

Texas Department of Transportation

125 EAST 11TH STREET, AUSTIN, TEXAS 78701-2483 | 512.463.8588 | WWW.TXDOT.GOV

March 11, 2024

City of Brenham
Mr. Atwood C. Kenjura – Mayor
3001 Aviation Way
Brenham, TX 77833

SUBJECT: Airport Master Plan Brenham Municipal Airport (11R)

Dear Mr. Kenjura:

The Brenham Municipal Airport Master Plan, prepared by Coffman Associates, and bearing your signature, is approved and the Airport Layout Plan (ALP) is accepted. A signed copy of the approved ALP is available to download.

An aeronautical study (no. 2024-ASW-69-NRA) was conducted on the proposed development. This determination does not constitute FAA approval or disapproval of the physical development involved in the proposal. It is a determination with respect to the safe and efficient use of navigable airspace by aircraft and with respect to the safety of persons and property on the ground.

In making this determination, the FAA has considered matters such as the effects the proposal would have on existing or planned traffic patterns of neighboring airports, the effects it would have on the existing airspace structure and projected programs of the FAA, the effects it would have on the safety of persons and property on the ground, and the effects that existing or proposed manmade objects (on file with the FAA), and known natural objects within the affected area would have on the airport proposal.

The FAA has only limited means to prevent the construction of structures near an airport. The airport sponsor has the primary responsibility to protect the airport environs through such means as local zoning ordinances, property acquisition, avigation easements, letters of agreement or other means.

This ALP approval is conditioned on acknowledgment that any development on airport property requiring Federal environmental approval must receive such written approval from FAA/TxDOT prior to commencement of the subject development. This Master Plan approval is also conditioned on acceptance of the plan under local land use laws. We encourage appropriate agencies to adopt land use and height restrictive zoning based on the plan.

Approval of the plan does not indicate that the United States or the State of Texas will participate in the cost of any development proposed. AIP funding requires evidence of eligibility and justification at the time a funding request is ripe for consideration. When construction of any proposed structure or development indicated on the plan is undertaken, such construction requires normal 45-day advance notification to FAA for review in accordance with applicable Federal Aviation Regulations (i.e., Parts 77, 157, 152, etc.). More notice is generally beneficial to ensure that all statutory, regulatory, technical, and operational issues can be addressed in a timely manner.

Please attach this letter to the Airport Master Plan and retain it in the airport. We wish you great success in your plans for the development of the airport.

Sincerely,

Emily Lambert

Emily Lambert
TxDOT Airport Planner

CC: Chandra Burks, Coffman Associates
Jillian M. Thackston, FAA
Jim Halley, City of Brenham

AIRPORT LAYOUT PLAN
for the
BRENHAM MUNICIPAL AIRPORT

Prepared for

City of BRENHAM

DRAWING INDEX

LOCATION MAP

VICINITY MAP

COUNTY MAP

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13A PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

DocuSigned by: 3/6/2024
DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR.

SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

DocuSigned by: Atwood C. Kenjura 3/6/2024
SIGNATURE — DATE
Mayor — Atwood C. Kenjura
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

PREPARED BY:
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Scottsdale, Az 85254
(602) 993-6999, Fax (7196)

Coffman Associates Airport Consultants
www.coffmanassociates.com

C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE

M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

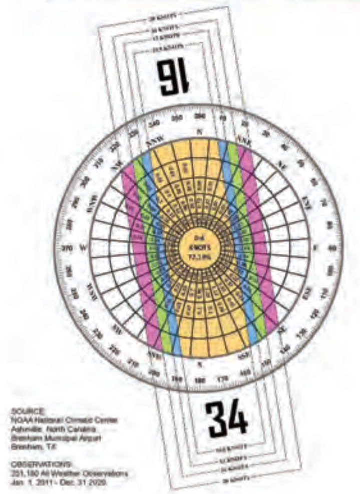
TITLE SHEET

BRENHAM MUNICIPAL AIRPORT (11R)
BRENHAM, TEXAS

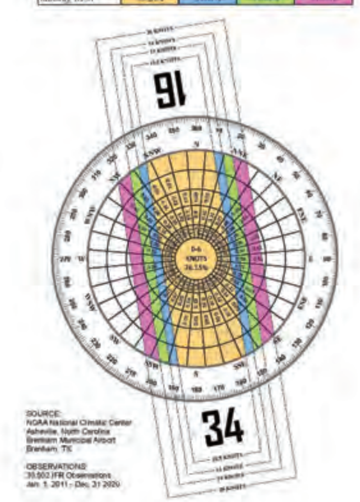
Texas Department of Transportation Aviation Division

SHEET 1 OF 16

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16/34	99.17%	99.69%	99.94%	99.99%



IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16/34	99.20%	[illegible]	[illegible]	[illegible]



RUNWAY DATA TABLE

RUNWAY DATA TABLE	RUNWAY 16-34 EXISTING		FUTURE		ULTIMATE	
Runway Identification	16	34	17	35	17	35
Runway Design Code (RDC)	B-II-4000		B-II-4000		C-II-4000	
Approach Reference Code (APRC)	B/II/4000		SAME		SAME	
Departure Reference Code (DPRC)	B/II		SAME		B/II & D/II	
Runway Surface Material	ASPHALT		SAME		SAME	
Runway Pavement Strength By Wheel Loading (in thousands of lbs.)	30 S		SAME		60 DWL	
Runway Pavement Strength by PCN	N/A		N/A		N/A	
Runway Surface Treatment	NONE		NONE		NONE	
Runway Effective Gradient	1.12%		SAME		1.11%	
Runway Percent Wind Coverage — 10.5 knots	99.17%		SAME		SAME	
Runway Percent Wind Coverage — 13 knots	99.69%		SAME		SAME	
Runway Percent Wind Coverage — 16 knots	99.94%		SAME		SAME	
Runway Percent Wind Coverage — 20 knots	99.99%		SAME		SAME	
Runway Dimensions (L x W)	6,003' x 75'		SAME		6,503' x 100'	
Runway End Coordinates — Latitude	30° 13' 40.20" N	30° 12' 41.46" N	SAME	SAME	30° 13' 45.003" N	30° 12' 41.374" N
Runway End Coordinates — Longitude	96° 22' 33.01" W	96° 22' 22.69" W	SAME	SAME	96° 22' 23.366" W	96° 22' 23.366" W
Runway End Elevation	317.70' MSL	250.44' MSL	SAME	SAME	322.50' MSL	250.44' MSL
Runway Displaced Threshold Coordinates — Latitude	N/A	N/A	SAME	SAME	SAME	30° 12' 42.098" N
Runway Displaced Threshold Coordinates — Longitude	N/A	N/A	SAME	SAME	SAME	96° 22' 23.493" W
Runway Displaced Threshold Distance	N/A	N/A	SAME	SAME	SAME	74'
Runway Displaced Threshold Elevation	N/A	N/A	SAME	SAME	SAME	251.23' MSL
Runway Safety Area Dimensions (width x length beyond end) - Design Std.	150' x 300'	150' x 300'	SAME	SAME	500' x 1,000'	500' x 1,000'
Runway Safety Area Dimensions (width x length beyond end) - Actual	150' x 300'	150' x 300'	SAME	SAME	500' x 1,000'	500' x 526'
Runway Lighting Type	MIRL		SAME		SAME	
Runway Protection Zone Dimensions	1,700' X 1,000' X 1,510'	1,700' X 1,000' X 1,510'	SAME	SAME	SAME	SAME
Runway Marking Type	NON-PRECISION		SAME		SAME	
14 CFR Part 77 Approach Slope	34:1	34:1	SAME	SAME	SAME	SAME
14 CFR Part 77 Approach Type	NP-C	NP-D	NP-D	SAME	SAME	SAME
Approach Visibility Minimums	7/8 MILE	3/4 MILE	3/4 MILE	SAME	SAME	SAME
Type of Aeronautical Survey Required for Approach	VERTICALLY GUIDED	VERTICALLY GUIDED	SAME	SAME	SAME	SAME
Departure Surface (Yes or N/A)	Y	Y	SAME	SAME	SAME	SAME
Runway Object Free Area Dimensions (width x length beyond end)	500' x 300'	500' x 300'	SAME	SAME	800' x 1,000'	800' x 526'
Runway Obstacle Free Zone Dimension (width x length beyond end)	400' x 200'	400' x 200'	SAME	SAME	SAME	SAME
13B Approach Surfaces*	5 & 6	5 & 6	SAME	SAME	SAME	SAME
Runway Visual and Instrument Navaids	GPS, PAPI-2(16), PAPI-4(34), REILs		GPS, PAPI-4 (17-35), REILs		SAME	
Touchdown Zone Elevation	318.00' MSL	269.00' MSL	SAME	SAME	322.50' MSL	283.74' MSL
Vertical Datum	NAVD88					
Horizontal Datum	NAD83					

*Tables 3-2, 3-3, & 3-4 in AC 150/5300-13B

AIRPORT DATA

City: BRENHAM, TEXAS	County: WASHINGTON	Owner: CITY OF BRENHAM	
Airport Name & ID: BRENHAM MUNICIPAL AIRPORT (11R)	EXISTING	FUTURE	ULTIMATE
Airport Reference Code (ARC)	B-II	SAME	C-II
Mean Maximum Temperature of Hottest Month	95°F (AUG)		
Airport Elevation (NAVD 88)	317.70' msl	SAME	322.50' msl
Airport Navigational Aids	GPS, ROTATING BEACON, PAPI-2, PAPI-4, REILs, LIGHTED WIND CONE, ASR-11	GPS, ROTATING BEACON, PAPI-4, REILs, LIGHTED WIND CONE, ASR-11	SAME
Airport Reference Point (ARP) Coordinates — Latitude	30° 13' 10.832" N	SAME	30° 13' 13.188" N
Airport Reference Point (ARP) Coordinates — Longitude	96° 22' 27.850" W	SAME	96° 22' 28.955" W
Miscellaneous Facilities	AWOS	SAME	SAME
Design Critical Aircraft	CITATION II/SP/LATITUDE	SAME	CHALLENGER 600/604
Wingspan of Design Aircraft (Feet)	52.17'	SAME	64.33
Approach Speed of Design Aircraft (Knots)	112	SAME	125
Undercarriage Width of Design Aircraft (Feet)	13.33	SAME	13
Magnetic Declination (Degrees)	2° 33' E		
Declination Date	01/2023		
Declination Source	NOAA		
NPIAS Code	REGIONAL GA		
State System Plan Role	BUSINESS/CORPORATE		

ELECTRONIC AIRPORT NAVAID OWNERSHIP	
NAVAID	OWNER
Beacon	Airport
PAPI's	Airport
REIL's	Airport
MIRL's	Airport
Windsocks	Airport
Signage	Airport
AWOS	Airport

Taxiway Data Table								
Existing/Future/ Ultimate Taxiway/Taxilane Designation	Width	Taxiway Design Group (TDG)	Taxiway/Taxilane Safety Area Dimension	Taxiway Object Free Area	Taxilane Object Free Area	Taxiway/Taxilane Lighting	Taxiway & Taxilane Separation[1]	Taxiway Edge Safety Margin (TESM)
A	40'	2A	79'	124'	110'	GREEN CENTERLINE REFLECTORS/MITL	62'	7.5'
A1 - A5	40'	2A	79'	124'	110'	GREEN CENTERLINE REFLECTORS/MITL	62'	7.5'
A6	35'	2A	79'	124'	110'	MITL	62'	7.5'
B1	35'	2A	79'	124'	110'	MITL	62'	7.5'
B	35'	2A	79'	124'	110'	MITL	62'	7.5'
B2	35'	2A	79'	124'	110'	MITL	62'	7.5'

[1] Objects located inside the TSA & TOFA/Distance from object to taxiway/taxilane centerline. See Table 4-1 in AC 150/5300-13B

MODIFICATIONS TO STANDARDS APPROVAL TABLE			
APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
NONE REQUIRED			

RUNWAY DECLARED DISTANCE	EXISTING		FUTURE		ULTIMATE	
	16	34	17	35	17	35
Takeoff Run Available (TORA)	6,003'	6,003'	SAME	SAME	6,503'	6,503'
Takeoff Distance Available (TODA)	6,003'	6,003'	SAME	SAME	6,503'	6,503'
Accelerate-Stop Distance Available (ASDA)	6,003'	6,003'	SAME	SAME	6,029'	6,503'
Landing Distance Available (LDA)	6,003'	6,003'	SAME	SAME	6,029'	6,429'

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

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DocuSigned by: 3/6/2024

Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

DocuSigned by: Atwood C. Kenjura 3/6/2024

SIGNATURE — DATE

Mayor Atwood C. Kenjura

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

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Coffman Associates
Airport Consultants
www.coffmanassociates.com

C. BURKS — DESIGNED BY — SEPTEMBER 2023 — DATE
M. BEAVER — DRAWN BY — SEPTEMBER 2023 — DATE

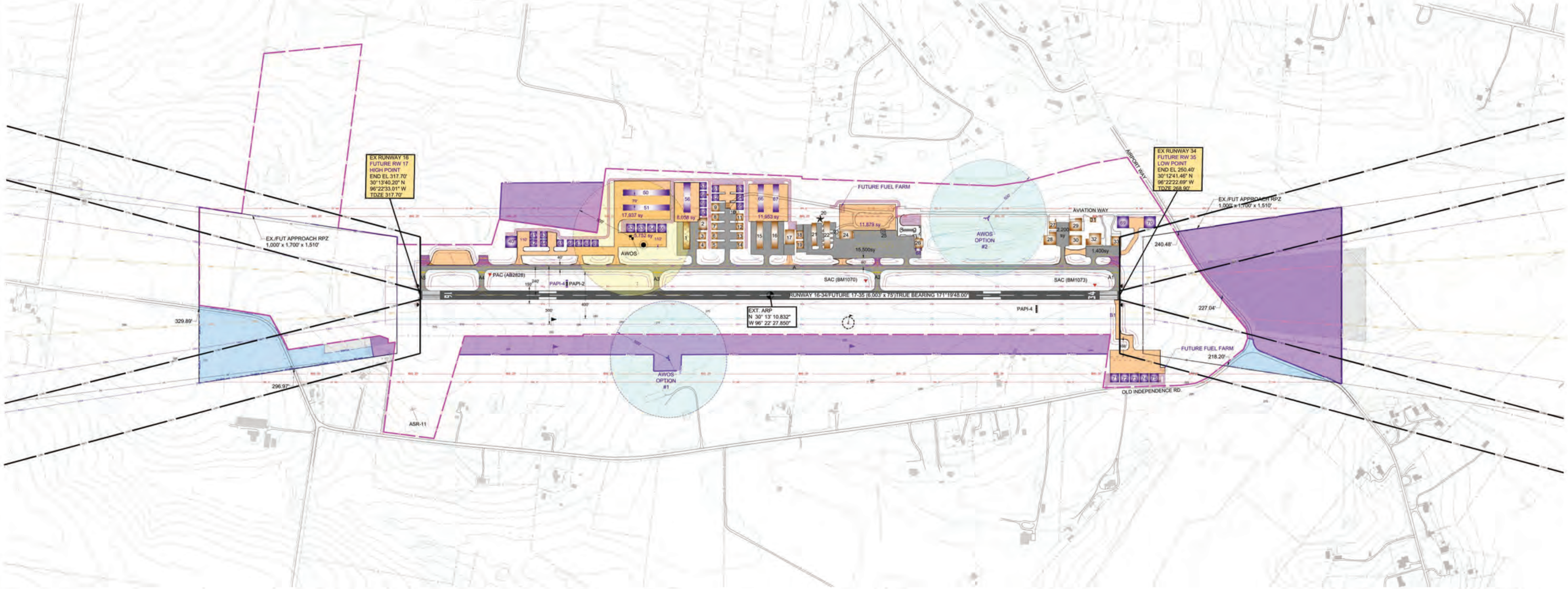
NO.	REVISIONS	BY	CHK'D	DATE

AIRPORT DATA SHEET

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation Aviation Division



EXISTING AIRPORT FACILITES		
#	Facility Name	Top Elevation ft. msl
1	T-HANGAR (10 UNIT)	±283.3'
2	EXECUTIVE HANGAR	±292.0'
3	EXECUTIVE HANGAR	±292.3'
4	EXECUTIVE HANGAR	±290.1'
5	EXECUTIVE HANGAR	292.8'
6	EXECUTIVE HANGAR	292.6'
7	EXECUTIVE HANGAR	292.8'
8	EXECUTIVE HANGAR	291.9'
9	EXECUTIVE HANGAR	±292.0'
10	BUILDING	270.0'
11	EXECUTIVE HANGAR	289.8'
12	EXECUTIVE HANGAR	290.2'
13	EXECUTIVE HANGAR	290.7'
14	EXECUTIVE HANGAR	291.3'
15	T-HANGAR (10 UNIT)	283.3'
16	T-HANGAR (10 UNIT)	±283.3'
17	CONVENTIONAL HANGAR	±283.3'
18	EXECUTIVE HANGAR	±283.3'
19	EXECUTIVE HANGAR	±283.3'
20	ROTATING BEACON	306.5'
21	T-HANGAR (6 UNIT)	272.3'
22	T-HANGAR (10 UNIT)	273.2'
23	BUILDING	±283.3'
24	AIRPORT MAINTENANCE HANGAR	280.1'
25	FUEL FARM	255.3'
26	TERMINAL	277.6'
27	EXECUTIVE HANGAR	277.9'
28	CONVENTIONAL HANGAR	281.4'
29	CONVENTIONAL HANGAR	281.3'
30	CONVENTIONAL HANGAR	281.4'
31	FUEL FARM (FBO)	255.1'
32	CONVENTIONAL HANGAR	281.4'
33	EXECUTIVE HANGAR	281.4'

SURVEY MONUMENTS

DESIGNATION	PAC/SAC	PERMANENT IDENTIFIER	LATITUDE	LONGITUDE
11R A	PAC	AB2828	30° 13' 34.63014" N	96° 22' 29.97258" W
BRENPORT AZ MK	SAC	BM1073	30° 12' 43.68839" N	96° 22' 22.05148" W
BRENPORT	SAC	BM1070	30° 13' 02.98381" N	96° 22' 25.00810" W

FUTURE AIRPORT FACILITIES

#	Facility Name	Top Elevation ft. msl*	#	Facility Name	Top Elevation ft. msl*
40	CONVENTIONAL HANGAR	±282.0'	58	EXECUTIVE HANGAR	±272.0'
41	EXECUTIVE HANGAR	±307.0'	59	EXECUTIVE HANGAR	±272.0'
42	EXECUTIVE HANGAR	±307.0'	60	EXECUTIVE HANGAR	±277.0'
43	EXECUTIVE HANGAR	±307.0'	61	EXECUTIVE HANGAR	±282.0'
44	EXECUTIVE HANGAR	±307.0'	62	EXECUTIVE HANGAR	±267.0'
45	EXECUTIVE HANGAR	±307.0'	63	EXECUTIVE HANGAR	±262.0'
46	EXECUTIVE HANGAR	±307.0'	64	EXECUTIVE HANGAR	±272.0'
47	EXECUTIVE HANGAR	±307.0'	65	EXECUTIVE HANGAR	±272.0'
48	EXECUTIVE HANGAR	±307.0'	66	T-HANGAR	±260.0'
49	EXECUTIVE HANGAR	±307.0'	67	T-HANGAR	±260.0'
50	T-HANGAR	±290.0'	68	TERMINAL EXPANSION	±275.0'
51	T-HANGAR	±290.0'	69	CONVENTIONAL HANGAR	±271.0'
52	EXECUTIVE HANGAR	±292.0'	70	CONVENTIONAL HANGAR	±271.0'
53	EXECUTIVE HANGAR	±292.0'	71	EXECUTIVE HANGAR	±247.0'
54	EXECUTIVE HANGAR	±292.0'	72	EXECUTIVE HANGAR	±247.0'
55	EXECUTIVE HANGAR	±292.0'	73	EXECUTIVE HANGAR	±247.0'
56	T-HANGAR	±280.0'	74	EXECUTIVE HANGAR	±247.0'
57	EXECUTIVE HANGAR	±267.0'	75	EXECUTIVE HANGAR	±247.0'

*Top elevation estimated based off common structure height

LEGEND

EXISTING	FUTURE	DESCRIPTION
		AIRPORT PROPERTY LINE
		SECTION CORNERS
	N/A	AIRPORT REFERENCE POINT (ARP)
	N/A	AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
BRL 25'		BUILDING RESTRICTION LINE (25')
BRL 35'		BUILDING RESTRICTION LINE (35')
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE PAVEMENT
		CRITICAL AREA
	N/A	RUNWAY PAVEMENT
		TAXIWAY APRON PAVEMENT
	N/A	FENCE LINE
		HOLD MARKING
		RUNWAY MARKING
		TAXIWAY APRON MARKING
		ROADS AND PARKING PAVEMENT
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	OBSTACLE FREE ZONE
RPZ		RUNWAY PROTECTION ZONE
TOFA	TOFA (U)	TAXIWAY OBJECT FREE AREA
TSA	TSA (U)	TAXIWAY SAFETY AREA
		RUNWAY END IDENTIFIER LIGHTS (REIL)
		TIE-DOWNS
		PAPI-4
		WINDSOCK
		TREELINE
		TOPOGRAPHIC CONTOURS

MAGNETIC NORTH
NORTH

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 400 800
SCALE IN FEET

GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates are from adip.faa.gov. CAD linework shown in this set was collected from the previous ALP Set. Any additional existing features were manually extracted from available ortho imagery.
2. Road intersection elevations include appropriate height adjustment.
3. See Terminal Area Drawings for close-in dimensional details.

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DocuSigned by:
3/11/2024
DIRECTOR, AVIATION DIVISION DATE

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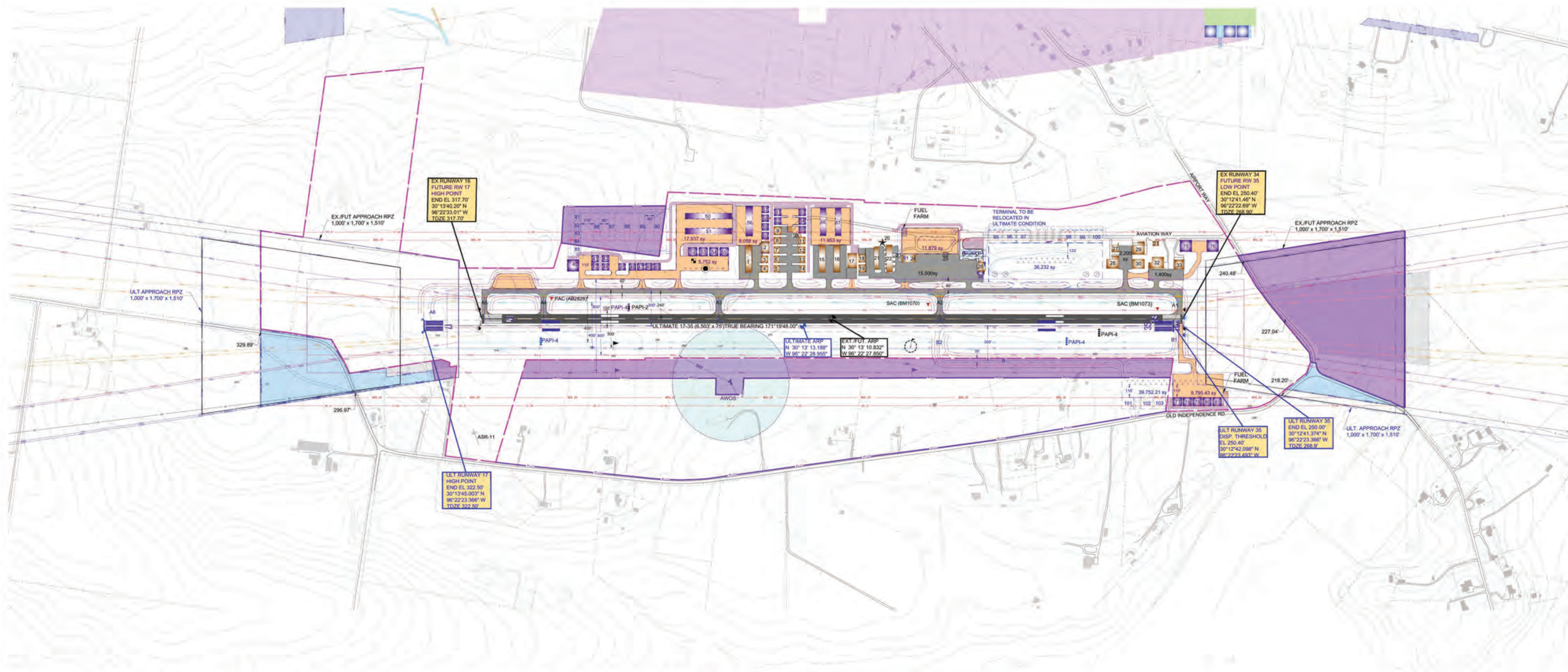
C. BURKS SEPTEMBER 2023
DESIGNED BY DATE
M. BEAVER SEPTEMBER 2023
DRAWN BY DATE

AIRPORT LAYOUT PLAN DRAWING - EXISTING/FUTURE

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division



EXISTING AIRPORT FACILITES		
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FUTURE AIRPORT FACILITIES					
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49	EXECUTIVE HANGAR	±307.0'	67	T-HANGAR	±260.0'
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51	T-HANGAR	±290.0'	69	CONVENTIONAL HANGAR	±271.0'
52	EXECUTIVE HANGAR	±292.0'	70	CONVENTIONAL HANGAR	±271.0'
53	EXECUTIVE HANGAR	±292.0'	71	EXECUTIVE HANGAR	±247.0'
54	EXECUTIVE HANGAR	±292.0'	72	EXECUTIVE HANGAR	±247.0'
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56	T-HANGAR	±280.0'	74	EXECUTIVE HANGAR	±247.0'
57	EXECUTIVE HANGAR	±267.0'	75	EXECUTIVE HANGAR	±247.0'

*Top elevation estimated based off common structure height

ULTIMATE AIRPORT FACILITIES		
#	Facility Name	Top Elevation ft. msl*
81	EXECUTIVE HANGAR	±307.0'
82	EXECUTIVE HANGAR	±307.0'
83	EXECUTIVE HANGAR	±307.0'
84	EXECUTIVE HANGAR	±312.0'
85	EXECUTIVE HANGAR	±312.0'
86	T-HANGAR	±296.0'
87	T-HANGAR	±291.0'
88	T-HANGAR	±286.0'
89	T-HANGAR	±286.0'
90	T-HANGAR	±286.0'
91	TERMINAL BUILDING	±278.0'
92	EXECUTIVE HANGAR	±247.0'
93	EXECUTIVE HANGAR	±247.0'
94	EXECUTIVE HANGAR	±247.0'
95	CONVENTIONAL HANGAR	±271.0'
96	CONVENTIONAL HANGAR	±271.0'
97	CONVENTIONAL HANGAR	±271.0'
98	CONVENTIONAL HANGAR	±271.0'
99	CONVENTIONAL HANGAR	±271.0'
100	CONVENTIONAL HANGAR	±271.0'
101	CONVENTIONAL HANGAR	±271.0'
102	CONVENTIONAL HANGAR	±271.0'
103	CONVENTIONAL HANGAR	±271.0'

*Top elevation estimated based off common structure height

SURVEY MONUMENTS

DESIGNATION	PAC/SAC	PERMANENT IDENTIFIER	LATITUDE	LONGITUDE
11R A	PAC	AB2828	30° 13' 34.63014" N	96° 22' 29.97258" W
BRENPORT AZ MK	SAC	BM1073	30° 12' 43.68839" N	96° 22' 22.05148" W
BRENPORT	SAC	BM1070	30° 13' 02.98381" N	96° 22' 25.00810" W

LEGEND

EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			AIRPORT PROPERTY LINE
	SAME	N/A	AIRPORT ROTATING BEACON
			SECTION CORNERS
	N/A		AIRPORT REFERENCE POINT (ARP)
	DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
			AVIGATION EASEMENT
BRL	BRL 25'	BRL	BUILDING RESTRICTION LINE (25')
	BRL 35'		BUILDING RESTRICTION LINE (35')
			STRUCTURES ON AIRPORT
			STRUCTURE OFF AIRPORT
N/A			ABANDON/REMOVE PAVEMENT
			CRITICAL AREA
	SAME		RUNWAY PAVEMENT
			TAXIWAY APRON PAVEMENT
			RUNWAY MARKING
	SAME	SAME	FENCE LINE
			TAXIWAY APRON MARKING
			ROADS AND PARKING PAVEMENT
RPZ	SAME	RPZ(U)	RUNWAY PROTECTION ZONE
OFA	SAME	OFA(U)	OBJECT FREE AREA
RSA	SAME	RSA(U)	RUNWAY SAFETY AREA
	SAME		OBSTACLE FREE ZONE
TOFA	TOFA (U)	TOFA (U)	TAXIWAY OBJECT FREE AREA
TSA	TSA (U)	TSA (U)	TAXIWAY SAFETY AREA
			TIE-DOWNS
	SAME		RUNWAY END IDENTIFIER LIGHTS (REIL)
			HOLD MARKING
			PAPI-4
		SAME	WINDSOCK
			TREELINE
			TOPOGRAPHIC CONTOURS

MAGNETIC NORTH
NORTH

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 400 800
SCALE IN FEET

GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates are from adip.faa.gov. CAD linework shown in this set was collected from the previous ALP Set. Any additional existing features were manually extracted from available ortho imagery.
2. Road intersection elevations include appropriate height adjustment.
3. See Terminal Area Drawings for close-in dimensional details.

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13A PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

DocuSigned by: 3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

DocuSigned by: Atwood C. Kenjura 3/6/2024
SIGNATURE — DATE
Mayor — Atwood C. Kenjura
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PREPARED BY:
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www.coffmanassociates.com

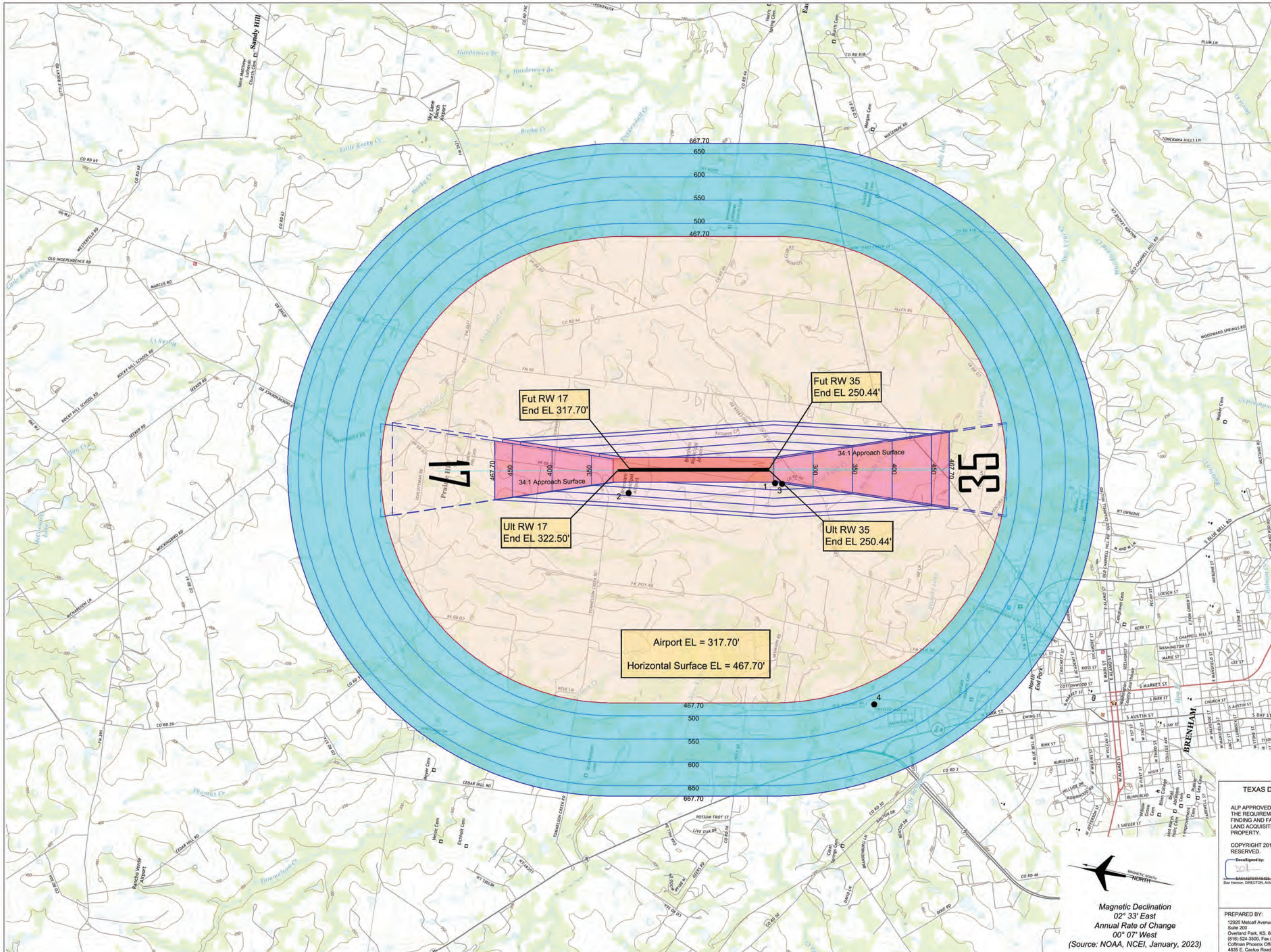
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

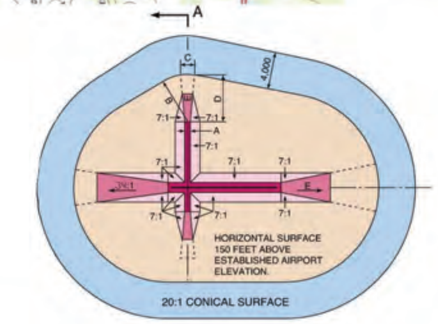
AIRPORT LAYOUT PLAN DRAWING - ULTIMATE

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

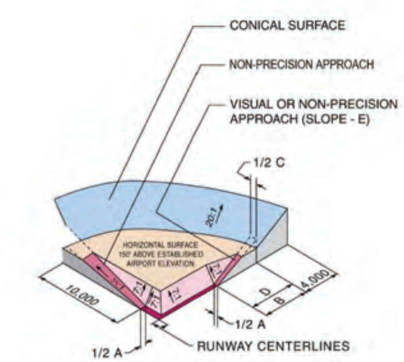
Texas Department of Transportation
Aviation Division





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

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



ISOMETRIC VIEW OF SECTION A-A

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

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 2000 4000
SCALE IN FEET

Part 77 Surface Obstructions

ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft.	AGL (ft.)	Top Elevation (ft.	Penetration Value (ft.)	Surface Obstructed	Remediation
1	Tree	N/A	48-114956	Unknown	Unknown	278.00	22.76	Transitional	Trim/Remove
2	Tower	N/A	48-023554	300.00	110.00	410.00	21.80	Transitional	Add Obstruction Lighting
3	Tree	N/A	48-043580	Unknown	Unknown	293.00	28.44	Transitional	Trim/Remove
4	Tower	2021-ASW-15589-OE	48-002117	336.00	360.00	696.00	176.25	Conical	Tower lighted. See No Hazard Determination letter dated 2/16/22

GENERAL NOTES:

1. Land use decisions are made by the Brenham-Washington County Joint Airport Zoning Board (JAZB) in accordance with Texas Local Government Code § 241.014. Height restrictions are codified under City of Brenham, TX Code of Ordinances, Chapter 3, Article 2 § 3-34. (Adopted 3/10/1983). https://ecode360.com/39305023.
2. No survey was conducted for this project. Existing runway end coordinates and airport elevation are from adip.faa.gov.
3. This airspace was analyzed against obstruction points published by adip.faa.gov.
4. Close in approach obstructions are detailed on inner-approach drawings.
5. Profile view checklist items are on Sheets 6 of this set.

LEGEND

● # OBSTRUCTION IDENTIFIER

NO.	REVISIONS	BY	CHK'D	DATE

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Mayor Atwood C. Kenjura
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Coffman Associates Airport Consultants www.coffmanassociates.com

C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

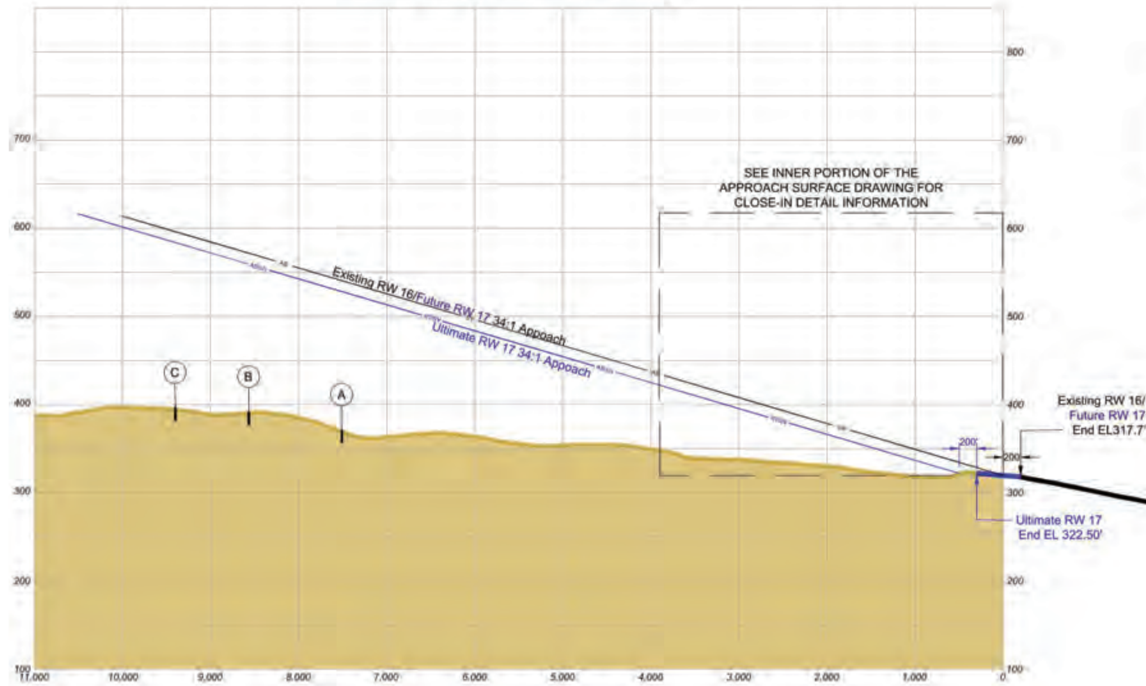
AIRPORT AIRSPACE DRAWING

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division

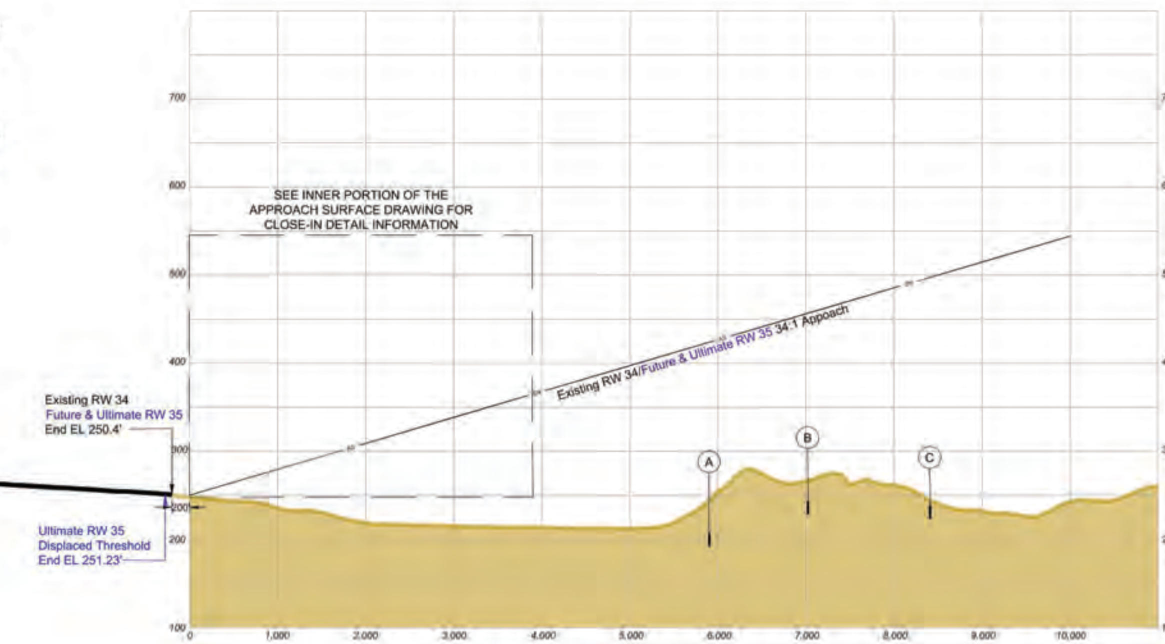
RUNWAY 16/17 OUTER APPROACH PROFILE



0 1000 2000
HORIZONTAL SCALE IN FEET

0 100 200
VERTICAL SCALE IN FEET

RUNWAY 34/35 OUTER APPROACH PROFILE



Existing16/Future17 Outer-Approach Road Points					
ID	**Feature**	**Ground Elevation (ft.**	**Adjustment (ft.)**	**Top Elevation (ft.**	**Clearance (ft.)**
A	Prairie Hill Rd	342.67	15.00	357.67	182.81
B	Schlottman Rd	379.08	15.00	394.08	177.16
C	County Rte. 63	372.89	15.00	387.89	207.10

Existing 34/Future 35 Outer-Approach Road Points					
ID	**Feature**	**Ground Elevation**	**Adjustment (ft.)**	**Top Elevation (ft.**	**Clearance (ft.)**
A	Hwy 105	206.09	15.00	221.09	200.71
B	Hwy 106	238.29	15.00	253.29	203.89
C	Hwy 107	240.23	15.00	255.23	242.04

Ultimate 17 Outer-Approach Road Points					
ID	**Feature**	**Ground Elevation (ft.**	**Adjustment (ft.)**	**Top Elevation (ft. msl.)**	**Clearance (ft.)**
A	Prairie Hill Rd.	346.74	15.00	361.74	169.32
B	Schlottman Rd.	377.96	15.00	392.96	168.60
C	County Rte. 63	371.00	15.00	386.00	198.34

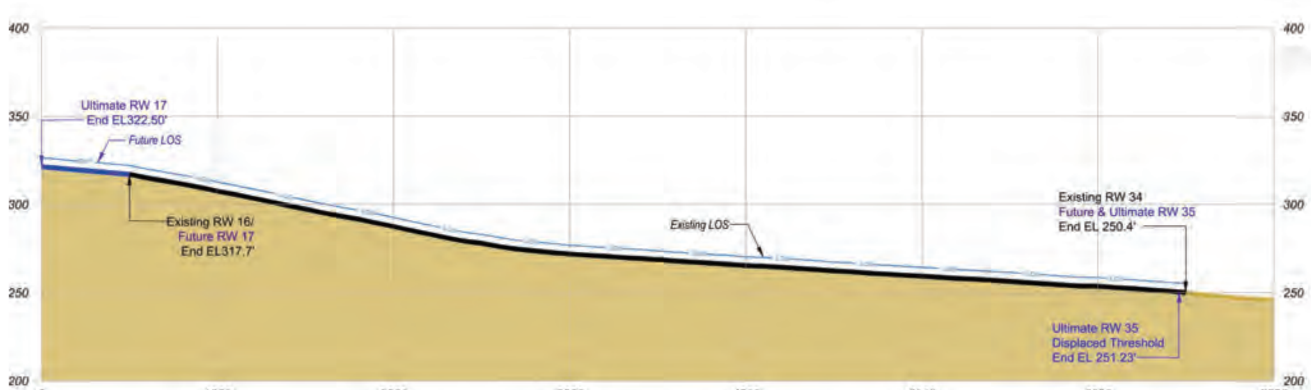
Ultimate 35 Outer-Approach Road Points					
ID	**Feature**	**Ground Elevation**	**Adjustment (ft.)**	**Top Elevation (ft. msl.)**	**Clearance (ft.)**
A	Hwy 105	206.76	15.00	221.76	201.46
B	Hwy 105	240.07	15.00	255.07	203.64
C	Hwy 105	240.76	15.00	255.76	243.07

Existing 16/Future 17 Outer-Approach Obstructions									
ID	**Feature**	**FAA Study #**	**ADIP ID #**	**Ground Elevation (ft.**	**AGL (ft.)**	**Top Elevation (ft. msl.)**	**Penetration Value (ft.)**	**Remediation**	
No Obstructions									

Existing 34/Future 35 Outer-Approach Obstructions									
ID	**Feature**	**FAA Study #**	**ADIP ID #**	**Ground Elevation (ft.**	**AGL (ft.)**	**Top Elevation (ft. msl.)**	**Penetration Value (ft.)**	**Remediation**	
No Obstructions									

Ultimate 17 Outer-Approach Obstructions									
ID	**Feature**	**FAA Study #**	**ADIP ID #**	**Ground Elevation (ft. msl.)**	**AGL (ft.)**	**Top Elevation (ft. msl.)**	**Penetration Value (ft.)**	**Remediation**	
No Obstructions									

Ultimate 35 Outer-Approach Obstructions									
ID	**Feature**	**FAA Study #**	**ADIP ID #**	**Ground Elevation (ft. msl.)**	**AGL (ft.)**	**Top Elevation (ft. msl.)**	**Penetration Value (ft.)**	**Remediation**	
No Obstructions									



RUNWAY 17-35 PROFILE

0 500 1000
HORIZONTAL SCALE IN FEET

0 50 100
VERTICAL SCALE IN FEET

(A) Road Callouts

GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates and airport elevation are from adip.faa.gov.
2. Road intersection ground elevations and ground profile taken from USGS 1/3 Arc Second data.

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

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DocuSigned by:
3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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DocuSigned by:
Atwood C. Kenjura — 3/6/2024
SIGNATURE — DATE
Mayor — Atwood C. Kenjura
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

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Coffman Phoenix Office:
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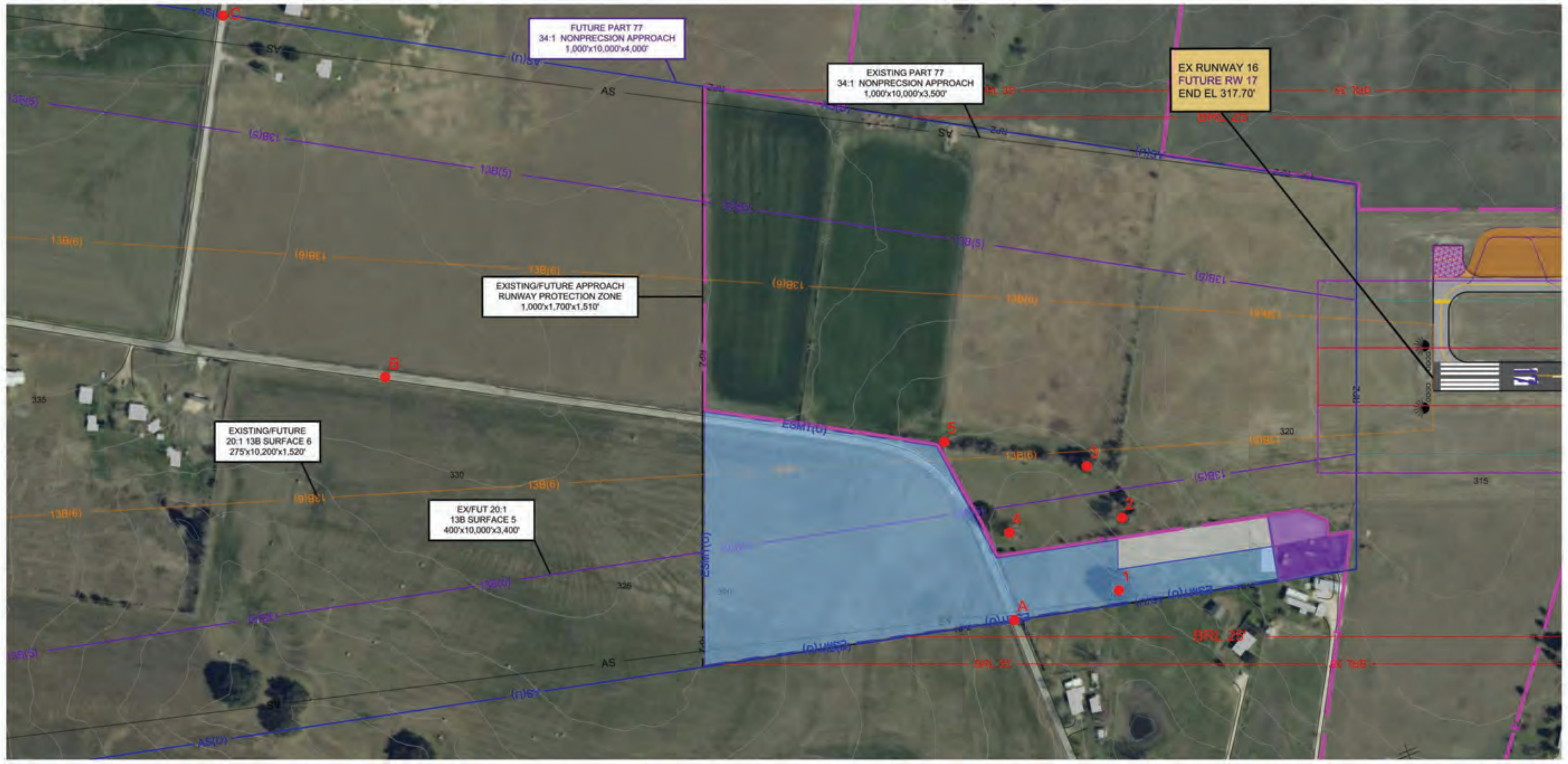
Coffman Associates
Airport Consultants
www.coffmanassociates.com

C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

AIRPORT AIRSPACE
APPROACH PROFILE RUNWAY 16-34/17-35
BRENHAM MUNICIPAL AIRPORT (11R)
BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division



Existing16/Future 17 Inner-Approach Obstructions									
ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft.) Existing 16 Approach	Penetration Value (ft.) Future 17 Approach	Remediation
1	Tree	N/A	48-043468	Unknown	Unknown	351.00	15.21	15.21	Trim/Remove
2	Tree	N/A	48-042946	302.00	36.00	338.00	2.46	2.46	Trim/Remove
3	Tree	N/A	48-043574	Unknown	Unknown	348.00	9.75	9.75	Trim/Remove
4	Tree	N/A	48-043575	Unknown	Unknown	348.00	3.84	3.84	Trim/Remove
5	Tree	N/A	48-043576	Unknown	Unknown	350.00	0.86	0.86	Trim/Remove

Existing 16/Future 17 Inner-Approach Road Points					
ID	Feature	Ground Elevation (ft. msl.)	Adjustment (ft.)	Top Elevation (ft. msl.)	Clearance (ft.)
A	Old Independence	296.97	15.00	311.97	31.80
B	Old Independence	333.61	15.00	348.61	43.32
C	Hopmann	329.13	15.00	344.13	60.23

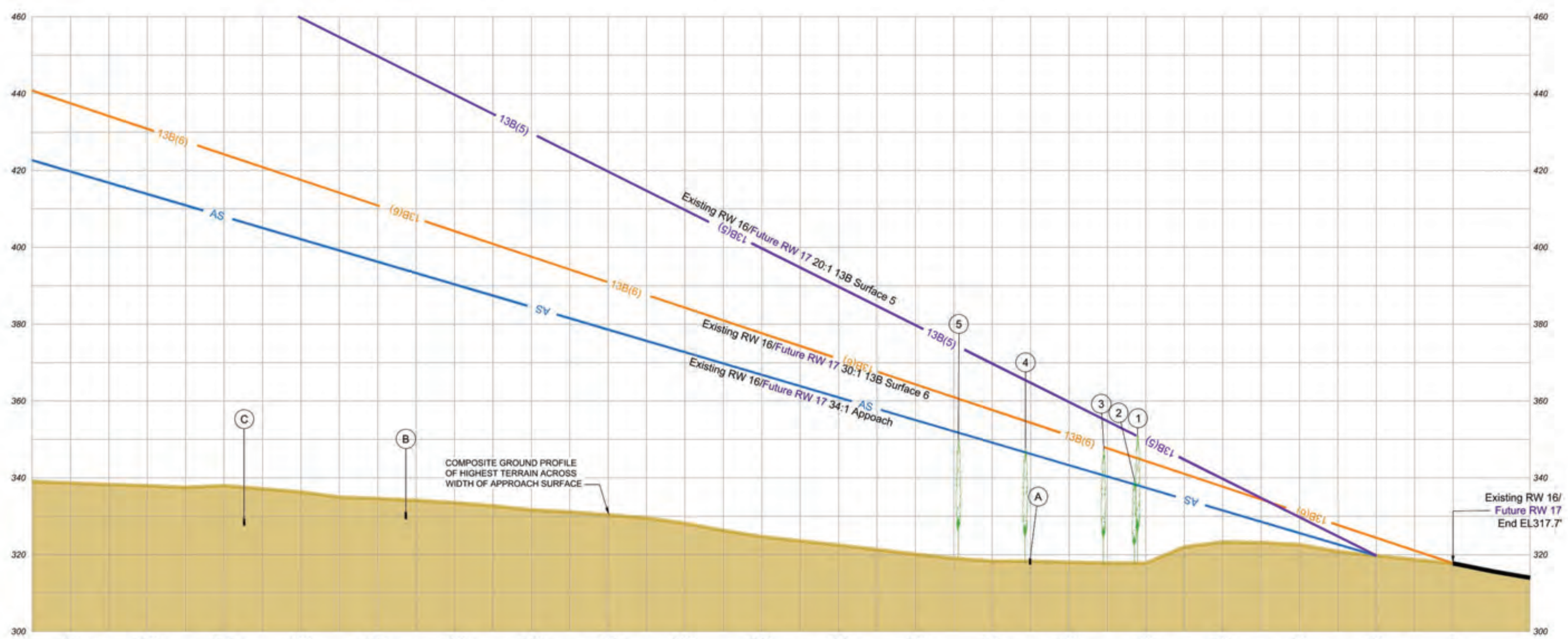
LEGEND

- OBSTRUCTION IDENTIFIER
- ROAD IDENTIFIER
- SIGNIFICANT OBJECTS PROFILE VIEW

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET



GENERAL NOTES:

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2. This airspace was analyzed against obstruction points published by adip.faa.gov.
3. Ground contours, Road intersection ground elevations, and ground profile taken from USGS 1/3 Arc Second data.
4. Imagery source: 2023 Microsoft Corporation, 2023 Maxar, CNES (2023), Distribution Airbus DS

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DocuSigned by: [signature] 3/6/2024
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C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE

M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

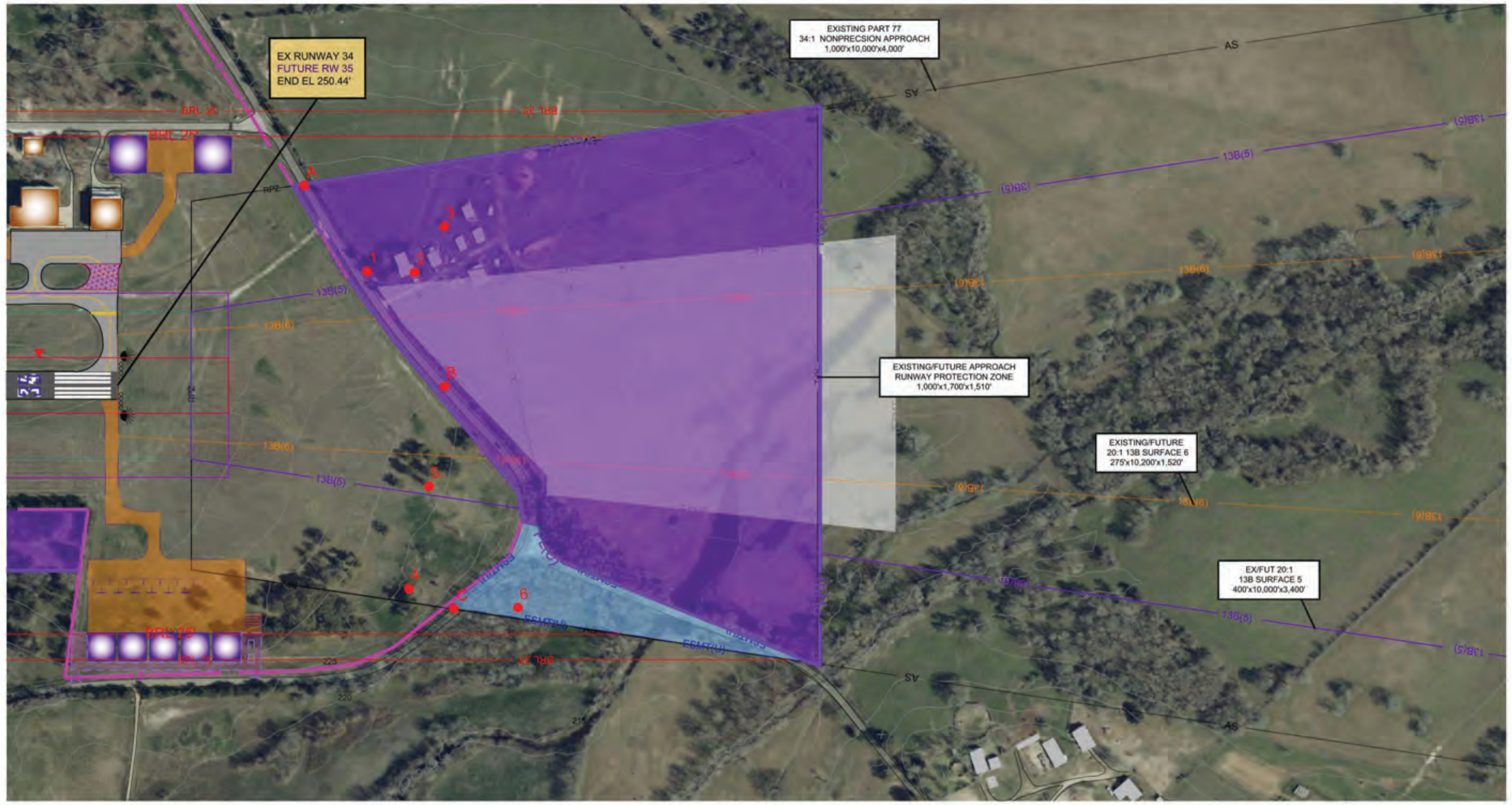
NO.	REVISIONS	BY	CHK'D	DATE

INNER PORTION OF THE APPROACH SURFACE DRAWING EXISTING RW16/FUTURE RW 17

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division



Existing 34/Future 35 Inner-Approach Obstructions								
ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value Existing 34/Future 35 Approach	Remediation
1	Tree	N/A	48-043206	242.00	28.00	270.00	5.52	Trim/Remove
2	Tree	N/A	48-043207	224.00	66.00	290.00	22.15	Trim/Remove
3	Tree	N/A	48-043591	Unknown	Unknown	280.00	11.86	Trim/Remove
4	Tree	N/A	48-114955	226.00	46.00	272.00	2.54	Trim/Remove
5	Pole	N/A	48-027081	241.00	35.00	276.00	5.33	Lower/Relocate
6	Tree	N/A	48-043666	Unknown	Unknown	292.00	15.45	Trim/Remove

Existing 34/Future 35 Inner-Approach Road Points					
ID	Feature	Ground Elevation (ft.	Adjustment (ft.)	Top Elevation (ft. msl.)	Clearance (ft.)
A	Airport Rd.	240.48	15.00	255.48	3.89
B	Airport Rd.	227.04	15.00	242.04	28.54
C	Old Independence	218.20	15.00	233.20	38.35

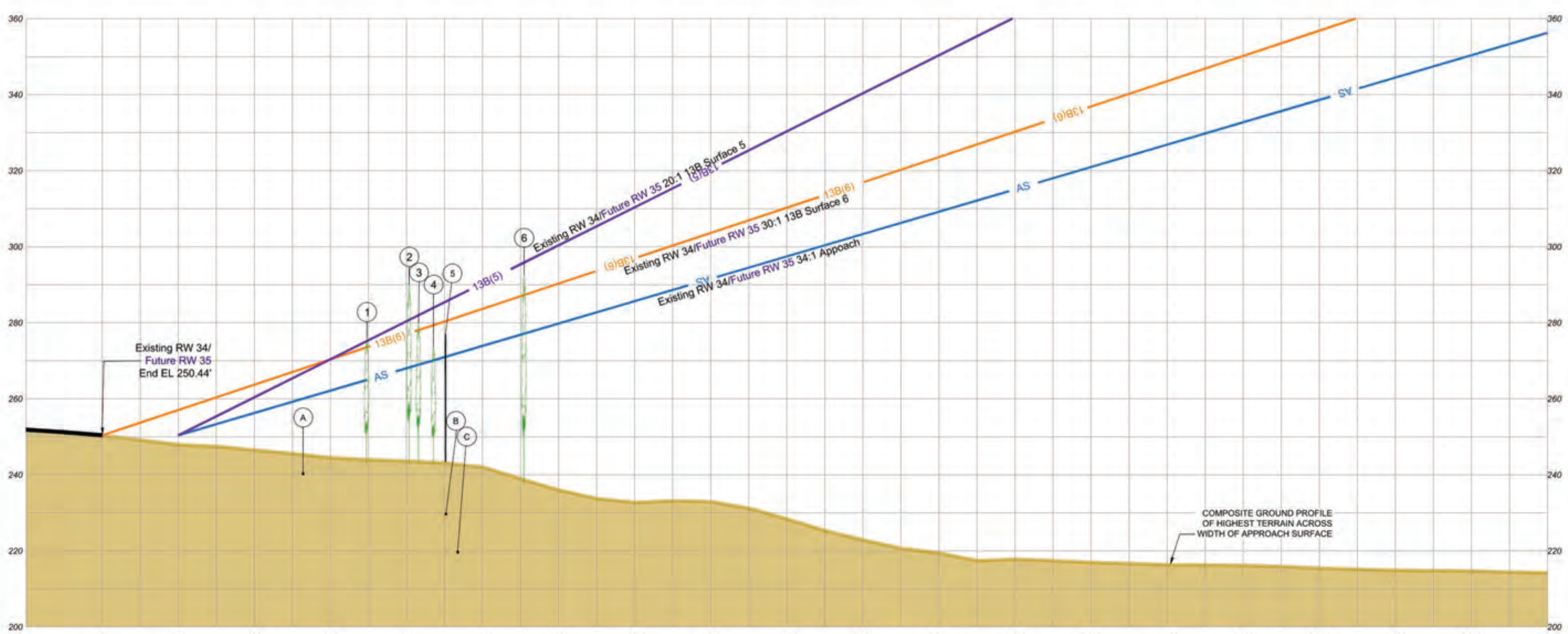
LEGEND

- OBSTRUCTION IDENTIFIER
- ROAD IDENTIFIER
- SIGNIFICANT OBJECTS PROFILE VIEW

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET



GENERAL NOTES:

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3. Ground contours, Road intersection ground elevations, and ground profile taken from USGS 1/3 Arc Second data.
4. Imagery source: 2023 Microsoft Corporation, 2023 Maxar, CNES (2023), Distribution Airbus DS

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
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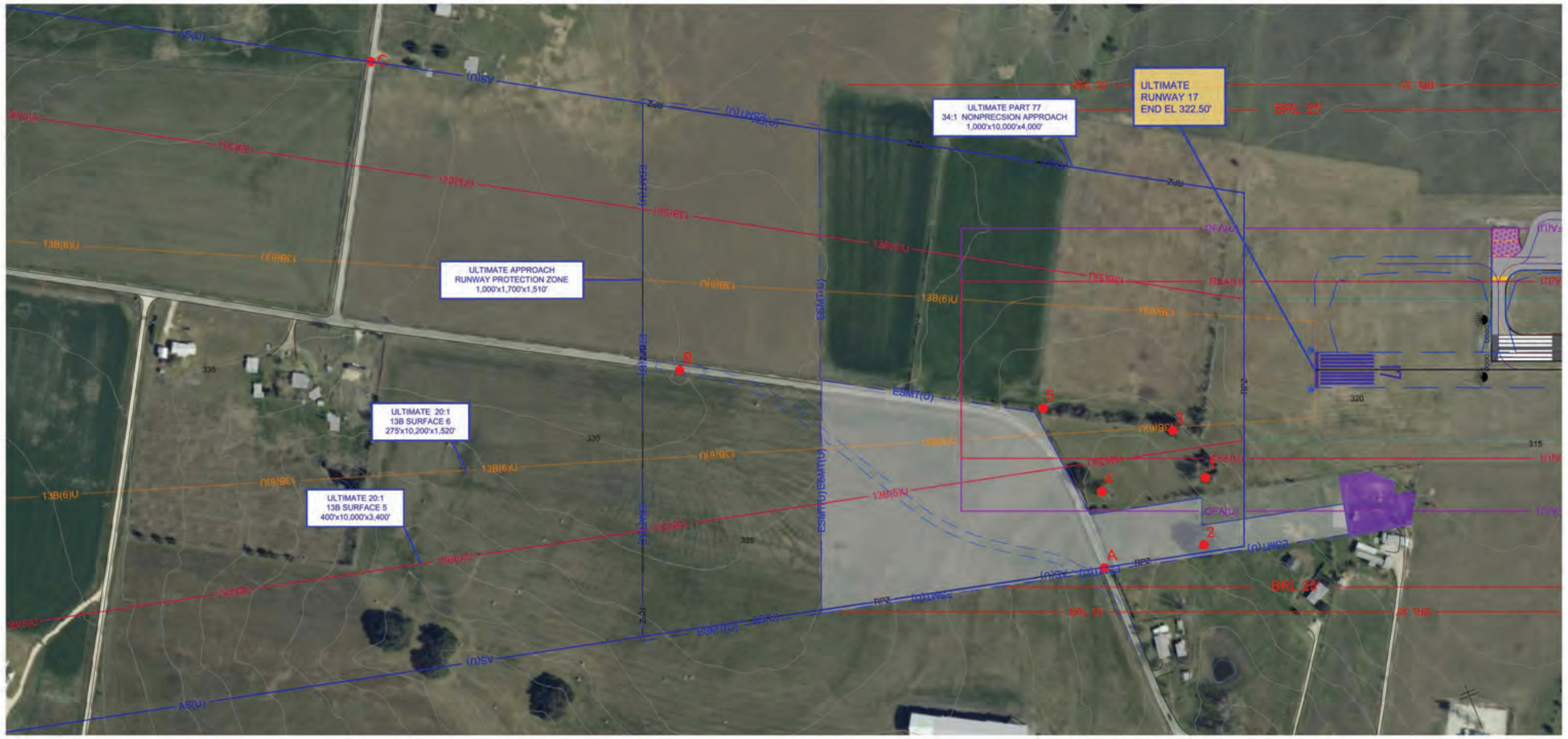
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

INNER PORTION OF THE APPROACH SURFACE DRAWING EXISTING RW 34/FUTURE RW 35
BRENHAM MUNICIPAL AIRPORT (11R)
BRENHAM, TEXAS

Texas Department of Transportation Aviation Division



Ultimate 17 Inner-Approach Obstructions										
ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft.) Ultimate 17	Penetration Value (ft.) Ultimate 17 13B	Penetration Value (ft.) Ultimate 17 13B	Remediation
1	Tree	N/A	48-042946	302	36	338	12.36	N/A	N/A	Trim/Remove
2	Tree	N/A	48-043468	Unknown	Unknown	351	25.12	N/A	N/A	Trim/Remove
3	Tree	N/A	48-043574	Unknown	Unknown	348	19.66	15.57	N/A	Trim/Remove
4	Tree	N/A	48-043575	Unknown	Unknown	348	13.74	N/A	N/A	Trim/Remove
5	Tree	N/A	48-043576	Unknown	Unknown	350	10.76	N/A	1.86	Trim/Remove

Ultimate 17 Inner-Approach Road Points					
ID	Feature	Ground Elevation (ft.	Adjustment (ft.)	Top Elevation (ft. msl.)	Clearance (ft.)
A	Old Independence	296.97	15.00	311.97	22.06
B	Old Independence	329.89	15.00	344.89	24.46
C	Hopmann	335.51	15.00	350.51	44.52

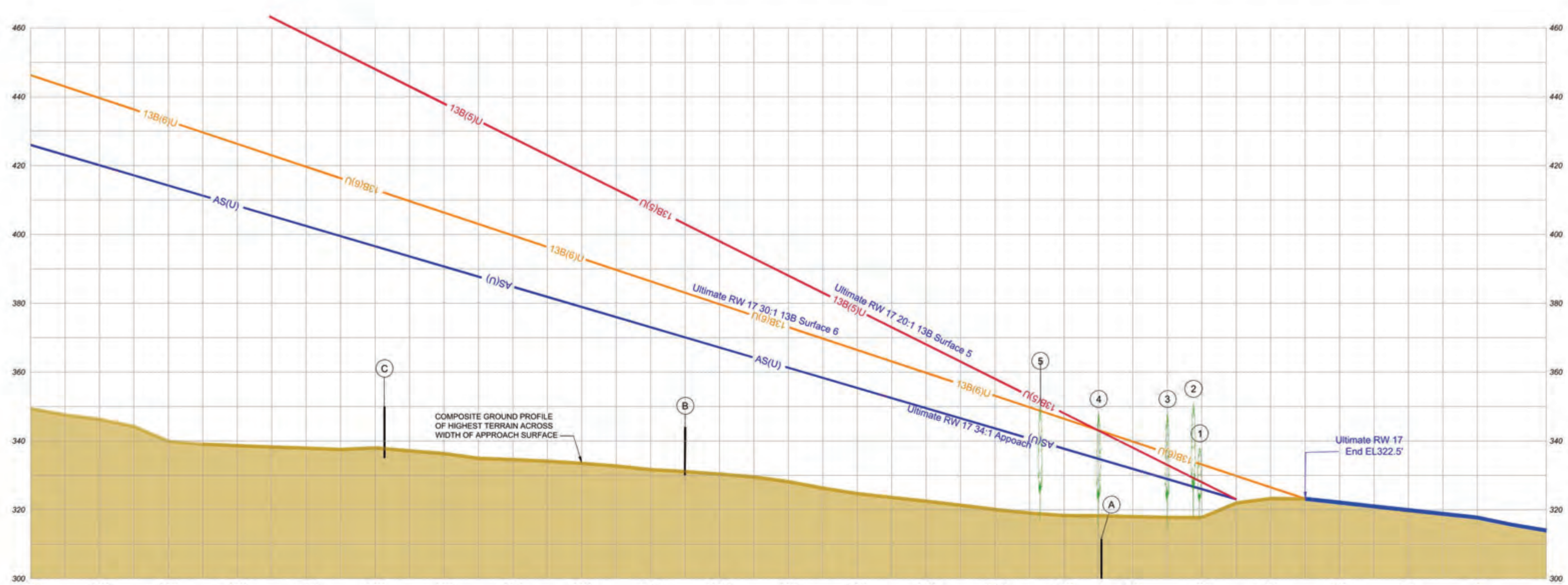
LEGEND

- OBSTRUCTION IDENTIFIER
- ROAD IDENTIFIER
- SIGNIFICANT OBJECTS PROFILE VIEW

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET



GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates and airport elevation are from adip.faa.gov.
2. This airspace was analyzed against obstruction points published by adip.faa.gov.
3. Ground contours, Road intersection ground elevations, and ground profile taken from USGS 1/3 Arc Second data.
4. Imagery source: 2023 Microsoft Corporation, 2023 Maxar, CNES (2023), Distribution Airbus DS

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13A PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

DocuSigned by: 3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR.

SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

DocuSigned by: Atwood C. Kenjura 3/6/2024
SIGNATURE — DATE
Mayor Atwood C. Kenjura
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

PREPARED BY:
12920 Metcalf Avenue
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Coffman Associates Airport Consultants www.coffmanassociates.com

C. BURKS — DESIGNED BY — SEPTEMBER 2023 — DATE
M. BEAVER — DRAWN BY — SEPTEMBER 2023 — DATE

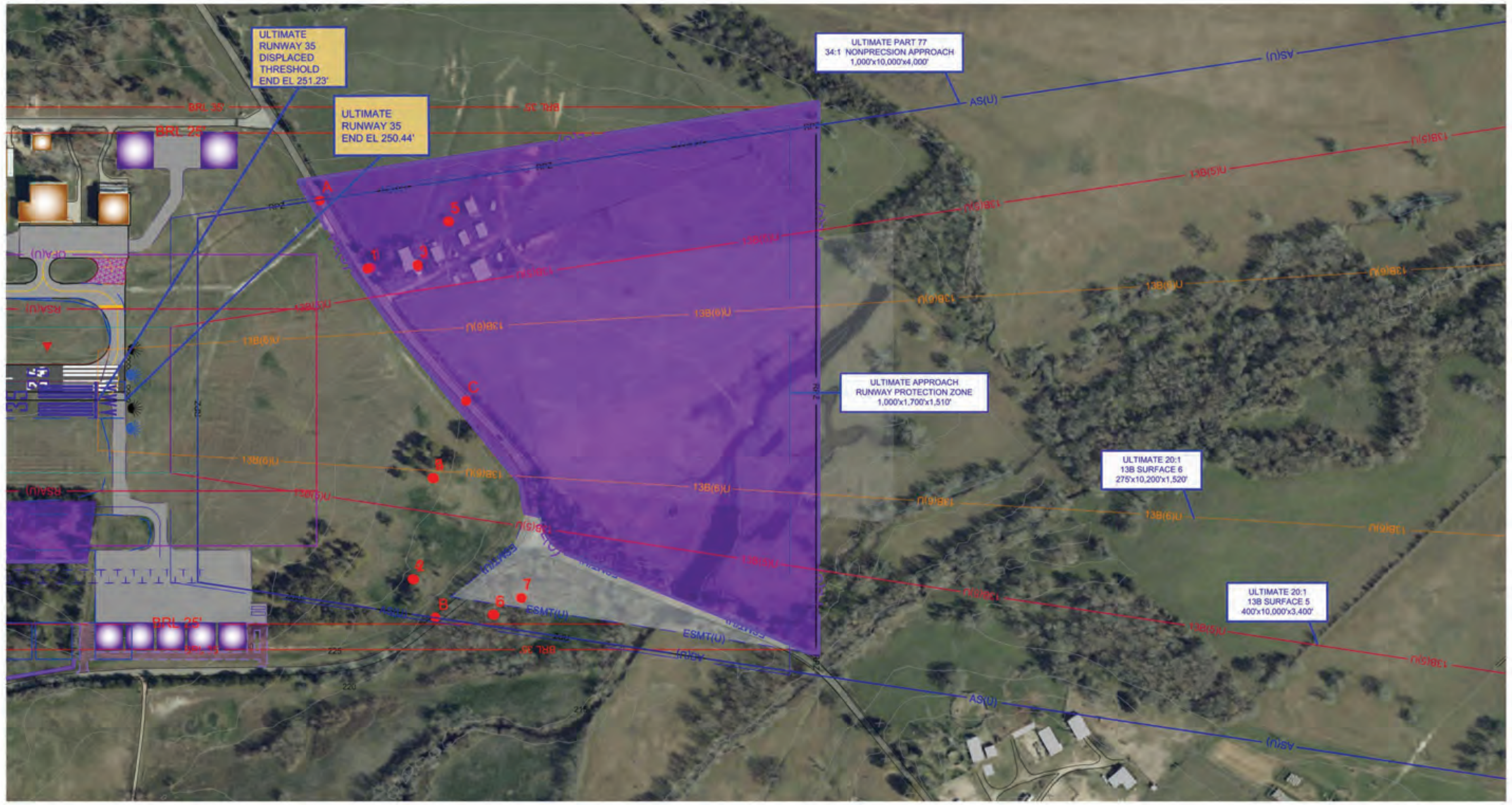
NO.	REVISIONS	BY	CHK'D	DATE

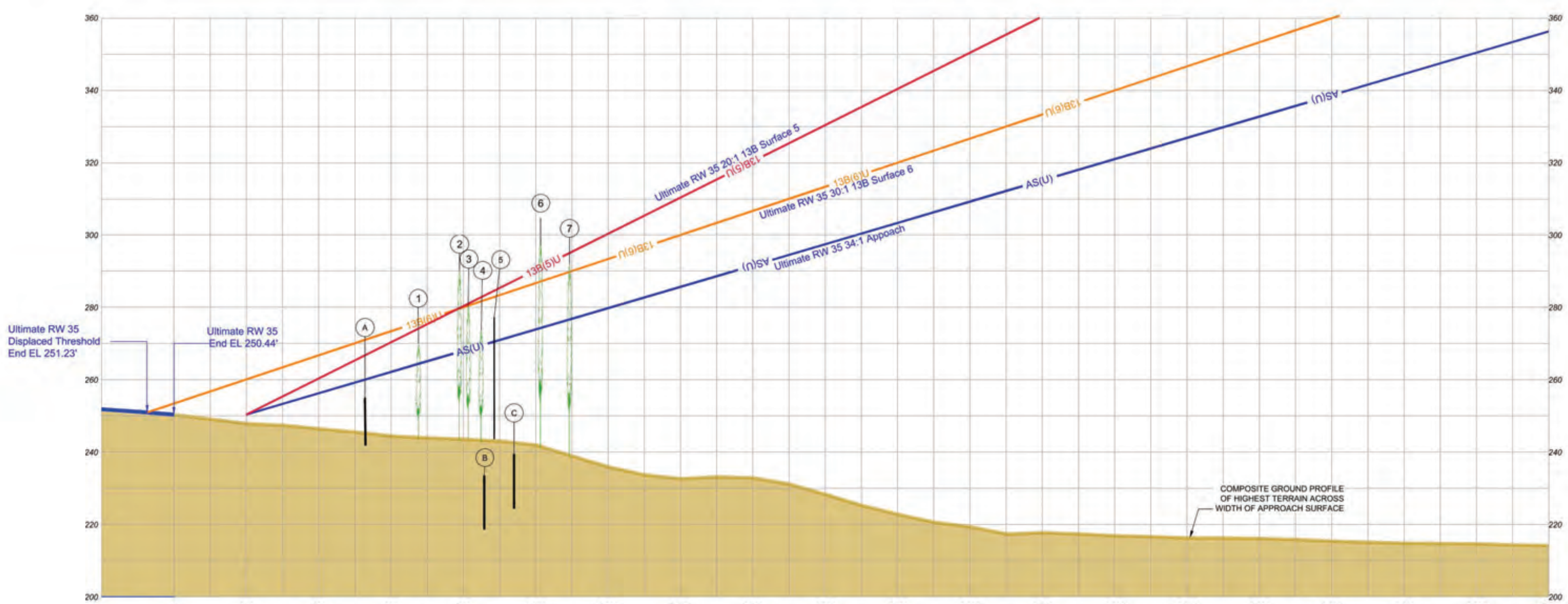
INNER PORTION OF THE APPROACH SURFACE DRAWING ULTIMATE RUNWAY 17

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation Aviation Division





Ultimate 35 Inner-Approach Obstructions								
ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Ultimate 35 Approach	Remediation
1	Tree	N/A	48-043206	242.00	28.00	270.00	5.52	Trim/Remove
2	Tree	N/A	48-043207	224.00	66.00	290.00	22.15	Trim/Remove
3	Tree	N/A	48-043591	Unknown	Unknown	280.00	11.86	Trim/Remove
4	Tree	N/A	48-114955	226.00	46.00	272.00	2.54	Trim/Remove
5	Pole	N/A	48-027081	241.00	35.00	276.00	5.33	Lower/Relocate
6	Tree	N/A	48-043665	Unknown	Unknown	299.00	24.67	Trim/Remove
7	Tree	N/A	48-043666	Unknown	Unknown	292.00	15.45	Trim/Remove

Ultimate 35 Inner-Approach Road Points					
ID	Feature	Ground Elevation	Adjustment (ft.)	Top Elevation (ft. msl.)	Clearance (ft.)
A	Airport Rd.	241.79	15.00	256.79	3.56
B	Independence Rd.	219.04	15.00	234.04	35.65
C	Airport Rd.	224.48	15.00	239.48	32.69

LEGEND

OBSTRUCTION IDENTIFIER

ROAD IDENTIFIER

SIGNIFICANT OBJECTS PROFILE VIEW

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates and airport elevation are from adip.faa.gov.
2. This airspace was analyzed against obstruction points published by adip.faa.gov.
3. Ground contours, Road intersection ground elevations, and ground profile taken from USGS 1/3 Arc Second data.
4. Imagery source: 2023 Microsoft Corporation, 2023 Maxar, CNES (2023), Distribution Airbus DS

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13A PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

DocuSigned by: 3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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DocuSigned by: Atwood C. Kenjura 3/6/2024
SIGNATURE — DATE
Mayor — Atwood C. Kenjura
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

PREPARED BY:
12920 Metcalf Avenue
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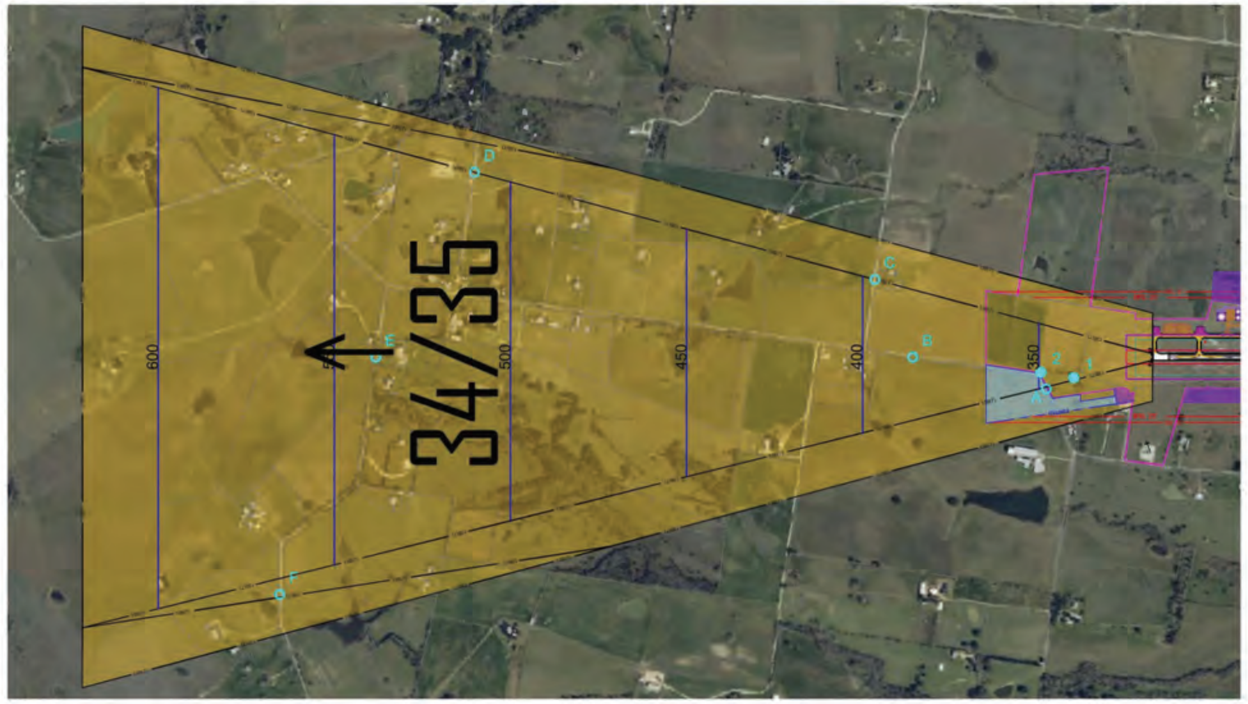
(602) 993-6999, Fax (7196)
Coffman Associates Airport Consultants
www.coffmanassociates.com

C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE

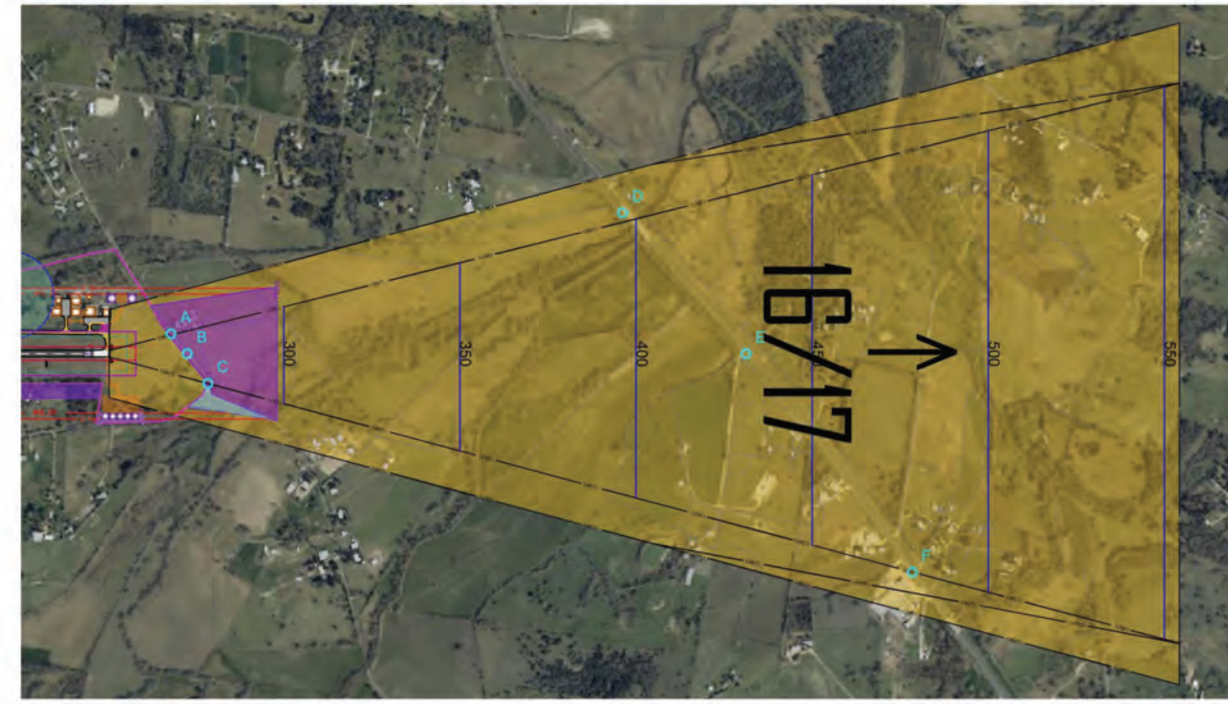
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

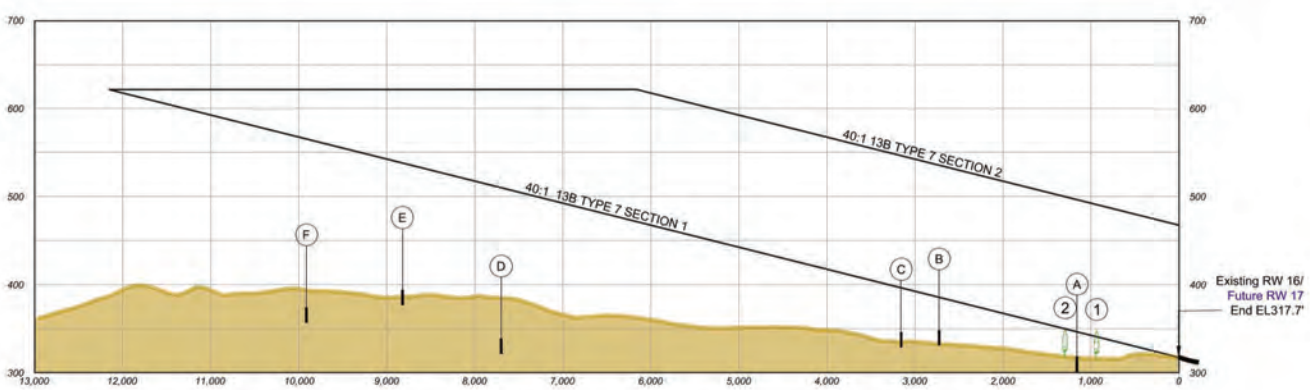
INNER PORTION OF THE APPROACH SURFACE DRAWING ULTIMATE RUNWAY 35
BRENHAM MUNICIPAL AIRPORT (11R)
BRENHAM, TEXAS

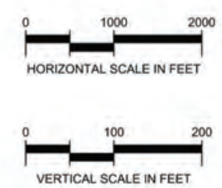
Texas Department of Transportation
Aviation Division

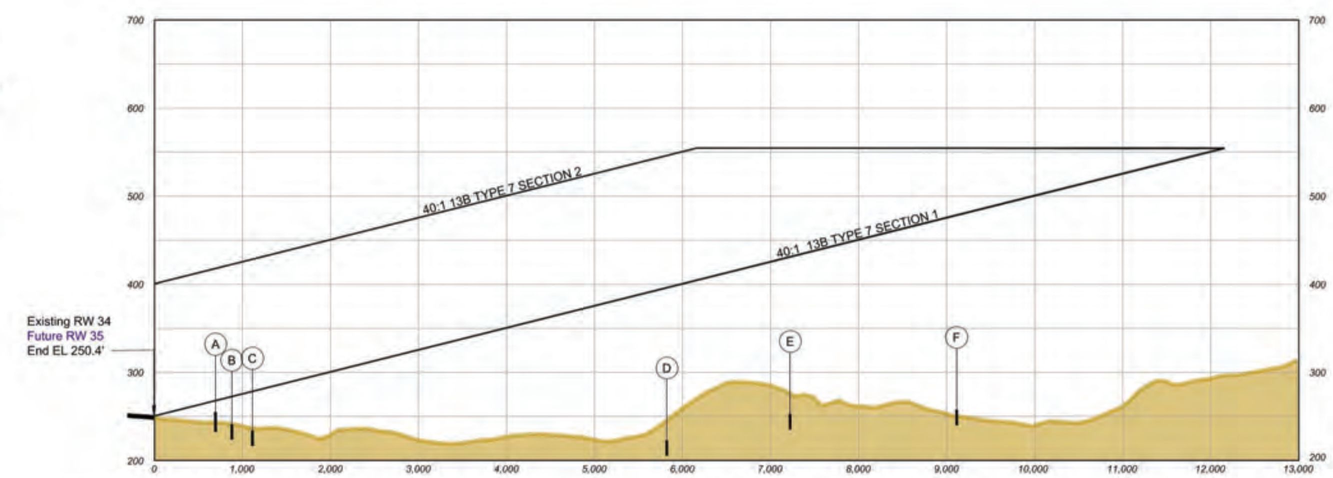


Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)









Existing 16/Future 17 End Departure Obstructions								
ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft.)	Remediation
1	Tree	N/A	48-043574	Unknown	Unknown	348.00	7.83	Trim/Remove
2	Tree	N/A	48-043576	Unknown	Unknown	350.00	0.57	Trim/Remove

Existing 34/Future 35 End Departure Obstructions								
ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft.)	Remediation
No Obstructions								

Existing 16/Future 17 End Departure Road Points					
ID	Feature	Ground Elevation (ft. msl.)	Adjustment (ft.)	Top Elevation (ft.	Clearance (ft.)
A	Old Independence	303.39	15.00	318.39	29.47
B	Old Independence	333.61	15.00	348.61	37.18
C	Hopmann	331.29	15.00	346.29	50.29
D	Prairie Hill	324.05	15.00	339.05	171.56
E	Schlottman	379.08	15.00	394.08	144.13
F	Schlottman	359.50	15.00	374.50	191.00

Existing 34/Future 35 End Departure Road Points					
ID	Feature	Ground Elevation (ft. msl.)	Adjustment (ft.)	Top Elevation (ft.	Clearance (ft.)
A	Airport Rd.	240.26	15.00	255.26	12.67
B	Airport Rd.	227.04	15.00	242.04	30.52
C	Airport Rd.	219.03	15.00	234.03	44.37
D	Hwy 105	208.00	15.00	223.00	173.11
E	Hwy 105	238.29	15.00	253.29	177.88
F	Hwy 105	242.81	15.00	257.81	220.61

LEGEND

13B (7)	EXISTING 13B SURFACE 7
	EXISTING PROPERTY BOUNDARY
(U)	FUTURE PROPERTY BOUNDARY
OBS # 1	OBSTRUCTION IDENTIFIER
	ROAD IDENTIFIER

GENERAL NOTES:

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2. This airspace was analyzed against obstruction points published by adip.faa.gov.
3. Ground contours, Road intersection ground elevations, and ground profile taken from USGS 1/3 Arc Second data.
4. Imagery source: 2023 Microsoft Corporation, 2023 Maxar, CNES (2023), Distribution Airbus DS

NO.	REVISIONS	BY	CHK'D	DATE

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AVIATION DIVISION

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DocuSigned by: 3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

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DocuSigned by: Atwood C. Kenjura 3/6/2024
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Mayor — Atwood C. Kenjura
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

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Coffman Associates Airport Consultants www.coffmanassociates.com

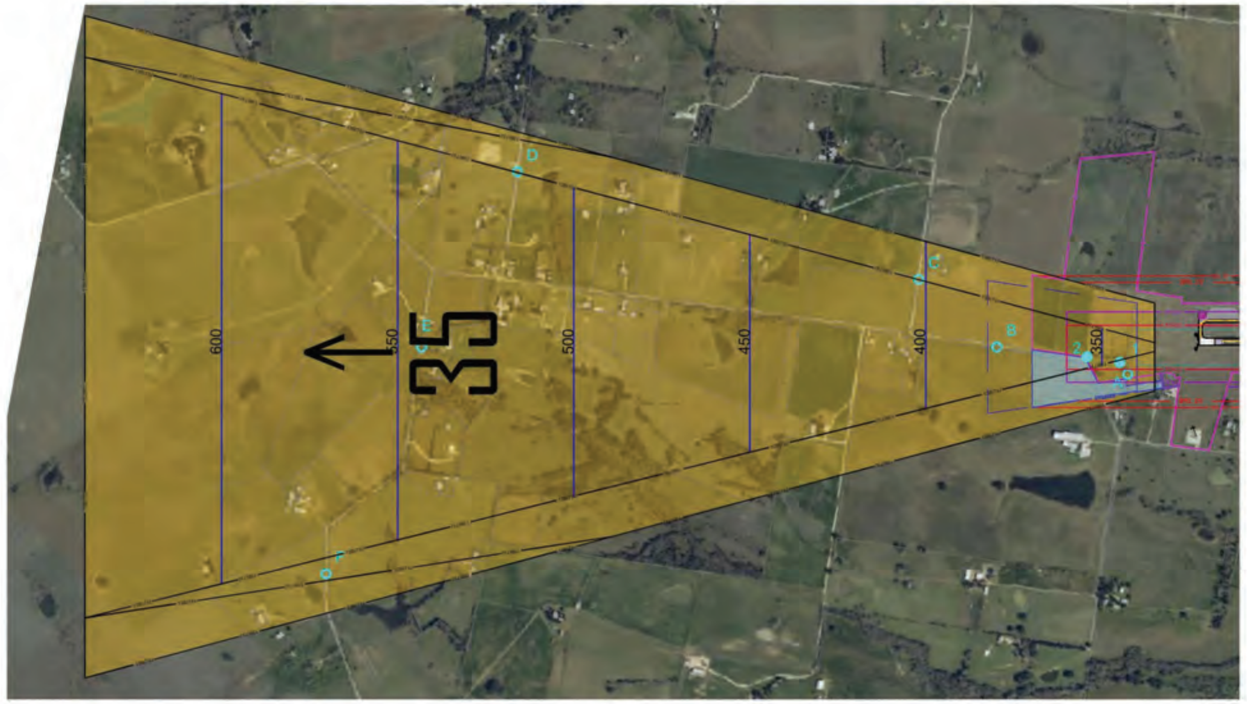
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

EXISTING RW 16-34/FUTURE RW 17/35 DEPARTURE SURFACE DRAWING

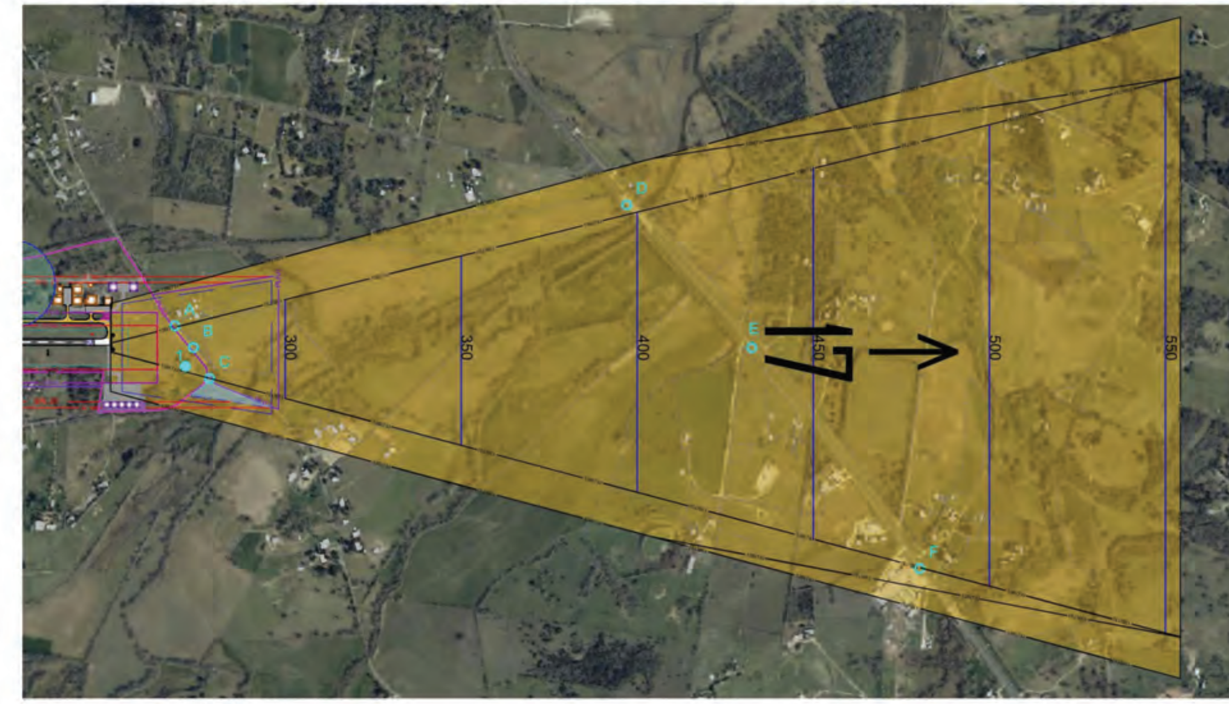
BRENHAM MUNICIPAL AIRPORT (11R)

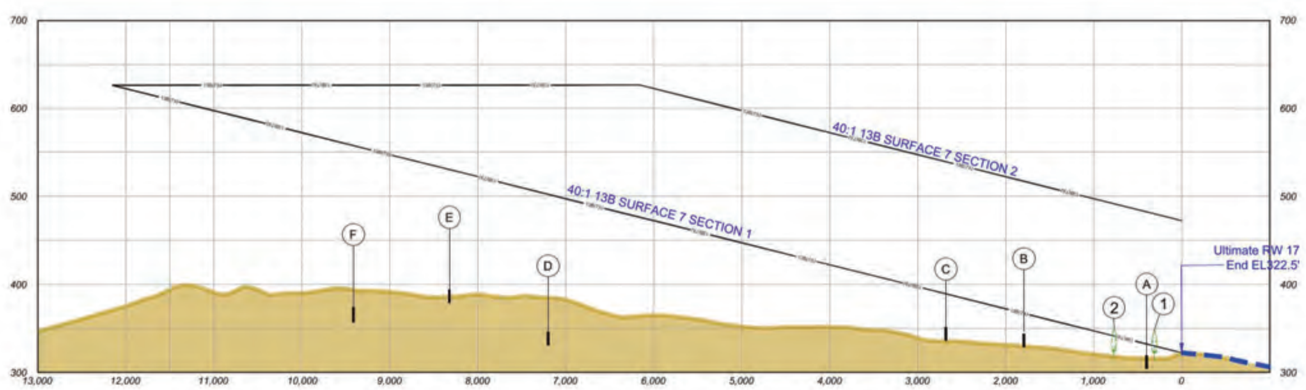
BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division



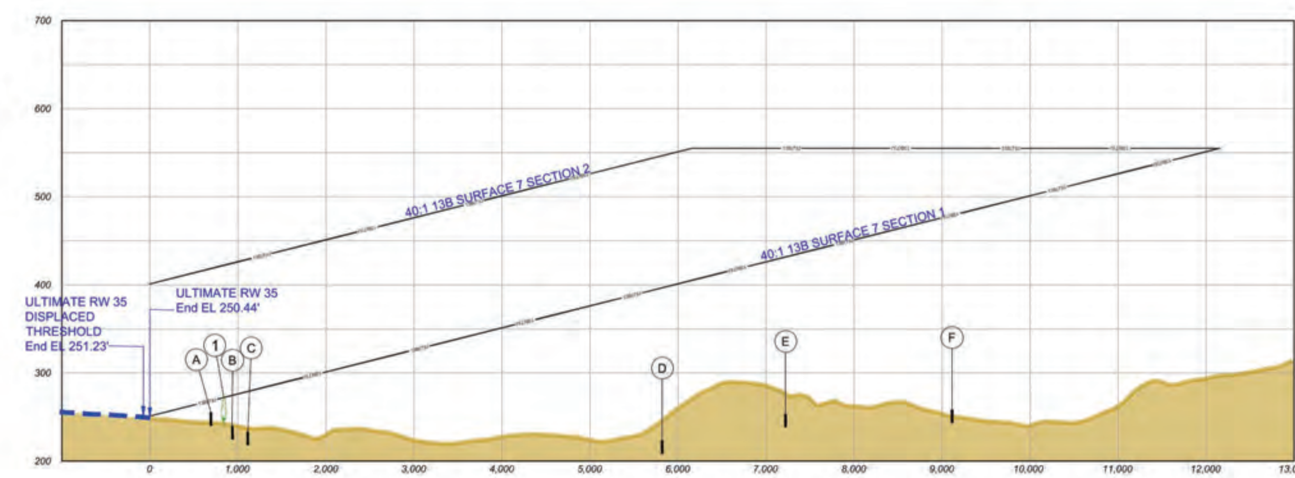
Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)





0 1000 2000
HORIZONTAL SCALE IN FEET

0 100 200
VERTICAL SCALE IN FEET



Ultimate 17 End Departure Obstructions

ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft.)	Remediation
1	Tree	N/A	48-043574	Unknown	Unknown	348.00	15.53	Trim/Remove
2	Tree	N/A	48-043576	Unknown	Unknown	350.00	8.27	Trim/Remove

Ultimate 35 End Departure Obstructions

ID	Feature	FAA Study #	ADIP ID #	Ground Elevation (ft. msl.)	AGL (ft.)	Top Elevation (ft. msl.)	Penetration Value (ft.)	Remediation
1	Tree	N/A	48-114955	Unknown	Unknown	272.00	0.40	Trim/Remove

Ultimate 17 End Departure Road Points

ID	Feature	Ground Elevation (ft. msl.)	Adjustment (ft.)	Top Elevation (ft. msl.)	Clearance (ft.)
A	Old Independence	304.61	15.00	319.61	21.35
B	Old Independence	329.00	15.00	344.00	22.43
C	Hopmann	336.65	15.00	351.65	37.87
D	Prairie Hill	331.14	15.00	346.14	157.32
E	Schlottman	377.96	15.00	392.96	137.74
F	Schlottman	362.59	15.00	377.59	180.21

Ultimate 35 End Departure Road Points

ID	Feature	Ground Elevation (ft. msl.)	Adjustment (ft.)	Top Elevation (ft. msl.)	Clearance (ft.)
A	Airport Rd.	239.80	15.00	254.80	13.86
B	Airport Rd.	224.46	15.00	239.46	34.42
C	Airport Rd.	217.93	15.00	232.93	45.52
D	Hwy 105	206.83	15.00	221.83	175.13
E	Hwy 105	240.07	15.00	255.07	177.39
F	Hwy 105	241.46	15.00	256.46	223.66

LEGEND

- ULTIMATE 13B SURFACE 7
- EXISTING PROPERTY BOUNDARY
- ULTIMATEP ROPERTY BOUNDARY
- OBSTRUCTION IDENTIFIER
- ROAD IDENTIFIER

GENERAL NOTES:

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4. Imagery source: 2023 Microsoft Corporation, 2023 Maxar, CNES (2023), Distribution Airbus DS

NO.	REVISIONS	BY	CHK'D	DATE

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AVIATION DIVISION

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Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

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DocuSigned by: Atwood C. Kenjura 3/6/2024
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www.coffmanassociates.com

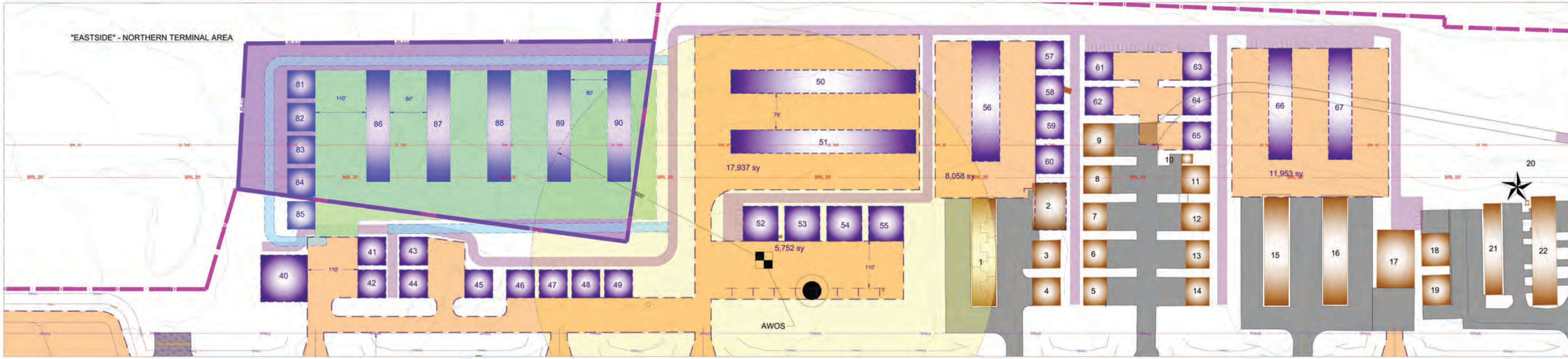
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

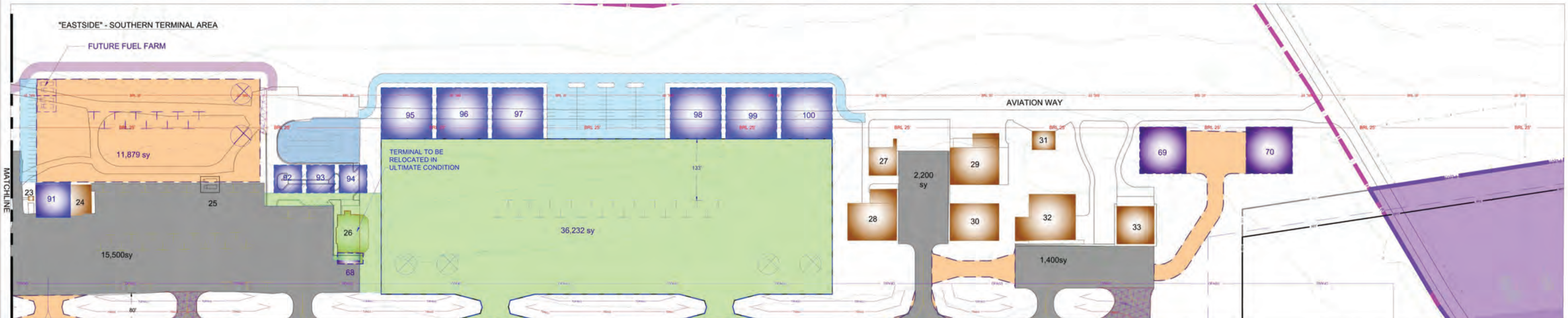
ULTIMATE RW 17/35 DEPARTURE SURFACE DRAWING

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division





EXISTING AIRPORT FACILITES

#	Facility Name	Top Elevation ft. msl
1	T-HANGAR (10 UNIT)	±283.3'
2	EXECUTIVE HANGAR	±292.0'
3	EXECUTIVE HANGAR	±292.3'
4	EXECUTIVE HANGAR	±290.1'
5	EXECUTIVE HANGAR	292.8'
6	EXECUTIVE HANGAR	292.6'
7	EXECUTIVE HANGAR	292.8'
8	EXECUTIVE HANGAR	291.9'
9	EXECUTIVE HANGAR	±292.0'
10	BUILDING	270.0'
11	EXECUTIVE HANGAR	289.8'
12	EXECUTIVE HANGAR	290.2'
13	EXECUTIVE HANGAR	290.7'
14	EXECUTIVE HANGAR	291.3'
15	T-HANGAR (10 UNIT)	283.3'
16	T-HANGAR (10 UNIT)	±283.3'
17	CONVENTIONAL HANGAR	±283.3'
18	EXECUTIVE HANGAR	±283.3'
19	EXECUTIVE HANGAR	±283.3'
20	ROTATING BEACON	306.5'
21	T-HANGAR (6 UNIT)	272.3'
22	T-HANGAR (10 UNIT)	273.2'
23	BUILDING	±283.3'
24	AIRPORT MAINTENANCE HANGAR	280.1'
25	FUEL FARM	255.3'
26	TERMINAL	277.6'
27	EXECUTIVE HANGAR	277.9'
28	CONVENTIONAL HANGAR	281.4'
29	CONVENTIONAL HANGAR	281.3'
30	CONVENTIONAL HANGAR	281.4'
31	FUEL FARM (FBO)	255.1'
32	CONVENTIONAL HANGAR	281.4'
33	EXECUTIVE HANGAR	281.4'

FUTURE AIRPORT FACILITIES

#	Facility Name	Top Elevation ft. msl*	#	Facility Name	Top Elevation ft. msl*
40	CONVENTIONAL HANGAR	±282.0'	58	EXECUTIVE HANGAR	±272.0'
41	EXECUTIVE HANGAR	±307.0'	59	EXECUTIVE HANGAR	±272.0'
42	EXECUTIVE HANGAR	±307.0'	60	EXECUTIVE HANGAR	±277.0'
43	EXECUTIVE HANGAR	±307.0'	61	EXECUTIVE HANGAR	±282.0'
44	EXECUTIVE HANGAR	±307.0'	62	EXECUTIVE HANGAR	±267.0'
45	EXECUTIVE HANGAR	±307.0'	63	EXECUTIVE HANGAR	±262.0'
46	EXECUTIVE HANGAR	±307.0'	64	EXECUTIVE HANGAR	±272.0'
47	EXECUTIVE HANGAR	±307.0'	65	EXECUTIVE HANGAR	±272.0'
48	EXECUTIVE HANGAR	±307.0'	66	T-HANGAR	±260.0'
49	EXECUTIVE HANGAR	±307.0'	67	T-HANGAR	±260.0'
50	T-HANGAR	±290.0'	68	TERMINAL EXPANSION	±275.0'
51	T-HANGAR	±290.0'	69	CONVENTIONAL HANGAR	±271.0'
52	EXECUTIVE HANGAR	±292.0'	70	CONVENTIONAL HANGAR	±271.0'
53	EXECUTIVE HANGAR	±292.0'			
54	EXECUTIVE HANGAR	±292.0'			
55	EXECUTIVE HANGAR	±292.0'			
56	T-HANGAR	±280.0'			
57	EXECUTIVE HANGAR	±267.0'			

*Top elevation estimated based off common structure height

ULTIMATE AIRPORT FACILITIES

#	Facility Name	Top Elevation ft. msl*
81	EXECUTIVE HANGAR	±307.0'
82	EXECUTIVE HANGAR	±307.0'
83	EXECUTIVE HANGAR	±307.0'
84	EXECUTIVE HANGAR	±312.0'
85	EXECUTIVE HANGAR	±312.0'
86	T-HANGAR	±296.0'
87	T-HANGAR	±291.0'
88	T-HANGAR	±286.0'
89	T-HANGAR	±286.0'
90	T-HANGAR	±286.0'
91	TERMINAL BUILDING	±278.0'
92	EXECUTIVE HANGAR	±247.0'
93	EXECUTIVE HANGAR	±247.0'
94	EXECUTIVE HANGAR	±247.0'
95	CONVENTIONAL HANGAR	±271.0'
96	CONVENTIONAL HANGAR	±271.0'
97	CONVENTIONAL HANGAR	±271.0'
98	CONVENTIONAL HANGAR	±271.0'
99	CONVENTIONAL HANGAR	±271.0'
100	CONVENTIONAL HANGAR	±271.0'

*Top elevation estimated based off common structure height

GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates are from adip.faa.gov. CAD linework shown in this set was collected from the previous ALP Set. Any additional existing features were manually extracted from available ortho imagery.

LEGEND

EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			AIRPORT PROPERTY LINE
★	N/A	N/A	AIRPORT ROTATING BEACON
			AVIGATION EASEMENT
	BRL 25'		BUILDING RESTRICTION LINE (25')
	BRL 35'		BUILDING RESTRICTION LINE (35')
			STRUCTURES ON AIRPORT
			STRUCTURE OFF AIRPORT
N/A			ABANDON/REMOVE PAVEMENT
			CRITICAL AREA
			TAXIWAY APRON PAVEMENT
	N/A	SAME	FENCE LINE
			TAXIWAY APRON MARKING
			ROADS AND PARKING PAVEMENT
OFA	OFA(U)	OFA(U)	OBJECT FREE AREA
TOFA	TOFA (U)	TOFA (U)	TAXIWAY OBJECT FREE AREA
TSA	TSA (U)	TSA (U)	TAXIWAY SAFETY AREA
			TIE-DOWNS
			TREELINE

MAGNETIC NORTH
NORTH

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 100 200
SCALE IN FEET

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13A PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

DocuSigned by: [signature] 3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

DocuSigned by: Atwood C. Kenjura 3/6/2024
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Mayor — Atwood C. Kenjura
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

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(602) 993-6999, Fax (7196)
Coffman Associates
Airport Consultants
www.coffmanassociates.com

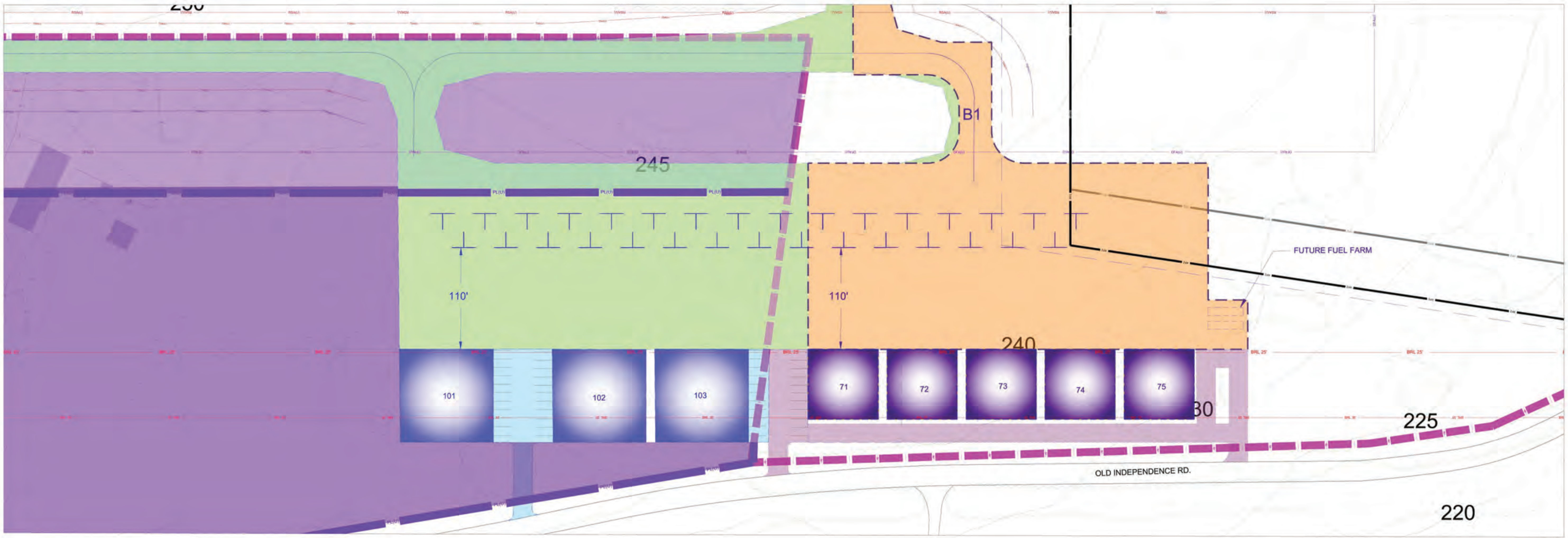
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

EAST SIDE TERMINAL AREA DRAWING

BRENHAM MUNICIPAL AIRPORT (11R)
BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division

WEST SIDE TERMINAL AREA



FUTURE AIRPORT FACILITIES		
#	Facility Name	Top Elevation ft. msl*
71	EXECUTIVE HANGAR	±247.0'
72	EXECUTIVE HANGAR	±247.0'
73	EXECUTIVE HANGAR	±247.0'
74	EXECUTIVE HANGAR	±247.0'
75	EXECUTIVE HANGAR	±247.0'

ULTIMATE AIRPORT FACILITIES		
#	Facility Name	Top Elevation ft. msl*
101	CONVENTIONAL HANGAR	±271.0'
102	CONVENTIONAL HANGAR	±271.0'
103	CONVENTIONAL HANGAR	±271.0'

*Top elevation estimated based off common structure height

LEGEND

EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			AIRPORT PROPERTY LINE
			AVIGATION EASEMENT
	BRL 25'		BUILDING RESTRICTION LINE (25')
	BRL 35'		BUILDING RESTRICTION LINE (35')
			STRUCTURES ON AIRPORT
			STRUCTURE OFF AIRPORT
N/A			ABANDON/REMOVE PAVEMENT
			CRITICAL AREA
			TAXIWAY APRON PAVEMENT
	N/A	SAME	FENCE LINE
			TAXIWAY APRON MARKING
			ROADS AND PARKING PAVEMENT
OFA	OFA(U)	OFA(U)	OBJECT FREE AREA
TOFA	TOFA (U)	TOFA (U)	TAXIWAY OBJECT FREE AREA
TSA	TSA (U)	TSA (U)	TAXIWAY SAFETY AREA
			TIE-DOWNS
			TREELINE

MAGNETIC NORTH
NORTH

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 50 100
SCALE IN FEET

GENERAL NOTES:

1. No survey was conducted for this project. Existing runway end coordinates are from adip.faa.gov. CAD linework shown in this set was collected from the previous ALP Set. Any additional existing features were manually extracted from available ortho imagery.

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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Dan Harmon, DIRECTOR, AVIATION DIVISION — DATE

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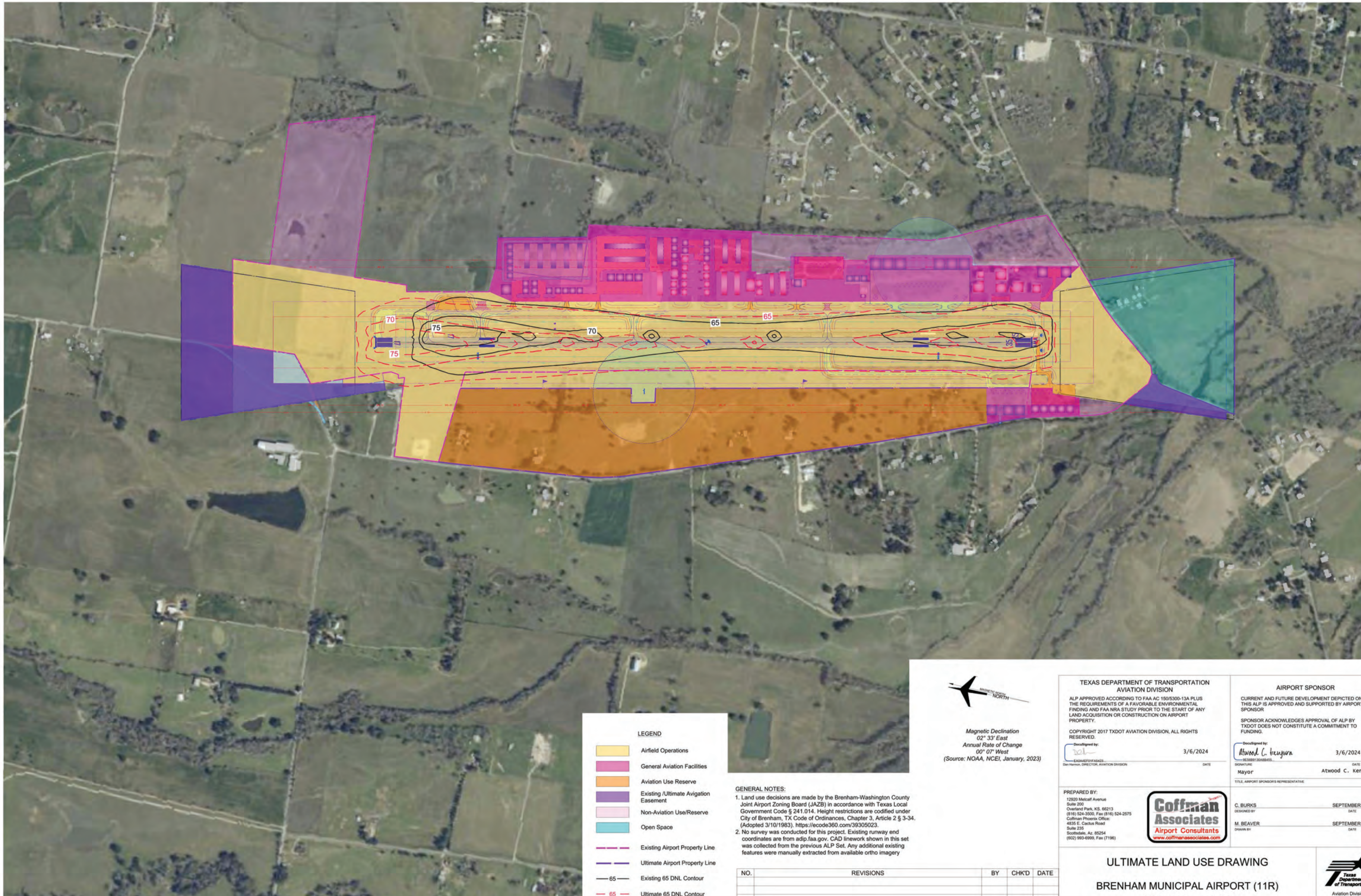
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

WEST SIDE TERMINAL AREA DRAWING
BRENHAM MUNICIPAL AIRPORT (11R)
BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division



LEGEND

- Airfield Operations
- General Aviation Facilities
- Aviation Use Reserve
- Existing /Ultimate Avigation Easement
- Non-Aviation Use/Reserve
- Open Space
- Existing Airport Property Line
- Ultimate Airport Property Line
- 65 Existing 65 DNL Contour
- 65 Ultimate 65 DNL Contour

GENERAL NOTES:

1. Land use decisions are made by the Brenham-Washington County Joint Airport Zoning Board (JAZB) in accordance with Texas Local Government Code § 241.014. Height restrictions are codified under City of Brenham, TX Code of Ordinances, Chapter 3, Article 2 § 3-34. (Adopted 3/10/1983). https://ecode360.com/39305023.
2. No survey was conducted for this project. Existing runway end coordinates are from adip.faa.gov. CAD linework shown in this set was collected from the previous ALP Set. Any additional existing features were manually extracted from available ortho imagery

MAGNETIC NORTH
NORTH

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

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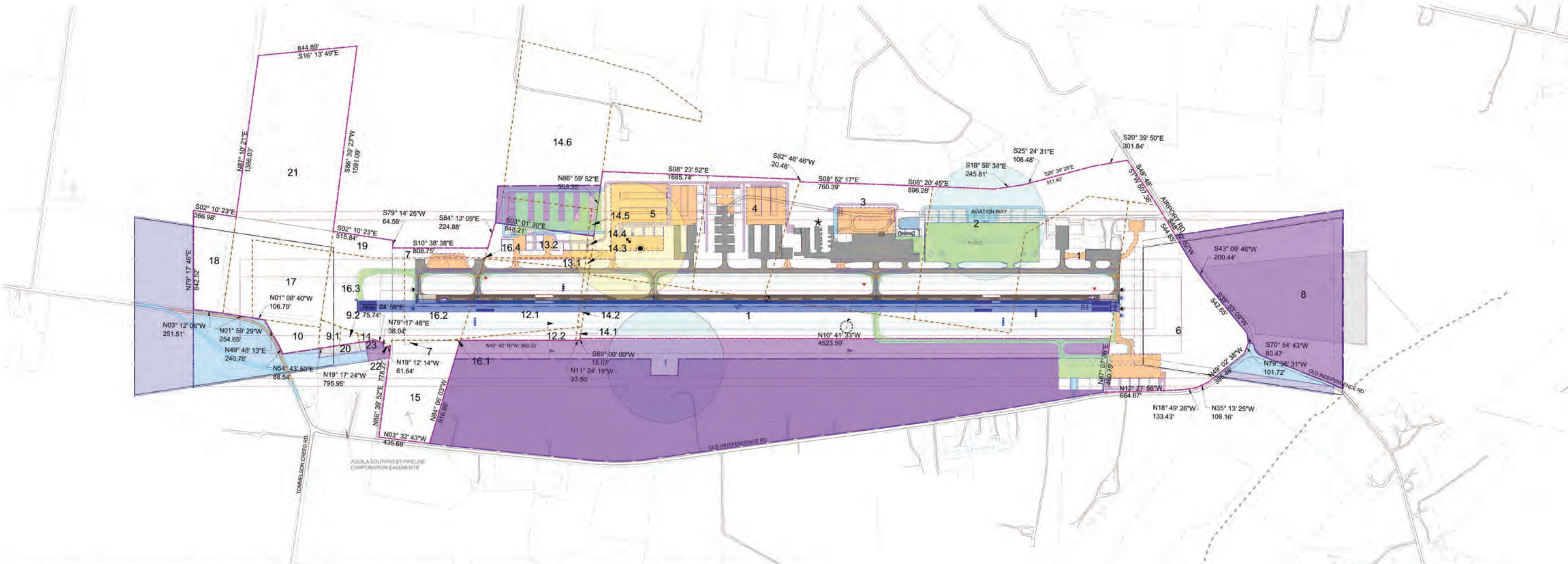
C. BURKS — SEPTEMBER 2023
DESIGNED BY — DATE
M. BEAVER — SEPTEMBER 2023
DRAWN BY — DATE

ULTIMATE LAND USE DRAWING

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division



PARCEL NUMBER	ACQUIRED ACREAGE	ADJUSTED ACREAGE	ACREAGE ADJUSTMENT NOT	INSTRUMENT TYPE	PROPERTY INTEREST	GRANTOR/REMARKS	COUNTY RECORD VOL./PAGE	DATE FILED	FUNDING	DATE OF RELEASE	DATE OF DISPOSAL	COMMENTS
1	46.622			WARRANTY DEED	FEE SIMPLE	RAYMOND JESKE ET UX.	251/470	3/6/1964	FAAP 9-41-189-C401			
2	31.125			WARRANTY DEED	FEE SIMPLE	JOHNIE MAE CARAWAY	251/559	3/16/1964	FAAP 9-41-189-C401			
3	31.125			WARRANTY DEED	FEE SIMPLE	LILLIE MAE CARAWAY DOCKERY ET VIR	251/561	3/16/1964	FAAP 9-41-189-C401			
4	16.395			WARRANTY DEED	FEE SIMPLE	PEARL ROBINSON ET VIR	251/562	3/16/1964	FAAP 9-41-189-C401			
5	19.036			WARRANTY DEED	FEE SIMPLE	ROBBIE LEE ALCORN ROSS ET AL.	251/564	3/16/1964	FAAP 9-41-189-C401			
6	28.994			WARRANTY DEED	FEE SIMPLE	B. T. HOGAN ET AL.	253/101	6/3/1964	FAAP 9-41-189-C401			
7	22.694			CLEAR ZONE EASEMENT	CLEAR ZONE EASEMENT	FRED WEGNER ET UX.	304/556	4/15/1971	SPONSOR			LAND ENCUMBERED BY EASEMENT NOW OWNED IN FEE
8	18.392			JUDGEMENT ON THE AWARD	CLEAR ZONE EASEMENT	BURNEY H. RIECHERS ET AL.	305/595	6/23/1971	SPONSOR			
9.1	0.8114			WARRANTY DEED	FEE SIMPLE	KATHRYN R. JANNER ET AL. (FIRST TRACT)	597/138	12/27/1988	AIP 5-48-0029-04			
9.2	0.4161			WARRANTY DEED	FEE SIMPLE	KATHRYN R. JANNER ET AL. (SECOND TRACT)	597/138	12/27/1988	AIP 5-48-0029-04			
10	2.051			WARRANTY DEED	FEE SIMPLE	GARY MARBURGER ET UX.	597/146	12/27/1988	AIP 5-48-0029-04			
11	0.1229			WARRANTY DEED	FEE SIMPLE	JEFFREY AUBIHL ET UX.	597/150	12/27/1988	AIP 5-48-0029-04			
12.1	12.524			WARRANTY DEED	FEE SIMPLE	ALMA WEGNER (FIRST TRACT)	597/231	12/28/1988	AIP 5-48-0029-04			
12.2	1.350			WARRANTY DEED	FEE SIMPLE	ALMA WEGNER (SECOND TRACT)	597/231	12/28/1988	AIP 5-48-0029-04			
13.1	0.9529			WARRANTY DEED	FEE SIMPLE	ALMA WEGNER (TRACT ONE)	597/237	12/28/1988	AIP 5-48-0029-04			
13.2	8.798	4.7598	PORTION CONVEYED TO EDGAR C. GRIFFIN ET AL. AS PART OF TRACT TWO IN VOL. 611/329	WARRANTY DEED	FEE SIMPLE	ALMA WEGNER (TRACT TWO)	597/237	12/28/1988	AIP 5-48-0029-04	N/A	PORTION CONVEYED TO EDGAR C. GRIFFIN ET AL. BY DEED	
14.1	0.0900			WARRANTY DEED	FEE SIMPLE	JOYCE SMITH (TRACT ONE)	599/13	1/30/1989	AIP 5-48-0029-04			
14.2	0.4578			WARRANTY DEED	FEE SIMPLE	JOYCE SMITH (TRACT TWO)	599/13	1/30/1989	AIP 5-48-0029-04			
14.3	0.0934			WARRANTY DEED	FEE SIMPLE	JOYCE SMITH (TRACT THREE)	599/13	1/30/1989	AIP 5-48-0029-04			
14.4	0.2008			WARRANTY DEED	FEE SIMPLE	JOYCE SMITH (TRACT FOUR)	599/13	1/30/1989	AIP 5-48-0029-04			
14.5	0.2558	0	CONVEYED TO EDGAR C. GRIFFIN ET AL. AS PART OF TRACT TWO IN VOL. 611/329	WARRANTY DEED	FEE SIMPLE	JOYCE SMITH (TRACT FIVE)	599/13	1/30/1989	AIP 5-48-0029-04	N/A	9/7/1989	
14.6	28.423	0	CONVEYED TO EDGAR C. GRIFFIN ET AL. AS TRACT ONE IN VOL. 611/329	WARRANTY DEED	FEE SIMPLE	JOYCE SMITH (TRACT SIX)	599/13	1/30/1989	AIP 5-48-0029-04	N/A	9/7/1989	
15	10.094			WARRANTY DEED	FEE SIMPLE	EDGAR C. GRIFFIN ET AL.	608/334	7/14/1989	AIP 5-48-0029-04			
16.1	0.0115			WARRANTY DEED	FEE SIMPLE	EDGAR C. GRIFFIN ET AL. (FIRST TRACT)	608/326	7/14/1989	AIP 5-48-0029-04			
16.2	9.268			WARRANTY DEED	FEE SIMPLE	EDGAR C. GRIFFIN ET AL. (SECOND TRACT)	608/326	7/14/1989	AIP 5-48-0029-04			
16.3	10.406			WARRANTY DEED	FEE SIMPLE	EDGAR C. GRIFFIN ET AL. (THIRD TRACT)	608/326	7/14/1989	AIP 5-48-0029-04			
16.4	0.0036			WARRANTY DEED	FEE SIMPLE	EDGAR C. GRIFFIN ET AL. (FOURTH TRACT)	608/326	7/14/1989	AIP 5-48-0029-04			
17	9.454			WARRANTY DEED	FEE SIMPLE	ELLISON'S GREENHOUSES, INC.	611/13	8/30/1989	AIP 5-48-0029-04			
18	5.902			WARRANTY DEED	FEE SIMPLE	GLADYS JOYCE ROSENBAUM ET VIR	1309/513	5/14/2009	TXDOT CSJ NO. 0717BRENM			
19	3.599			WARRANTY DEED	FEE SIMPLE	EDGAR C. GRIFFIN AND RIZZO FAMILY PARTNER:	1309/938	5/19/2009	TXDOT CSJ NO. 0717BRENM			
20	0.603			AVIGATION EASEMENT	AVIGATION EASEMENT	KEITH KROLL ET UX.	1309/945	5/19/2009	TXDOT CSJ NO. 0717BRENM			
21	34.896			WARRANTY DEED	FEE SIMPLE	LOS ACRES DEL SOL, INC.	1321/549	9/15/2009	TXDOT CSJ NO. 0717BRENM			
22	0.0313			WARRANTY DEED	FEE SIMPLE	JEFFERY AUBIHL AND JANET AUBIHL	1332/330	2/1/2010	TXDOT CSJ NO. 0717BRENM			
23	0.3177			AVIGATION EASEMENT	AVIGATION EASEMENT	JEFFERY AUBIHL AND JANET AUBIHL	1332/337	2/1/2010	TXDOT CSJ NO. 0717BRENM			

PROPERTY LEGEND

- Ultimate Property Line
- Existing Property Line
- Ultimate Airport Property
- Parcel Boundary
- Existing Airport Easement
- Future Airport Easement
- Ultimate Airport Easement

MAGNETIC NORTH
NORTH

Magnetic Declination
02° 33' East
Annual Rate of Change
00° 07' West
(Source: NOAA, NCEI, January, 2023)

0 400 800
SCALE IN FEET

STRAND ASSOCIATES

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DocuSigned by: Atwood C. Kenjura 3/6/2024
Dan Harmon, DIRECTOR, AVIATION DIVISION DATE

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C. BURKS SEPTEMBER 2023
DESIGNED BY DATE
M. BEAVER SEPTEMBER 2023
DRAWN BY DATE

EXHIBIT "A" AIRPORT PROPERTY INVENTORY MAP

BRENHAM MUNICIPAL AIRPORT (11R)

BRENHAM, TEXAS

Texas Department of Transportation
Aviation Division

City of BRENHAM

Appendix C

DRAFT HEIGHT/HAZARD ZONING ORDINANCE

Appendix C
Draft Height and Hazard Ordinance

This appendix includes a height and hazard zoning ordinance based on the guidance included in Appendix D of the Texas Department of Transporta. on-Aviation Division's (TxDOT) Airport Compatibility Guidelines.[1]

It is important to note that adoption of a height and hazard zoning ordinance requires several steps which must be completed in a specific sequence. Prior to proceeding with the process, the text of the draft ordinance should be reviewed by legal counsel. The steps are presented below and are preceded by the following note in the Texas Department of Transportation-Aviation Division's (TxDOT) Airport Compatibility Guidelines.

"IMPORTANT: Do not deviate from the numerical order of procedural steps and assure no step is taken before the preceding step is finished."

Checklist of Procedural and Legal Actions required for the Adoption of an Airport Zoning Ordinance:

1. City Ordinance creating a Joint Airport Zoning Board (JAZB) and appointing city's representatives to that board.
2. County Order creating a JAZB and appointing county's representative to that board.
3. Oaths of office administered to members of the JAZB.
4. Election of 5th member of the JAZB who shall serve as chairperson of that board.
5. Oath of office administered to chairperson of the JAZB.
6. JAZB sets date of public hearing.

[1] https://ftp.txdot.gov/pub/txdot-info/avn/avninfo/Airport_Compatibility_Guidelines.pdf

7. Notice of public hearing published in local newspaper(s).
8. Proof of publication collected for each newspaper.
   Note: The above steps 7 & 8 should be repeated for each political subdivision affected by the zoning.
9. Notice of public hearing posted in city hall and/or county courthouse for each jurisdiction participating in the zoning.
10. Conduct public hearing.
11. Adopt zoning ordinance.
12. Attorney's certification.
13. Adopted ordinance filed with County Clerk for each county participating in the zoning.
14. Copy of procedural forms and adopted ordinance provided to each political subdivision participating in the zoning process.

AIRPORT HAZARD ZONING ORDINANCE

BRENHAM MUNICIPAL AIRPORT HAZARD ZONING REGULATIONS

Regulating and restricting the height of structures and objects of natural growth and otherwise regulating the use of property in the vicinity of the Brenham Municipal Airport, Brenham Texas, by creating the appropriate zones and establishing the boundaries thereof; providing for restrictions of such zones and the enforcement of such restrictions; defining certain terms used herein; referring to the Brenham Municipal Airport Hazard Zoning Map dated ________, which is incorporated in and made a part of these regulations; providing for a board of adjustment; and imposing penalties.

Whereas, these regulations are adopted pursuant to the authority conferred by the Airport Zoning Act, Texas Local Government Code, §§241.001 et seq.

Whereas the Legislature of the State of Texas finds that:

- an airport hazard endangers the lives and property of users of the airport and of occupants of land in the vicinity of the airport;
- an airport hazard that is an obstruction reduces the size of the area available for the landing, taking off, and maneuvering of aircraft, tending to destroy or impair the utility of the airport and the public investment in the airport;
- the creation of an airport hazard is a public nuisance and an injury to the community served by the airport affected by the hazard;
- it is necessary in the interest of the public health, public safety, and general welfare to prevent the creation of an airport hazard;
- the creation of an airport hazard should be prevented, to the extent legally possible, by the exercise of the police power without compensation; and
- the prevention of the creation of an airport hazard and the elimination, the removal, the alteration, the mitigation, or the marking and lighting of an airport hazard are public purposes for which a political subdivision may raise and spend public funds and acquire land or interests in land.

Accordingly, it is declared that the City of Brenham benefits from the use of the Brenham Municipal Airport and the City Council of the City of Brenham permits the Brenham Municipal Airport to be used by the public to an extent that the airport fulfills an essential community purpose; therefore, the Brenham Municipal Airport is used in the interest of the public.

Therefore, be it ordered by the Brenham-Washington County Joint Airport Zoning Board of the City Council of the City of Brenham Texas, and the Commissioners Court of Washington County, Texas:

Section 1. Short Title

These regulations shall be known and may be cited as the "**Brenham Municipal Airport Hazard Zoning Regulations**."

Section 2. Definitions

As used in these regulations, unless the context other requires:

A. **Administrative Agency.** The appropriate person or office of a political subdivision which is responsible for the administration and enforcement of the regulations prescribed herein. The administrative agency is set forth in Section 3 of these regulations.

B. **Airport.** The Brenham Municipal Airport, Brenham, Texas; including the ultimate development of that facility.

C. **Airport Elevation.** The established elevation of the highest point on the runway, either existing or planned, at the airport measured in feet above mean sea level (MSL). The airport elevation of the Brenham Municipal Airport is 317.70 feet above mean sea level (MSL).

D. **Airport Hazard.** Any structure, tree, or use of land which obstructs the airspace required for the flight of aircraft or obstructs or interferes with the control, tracking, and/or data acquisition in the landing, takeoff, or flight at an airport or any installation or facility relating to flight, tracking, and/or data acquisition of the flight craft; is hazardous to, interferes with, or obstructs such landing, takeoff, or flight of aircraft; or is hazardous to or interferes with tracking and/or data acquisition pertaining to flight and flight vehicles.

E. **Approach Surface.** A surface longitudinally centered on the extended runway centerline, extending outward and upward from each end of the primary surface and at the same slope as the approach zone height limitation slope set forth in Section 5 of these regulations. In plan, the perimeter of the approach surface coincides with the perimeter of the approach surface.

F. **Approach, Conical, Horizontal, and Transitional Zones.** These zones are set forth in Section 4 of these regulations.

G. **Board of Adjustment.** A board so designated by these regulations as provided in Texas Local Government Code, §241.032. Provisions for the board of adjustment are set forth in Section 9 of these regulations.

H. Conical Surface. A surface extending outward and upward from the periphery of the horizontal surface at a slope of twenty (20) feet horizontally for each one (1) foot vertically for a horizontal distance of four thousand (4,000) feet.

I. Hazard to Air Navigation. An obstruction or use of land determined to have a substantial adverse effect on the sage and efficient utilization of navigable airspace.

J. Height. For the purpose of determining the height limits in all zones set forth in these regulations and shown on the hazard zoning map, the datum shall be height above mean sea level (MSL) elevation as measured in feet.

K. Horizontal Surface. A horizontal plane one-hundred fifty (150) feet above the established airport elevation which in plan coincides with the perimeter of the horizontal surface.

L. Nonconforming Use, Structure, or Tree. Any structure, tree, or use of land which is inconsistent with the provisions of these regulations, and which is existing as of the effective date of these regulations.

M. Nonprecision Instrument Runway. A runway having an existing instrument approach procedure utilizing air navigation facilities or other equipment that provides only horizontal guidance or area type navigation equipment. This also includes a runway for which a nonprecision instrument approach procedure has been approved or planned. Runway 16-34 is considered a nonprecision instrument runway.

N. Obstruction. Any structure, tree, or other object, including a mobile object, which exceeds a limiting height set forth in Section 5 of these regulations or is an airport hazard.

O. Person. An individual, firm, partnership, corporation, company, association, joint stock association, or body politic and includes a trustee, receiver, assignee, administrator, executor, guardian, or other representative.

P. Primary Surface. A 1,000-foot-wide surface longitudinally centered on the runway extending the full length of the ultimate runway configuration plus two hundred (200) feet beyond each ultimate end of the runway. The elevation of any point on the primary surface is the same as the nearest point on the existing or ultimate runway centerline.

Q. Runway. A defined area on the airport prepared for the landing and taking off of aircraft along its length. The existing length of Runway 16-34 at the Brenham Municipal Airport is 6,003 feet. The planned ultimate length of Runway 16-34 at the Brenham Municipal Airport is 6,503 feet.

R. Structure. An object, including a mobile object, constructed or installed by man including, but not limited to, buildings, towers, cranes, smokestacks, poles, earth formations, overhead power lines, and traverse ways. Traverse ways are considered to be the heights set forth in 14 C.F.R. Part 77.23.

S. **Transitional Surfaces.** Surfaces extending perpendicular to the runway centerline and the extended runway centerline outward from the edges of the primary surface and the approach surfaces at a slope of seven (7) feet horizontally for each one (1) foot vertically to where they intersect the horizontal surface. Transitional surfaces for those portions of the precision approach surface which extend through and beyond the limits of the conical surface extend at a slope of seven (7) feet horizontally for each one (1) foot vertically for a distance of five thousand (5,000) feet measured horizontally from either edge of the approach surface and perpendicular to the extended runway centerline.

T. **Tree.** Any type of flora and an object of natural growth.

Section 3. Administrative Agency

It shall be the duty of the office of the City of Brenham Development Services Department to administer and enforce the regulations prescribed herein and is hereby designated as the administrative agency.

Section 4. Zones

In order to carry out provisions of these regulations, there are hereby created and established certain zones which include all of the land lying beneath the approach surfaces, conical surface, horizontal surface, and transitional surfaces as they apply to the airport. Such surfaces are shown on the Brenham Municipal Airport Hazard Zoning Map dated ____________________, and depicted on **Exhibits C1 and C2,** which is hereby attached to these regulations and made a part hereof. An area located in more than one of the following zones is considered to be only in the zone with the more restrictive height limitation. The various zones are hereby established and defined as follows:

A. **Approach Zones.** Approach zones are hereby established beneath the approach surfaces at the ends of Runway 16-34 at the airport. The approach surface shall have an inner edge width of one thousand (1,000) feet, which coincides with the width of the primary surface, at a distance of two-hundred (200) feet beyond each runway end, widening thereafter uniformly to a width of four thousand (4,000) feet at a horizontal distance of ten thousand (10,000) feet beyond the end of the primary surface. The centerline of the approach surface is the continuation of the centerline of the runway.

B. **Conical Zone.** A conical zone is hereby established beneath the conical surface at the airport which extends outward from the periphery of the horizontal surface for a horizontal distance of four thousand (4,000) feet.

C. **Horizontal Zone**. A horizontal zone is hereby established beneath the horizontal surface at the airport which is a plane one-hundred fifty (150) feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of ten thousand (10,000) feet radii from the center of each end of the primary surface and connecting the adjacent arcs by lines tangent to those arcs.

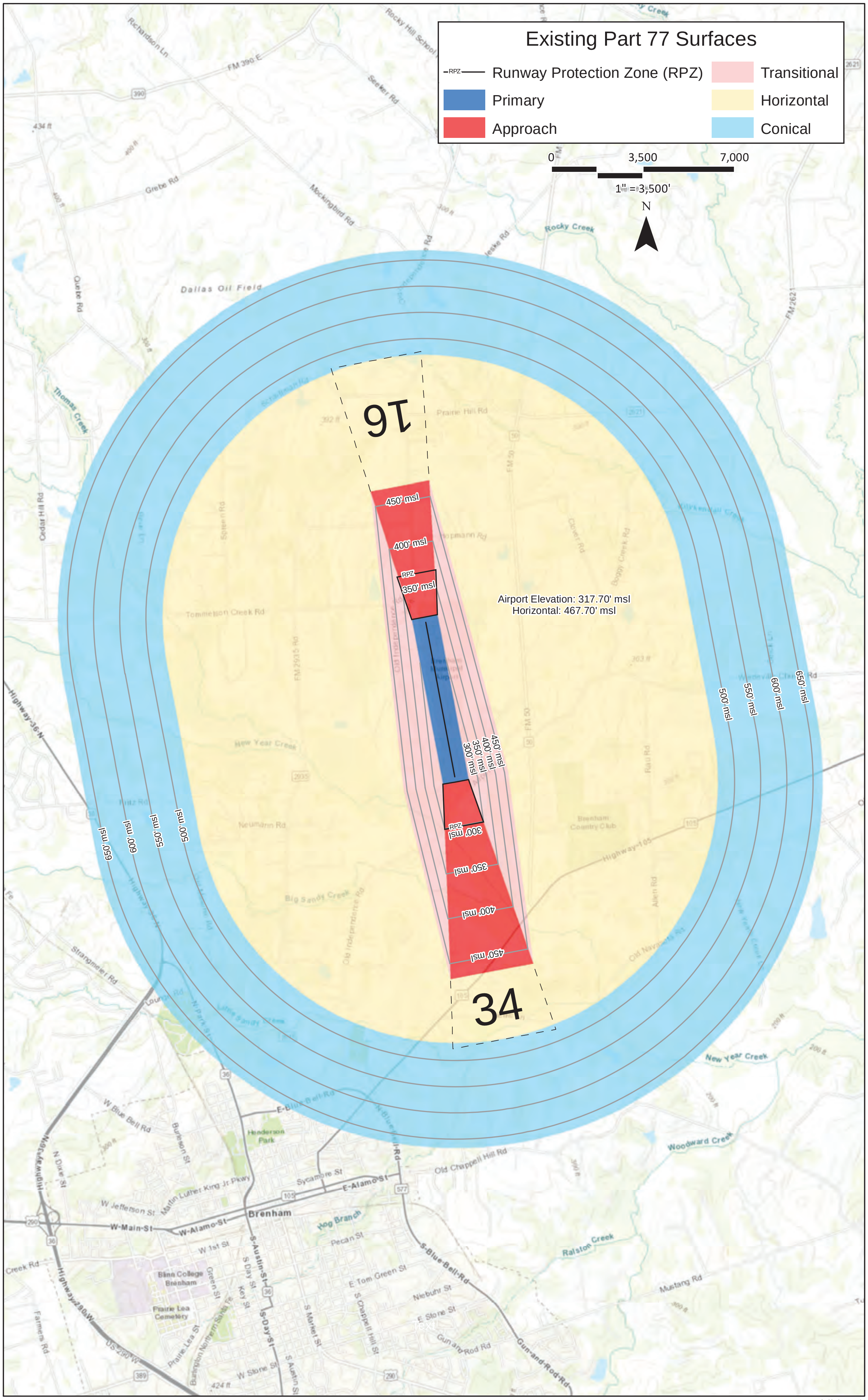

Exhibit C1
Existing Part 77 Surfaces

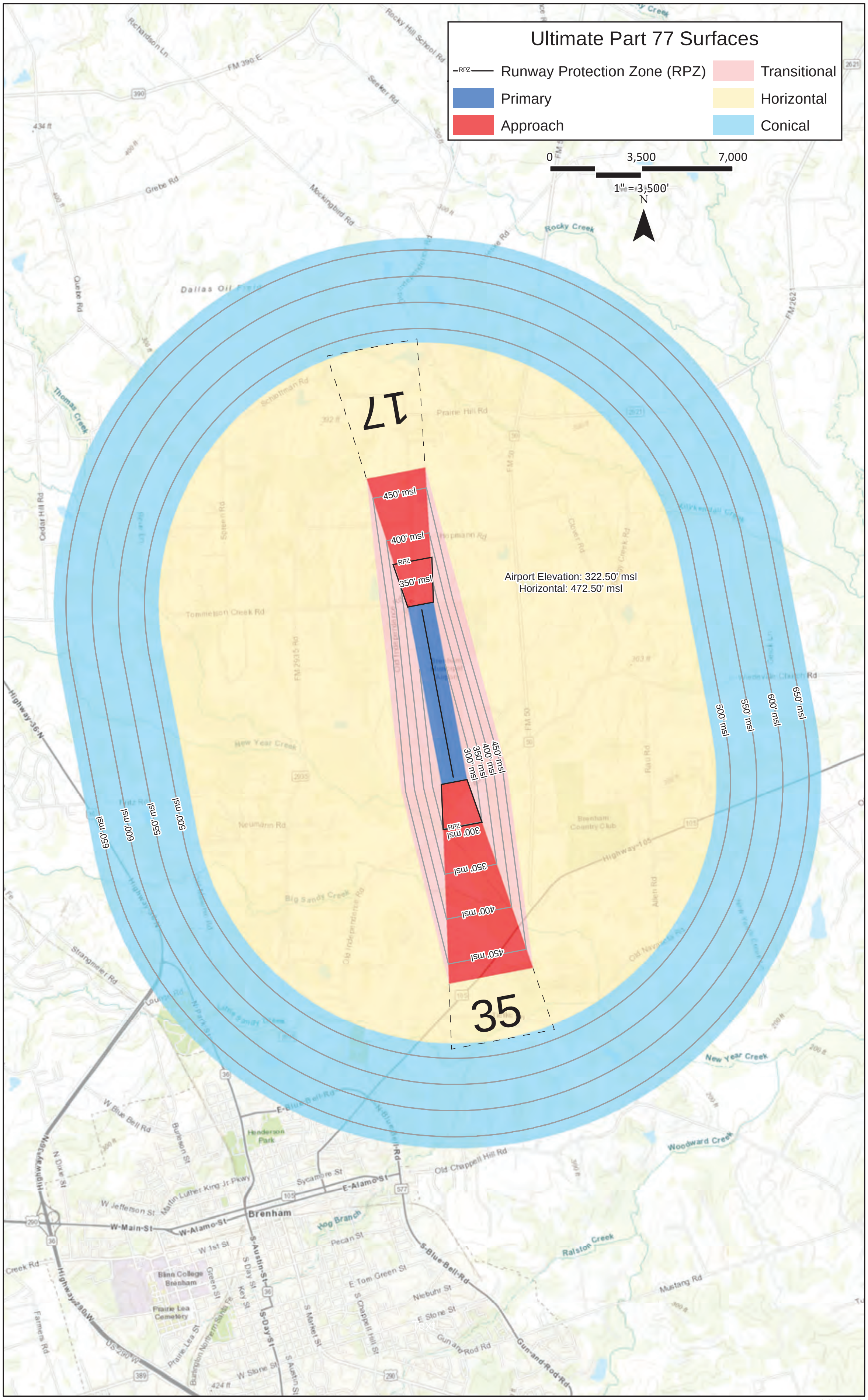

Exhibit C2
Ultimate Part 77 Surfaces

D. Transitional Zones. Transitional zones are herby established beneath the transitional surfaces at the airport. Transitional surfaces, symmetrically located on either side of the runway, have variable widths as shown on the Brenham Municipal Airport Hazard Zoning Map. Transitional surfaces extend outward perpendicular to the runway centerline and the extended runway centerline from the periphery of the primary surface and the approach surfaces to where they intersect the horizontal surface. Where the precision instrument runway approach surface projects through and beyond the conical surface, there are herby established transitional zones beginning at the sides of and at the same elevation as the approach surface and then extending for a horizontal distance of five thousand (5,000) feet as measured perpendicular to the extended runway centerline.

Section 5. Height Limitations

Except as otherwise provided in Section 8 of these regulations, no structure shall be erected, altered, or replaced and no tree shall be allowed to grow in any zone created by these regulations to a height in excess of the applicable height limitations herein established for such zone except as provided in Paragraph E of this Section. Such applicable height limitations are hereby established for each of the zones in question as follows:

A. Approach Zones. Slope one (1) foot in height for each thirty-four (34) feet in horizontal distance beginning at the end of and at the same elevation as the primary surface and extending to a point then thousand (10,000) feet beyond the end of the primary surface.

B. Conical Zone. Slopes one (1) foot in height for each twenty (20) feet in horizontal distance beginning at the periphery of the horizontal zone and at one-hundred fifty (150) feet above the airport elevation and extending to a height of three-hundred fifty (350) feet above the airport elevation, or to a height of 667.70 feet above mean sea level.

C. Horizontal Zone. Established at one-hundred fifty (150) feet above the airport elevation, or at a height 467.70 feet above mean sea level.

D. Transitional Zones. Slope one (1) foot in height for each seven (7) feet in horizontal distance beginning at the sides of and at the same elevations as the primary surface and the approach surfaces.

E. Excepted Height Limitation. Nothing contained in these regulations shall be construed as prohibiting the growth, construction, or maintenance of any structure or tree to a height of up to fifty (50) feet above the surface of the land at its location.

Section 6. Land Use Restrictions

Except as provided in Section 7 of these regulations, no use may be made of land or water within any zone established by these regulations in such a manner as to create electrical interference with navigational signals or radio communications between the airport and aircraft, make it difficult for pilots to distinguish between airport lights and others, result in glare in the eyes of pilots using the airport, impair visibility in the vicinity of the airport, create potential bird strike hazards, or otherwise in any way endanger or interfere with the landing, taking off, or maneuvering of aircraft intending to use the airport.

Section 7. Nonconforming Uses, Structures, and Trees

A. **Nonconforming Uses.** Nothing contained in these regulations shall be construed as requiring changes in or interference with the continuance of any nonconforming use of land.

B. **Nonconforming Structures.** Nothing contained in these regulations shall be construed as to require the removal, lowering, or other change to any existing nonconforming structure including all phases or elements of a multiphase structure the construction of which was begun prior to the effective date of these regulations and is diligently prosecuted.

C. **Nonconforming Trees.** Nothing in these regulations shall be construed as to require the removal, lowering, or other change to any nonconforming tree. However, any nonconforming tree which grows to a greater height than it was as of the effective date of these regulations is subject to the provisions of these regulations as described in Section 5 herein above.

Section 8. Permits and Variances

A. **Permits.** Any person who desires to replace, rebuild, substantially change, or repair a nonconforming structure or replace or replant a nonconforming tree must apply for and receive a permit, and the permit shall be granted. However, no permit shall be granted which would allow the establishment of an airport hazard or allow a nonconforming structure or tree to exceed its original height or become a greater hazard to air navigation than it was at the time of the adoption of these regulations. Applications for permits shall be applied to and issued by the administrative agency.

B. **Variances.** Any person who desires to erect, substantially change, or increase the height of any structure or establish or allow the growth of any tree which would exceed the height limitations set forth in Section 5 of these regulations or change the use of property in such a way as to create a hazardous condition as described in Section 6 of these regulations must apply to the board of adjustment and receive a variance. The application for variance must be accompanied by a determination from the Federal Aviation Administration under 14 C.F.R. Part 77 as to the effect of the proposal on the operation of air navigation facilities and the safe, efficient use of navigable airspace.

   Such variances shall be allowed where it is duly found that a literal application or enforcement of the regulations will result in practical difficulty or unnecessary hardship and the granting of relief would result in substantial justice, not be contrary to the public interest, and be in accordance with the spirit of these regulations.

C. **Requirements and Reasonable Conditions**
   (1) Any permit granted may, at the discretion of the administrative agency, impose a requirement to allow the installation and maintenance, at the expense of the administrative agency, of any markers or lights as may be necessary to indicate to flyers the presence of an airport hazard.

(2) Any variance granted may, at the discretion of the board of adjustment, impose any reasonable conditions as may be necessary to accomplish the purpose of these regulations.

Section 9. Board of Adjustment

A. The Board of Adjustment of the City of Brenham is hereby designated as the board of adjustment for the purposes of these regulations and shall have and exercise the following powers:

(1) to hear and decide appeals from any order, requirement, decision, or determination made by the Administrative Agency in the administration or enforcement of these regulations;

(2) to hear and decide special exceptions to the terms of these regulations when the board is required to do so; and

(3) to hear and decide specific variances.

B. The board of adjustment shall be comprised of five (5) members and shall adopt rules for its governance and procedure in harmony with the provisions of these regulations. Meetings of the board of adjustment shall be held at the call of the chairman and at such times as the board of adjustment may determine. The chairman, or in his/her absence the acting chairman, may administer oaths and compel the attendance of witnesses. All hearings of the board of adjustment shall be public. The board of adjustment shall keep minutes of its proceedings showing the vote of each member upon each question or if any member is absent or fails to vote, indicating such fact and shall keep records of its examinations and other official actions, all of which shall immediately be filed in the office of the board of adjustment or in the office of City of Brenham Development Services Department. All such records shall be public records.

C. The board of adjustment shall make written findings of fact and conclusions of law stating the facts upon which it relied when making its legal conclusions in reversing, affirming, or modifying any order, requirement, decision, or determination which comes before it under the provisions of these regulations.

D. The concurring of four (4) members of the board of adjustment shall be necessary to reverse any order, requirement, decision, or determination of the administrative agency, to decide in favor of the applicant on any matter upon which it is required to pass under these regulations, or to affect any variance to these regulations.

Section 10. Appeals

A. Any person aggrieved, or any taxpayer affected by a decision of the administrative agency made in the administration of these regulations may appeal to the board of adjustment if that person or taxpayer is of the opinion that a decision of the administrative agency is an improper application of these regulations. This same right of appeal is extended to the governing bodies of the City of Brenham and Washington County, Texas, and to the Brenham-Washington County Joint Airport Zoning Board.

B. All appeals hereunder must be taken within a reasonable time as provided by the rules of the board of adjustment by filing a notice of appeal with the board of adjustment and the administrative agency specifying the grounds for the appeal. The administrative agency shall forthwith transmit to the board of adjustment all papers constituting the record upon which the action appealed was taken.

C. An appeal shall stay all proceedings in furtherance of the action appealed unless the administrative agency certifies in writing to the board of adjustment that by reason of the facts stated in the certificate, a stay would, in the opinion of the administrative agency, cause imminent peril to life or property. In such case, proceedings shall not be stayed except by order of the board of adjustment on notice to the administrative agency and on due cause shown.

D. The board of adjustment shall fix a reasonable time for hearing appeals, give public notice and due notice to the parties in interest, and decide the same within a reasonable time. Upon the hearing, any party may appear in person, by agent, and/or attorney.

E. The board of adjustment may reverse or affirm, in whole or in part, or modify the administrative agency's order, requirement, decision, or determination from which an appeal is taken and make the correct order, requirement, decision, or determination, and for this purpose the board of adjustment has the same authority as the administrative agency.

Section 11. Judicial Review

Any person aggrieved or any taxpayer affected by a decision of the board of adjustment may present to a court of record a petition stating that the decision of the board of adjustment is illegal and specifying the grounds of the illegality as provided by and in accordance with the provisions of the Texas Local Government Code, §241.041. This same right of appeal is extended to the governing bodies of the City of Brenham, Texas, and Washington County, Texas, and to the Brenham-Washington County Joint Airport Zoning Board.

Section 12. Enforcement and Remedies

The governing bodies of the City of Brenham, Texas, or Washington County, Texas, or the Brenham-Washington County Joint Airport Zoning Board may institute in a court of competent jurisdiction an action to prevent, restrain, correct, or abate any violation of these regulations or of any order or ruling made in connection with their administration or enforcement including, but not limited to, an action for injunctive relief.

Section 13. Penalties

Each violation of these regulations or of any order or ruling promulgated hereunder shall constitute a misdemeanor and upon conviction shall be punishable by a fine of not more than $200 and each day a violation continues to exist shall constitute a separate offense.

Section 14. Conflicting Regulations

Where there exists a conflict between any of the regulations or limitations prescribed herein and any other regulation applicable to the same area, whether the conflict be with respect to the height of structures or trees, the use of land, or any other matter, the more stringent limitation or requirement shall control.

Section 15. Severability

If any of the provisions of these regulations or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions or application of these regulations which can be given effect without the invalid provision or application and to this end, the provisions of these regulations are declared to be servable.

Section 16. Adherence with State Laws

Any actions brought forth by any person or taxpayer as a result of the administration, enforcement, or the contesting of these regulations will be in accordance with the provisions of Texas Local Government Code, §§241.001 et seq and other applicable State laws.

Section 17. Effective Date

Whereas, the immediate operation of the provisions of these regulations is necessary for the preservation of the public health, safety, and general welfare, an emergency is hereby declared to exist and these regulations shall be in full force and effect from and after their adoption by the Brenham-Washington County Airport Zoning Board.

Adopted by the Brenham-Washington County Airport Zoning Board this ___ day of _____ 20____.

____

Chairman, ________________ Joint Airport Zoning Board

___________________________________ ___________________________________
Member Member

___________________________________ ___________________________________
Member Member

Attest:_______________________________________
City Secretary of the City of Brenham, Texas

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Airport Consultants

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