Ralph M. Hall Municipal Airport

City of Rockwall

Airport Development Plan

Final Report

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TABLE OF CONTENTS

INVENTORY OF EXISTING CONDITIONS – CHAPTER ONE PAGE

AVIATION ACTIVITY FORECASTS – CHAPTER TWO PAGE

AIRPORT FACILITY REQUIREMENTS – CHAPTER THREE PAGE

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES **PAGE**

TABLE OF CONTENTS

FIGURES **PAGE**

TABLE OF CONTENTS

FIGURES – CONTINUED **PAGE**

EXECUTIVE SUMMARY

The goal of the Ralph M. Hall Municipal Airport Development Plan is to provide a realistic and proactive framework for the City of Rockwall and The Rockwall Economic Development Corporation to identify, evaluate, and prioritize opportunities to redevelop the Airport to be an attractive alternative to other airports in the region. The Development process throughout this project included meetings with City personnel, REDC personnel, and various community leaders to solicit recommendations and receive input to create a document that exhibits a systematic approach to airport development.

DEVELOPMENT PLAN APPROACH

This Development Plan covers the period of 2012 through 2032 and includes the following components:

- Inventory and background data;
- Forecast of aviation demand;
- Facility requirements and needs;
- Alternatives development; and
- Phased development plan.

East of the growing DFW Metro-plex, the Airport is well situated to play a vital role in the economic growth and vitality of Rockwall and the region. While support for the Airport has been on the periphery for many years, its importance as an economic generator has been realized and support for integrating this asset into future transportation improvements will be a building block to achieve and provide a welcoming “front door" to the community.

Located on a small 50 acre footprint with a single runway exhibiting a length of 3,373 feet and a width of 45 feet, aeronautical operations at the Airport are forecast to increase from a current level of 15,000 aircraft movements to 25,200 by 2032 with based aircraft numbers expected to increase from 71 to 92 by the end of the planning period. While a majority of the operations will be conducted locally, the itinerant percentage of total operations increases from 21 percent in 2012 to 33 percent in 2032. These itinerant operations are indicative of greater use of the airfield from locations outside the region and larger, more complex business type aircraft.

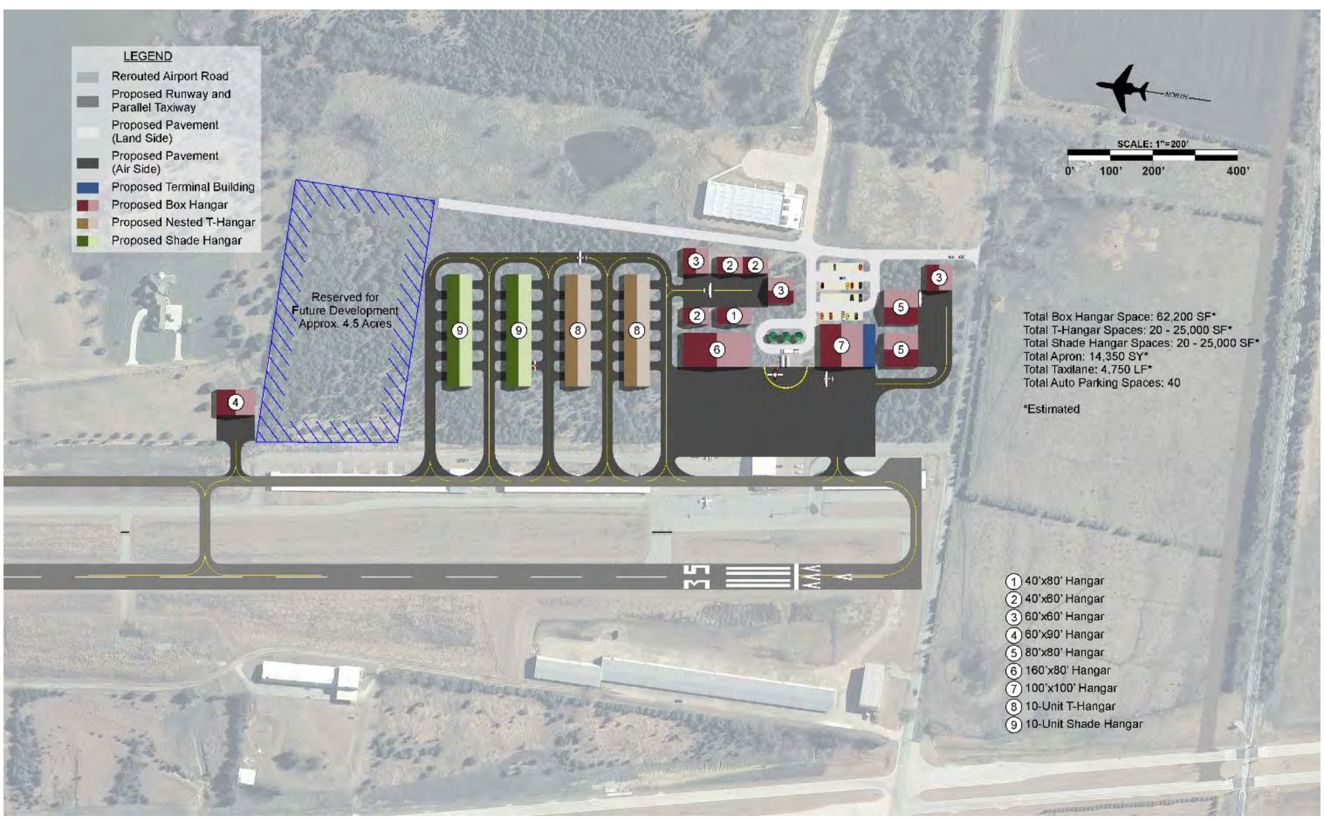
ALTERNATIVES ANALYSIS

A thorough analysis of future airport facility requirements ensures support facilities are able to meet forecast demand and meet FAA design criteria standards. After several iterations of proposed layouts that included examining runway extensions both north and south to 5,000 feet in length, a recommended development plan was developed based on input from the City and REDC. This plan included both airside and landside concepts.

Key improvement needs during the next 5-years include:

- Correcting Runway width and line-of-sight deficiencies;
- Constructing a new parallel taxiway with proper runway/taxiway centerline distance to correct several airside deficiencies;
- Need to implement declared distances to correct RSA/ROFA deficiencies off the southern runway end; and
- Need to construct and relocate the existing terminal area on the east side of the airport to include terminal building, apron, hangars, fuel facilities, and taxilanes.

Within the next five years, it is forecasted that T-hangar space will need to expand from its current square footage of 68,000 to 78,300 and executive/box hangar type facilities will need to add an additional 7,700 square footage of space. The T-hangars (both open shade and bi-fold door) would accommodate a total of 40 individual units while the executive/box hangars equate to a total of 16 individual structures varying in size from 2,400 square feet to over 10,000 square feet.



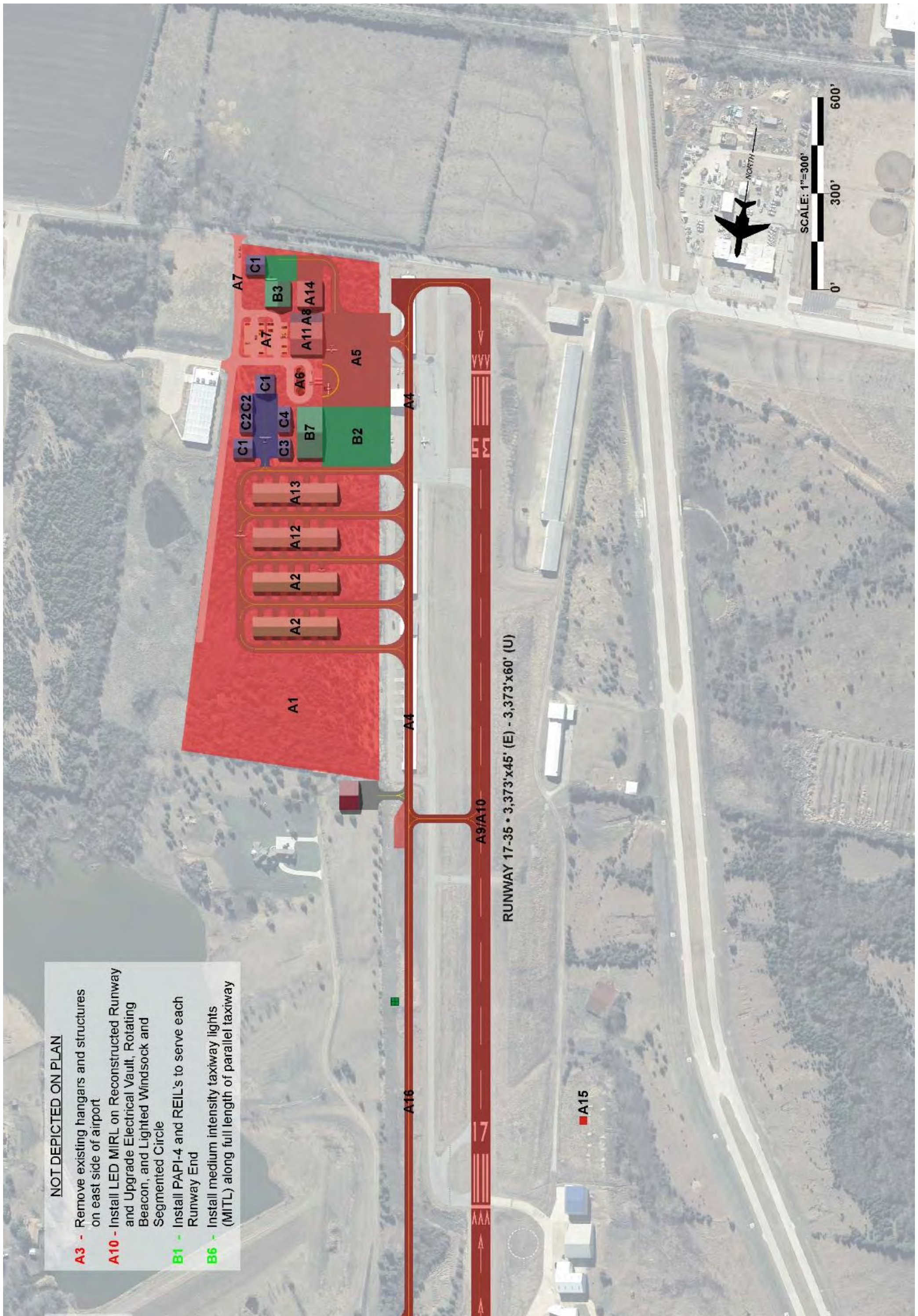
PREFERRED DEVELOPMENT PLAN

Based on anticipated demand and associated facility needs, a phased development plan was created to provide general phasing and capital projects financial guidance to airport sponsors over the 20-year planning period. The Phased Development Plan stages the proposed improvements based on the interrelationships of individual projects and from input received from City and REDC staff. This plan also establishes the basic finances for each development action and identifies potential funding sources. The proposed Capital Improvement Program presents capital improvement projects during the short-term 5-year time frame, mid-term 6-10 year time frame, or the long-term 11-20-year time frame. A summary of the totals for the 20-year CIP is provided below. Individual projects can be found in the *Phased Development Plan* Chapter and are depicted in the following *Phased Development Plan* graphic.

Phase	Local Funding	State/Federal Funding	Total Cost
Phase I Total	$1,371,000	$10,014,000	$11,385,000
Phase II Total	$291,000	$2,559,000	$2,850,000
Phase III Total	$360,000	$1,495,000	$1,855,000
Total All Phases	$2,022,000	$14,068,000	$16,090,000

SUMMARY

This Airport Development Plan balances needed Airport improvements with the goals of the Airport, REDC, and community leadership and arrived at a consensus on how to best meet future demand. The participation process required much coordination, technical expertise, and feedback, along with airport sponsor participation. The culmination of this process is a workable, usable, and focused plan that can be executed realistically, providing for the future needs of the Ralph M. Hall Municipal Airport.


LEGEND
Phase I
Phase II
Phase III
NOT DEPICTED ON PLAN
A3 - Remove existing hangars and structures on east side of airport
A10 - Install LED MIRL on Reconstructed Runway and Upgrade Electrical Vault, Rotating Beacon, and Lighted Windsock and Segmented Circle
B1 - Install PAPI-4 and REIL's to serve each Runway End
B6 - Install medium intensity taxiway lights (MITL) along full length of parallel taxiway
RUNWAY 17-35 • 3,373'x45' (E) - 3,373'x60' (U)
SCALE: 1"=300'
0'
300'
600'
NORTH
A1
A2
A2
A12
A13
A4
A4
A5
A6
A7
A7
A8
A9/A10
A11
A14
A15
A16
B2
B3
B7
C1
C1
C1
C2
C2
C3
C4
17
35

CHAPTER ONE: INVENTORY OF EXISTING CONDITIONS

INTRODUCTION

The City of Rockwall and Rockwall County are located on the blackland prairies of north central Texas and named for a unique below ground archaeological rock formation that crosses the county. Bounded on the west by Lake Ray Hubbard, Rockwall has become a desirable suburb for residents and businesses within the fastest growing areas of the Dallas Fort Worth (DFW) Metroplex and State of Texas.

Ralph M. Hall Municipal Airport is owned and operated by the City of Rockwall. The airport name honors Congressman Ralph M. Hall who has served the 4th Congressional District of Texas since 1980. Congressman Hall was born and raised in Rockwall County. Shortly after completing law school at the University of Texas at Austin his service to the region began as the Rockwall County Judge between 1950 and 1962. From 1962 to 1972 he served in the Texas Senate representing the citizens of Rockwall and Rockwall County.

The City is ultimately responsible for operating the Airport, weighing policy considerations, and complying with all pertinent federal, state, and local regulations. The City has contracted with the airport's FBO (Rockwall Aviation) to oversee the day-to-day operation and maintenance of the airport. The airport plays an important role in the local and regional airport and airspace system, and it is an integral component of the transportation network that serves the City of Rockwall and the eastern portion of the DFW Metroplex.

Previous airport planning for Rockwall's airport was completed in 2001 as part of the discovery process to potentially relocate the airport. During the intervening years, changes have transpired within the aviation industry on local, state, and national levels that impact general aviation (GA) airports. These changes necessitate a reevaluation of the airport's needs and facilities. This document focuses on the overall planning goal to evaluate current facilities, forecast future demand, and plan for development that meets standards and demands within the constrained environs surrounding Ralph M. Hall Municipal Airport.

STRENGTHS, WEAKNESSES, OPPORTUNITIES, THREATS (SWOT) ANALYSIS

During the initial kickoff meeting with the City and airport committee, a roundtable discussion was held to define and evaluate the airport's potential to achieve goals and objectives set forth by the sponsor. Based on the roundtable discussion, a wide variety of airport and community strengths, weaknesses, opportunities, and threats were mentioned and discussed. The SWOT for the airport was considered throughout the planning process and was utilized to help provide a revised vision/mission statement and cohesive development direction for the airport during the next 5-10 year period. **Figure 1-1** on the following page illustrates the results of the SWOT analysis.

While both the City and Rockwall Economic Development Corporation (REDC) understand how important the airport is within the community, they also recognize the current location's development challenges. Due to the surrounding terrain and overhead electric transmission lines on the north, existing road and rail line to the south, and limited availability of property for expansion, the airport is constrained in its capabilities to provide more of the services expected within a growing community and business-friendly environment. This issue has been acknowledged, and all personnel are working to ensure the airport is integrated into all future goals, objectives, and plans set forth by the entities that promote the City and the REDC. Personnel from the City and REDC collaborated to rewrite the mission statement for the airport based on the outcome and findings of the SWOT analysis. The new airport mission statement is "To provide resident pilots and aircraft owners a safe recreational facility while offering regional corporations and growing businesses a local transportation base with national reach and accessibility to Rockwall's thriving economy." This new mission statement identifies and emphasizes the overarching direction for the future of the Ralph M. Hall Municipal Airport.

FIGURE 1-1
SWOT ANALYSIS MATRIX
RALPH M. HALL MUNICIPAL AIRPORT

SWOT Analysis

Strengths (+ Internal)
- DFW Metro Location
- Outside DFW Class B Airspace
- Auto access - new roads and connection to I-30
- Cross-section of existing based aircraft
- Common mission of stakeholders
- Vacant land and vacant publicly owned land in the airport vicinity

Weaknesses (- Internal)
- Deficiency in meeting FAA/TxDOT design standards
- Lack of necessary airport infrastructure
- Ability to provide common ammenties needed
- Insufficient runway to support business-category aircraft
- Physical contraints to airport expansion

Opportunities (+ External)
- Business growth and economic development in the City
- City's and County's growing diversity
- Terminal redevelopment offering a clean slate approach
- Potential for public - private partnerships
- Current Economic Development Success

Threats (- External)
- Public preception of airport
- Lack of positve airport information on local webpages
- Potential for residential development based on zoning near the airport
- Public safety issue s

Because local airports are such an important aspect of a City and are often the “front door” to a community, promoting and marketing such an important asset is key to attracting businesses and keeping local citizens engaged and abreast of the airport’s importance in the community. Having positive, accurate airport information and data on the primary websites for the City, Chamber of Commerce, and REDC is vital in building local citizen support for effective transportation infrastructure improvements that pay dividends long into the future.

FACILITY INVENTORY PROCESS

As the initial step in the airport planning program, the inventory is a systematic data-collection process that provides an understanding of past and present aviation factors associated with Ralph M. Hall Municipal Airport. A comprehensive inventory, including the following major inventory tasks, is used to form the basis for airport recommendations throughout the Airport Development Plan.

- An on-site inspection (conducted in June 2012) and inventory of airport facilities, equipment, and services to assess existing physical conditions.
- Discussions with City officials, the REDC board members, Fixed Base Operator (FBO), and airport tenants regarding recent airport trends, operations, and services.
- The collection of airport activity data, project records, and aeronautical background information; a review of historical airport information, previous airport layout plans, maps, charts, and photographs of airport facilities.
- The collection of regional, county, City and airport development information to understand regional economic conditions and to determine the surrounding airport service area characteristics.
- Review of current and planned on and off-airport land use development and property information, including surrounding land use patterns, existing and proposed transportation developments, infrastructure, and utilities.
- The collection of regional climatic information, including predominant winds, cloud and visibility conditions, and precipitation levels.

AIRPORT CHARACTERISTICS

AIRPORT LOCATION AND ACCESS

Ralph M. Hall Municipal Airport is two miles east of Downtown Rockwall, approximately two miles from the REDC Technology Park, and 23 miles east of downtown Dallas. It is classified as a general aviation (GA) airport within the Federal Aviation Administration's (FAA) *National Plan of Integrated Airport Systems* (NPIAS), a community service airport within the *Texas Airport System Plan*, and a local airport within the newly published FAA document *General Aviation Airports: A National Asset*. The airport contains approximately 50 acres, experiences an estimated 15,000 annual operations, and bases 72 GA aircraft ranging from small single-engine aircraft to a Citation Mustang, a small business jet.

Direct access to the airport is provided by Airport Road on the south and is bordered by State Highway 66 on the north and the newly constructed John King Boulevard with an Interstate

30 interchange just 1.5 miles south of the airport. The published airport elevation is 574 feet above mean sea level (MSL), with airfield coordinates of 32˚ 55' 50.140" N and 96˚ 26' 07.748" W. The current magnetic declination at the airport is 3˚ 39" E (NOAA National Geophysical Data Center, 06/12) with an estimated variation change of 0˚ 7' W per year.

AIRPORT PROJECT HISTORY

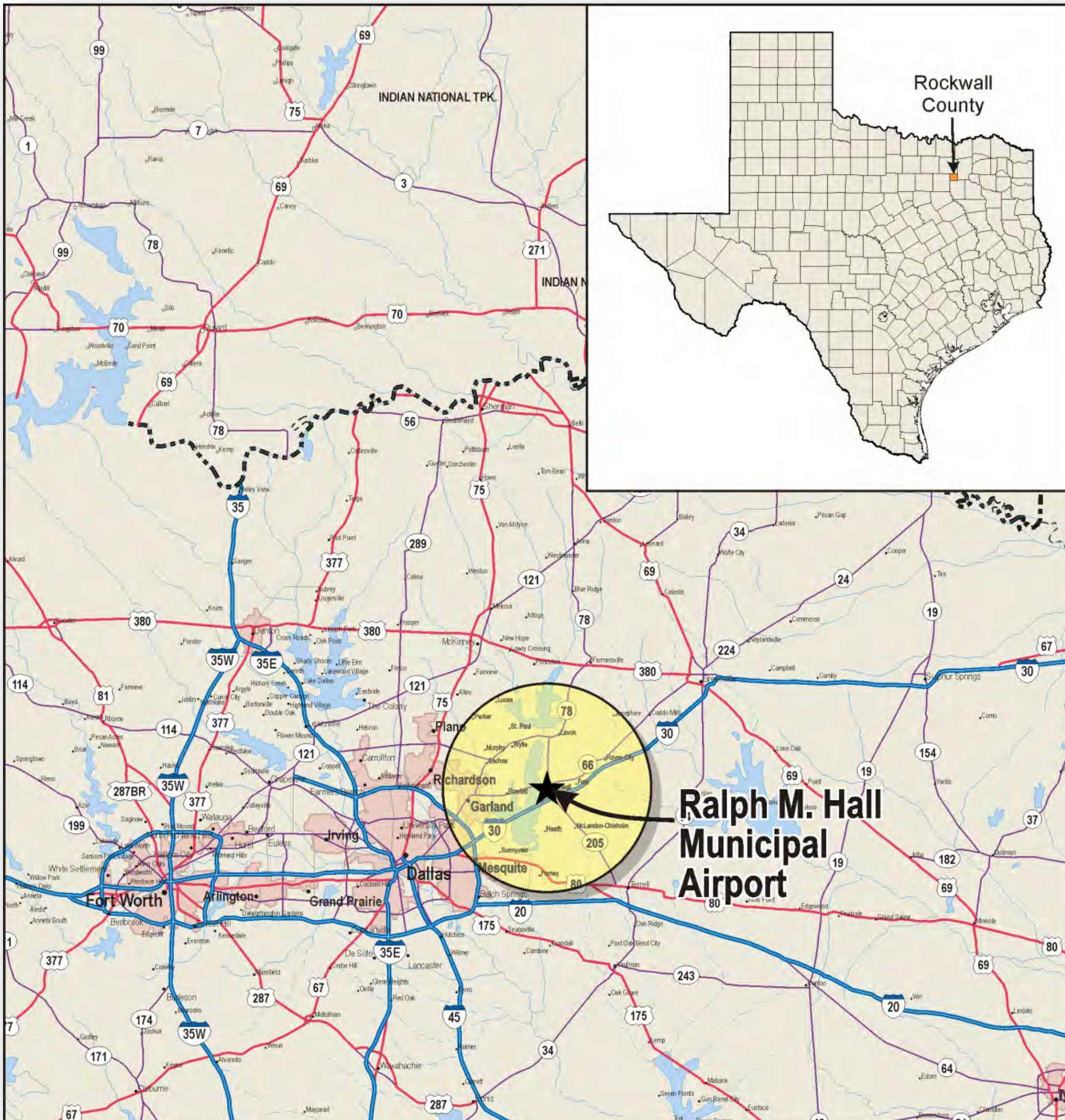
Table 1-1, *Historical Airport Project Funding,* shows the airport's development history that involved funding assistance from federal or state sources. According to records, since 1970, the airport has received $366,863 from the FAA and $241,926 from the Texas Department of Transportation, Aviation Division (TxDOT) for various improvements. The airport sponsor's share of grant match for major projects from either FAA or TxDOT funding is 10 percent. Based on this, the local investment in capital improvements at the airport since 1970 is approximately $160,173.

TABLE 1-1
HISTORIC AIRPORT PROJECT FUNDING
RALPH M. HALL MUNICIPAL AIRPORT

Year	Local Total	State Total	Federal Total	Project Description
1970	$0	$9,600	$0	Purchase land; resurface runway
1974	$0	$25,000	$0	Construct hangar and taxiway
1978	$0	$0	$44,645	Complete Airport Master Plan
1997	$2,448	$22,028	$0	Prepare needs assessment (feasibility study)
1999	$2,500	$0	$22,500	Site Selection Study
2001	$10,000	$0	$90,000	Environmental Assessment and Airport Master Plan
2006	$22,505	$22,505	$0	RAMP: Herbicide, restripe taxiway, replace maintenance ship roof, paint hangar #1 and terminal building, interior repairs to terminal, purchase insecticide
2007	$23,302	$0	$209,718	Overlay and mark runway 17/35, parallel taxiway, stub taxiway, and rehab apron
2007	$30,031	$30,031	$0	RAMP: Repair and repaint terminal hangar and airport hangars; overlay airport entrance road
2008	$30,775	$30,775	$0	RAMP: Herbicide, painting of various hangars, construct parking area
2009	$4,975	$4,975	$0	RAMP: Replacement of terminal HVAC and associated work
2010	$1,950	$1,950	$0	RAMP: Pavement repairs and maintenance
2012	$31,687	$95,062	$0	AWOS
	$160,173	$241,926	$366,863	

Source: TXDOT, Aviation Division, TADS Database; Federal Total – Federal Aviation Administration; State Total – TXDOT Aviation.

**FIGURE 1-2
AIRPORT VICINITY AND LOCATION MAP
RALPH M. HALL MUNICIPAL AIRPORT**



Source: MileByMile.com

AIRPORT ROLE

The role an airport plays within its community and the local airport system is defined by the facilities and services offered to the general aviation public. GA airports play an extremely important role in supporting economic development and providing opportunities for local businesses to expand. Often, local citizens and the public at large misunderstand an airport's importance to its community and surrounding region.

The City has defined the airport with a vision statement that informs local citizens about the airport's importance and integrates the airport into Rockwall's overall transportation theme: "*Enhance and maintain the Rockwall Municipal Airport so that it continues to be a viable asset to the City and to allow it to achieve its potential economic vitality.*" At the time it was composed, this statement clearly defined the direction the City would employ for the airport.

The FAA defines an airport's role by applying airport design criteria from FAA Advisory Circular (AC) 150/530013A, *Airport Design*. The existing Airport Reference Code (ARC) category for Ralph M. Hall Municipal is B-I. This reference code is consistent with the types of aircraft that operate on the field today and will be reexamined based on the 20-year forecast of aviation growth for the airport.

The ARC is a coding system to help identify and determine the appropriate design criteria for each airport. This ARC correlates the design and layout of an airport to the operational and physical characteristics of the "critical design aircraft," which directly influences pertinent safety criteria such as runway length, runway width, runway/taxiway separation distances, building setbacks, size of required safety and object free areas, etc. The design aircraft, as defined by the FAA, is the largest type of aircraft expected to operate at an airport on a regular basis, with a minimum of 500 operations (landings or takeoffs) per year; however, TxDOT defines critical aircraft based on a minimum of 250 operations per year.

The ARC has two components. The first component, depicted by a letter (e.g., A, B, C, D, or E), is the aircraft approach category and relates to aircraft approach speed based on operational characteristics. The second component, depicted by a Roman numeral (e.g., I, II, III, IV, V, or VI), is the airplane design group and relates to aircraft wingspan and/or tail height. For example, a Beechcraft King Air 200 with an approach speed of 103 knots and wingspan of 54.5 feet has an ARC of B-II, while a larger corporate jet such as the Gulfstream IV (G-IV) exhibiting an approach speed of 145 knots and wingspan of 77.8 feet would have an ARC of D-II. **Table 1-2**, *Airport Reference Code*, illustrates the components comprising the ARC.

TABLE 1-2
AIRPORT REFERENCE CODE
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Approach Category		
Category	**Speed**	
A	< 91 Knots	
B	91 - < 121 Knots	
C	121 - <141 Knots	
D	141 - < 166 Knots	
E	≥ 166 Knots	
Airplane Design Group [1]		
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

Source: FAA Advisory Circular 150/5300-13A, *Airport Design*.
[1] Where an airplane is in two categories, the most demanding category takes precedence.

As previously stated, TxDOT defines Ralph M. Hall Municipal as a Community Service Airport (CSA). Based on TXDOT's manual of "Policies and Standards, June 2007" and the *2012 Texas Airport System Plan*, the minimum requirements for CSA serving aircraft weighing less than 12,500 pounds are:

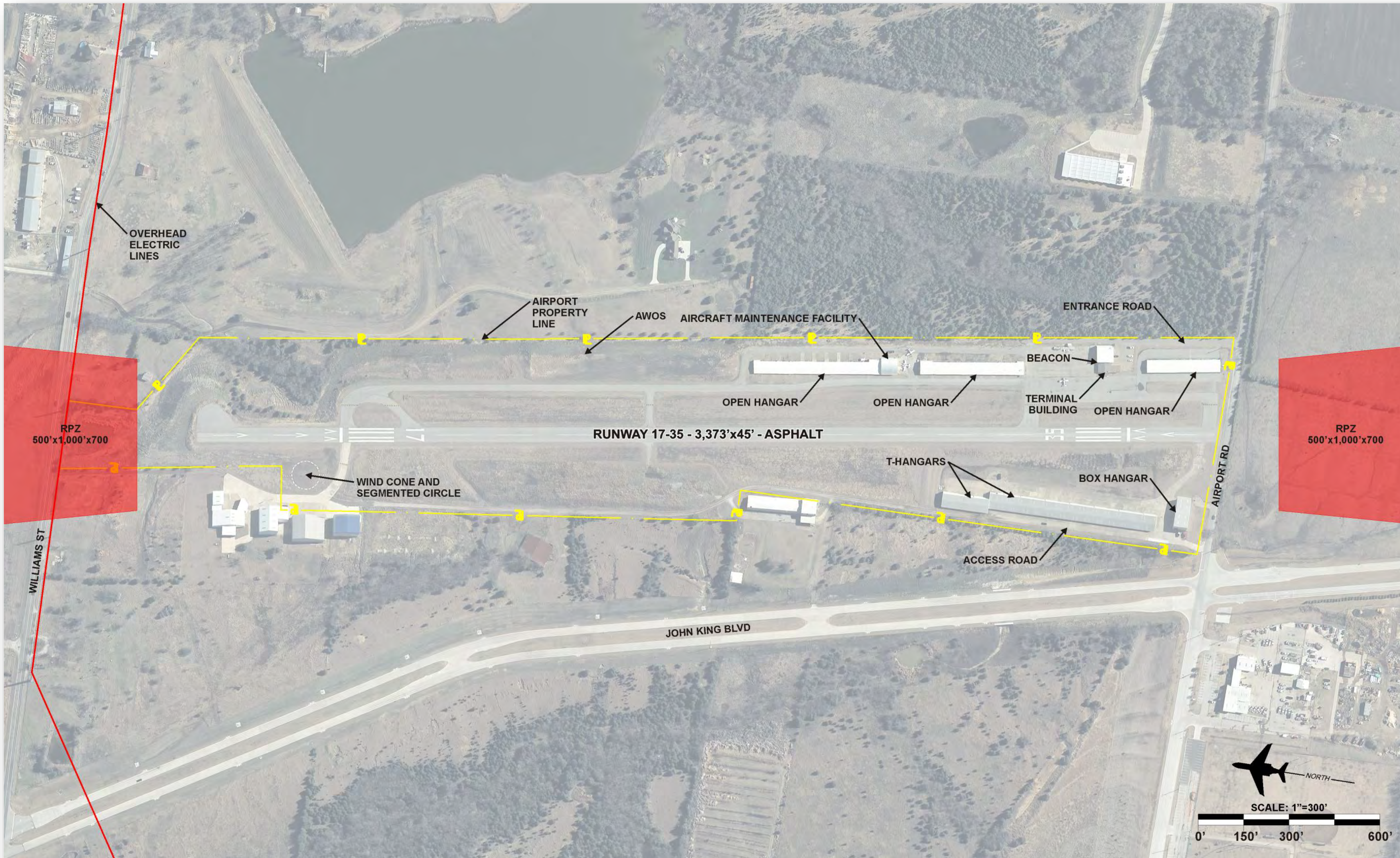
- Applicable Design Standard / Airport Reference Code
  - B-I
- Minimum Runway
  - Length: Designed for 95 percent of small aircraft fleet
  - Width: 60 Feet
  - Pavement Strength: 12,500 pound single-wheel loading
- Minimum Taxiway
  - Stub taxiway to tie-down area and runway end turnarounds

- Minimum Apron
  - Area needed for itinerant and local parking and maneuvering is based on AC 150/5300-13A, *Airport Design* – Appendix 5 – 360 square yards for each itinerant aircraft and 300 square yards for each based aircraft
- Minimum Instrument Approach Type and Visibility Minimums
  - Non-precision, 1-mile
- Minimum Lighting
  - Medium intensity runway lights (MIRL) and MITL taxiway turnout lights
- Minimum Visual Approach Aids
  - Lighted wind indicator, segmented circle, rotating beacon, and PAPI
- Minimum Facilities
  - AWOS, fuel, and terminal building

AIRFIELD FACILITIES INVENTORY

As shown in **Figure 1-3**, *Existing Airport Layout*, Ralph M. Hall Municipal Airport operates as a single-runway system with supporting taxiways that provide access to the terminal area and other airfield structures.

FIGURE 1-3
EXISTING AIRPORT LAYOUT
RALPH M. HALL MUNICIPAL AIRPORT



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AIRSIDE FACILITIES

RUNWAYS

Runway 17/35 is 3,373 feet long and 45 feet wide. The Runway 17 threshold is displaced 470 feet, and the Runway 35 threshold is displaced 289 feet. All piston-type and small turbine aircraft utilize this runway, which is constructed of asphalt and is in fair condition. According to the FAA *5010 Airport Master Record, 2012*, the main landing gear gross weight bearing capacity for the runway is published at 12,000 pounds for single-wheel gear type aircraft. The runway is equipped with a Low Intensity Runway Light (LIRL) system and marked with non-precision runway markings. To meet design standards for current conditions, the runway should be widened to 60 feet, and the LIRL should be upgraded to MIRLs. There is a line-of-sight situation and threshold displacements that should be addressed to meet standards for grading and safety area requirements.

TAXIWAYS

Additional airside facilities at the airport include a partial-length parallel taxiway and its four connectors. Each taxiway is approximately 20 feet wide and provides access from the runway to the various landside aircraft use areas. Centerline separation distance from the taxiway to the runway varies from 125 feet on the south end to 177 feet at midfield to 152 feet on the north end. This parallel taxiway does not have any lighting or centerline reflectors. Current taxiway widths and separation distances do not meet design standards. The runway-to-taxiway separation distance should be 225 feet, and taxiway width should be a minimum of 25 feet. Taxiway lighting at connectors and centerline reflectors are minimum upgrade recommendations.

APRONS

The airport has one parking apron for based and itinerant aircraft that provides approximately 25,200 square feet (2,800 square yards) of parking and maneuvering space. This asphalt apron is located on the southeast portion of the airfield, adjacent to the GA terminal building and FBO hangar. The apron is in fair condition and is not marked with designated tie-down spaces or taxilanes. With 72 based aircraft, the apron should be a minimum of 21,600 square yards with additional space for itinerant aircraft parking and maneuvering. Future needs will be examined in the Facility Requirements Chapter.

LANDSIDE FACILITIES

Landside facilities consist of items like the terminal building, aircraft storage, auto access, aircraft fueling facilities, and many other items described below.

GENERAL AVIATION TERMINAL

The airport's GA terminal, located on the southeast corner of the airfield, consists of approximately 1,200 square feet of space. The terminal provides a lounge area, restrooms, office area, and flight planning space. This facility is well maintained and offers adequate auto parking.

GENERAL AVIATION HANGARS

There are eight hangars of various types and sizes located within airport property, and there are five hangars that have Through-the-Fence (TTF) access to operate and use the airfield. The TTF hangars do not have an access fee to use the airfield; however, regulations stipulate that any newly constructed hangars will not be grandfathered in and will be required to pay an access fee to utilize the airfield

Three of the hangars on the east-side of airport property are open/shade type, accommodating up to 36 aircraft, while the enclosed hangars can accommodate as many as 29 more aircraft. There are six aircraft stored within the TTF hangars. All hangars appear to be in fair to good condition and are along both the east and west sides of the runway. All enclosed hangars are fully occupied while there are some of the open/shade hangars that are unoccupied. There are approximately ten individuals on a waiting list who desire enclosed hangar storage for their aircraft at Ralph M. Hall Municipal.

FIXED BASED OPERATOR (FBO)

The FBO on the field is Rockwall Aviation. Rockwall Aviation provides various services for both based and itinerant aircraft, which range from fueling (100LL and Jet A) to aircraft maintenance and bottled oxygen. Offices for Rockwall Aviation are located in the GA terminal building.

FUEL FACILITY

The aviation fuel storage at the airport includes one 12,000 gallon in-ground AVGAS storage tank, one (1) 600 gallon AVGAS mobile dispenser, and one 2,200 gallon Jet-A mobile dispenser. The City owns the in-ground tank and mobile AVGAS truck, while the FBO owns the Jet-A mobile unit and the fuel. The City receives a fuel flowage fee (three percent of gross) from the FBO for use of the city-owned tanks and operation of the fueling system.

The following table, **Table 1-3**, *Airport Fuel Sales, 2007 – 2012*, provides a summary of fuel sales conducted at the airport since 2007. Sales have fluctuated over the years from a high of 55,667 gallons in 2010 to a low of 33,961 gallons in 2009, with the five-year average equating to 33,788 gallons. Based on conversations with the FBO, Jet-A sales account for approximately 5,000 gallons per year.

TABLE 1-3
AIRPORT FUEL SALES, 2007 – 2012
RALPH M. HALL MUNICIPAL AIRPORT

Year	AVGAS (gallons)	Jet A (gallons)	Total (gallons)
2007[1]	12,762	1,700	14,462
2008	35,174	5,000	40,174
2009	28,961	5,000	33,961
2010	50,667	5,000	55,667
2011	36,005	5,000	41,005
2012[2]	36,245	5,000	41,245

Source: City of Rockwall
[1] 2007 includes only last four months of fuel sales. Full year not available.
[2] 2012 includes only fuel sales through October. Full year not available.

SEGMENTED CIRCLE AND BEACON

The wind cone and segmented circle, which conveys wind direction and traffic patterns, is located in the northwest portion of the airport, just east of the TTF hangars. The traffic patter indicator restricts aircraft from circling to the west of the airport. There is not an obvious reason to restrict the traffic pattern to the airport's east side and use of a standard left-hand traffic pattern should be considered.

The airport beacon, a tower with alternating green and white lights indicating an airports location, is found on the east side of the airport, atop the hangar behind the terminal building.

AIRFIELD AND TERMINAL AREA SECURITY

Ralph M. Hall Municipal Airport is typical of many general aviation airports in a rural or semi-rural setting. These airports have primarily served the local community with most of the based aircraft as small single-engine piston aircraft and security was not typically a concern. However since 9/11, when aviation was used in the terrorist attacks, there is greater awareness that aviation can be used in criminal activity. The general public now expects their local airport to take reasonable steps to discourage criminal activity. For the airport user, the improvements to access control will also provide a safer operating environment for aircraft by restricting unauthorized vehicles.

Controlling access at GA airports is a significant challenge because few are attended full-time. Additionally, the broad array of operations and activities at GA airports present their own unique challenges. Many aircraft owners have taken appropriate steps to lock their leased hangars and keep their aircraft locked with keys located away from their aircraft. At Ralph M. Hall Municipal, most of the exterior is not secured with any sort of fencing or controlled access gates. The only exception is the TTF area where the hangar owners have installed fencing and an automated gate to prohibit vehicle access.

Considering the current aircraft using the airport, and increased activity by more complex aircraft, these reasonable access control measures include a perimeter fence with vehicle access to some hangars and secured access gates in key locations. The terminal building and most large hangars should be accessible by vehicles for customers and deliveries. The access gates can be configured to limit access to existing tenants and access can be gained through buildings for other airport users. If there is a need to control wildlife, the airport should consider an increased fence height sufficient to restrict the species of greatest concern.

Security can be further enhanced by installing surveillance cameras which may be monitored or recorded. This is a recent trend at GA airports which can be achieved at minimal cost. The most common camera placements include the terminal building, access control gates, and fuel farm. These cameras can be placed at any location on the airport. Under the TxDOT Routine Airport Maintenance Program (RAMP), surveillance cameras are eligible for grant.

Many airports similar to Ralph M. Hall Municipal know their regular users: the local pilots, aircraft owners, and businesses. Most GA airports have implemented some form of the Aircraft Owners and Pilots Association's "*Airport Watch*" Program. This program has produced a heightened awareness by local pilots and aircraft owners, empowering them with confidence to report oddities at their respective airports. Continued emphasis on this type of surveillance and monitoring is highly recommended. Periodic tenant meetings will foster their knowledge of one another and promote a higher degree of security and safety.

The Phased Development Plan chapter includes information on providing future fencing, access gates, and camera surveillance at the airport.

ENVIRONMENTAL OVERVIEW

An analysis and inventory of the environment on and surrounding an airport identifies resources that may need to be addressed prior to implementation of any future proposed airport planning recommendations. This process provides notification to the airport sponsor that some coordination and correspondence with various state and federal agencies may be required before any construction takes place.

SOILS

Rockwall County is in the north-central part of Texas within the Blackland Prairies ecological-region. It has a total area of 82,560 acres, or about 129 square miles, with approximately 73,000 acres attributed to land area and 9,500 acres attributed to water area. The area is dissected by many small streams within the Trinity River Watershed. Approximately 11 percent of the soils in the county, meet the requirement for prime farmland classification, which is soil classified by the US Department of Agriculture that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The soil around the airport is classified as Houston Black-Heiden, which is characterized by moderately well drained and well drained, very slowly permeable, calcareous soils that are clayey throughout. It doesn't appear the airport and its potential for development would impose a burden on designated prime farmland; however, coordination with the United States Department of Agriculture National Resource Conservation Service (NRCS) is encouraged to verify such is the case when additional development does occur at the airport.

HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

The *National Historic Preservation Act of 1966* requires that an initial review be made to determine if any properties in or eligible for inclusion in the National Register of Historic Places are within the area of a proposed action's potential environmental impact. The *Archaeological and Historic Preservation Act of 1974* provides for the survey, recovery, and preservation of significant scientific, pre-historic, historical, archaeological, or paleontological data when such data may be destroyed or irreparably lost due to a federal, federally funded, or federally licensed project. There does not appear to be any structures on the airfield that would be considered historic or included in the National Register; however, coordination and a thorough investigation with the Texas Historic Commission should be conducted through both the state and federal cultural resources offices before any new construction or recommendations occur on the airfield.

FISH, WILDLIFE, AND PLANTS

The *Endangered Species Act* requires each federal agency to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species. As provided by the Texas Parks and Wildlife Department, several species are listed for Rockwall County. As defined by the U.S. Fish and Wildlife, Endangered Species is any species of wildlife whose continued existence as a viable component of the state's wild fauna is determined to be in jeopardy, and a Threatened Species is any species of wildlife that appears likely, within the foreseeable future, to become an endangered species. **Table**

1-4, *Rockwall County Threatened and Endangered Species,* on the following page lists the threatened and endangered species for Rockwall County on both a federal and state status.

It is uncertain if these species reside near or on airport property; therefore coordination with both the U.S. Fish and Wildlife Service and Texas Parks and Wildlife will be required before any future construction is commenced.

TABLE 1-4
ROCKWALL COUNTY THREATENED AND ENDANGERED SPECIES
RALPH M. HALL MUNICIPAL AIRPORT

Common Name	Genus/Species	Federal Status	State Status
Reptiles			
Alligator snapping turtle	Macrochelys temminckii		T
Texas horned lizard	Phrynosoma cornutum		T
Timber/Canebrake rattlesnake	Crotalus horridus		T
Birds			
American Peregrine Falcon	Falco peregrines anatum	DL	T
Arctic Peregrine Falcon	Falco peregrines tundrius	DL	
Bald Eagle	Haliaeetus leucocephalus	DL	T
Peregrine Falcon	Falco peregrines	DL	T
Piping Plover	Charadrius melodus	LT	T
Sprague's Pipit	Anthus spragueii	C	
White-faced Ibis	Plegadis chihi		T
Whooping Crane	Grus americana	LE	E
Wood Stork	Mycteria Americana		T
Mammals			
Red Wolf	Canis rufus	LE	E
Mollusks			
Louisiana pigtoe	Pleurobema riddellii		T
Sandbank pocketbook	Lampsilis satura		T
Texas heelsplitter	Potamilus amphichaenus		T

Source: Texas Parks and Wildlife Department Online Database
T = State Listed Threatened
C = Federal Candidate for Listing
E = State Listed Endangered.
DL/PDL = Federally Delisted/Proposed for De-listing
LE/LT = Federally Listed Endangered/Threatened
NL = Not Federally listed
SA = Threatened by Similarity of Appearance
Blank = Rare, but with no regulatory listing status

AIRSPACE SYSTEM AND AIDS TO NAVIGATION (NAVAIDS)

All flights conducted within the national airspace system, whether under Visual Flight Rules (VFR) or Instrument Flight Rules (IFR), do so based on regulations mandated by the FAA. Based on these rules, each airport—whether private or public—has a specific role that it plays as part of this system.

AIR TRAFFIC SERVICE AREAS AND AVIATION COMMUNICATIONS

FAA air traffic controllers, stationed at *En-Route Control Centers or Air Route Traffic Control Centers* (ARTCC), provide for the safe movement of aircraft operating primarily under IFR conditions within a defined geographic jurisdiction. There are currently 20 geographic ARTCC's established within the continental United States, each one responsible for a specific geographic region or boundary delineation. Ralph M. Hall Municipal Airport is located within the Fort Worth ARTCC, which controls airspace in portions of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS)
AUTOMATED WEATHER OBSERVATION SYSTEM (AWOS)

An ASOS/AWOS provides weather observations that include air and dew point temperature, wind, air pressure, visibility, sky conditions, and precipitation. This data is captured minute-by-minute, 24 hours a day, to help pilots and flight dispatchers prepare and monitor weather forecasts, plan flight routes, and provide necessary information for takeoffs and landings. This information is received and transmitted via discrete VHF radio frequencies through the voice portion of a local NAVAID or local telephone line. The AWOS also disseminates current weather hourly observations into a national weather service database made available preflight planning and weather reports. In May 2012, the airport had a new AWOS installed southeast of the Runway 17 end and to the north of the existing east-side hangars. Alternate weather observations in the area include: Mesquite Metro, Terrell Municipal, or Collin County Regional.

AIRSPACE

As seen in **Figure 1-4**, *Airspace/NAVAIDs Summary*, the local airspace immediately surrounding Ralph M. Hall Municipal Airport is designated as Class E airspace. Class E airspace generally exists in the absence of Class A, B, C, and D airspace extending upward from either 700 feet or 1,200 feet above the surface to 18,000 feet MSL within 5 miles of airports without control towers and is intended to provide a transition area for instrument approaches. VFR traffic is allowable without radio communications; however, IFR flights and aircraft must be capable of communicating with Air Traffic Control (ATC) and be equipped with Mode C altitude reporting transponders. Currently, the Class E airspace associated with the airport, which is just outside the 30-nautical mile DFW Class B controlled airspace area, has a floor established 700 feet above the surface of the field.

NAVIGATIONAL AID (NAVAID)

Airport NAVAIDs, located on the field or at other locations in the region, are specialized equipment that provides pilots with electronic guidance and visual references to execute instrument approaches and landings and point-to-point navigation. The NAVAIDs available for use by pilots in the vicinity of the airport are a Non-Directional Beacon (NDB), Very High Frequency (VHF) Omnidirectional Range/Distance Measuring Equipment (VOR/DME), and a Very High Frequency Omnidirectional Range/Tactical Air Navigation (VORTAC). An NDB is a general-purpose low- or medium-frequency radio beacon that allows a properly equipped aircraft to “home” in on or determine its bearing relative to the sender. A VOR/DME is a system of VHF Omnidirectional Range Radio Beacons that emit signals to aid navigation instruments in aircraft to determine the location of the VOR station from the aircraft with respect to magnetic north. The co-located distance-measuring equipment (DME) is used to measure the slant range distance of an aircraft from the navigational aid in nautical miles. A VORTAC is essentially the same thing as a VOR/DME but is co-located with a military Tactical Air Navigation system that is available for civil use. Due to the high costs of maintaining most of this navigation equipment, as well as the advances, accuracy, and less costly GPS navigation capabilities, under direction of the NEXT GEN initiative, the FAA has developed a program to decommission this equipment once it reaches the end of its useful life and transition to GPS capabilities full time.

The NAVAIDs associated with Ralph M. Hall Municipal Airport depicted in **Figure 1-4** and described in **Table 1-5** include four VOR’s and eight NDB’s.

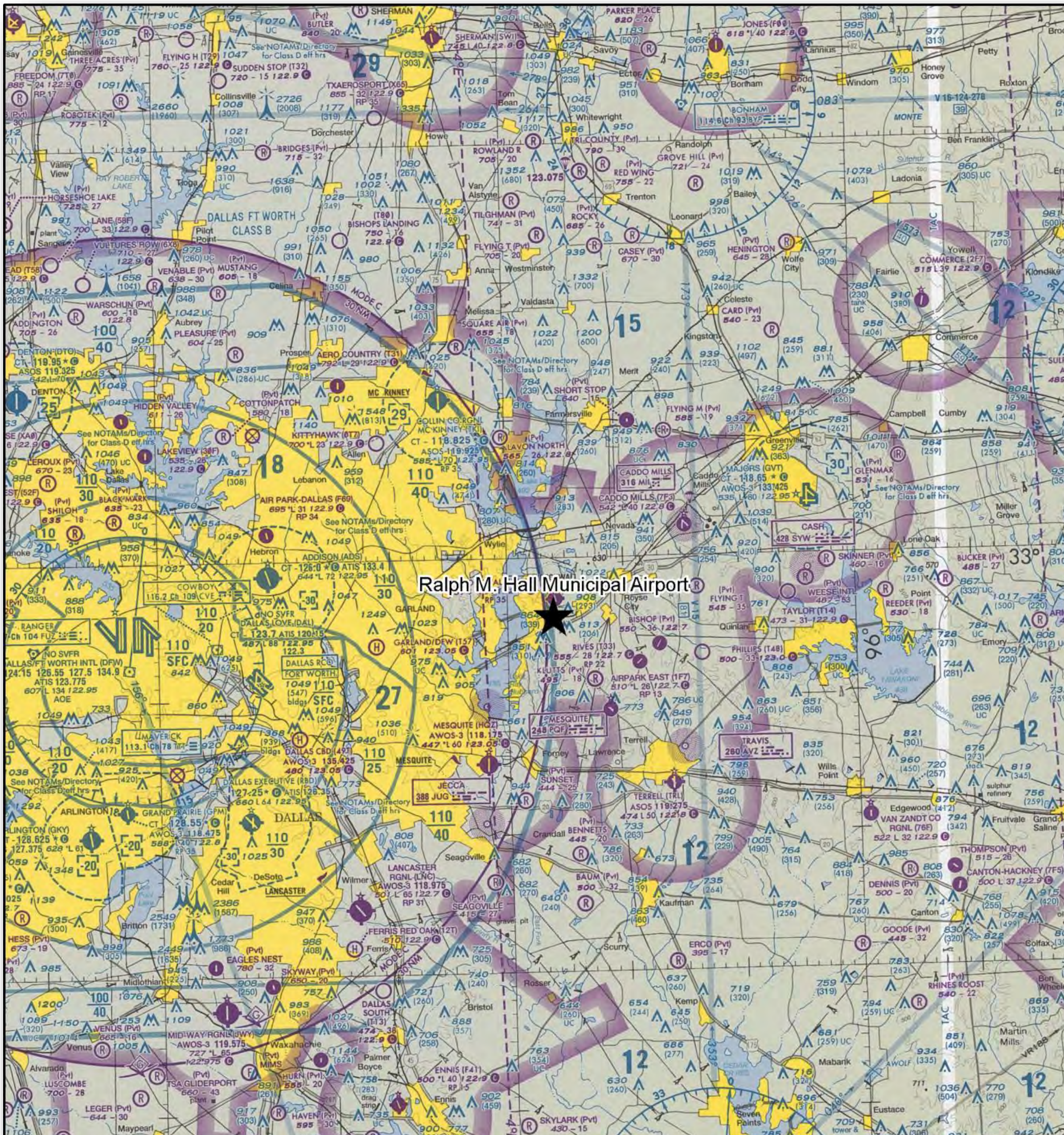
TABLE 1-5
NAVIADS
RALPH M. HALL MUNICIPAL AIRPORT

Name	Frequency	Distance From (Nautical Miles)
NDB		
Mesquite (PQF)	248	8.7, SSW
Caddo Mills (MII)	316	11.5, NE
Travis (AVZ)	260	13.9, SSE
Jecca (JUG)	388	16.5, SSW
Cash (SYW)	428	18.8, East
Lancaster (LNC)	239	25.6, SSW
VOR/DME		
Cowboy (CVE)	116.20	23.7, West
Maverick (TTT)	113.10	30.7, West
VORTAC		
Ranger (FUZ)	115.70	37.6, West
Bonham (BYP)	114.60	37.8, NNE

Source: AirNav: F46 – Ralph M. Hall Municipal Airport, May 2012
Dallas Sectional Map, May 2012
Cedar Creek NDB has been recently decommissioned.

Currently, there are three published straight-in or circling instrument approach procedures at the Ralph M. Hall Municipal Airport, and details for these approaches are located in **Table 1-6**, *Instrument Approach Procedures*, on page 1.23.

FIGURE 1-4
AIRSPACE/NAVAIDS SUMMARY
RALPH M. HALL MUNICIPAL AIRPORT



Source: Dallas Sectional (May 2012)

TABLE 1-6
INSTRUMENT APPROACH PROCEDURES
RALPH M. HALL MUNICIPAL AIRPORT

Runway End	Approach Type	Visibility Minimums	Ceiling Minimum
Runway17	RNAV (GPS) – LNAV DA Straight-In	Category A & B – 1 Mile Category C – 1 ½ Miles Category D – NA	1,140' MSL/566' AGL 1,140' MSL/566' AGL N/A
Runway 35	RNAV (GPS) – LNAV DA Straight-In	Category A & B – 1 Mile Category C – 1 ¾ Miles Category D – NA	1,200' MSL/626' AGL 1,200' MSL/626' AGL N/A
Runway 17/35	NDB-A – Circling [1]	Category A – 1 Mile Category B – 1 ¼ Miles Category C – 2 ½ Miles Category D – NA	1,400' MSL/826' AGL 1,400' MSL/826' AGL 1,400' MSL/826' AGL N/A

Source: U.S. Digital Terminal Procedures Publications, 31 May 2012
Category equates to Aircraft Approach Category
[1] Mesquite NDB

AIRPORT SERVICE AREA

The airport service area is a geographic region served by a select airport. A determination can be made regarding the service area covered by the Ralph M. Hall Municipal Airport by locating competing airports and their relative distance to population centers, assessing the role of surrounding airports, and evaluating their facilities, equipment, and services, as well as programmed expansion projects.

Surrounding airports have varying degrees of influence on the airport service area with respect to competing services (flight training, charters, fuel, maintenance, courtesy car, security, etc.), facilities and equipment, NAVAIDs, and accessibility. It should be noted, however, that the demand for aviation facilities does not necessarily conform to political or geographical boundaries.

The service area for the Ralph M. Hall Municipal Airport was determined by applying the following service-area models:

- **NPIAS Service Area:** This service area is defined by application of FAA Order 5090.B, Field Formulation of the National Plan of Integrated Airport Systems (NPIAS). The NPIAS Service Area is defined by an area encompassed by 30-minute (25-mile) ground access to the originating airport. Several public-use airports and privately owned facilities fall within this 25-mile area, which excludes the NPIAS criteria from realistically defining the entire service-area boundary.

- **Composite Service Area:** This service area takes into consideration the role and service level of each civilian public-use airport in the immediate area that provides service to the GA community, other population centers, and ground access distance and travel times between surrounding public-use GA airports. The composite service area is then defined by the consultant through an interpolation of these parameters as they relate to each other.

Table 1-7, *Area Public-Use Airport Facilities*, lists information regarding the facilities and services offered at the nearest public-use GA airports to the Ralph M. Hall Municipal Airport. Understanding the capabilities and influence of the surrounding airports provides insight into existing and future aviation demand and the airport role and service area.

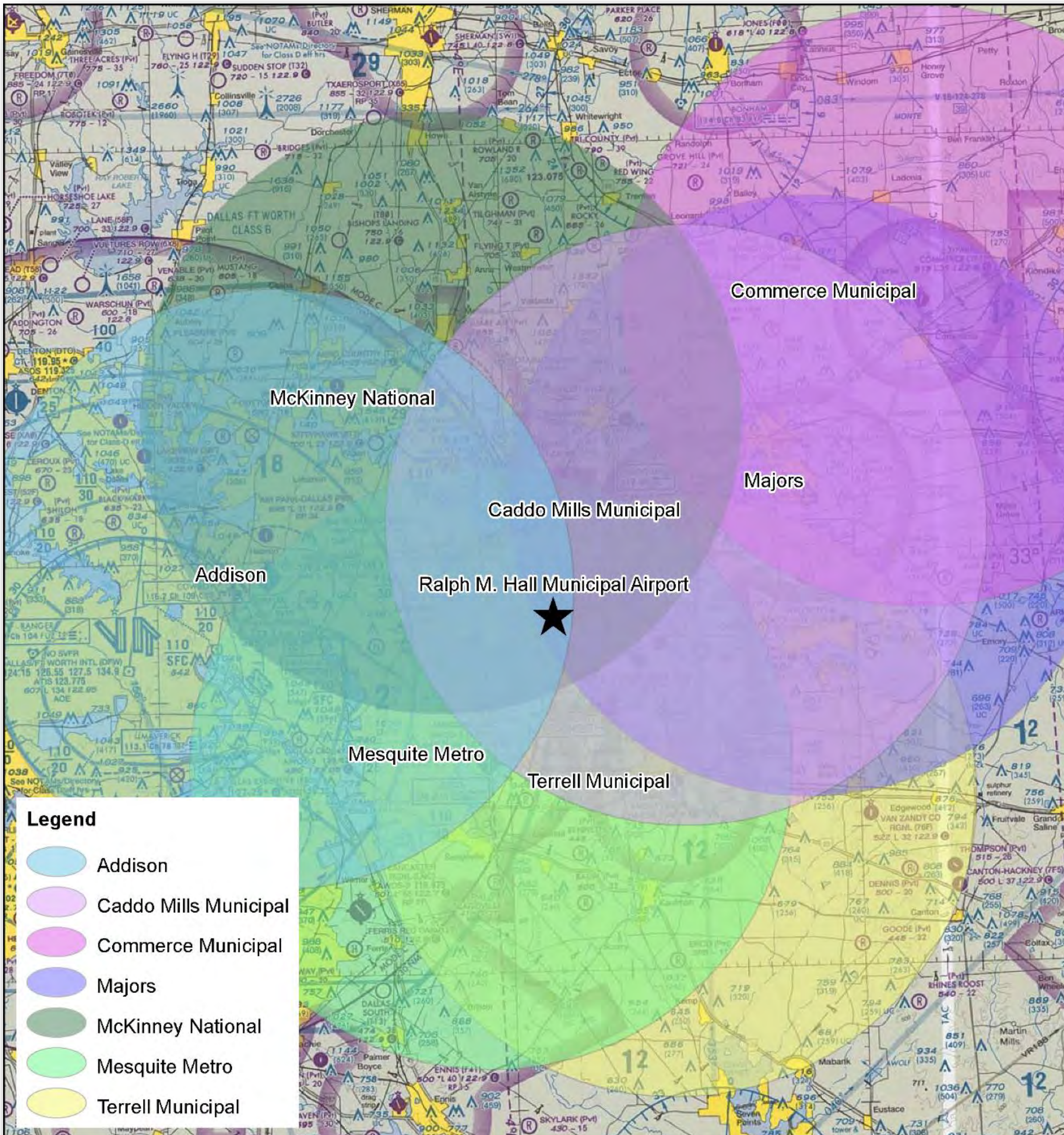
Figure 1-5, *Airport NPIAS Service Area*, and **Figure 1-7**, *Composite Service Area*, illustrates the NPIAS and Composite Service Areas for the Ralph M. Hall Municipal Airport. The Composite Service Area includes all of the Rockwall County Area as well as much of the surrounding region.

TABLE 1-7
AREA PUBLIC-USE AIRPORT FACILITIES
RALPH M. HALL MUNICIPAL AIRPORT

Airport	Distance from Ralph M. Hall Municipal(NM)	Runway Characteristics	Aircraft/ Operations	Airport Services
Ralph M. Hall Municipal (F46)	---	17/35 – 45' x 3,373'	72 Based A/C 15,000 ops/yr	Fuel, terminal, courtesy car, aircraft parking, hangars, flight training, maintenance
Caddo Mills Municipal (7F3)	11.6 NE	17/35 – 75' x 4,000' 13/31 – 150' x 4,000'	13 Based A/C 13,000 ops/yr	Fuel, hangars
Mesquite Metro (HQZ)	12.0 SW	17/35 – 100' x 5,999'	188 Based A/C 100,000 ops/yr	Fuel, terminal, parking, flight training and rentals, hangars, courtesy car. ATCT, catering, rental cars, maintenance
Terrell Municipal (TRL)	15.8 SE	17/35 – 75' x 5,006'	61 Based A/C 25,500 ops/yr	Fuel, terminal, parking, flight training and rentals, aerial tours, hangars, maintenance, courtesy car
McKinney National (TKI)	16.8 NW	17/35 – 100' x 7,001'	205 Based A/C 103,000 ops/yr	Fuel, terminal, parking, flight training and rentals, hangars, courtesy car. ATCT, catering, rental cars, maintenance, full service FBO
Addison (ADS)	20.3 W	15/33 – 100' x 7,202'	603 Based A/C 94,000 ops/yr	Fuel, terminal, parking, flight training and rentals, hangars, courtesy car. ATCT, catering, rental cars, maintenance, oxygen, 3 full service FBO's, GPU
Majors Airport (GVT)	20.4 NE	17/35 – 150' x 8,030'	31 Based A/C 36,000 ops/yr	Fuel, terminal parking and hangars, courtesy car
Commerce Municipal (2F7)	24.7 NE	18/36 – 60' x 3,909'	7 Based A/C 6,000 ops/yr	Fuel, terminal parking and hangars, courtesy car

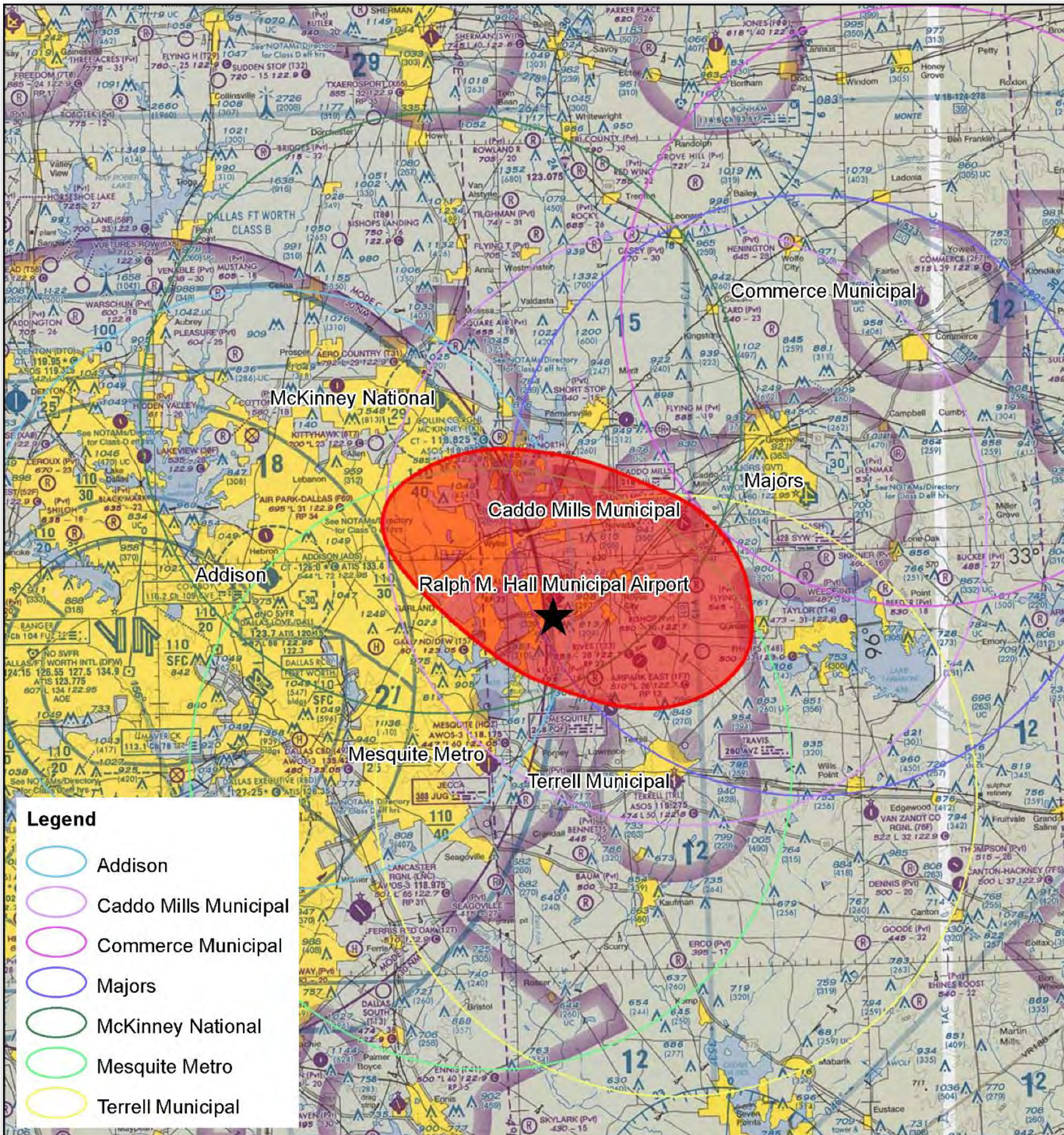
Source: NOAA FAA Dallas Sectional Aeronautical Chart, 2012, FAA 5010 Data Sheets, and airnav.com

FIGURE 1-5
AIRPORT NPIAS SERVICE AREA
RALPH M. HALL MUNICIPAL AIRPORT



Source: Dallas Sectional (May 2012)

FIGURE 1-6
COMPOSITE SERVICE AREA
RALPH M. HALL MUNICIPAL AIRPORT



Source: Dallas Sectional (May 2012)

INTERVIEW/SURVEY RESPONSES

OVERVIEW OF SURVEY FINDINGS

As part of the inventory process, a survey was distributed during the initial Airport Meeting on September 6, 2012 with the Rockwall Economic Development Corporation to a cross section of airport users and based aircraft owners. This airport survey was conducted to help identify airport use patterns, current conditions, and potential long-range improvement needs and priorities. A total of 24 surveys were completed.

The airport users were asked to prioritize the most important airfield and terminal area facilities and airport factors within four categories: very good, good, needs improvement, and poor. A majority of the respondents are pilots who fly their aircraft for personal or corporate business an average of ten times per month. Results of the findings are shown in **Table 1-8**, *Pilot/Aircraft Owners Survey Results*. Based on the scoring method, a higher score expresses that an airside or terminal facility is in good condition or is more highly valued by survey respondents. A majority of the respondent's at the Airport operate aircraft for pleasure/recreation, followed by personal business with a few individuals utilizing the Airport for either flight training or Part 135 Corporate purposes.

Most telling from the results of this survey is 80 percent of the respondents state the existing pilot and passenger services are **not** adequate for accommodating either pilots or visitors at the Airport. Across the board, the respondents gave the Airport low marks for most terminal and airside facilities. Results of the survey can be seen in the following table, **Table 1-8**, *Pilot/Aircraft Owners Survey Results*. The area with the most positive return involved weather reporting, traffic patterns, and communications coverage.

TABLE 1-8
PILOT/AIRCRAFT OWNERS SURVEY RESULTS
RALPH M. HALL MUNICIPAL AIRPORT

Airside Facilities		Terminal Facilities	
Item	**Avg. Rating**	**Item**	**Avg. Rating**
Automated weather reporting	4.2	Aircraft maintenance/repair	2.6
Airport traffic patterns	3.3	Regulations/contracts/leases	2.6
Communications coverage	3.2	Airport line service operations	2.5
NAVAID/radar coverage	2.6	Auto access/parking	2.5
Instrument procedures	2.6	Fuel dispensing/availability	2.4
Airspace/approach obstructions	2.4	Water drainage/flooding	2.0
Airfield Pavement Strength	2.2	Apron tie-down/parking space	1.9
Runway length/Width	2.1	Hangar availability	1.8
Airfield pavement markings/signs	2.0	Terminal building accommodations	1.7
Airport Lighting	1.9	Courtesy/rental car availability	1.4
Runway Edge Lighting System	1.5	Commercial franchise space	1.1
Taxiway system/maneuvering	1.5	Terminal security/fencing/lighting	1.0
Taxiway lighting system	1.3		
Runway visual aids (PAPI/REILS)	1.0		

Source: On-line Pilot Survey. Ratings are averages of all received surveys. Based on scale of 1-4, 4 = very good, 3 = good, 2 = needs improvement, and 1 = poor.

CLIMATIC CHARACTERISTICS

AIRPORT WIND ANAYLYSIS

There are three measures that relate to cloud ceilings and visibilities that are important to airfield capacity limitations and runway orientation. Visual Flight Rules (VFR) conditions occur when the cloud ceiling is at least 1,000 feet AGL and visibility is at least 3 statute miles. Instrument Flight Rule (IFR) conditions occur when the cloud ceiling is at least 500 feet but less than 1,000 feet AGL and/or visibility is at least 1 statute mile but less than 3 statute miles.

Poor Visibility and Ceiling (PVC) conditions exist when the cloud ceiling is less than 500 feet and/or visibility is less than 1 statute mile.

Weather conditions play an important role in influencing how airfield and runway components are developed and utilized. According to FAA design criteria, it is recommended that an airport's primary runway orientation achieve 95 percent wind coverage at various crosswind components. These crosswind components vary from 10.5 knots for the smallest GA aircraft to 20 knots for the largest. In an effort to determine the impacts of crosswinds and wind conditions at the airport, wind data was obtained from the nearest National Oceanic and Atmospheric Administration (NOAA) reporting station providing at least 10 years worth of full-time weather reporting (Collin County Regional Airport, 1998-2008, station #72254, 78,643 observations).

The wind tabulations for both VFR and IFR conditions are shown in the following table, **Table 1-9**, *Wind Coverage Summaries*. The crosswind component is dependent upon the type of aircraft that utilizes the airport on a regular basis. Planning standards state that a crosswind component of 10.5 knots is the maximum for ARC A-I and B-I aircraft, 13 knots is the maximum for ARC A-II and B-II aircraft, 16 knots is the maximum for ARC A-III to D-III aircraft, and 20 knots is the maximum for aircraft exhibiting greater than an ARC of D-III.

TABLE 1-9
WIND COVERAGE SUMMARIES
RALPH M. HALL MUNICIPAL AIRPORT

All Weather Wind Coverage Summary		
Runway	**10.5 Knots**	**13 Knots**
17	81.52%	82.29%
35	64.20%	65.25%
Combined	97.12%	98.52%
IFR Wind Coverage Summary		
Runway	**10.5 Knots**	**13 Knots**
17	71.81%	72.64%
35	75.15%	76.68%
Combined	96.43%	98.14%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center. Station #72254, Collin County Regional Airport, McKinney, Texas. Period of Record 1998-2008. 78,643 observations.

As indicated, the primary runway at the airport achieves the minimum 95 percent crosswind coverage for all crosswind components for both VFR and IFR conditions. Based on this information, and the airport's current runway orientation, there is no evidence or warranting to provide an additional crosswind runway.

AIRPORT ENVIRONS

Land use controls are an important element and tool for both cities and counties to provide a unified systematic approach to guide development and control land uses within their limits or boundaries. An inventory of the existing land uses and zoning patterns surrounding an airport is an important element in the airport planning process. Land use compatibility with airport development can be facilitated with a thorough knowledge of what land uses are proposed and what, if any, changes need to be made.

EXISTING LAND USE

The existing land uses in the general vicinity of the airport primarily include open, undeveloped land. However, one single-family residential area exists east of the central portion of the airport, while commercial activity occurs southwest and northeast of the airport.

EXISTING ZONING

Rockwall County, as with most Texas counties, does not have written zoning ordinances or coinciding zoning maps that identify the most appropriate land use in a designated location; however, the City of Rockwall does have an adopted Zoning Map that was updated in March 2012.

Currently, the Ralph M. Hall Municipal Airport and most of the surrounding adjacent areas are zoned as Agricultural; however, there is a portion of property northwest of the airport that is categorized as Planned Development. Although the airport is zoned agricultural it is also designated with a special use permit category for airport use. Based on the activities that occur at airports, most are typically zoned as some element of Industrial use. Since agricultural use allows residences, it is recommended that in the near future, the City reclassify the existing Agricultural zoning and surrounding areas to a more compatible zone such as Light Industrial. A graphic of the local zoning around the airport can be found in **Figure 1-7**.

Due to the inherent nature of airports, it is imperative that the local oversight agency revise its Height and Hazard Zoning Ordinance to protect the airspace within its vicinity to ensure a safe operating environment for aircraft that are utilizing the airport. Such an ordinance helps to ensure that proposed structures built within a designated zone are at a height that does not conflict with airport airspace and aircraft operations. Developed in accordance with the Texas Airport Zoning Act, and provided by TXDOT, the airport adopted an Airport Height and Hazard Zoning Ordinance on April 19, 1965. Runway 17 / 35 is zoned as a 3,371' x 45' runway with both ends reflecting non-precision criteria. Because this ordinance was developed so long ago, it is recommended, the City adopt an updated Height Hazard and Zoning Map reflective of the current instrument approach procedures and proposed development for the airport.

In addition to the existing zoning for the airport, the City has proposed extra protection for the airport through an Airport Overlay District. According to City documentation, this district shall be in addition to the regulations of a standard zoning district and shall supersede such regulations where conflict exists with these regulations. Its proposed purpose is to provide both airspace protection and land-use compatibility with airport operations at the Ralph M. Hall Municipal Airport. This district, through establishment of airport zones and corresponding regulations, provides for independent review of development proposals in order to promote the public interest in safety, health, and general welfare of the City of Rockwall. Therefore, the City of Rockwall deems it necessary to regulate uses of land located within or near the traffic patterns of the airport by regulating the height of structures and objects of natural growth and by regulating land uses within the runway protection zones**. Figures 1-8** and **1-9** provide a graphic representation of the surrounding airspace and Overlay District.

In addition to zoning to protect the airport from encroachment and incompatible land uses, the airport is void of Minimum Standards and Rules and Regulations, which play an instrumental role ensuring building consistency, guidelines for a level playing field regarding rents, approved businesses, operators, etc. On their website, TXDOT provides a basic template for each of these elements. It is recommended that the airport adopt these items, revised to reflect local issues and needs, to ensure consistency, compatibility, and order at the airport.

FIGURE 1-7
EXISTING ZONING
RALPH M. HALL MUNICIPAL AIRPORT

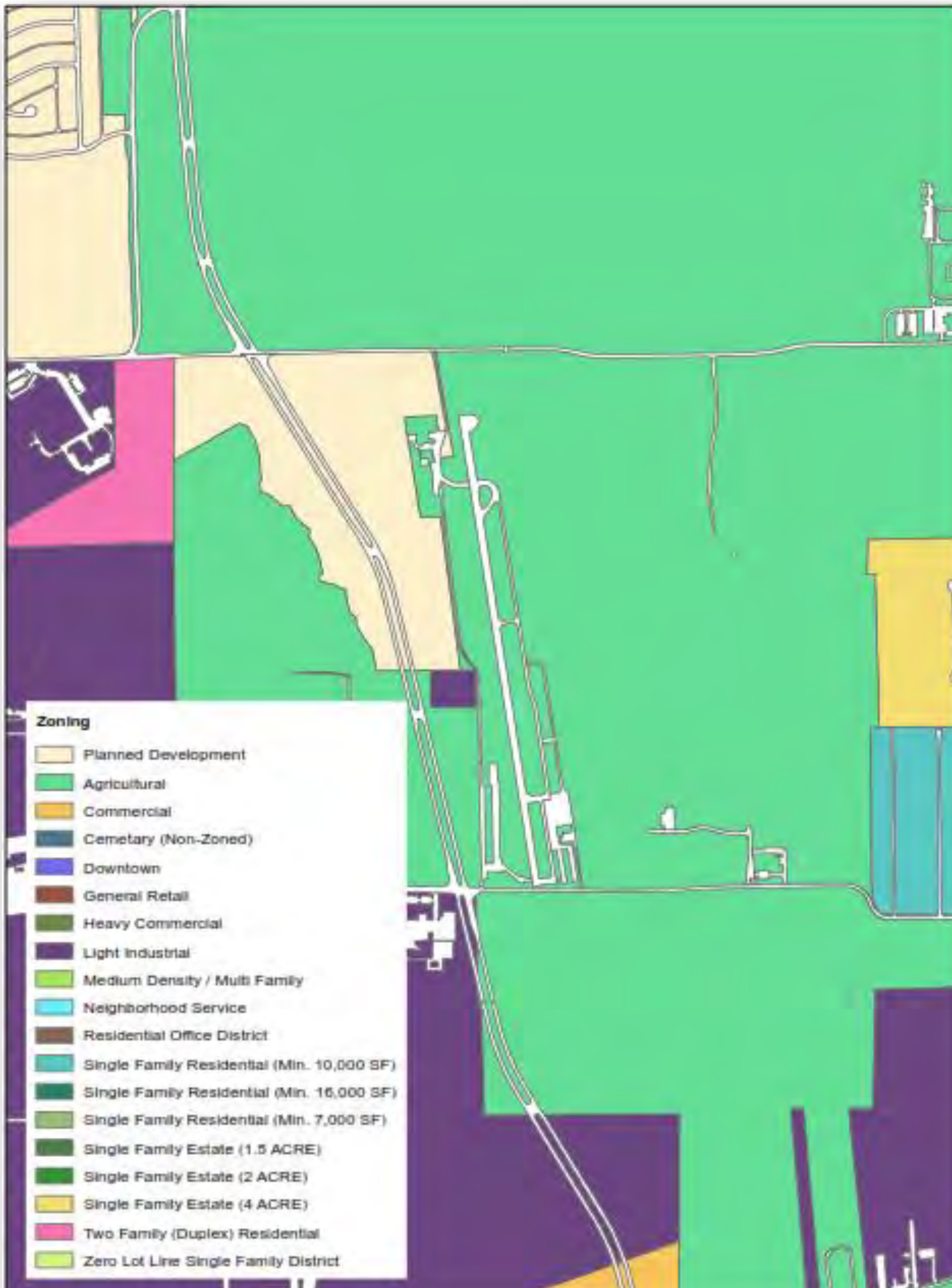


FIGURE 1-8
EXISTING AIRPORT AIRSPACE
RALPH M. HALL MUNICIPAL AIRPORT

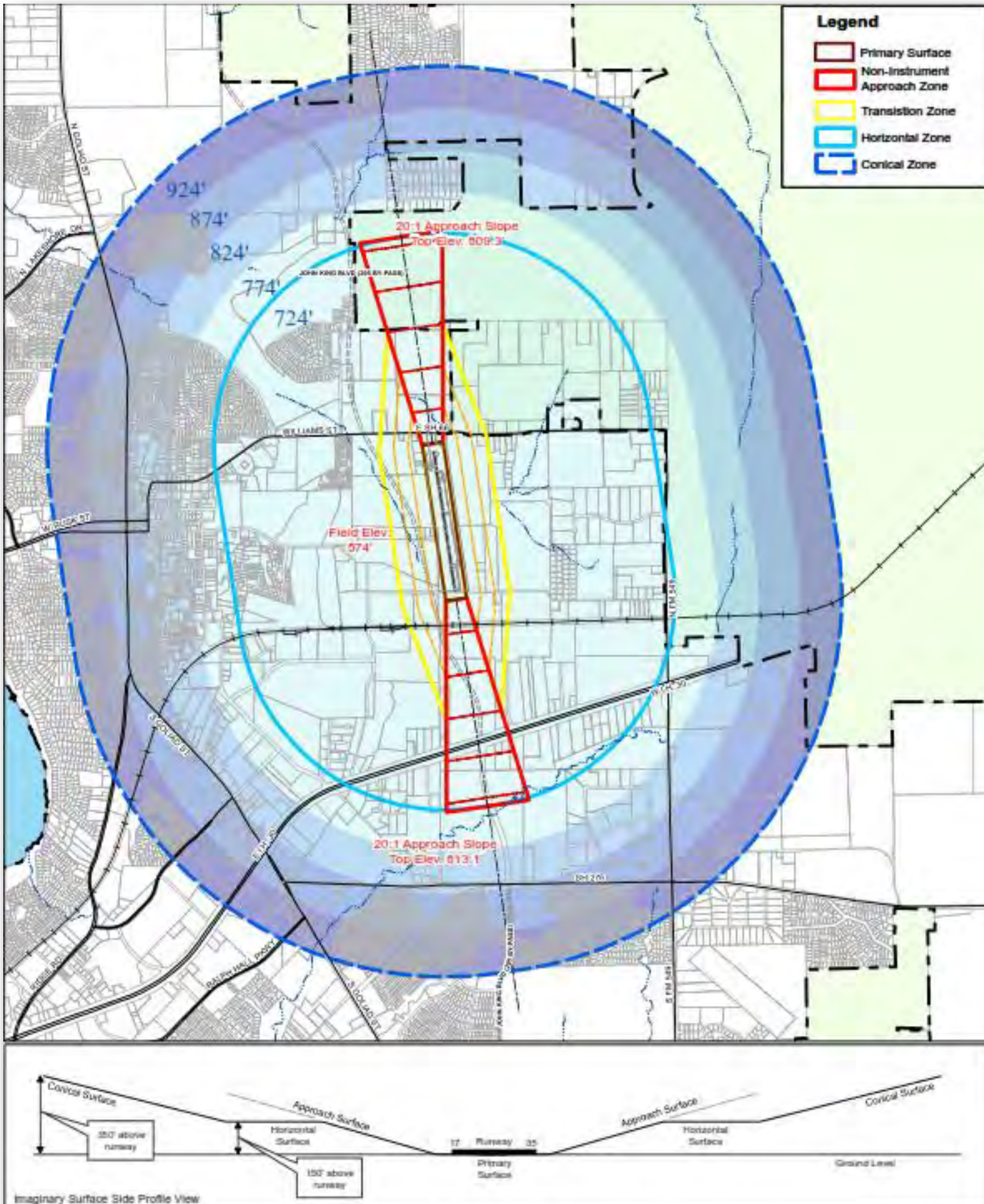
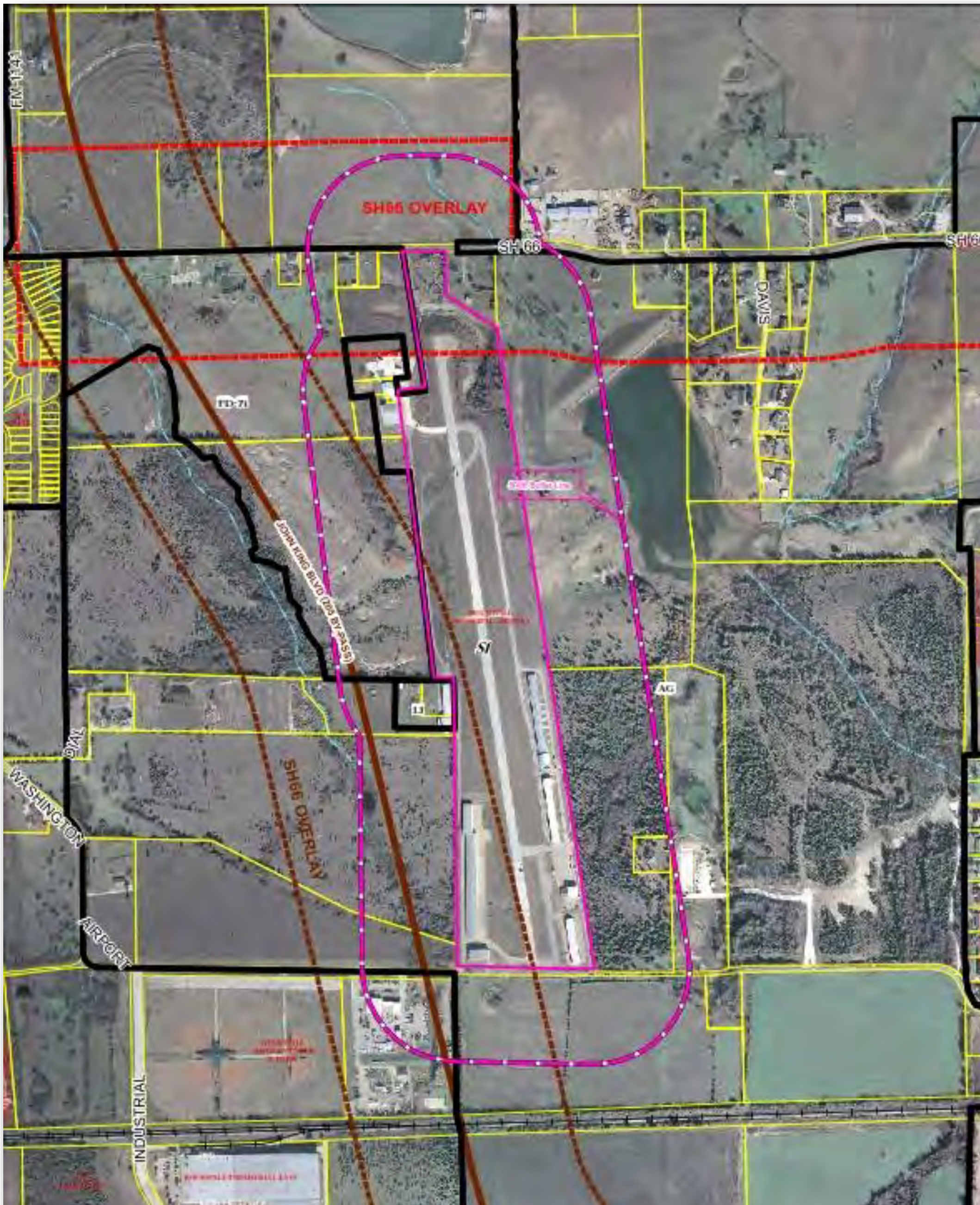


FIGURE 1-9
PROPOSED AIRPORT OVERLAY DISTRICT
RALPH M. HALL MUNICIPAL AIRPORT



SOCIOECONOMIC DATA

Socioeconomic conditions of an area are an essential element in determining and understanding the relationship and related impact on aviation in a community and region. Typical socioeconomic indicators are population, employment, and income.

POPULATION

Situated east of Dallas and east of Lake Ray Hubbard, Rockwall County is projected to grow in population over the next 20 years. While the City of Rockwall is considered a bedroom community for the Dallas Metroplex, local businesses and industries will likely continue to expand and be attracted to the region. Additionally, Texas is experiencing growth due to the retirement of the "Baby Boomer" population, moderate cost of living, and business-friendly environment. **Table 1-10**, *Historical and Projected Populations*, shows the history of population and future projections as formulated by the Texas Water Development Board through 2040. These projections reflect a 3.1 percent annual growth rate for the City of Rockwall, 2.7 percent for Rockwall County, and 1.3 percent annual rate for Texas. These percentages compare to the adjacent counties of Dallas, with a 0.7 percent annual growth rate, Collin, with a 2.2 percent annual growth rate, and Kaufman, with a 3.1 percent annual growth rate.

TABLE 1-10
HISTORIC AND PROJECTED POPULATIONS
RALPH M. HALL MUNICIPAL AIRPORT

Year	City of Rockwall	Rockwall County	State of Texas	City/County Population Ratio
2010	37,490	78,337	25,145,561	47.8%
2015	51,042	115,265	27,519,395	44.2%
2020[1]	64,647	141,386	29,650,388	45.7%
2025[1]	72,323	156,380	31,681,204	46.2%
2030[1]	80,000	171,373	33,712,020	46.6%
2035[1]	86,797	185,208	35,723,221	46.8%
2040[1]	93,595	199,044	37,734,422	47.0%

Source: Texas Water Development Board and US Census Bureau
[1] Projections

INCOME

Based on information provided by the U.S. Census Bureau, 2010 Census Data, the median household income for the City of Rockwall was $72,185, Rockwall County was $78,032, Texas was $49,646, and the nation was $51,914. This compares to the per capita income that ranged from $30,926 for the City of Rockwall, $33,274 for Rockwall County, $24,870 for Texas, and $27,334 for the United States. Additionally, in 2010, the unemployment rate was 4.0 percent for the City of Rockwall, 5.7 percent for Rockwall County, 7.0 percent for the Texas, and 10.8 percent for the United States.

Table 1-11, *Household Income Distribution*, displays the household income for the City of Rockwall, Rockwall County, Texas, and the United States. Studies completed by the U.S. Department of Commerce have determined that the likelihood of taking a trip by air increases as family income increases. A parallel can be applied to the GA market potential. The inclination to own a GA aircraft or travel with commercial air carriers is a direct function of income. Using income as a gauge to aviation activity, statistics indicate that 48 percent of City of Rockwall households earn income of $50,000 or more and 52 percent of Rockwall County households earn above this threshold. This level of income is important because it identifies a segment of the local population capable of participating in GA activity.

TABLE 1-11
HOUSEHOLD INCOME DISTRIBUTION
RALPH M. HALL MUNICIPAL AIRPORT

Locale	< $15,000	$15,000 - $24,999	$25,000 - $34,999	$35,000 - $49,999	$50,000 - $74,999	≥ $75,000	% Above $75,000
City of Rockwall	7.0%	4.6%	5.8%	13.1%	21.6%	47.8%	47.8%
Rockwall County	5.1%	4.2%	5.7%	11.1%	21.2%	52.7%	52.7%
State of Texas	13.4%	11.4%	11.1%	14.3%	18.1%	28.5%	28.5%
United States	13.4%	11.5%	10.8%	14.2%	18.3%	31.7%	31.7%

Source: US Census Bureau, 2010 Census Data

FINANCIAL AND MANAGEMENT OVERVIEW

This section identifies the structure, constraints, requirements, and opportunities for financing the Airport Development Plan (ADP) and any recommended capital improvement program (CIP). Historical financial performance is presented in the form of past revenues and expenses attributable to the City of Rockwall. For purposes of the financial plan, the airport's ability to generate revenues and cover operating costs is a primary concern. In this regard, increased revenues can be used to pay operating costs and, if sufficiently large enough, can be used to pay portions of the local share of capital development or other non-operating costs. **Table 1-12**, *Comparison of Operating Revenue and Expenses*, presents a financial comparison for the airport. From the historical financial information, the total operating expenses fluctuated year to year, ranging from a low of $5,361 in FY 2011, to a high of $39,848 in FY 2008.

Operating revenues also fluctuated each year from a low of $10,621 in FY 2009 to a high of $13,809 in FY 2010. The five-year average in operating revenue was $12,015 per year or $6,861 less than the $18,876 average operating expenses during the same period. The obvious conclusion from the review of historical revenues and expenses is that the significant gap in operating revenue and expense categories will likely require both revenue increases and cost-cutting efficiencies in order to reduce or eliminate airport sponsor subsidies. It should be noted that most public-use GA airports in the United States do not cover expenses with revenues and must be subsidized by their owners/sponsors.

TABLE 1-12
COMPARISON OF OPERATING REVENUE AND EXPENSES
RALPH M. HALL MUNICIPAL AIRPORT

Year	Operating Revenues	Grant Revenue	Operating Expenditure	Capital Expenditure	Net Revenue (Deficit)
2007	$11,933	$43,429	$9,734	$62,088	($16,460)
2008	$12,850	$30,775	$9,774	$60,850	($26,999)
2009	$10,621		$10,184		$437
2010	$13,810	$1,950	$8,406	$4,140	$3,213
2011	$11,351		$8,236	$2,533	$582
2012	$12,537	$95,062	$10,813	$126,355	($29,569)

Source: City of Rockwall/Ralph M. Hall Municipal Airport personnel
Expenditures include grant match

SUMMARY

This chapter provides general background information pertaining to the airport, its operating environment, and its physical surroundings. This chapter is vital from the standpoint that it will be used as a reference tool in the analysis and design process that is required to prepare the airport's aviation demand forecasts, facility requirements, and future development plan.

Operationally, the airport has experienced highs and lows. It provides GA services to the residents of Rockwall County as well as some from neighboring counties. The airport's primary runway (Runway 17/35) supports current operations but should be widened to meet design standards and is complemented by a partial parallel taxiway. There are 72 based aircraft of various different sizes conducting a reported 15,000 annual operations.

The SWOT analysis was an important exercise to identify how to integrate the airport into the City's overall transportation theme and to help provide a greater understanding of the commitment involved in supporting such an important transportation asset. Information from the SWOT analysis has provided the necessary emphasis and guidance to move forward in developing the remainder of this planning tool and for integration into future City plans and objectives. Additionally, the SWOT analysis has stressed the importance of the airport as an economic development tool with which to attract businesses and promote the Rockwall area as a dynamic and thriving community as well as the REDC Technology Park.

The next step in the planning process is to formulate forecasts for the type and quantity of future aviation activity expected to occur at the airport during the next 20-year planning period.

CHAPTER TWO: AVIATION ACTIVITY FORECASTS

INTRODUCTION

Forecasting aviation activity helps the local airport sponsor guide future airport facility and equipment needs. The preferred demand forecasts are used to identify the type, extent, and timing of aviation development. In addition, the forecasts are instrumental in identifying airport-related infrastructure and capacity needs and estimating the financial feasibility of airport development alternatives.

Airport activity is often influenced by the types of aviation services offered to transient and based aircraft and by the general business environment at the airport and in the local community. In addition, factors such as vigorous local airport marketing, gains in sales and services, increased industrialization, changes in transportation preferences, and fluctuations in the national or local economy all influence aviation demand. Aviation activity forecasts are developed in accordance with national trends and regional/local influences and in context with the inventory findings. This chapter examines aviation trends and the numerous factors that have influenced those trends in the United States, Texas, and Rockwall.

NATIONAL GENERAL AVIATION TRENDS

An understanding of recent and anticipated trends within the general aviation (GA) industry is important when assessing aviation demand in Rockwall and at the Ralph M. Hall Municipal Airport. National trends can provide insight into the potential future of aviation activity—some may affect aviation demand in the study area while others will have little or no appreciable impact on local aviation demands.

Various data sources were examined and used to support the analysis of national GA trends. Those sources include:

- Federal Aviation Administration, *FAA Aerospace Forecasts, Fiscal Years 2012 - 2032*

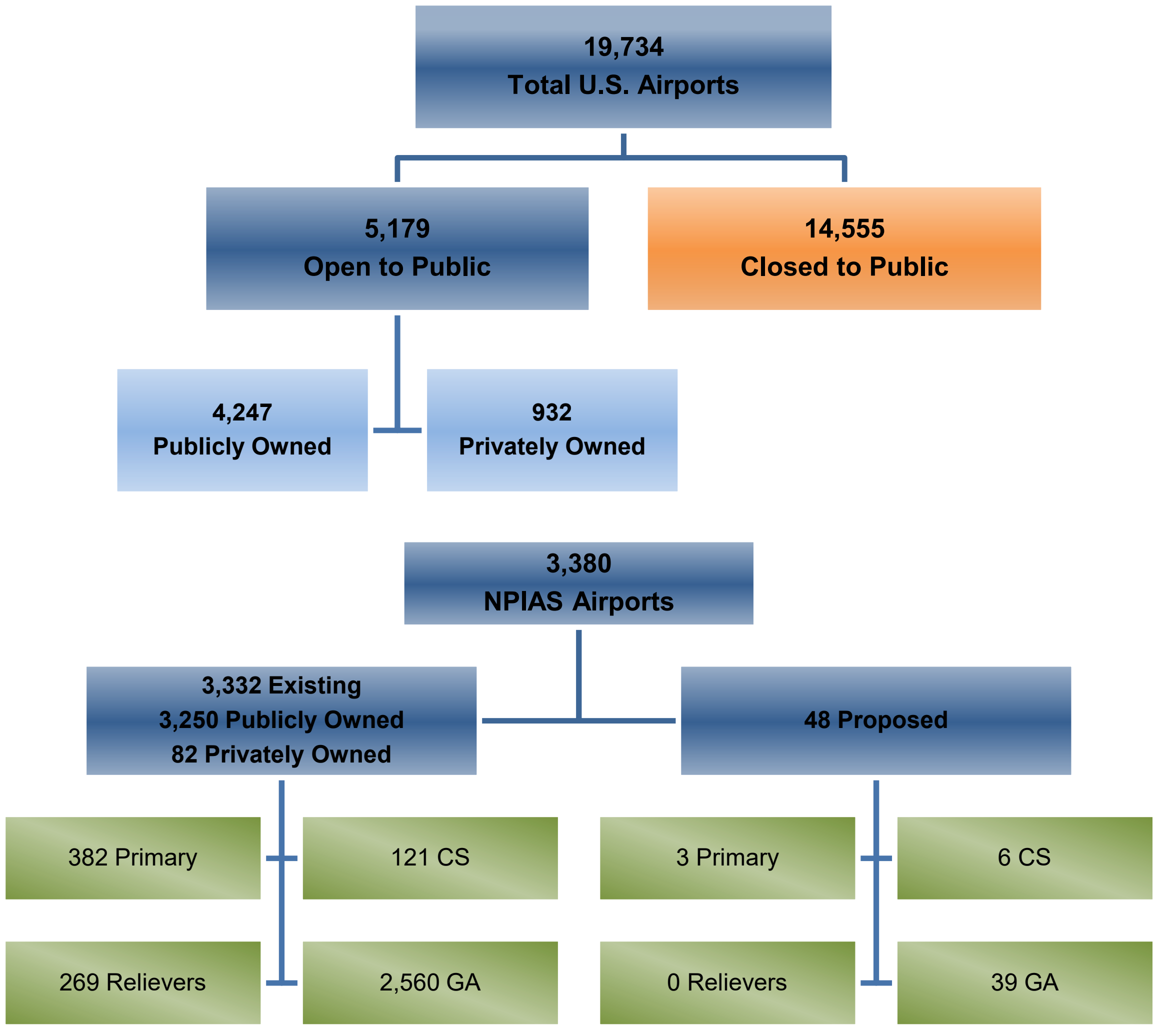
- National Business Aircraft Association (NBAA), *NBAA Business Aviation Fact Book, 2010*
- General Aviation Manufacturers Association (GAMA), *General Aviation Statistical Databook and Industry Outlook, 2010*

GENERAL AVIATION OVERVIEW

GA aircraft are defined as all aircraft not flown by commercial airlines or the military. GA activity is divided into six use categories, as defined by the FAA.

- Personal
- Instructional
- Corporate
- Business
- Air Taxi/Air Tours
- Other

Personal use and air taxi (FAR Part 135) use of GA aircraft are the two largest components of GA activity. These operations occur primarily at GA airports across the nation. At the date of this plan, there are 19,734 public and private airports located throughout the United States, and 5,179 of these are open to public use. The following graphic displays the breakdown of airports as described in the FAA's *2011 – 2015 National Plan of Integrated Airport System* (NPIAS). The number and distribution of public-use airports available to GA users provides a valuable transportation and economic resource to local communities, businesses, and individuals throughout the region, state, and nation.



Primary – Commercial Service airports enplaning more than 10,000 passengers per year.
CS – Commercial Service airports having more than 2,500 enplaned passengers per year.

GENERAL AVIATION INDUSTRY

A historical perspective of the GA industry provides valuable insights. The GA industry began a pronounced decline in 1978. This decline continued in a sporadic manner through most of the 1980s and into the early 1990s with minimal recoveries in the latter years. Nationally, this decline resulted in the loss of more than 100,000 manufacturing jobs and a drop in aircraft production from about 18,000 annually to only 928 aircraft in 1994. This was accompanied by a dramatic drop in the number of new student pilots.

In 1994, the passage and adoption of the *General Aviation Revitalization Act* (GARA) brought some relief to the GA aircraft industry by establishing an 18-year statute of repose on liability related to the manufacturing of all GA aircraft and their components. This legislation prompted some general aviation aircraft manufacturers to return their single-engine piston aircraft production lines to limited output. Aircraft production levels have remained well below those experienced during the 1960s and 1970s due to continually rising manufacturing costs.

More recently, the terrorist attacks of 2001, the continued war on terror, and the current prolonged recessionary national economy have had a dampening effect on GA industry trends—as witnessed by layoffs at aircraft manufacturers and the limited numbers of new aircraft orders worldwide. Significant restrictions were placed on GA flying after 9/11, which resulted in severe limitations being placed on GA activity in a number of important areas of the country. Most of these restrictions have now been lifted, and business and corporate aviation is experiencing some positive gains resulting from additional GA aircraft use for business and corporate travel. This benefit has been tied directly to the increased security measures implemented at commercial service airports that significantly influence travel times.

While the downturn in the economy since 2008 has depressed growth in the GA industry, current trends show a favorable rebound over the next decade. While the GA sector is forecast to grow 2.5 percent annually through 2030, a majority of this growth is in the business/corporate sector, which can be witnessed by the most recent order from NetJets for 425 jets. NetJets is the largest provider of on-demand fractional aircraft.

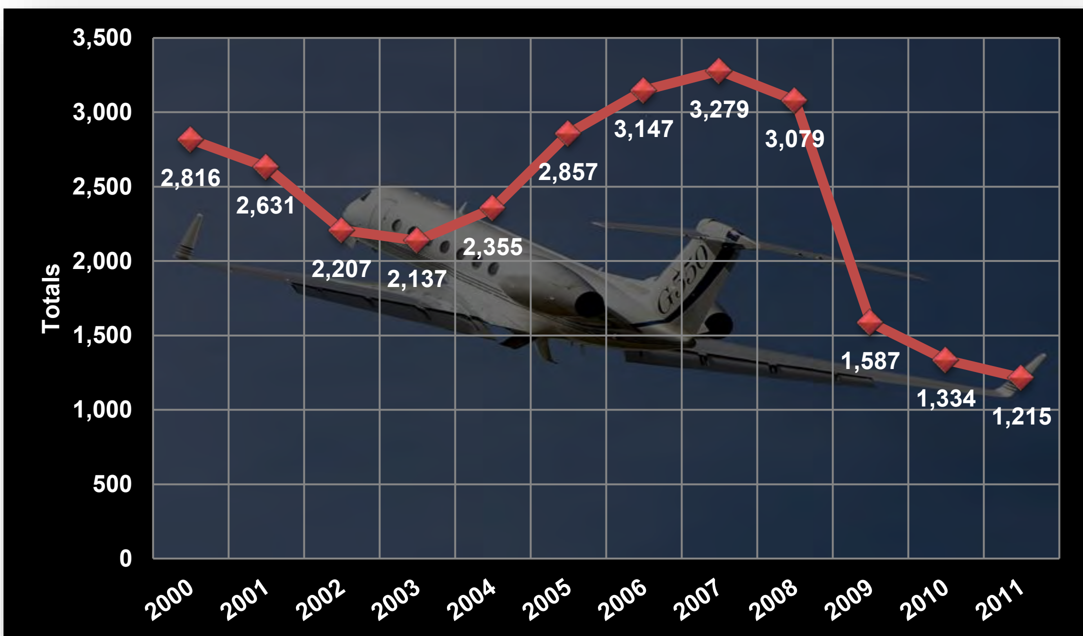
GENERAL AVIATION FUNCTION AND ROLE

The FAA recognizes three broad categories of aviation activity: GA, certificated air carrier, and military. Convenient, safe, and rapid accessibility is one of the most important variables affecting community growth and economic vitality. GA includes all civilian aircraft other than certificated air carriers and military aircraft, and FAA statistics indicate that GA represents the largest, and in many ways, the most significant segment of the national air transportation system, accounting for 96 percent of all civilian airports, 95 percent of all civilian aircraft, 84 percent of all pilots, and about 75 percent of all aircraft operations. With nearly 80 percent of GA flying conducted for business purposes, GA has directly contributed to manufacturing and service industries moving to the edges of large metropolitan areas (like DFW) and to rural communities with adequate aviation facilities.

HISTORICAL GENERAL AVIATION SHIPMENTS AND BILLINGS

The shipment of GA aircraft is an important indicator used to measure the health of GA in the United States. Shipments represent new GA aircraft that have entered the active GA fleet, and billings represent the cost of those new aircraft shipments. Total annual shipments and billings of GA aircraft are tracked and reported by the General Aviation Manufacturers Association (GAMA). **Figure 2-1**, *U.S. Aircraft Shipments, 2000-2011,* depicts historical GA shipment and billing statistics for aircraft manufactured in the United States from 2000 through 2011.

FIGURE 2-1
U.S. AIRCRAFT SHIPMENTS, 2000 - 2011



Source: GAMA Statistical Databook, 2011

GAMA also tracks total billings to both domestic and international customers for GA aircraft manufactured in the United States. As illustrated in **Figure 2-2**, *U.S. Aircraft Shipments Billings, 2000-2011*, GAMA's statistics indicate that while aircraft shipments have increased since 1998, the billings (or costs) associated with those aircraft shipments have increased much more significantly. This is another factor that is indicative of the growing sophistication of the new aircraft entering the GA fleet.

FIGURE 2-2
U.S. AIRCRAFT SHIPMENTS BILLINGS, 2000 - 2011

Source: GAMA Statistical Databook, 2011

BUSINESS USE OF GENERAL AVIATION

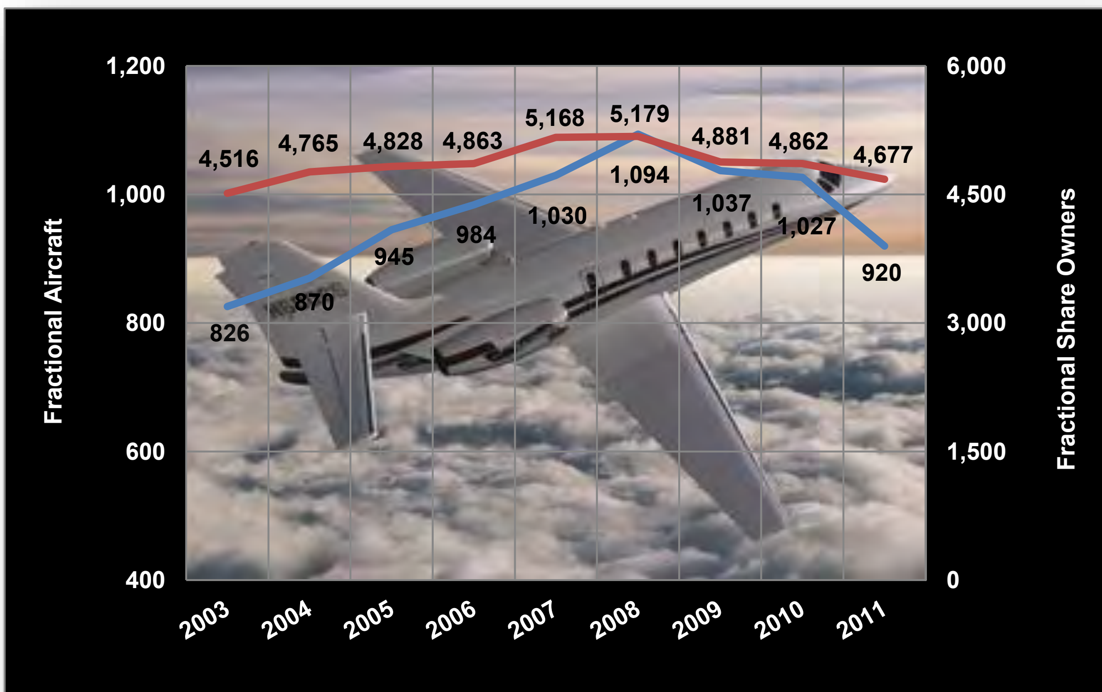
Business aviation is the fastest growing segment of GA. More and more companies and individuals are using GA aircraft as a tool to improve their business efficiency and productivity. Many of the nation's employers who use GA are members of the National Business Aviation Association (NBAA). The NBAA indicates that approximately 95 percent of all Fortune 500 companies operate GA aircraft of various sizes and complexities. In fact:

- Among Business Week's 2010 "*50 Most Innovative Companies*," 95 percent of the S&P 500 companies on the list own and use business aircraft.
- Among Fortune's 2010 "*100 Best Places to Work*," 86 percent of the S&P 500 companies on the list utilize their own business aircraft.
- Among Business Week's 2010 "*25 Best Customer Service Companies*," 90 percent of the S&P 500 on the list own and operate GA aircraft for business travel.
- Among Business Week's 2010 "*100 Best Brands*," 98 percent of the S&P 500 companies on the list utilize their own aircraft.

- Among Fortune's 2010 "*50 World's Most Admired Companies*," 95 percent of the S&P 500 companies on list utilize their own aircraft.

Smaller companies using business aircraft is on the rise as various chartering, leasing, time-sharing, interchange agreements, partnerships, and management contracts have emerged. **Figure 2-3**, *U.S. Fractional Ownership, 2003-2011*, illustrates the growth of fractional ownership in the United States. Fractional ownership arrangements began to appear in the mid-1980s. Since the mid-1990s, their growth has been significant. According to GAMA, in 2002 there were 4,244 fractional ownership arrangements representing 780 aircraft; by 2010, there were approximately 4,862 arrangements representing 1,027 aircraft. This growth in an eight-year period equates to a growth factor of 25 percent or 3.1 percent annually for fractional aircraft and 13.5 percent or 1.5 percent annually for fractional arrangements. This percentage will likely increase over the years due to the availability of fractional ownership opportunities and the aggressive marketing of companies like NetJets.

FIGURE 2-3
U.S. FRACTIONAL OWNERSHIP, 2003 - 2011



Source: GAMA Statistical Databook, 2011

FAA AEROSPACE FORECASTS

Annually, the FAA publishes aerospace forecasts that summarize existing conditions and attempt to predict trends in aviation activity components. Each published forecast provides an analysis of previous aerospace forecasts and updates them in reference to the year's trends in aviation and economic activity. Many factors are considered in the FAA's development of aerospace forecasts. Some of the most important considerations are United States and international economic forecasts and anticipated trends in fuel costs. In general, the FAA's aerospace forecasts provide one of the most detailed evaluations of historical and forecast aviation trends. They provide the general framework for examining future levels of aviation activity for the nation, specific states and regions, and airports. Items monitored and forecast by the FAA on an annual basis include:

- Active pilots
- Active aircraft fleet
- Active hours flown

Historical and projected activity in each of these categories will be examined in the following sections. Data presented is based on the most recent available data, contained in *FAA Aerospace Forecasts, Fiscal Years 2012-2032*.

ACTIVE PILOTS

Active pilots are defined by the FAA as individuals who hold both a pilot certificate and a valid medical certificate. **Table 2-1** summarizes historical and projected U.S. active pilots by certificate type.

TABLE 2-1
HISTORICAL AND PROJECTED U.S. ACTIVE PILOTS BY CERTIFICATE

Certificate Type	2010	2015[1]	2020[1]	2025[1]	2032[1]	% Annual Growth
Student	119,119	114,115	111,950	112,685	116,720	-0.1%
Recreational	212	230	230	225	220	-0.0%
Sport Pilot	3,682	6,150	8,000	10,100	13,900	6.0%
Private	202,020	190,550	188,800	192,250	199,300	-0.1%
Commercial	123,705	118,950	119,750	122,750	130,100	0.4%
Airline Transport	142,198	144,500	148,100	152,600	160,300	0.6%
Rotorcraft	15,377	16,000	18,800	22,300	28,250	3.0%
Glider	21,275	21,260	21,405	21,570	21,805	0.1%
Instrument Rated[2]	318,001	312,950	318,500	325,850	339,700	0.4%
Total Pilots	***627,588***	***611,755***	***617,035***	***634,480***	***670,595***	***0.3%***

Source: FAA Aerospace Forecasts, Fiscal Years 2012-2032
1 2015, 2020, 2025, and 2032 figures have been estimated and forecast by the FAA respectively
2 Instrument rated pilots are not inclusive of overall total

As shown in **Table 2-1**, the FAA projects steady growth in the active pilot population through 2030. Total active pilots are projected to increase from 627,588 in 2010 to approximately 670,595 by 2032, which represents an annual growth rate of approximately 0.3 percent. Through 2030, the following pilot types are projected to experience the greatest annual growth percentage: sport pilots (6.0 percent), rotorcraft pilots (3.0 percent), and airline transport pilots (0.6 percent).

During the timeframe from 2000 through 2010, the number of active private pilots declined approximately 2.2 percent annually. In the initial forecast years, this trend is expected to continue; however, in the out years, active private pilots are expected to rebound. It is important to recognize that instrument-rated pilots will continue to be a growing segment within the active pilot population through 2032 as a result of the increasing sophistication of today's aircraft and their avionics suites.

ACTIVE GENERAL AVIATION AIRCRAFT AND AIR TAXI FLEET

The FAA tracks the number of active GA aircraft in the United States fleet. An active aircraft is one that is currently registered and has flown at least one hour during the year. **Table 2-2** summarizes recent active GA aircraft trends along with FAA projections of active aircraft, by aircraft type.

TABLE 2-2
HISTORICAL AND PROJECTED U.S. ACTIVE AIRCRAFT

Aircraft Type	2010	2015[1]	2020[1]	2025[1]	2032[1]	% Annual Growth
Single-Engine Piston	139,519	135,010	132,335	132,150	135,340	-0.1%
Multi-Engine Piston	15,900	15,570	15,175	14,815	14,350	-0.5%
TOTAL PISTON	***155,419***	***150,580***	***147,510***	***146,965***	***149,690***	***-0.1%***
Turbo-Prop	9,369	9,720	10,120	10,625	11,445	0.9%
Turbo-Jet	11,484	13,340	16,265	20,020	26,935	4.0%
TOTAL TURBINE	***20,853***	***23,060***	***26,385***	***30,645***	***38,380***	***2.9%***
Rotorcraft	10,102	11,750	13,445	15,320	18,225	2.7%
Experimental	24,784	25,500	27,160	28,820	31,140	1.2%
Sport	6,528	7,530	9,315	9,100	10,195	2.1%
Other	5,684	5,650	5,615	5,585	5,545	-0.1%
TOTAL AIRCRAFT	**223,370**	**224,070**	**229,430**	**236,435**	**253,175**	**0.6%**

Source: FAA Aerospace Forecasts, Fiscal Years 2012-2032
[1] 2015, 2020, 2025, and 2032 figures have been estimated and forecast by the FAA respectively

As shown in **Table 2-2**, total active aircraft are expected to increase at 0.6 percent annually. Jet, helicopter, and sport aircraft will experience the largest growth. Since 2005, the trend for active aircraft is witnessing an upturn when compared to the downturn between 2000 and 2005, which was a result of an economic downturn and attrition of older piston aircraft. However, the outlook for new aircraft in all categories is a positive sign that this important and necessary component of commerce and recreation is adapting and will continue to play a vital role in society.

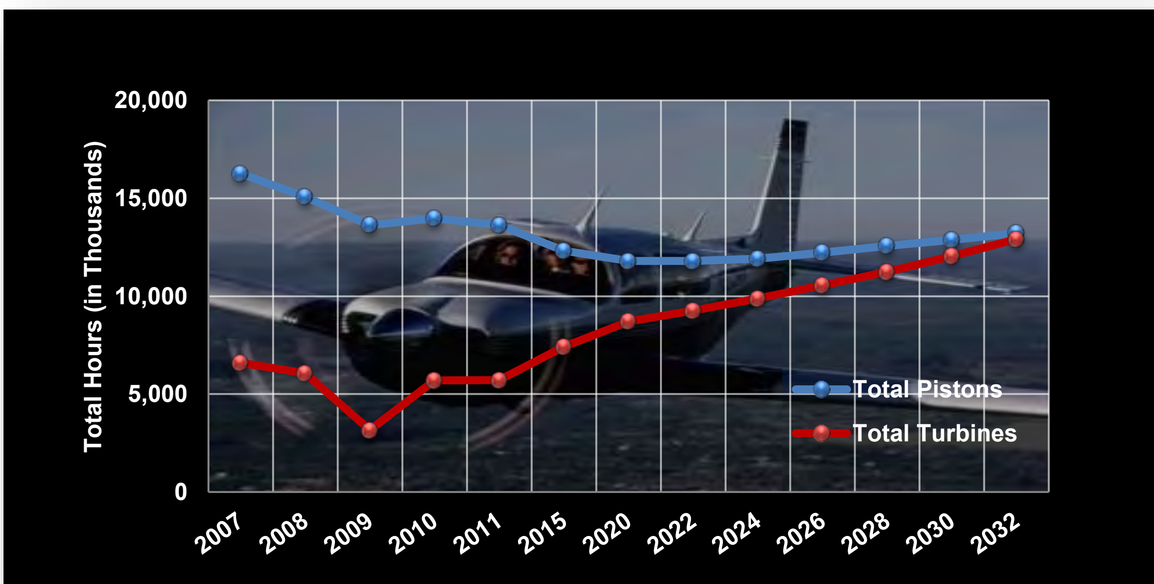
One of the most important trends identified by the FAA in these forecasts is the relatively strong growth anticipated in active GA jet aircraft. This trend illustrates a movement in the GA community toward higher-performing, more demanding aircraft. Growth in GA business jet aircraft is projected to significantly outpace growth in all other segments of the GA aircraft fleet through the forecast period.

ACTIVE HOURS FLOWN

The FAA also uses hours flown as another measure to project general aviation activity. Hours flown in GA aircraft since 2000 has fluctuated for both piston and turbine aircraft. As turbine-type aircraft utilization was increasing, piston aircraft utilization was decreasing until 2007 when both segments declined until 2010. While piston-type aircraft will virtually show little growth, turbine-type aircraft are expected to steadily increase for the next several years. Turbine growth is expected to increase at an average annual rate of 10.6 percent versus a 3.8 percent average annual growth for pistons over this same time period. **Figure 2-4**, *Active General Aviation and Air Taxi Hours Flown,* depicts general aviation hours flown from 2007 through 2011 as well as projected hours to be flown through 2032.

As presented by the FAA in their *Aerospace Forecasts Fiscal Years, 2012-2032*, the annual growth in hours flown for all aircraft over the forecast period is approximately 2.2 percent. Compared to the projected average annual growth rate of the GA active fleet, approximately 0.9 percent, the projected increase indicates an anticipation of greater aircraft utilization. Hours flown by GA aircraft are estimated to reach approximately 36.8 million by 2032, compared to an estimated 24.3 million in 2011.

FIGURE 2-4
ACTIVE GENERAL AVIATION AND AIR TAXI HOURS FLOWN



Source: FAA Aerospace Forecasts, Fiscal Years 2012-2032

SUMMARY OF NATIONAL GENERAL AVIATION TRENDS

General aviation activity is cyclical in nature, which has been demonstrated by the historical data presented. Regardless of the GA activity rebounding due to GARA during the mid and late-1990s, the terrorist attacks of 2001, the war on terror, and the economic downturn have depressed GA activity over recent years. A slow to moderate recovery has begun with increasing aircraft deliveries and hours flown as well as the introduction of new innovative aircraft into the GA fleet. FAA projections of general aviation activity, including active pilots, active aircraft, and hours flown, all show promising growth through the forecast horizon of 2032. Following stalled growth, most components of GA activity are projected to rebound and surpass previous activity levels. An important national trend that has the potential to impact general aviation in Rockwall is the growing proportion of jet aircraft in the active GA fleet and the growing sophistication of both active pilots and aircraft. The ability of Rockwall to accommodate the growing activity by GA and specifically small business jet and turboprop aircraft will be an important consideration.

TERMINAL AREA FORECAST

The Terminal Area Forecast (TAF) is a detailed FAA forecast-planning database produced each year covering airports in the NPIAS. The TAF is prepared to assist the FAA in meeting its planning, budgeting, and staffing requirements. The TAF forecasts are made at the individual airport level and are based in part on the national FAA Aerospace Forecasts. The TAF contains historical and forecast data for enplanements, airport operations, instrument operations, and based aircraft. The data cover the 264 FAA and 239 contract-towered airports, 228 terminal radar approach control facilities, and 2,873 non-FAA airports as of 2010. Data in the TAF are presented on a U.S. Governmental fiscal year basis. The TAF assumes an unconstrained demand for aviation services.

As its primary input, the TAF uses the FAA *Aerospace Forecasts* from the specific year. Aviation activity forecasts for FAA-towered and federal contract-towered airports are developed using historical relationships between airport passenger demand and/or activity measures and local and national factors that influence aviation activity. At airports similar to Rockwall, the TAF data is generated off of historical data reported by the airport or airport sponsor. The TAF generally reflects a slight or zero-percent growth rate due to an inability to conduct aircraft operations counts in the absence of a control tower. Based on the TAF for Ralph M. Hall Municipal Airport, the FAA reflects a zero-percent growth rate and is showing the same number of annual operations through 2032. While this is not uncommon at most GA airports across the country, it renders this forecast virtually unusable as a baseline from which to perform realistic forecasts for future use.

The FAA recognizes a based aircraft as an actively registered airplane stationed at a select airport that regularly uses the airport as the primary “home base” for filing flight plans, frequently uses available airport amenities, and/or maintains a formal commitment for long-term aircraft parking/storage. An aircraft operation is one take off and/or landing of an aircraft. Aircraft operations are identified as local and itinerant. Local operations consist of those within a 20-mile radius of the airport generally with departure and terminus at the same airport, while itinerant operations include all operations other than local, having a terminus of flight or origination of flight at another airport at least 20 miles away.

The following observations were identified at the airport as part of the inventory of historical and current airport activity levels:

- **Aircraft Activity Summary:** Based aircraft at the Ralph M. Hall Municipal Airport have varied widely from a low of 71 in 2011 to a high of 87 in 2000.
- **Operational Activity Summary:** Reported airport operations have remained steady each year since the early 2000 at 38,020.

The TAF and the readily available historical data do not provide a true indication of the types and numbers of operations that occur at the airport. It is those individuals which are actively engaged and present at the airport on a regular basis that provide a more accurate assessment as to what is occurring at the airport. Based on discussions with airport and sponsor personnel, there were approximately 15,000 airport operations in 2011 and 72 based aircraft as of June 2012. In an effort to validate the operational estimate from the FBO the 2000 operational level of 38,020 was taken and reduced at the annual rate of decline in GA operations nationwide and reported in the FAA Aerospace Forecasts. When this is done the level of operations calculated is within 5.0 percent of the FBO’s operations estimate. In an effort to begin the forecasts with as accurate data as possible, this figure will be utilized as the baseline number to calculate forecasts for the Ralph M. Hall Municipal Airport.

GENERAL AVIATION DEMAND FORECASTS

Based on information obtained in the inventory analysis, the following factors and assumptions have been incorporated into the GA forecasts of based aircraft and annual operations for Ralph M. Hall Municipal Airport:

- An “unconstrained” forecast of aviation demand assumes facility improvements will lead the demand with the proactive nature of the local airport sponsor.

- Greater aircraft utilization resulting from airfield and terminal area improvements can be both directly and indirectly linked to economic development activity by the local community.
- Future operational levels are attributable to business needs, flight training, and recreational interests.
- Future airport facilities will need to accommodate a broad array of GA aircraft and remain flexible to accommodate larger business-type aircraft.
- The growing popularity of fractional ownership of corporate jets by business owners, the design of more efficient single-engine aircraft, and the introduction of light sport aircraft and very light jets will all have a positive influence on the forecasts at Ralph M. Hall Municipal Airport.
- The forecast of based aircraft and operational levels is tied to the potential for the airport to attract employment and economic development to the area that could be aviation-related.

FORECAST METHODOLOGIES

Development of aviation forecasts involves analytical and judgmental assumptions to realize the highest level of forecast confidence. The GA demand forecasts are developed in accordance with national trends and in context with the inventory findings, including local population and per capita income trends. The forecasts developed here begin with baseline information from 2011 and with 2012 as the first forecast year. National GA trends and forecasts, used to provide a baseline of growth rates, are provided by the *FAA Aerospace Forecasts, Fiscal Years 2012-2032*. These forecasts are unconstrained, indicating facilities will be developed as the need arises. Various forecast techniques are used to develop GA forecasts for Ralph M. Hall Municipal Airport and could include:

TREND ANALYSIS

Trend analysis is the simplest and most familiar form of forecasting and is also one of the most widely used. Historical data is collected and used to forecast an estimate of the aviation demand element into future years. An assumption of this forecast method is that historical levels for aviation demands will continue and influence similar linear progressions on the future demand levels. Though this assumption seems broad in its application, it can serve as a reliable benchmark against other forecast methods.

REGRESSION ANALYSIS

The forecasts of aviation demand (the dependent variable) are projected on the basis of one or more external indicators (the independent variables). Historical values for both the dependent and independent variables are analyzed to determine their relationships. Once defined, this relationship is used to project the dependent variable with a forecast or projection of the independent variable. In aviation forecasting, an example of the dependent variable is based aircraft. Population or median household income levels are commonly used independent variables that aid in the projection of aviation growth.

MARKET ANALYSIS

These aviation demand forecasts are developed based on a causal model technique in which independent variables statistically relate the relationship(s) between historical events and aviation demands. This forecast method typically uses an easily identifiable independent variable such as population, which has a high correlation on the indirect cause-and-effect relationship within certain segments of the GA industry. The market share often employs a static and dynamic variable relationship between community factors and GA trends that aids in predicting aviation growth based on forecast community indicators such as population.

AIRCRAFT OPERATIONS FORECAST

In developing the GA projections, several existing GA forecasts were reviewed. As presented in **Table 2-3** and **Figure 2-5**, *Summary of Aircraft Operations Forecasts, 2012-2032*, this assessment includes the annual growth rate of 3.2 percent for Rockwall, the North Central Texas Council of Governments (NCTCOG) *2012 Aviation System Plan*, which postulates an annual growth rate of 1.5%, and the *FAA Aerospace Forecast Fiscal Years, 2012-2032*, which utilizes a 1.7 percent average annual increase for all sectors of GA. Typically, operation levels correlate directly with population; however, due to the accelerated growth rate for population within the City of Rockwall and Rockwall County, this forecast would be overly optimistic when applying the coinciding growth rate percentage to aircraft operations.

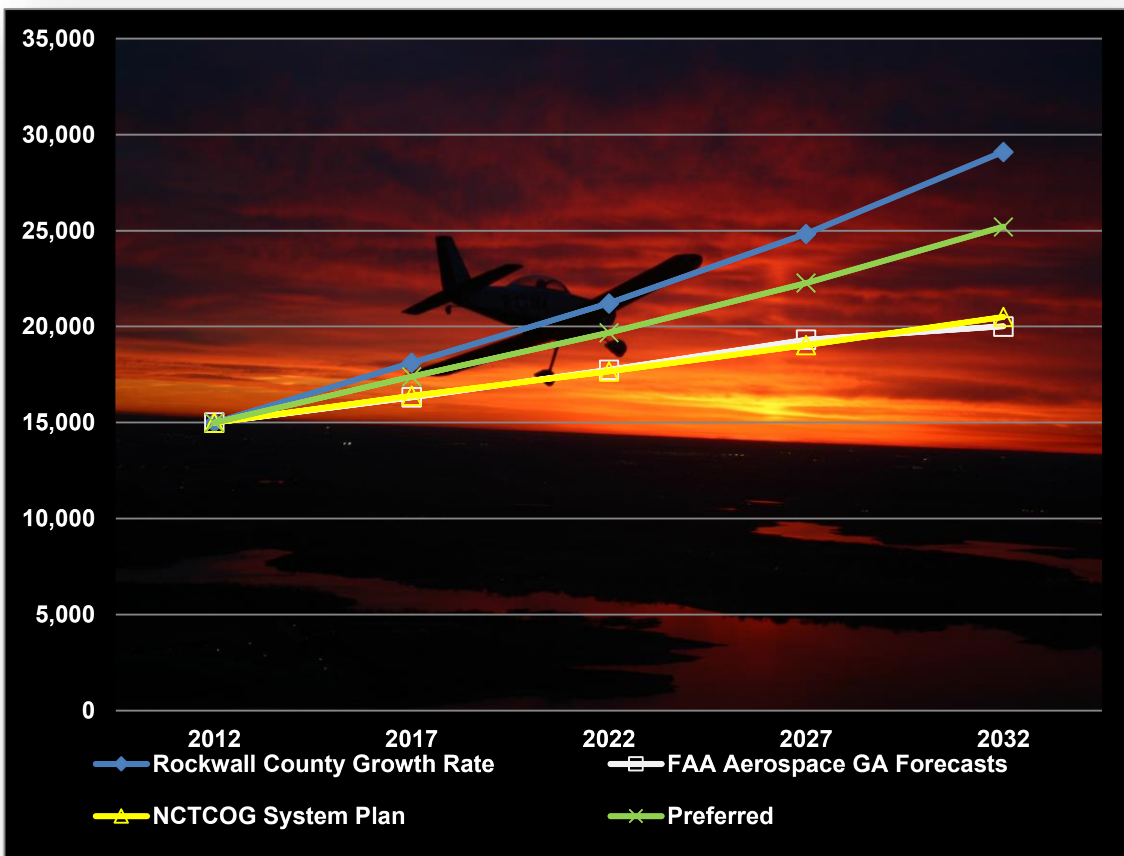
The preferred operations forecast chosen for the airport is based on an average growth rate of 2.5 percent equating to the average annual percentage growth rate of the Rockwall County population and the average annual growth rate postulated by the FAA for GA. Additionally, due to the growth of business development within the Rockwall Technology Park, as well as the capability of the city to continue to attract similar type businesses, the 2.5 percent average annual growth rate is a realistic figure for potential operations to occur at the airport over the course of the next 20 years.

TABLE 2-3
SUMMARY OF AIRCRAFT OPERATIONS FORECASTS, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Year	Rockwall County Growth Rate	FAA Aerospace GA Forecasts	NCTCOG System Plan	Preferred
2012[1]	15,000	15,000	15,000	15,000
2017	18,120	16,319	16,402	17,397
2022	21,211	17,754	17,669	19,683
2027	24,829	19,319	19,035	22,269
2032	29,100	20,014	20,500	25,200

Source: Garver, FAA TAF – FAA APO Terminal Area Forecasts
[1] Actual/Baseline

FIGURE 2-5
SUMMARY OF AIRCRAFT OPERATIONS FORECASTS, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver Forecast Data for Ralph M. Hall Municipal Airport, 2012

AIRCRAFT FLEET MIX FORECAST

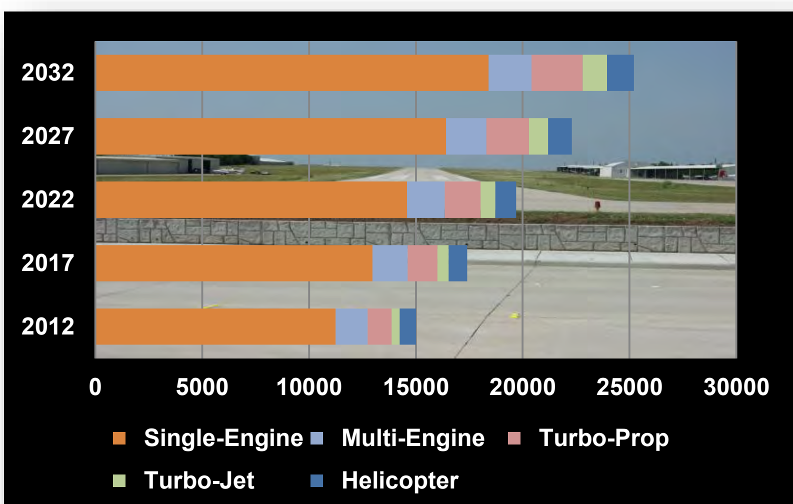
Table 2-4 and **Figure 2-6**, *Summary of Operations by Aircraft Type, 2012-2032*, displays the aircraft fleet mix operations forecast for the airport for each phase throughout the 20-year planning period. The operations forecast of aircraft mix is used to determine future airfield design, facility, and service needs, and the configuration of terminal area facilities.

TABLE 2-4
SUMMARY OF OPERATIONS BY AIRCRAFT TYPE, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Operations By Type	2012[1]	2017	2022	2027	2032
General Aviation	***15,000***	***17,400***	***19,700***	***22,300***	***25,200***
Single-Engine	11,240	12,970	14,590	16,410	18,400
Multi-Engine	1,500	1,650	1,770	1,890	2,020
Turbo-Prop	1,130	1,390	1,670	2,000	2,390
Turbo-Jet	380	520	690	890	1,130
Helicopter	750	870	980	1,110	1,260
Total	***15,000***	***17,400***	***19,700***	***22,300***	***25,200***

Source: Garver
[1] Actual/Baseline

FIGURE 2-6
SUMMARY OF OPERATIONS BY AIRCRAFT TYPE, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver Forecast Data for Ralph M. Hall Municipal Airport, 2012

Total operations can be further broken down into categories and design groups. This additional breakdown helps to better define the types of aircraft that will operate at the airport in the future. It also allows for better planning of future facilities and airside needs for the airport and the ability to justify such facilities when the market demands such construction. **Table 2-5**, *Fleet Mix Operations by Design Group, 2012-2032*, displays this breakdown for the 20-year planning effort.

TABLE 2-5
FLEET MIX OPERATIONS BY DESIGN GROUP, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Approach Category	2012 [1]	2017	2022	2027	2032
Category A (Less than 91 knots)	10,556	11,820	13,584	14,483	15,681
Category B (92-120 knots)	4,444	5,532	6,044	7,721	9,399
Category C (121-140 knots)	0	48	72	96	120
Airplane Design Group					
Group I (Wingspan less than 49 feet)	14,154	16,407	18,559	20,986	23,690
Group II (Wingspan 49 feet to 78 feet)	96	123	161	204	250
Helicopter	750	870	980	1,110	1,260
Total	***15,000***	***17,400***	***19,700***	***22,300***	***25,200***

Source: Garver
[1] Actual/Baseline
Aircraft Approach Category is based on 1.3 times the stall speed of the aircraft at the maximum certified landing weight in the landing configuration. Representative of the anticipated operations for each aircraft approach category and airplane design group. Totals may not equal due to rounding.

LOCAL AND ITINERANT OPERATIONS

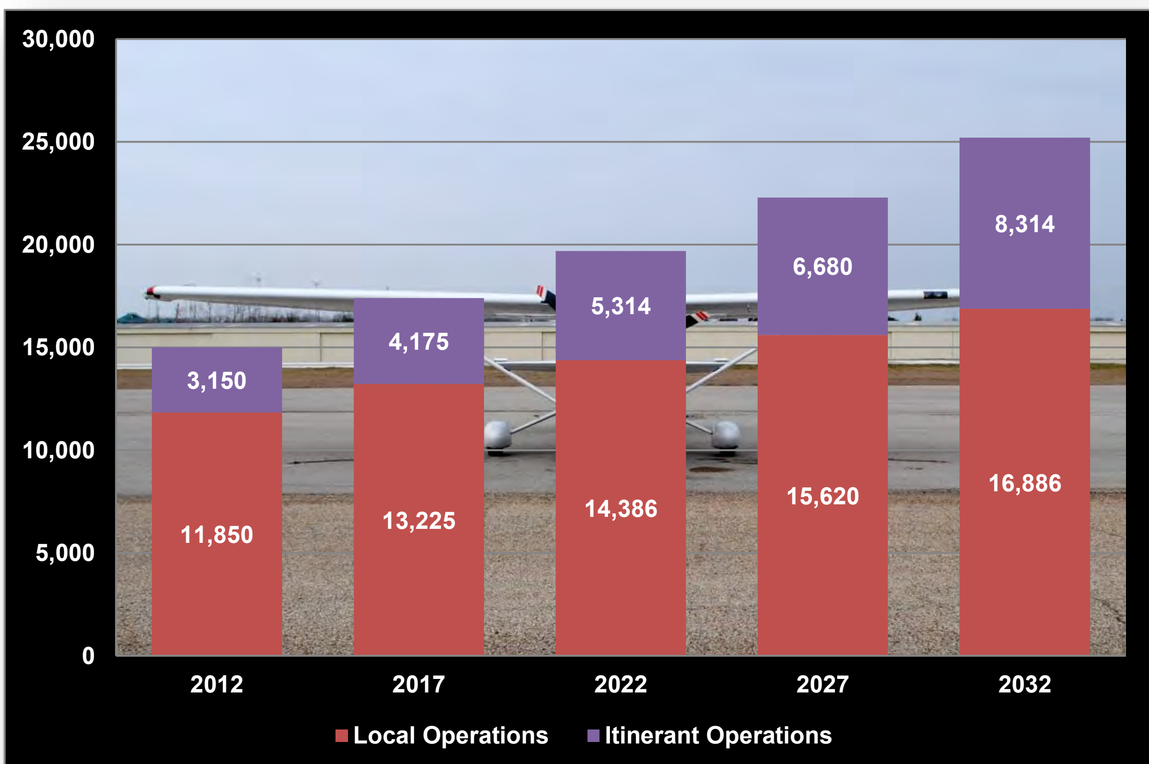
According to FAA Order 7210.3U, *Facility Operation and Administration, February 16, 2006*, a local operation is any operation performed by an aircraft that "remains in the local traffic pattern, performs a simulated instrument approach, or operates to or from the Airport and a practice area within a 20-mile radius of the field or tower." An itinerant operation is any operation that is not considered local. According to FAA Form 5010 airport data, 79 percent of the operations conducted at the airport are local and 21 percent are itinerant. These percentages are expected to fluctuate slightly. Due to the amount of population growth exhibited in the region, and the potential to attract additional business opportunities to the Rockwall area, it is assumed that the airport will accommodate more business traffic over the planning period, increasing the itinerant portion to 33 percent and decreasing the local portion to 67 percent. **Table 2-6** and **Figure 2-7**, *Summary of Local and Itinerant Operations, 2012-2032*, provides a summary of this information.

TABLE 2-6
SUMMARY OF LOCAL AND ITINERANT OPERATIONS, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Year	2012[1]	2017	2022	2027	2032
Local Operations	11,850	13,225	14,386	15,620	16,886
Itinerant Operations	3,150	4,175	5,314	6,680	8,314
Total	***15,000***	***17,400***	***19,700***	***22,300***	***25,200***

Source: Garver
[1] Actual/Baseline

FIGURE 2-7
SUMMARY OF LOCAL AND ITINERANT OPERATIONS, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver Forecast Data for Ralph M. Hall Municipal Airport, 2012

ANNUAL INSTRUMENT APPROACH FORECAST

Table 2-7, *Annual Instrument Approach Forecasts, 2012-2032*, summarizes the forecast of annual civilian instrument approaches at Ralph M. Hall Municipal Airport throughout the planning period. The forecast of annual instrument approaches (AIAs) provides further guidance in determining requirements for the type, extent, and timing of future navigational aid (NAVAID) equipment. These figures are strictly for IFR operations conducted during instrument meteorological conditions (IMC), which exist whenever the cloud ceiling is at or below 1,000 feet and/or visibility is lower than 3 miles. If instrument approaches are calculated for marginal visual flight rules (MVFR) conditions, the monthly potential instrument approaches to Ralph M. Hall Municipal Airport would nearly double. MVFR weather conditions occur whenever the cloud ceiling is lower than 3,000 feet and/or the visibility is less than 5 miles.

TABLE 2-7
ANNUAL INSTRUMENT APPROACH FORECASTS, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Category	2012 [1]	2017	2022	2027	2032
Itinerant Operations					
Operations	3,150	3,905	4,910	6,110	7,540
% IFR Rated Pilots	50.6%	52.7%	53.3%	53.4%	52.6%
Estimated Instrument Approach Operations	**100**	**130**	**160**	**200**	**240**
Local Operations					
Operations	11,800	13,490	14,770	15,150	17,650
% IFR Rated Pilots	50.6%	52.7%	53.3%	53.4%	52.6%
Estimated Instrument Approach Operations	**380**	**430**	**470**	**520**	**570**
Total Annual Instrument Approaches	**480**	**560**	**630**	**720**	**810**

Source: Garver

[1] Actual/Baseline. Numbers have been rounded and may not equate to actual percentages.

FORECAST OF BASED AIRCRAFT

The number of GA aircraft that can be expected to base at an airport facility is dependent on several factors, such as available facilities, airport operator services, airport proximity and access, etc. GA operators are particularly sensitive to both the quality and location of their basing facilities, with proximity of home and work often identified as the primary consideration in the selection of an aircraft-basing location. According to airport personnel, existing hangars are at capacity, consisting of 71 aircraft: 61 single-engine, eight multi-engine, one single-engine turbo-prop, and one business jet. Demand for aircraft hangar storage is moderate, as shown by the existing waiting list of 10 individuals.

Determining the number and type of aircraft anticipated to be based at an airport is a vital component in developing the plan for the airport. Depending on the potential market and forecast, the airport will tailor the plan in response to anticipated demand. Generally, there is a relationship between aviation activity and based aircraft in terms of Operations per Based Aircraft (OPBA). The national trend has been changing with more aircraft being used for business purposes and less for recreation or pleasure. This trend impacts the OPBA in that business aircraft are usually flown more often than pleasure aircraft.

Based on existing operations levels, the current OPBA for the airport is 211. Applying the OPBA through the 20-year planning period derives an average annual growth rate of 1.25 percent. This growth rate is comparable to 0.6 percent for all GA aircraft reflected in the *FAA Aerospace Forecasts, 2012-2032* and a 2.0 percent annual growth rate calculated by *NCTCOG, 2012 Aviation System Plan*. **Table 2-8** provides a summary of the forecasts for based aircraft anticipated at the airport over the 20-year planning period. The preferred forecast takes into account the existing wait list for aircraft storage, the airport's ability to attract aircraft stored at other facilities within the region, and potential business climate and growth within Rockwall and Rockwall County.

TABLE 2-8
SUMMARY OF BASED AIRCRAFT FORECASTS, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Year	FAA Aerospace (all aircraft)	NCTCOG (System Plan)	Preferred (OPBA)
2012[1]	71	71	71
2017	74	80	76
2022	76	88	81
2027	78	97	86
2032	81	108	92

Source: Garver, FAA TAF – Terminal Area Forecasts
[1] Actual/Baseline – Fixed Base Operator

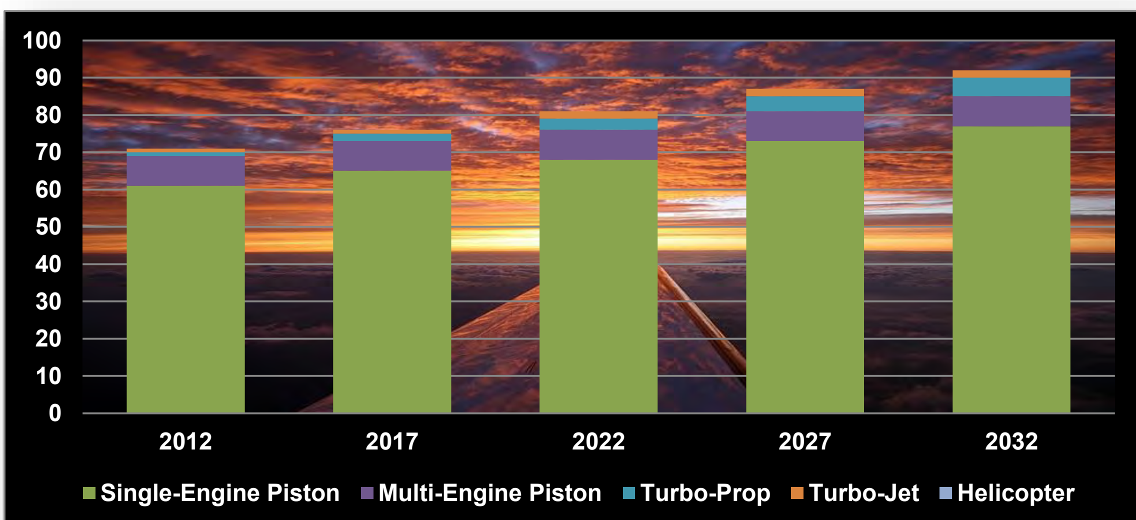
The mix of based aircraft for incremental periods throughout the planning period is illustrated in **Table 2-9** and **Figure 2-8**, *General Aviation Based Aircraft Fleet Mix, 2012-2032*. With an existing high percentage of single-engine aircraft based on the field, the percentage of turbine aircraft, particularly turbo-prop, are expected to increase as a part of the total based aircraft population. This is in line with overall trends in GA with aircraft being used more and more for business purposes.

TABLE 2-9
GENERAL AVIATION BASED AIRCRAFT FLEET MIX, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Type	2012[1]	2017	2022	2027	2032
Single-Engine Piston	61	65	68	72	77
Multi-Engine Piston	8	8	8	8	8
Turbo-Prop[2]	1	2	3	4	5
Turbo-Jet	1	1	2	2	2
Helicopter	0	0	0	0	0
Total	**71**	**76**	**81**	**86**	**92**

Source: Garver
[1] Actual/Baseline
[2] Includes single-engine aircraft

FIGURE 2-8
GENERAL AVIATION BASED AIRCRAFT FLEET MIX, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver Forecast Data for Ralph M. Hall Municipal Airport, 2012

CRITICAL AIRCRAFT

The "critical" aircraft at the Airport is the largest and most demanding aircraft conducting at least 500 operations per year on the airfield. Determining the critical aircraft is important for assessing airport design and layout and the structural and equipment needs for both the airfield and terminal area. It is evaluated with respect to size, speed, and weight. Based on the types of aircraft utilizing the airport today, the existing "critical" aircraft is in the Runway Design Code (RDC) B-I category. This category primarily includes aircraft that typically weigh less than 12,500 pounds such as the Piper PA-46 Malibu, Cessna 421/425, and Cessna Mustang that are based at and use the airport daily.

Today, the Airport accommodates some larger aircraft weighing more than 12,500 pounds such as the Cessna CitationJets, Beechjet 400s, and Beechcraft King Air 350 turbo-props. The City of Rockwall and the Rockwall Economic Development Corporation (REDC) are aggressively marketing business development in the community evidenced by the growth of the tax base in the City and County of more than 10% in the last year to over $950 Million which is expected to double in the next five years. New, growing businesses in Rockwall are using the airfield on a more frequent basis and have indicated to the City that their preferred minimum runway length to operate their King Air fleet at Rockwall is 4,000-feet. This is confirmed by referencing the King Air 200 operational charts for balanced field length which shows that at 575-feet MSL on a 95°F day in no-wind conditions the runway length needed is 3,850-feet.

The forecasts of aviation demand reflect this growth trend in Rockwall and Rockwall County. By the end of the forecast period (2032) the airport is expected to support more than 90 based aircraft that includes two business jets and 13 twin engine business class aircraft. Operations reflect this growth as well with nearly 10,000 operations by Aircraft Approach Category B aircraft many of which will weigh more than 12,500 pounds.

TABLE 2-10
CRITICAL AIRCRAFT COMPARISONS
RALPH M. HALL MUNICIPAL AIRPORT

	Piper Malibu PA-46	Cessna 421	Cessna Mustang	Beechcraft King Air 200	Cessna Citation Bravo
Wing-Span	43'	41' 1 ½"	43' 2"	54' 6"	52' 2"
Length	28' 4 ¾"	36' 9"	40' 7"	43' 9"	47' 2"
Max Take-Off Weight	4,340 lbs	7,450 lbs	8,645 lbs	12,500 lbs	14,800 lbs
Fuel Capacity	120 gal.	170 gal.	385 gal.	540 gal.	715 gal.
Range (NM)	**1,555**	**1,487**	**1,167**	**2,075**	**1,290**
Balanced Field Length	**2,380' (ISA)**	**2,516' (ISA)**	**3,110' (ISA)**	**3,850' ***	**4,635' ***

Source: Garver; * Calculated using Cessna/Beechcraft Flight Planning Guides for KingAir 200, Mustang, and Bravo Citation Models during mean maximum temperature (95°F) at 575' MSL

The Cessna Mustang, the existing critical aircraft, is part of a growing trend of the Very Light Jet (VLJ) aircraft segment. Since its inception in the late 1990s, this category of aircraft is slowly becoming more and more popular within the national fleet. Not only are turbo-jet aircraft capable of being operated with a single pilot, they have a range of approximately 1,000 miles and can operate at airports with less than 5,000 feet of runway. Despite the airfield's existing constraints it currently accommodates this growing segment of aviation. Future airfield enhancements will provide for the increasing use by these types and larger business jet aircraft weighing between 12,500 and 30,000 pounds. **Table 2-10** above compares the most demanding aircraft based at and forecast to use the Airport and reflects the aggressive pursuit of business growth in the local community by the City and REDC.

Source: Garver, Aviation Database

The future critical aircraft is reflective of the aggressively growing business marketplace that is Rockwall County. The REDC continues to provide outstanding growth and development opportunities for new business and industrial growth to match the ever increasing population and tax base of Rockwall. The aviation demand forecasts developed for the Airport reflect this emphasis through identification of the growth of both turbo-prop and business jet aircraft. These categories are expected to grow from one each to more than six combined by 2032. Operations by business class turbo-prop and jet aircraft are expected to climb from approximately 1,400 in 2012 to over 3,500 by 2032. As appropriate aviation facilities are planned for and developed at Ralph M. Hall Municipal, increasing numbers of larger aircraft can and will be utilized to access this thriving business minded community.

FORECAST SUMMARY

The various forecast elements are displayed in **Table 2-11**, *Aviation Forecast Summary, 2012-2032*. The forecasts, combined with the inventory data, will be used to identify and develop the facility requirements and the need for improved general aviation facilities to serve the Ralph M. Hall Municipal Airport. The next chapter, Facility Requirements, identifies the types and extent of facilities needed to adequately accommodate the demand levels identified in this chapter.

TABLE 2-11
AVIATION FORECAST SUMMARY, 2012-2032
RALPH M. HALL MUNICIPAL AIRPORT

Year	2012 [1]	2017	2022	2027	2032
Based Aircraft By Type					
Single-Engine	61	65	68	72	77
Multi-Engine	8	8	9	9	9
Turbo-Prop	1	2	2	3	3
Turbo-Jet	1	1	2	2	3
Helicopter	0	0	0	0	0
Total Based Aircraft	**71**	**76**	**81**	**86**	**92**
Operations					
General Aviation	***15,000***	***17,400***	***19,700***	***22,300***	***25,200***
Single-Engine	11,240	12,970	14,590	16,410	18,400
Multi-Engine	1,500	1,650	1,770	1,890	2,020
Turbo-Prop	1,130	1,390	1,670	2,000	2,390
Turbo-Jet	380	520	690	890	1,130
Helicopter	750	870	980	1,110	1,260
Local Operations	11,850	13,225	14,386	15,620	16,886
Itinerant Operations	3,150	4,175	5,314	6,680	8,314
Total	***15,000***	***17,400***	***19,700***	***22,300***	***25,200***

Source: Garver
[1] Actual/Baseline

CHAPTER THREE: AIRPORT FACILITY REQUIREMENTS

INTRODUCTION

This chapter identifies the existing facilities and long-range requirements needed to meet the forecast demand as planned in accordance with Federal Aviation Administration (FAA) airport design standards and airspace criteria. Identifying a needed facility does not necessarily constitute a "requirement," but rather it is an "option" for facility improvements to accommodate existing and future aviation activity and for the airport to strive toward when meeting the recommended standards established by the FAA or state agency. Ultimately, market demand and the local airport sponsor will drive the requirements for construction and development at the airport.

Facility requirements can be grouped into two categories: airfield/airside and terminal area/landside. Airside facility components include runways, taxiways, NAVAIDs, airfield marking/signage, and lighting; terminal area components are comprised of hangars, terminal building, aircraft parking apron, fuel dispensing units, security, vehicular parking, and airport access requirements.

AIRPORT REFERENCE CODE (ARC) CLASSIFICATION

As previously mentioned in the *Inventory* chapter, the Airport Reference Code (ARC) for an airport, as described in FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, is a coding system to help identify and determine the appropriate design criteria for each airport. This ARC correlates the airport design and layout to the operational and physical characteristics of the critical/design aircraft. The ARC directly influences pertinent safety criteria such as runway length, runway width, runway/taxiway separation distances, building setbacks, size of required safety and object free areas, etc. The critical and/or design aircraft is based on the largest aircraft within a family of aircraft expected to operate at an airport on a regular basis. Regular basis is defined as a minimum of 500 operations (landings or takeoffs) per year by the FAA/TxDOT.

The ARC has two components. The first component, depicted by a letter (i.e., A, B, C, D, or E), is the aircraft approach category (AAC) and relates to aircraft approach speed based on operational characteristics. The second component, depicted by a Roman numeral (i.e., I, II, III, IV, V, or VI), is the airplane design group (ADG) and relates to aircraft wingspan and/or tail height. For example, a Beechcraft King Air 200, with an approach speed of 103 knots and wingspan of 54.5 feet, has an ARC of B-II, while a larger corporate jet such as the Gulfstream IV (G-IV/G450) exhibiting an approach speed of 145 knots and wingspan of 77.8 feet has an ARC of D-II. **Table 3-1**, *Airport Reference Code*, illustrates the components comprising the ARC.

TABLE 3-1
AIRPORT REFERENCE CODE
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Approach Category		
Category	**Speed**	
A	< 91 Knots	
B	91 - < 121 Knots	
C	121 - <141 Knots	
D	141 - < 166 Knots	
E	≥ 166 Knots	
Airplane Design Group [1]		
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

Source: FAA AC 150/5300-13A, *Airport Design*.
[1] When an aircraft falls into two different categories, the more demanding/restrictive of the two should be used/applied.

Currently, TxDOT, Aviation Division classifies the Ralph M. Hall Municipal Airport as a Community Service airport, ≤ 12,500 pounds, with a current and future ARC of B-I. This is consistent with the information provided on the latest approved Airport Layout Drawing (ALD). A review of the existing airport configuration, setbacks, and safety areas confirms that ARC B-I is the current designation for the airport. A breakdown and comparison of ARCs and similar-type aircraft can be seen in the following illustration, **Figure 3-1**, *Comparison of Airport Reference Code Aircraft*.

FIGURE 3-1
COMPARISON OF AIRPORT REFERENCE CODE AIRCRAFT
RALPH M. HALL MUNICIPAL AIRPORT

Source: Garver aircraft performance files.

RUNWAY REQUIREMENTS

RUNWAY LENGTH

FAA AC 150/5325-4B, *Runway Length Requirements*, provides guidance to help determine the recommended runway lengths for an airport, which is predicated on the ARC category of aircraft using an airport. By design, the primary runway is typically the longest runway, has the most favorable wind conditions, provides the greatest pavement strength, and has the lowest straight-in instrument approach minimums. Presently, Runway 17/35 is 3,373 feet long and 45 feet wide. **Table 3.2**, *Runway Length Requirements*, shows the runway design lengths for Ralph M. Hall Municipal Airport.

TABLE 3-2
RUNWAY LENGTH REQUIREMENTS
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Category	Length	Deficiency
Small aircraft with less than 10 seats		
95% of small aircraft fleet	3,300'	0'
100% of small aircraft fleet	4,000'	627'
Aircraft between 12,500 and 60,000 pounds		
75% of fleet at 60% useful load	5,500'	2,127'
75% of fleet at 90% useful load	7,100'	3,727'
100% of fleet at 60% useful load	5,800'	2,427'
100% of fleet at 90% useful load	9,200'	5,827'

Source: AC 150/5325-4B, *Runway Length Requirements for Airport Design*, Figures 3-1 and 3-2.
Generalized length only. Actual length requirements/need should be calculated based on the specific aircraft's operational nomographs.
Useful load refers to all usable fuel, passengers, and cargo.
Calculations based on 574' airport elevation and mean maximum daily temperature of 95˚F.
Figures are increased 10 feet for each foot of elevation difference between high and low points of runway centerline.

Runway 17/35 meets the length requirements for 95 percent of the small-aircraft GA fleet with less than 10 seats; however, the runway length is deficient in accommodating the remaining groups of aircraft identified in the AC nomographs. Any future runway improvements to accommodate a wider use by all categories of GA aircraft should be depicted on an approved ALD and will require justification and approval through TxDOT before any funding assistance is granted.

Actual runway length is a function of elevation, temperature, and stage length. As temperatures change, the runway length requirements change accordingly. Thus, if a runway is designed to accommodate 75 percent of the fleet at 60 percent useful load, this does not prevent larger aircraft from utilizing the runway at certain times and during specific climatic conditions and aircraft operating parameters. However, the amount of time such operations can safely occur is restricted. These design runway lengths do not absolve the pilot from calculating the specific runway length needed to conduct a safe take-off or landing for the specific aircraft being operated during current weather conditions at the airfield.

RUNWAY WIDTH

Similar to runway length, minimum runway width is promulgated by criteria set forth in FAA AC 150/5300-13A, *Airport Design*. Design criteria states an airport with a B-I reference code should have a minimum runway width of 60 feet. Currently, the airport's runway width of 45 feet is deficient by 15 feet and does not meet either FAA or TxDOT standards. This deficiency should be a priority for remediation when financially feasible and when funding becomes available.

RUNWAY STRENGTH

The runway pavement strength for the airport is rated at 12,000 pounds for single-wheel aircraft. While there is no set standard for pavement strength, design criteria categorize aircraft as either small aircraft (12,500 pounds or less) or large aircraft (12,500 pounds or greater). When airports consistently attract large aircraft (greater than 12,500 pounds with at least 500 annual operations), pavement strength is based on that particular aircraft. Ralph M. Hall Municipal does not exceed the 12,500-pound threshold. When the runway is widened to 60 feet, it is recommended that the pavement strength support existing and forecast aircraft types with minimum pavement strength of 12,500 pounds (single wheel gear (SWG) configuration) with a recommended increase, as demand warrants, to 30,000 pounds SWG.

AIRFIELD DESIGN STANDARDS

Compliance with airport design standards is required to maintain a minimum level of operational safety. The major airport design elements, as follows, are established from FAA AC 150/5300-13A, *Airport Design* and Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*, and design elements should conform with FAA airport design criteria without modification to standards.

RUNWAY SAFETY AREA (RSA) AND TAXIWAY SAFETY AREA (TSA)

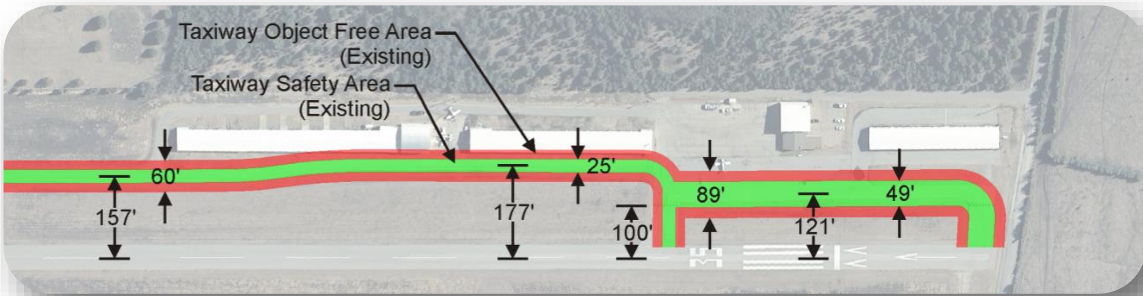
The RSA/TSA is a two-dimensional area surrounding and extending beyond the runway and taxiway centerlines. This safety area is provided to reduce the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway or taxiway. In addition, it must be cleared and free of objects except those required for air navigation and graded to transverse and longitudinal standards to prevent water accumulation, as consistent with local drainage requirements. Under dry conditions, the RSA/TSA must support emergency equipment and aircraft without causing structural damage or injury to the occupants. The airport must own the entire RSA/TSA in "fee simple" title.

Based on FAA ARC B-I design standards, the RSA should extend beyond the end of the runway for 240 feet and have a width of 120 feet. The Runway 17/35 RSA lengths beyond the pavement end and width do not meet design standards. The current RSA available beyond the Runway 35 end is zero while beyond the Runway 17 end only 50 feet is available. Steep slopes north of the Runway 17 end and the road beyond the Runway 35 end prevent the airport from meeting RSA length standards. Slopes along the runway's east side north of the displaced threshold do not allow the RSA design standards to be met. However, the RSA length standard may be met within the existing displaced thresholds through the implementation of "Declared Distances." Declared Distances inform pilots to account for a reduction in the published runway length during takeoff and landing. The RSA lateral slope standards may not be met through Declared Distances. A topographic ground survey of this area is recommended to determine the area that meets lateral slope standards, allowing for an accurate application of Declared Distances. Additional information pertaining to this deficiency will be addressed in the *Alternatives* chapter.

Based on FAA design standards for B-I airports designed for small aircraft only, the runway-to-taxiway separation standard is 150 feet with a TSA width of 49 feet. However, when the airport is designed to serve some larger aircraft that weigh in excess of 12,500 pounds, the runway-to-taxiway separation standard widens out to 225 feet while the TSA width remains 49 feet. The airport partially meets the design standards for runway-to-taxiway separation except along the southern 635 feet where the separation measures approximately 121 feet. If the airport were to plan to support large aircraft, the location of the northern shade hangars, terminal building, and propone tank encroach on these standards and the airport does not meet these TSA design standards. **Figures 3-2, 3-3,** and **3-4** depict the existing conditions, existing standards, and future standard conditions for the parallel taxiway system and TSA.

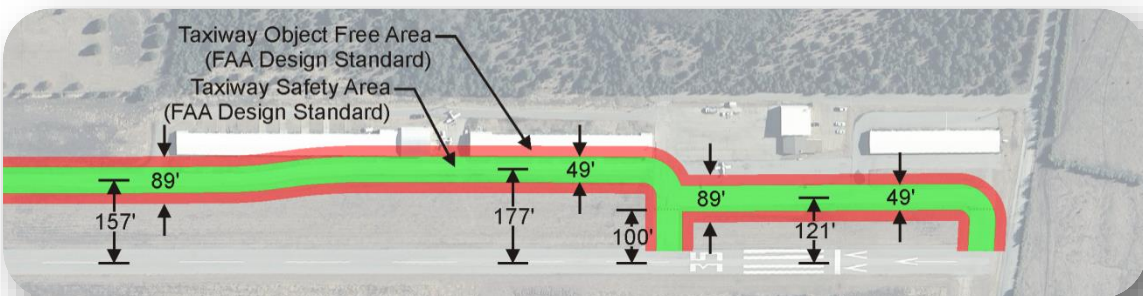
With the establishment of non-precision instrument approach procedures, the airport's parallel taxiway no longer meets separation standards and should be reconstructed at an offset of 225 feet. Additional information pertaining to this deficiency will be addressed in the *Alternatives* chapter.

FIGURE 3-2
PARALLEL TAXIWAY EXISTING TSA/TOFA
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

FIGURE 3-3
PARALLEL TAXIWAY EXISTING TSA/TOFA STANDARDS
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

FIGURE 3-4
FUTURE PARALLEL TAXIWAY AND STANDARD TSA/TOFA
RALPH M. HALL MUNICIPAL AIRPORT

Source: Garver, 2012

OBJECT FREE AREA (OFA)

The OFA is a two-dimensional area surrounding runways, taxiways, and taxilanes. It must remain clear of objects except those used for air navigation or aircraft ground maneuvering purposes, and it requires clearance of above-ground objects protruding higher than the runway edge elevation at an adjacent point within the OFA. An object is considered any ground structure, navigational aid, person, equipment, terrain, or parked aircraft. The airport must own the entire OFA in “fee simple” title.

The ARC B-I exclusively small aircraft runway object free area (ROFA) width standard is 250 feet while the ARC B-I OFA width of 400 feet applies to airports that are or could be supporting operations by aircraft weighing more than 12,500 pounds. The ROFA length beyond pavement end is prescribed at 240 feet for both cases. The airport meets the small aircraft only ROFA width standards; however, it does not meet the ROFA requirement length of 240 feet beyond each runway end nor does it meet the 400-foot ROFA width. Similar to the RSA, the airport will need to implement Declared Distances to achieve this requirement until such time as ROFA standards can be achieved. **Figures 3-5** and **3-6** depict this data. This need will be addressed in the *Alternatives* chapter.

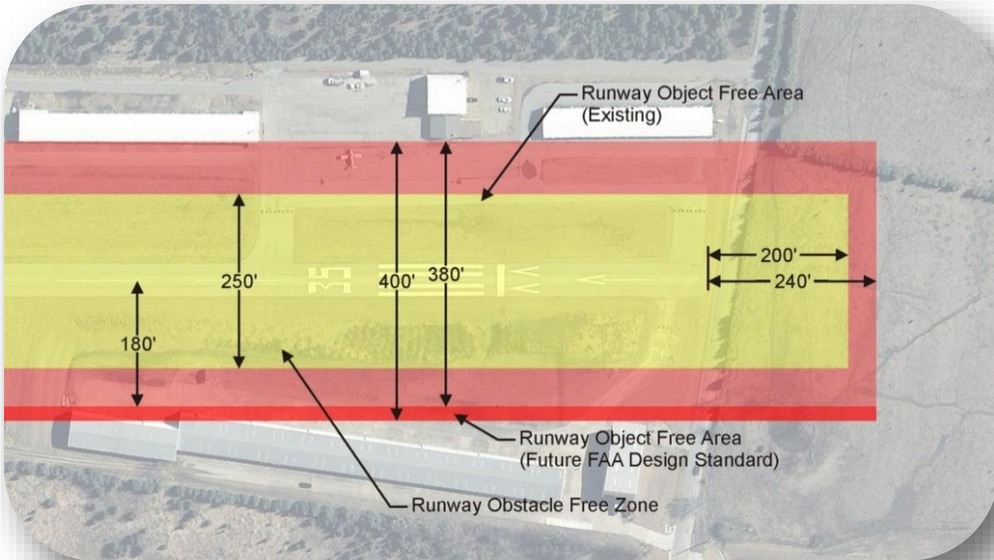
The taxiway object free area (TOFA) standard width is 89 feet. The airport does not meet this standard as a result of the existing shade hangars, terminal building, and propone tank. When future development warrants, the portion of non-compliant taxiway should be reconstructed at the correct design separation, and any future buildings will be located beyond the TOFA.

OBSTACLE FREE ZONE (OFZ)

The OFZ is airspace above a surface centered on the runway centerline, and it precludes taxiing and parked airplanes and object penetrations except for frangible post-mounted NAVAIDs expressly located in the OFZ by function. Based on existing facilities and operations, only the Runway OFZ is applicable. The length of the OFZ is fixed at 200 feet beyond the associated runway end. The width depends on the size of aircraft served by the airport and runway approach visibility minimums. The current and future runway OFZ standard width is 250 feet. The location of Airport Road south of the Runway 35 end prohibits meeting the existing OFZ standards and should be addressed at the next major runway project

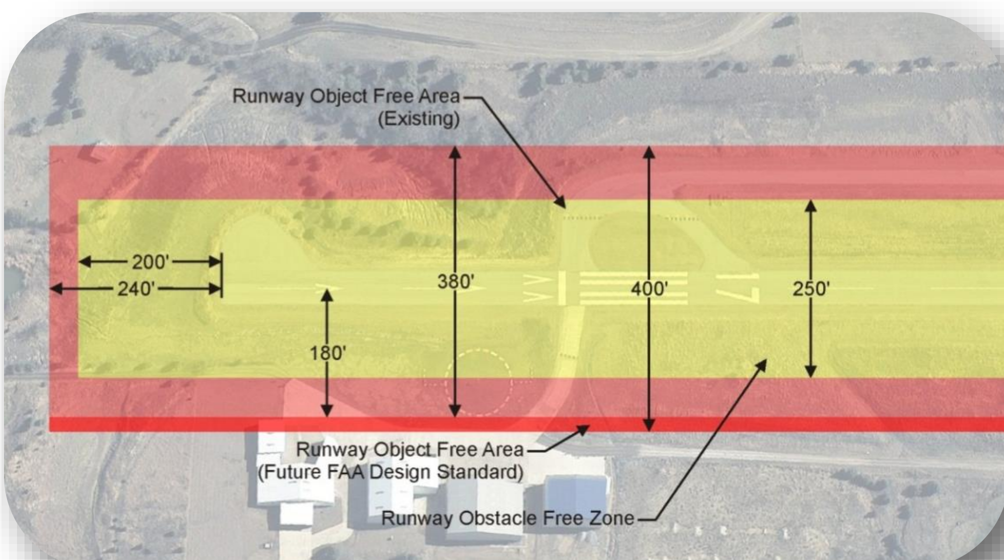
In the past the airport has served aircraft weighing more than 12,500 pounds. The community is actively and aggressively marketing the airport to existing and potential businesses. Consideration should be given to meeting the next level of standard in the future in anticipation of greater airport utilization by aircraft weighing more than 12,500 pounds and meeting the economic growth already present in Rockwall. The runway OFZ standard is not correctable through the application of Declared Distances.

FIGURE 3-5
RUNWAY 35 OFZ/OFA – EXISTING AND STANDARD
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

FIGURE 3-6
RUNWAY 17 OFZ/OFA – EXISTING AND STANDARD
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

BUILDING RESTRICTION LINE (BRL)

The BRL represents the boundary that separates the airside and landside facilities and identifies recommended building area locations based on airspace and visibility criteria. The BRL is established with reference to the FAR Part 77 primary and transitional surfaces, as well as the airfield safety areas. Based on the activity at the field, instrument approach types (not lower than ¾-mile), and ARC designation, a recommended BRL is 425 feet from the runway centerline providing 25 feet of structure height clearance. If a new instrument approach with lower than ¾-mile visibility minimums is developed and implemented in the future, this distance would increase to 675 feet for a 25-foot building height. Similar to the above-mentioned safety criteria, the current facilities locations are at or inside the recommended BRL. When new development or terminal redevelopment occurs, it is imperative the airport ensure new structures are constructed in a way that does not create additional or new obstructions to the FAR Part 77 airspace surfaces.

RUNWAY APPROACH SURFACE

The approach surface is a three-dimensional trapezoidal FAR Part 77 imaginary surface extending beyond each runway end and has a defined slope requiring clearance over structures and objects beyond the runway threshold. The purpose of the approach surface is to provide proper clearance for the safe approach and landing of aircraft. The existing approach surface begins 200 feet from each displaced threshold. At this point it is 500 feet wide at the inner location with a 5,000-foot depth/length, and a 2,000-foot outer width.

While FAR Part 77 provides the basic framework to identify existing obstructions within the vicinity of the airport, the FAA recently published new airspace criteria for vertically or non-vertically guided approaches to airports. This new criteria provides guidelines and specifications for listing obstructions in support of the new Airports Geographic Information System (A-GIS) initiative and can be found in AC 150/5300-18B. Until this new program is completely up and operational, it is uncertain what affect it will have on airports and how it will be applied in a cost-effective manner.

RUNWAY PROTECTION ZONE (RPZ)

The RPZ is a two-dimensional trapezoid area beginning 200 feet beyond the paved runway end and extends along the runway centerline. The purpose of the RPZ is to enhance the protection of people and property on the ground and to prevent potentially hazardous obstructions to aircraft operations. RPZ dimensions are determined by the type of aircraft expected to operate at an airport or on a specific runway (small or large) and the type of approach planned for the runway ends (visual, precision, or non-precision). The recommended visibility minimums for the runway ends are determined with respect to published instrument approach procedures, the ultimate runway ARC, airfield design standards, instrument meteorological conditions, wind conditions, and physical constraints (approach slope clearance) beyond the extended runway centerline. The FAA recommends that airports own the entire RPZ in "*fee simple*" title and that the RPZ be clear of any non-aeronautical structure or object that would interfere with the arrival and departure of aircraft. However, if "fee simple" interest is unachievable, the next best option is controlling the heights of objects through an avigation easement. While some automobile parking is allowable within the RPZ, provided they are outside the central portion, other land uses such as residences, fuel facilities, and places of public gathering (i.e., churches, schools, hospital, office buildings, and shopping centers) are not permitted within the RPZ. FAA interim guidance (Sept 2012) addressed the allowance of public roadways and rail lines in RPZs. The interim guidance indicates that if a runway end location changes every effort should be made to limit or eliminate public roads and rail lines from the central portion of the RPZ. **Table 3-3**, *Runway Protection Zone Dimensions*, delineates the RPZ requirements. The current RPZ dimensions for Runway 17/35 are 500' x 1,000' x 700' and extend beyond existing airport property. A portion of this property is controlled through easements owned by the City.

TABLE 3-3
RUNWAY PROTECTION ZONE DIMENSIONS
RALPH M. HALL MUNICIPAL AIRPORT

Approach Visibility Minimums	Facilities Expected to Serve	Length	Inner Width	Outer Width	Acres
Visual and Not Lower than 1-Mile	Small Aircraft Exclusively	1,000'	250'	450'	8.035
	Aircraft Approach Categories A & B	1,000'	500'	700'	13.770

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

RUNWAY LINE OF SIGHT

An acceptable runway profile permits any two points (generally each runway end) 5 feet above the runway centerline to be mutually visible for the entire runway length. The sight distance along a runway from an intersecting taxiway needs to be sufficient to allow a taxiing aircraft to enter safely or cross the runway, in addition to seeing vehicles, wildlife, and other hazardous objects. However, if the runway offers a full-length parallel taxiway, an unobstructed line of sight may exist from any point 5 feet above the runway centerline to any other point 5 feet above the runway centerline for half the runway length. There are no line-of-sight requirements for taxiways. As mentioned in the *Inventory* chapter, the airport does not meet line-of-sight requirements due to the elevation point at the center of the runway. This center-point is approximately 14.8 feet above the Runway 35 end elevation and 11 feet above the Runway 17 end elevation. Continued diligence on the part of pilots and other operators to communicate effectively remains the best alternative to overcome this safety issue until the runway can be reconstructed and the runway profile corrected.

AIRSIDE DESIGN STANDARD DEFICIENCIES

Table 3-4, *Airport Design Standards*, summarizes the areas where the airport falls short of meeting FAA design standards for B-I airports. Currently, Runway 17/35 is deficient in runway width, runway-to-parallel taxiway centerline separation, runway centerline to holdlines, runway centerline to aircraft parking area, RSA, ROFA, ROFZ, taxiway width, TSA, and TOFA within proximity of the existing hangars. Remedies for each of these elements will be addressed in the following *Alternatives* chapter.

TABLE 3-4
AIRPORT DESIGN STANDARDS
RALPH M. HALL MUNICIPAL AIRPORT

Item	Runway 17/35	FAA Design Standard (B-I, Not Lower than ¾-mile vis. Min)
Runway Design		
Width	**45'**	60'
RSA Width	120'	120'
RSA Length Beyond R/W End	**50'/0'**	240'/240'
OFA Width	**380'**	400'
OFA Length Beyond R/W End	**50'/0'**	240'/240'
Obstacle Free Zone Width	250'	250'
Obstacle Free Zone Length	**0'/200'**	200'
Runway Setbacks - Runway Centerline to:		
Parallel Taxiway Centerline	**121'/157'/177'**	225'
Holdline	**100'**	200'
Aircraft Parking Area	**140'**	250'
Taxiway Design		
Width	**17'/23'**	25'
Safety Area Width	**25'**/49'	49'
Object Free Area Width	**60'**/89'	89'

Source: AC 150/5300-13A, *Airport Design*.
Bold type indicates design deficiency.

AIRFIELD LIGHTING AND MARKING REQUIREMENTS

Airport lighting is used to help maximize the utility of an airport during day, night, and adverse weather conditions. FAA Order 7021.2C, *Airport Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services* specifies minimum activity levels to qualify for visual and electronic navigational aids and equipment. A discussion of the recommended lighting systems for the Ralph M. Hall Municipal Airport follows.

RUNWAY LIGHTING/PAVEMENT MARKING

Pilot-controlled medium intensity runway lighting (MIRL) is recommended as the standard lighting system to define the lateral and longitudinal limits of the runway system. If a precision approach is considered at the airport, then high intensity runway lights (HIRL) along with an approach lighting system are recommended. Runway pavement markings should follow requirements as prescribed in FAA AC 150/5340-1J, *Standards for Airport Markings*.

Runway 17/35 is lighted with low intensity runway lights (LIRL) and marked with non-precision approach runway markings. New developments in LED technology have dramatically lowered the cost to maintain and operate runway lighting; however, the initial up-front cost is slightly more expensive. It is recommended any future runway lighting be LED-type fixtures.

TAXIWAY LIGHTING/PAVEMENT MARKING (MITL)

Medium intensity taxiway lights (MITL) are the recommended lighting system for all taxiway exit areas and turning radii. MITLs can also be pilot-controlled and wired to the same remote system as the runway lights. However, similar to runway lighting, new LED taxiway lighting technology is proving to be beneficial. While these lights do have a higher up-front cost, those that have been installed in the last five years are seeing a return on investment within three to five years through cost savings in power-use reductions. Taxiway edge reflectors can be used as a less expensive lighting alternative. In addition, all paved taxiways should be painted with standard taxiway markings as prescribed in FAA AC 150/5340-1J, *Standards for Airport Markings*. Currently, the airport does not have taxiway lighting; however, when funding allows for improving the runway/taxiway separation distance deficiency, it is recommended new LED MITLs be installed along the parallel taxiway and connector taxiways.

RUNWAY END IDENTIFIER LIGHTS (REIL)

This lighting system provides rapid and positive identification of the runway approach end, consisting of a pair of synchronized (directional) flashing white strobes located laterally along the runway threshold. REILs are typically installed along with threshold lights at each runway end. Currently, no REILs are in place on either end of Runway 17/35. REILs are not commonly needed unless an airport is situated within an area of heavy light pollution or adjacent to areas that would deem them necessary at specific times such as a lighted ball field, lighted rodeo grounds, etc.

VISUAL GUIDANCE INDICATORS (PRECISION APPROACH PATH INDICATORS – PAPI)

This lighting system emits a sequence of colored light beams providing continuous visual descent guidance information along the desired final approach descent path (normally at three degrees for three nautical miles during daytime, and up to five nautical miles at night) to the runway touchdown point. The system normally consists of two (PAPI-2) or four (PAPI-4) lamp housing units installed 600 to 800 feet from the runway threshold and offset 50 feet to the left of the runway edge. Due to the safety-enhancing capability a vertical guidance system a PAPI-2 provides, it is recommended for each runway. Evaluation of this element will be reviewed in the *Capital Improvements Program* chapter.

AIRPORT SIGNS

Standard airport signs provide runway and taxiway location, direction, and mandatory instructions for aircraft movement on the ground. A system of standard signs is recommended to indicate runway, taxiway, and aircraft-parking destinations. FAA AC 150/5345-44G, *Specifications for Taxiway and Runway Signs*, and FAA AC 150/5340-18D, *Standards for Airport Sign Systems*, should be followed for proper implementation of airport signs. The airport currently does not provide any guidance signs. This option is recommended when financially feasible or operationally necessary.

WIND CONE/SEGMENTED CIRCLE/AIRPORT BEACON

A segmented circle with a lighted wind cone, only required at airports with published non-standard traffic patterns, is recommended as the standard wind indicator and airport traffic pattern delineator. While the airport provides a wind cone and segmented circle at the northwest corner of the airfield, they are not lighted.

The airport rotating beacon is used for visual airport identification during nighttime hours, inclement weather, and low-visibility conditions. The beacon is located atop the hangar behind the terminal building on the east-side terminal area.

MAIN PARKING APRON LIGHTING

It is essential for safety and security that the main apron/ramp area be equipped with adequate lighting to illuminate the main aircraft parking, fueling, and hangar taxilane areas. Current lighting on the ramp is accomplished by four halogen lamps attached to adjacent hangars/buildings or power poles. Additional lighting is recommended for the safety of future terminal area operations. Numerous economical light fixtures are available that offer lighting solutions for the airport.

NAVIGATION SYSTEMS AND WEATHER AIDS

Airport navigation aids (NAVAIDs) are installed on or near an airport to increase the airport's accessibility during night and inclement weather conditions and to provide electronic guidance and visual references for executing an instrument approach to the airport or runway.

FAA Order 7021.2C, *Airport Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services*, specifies minimum activity levels to qualify for instrument approach equipment and approach procedures. As forecasted in the previous chapter, approximately 810 operations, or 3.2 percent, will be conducted under instrument conditions by the end of the 20-year planning period. The following describes the status of existing and new NAVAIDs that are, or could be, used at Ralph M. Hall Municipal Airport.

VERY HIGH FREQUENCY ONMI-DIRECTIONAL RADIO RANGE (VOR/VORTAC)

The VOR/VORTAC system emits a very high frequency radio signal utilized for both enroute navigation and non-precision approaches. It provides the instrument-rated pilot with 360 degrees of azimuth information oriented to magnetic north. Due to the recent development of more precise navigational systems, the FAA plans to phase out VORs. At this writing, the VOR decommissioning timetable is uncertain. There are many airports in the GA fleet that continue to use VOR navigation as their primary instrumentation. The nearest VORTAC to the airport is RANGER located 36 miles to the west.

NON-DIRECTIONAL BEACON (NDB)

The NDB emits a low to medium radio frequency equally in all directions whereby a pilot with the proper aircraft equipment can "home" on the signal or track to the station. Although the NDB is a low-cost navigational aid, it is, including the compass locator, being phased-out by the FAA (no longer eligible for AIP and F&E funds) due to the recent development of new and more precise navigational systems. The nearest NDB associated with the airport is the MESQUITE NDB, located at Mesquite Metro Airport.

GLOBAL POSITIONING SYSTEM (GPS)

GPS is a highly accurate worldwide satellite navigational system that is unaffected by weather and provides point-to-point navigation by encoding transmissions from multiple satellites and ground-based data-link stations using an airborne receiver. GPS is presently FAA-certified for en-route, and non-precision instrument approach navigation with precision instrument approaches based on GPS are being developed for commercial airports and coming online in the near future. The current program provides for GPS stand-alone and overlay approaches (GPS overlay approaches published for runways with existing VOR/DME, RNAV, and NDB approaches). Recently, the selective availability segment of the channel was decommissioned, thereby enhancing the accuracy of the GPS signal. The Wide Area Augmentation System (WAAS) is under final development and testing stages, and when it is installed at or near an airport, it provides a signal correction that enables GPS precision approaches. A straight-in area navigation instrument approach is available to both Runway 17 and 35 utilizing GPS signals and on-aircraft receivers to guide the pilot and aircraft to a safe landing at the airport.

AUTOMATED WEATHER OBSERVING SYSTEM (AWOS)/AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS)

Automated weather systems consist of various types of sensors, a processor, a computer-generated voice subsystem, and a transmitter to broadcast minute-by-minute weather data from a fixed location directly to the pilot. The information is transmitted over the voice portion of a local NAVAID (VOR or DME) or a discrete VHF radio frequency. The transmission is broadcast in 20-30 second messages in standard format, and the messages can be received within 25 nautical miles of the automated weather site.

AWOS/ASOS are significant for non-towered airports with instrument procedures to relay accurate and invaluable weather information to pilots. At airports with instrument procedures, an AWOS/ASOS weather report eliminates the remote altimeter setting penalty, thereby permitting lower minimum descent altitudes (lower approach minimums). These systems should be sited within 500 to 1,000 feet of the primary runway centerline.

FAA Order 6560.20B, *Siting Criteria for Automated Weather Observing Systems*, assists in the site planning for AWOS/ASOS systems. According to all pertinent airport-related information (Airport Facilities Directory, AirNav.com, FAA Form 5010), as well as a windshield survey, the airport is equipped with an AWOS-3 that meets all of the parameters of FAA Order 6560.20B. An AWOS was recently installed at the airfield, approximately 270 feet east of the runway and 700 feet north of the last shade T-hangar.

TERMINAL AREA AND LANDSIDE FACILITIES

The key terminal area requirements are developed in consideration of the following general landside design concepts:

- Future terminal area development for GA airports serving utility and larger-than-utility aircraft should be centralized.
- Planned development should allow for incremental linear expansion of facilities and services in a modular fashion along an established flightline. Major design considerations involve minimizing earthwork/grading, avoiding flood-prone areas, and integrating existing paved areas to reduce pavement (taxilane) costs.
- Future terminal expansion should allow sufficient maneuverability and accessibility for appropriate types (mix) of GA aircraft within secured access areas.
- Future terminal area development should enhance safety, visibility, and be aesthetically pleasing based on the airport's established minimum standards.
- Future facilities should accommodate the peak-month operations, passengers, and patrons at the airfield as identified in the forecast of aviation demand in the previous chapter.

TERMINAL BUILDING

The all-purpose terminal building serves both a functional and social capacity central to the operation, promotion, and identity of the airport. Toward these goals, the terminal building should provide the following facilities or accommodations: pilot/patron lobby or meet/greet area, radio communications through the CTAF, flight-planning facilities, ADA-compliant restrooms, sales counter for pilot and aircraft supplies, offices for FBO/airport management, pilot lounge, and local telephone service.

The airport's current terminal, pictured below, provides most of these facilities. However, the lounge and meeting area is shared with the flight-planning area. Additionally, the available unisex restroom may not be ADA compliant. There is an adequate sales counter for pilot supplies and purchase of aviation fuel/oil that is staffed during normal business hours by FBO personnel. Office space for the FBO is located behind the sales counter and provides ample space for airport management. There are two entrances, and neither is marked for those unfamiliar with the airfield.

AIRCRAFT STORAGE (HANGARS)

Existing and future hangar areas should achieve a balance between maintaining an unobstructed expansion area, minimizing pavement development, and allowing convenient access. For planning purposes, hangars should accommodate at least 95 percent of all based GA aircraft. Typically, single-engine aircraft demand 1,000 to 1,200 square feet; twin-propeller aircraft require 1,200 to 3,000 square feet; and business turboprop/jet aircraft require approximately 3,000 square feet. General hangar design considerations include the following:

- Construction of aircraft hangars beyond an established building restriction line (BRL) surrounding the runway and taxiway areas. Moreover, they must be built beyond the runway obstacle free zone (OFZ), runway and taxiway object free area (OFA), and remain clear of the FAR Part 77 Surfaces (Transitional, Approach and Primary) and Threshold Siting Surfaces.
- Maintain the minimum recommended clearance between T-hangars: 75 feet for one-way traffic and 125 feet for two-way traffic. Taxilanes supporting T-hangars should be no less than 25 feet wide. Individual paved approaches to each hangar stall are typically less costly but not preferred to paving the entire T-hangar access/ramp area.
- Construct additional hangar space to accommodate 95 percent of the based aircraft forecasts.
- Include interior and exterior lighting and electrical connections on new hangar construction. Block-style straight-unit T-hangars occupy more space but are generally preferred over nested T-hangars and can be extended more easily. Enclosed hangar storage with bi-fold doors is recommended.
- Ensure adequate drainage with minimal slope differential between the hangar door and taxilane. A hard-surfaced hangar floor is recommended, with less than one percent downward slope to the taxilane/ramp.
- Segregate hangar development based on the hangar type and function. From a planning standpoint, hangars should be centralized in terms of auto access and located along the established flight line to minimize costs associated with access, drainage, utilities, and automobile-parking expansion.

The airport provides hangar space for 100 percent of based aircraft; however, almost half of the based aircraft are stored in shade T-hangars and one-third of these aircraft owners are on a waiting list for enclosed hangars. All of the enclosed hangars are currently full and there are no plans to construct new enclosed hangars.

ON-APRON AIRCRAFT STORAGE (BASED AIRCRAFT/ITINERANT AIRCRAFT APRON)

Paved aircraft parking and tie-down areas should be provided for approximately 40 percent of the peak/design day itinerant aircraft, plus approximately 25 percent of the based aircraft. FAA airport planning criteria recommends 360 square yards (3,240 square feet) per itinerant aircraft space and approximately 400 square yards (3,600 square feet) per based aircraft. Other site-specific apron planning and design considerations include:

- Maintaining the apron area beyond all airfield safety areas per airport design requirements (RSA, OFA, RPZ, and OFZ).
- Preserving the minimum runway centerline-to-aircraft parking apron separation of 200 feet for ARC B-I with approach visibility minimums not lower than ¾-mile.
- Planning for sufficient aircraft taxiing and maneuvering space for entering and exiting the aircraft parking apron without risk of structural damage, and to allow two-way passing of aircraft leading to the connecting taxiway. It is preferable for the main aircraft apron to be located near the mid-section of the primary runway with sufficient space to allow for a continuation of building and hangar expansion adjacent to the terminal area flight line.

As reported in the *Inventory* chapter, the current aircraft parking apron is small with only 2,800 square yards accommodating three tiedowns and minor maneuvering space for based or itinerant aircraft to operate. Based on design recommendations, the existing apron should be nearly 22,000 square yards. Plans for apron expansion should be considered in the near future.

FUEL STORAGE REQUIREMENTS

Fuel storage requirements are based on existing fuel flowage and the forecast of annual operations, aircraft utilization, average fuel consumption rates, and forecast mix of GA aircraft. On average, the typical single-engine airplane consumes 12.0 gallons of fuel per hour and flies approximately 100 nautical miles (1.0 to 1.5 hours) per flight. Turbine aircraft generally fly greater distances, averaging 300 nautical miles and approximately 1.5 to 2.0 hours. Market conditions will determine the ultimate need for fuel tanks and their size. The photo below depicts typical above-ground aviation fuel storage and dispensing facility.

The following guidelines should be implemented when planning future airport fuel facilities:

- Aircraft fueling facilities should remain open continually (24-hour access), remain visible, and be within close proximity to the terminal building or FBO to enhance security and convenience.
- Fuel-storage capacity should be sufficient for average peak-hour month activity, which normally occurs during the summer months.
- Fueling systems should permit adequate wing-tip clearance to other structures, designated aircraft parking areas (tie-downs), maneuvering areas, and object free areas (OFA) associated with taxilane and taxiway centerlines.
- The FAA recommends locating the fuel facilities beyond the runway safety areas (RSA) and the building restriction line (BRL). All fuel storage tanks should be equipped with monitors to meet current state and federal environmental regulations and be sited in accordance with local fire codes.
- A dedicated fuel truck is typically used for Jet-A due to the liability associated with towing and maneuvering these expensive aircraft up to and in the vicinity of fueling facilities.
- Adequate truck transport access should be maintained to the fuel storage tanks for fuel delivery.
- The tanks should be capable of storing at least one month's supply of fuel to minimize delivery charges.

Current fuel storage and delivery, as described in the *Inventory* chapter, includes one 12,000-gallon under-ground AVGAS storage tank (UST), one 600-gallon AVGAS truck, and one 2,200-gallon Jet-A truck. There is also a hose/reel pump system for dispensing AVGAS directly from the UST. Fuel deliveries must be made via the airport access road on the east side of the airfield. This is a narrow asphalt road that terminates north of the UST and does not provide adequate maneuvering for the delivery transport truck to turn around without getting out onto the airfield.

FBO fuel sales records indicate that in 2011 nearly $200,000 and more than 41,000 gallons of AVGAS and Jet-A fuel was dispensed with a monthly average of more than 3,400 gallons. The FBO currently takes a partial load of Jet-A into the 2,200 gallon truck. Because of the partial load it is more costly. Future operational levels and cost savings indicate a need for additional fuel storage to avoid the airport having to take multiple fuel deliveries during a single month. Additional recommendations for fuel system improvements at Ralph M. Hall Municipal Airport include:

- 24-hour fuel dispensing system.
- Adequate aircraft maneuvering space near the fuel pumps.
- Construction of bollards around the above-ground fuel system.
- Containment parking for fuel delivery trucks and on-airport dispensing trucks.

AUTO PARKING, CIRCULATION, AND ACCESS REQUIREMENTS

Automobile parking requirements are calculated using 1.4 spaces per design-hour passenger, which is typical for non-towered GA airports. Based aircraft owners commonly park in their individual hangars while flying. Maintaining a dedicated public auto parking lot in close proximity to the terminal building to provide convenient access for pilots and passengers is essential. Auto parking, circulation, and access/security recommendations will be reviewed in the *Alternatives* chapter of this report.

FIXED BASE OPERATOR (FBO) AND AIRPORT SERVICES

At most GA airports across the country, the presence of an FBO operating on the field can pay dividends for not only pilots and based aircraft owners, but also for airport sponsors. As GA airports reach a given level of activity, typically more than 100 based aircraft, the sponsor provides a full or part-time airport manager to oversee day-to-day operations and represent the sponsor to airport tenants and patrons. At some airports, an FBO located on the field fills this role, which is the case at Ralph M. Hall Municipal Airport.

Rockwall Aviation, the FBO, provides day-to-day presence on the airfield, aircraft maintenance, sale of aviation fuel/oil and pilot supplies, and collection of hangar rent on city-owned hangars. The terminal building occupied by the FBO is serviceable and well maintained. Fueling service and pilot supplies are provided by the FBO during normal business hours from the terminal building. Rockwall Aviation's aircraft maintenance is a service provided to based and itinerant aircraft from hangars on both sides of the airfield with the primary hangar between the two northern shade T-hangars. The FBO appears to have a good maintenance business flow as two aircraft were undergoing repairs or inspection in the east-side hangar and as many as four aircraft were being worked on from the west-side hangar. Fuel sales by the FBO indicate a need for additional AVGAS storage. Additionally, the FBO has several positive comments listed on the AirNav webpage concerning both the fueling service and aircraft maintenance.

In addition to airport ownership, and capital support and oversight for the airport, the City owns the fuel storage tanks and all of the hangars on the east side of the airfield. Hangars on the west-side are privately owned, on leased property or via TTF arrangements. As the airport completes improvements and grows to accommodate additional traffic, the day-to-day oversight and responsibilities should shift from the FBO to the City. Based on the existing responsibilities of both the City and the FBO, long-term duties for each entity should be reconciled or renegotiated when warranted. A list of recommended future responsibilities is highlighted below.

- Proposed City/Airport Responsibilities
- On-site full- or part-time manager
- Providing an airport courtesy car for itinerant patrons
- Collecting hangar rents
- Hangar lease agreements/management
- Aircraft maintenance
- Mowing and maintaining grounds and terminal building
- Maintaining fuel storage tanks, on-apron dispensing, and delivery trucks
- Adhering to FAA/TxDOT standards and regulations
- Proposed FBO Responsibilities
- Flight training and supplies
- Secondary contact for airport-related items

SUMMARY OF AIRPORT TERMINAL AREA FACILITY REQUIREMENTS

Table 3.5, *Summary – Aviation Facility Requirements*, summarizes terminal area facility requirements to accommodate the GA activity projected for the airport during each of the three phases spanning the 20-year planning period. As the numbers on the following page indicate, the airport's current airside and landside facilities are inadequate for both the existing and itinerant forecast operations levels and will need to be expanded. On the airside, the terminal building and associated parking will need to expanded 1,400 square feet and 25 parking spaces, respectively. On the landside, the aircraft parking apron will need to be increased 9,300 square yards, hangar space will need to increase 4,400 square yards, and fuel storage tanks will need to be capable of accommodating an additional 10,100 gallons of fuel per month. A detailed illustration of these needs will be provided in the following *Alternatives* chapter.

TABLE 3-5
SUMMARY – AVIATION TERMINAL FACILITY NEEDS
RALPH M. HALL MUNICIPAL AIRPORT

Facility	2012	Phase 1 (0-5 Years)	Phase 2 (6-10 Years)	Phase 3 (11-20 Years)
Based Aircraft	71	76	81	92
Annual Operations	15,000	17,400	19,700	25,200
Terminal Building [2]				
Public Use Space	800 ft^2	1,200 ft^2	1,400 ft^2	1,700 ft^2
Lease Use Space	400 ft^2	800 ft^2	900 ft^2	1,100' ft^2
Total Building Space	1,200 ft^2	2,000 ft^2	2,300 ft^2	2,800 ft^2
Paved Auto Parking	3,000 ft^2	6,100 ft^2	8,100 ft^2	10,100 ft^2
Auto Parking Spaces	8-10	15	20	25
Aircraft Parking Apron [1]				
Based Apron	2,800 yds^2	5,200 yds^2	5,400 yds^2	6,200 yds^2
Itinerant Apron	2,800 yds^2	2,900 yds^2	3,700 yds^2	5,900 yds^2
Total Apron	2,800 yds^2	8,100 yds^2	9,100 yds^2	12,100 yds^2
Hangars				
T-Hangars	7,644 yds^2	8,700 yds^2	9,800 yds^2	11,000 yds^2
Executive/Corporate [3]	444 yds^2	1,300 yds^2	4,500 yds^2	5,000 yds^2
Through-the-Fence [4]	3,588 yds^2	3,588 yds^2	0 yds^2	0 yds^2
Total Hangar Space	11,676 yds^2	12,588 yds^2	14,300 yds^2	16,000 yds^2
Monthly Fuel Storage Needs				
AVGAS/100LL	4,800 gallons	5,700 gallons	6,900 gallons	9,100 gallons
Jet-A	500 gallons	700 gallons	1,200 gallons	1,700 gallons
Total Average Monthly Volume	5,300 gallons	6,400 gallons	8,100 gallons	10,800 gallons

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

[1] The existing aircraft parking apron does not differentiate between based and itinerant areas. Calculations are for single-and twin-engine aircraft weighing 12,500 pounds or less.

[2] Public and lease space does not necessarily need to be provided with the terminal facility. It can be accommodated in facilities such as FBO hangars, T-hangars, other individual hangars, etc.

[3] This type of hangar typically accommodates more than one aircraft.

[4] Assumes no new through-the-fence access will be granted. All new hangars will be constructed on airport property.

CHAPTER THREE: AIRPORT FACILITY REQUIREMENTS

INTRODUCTION

This chapter identifies the existing facilities and long-range requirements needed to meet the forecast demand as planned in accordance with Federal Aviation Administration (FAA) airport design standards and airspace criteria. Identifying a needed facility does not necessarily constitute a "requirement," but rather it is an "option" for facility improvements to accommodate existing and future aviation activity and for the airport to strive toward when meeting the recommended standards established by the FAA or state agency. Ultimately, market demand and the local airport sponsor will drive the requirements for construction and development at the airport.

Facility requirements can be grouped into two categories: airfield/airside and terminal area/landside. Airside facility components include runways, taxiways, NAVAIDs, airfield marking/signage, and lighting; terminal area components are comprised of hangars, terminal building, aircraft parking apron, fuel dispensing units, security, vehicular parking, and airport access requirements.

AIRPORT REFERENCE CODE (ARC) CLASSIFICATION

As previously mentioned in the *Inventory* chapter, the Airport Reference Code (ARC) for an airport, as described in FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, is a coding system to help identify and determine the appropriate design criteria for each airport. This ARC correlates the airport design and layout to the operational and physical characteristics of the critical/design aircraft. The ARC directly influences pertinent safety criteria such as runway length, runway width, runway/taxiway separation distances, building setbacks, size of required safety and object free areas, etc. The critical and/or design aircraft is based on the largest aircraft within a family of aircraft expected to operate at an airport on a regular basis. Regular basis is defined as a minimum of 500 operations (landings or takeoffs) per year by the FAA/TxDOT.

The ARC has two components. The first component, depicted by a letter (i.e., A, B, C, D, or E), is the aircraft approach category (AAC) and relates to aircraft approach speed based on operational characteristics. The second component, depicted by a Roman numeral (i.e., I, II, III, IV, V, or VI), is the airplane design group (ADG) and relates to aircraft wingspan and/or tail height. For example, a Beechcraft King Air 200, with an approach speed of 103 knots and wingspan of 54.5 feet, has an ARC of B-II, while a larger corporate jet such as the Gulfstream IV (G-IV/G450) exhibiting an approach speed of 145 knots and wingspan of 77.8 feet has an ARC of D-II. **Table 3-1**, *Airport Reference Code*, illustrates the components comprising the ARC.

TABLE 3-1
AIRPORT REFERENCE CODE
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Approach Category	
Category	**Speed**
A	< 91 Knots
B	91 - < 121 Knots
C	121 - <141 Knots
D	141 - < 166 Knots
E	≥ 166 Knots

Airplane Design Group [1]		
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

Source: FAA AC 150/5300-13A, *Airport Design*.
[1] When an aircraft falls into two different categories, the more demanding/restrictive of the two should be used/applied.

Currently, TxDOT, Aviation Division classifies the Ralph M. Hall Municipal Airport as a Community Service airport, $\leq$ 12,500 pounds, with a current and future ARC of B-I. This is consistent with the information provided on the latest approved Airport Layout Drawing (ALD). A review of the existing airport configuration, setbacks, and safety areas confirms that ARC B-I is the current designation for the airport. A breakdown and comparison of ARCs and similar-type aircraft can be seen in the following illustration, **Figure 3-1**, *Comparison of Airport Reference Code Aircraft*.

FIGURE 3-1
COMPARISON OF AIRPORT REFERENCE CODE AIRCRAFT
RALPH M. HALL MUNICIPAL AIRPORT

Source: Garver aircraft performance files.

RUNWAY REQUIREMENTS

RUNWAY LENGTH

FAA AC 150/5325-4B, *Runway Length Requirements*, provides guidance to help determine the recommended runway lengths for an airport, which is predicated on the ARC category of aircraft using an airport. By design, the primary runway is typically the longest runway, has the most favorable wind conditions, provides the greatest pavement strength, and has the lowest straight-in instrument approach minimums. Presently, Runway 17/35 is 3,373 feet long and 45 feet wide. **Table 3.2**, *Runway Length Requirements*, shows the runway design lengths for Ralph M. Hall Municipal Airport.

TABLE 3-2
RUNWAY LENGTH REQUIREMENTS
RALPH M. HALL MUNICIPAL AIRPORT

Aircraft Category	Length	Deficiency
Small aircraft with less than 10 seats		
95% of small aircraft fleet	3,300'	0'
100% of small aircraft fleet	4,000'	627'
Aircraft between 12,500 and 60,000 pounds		
75% of fleet at 60% useful load	5,500'	2,127'
75% of fleet at 90% useful load	7,100'	3,727'
100% of fleet at 60% useful load	5,800'	2,427'
100% of fleet at 90% useful load	9,200'	5,827'

Source: AC 150/5325-4B, *Runway Length Requirements for Airport Design*, Figures 3-1 and 3-2.
Generalized length only. Actual length requirements/need should be calculated based on the specific aircraft's operational nomographs.
Useful load refers to all usable fuel, passengers, and cargo.
Calculations based on 574' airport elevation and mean maximum daily temperature of 95˚F.
Figures are increased 10 feet for each foot of elevation difference between high and low points of runway centerline.

Runway 17/35 meets the length requirements for 95 percent of the small-aircraft GA fleet with less than 10 seats; however, the runway length is deficient in accommodating the remaining groups of aircraft identified in the AC nomographs. Any future runway improvements to accommodate a wider use by all categories of GA aircraft should be depicted on an approved ALD and will require justification and approval through TxDOT before any funding assistance is granted.

Actual runway length is a function of elevation, temperature, and stage length. As temperatures change, the runway length requirements change accordingly. Thus, if a runway is designed to accommodate 75 percent of the fleet at 60 percent useful load, this does not prevent larger aircraft from utilizing the runway at certain times and during specific climatic conditions and aircraft operating parameters. However, the amount of time such operations can safely occur is restricted. These design runway lengths do not absolve the pilot from calculating the specific runway length needed to conduct a safe take-off or landing for the specific aircraft being operated during current weather conditions at the airfield.

RUNWAY WIDTH

Similar to runway length, minimum runway width is promulgated by criteria set forth in FAA AC 150/5300-13A, *Airport Design*. Design criteria states an airport with a B-I reference code should have a minimum runway width of 60 feet. Currently, the airport's runway width of 45 feet is deficient by 15 feet and does not meet either FAA or TxDOT standards. This deficiency should be a priority for remediation when financially feasible and when funding becomes available.

RUNWAY STRENGTH

The runway pavement strength for the airport is rated at 12,000 pounds for single-wheel aircraft. While there is no set standard for pavement strength, design criteria categorize aircraft as either small aircraft (12,500 pounds or less) or large aircraft (12,500 pounds or greater). When airports consistently attract large aircraft (greater than 12,500 pounds with at least 500 annual operations), pavement strength is based on that particular aircraft. Ralph M. Hall Municipal does not exceed the 12,500-pound threshold. When the runway is widened to 60 feet, it is recommended that the pavement strength support existing and forecast aircraft types with minimum pavement strength of 12,500 pounds (single wheel gear (SWG) configuration) with a recommended increase, as demand warrants, to 30,000 pounds SWG.

AIRFIELD DESIGN STANDARDS

Compliance with airport design standards is required to maintain a minimum level of operational safety. The major airport design elements, as follows, are established from FAA AC 150/5300-13A, *Airport Design* and Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*, and design elements should conform with FAA airport design criteria without modification to standards.

RUNWAY SAFETY AREA (RSA) AND TAXIWAY SAFETY AREA (TSA)

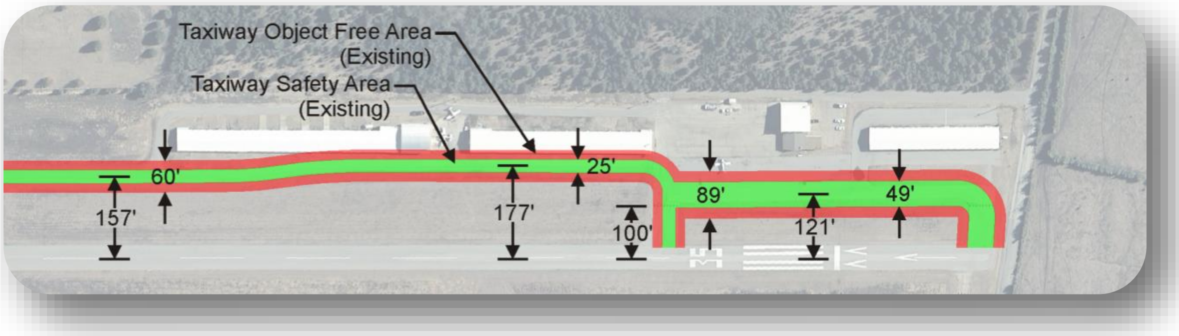
The RSA/TSA is a two-dimensional area surrounding and extending beyond the runway and taxiway centerlines. This safety area is provided to reduce the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway or taxiway. In addition, it must be cleared and free of objects except those required for air navigation and graded to transverse and longitudinal standards to prevent water accumulation, as consistent with local drainage requirements. Under dry conditions, the RSA/TSA must support emergency equipment and aircraft without causing structural damage or injury to the occupants. The airport must own the entire RSA/TSA in “fee simple” title.

Based on FAA ARC B-I design standards, the RSA should extend beyond the end of the runway for 240 feet and have a width of 120 feet. The Runway 17/35 RSA lengths beyond the pavement end and width do not meet design standards. The current RSA available beyond the Runway 35 end is zero while beyond the Runway 17 end only 50 feet is available. Steep slopes north of the Runway 17 end and the road beyond the Runway 35 end prevent the airport from meeting RSA length standards. Slopes along the runway’s east side north of the displaced threshold do not allow the RSA design standards to be met. However, the RSA length standard may be met within the existing displaced thresholds through the implementation of “Declared Distances.” Declared Distances inform pilots to account for a reduction in the published runway length during takeoff and landing. The RSA lateral slope standards may not be met through Declared Distances. A topographic ground survey of this area is recommended to determine the area that meets lateral slope standards, allowing for an accurate application of Declared Distances. Additional information pertaining to this deficiency will be addressed in the *Alternatives* chapter.

Based on FAA design standards for B-I airports designed for small aircraft only, the runway-to-taxiway separation standard is 150 feet with a TSA width of 49 feet. However, when the airport is designed to serve some larger aircraft that weigh in excess of 12,500 pounds, the runway-to-taxiway separation standard widens out to 225 feet while the TSA width remains 49 feet. The airport partially meets the design standards for runway-to-taxiway separation except along the southern 635 feet where the separation measures approximately 121 feet. If the airport were to plan to support large aircraft, the location of the northern shade hangars, terminal building, and propone tank encroach on these standards and the airport does not meet these TSA design standards. **Figures 3-2, 3-3,** and **3-4** depict the existing conditions, existing standards, and future standard conditions for the parallel taxiway system and TSA.

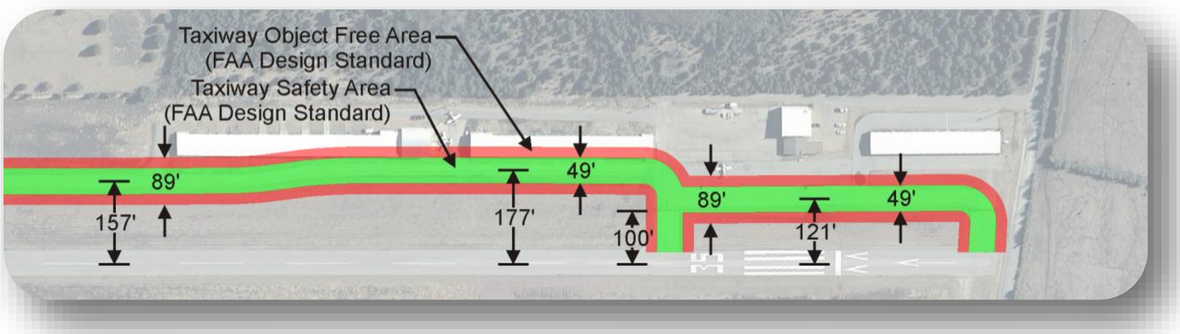
With the establishment of non-precision instrument approach procedures, the airport’s parallel taxiway no longer meets separation standards and should be reconstructed at an offset of 225 feet. Additional information pertaining to this deficiency will be addressed in the *Alternatives* chapter.

FIGURE 3-2
PARALLEL TAXIWAY EXISTING TSA/TOFA
RALPH M. HALL MUNICIPAL AIRPORT



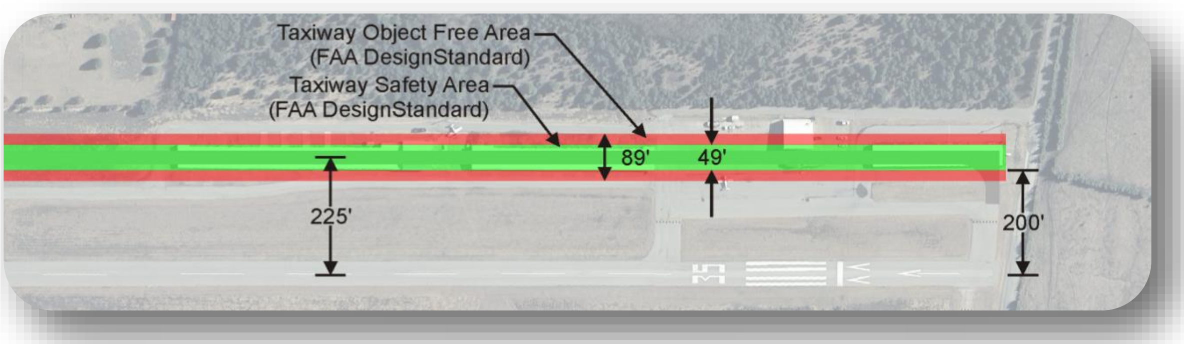
Source: Garver, 2012

FIGURE 3-3
PARALLEL TAXIWAY EXISTING TSA/TOFA STANDARDS
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

FIGURE 3-4
FUTURE PARALLEL TAXIWAY AND STANDARD TSA/TOFA
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

OBJECT FREE AREA (OFA)

The OFA is a two-dimensional area surrounding runways, taxiways, and taxilanes. It must remain clear of objects except those used for air navigation or aircraft ground maneuvering purposes, and it requires clearance of above-ground objects protruding higher than the runway edge elevation at an adjacent point within the OFA. An object is considered any ground structure, navigational aid, person, equipment, terrain, or parked aircraft. The airport must own the entire OFA in "fee simple" title.

The ARC B-I exclusively small aircraft runway object free area (ROFA) width standard is 250 feet while the ARC B-I OFA width of 400 feet applies to airports that are or could be supporting operations by aircraft weighing more than 12,500 pounds. The ROFA length beyond pavement end is prescribed at 240 feet for both cases. The airport meets the small aircraft only ROFA width standards; however, it does not meet the ROFA requirement length of 240 feet beyond each runway end nor does it meet the 400-foot ROFA width. Similar to the RSA, the airport will need to implement Declared Distances to achieve this requirement until such time as ROFA standards can be achieved. **Figures 3-5** and **3-6** depict this data. This need will be addressed in the *Alternatives* chapter.

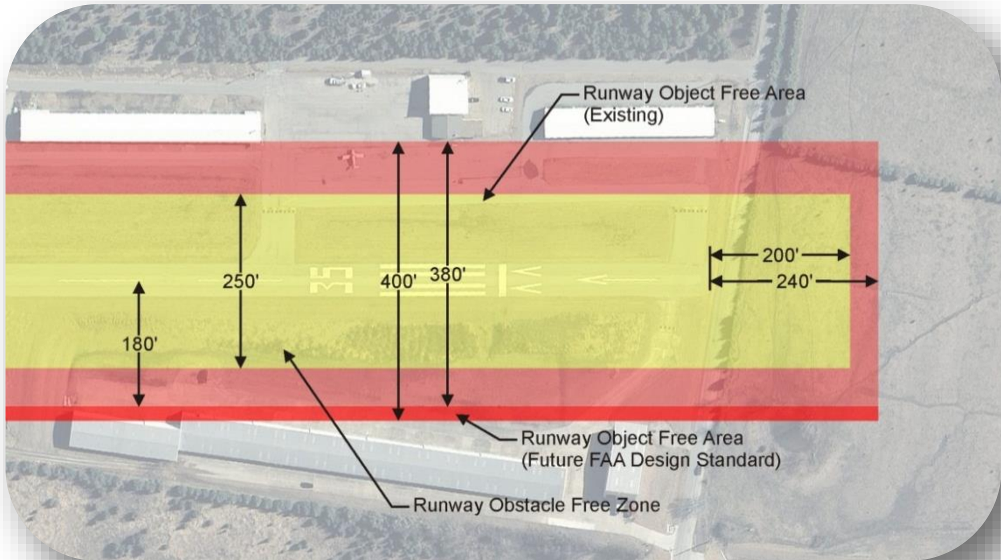
The taxiway object free area (TOFA) standard width is 89 feet. The airport does not meet this standard as a result of the existing shade hangars, terminal building, and propone tank. When future development warrants, the portion of non-compliant taxiway should be reconstructed at the correct design separation, and any future buildings will be located beyond the TOFA.

OBSTACLE FREE ZONE (OFZ)

The OFZ is airspace above a surface centered on the runway centerline, and it precludes taxiing and parked airplanes and object penetrations except for frangible post-mounted NAVAIDs expressly located in the OFZ by function. Based on existing facilities and operations, only the Runway OFZ is applicable. The length of the OFZ is fixed at 200 feet beyond the associated runway end. The width depends on the size of aircraft served by the airport and runway approach visibility minimums. The current and future runway OFZ standard width is 250 feet. The location of Airport Road south of the Runway 35 end prohibits meeting the existing OFZ standards and should be addressed at the next major runway project

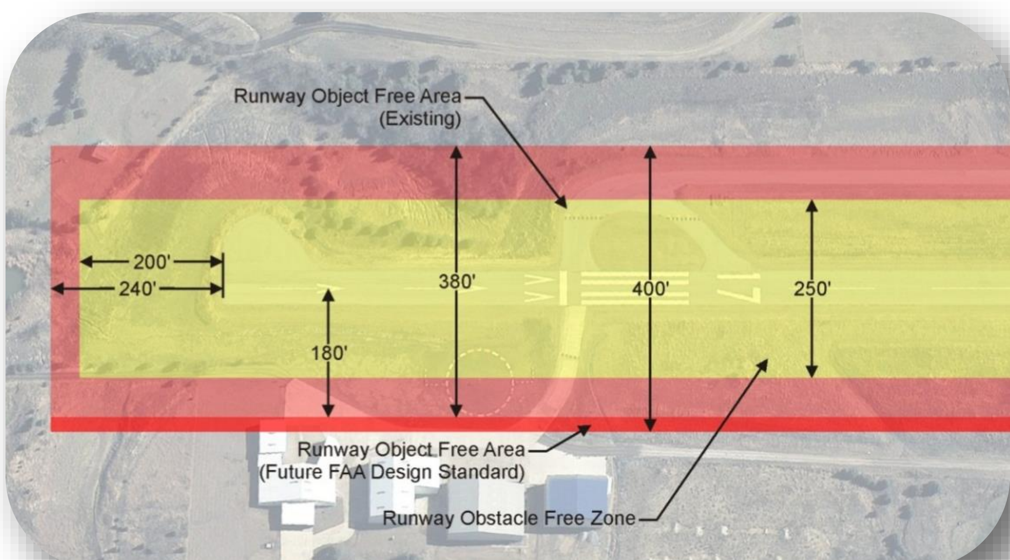
In the past the airport has served aircraft weighing more than 12,500 pounds. The community is actively and aggressively marketing the airport to existing and potential businesses. Consideration should be given to meeting the next level of standard in the future in anticipation of greater airport utilization by aircraft weighing more than 12,500 pounds and meeting the economic growth already present in Rockwall. The runway OFZ standard is not correctable through the application of Declared Distances.

FIGURE 3-5
RUNWAY 35 OFZ/OFA – EXISTING AND STANDARD
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

FIGURE 3-6
RUNWAY 17 OFZ/OFA – EXISTING AND STANDARD
RALPH M. HALL MUNICIPAL AIRPORT



Source: Garver, 2012

BUILDING RESTRICTION LINE (BRL)

The BRL represents the boundary that separates the airside and landside facilities and identifies recommended building area locations based on airspace and visibility criteria. The BRL is established with reference to the FAR Part 77 primary and transitional surfaces, as well as the airfield safety areas. Based on the activity at the field, instrument approach types (not lower than ¾-mile), and ARC designation, a recommended BRL is 425 feet from the runway centerline providing 25 feet of structure height clearance. If a new instrument approach with lower than ¾-mile visibility minimums is developed and implemented in the future, this distance would increase to 675 feet for a 25-foot building height. Similar to the above-mentioned safety criteria, the current facilities locations are at or inside the recommended BRL. When new development or terminal redevelopment occurs, it is imperative the airport ensure new structures are constructed in a way that does not create additional or new obstructions to the FAR Part 77 airspace surfaces.

RUNWAY APPROACH SURFACE

The approach surface is a three-dimensional trapezoidal FAR Part 77 imaginary surface extending beyond each runway end and has a defined slope requiring clearance over structures and objects beyond the runway threshold. The purpose of the approach surface is to provide proper clearance for the safe approach and landing of aircraft. The existing approach surface begins 200 feet from each displaced threshold. At this point it is 500 feet wide at the inner location with a 5,000-foot depth/length, and a 2,000-foot outer width.

While FAR Part 77 provides the basic framework to identify existing obstructions within the vicinity of the airport, the FAA recently published new airspace criteria for vertically or non-vertically guided approaches to airports. This new criteria provides guidelines and specifications for listing obstructions in support of the new Airports Geographic Information System (A-GIS) initiative and can be found in AC 150/5300-18B. Until this new program is completely up and operational, it is uncertain what affect it will have on airports and how it will be applied in a cost-effective manner.

RUNWAY PROTECTION ZONE (RPZ)

The RPZ is a two-dimensional trapezoid area beginning 200 feet beyond the paved runway end and extends along the runway centerline. The purpose of the RPZ is to enhance the protection of people and property on the ground and to prevent potentially hazardous obstructions to aircraft operations. RPZ dimensions are determined by the type of aircraft expected to operate at an airport or on a specific runway (small or large) and the type of approach planned for the runway ends (visual, precision, or non-precision). The recommended visibility minimums for the runway ends are determined with respect to published instrument approach procedures, the ultimate runway ARC, airfield design standards, instrument meteorological conditions, wind conditions, and physical constraints (approach slope clearance) beyond the extended runway centerline. The FAA recommends that airports own the entire RPZ in "*fee simple*" title and that the RPZ be clear of any non-aeronautical structure or object that would interfere with the arrival and departure of aircraft. However, if "fee simple" interest is unachievable, the next best option is controlling the heights of objects through an avigation easement. While some automobile parking is allowable within the RPZ, provided they are outside the central portion, other land uses such as residences, fuel facilities, and places of public gathering (i.e., churches, schools, hospital, office buildings, and shopping centers) are not permitted within the RPZ. FAA interim guidance (Sept 2012) addressed the allowance of public roadways and rail lines in RPZs. The interim guidance indicates that if a runway end location changes every effort should be made to limit or eliminate public roads and rail lines from the central portion of the RPZ. **Table 3-3**, *Runway Protection Zone Dimensions*, delineates the RPZ requirements. The current RPZ dimensions for Runway 17/35 are 500' x 1,000' x 700' and extend beyond existing airport property. A portion of this property is controlled through easements owned by the City.

TABLE 3-3
RUNWAY PROTECTION ZONE DIMENSIONS
RALPH M. HALL MUNICIPAL AIRPORT

Approach Visibility Minimums	Facilities Expected to Serve	Length	Inner Width	Outer Width	Acres
Visual and Not Lower than 1-Mile	Small Aircraft Exclusively	1,000'	250'	450'	8.035
	Aircraft Approach Categories A & B	1,000'	500'	700'	13.770

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

RUNWAY LINE OF SIGHT

An acceptable runway profile permits any two points (generally each runway end) 5 feet above the runway centerline to be mutually visible for the entire runway length. The sight distance along a runway from an intersecting taxiway needs to be sufficient to allow a taxiing aircraft to enter safely or cross the runway, in addition to seeing vehicles, wildlife, and other hazardous objects. However, if the runway offers a full-length parallel taxiway, an unobstructed line of sight may exist from any point 5 feet above the runway centerline to any other point 5 feet above the runway centerline for half the runway length. There are no line-of-sight requirements for taxiways. As mentioned in the *Inventory* chapter, the airport does not meet line-of-sight requirements due to the elevation point at the center of the runway. This center-point is approximately 14.8 feet above the Runway 35 end elevation and 11 feet above the Runway 17 end elevation. Continued diligence on the part of pilots and other operators to communicate effectively remains the best alternative to overcome this safety issue until the runway can be reconstructed and the runway profile corrected.

AIRSIDE DESIGN STANDARD DEFICIENCIES

Table 3-4, *Airport Design Standards*, summarizes the areas where the airport falls short of meeting FAA design standards for B-I airports. Currently, Runway 17/35 is deficient in runway width, runway-to-parallel taxiway centerline separation, runway centerline to holdlines, runway centerline to aircraft parking area, RSA, ROFA, ROFZ, taxiway width, TSA, and TOFA within proximity of the existing hangars. Remedies for each of these elements will be addressed in the following *Alternatives* chapter.

TABLE 3-4
AIRPORT DESIGN STANDARDS
RALPH M. HALL MUNICIPAL AIRPORT

Item	Runway 17/35	FAA Design Standard (B-I, Not Lower than ¾-mile vis. Min)
Runway Design		
Width	**45'**	60'
RSA Width	120'	120'
RSA Length Beyond R/W End	**50'/0'**	240'/240'
OFA Width	**380'**	400'
OFA Length Beyond R/W End	**50'/0'**	240'/240'
Obstacle Free Zone Width	250'	250'
Obstacle Free Zone Length	**0'/200'**	200'
Runway Setbacks - Runway Centerline to:		
Parallel Taxiway Centerline	**121'/157'/177'**	225'
Holdline	**100'**	200'
Aircraft Parking Area	**140'**	250'
Taxiway Design		
Width	**17'/23'**	25'
Safety Area Width	**25'**/49'	49'
Object Free Area Width	**60'**/89'	89'

Source: AC 150/5300-13A, *Airport Design*.
Bold type indicates design deficiency.

AIRFIELD LIGHTING AND MARKING REQUIREMENTS

Airport lighting is used to help maximize the utility of an airport during day, night, and adverse weather conditions. FAA Order 7021.2C, *Airport Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services* specifies minimum activity levels to qualify for visual and electronic navigational aids and equipment. A discussion of the recommended lighting systems for the Ralph M. Hall Municipal Airport follows.

RUNWAY LIGHTING/PAVEMENT MARKING

Pilot-controlled medium intensity runway lighting (MIRL) is recommended as the standard lighting system to define the lateral and longitudinal limits of the runway system. If a precision approach is considered at the airport, then high intensity runway lights (HIRL) along with an approach lighting system are recommended. Runway pavement markings should follow requirements as prescribed in FAA AC 150/5340-1J, *Standards for Airport Markings*.

Runway 17/35 is lighted with low intensity runway lights (LIRL) and marked with non-precision approach runway markings. New developments in LED technology have dramatically lowered the cost to maintain and operate runway lighting; however, the initial up-front cost is slightly more expensive. It is recommended any future runway lighting be LED-type fixtures.

TAXIWAY LIGHTING/PAVEMENT MARKING (MITL)

Medium intensity taxiway lights (MITL) are the recommended lighting system for all taxiway exit areas and turning radii. MITLs can also be pilot-controlled and wired to the same remote system as the runway lights. However, similar to runway lighting, new LED taxiway lighting technology is proving to be beneficial. While these lights do have a higher up-front cost, those that have been installed in the last five years are seeing a return on investment within three to five years through cost savings in power-use reductions. Taxiway edge reflectors can be used as a less expensive lighting alternative. In addition, all paved taxiways should be painted with standard taxiway markings as prescribed in FAA AC 150/5340-1J, *Standards for Airport Markings*. Currently, the airport does not have taxiway lighting; however, when funding allows for improving the runway/taxiway separation distance deficiency, it is recommended new LED MITLs be installed along the parallel taxiway and connector taxiways.

RUNWAY END IDENTIFIER LIGHTS (REIL)

This lighting system provides rapid and positive identification of the runway approach end, consisting of a pair of synchronized (directional) flashing white strobes located laterally along the runway threshold. REILs are typically installed along with threshold lights at each runway end. Currently, no REILs are in place on either end of Runway 17/35. REILs are not commonly needed unless an airport is situated within an area of heavy light pollution or adjacent to areas that would deem them necessary at specific times such as a lighted ball field, lighted rodeo grounds, etc.

VISUAL GUIDANCE INDICATORS (PRECISION APPROACH PATH INDICATORS – PAPI)

This lighting system emits a sequence of colored light beams providing continuous visual descent guidance information along the desired final approach descent path (normally at three degrees for three nautical miles during daytime, and up to five nautical miles at night) to the runway touchdown point. The system normally consists of two (PAPI-2) or four (PAPI-4) lamp housing units installed 600 to 800 feet from the runway threshold and offset 50 feet to the left of the runway edge. Due to the safety-enhancing capability a vertical guidance system a PAPI-2 provides, it is recommended for each runway. Evaluation of this element will be reviewed in the *Capital Improvements Program* chapter.

AIRPORT SIGNS

Standard airport signs provide runway and taxiway location, direction, and mandatory instructions for aircraft movement on the ground. A system of standard signs is recommended to indicate runway, taxiway, and aircraft-parking destinations. FAA AC 150/5345-44G, *Specifications for Taxiway and Runway Signs*, and FAA AC 150/5340-18D, *Standards for Airport Sign Systems*, should be followed for proper implementation of airport signs. The airport currently does not provide any guidance signs. This option is recommended when financially feasible or operationally necessary.

WIND CONE/SEGMENTED CIRCLE/AIRPORT BEACON

A segmented circle with a lighted wind cone, only required at airports with published non-standard traffic patterns, is recommended as the standard wind indicator and airport traffic pattern delineator. While the airport provides a wind cone and segmented circle at the northwest corner of the airfield, they are not lighted.

The airport rotating beacon is used for visual airport identification during nighttime hours, inclement weather, and low-visibility conditions. The beacon is located atop the hangar behind the terminal building on the east-side terminal area.

MAIN PARKING APRON LIGHTING

It is essential for safety and security that the main apron/ramp area be equipped with adequate lighting to illuminate the main aircraft parking, fueling, and hangar taxilane areas. Current lighting on the ramp is accomplished by four halogen lamps attached to adjacent hangars/buildings or power poles. Additional lighting is recommended for the safety of future terminal area operations. Numerous economical light fixtures are available that offer lighting solutions for the airport.

NAVIGATION SYSTEMS AND WEATHER AIDS

Airport navigation aids (NAVAIDs) are installed on or near an airport to increase the airport's accessibility during night and inclement weather conditions and to provide electronic guidance and visual references for executing an instrument approach to the airport or runway.

FAA Order 7021.2C, *Airport Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services*, specifies minimum activity levels to qualify for instrument approach equipment and approach procedures. As forecasted in the previous chapter, approximately 810 operations, or 3.2 percent, will be conducted under instrument conditions by the end of the 20-year planning period. The following describes the status of existing and new NAVAIDs that are, or could be, used at Ralph M. Hall Municipal Airport.

VERY HIGH FREQUENCY ONMI-DIRECTIONAL RADIO RANGE (VOR/VORTAC)

The VOR/VORTAC system emits a very high frequency radio signal utilized for both enroute navigation and non-precision approaches. It provides the instrument-rated pilot with 360 degrees of azimuth information oriented to magnetic north. Due to the recent development of more precise navigational systems, the FAA plans to phase out VORs. At this writing, the VOR decommissioning timetable is uncertain. There are many airports in the GA fleet that continue to use VOR navigation as their primary instrumentation. The nearest VORTAC to the airport is RANGER located 36 miles to the west.

NON-DIRECTIONAL BEACON (NDB)

The NDB emits a low to medium radio frequency equally in all directions whereby a pilot with the proper aircraft equipment can "home" on the signal or track to the station. Although the NDB is a low-cost navigational aid, it is, including the compass locator, being phased-out by the FAA (no longer eligible for AIP and F&E funds) due to the recent development of new and more precise navigational systems. The nearest NDB associated with the airport is the MESQUITE NDB, located at Mesquite Metro Airport.

GLOBAL POSITIONING SYSTEM (GPS)

GPS is a highly accurate worldwide satellite navigational system that is unaffected by weather and provides point-to-point navigation by encoding transmissions from multiple satellites and ground-based data-link stations using an airborne receiver. GPS is presently FAA-certified for en-route, and non-precision instrument approach navigation with precision instrument approaches based on GPS are being developed for commercial airports and coming online in the near future. The current program provides for GPS stand-alone and overlay approaches (GPS overlay approaches published for runways with existing VOR/DME, RNAV, and NDB approaches). Recently, the selective availability segment of the channel was decommissioned, thereby enhancing the accuracy of the GPS signal. The Wide Area Augmentation System (WAAS) is under final development and testing stages, and when it is installed at or near an airport, it provides a signal correction that enables GPS precision approaches. A straight-in area navigation instrument approach is available to both Runway 17 and 35 utilizing GPS signals and on-aircraft receivers to guide the pilot and aircraft to a safe landing at the airport.

AUTOMATED WEATHER OBSERVING SYSTEM (AWOS)/AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS)

Automated weather systems consist of various types of sensors, a processor, a computer-generated voice subsystem, and a transmitter to broadcast minute-by-minute weather data from a fixed location directly to the pilot. The information is transmitted over the voice portion of a local NAVAID (VOR or DME) or a discrete VHF radio frequency. The transmission is broadcast in 20-30 second messages in standard format, and the messages can be received within 25 nautical miles of the automated weather site.

AWOS/ASOS are significant for non-towered airports with instrument procedures to relay accurate and invaluable weather information to pilots. At airports with instrument procedures, an AWOS/ASOS weather report eliminates the remote altimeter setting penalty, thereby permitting lower minimum descent altitudes (lower approach minimums). These systems should be sited within 500 to 1,000 feet of the primary runway centerline.

FAA Order 6560.20B, *Siting Criteria for Automated Weather Observing Systems*, assists in the site planning for AWOS/ASOS systems. According to all pertinent airport-related information (Airport Facilities Directory, AirNav.com, FAA Form 5010), as well as a windshield survey, the airport is equipped with an AWOS-3 that meets all of the parameters of FAA Order 6560.20B. An AWOS was recently installed at the airfield, approximately 270 feet east of the runway and 700 feet north of the last shade T-hangar.

TERMINAL AREA AND LANDSIDE FACILITIES

The key terminal area requirements are developed in consideration of the following general landside design concepts:

- Future terminal area development for GA airports serving utility and larger-than-utility aircraft should be centralized.
- Planned development should allow for incremental linear expansion of facilities and services in a modular fashion along an established flightline. Major design considerations involve minimizing earthwork/grading, avoiding flood-prone areas, and integrating existing paved areas to reduce pavement (taxilane) costs.
- Future terminal expansion should allow sufficient maneuverability and accessibility for appropriate types (mix) of GA aircraft within secured access areas.
- Future terminal area development should enhance safety, visibility, and be aesthetically pleasing based on the airport's established minimum standards.
- Future facilities should accommodate the peak-month operations, passengers, and patrons at the airfield as identified in the forecast of aviation demand in the previous chapter.

TERMINAL BUILDING

The all-purpose terminal building serves both a functional and social capacity central to the operation, promotion, and identity of the airport. Toward these goals, the terminal building should provide the following facilities or accommodations: pilot/patron lobby or meet/greet area, radio communications through the CTAF, flight-planning facilities, ADA-compliant restrooms, sales counter for pilot and aircraft supplies, offices for FBO/airport management, pilot lounge, and local telephone service.

The airport's current terminal, pictured below, provides most of these facilities. However, the lounge and meeting area is shared with the flight-planning area. Additionally, the available unisex restroom may not be ADA compliant. There is an adequate sales counter for pilot supplies and purchase of aviation fuel/oil that is staffed during normal business hours by FBO personnel. Office space for the FBO is located behind the sales counter and provides ample space for airport management. There are two entrances, and neither is marked for those unfamiliar with the airfield.

AIRCRAFT STORAGE (HANGARS)

Existing and future hangar areas should achieve a balance between maintaining an unobstructed expansion area, minimizing pavement development, and allowing convenient access. For planning purposes, hangars should accommodate at least 95 percent of all based GA aircraft. Typically, single-engine aircraft demand 1,000 to 1,200 square feet; twin-propeller aircraft require 1,200 to 3,000 square feet; and business turboprop/jet aircraft require approximately 3,000 square feet. General hangar design considerations include the following:

- Construction of aircraft hangars beyond an established building restriction line (BRL) surrounding the runway and taxiway areas. Moreover, they must be built beyond the runway obstacle free zone (OFZ), runway and taxiway object free area (OFA), and remain clear of the FAR Part 77 Surfaces (Transitional, Approach and Primary) and Threshold Siting Surfaces.
- Maintain the minimum recommended clearance between T-hangars: 75 feet for one-way traffic and 125 feet for two-way traffic. Taxilanes supporting T-hangars should be no less than 25 feet wide. Individual paved approaches to each hangar stall are typically less costly but not preferred to paving the entire T-hangar access/ramp area.
- Construct additional hangar space to accommodate 95 percent of the based aircraft forecasts.
- Include interior and exterior lighting and electrical connections on new hangar construction. Block-style straight-unit T-hangars occupy more space but are generally preferred over nested T-hangars and can be extended more easily. Enclosed hangar storage with bi-fold doors is recommended.
- Ensure adequate drainage with minimal slope differential between the hangar door and taxilane. A hard-surfaced hangar floor is recommended, with less than one percent downward slope to the taxilane/ramp.
- Segregate hangar development based on the hangar type and function. From a planning standpoint, hangars should be centralized in terms of auto access and located along the established flight line to minimize costs associated with access, drainage, utilities, and automobile-parking expansion.

The airport provides hangar space for 100 percent of based aircraft; however, almost half of the based aircraft are stored in shade T-hangars and one-third of these aircraft owners are on a waiting list for enclosed hangars. All of the enclosed hangars are currently full and there are no plans to construct new enclosed hangars.

ON-APRON AIRCRAFT STORAGE (BASED AIRCRAFT/ITINERANT AIRCRAFT APRON)

Paved aircraft parking and tie-down areas should be provided for approximately 40 percent of the peak/design day itinerant aircraft, plus approximately 25 percent of the based aircraft. FAA airport planning criteria recommends 360 square yards (3,240 square feet) per itinerant aircraft space and approximately 400 square yards (3,600 square feet) per based aircraft. Other site-specific apron planning and design considerations include:

- Maintaining the apron area beyond all airfield safety areas per airport design requirements (RSA, OFA, RPZ, and OFZ).
- Preserving the minimum runway centerline-to-aircraft parking apron separation of 200 feet for ARC B-I with approach visibility minimums not lower than ¾-mile.
- Planning for sufficient aircraft taxiing and maneuvering space for entering and exiting the aircraft parking apron without risk of structural damage, and to allow two-way passing of aircraft leading to the connecting taxiway. It is preferable for the main aircraft apron to be located near the mid-section of the primary runway with sufficient space to allow for a continuation of building and hangar expansion adjacent to the terminal area flight line.

As reported in the *Inventory* chapter, the current aircraft parking apron is small with only 2,800 square yards accommodating three tiedowns and minor maneuvering space for based or itinerant aircraft to operate. Based on design recommendations, the existing apron should be nearly 22,000 square yards. Plans for apron expansion should be considered in the near future.

FUEL STORAGE REQUIREMENTS

Fuel storage requirements are based on existing fuel flowage and the forecast of annual operations, aircraft utilization, average fuel consumption rates, and forecast mix of GA aircraft. On average, the typical single-engine airplane consumes 12.0 gallons of fuel per hour and flies approximately 100 nautical miles (1.0 to 1.5 hours) per flight. Turbine aircraft generally fly greater distances, averaging 300 nautical miles and approximately 1.5 to 2.0 hours. Market conditions will determine the ultimate need for fuel tanks and their size. The photo below depicts typical above-ground aviation fuel storage and dispensing facility.

The following guidelines should be implemented when planning future airport fuel facilities:

- Aircraft fueling facilities should remain open continually (24-hour access), remain visible, and be within close proximity to the terminal building or FBO to enhance security and convenience.
- Fuel-storage capacity should be sufficient for average peak-hour month activity, which normally occurs during the summer months.
- Fueling systems should permit adequate wing-tip clearance to other structures, designated aircraft parking areas (tie-downs), maneuvering areas, and object free areas (OFA) associated with taxilane and taxiway centerlines.
- The FAA recommends locating the fuel facilities beyond the runway safety areas (RSA) and the building restriction line (BRL). All fuel storage tanks should be equipped with monitors to meet current state and federal environmental regulations and be sited in accordance with local fire codes.
- A dedicated fuel truck is typically used for Jet-A due to the liability associated with towing and maneuvering these expensive aircraft up to and in the vicinity of fueling facilities.
- Adequate truck transport access should be maintained to the fuel storage tanks for fuel delivery.
- The tanks should be capable of storing at least one month's supply of fuel to minimize delivery charges.

Current fuel storage and delivery, as described in the *Inventory* chapter, includes one 12,000-gallon under-ground AVGAS storage tank (UST), one 600-gallon AVGAS truck, and one 2,200-gallon Jet-A truck. There is also a hose/reel pump system for dispensing AVGAS directly from the UST. Fuel deliveries must be made via the airport access road on the east side of the airfield. This is a narrow asphalt road that terminates north of the UST and does not provide adequate maneuvering for the delivery transport truck to turn around without getting out onto the airfield.

FBO fuel sales records indicate that in 2011 nearly $200,000 and more than 41,000 gallons of AVGAS and Jet-A fuel was dispensed with a monthly average of more than 3,400 gallons. The FBO currently takes a partial load of Jet-A into the 2,200 gallon truck. Because of the partial load it is more costly. Future operational levels and cost savings indicate a need for additional fuel storage to avoid the airport having to take multiple fuel deliveries during a single month. Additional recommendations for fuel system improvements at Ralph M. Hall Municipal Airport include:

- 24-hour fuel dispensing system.
- Adequate aircraft maneuvering space near the fuel pumps.
- Construction of bollards around the above-ground fuel system.
- Containment parking for fuel delivery trucks and on-airport dispensing trucks.

AUTO PARKING, CIRCULATION, AND ACCESS REQUIREMENTS

Automobile parking requirements are calculated using 1.4 spaces per design-hour passenger, which is typical for non-towered GA airports. Based aircraft owners commonly park in their individual hangars while flying. Maintaining a dedicated public auto parking lot in close proximity to the terminal building to provide convenient access for pilots and passengers is essential. Auto parking, circulation, and access/security recommendations will be reviewed in the *Alternatives* chapter of this report.

FIXED BASE OPERATOR (FBO) AND AIRPORT SERVICES

At most GA airports across the country, the presence of an FBO operating on the field can pay dividends for not only pilots and based aircraft owners, but also for airport sponsors. As GA airports reach a given level of activity, typically more than 100 based aircraft, the sponsor provides a full or part-time airport manager to oversee day-to-day operations and represent the sponsor to airport tenants and patrons. At some airports, an FBO located on the field fills this role, which is the case at Ralph M. Hall Municipal Airport.

Rockwall Aviation, the FBO, provides day-to-day presence on the airfield, aircraft maintenance, sale of aviation fuel/oil and pilot supplies, and collection of hangar rent on city-owned hangars. The terminal building occupied by the FBO is serviceable and well maintained. Fueling service and pilot supplies are provided by the FBO during normal business hours from the terminal building. Rockwall Aviation's aircraft maintenance is a service provided to based and itinerant aircraft from hangars on both sides of the airfield with the primary hangar between the two northern shade T-hangars. The FBO appears to have a good maintenance business flow as two aircraft were undergoing repairs or inspection in the east-side hangar and as many as four aircraft were being worked on from the west-side hangar. Fuel sales by the FBO indicate a need for additional AVGAS storage. Additionally, the FBO has several positive comments listed on the AirNav webpage concerning both the fueling service and aircraft maintenance.

In addition to airport ownership, and capital support and oversight for the airport, the City owns the fuel storage tanks and all of the hangars on the east side of the airfield. Hangars on the west-side are privately owned, on leased property or via TTF arrangements. As the airport completes improvements and grows to accommodate additional traffic, the day-to-day oversight and responsibilities should shift from the FBO to the City. Based on the existing responsibilities of both the City and the FBO, long-term duties for each entity should be reconciled or renegotiated when warranted. A list of recommended future responsibilities is highlighted below.

- Proposed City/Airport Responsibilities
- On-site full- or part-time manager
- Providing an airport courtesy car for itinerant patrons
- Collecting hangar rents
- Hangar lease agreements/management
- Aircraft maintenance
- Mowing and maintaining grounds and terminal building
- Maintaining fuel storage tanks, on-apron dispensing, and delivery trucks
- Adhering to FAA/TxDOT standards and regulations
- Proposed FBO Responsibilities
- Flight training and supplies
- Secondary contact for airport-related items

SUMMARY OF AIRPORT TERMINAL AREA FACILITY REQUIREMENTS

Table 3.5, *Summary – Aviation Facility Requirements*, summarizes terminal area facility requirements to accommodate the GA activity projected for the airport during each of the three phases spanning the 20-year planning period. As the numbers on the following page indicate, the airport's current airside and landside facilities are inadequate for both the existing and itinerant forecast operations levels and will need to be expanded. On the airside, the terminal building and associated parking will need to expanded 1,400 square feet and 25 parking spaces, respectively. On the landside, the aircraft parking apron will need to be increased 9,300 square yards, hangar space will need to increase 4,400 square yards, and fuel storage tanks will need to be capable of accommodating an additional 10,100 gallons of fuel per month. A detailed illustration of these needs will be provided in the following *Alternatives* chapter.

TABLE 3-5
SUMMARY – AVIATION TERMINAL FACILITY NEEDS
RALPH M. HALL MUNICIPAL AIRPORT

Facility	2012	Phase 1 (0-5 Years)	Phase 2 (6-10 Years)	Phase 3 (11-20 Years)
Based Aircraft	71	76	81	92
Annual Operations	15,000	17,400	19,700	25,200
Terminal Building [2]				
Public Use Space	800 ft^2	1,200 ft^2	1,400 ft^2	1,700 ft^2
Lease Use Space	400 ft^2	800 ft^2	900 ft^2	1,100' ft^2
Total Building Space	1,200 ft^2	2,000 ft^2	2,300 ft^2	2,800 ft^2
Paved Auto Parking	3,000 ft^2	6,100 ft^2	8,100 ft^2	10,100 ft^2
Auto Parking Spaces	8-10	15	20	25
Aircraft Parking Apron [1]				
Based Apron	2,800 yds^2	5,200 yds^2	5,400 yds^2	6,200 yds^2
Itinerant Apron	2,800 yds^2	2,900 yds^2	3,700 yds^2	5,900 yds^2
Total Apron	2,800 yds^2	8,100 yds^2	9,100 yds^2	12,100 yds^2
Hangars				
T-Hangars	7,644 yds^2	8,700 yds^2	9,800 yds^2	11,000 yds^2
Executive/Corporate [3]	444 yds^2	1,300 yds^2	4,500 yds^2	5,000 yds^2
Through-the-Fence [4]	3,588 yds^2	3,588 yds^2	0 yds^2	0 yds^2
Total Hangar Space	11,676 yds^2	12,588 yds^2	14,300 yds^2	16,000 yds^2
Monthly Fuel Storage Needs				
AVGAS/100LL	4,800 gallons	5,700 gallons	6,900 gallons	9,100 gallons
Jet-A	500 gallons	700 gallons	1,200 gallons	1,700 gallons
Total Average Monthly Volume	5,300 gallons	6,400 gallons	8,100 gallons	10,800 gallons

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

[1] The existing aircraft parking apron does not differentiate between based and itinerant areas. Calculations are for single-and twin-engine aircraft weighing 12,500 pounds or less.

[2] Public and lease space does not necessarily need to be provided with the terminal facility. It can be accommodated in facilities such as FBO hangars, T-hangars, other individual hangars, etc.

[3] This type of hangar typically accommodates more than one aircraft.

[4] Assumes no new through-the-fence access will be granted. All new hangars will be constructed on airport property.

CHAPTER FOUR: AIRPORT ALTERNATIVES ANALYSIS

INTRODUCTION

This chapter describes the airfield and terminal area alternatives for the facility design criteria identified and recommended in the Facility Requirements chapter. The focus of this section is to evaluate the merits and deficiencies of alternatives, and provide the technical basis necessary for determining a preferred or recommended airport development plan.

While the assessment of alternatives is based on technical judgment, the most favorable airport improvement option should be compatible primarily with local planning standards and secondarily with regional and state planning standards. Additionally, it should be consistent with social, economic, political, and environmental goals. In order to determine the best possible course of action, the alternatives incorporate the following factors in the development and evaluation of potential options:

- Compliance with FAA airport and airspace guidelines and standards;
- Adherence with the short- and long-range goals and objectives of the City of Rockwall and the Rockwall Economic Development Corporation;
- Compatibility with existing and proposed on and off-airport land uses; and,
- Minimization of potential environmental impacts.

Critical to the success of the Airport is an effective use of all the properties at the field. The need to expand aircraft storage hangars and meet FAA design standards is evident. However, due to the lack of developable land at the Airport, pursuit of additional property for expansion purposes will be a major focus of the options presented. Alternatives will be laid out to most effectively use the potential property towards achieving the most income from the future development of the field and maximizing the business potential.

AIRSIDE ALTERNATIVES/RECOMMENDATIONS

Airside facilities are those that are used for supporting the active movement and circulation of aircraft and include runways, taxiways, and approach facilities and equipment. Landside facilities pertain to the aircraft apron areas, hangar development areas, terminal area development, and any business park/industrial development areas.

Because all airport functions relate to and revolve around the runway/taxiway layout, airside development is typically evaluated before landside development. Specific considerations include runway length, runway width, and approach protection criteria needed to support the forecast use of the field through the planning period. Following a review of these airside development alternatives, a review of landside development will also be presented. As part of this process, it is important to establish a set of goals that provide the framework for future airport development. These goals include:

- A safe, efficient operating environment that meets City, TxDOT, and FAA design and safety standards and recommendations.
- Enhancing the self-sustaining capability of the Airport by ensuring the highest and best use of available airport property maximizing airport revenue.
- Plan and develop the Airport in line with future needs and requirements of the City, Rockwall Economic Development Corporation (REDC), and in support of surrounding communities.
- Encourage protection of the established investment by minimizing potential land use conflicts.

UTILITIES/STATE HIGHWAY 66

Operations at the Airport and any airport expansion options are constrained on both runway ends due to the proximity of Airport Road and railroad on the south and the elevated transmission electrical lines and State Highway 66 on the north. A preferred alignment has been adopted by TXDOT and Rockwall County for State Highway 66 to widen from a two-lane to a four/six- lane divided urban roadway from SH 205 to FM 3549.

This corridor study proposes to leave the transmission lines in their current location with the new road constructed on either side; thus, the transmission lines will be located in the median of the new alignment. Conversations with ONCOR confirm the existing overhead lines are 100 feet tall. Inquiries concerning the potential to bury the power line or decrease the height above the ground to accommodate safer operating parameters for aircraft into and out of the Airport were conducted. Decreasing the height along the current alignment was not an option due to the existing line being classified as a “Double Circuit Line”. While burying the line underground would be an option allowable by ONCOR, the cost is ten times more than relocating, and could prove cost prohibitive. Burying the line would require a terminal station at the ingress and egress points of the line. Additionally, the line would have to be submerged in an oil based solution to keep the lines cool from the enormous amounts of heat generated.

The best option to eliminate conflict with the power lines is to purchase property or easement along an alignment approximately 1,600 feet beyond the Runway 17 end and re-route the lines. However, this option is likely cost prohibitive due to the amount of land that would be required and the length of relocating involved. For purposes of this Alternatives Chapter, it is assumed the power lines will remain in their current location. The City continues to explore resolution options with ONCOR that will improve safety at the Airport.

RUNWAY, TAXIWAY, AND INSTRUMENT APPROACH CAPABILITIES

RUNWAY CAPACITY AND ORIENTATION

- The Airport's only runway, Runway 17/35, provides adequate capacity to accommodate the forecast number of aircraft operations without excessive delay.
- The orientation of the runway provides the minimum 95% crosswind coverage for the entire fleet of aircraft forecast and expected to utilize the Airport.

***Recommendation:* The existing runway configuration provides adequate operational capacity and wind coverage meeting the 95% crosswind coverage recommendation from the FAA/TxDOT.**

RUNWAY WIDTH

The existing runway width of 45 feet is deficient by 15 feet in meeting minimum recommended standards. Due to the limited amount of development area on the field and the existing aircraft storage facility locations, the potential to increase the runway width to 60 feet and meet design standards will be difficult without the pursuit of additional property to relocate or redevelop existing terminal facilities on the east side of the airfield.

***Recommendation:* Widen runway to a minimum of 60 feet when financially feasible or when development opportunity allows.**

RUNWAY LENGTH

While the existing runway length is adequate in accommodating a majority of the small aircraft in the national fleet, it is deficient in accommodating most other aircraft outside this “small” classification. The existing displaced thresholds of 470 feet on the north end of the runway and 289 feet on the south end magnify this deficiency by decreasing the pavement available for landing further. Due to the constraints of the existing sight (topography, and Airport Road/rail-line on the south), discussed further in Appendices A and B, increasing runway length is not prudent or feasible due to the impacts of existing infrastructure associated with SH66, Airport Road, ONCOR’s electric transmission line, and the rail line south of the Airport.

The ability to re-capture runway length on the existing site does not necessarily require additional land or property. The FAA provides guidance to re-gain length by implementing “declared distances”. Declared distances, as defined by the FAA, “provides an equivalent runway safety area, runway object free area, or runway protection zone…where it is impracticable to meet standards by other means. Declared distances are also employed when there are obstructions in the runway approaches and/or departure surface that are beyond the ability of the airport owner to remove and result in a displaced threshold or change in the departure end of the runway.”

There are four (4) components of declared distances. These include the TORA (Take-off run available), TODA (Take-off distance available), ASDA (Accelerated Stop Distance Available), and LDA (Landing distance available). Declared distance lengths provide pilots the necessary information to make the appropriate decision for operating their aircraft in either a take-off or landing sequence at a particular airport. The Airport’s only responsibility would be to provide accurate declared distance data information to the FAA for inclusion in the Airport Facilities Directory. Two alternatives have been developed that involve declared distances which only apply to turbine aircraft per 150/5300-13A. Alternative one implements declared distances based on the existing runway/airport layout and the recent redevelopment of Airport Road. Alternative two considers extending the runway to the south and relocating Airport Road. Both alternatives can be seen in the following figures, **Figure 4-1** and **Figure 4-2**. Total runway length for Alternative One is 3,373 feet and for Alternative Two is 4,000 feet. Based on these elements, the lengths associated with declared distances are outlined in Table 4-1.

TABLE 4-1
ALTERNATIVE DECLARED DISTANCES
RALPH M. HALL MUNICIPAL AIRPORT

	Alternative One			Alternative Two	
	Runway 17	Runway 35		Runway 17	Runway 35
TORA	3,133’	3,183’	TORA	2,847’	3,248’
TODA	3,373’	3,373’	TODA	4,000’	4,000’
ASDA	3,133’	3,183’	ASDA	3,820’	4,000’
LDA	2,663’	2,894’	LDA	3,350’	2,847’

Source: Application of Declared Distance Calculations from FAA AC 150/5300-13A, *Airport Design*.
Declared distances for Alternative One are predicated on recovery of full safety areas north of the Runway 17 end.

Recommendation: **Maintain Runway 17/35 end locations and widen to 60 feet meeting recommended standards. Implement Declared Distances as depicted in Figure 4-1 until best option to extend Runway 17/35 for accommodating more complex mix of aircraft operations is available. Non-standard climb procedures should be requested from and published by the FAA in future publications of U.S. Terminal Procedures.**

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FIGURE 4-1
DECLARED DISTANCES - ALTERNATIVE 1

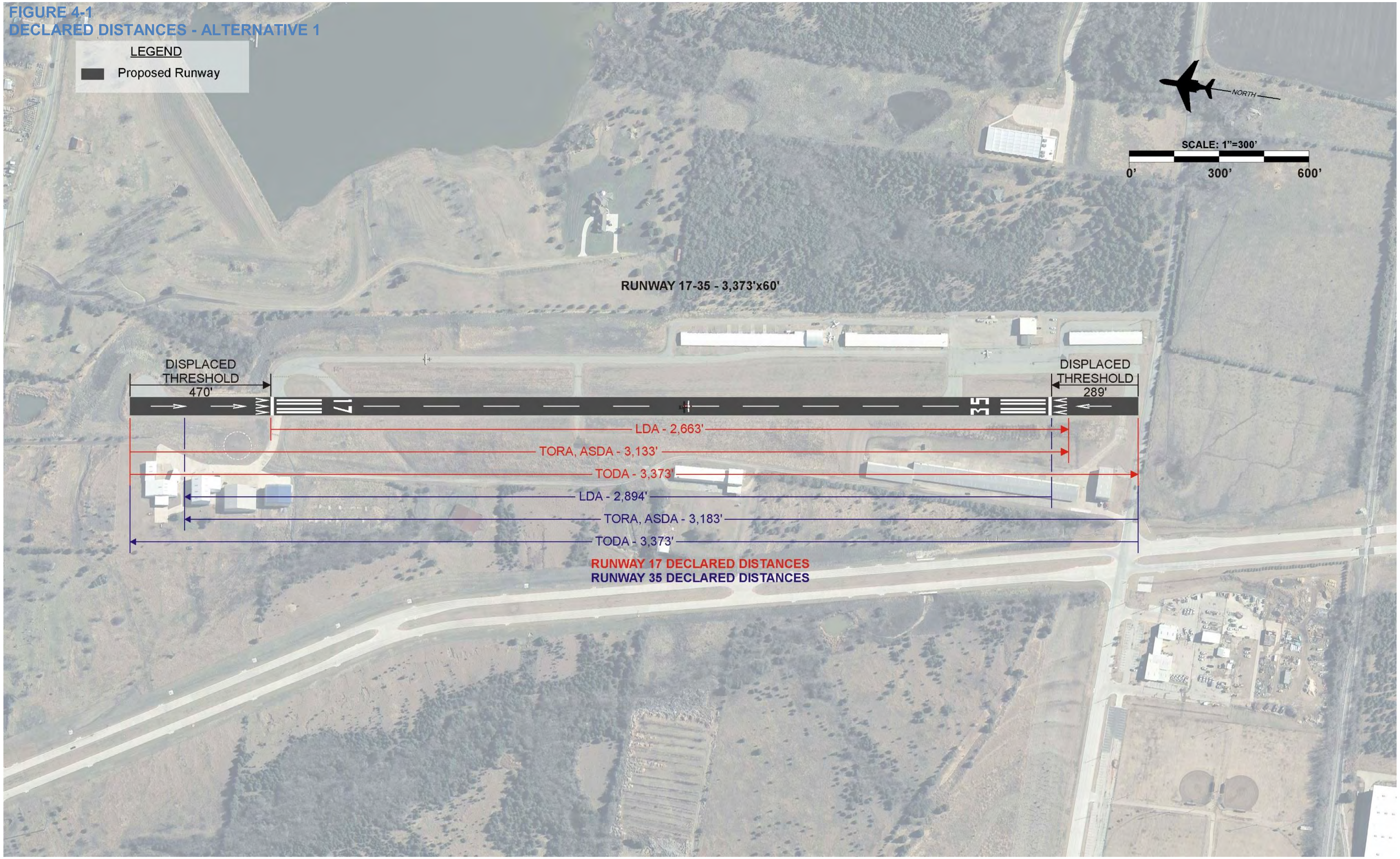

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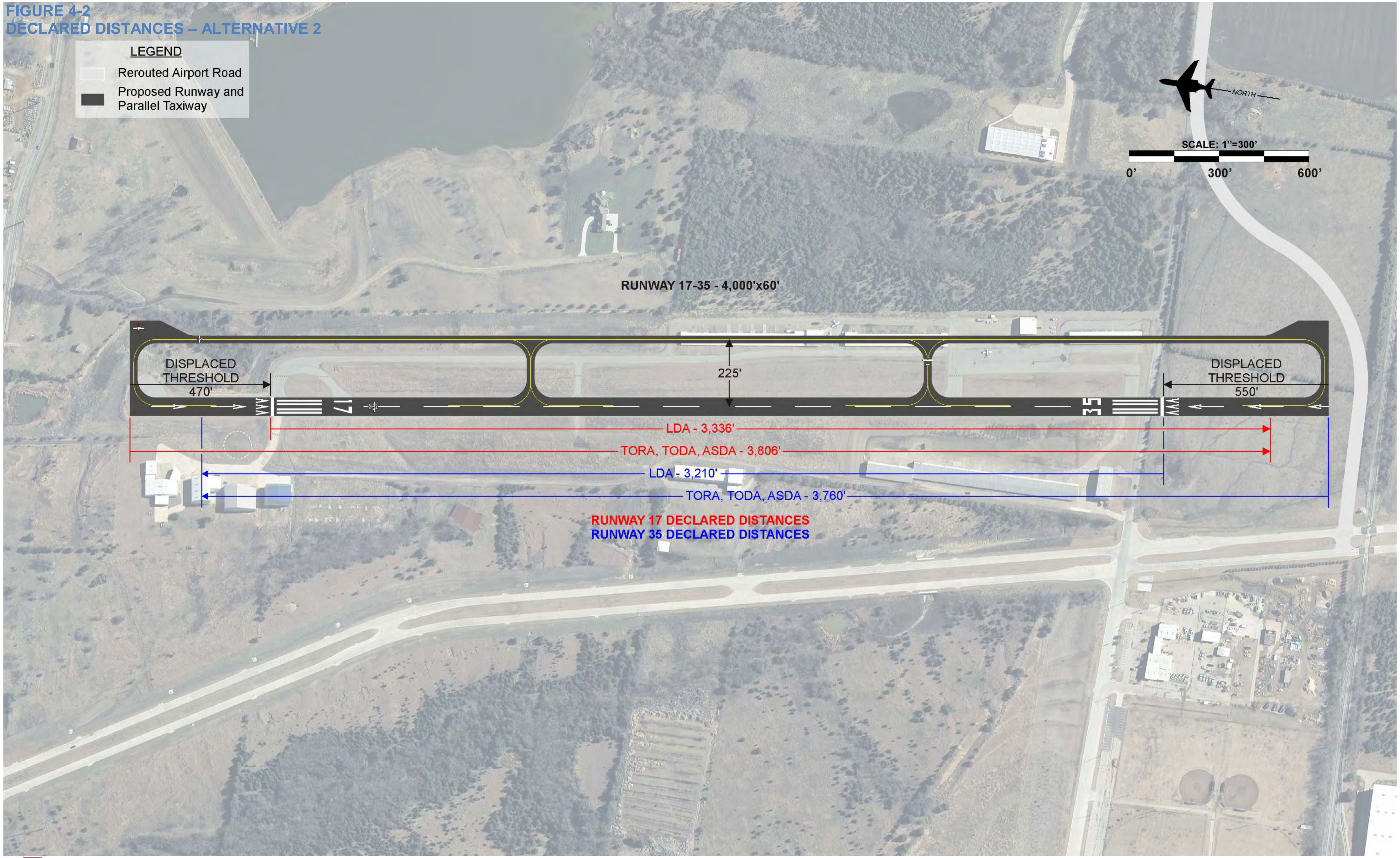
FIGURE 4-2
DECLARED DISTANCES – ALTERNATIVE 2



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DIMENSIONAL CRITERIA

The primary concerns with the current runway system relate to FAA specified dimensional criteria for safety areas and object free areas. **Figures 4-3** and **4-4** depict the deficiencies for these areas in graphic form. Each runway has its own set of standards and unique circumstances relating to the safety criteria. Currently, the safety area and taxiway setbacks are deficient and not within the recommended design parameters.

Recommendation: **Implement declared distances to meet standards beyond runway ends and either acquire additional property for redevelopment or reconstruct facilities beyond recommended safety area dimensions.**

INSTRUMENT APPROACH CAPABILITIES

Existing instrument approaches at the Airport include an RNAV/GPS (straight-in) and an NDB-A (circling) to both runway ends. The coinciding visibility and ceilings minimums for these approaches were referenced and shown in **Table 1-6** of the Inventory chapter.

Recommendation: **Retain the existing 1-mile visibility minimum approach to both runway ends. The ability to receive lower visibility minimums in the future will be dependent upon the power line issue remediation on the north and airport improvements that meet minimum design and safety standards.**

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FIGURE 4-3
RUNWAY 17 DEFICIENCIES

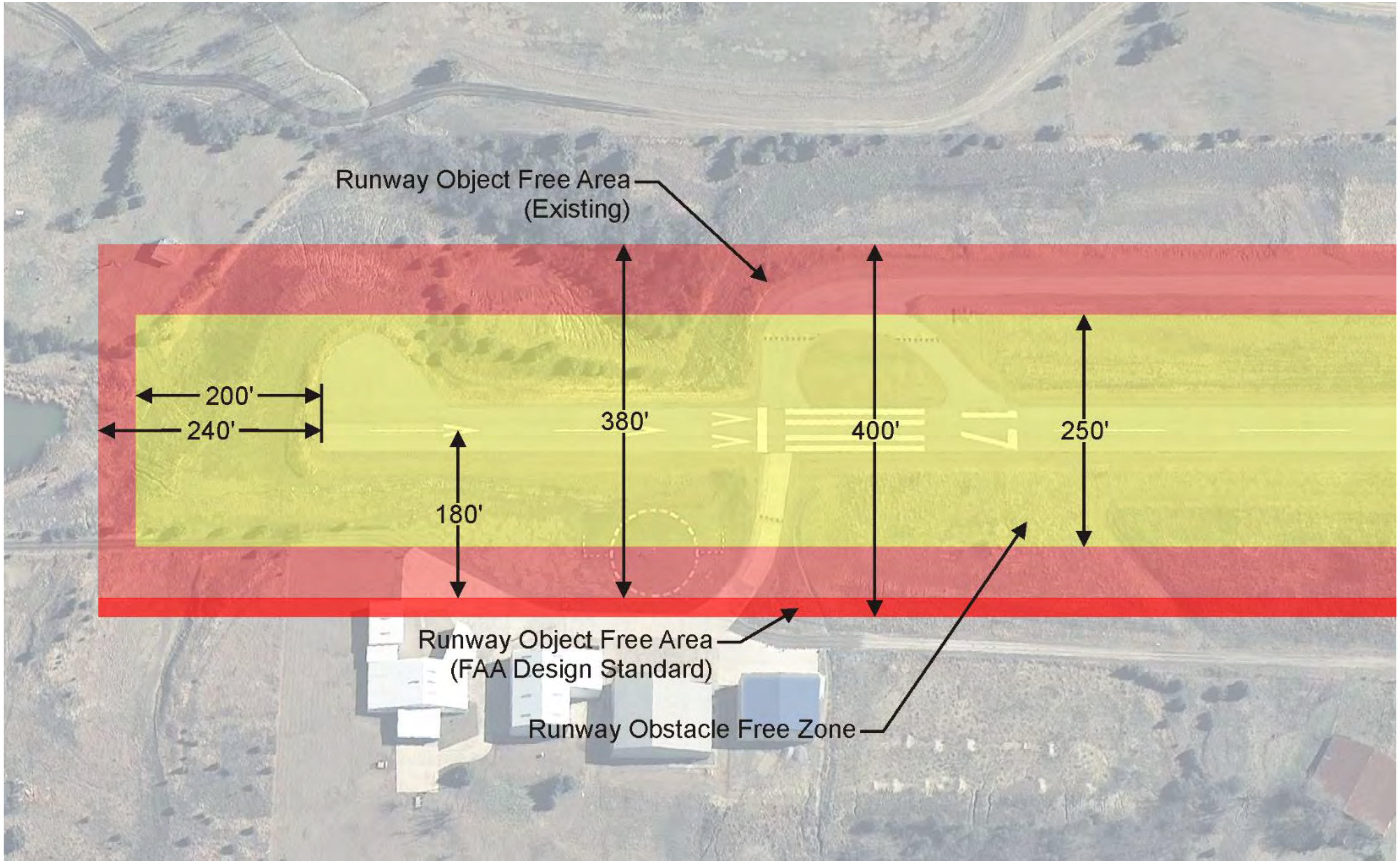

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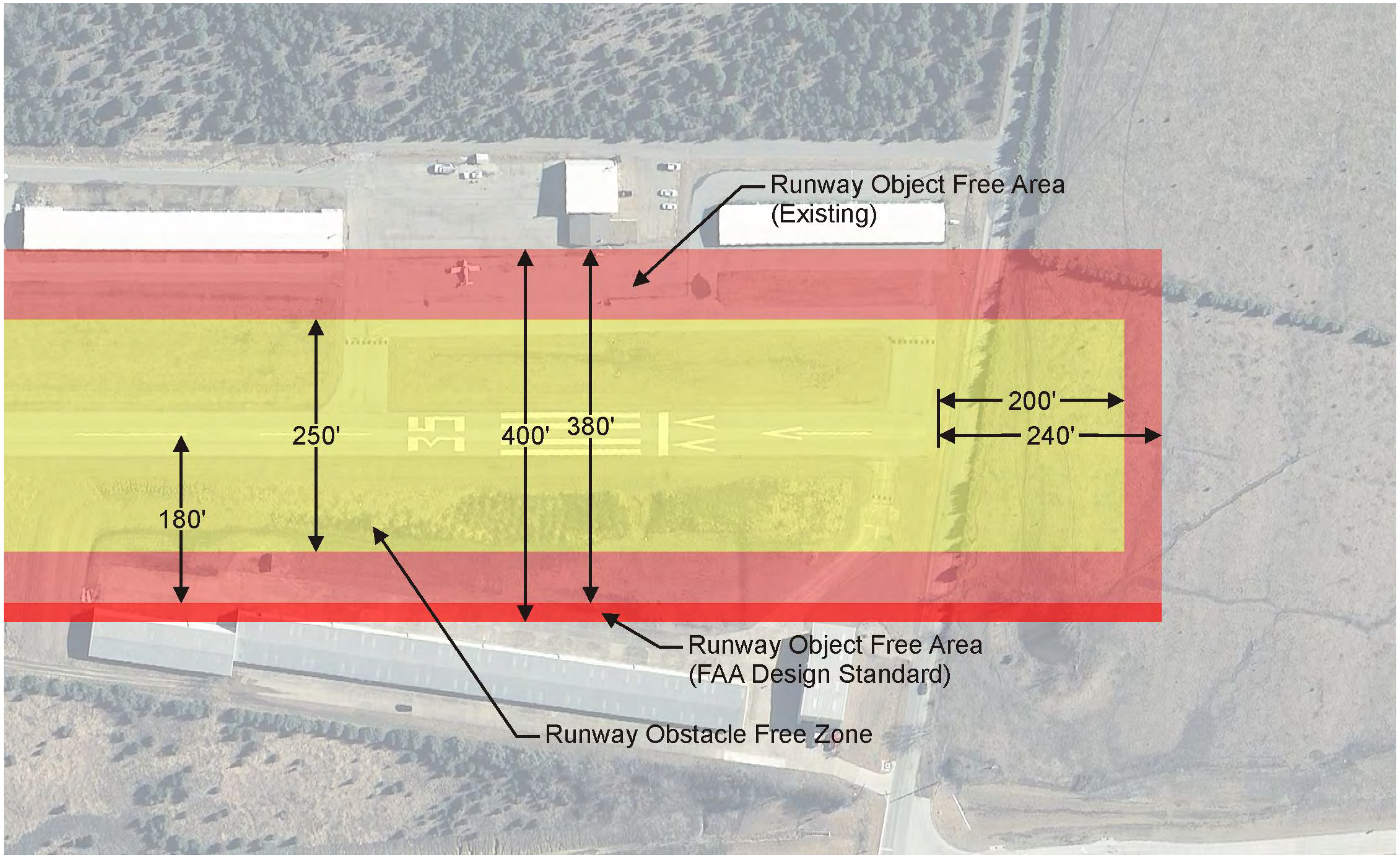
FIGURE 4-4
RUNWAY 35 DEFICIENCIES



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TAXIWAY SYSTEM

The existing taxiway system provides routing for taxiing aircraft between the runway system and various landside use areas on the Airport. However, required centerline distance separation does not meet FAA design standards. For safe aircraft navigation and maneuverability on the ground, it is imperative for the proper setbacks to be in place. Because of the current aircraft storage locations, the necessary safety areas are unachievable. The acquisition of the property to the east of the Airport will greatly enhance the ability for the Airport to meet standards by relocating all structures to this new area. Additionally, purchasing additional property will allow for the potential to construct a parallel (full or partial) taxiway without the need to navigate around the terminal area in a curvilinear fashion. **Figures 4-5, 4-6,** and **4-7** illustrates the current taxiway deficiencies and compares them with those needed to meet FAA design standards and recommendations.

Recommendation: **Acquire property to the east to re-locate or re-develop existing east-side terminal complex to meet design standards and provide the capability to construct a true parallel taxiway.**

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FIGURE 4-5
EXISTING TAXIWAY DEFICIENCIES

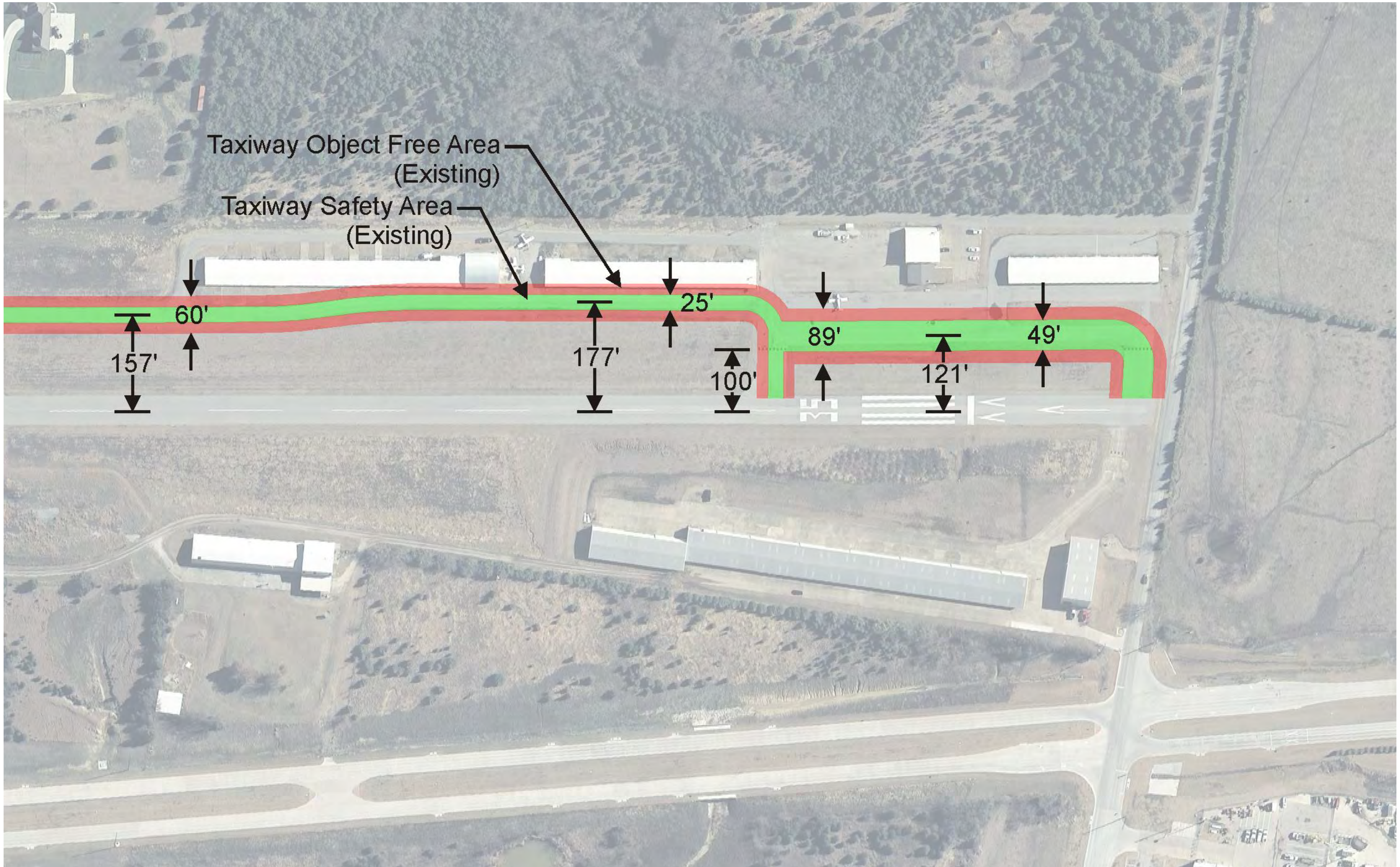

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FIGURE 4-6
FAA B-I TAXIWAY DESIGN STANDARDS

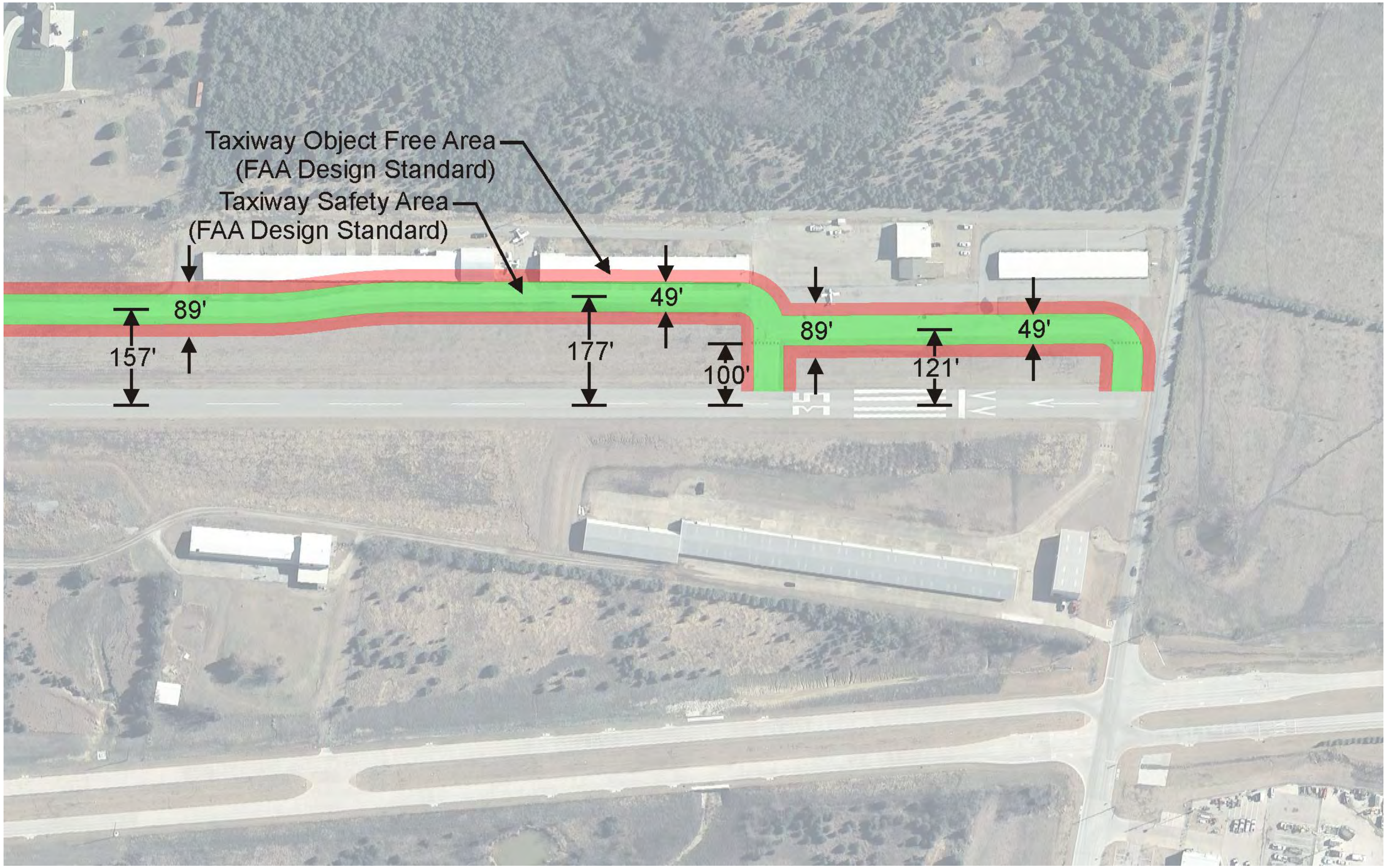

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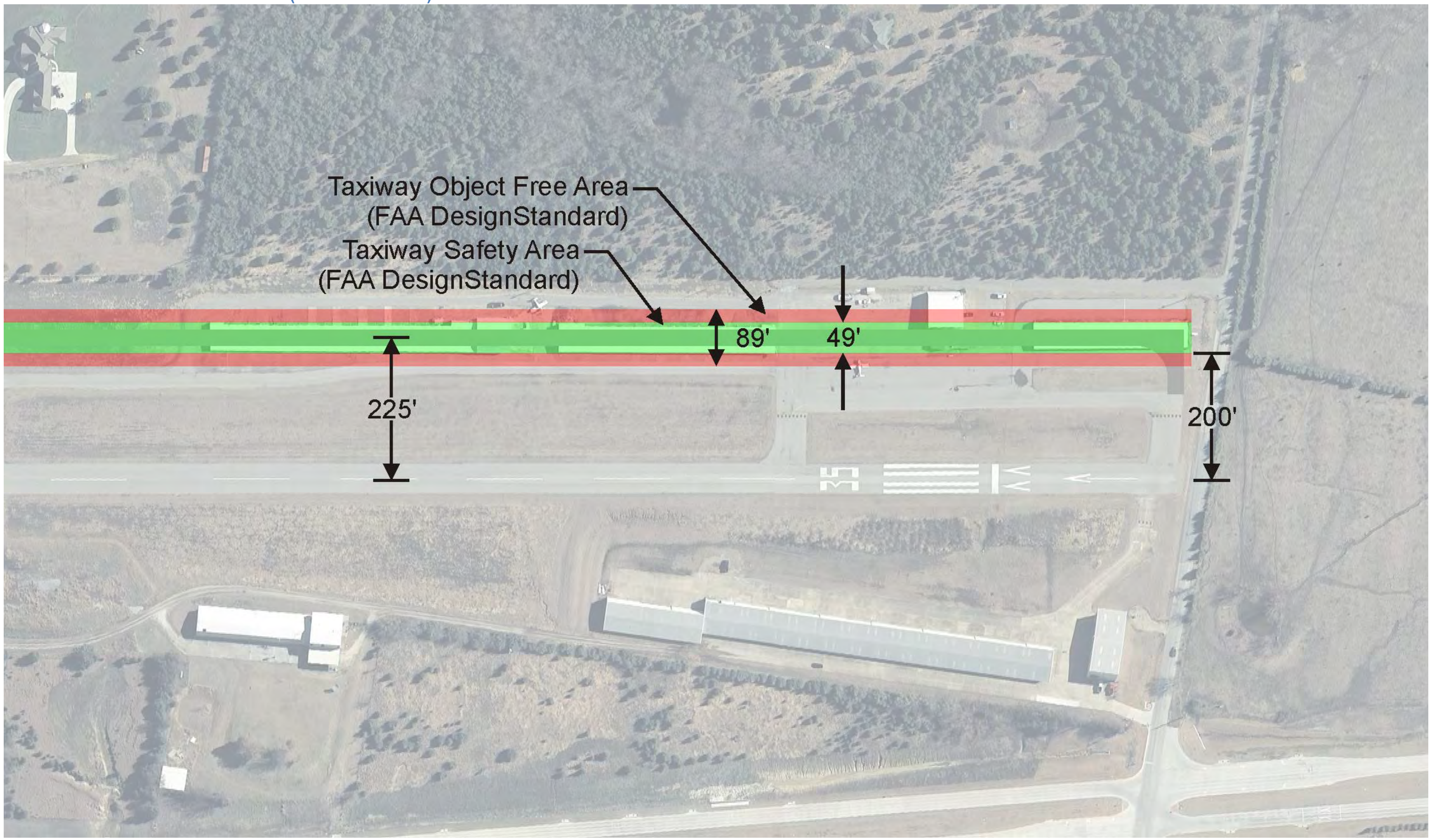
FIGURE 4-7
PROPOSED PARALLEL TAXIWAY LAYOUT (B-I STANDARDS)



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LANDSIDE ALTERNATIVES/RECOMMENDATIONS

With the framework of the Airport's ultimate airside development identified, concepts involving the placement of landside facilities can now be analyzed. The overall objective of the landside development at the Airport is to provide facilities that are conveniently located and accessible to the community and are flexible in meeting specific requirements of airport users and tenants.

AVIATION USE FACILITY DEVELOPMENT AREAS

Concepts for the development of aviation use areas at the Airport include considerations for various types of GA aircraft storage facilities and aircraft maintenance facilities. While there is limited developable land at the Airport, there is a 19 acre parcel of property adjacent to, and east, of the Airport's east side terminal area. The following four alternatives, **Figures 4-8** through **4-11**, assume acquisition of this 19 acre parcel and a relocation of Airport Road to achieve a longer runway for take-off and landing purposes.

When developing conceptual alternatives, it is imperative to follow the design criteria established by the FAA according to the Airport's ultimate associated Airport Reference Code (ARC), previously discussed in the Facility Requirements chapter, is B-I. Each option ensures that development can be done in a logical, sequenced fashion within the proximity of existing utilities to minimize construction costs as much as possible.

Each proposal integrates various sizes and uses of hangars accommodates all future needs as shown in **Table 3-5** in the Facilities Requirements chapter and minimizes the 19 acre parcel. Additionally, the Building Restriction Line (BRL), a reference line to delineate where development can occur in proximity to the runway, begins at the edge of a runway's primary surface, 250 feet from the runway centerline. From this edge, a building height will be based on the part 77 obstruction clearance of 7:1. Thus, a building that is approximately 25 feet tall would need to be placed no closer than 175 feet from the BRL and a 35 foot tall structure could be placed no closer than 245 feet from the established BRL.

ALTERNATIVE ONE (1)

This alternative provides a variety of hangar sizes from T-hangar units to individual executive hangars situated along a new parallel taxiway. A new terminal area, replete with a new terminal building, auto parking, and large apron for aircraft parking and fueling is located north of the newly proposed hangar layout. Airport access will continue to be provided from Airport Road.

- Estimated Total Enclosed T-Hangar Space: 45,000 ft^2
  - 10-unit (three) = 45,000 ft^2
- Estimated Total Box/Common Hangar Space: 94,000 ft^2
  - 40' x 40' (10 units) = 16,000 ft^2
  - 60' x 60' (8 units) = 28,800 ft^2
  - 80' x 80' (3 units) = 19,200 ft^2
  - 100' x 100' (2 units) = 30,000 ft^2
- Estimated Apron: 12,253 yds^2 (110,277 ft^2)
- Estimated Taxilane: 4,515 linear feet
- Estimated Auto Parking: 189 spaces

ALTERNATIVE TWO (2)

Alternative Two is similar to Alternative 1 with the exception this alternative proposes hangar layouts comprised of various sized T-hangars which are either enclosed or open shade type structures. Other than two large terminal area stand-alone hangars, no other individual box hangars are postulated in this Alternative. Access is continued to be provided off Airport Road.

- Estimated Total Enclosed T-Hangar Space: 75,000 ft^2
  - 10-unit (five) = 75,000 ft^2
- Estimated Total Shade T-Hangar Space: 44,700 ft^2
  - 10-unit (one) = 15,000 ft^2
  - 8-unit (two) = 22,000 ft^2
  - 4-unit (one) = 7,700 ft^2
- Estimated Total Box/Common Hangar Space): 20,000 ft^2
  - 100' x 100' (2 units) = 20,000 ft2
- Estimated Apron: 14,478 yds^2 (130,302 ft^2)
- Estimated Taxilane: 7,161 linear feet
- Estimated Auto Parking: 93 spaces

ALTERNATIVE THREE (3)

Alternative Three provides a mix of various T-hangar structures, as well as some individual box hangars. The hangars are split north and south of the proposed centralized terminal area. These facilities are situated along the new parallel taxiway. Access will continue to be provided by Airport Road.

- Estimated Total Enclosed T-Hangar Space: 67,200 ft^2
  - 10-unit (three) = 54,000 ft^2
  - 8-unit (one) = 13,200 ft^2
- Estimated Total Shade T-Hangar Space: 28,500 ft^2
  - 10-unit (one) = 18,000 ft^2
  - 5-unit (one) = 10,500 ft^2
- Estimated Total Box/Common Hangar Space): 34,800 ft^2
  - 40' x 40' (2 units) = 3,200 ft^2
  - 60' x 60' (6 units) = 21,600 ft^2
  - 100' x 100' (1 unit) = 10,000 ft^2
- Estimated Apron: 11,478 yds2 (103,302 ft^2)
- Estimated Taxilane: 6,268 linear feet
- Estimated Auto Parking: 72 spaces

ALTERNATIVE FOUR (4)

This alternative provides a good mix of T-hangars – enclosed and shade – and individual box hangars of various size along the parallel taxiway. The proposed terminal area for this option is located south of the proposed facilities and provides ample room for aircraft parking, maneuvering, and fueling. Access is provided by Airport Road.

- Estimated Total T-Hangar Space: 44,000 ft^2
  - 14-unit (two) = 44,000 ft^2
- Estimated Total Shade T-Hangar Space: 22,200 ft^2
  - 14-unit (one) = 22,200 ft^2
- Estimated Total Box/Common Hangar Space): 82,400 ft^2
  - 40’ x 40’ (12 units) = 19,200 ft^2
  - 60’ x 60’ (12 units) = 43,200 ft^2
  - 100’ x 100’ (2 units) = 20,000 ft^2
- Estimated Apron: 13,486 yds^2 (121,374 ft^2)
- Estimated Taxilane: 4,893 linear feet
- Estimated Auto Parking: 169 spaces

While all four alternatives maximize the 19 acre parcel adjacent to the Airport and provide a separation buffer between small aircraft and large and/or corporate type aircraft, Alternatives One and Four provide the most variety and mix of aircraft storage facilities for future development. Airports that provide the opportunity for individuals to build their own storage structure provide an avenue for the City or Airport to not be burdened with funding every facility at the field. Stand-alone box hangars provide a way for the Airport to capture land lease payments without the burden of out-of-pocket expenses for new structure costs.

FIGURE 4-8
LANDSIDE ALTERNATIVE 1

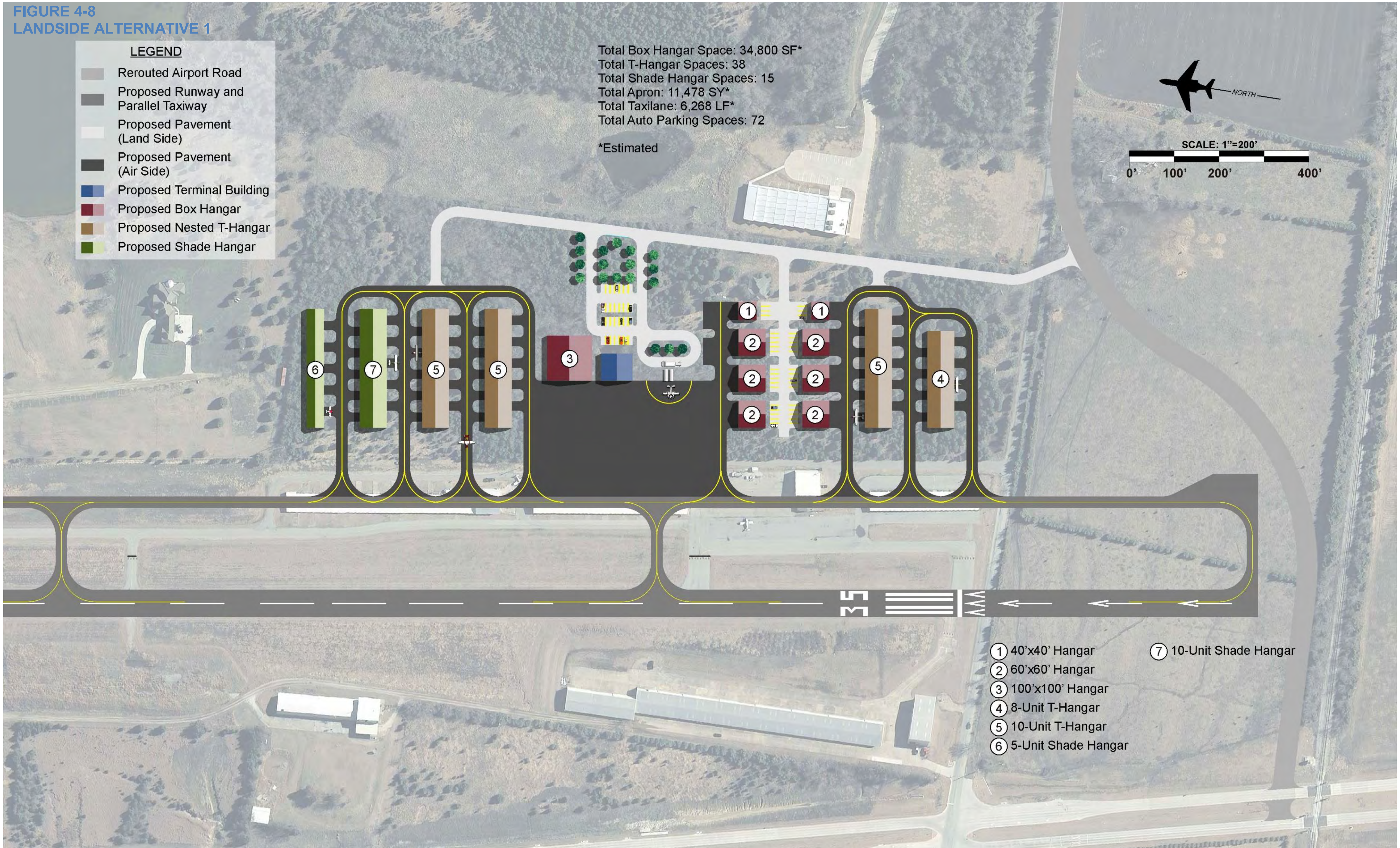

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FIGURE 4-9
LANDSIDE ALTERNATIVE 2

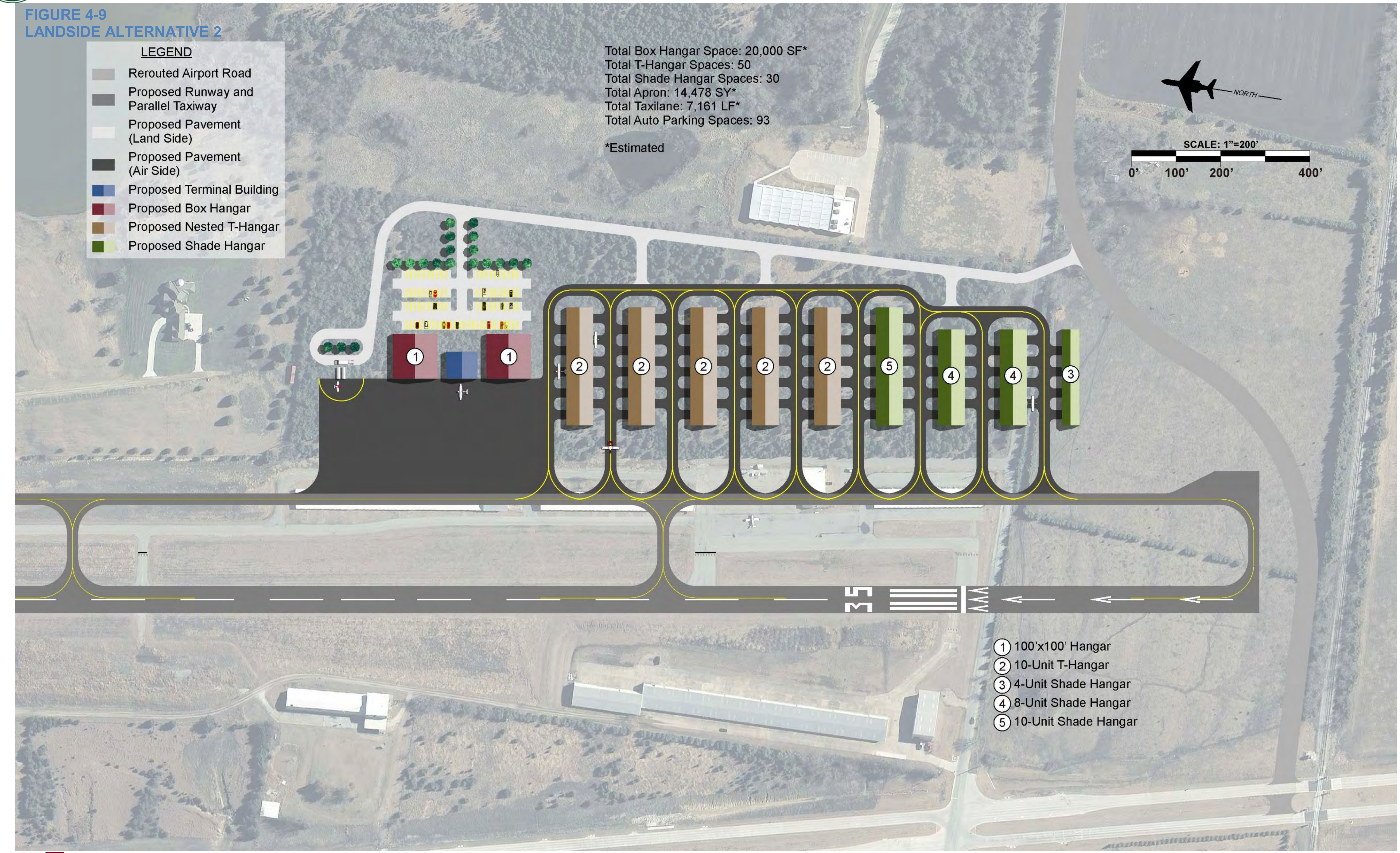

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FIGURE 4-10
LANDSIDE ALTERNATIVE 3

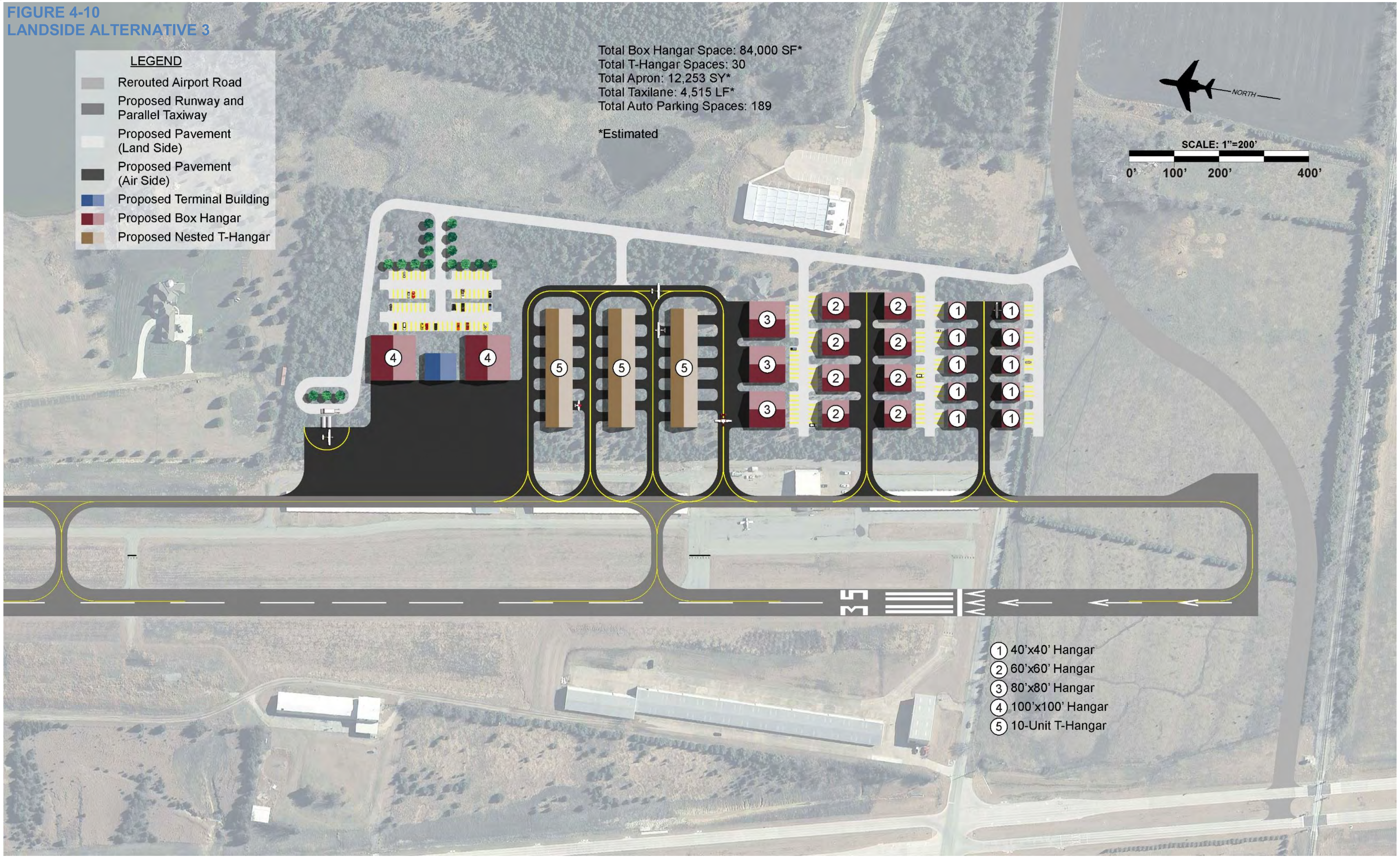

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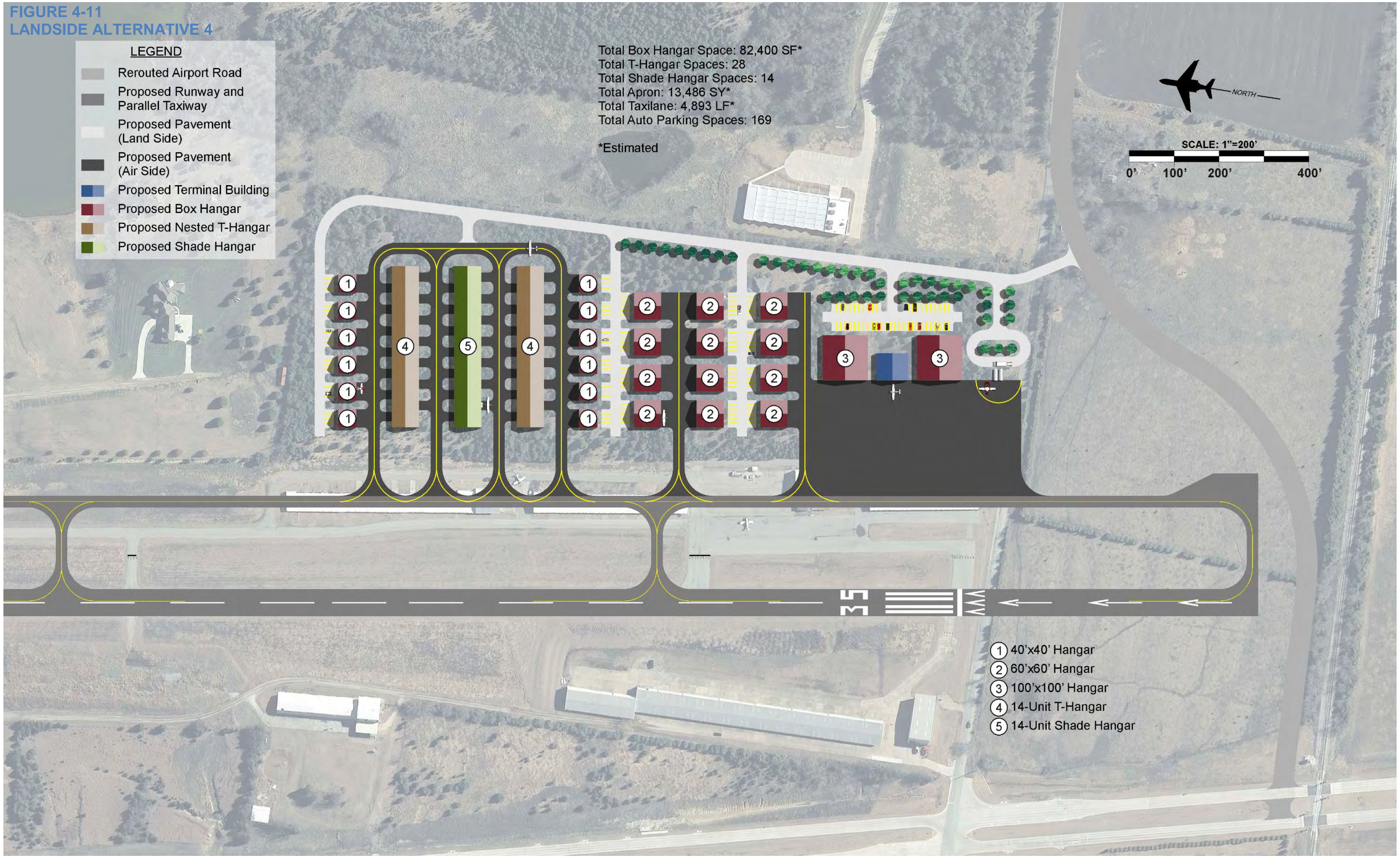
FIGURE 4-11
LANDSIDE ALTERNATIVE 4



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RECOMMENDED DEVELOPMENT PLAN

The preferred option for both airside and landside alternatives combine to form the recommended development plan. The recommended development plan provides the 20-year footprint for the Airport.

Following the concepts/options developed previously in this chapter, the City of Rockwall requested two additional evaluations of alternative development options. The first examined extending the runway to the north to achieve 5,000 feet of total runway length. It is included in Appendix A of this report for reference. The second evaluated the potential to extend the runway to 5,000 feet with the entire extension to the south. This additional evaluation is included in Appendix B of this report.

The recommended development plan is a compilation of the final alternatives presented in the body of this report and contained in the evaluations presented in Appendices A and B. The recommended plan, refined based on discussions with City, Airport Committee, and REDC, for the future development of the Ralph M. Hall Municipal Airport was selected.

Figure 4-12 depicts the preferred airside development that includes maintaining the existing runway length of 3,373 feet and widening the runway to 60 feet along the existing centerline. During the runway widening/reconstruction project the line-of-sight issue for the runway will be eliminated. The preferred airside development also includes redevelopment of the 25 foot wide parallel taxiway offset 225 feet east of the runway centerline, and installation of new lighting on the runway, parallel taxiway, rotating beacon, and windsock/segmented circle. It also includes the ultimate relocation of the AWOS from its current location to the west side of the airfield south of the existing through-the-fence hangars on the northwest end of the airfield.

The preferred landside development is depicted on **Figure 4-13**. Future east-side terminal development includes a new 3,000 square foot terminal building attached to a 100' x 100' corporate hangar, new aircraft parking apron, AvGAS/Jet-A fueling facility, new entrance road, and ample hangars to replace those removed for the airside development and in anticipation of the forecast need identified in the Forecast Chapter of this study. It also includes approximately 4.5 acres north of the proposed terminal redevelopment for future airport or potential tenant development, as demand warrants.

- Estimated Total T-Hangar Space: 25,000 ft^2
  - 10-unit (two) = 12,500 ft^2 per unit
- Estimated Total Shade T-Hangar Space: 25,000 ft^2
  - 10-unit (two) = 12,500 ft^2 per unit

- Estimated Total Box/Common Hangar Space): 62,200 ft^2
  - 40' x 80' (1 unit) = 3,200 ft^2
  - 40' x 60' (3 units) = 7,200 ft^2
  - 60' x 60' (3 units) = 10,800 ft^2
  - 60' x 90' (1 unit) = 5,400 ft^2 (residential through-the-fence)
  - 80' x 80' (2 units) = 12,800 ft^2
  - 160' x 80' (1 unit) = 12,800 ft^2
  - 100' x 100' (1 unit) = 10,000 ft^2
- Estimated Apron: 14,350 yds^2 (129,150 ft^2)
- Estimated Taxilane: 4,750 linear feet
- Estimated Auto Parking: 40 spaces

The declared distances based on the preferred airside development is depicted on **Figure 4-14**. Total runway length for the Preferred Alternative is 3,373 feet. The lengths associated with declared distances are outlined in **Table 4-2**.

TABLE 4-2
RECOMMENDED DEVELOPMENT
DECLARED DISTANCES
RALPH M. HALL MUNICIPAL AIRPORT

Preferred Alternative		
	Runway 17	Runway 35
TORA	3,133'	3,373'
TODA	3,133'	3,373'
ASDA	3,133'	3,373'
LDA	2,663'	3,084'

Source: Application of Declared Distance Calculations from FAA AC 150/5300-13A.
Declared distances are predicated on recovery of full safety areas north of the north end.

FIGURE 4-12
PREFERRED AIRSIDE/AIRFIELD DEVELOPMENT

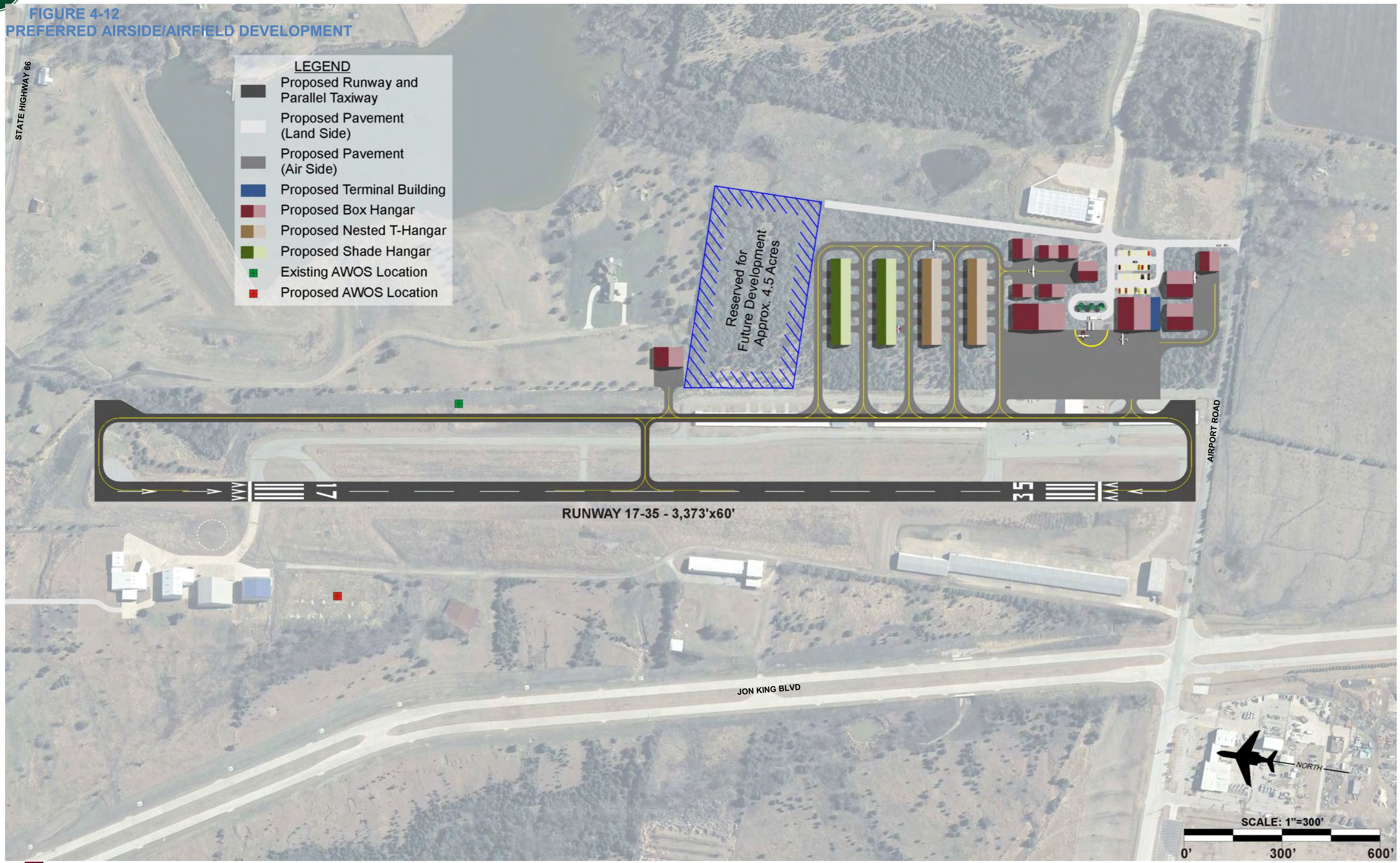

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FIGURE 4-13
PREFERRED LANDSIDE/TERMINAL DEVELOPMENT

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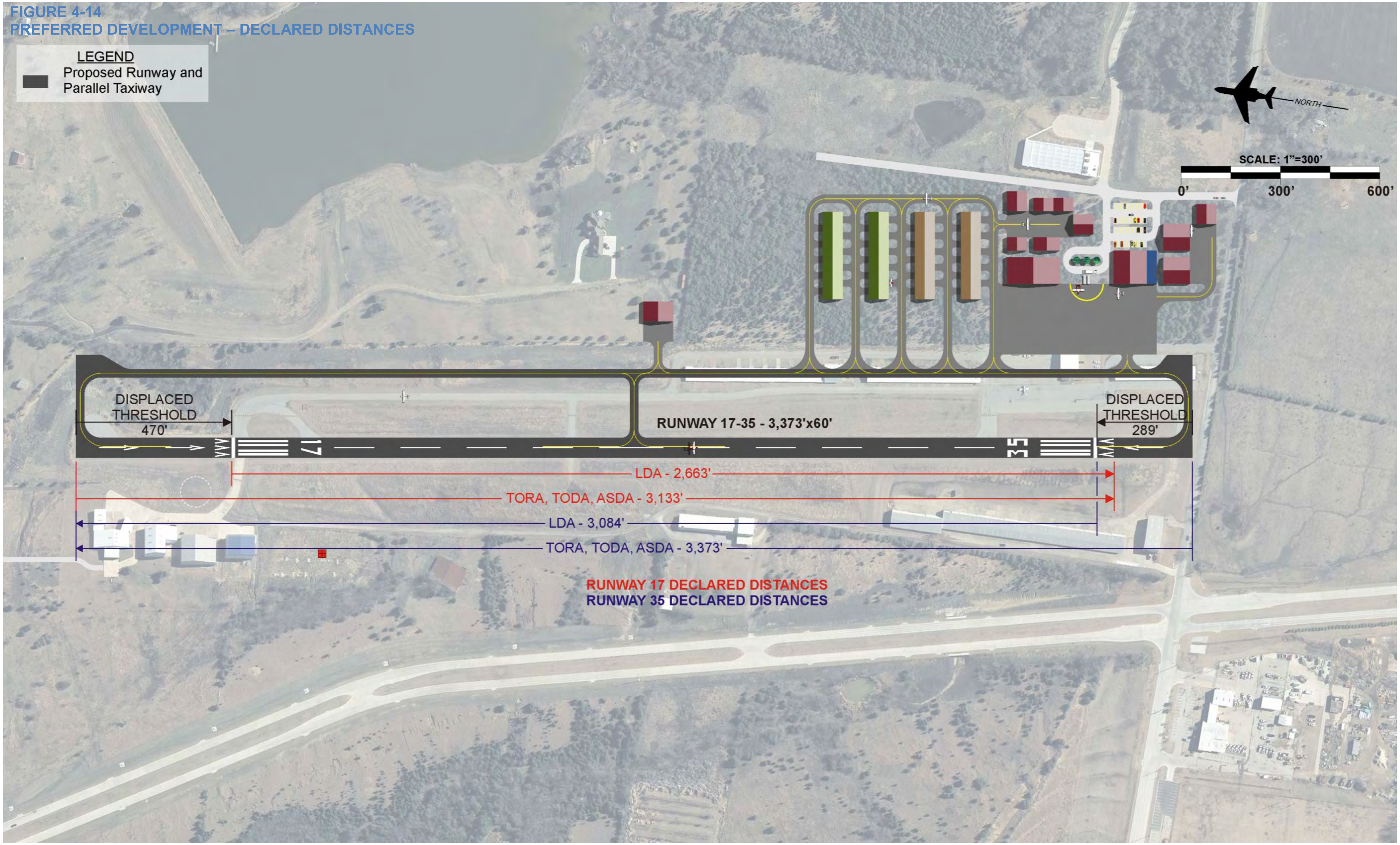
FIGURE 4-14
PREFERRED DEVELOPMENT – DECLARED DISTANCES



CHAPTER FIVE: PHASED DEVELOPMENT AND CAPITAL IMPROVEMENT PLAN

FUNDING SOURCES AND OPTIONS

Funding for general aviation airports is typically available from federal, state, and local sources. At the Ralph M. Hall Municipal Airport in Rockwall, Texas, a combination of funding sources, in addition to private financing, will be required during the short and long-term planning periods to implement the proposed airport development program. The Airport is recognized in the Federal Aviation Administration's (FAA) *National Plan of Integrated Airport Systems* (NPIAS) and is included in the most recent *Texas Airport System Plan Update (2010)* qualifying the airport for state and federal airport funding.

FEDERAL AVIATION ADMINISTRATION AIRPORT FUNDING PROGRAM

In Texas, federal airport entitlement, discretionary, and improvement program grants for general aviation and reliever airports are administered through the Texas Department of Transportation (TxDOT), Aviation Division as part of the FAA's State Block Grant Program. The *Airport Improvement Program* (AIP) provides federal planning and development grants to public-use airports included in the NPIAS. The Federal *Airport and Airways Trust Fund* is the source of all AIP funds. These funds are collected through aviation user-generated taxes (airline passenger tax, aircraft parts and fuel), and appropriated by Congress for eligible airport planning, design, construction, and improvement projects. The current system of federal airport funds is distributed by formula and discretion in accordance with provisions contained in the Airport and Airway Improvement Act of 1982, as amended. FAA Order 5100.38C, *AIP Handbook*, provides guidance and describes polices and administrative procedures for funding AIP projects.

The funding mechanism for the AIP requires authorization from Congress. On February 14, 2012, a re-authorization bill was signed into law funding the FAA and its programs annually through 2015 at the sum of $3.35 Billion per year. This new bill provides the capability for airports to initiate long-term planning and ends the five year battle of 23 short-term extensions since September 2007. Under AIP, the national priority system is used to distribute state-apportionment improvement funds in accordance with FAA provisions (population and land size).

As a Block Grant State since 1996, the TxDOT, Aviation Division channels the distribution of AIP funding to general aviation and reliever airports within Texas in accordance with the degree of need. TxDOT also assumes administrative responsibilities related to the distribution of AIP funds, with letters of interest, grant assurances, planning reviews, and other regulatory requirements relating to airport projects conducted under state control. The AIP funds for eligible airport development projects are funded at 90 percent federal and 10 percent local. Approximately $19.3 million was appropriated in 2011 through AIP funding and an additional $10.5 million through discretionary means for airport improvements in the State of Texas.

As a part of the *Wendell H. Ford Aviation Investment and Reform Act for the 21st Century* (AIR 21), general aviation airports listed in the NPIAS are authorized to receive non-primary airport entitlement (NPE) funds. Because Rockwall's airport is listed in the 2013-2017 NPIAS, the airport qualifies for this funding source. The airport could receive NPE funds equal to one fifth of the five-year cost estimate for airport improvements as listed in the NPIAS, to a maximum of $150,000 per year. Approximately $26.4 Million was appropriated to various airports across the state in 2011. These funds typically have a life span of 3 to 4 years and can be banked and rolled over from year to year in order to achieve large project funding without large outlays on behalf of the local airport sponsor.

FAA FACILITIES AND EQUIPMENT (F & E) FUNDING PROGRAM

Within the FAA's Airways Facilities Division, money is available through the Facilities and Equipment Fund (F&E) to purchase and/or install navigational aids (NAVAIDs), visual approach aids, approach lighting systems, and other air safety related technical equipment, which includes Air Traffic Control Towers (ATCT). Each F&E development project is evaluated independently through a cost/benefit analysis to determine funding eligibility and priority ranking.

STATE OF TEXAS FUNDING AND PROGRAMMING

In addition to the FAA's AIP, TxDOT also administers state funded programs for airport planning, maintenance, and construction projects. The funding is derived from a portion of the motor vehicle title and registration fees as part of the State Highway Fund (Fund #6). Each fiscal year's airport program funding level is appropriated by the state's general appropriations bill as part of the TxDOT budget. The most recent Texas AIP was funded at approximately $15.6 million. The state-local cost sharing for most projects under this program is set at 90 percent state and 10 percent local. Revenue generating projects like fuel facilities and other projects like weather stations can be funded at a 75 percent state and 25 percent local. Other projects like terminal buildings, routine maintenance projects, and small capital improvement program items can be funded under a 50-50 funding basis.

TxDOT provides airport maintenance grant assistance under the Routine Airport Maintenance Program (RAMP), intended to match local funds on a 50 percent basis for "lower-cost" airfield and terminal area improvement projects. Airfield items (runway crack seal, patching, herbicide, etc.) tend to carry a higher priority than terminal area items (entrance road paving, fencing, lighting, etc.), with determination of eligibility of specific items made by TxDOT. The State of Texas will match up to $50,000 for a total of $100,000 annually per airport, with the local sponsor responsible for costs in excess of this annual amount. Under RAMP, local governments are permitted to issue their own contracts for the scope of services by means of a standard one-page application form submitted to TxDOT. If the TxDOT District Office (Dallas) is unable to assist in the requested service, the local government may be approved to contract-out for services; however, the local contract will require TxDOT approval for scope and cost. In-kind force accounts are not acceptable for matching funds on RAMP projects. TxDOT typically issues multiple RAMP contracts for goods and services in combination with similar projects at other nearby airports.

In addition to RAMP, other grant programs and their eligibility requirements offered by Texas include:

- **Automated Weather Observation System (AWOS)**
  - 75/25 cost share (estimated cost $140,000)
  - Letter of interest

- **Terminal Building Program**
  - Airport property publicly owned or leased by public entity for at least 20 years
  - Airport must have airport manager or designated person on site on regular basis
  - Airport must have aviation fuel available for sale to flying public
  - 50/50 cost share for design and construction up to $1,000,000
  - 50/50 cost share for vehicle parking and entrance road up to $100,000
  - 90/10 cost share for aircraft parking apron in addition to the building grant amount
  - Letter of interest

- **Hangar Program**
  - 90/10 cost share
  - NPE only/state funding secondary if NPE is exhausted (case by case basis)
  - Capped at $600,000 for structures only, no cap for pavement
  - Airside needs must be met
  - Justification for additional hangar space required
  - Approved ALP designating location
  - Hangar lease and rate schedule in place
  - Adoption of Airport Minimum Standards if not already in place

- Letter of interest

- **Fuel Facility Development**
  - 75/25 cost share (NPE funding only)
  - Installation of new systems owned and controlled by airport sponsor only (above ground storage tank, dispensing system, and card reader for self-serve 100LL)
  - Airside needs must be met
  - Approved ALP designating location
  - Adoption of Airport Minimum Standards if not already in place
  - Evidence of compliance with environmental regulations, which includes a Storm Water Pollution Prevention Plan and Spill Prevention Control and Countermeasure Plan. Both plans eligible for RAMP grants
  - Letter of interest

LOCAL AIRPORT FUNDING

The local funding requirement for eligible federal or state-funded capital improvement projects normally totals 10 percent of the project development cost. However, as seen above, some airport projects still require a 25 to 50 percent match of the project specific development cost. AIP funding for general aviation airport improvements, even with the multiple federal and state programs, will place greater emphasis on the need for routine pavement maintenance and a continued financial commitment from the local airport sponsor in the future.

PRIVATE (THIRD PARTY) AIRPORT FINANCING

Rockwall's airport has received little or no private-sector money to facilitate airfield development. General aviation airports serving both business and personal aircraft often rely heavily on private sector financing for non-eligible improvement projects. These types of projects, which serve an individual need, have a business-related public benefit, or are beyond the financial resources of the airport sponsor or TxDOT. Private financing can range from a single monetary up-front payment for new hangar development to total financing of new airport structures, property, and facilities to routine maintenance.

Bank loans are considered short-term financing and are typically used at general aviation airports for hangar development and less capital-intensive terminal area improvements. Build-and-lease-back agreements can be used for hangar development either as a pledge to support bond issues or against mortgages on facilities constructed for a particular tenant. Ground-lease rates are nominal to reflect outstanding debt risk to the investor. The major disadvantages to ground leases are higher interest rates, and the non-assignable or restricted leasehold, which remains conditionally unsecured by the financing institution.

PHASED DEVELOPMENT AND PROJECT COST ESTIMATES

PHASED DEVELOPMENT PLAN

The phased development plan is the formulation of an orderly series of improvements intended to yield a safe, efficient, and attractive public facility in a timely and economical manner. A list of capital improvement projects has been assembled from the facility requirements and is based on the preferred airport development alternative selected by the City and an airport committee comprised of City Council members and Rockwall Economic Development Corporation (REDC) board members. This project list, along with the Capital Improvement Program (CIP), upon acceptance by the airport sponsor and TxDOT can be continuously updated by the sponsor and TxDOT.

The following guidelines have been employed in formulating the Phased Development Plan and CIP for Ralph M. Hall Municipal Airport:

- Overall, the development plan has been structured to provide flexibility to meet short and long-range goals. Therefore, individual projects should not be considered as a single improvement but as part of a series of projects that arrive at the ultimate development concept

- The development plan does not represent an obligation of local funds, nor does it require a funding commitment without justification of demand levels by the City of Rockwall, the REDC, TxDOT, or the FAA

- The expressed desire, intent, and ability of the City to achieve airport land use compatibility, coupled with favorable community and business support of the airport, remains an important funding consideration.

Each project is associated with a priority and phase separated by year. This CIP and Phased Development Plan described below and depicted in **Table 5-1** through 5**-3** and on **Figure 5-1** encompass three development and funding phases: Phase I (0-5 years), Phase II (6-10 years), and Phase III (11-20 years).

PHASE I INCLUDES THE FOLLOWING PROJECTS:

- Airfield Improvements
  - A4: Design and construct 25 foot wide partial parallel taxiway offset 225 feet from runway centerline
  - A9: Design and reconstruct Runway 17/35 removing line-of-sight issue, widening to 60 feet, and runway safety area improvement on north end

- A10: Airfield electrical improvements – new electrical vault, runway lights, airport rotating beacon, lighted windsock and new segmented circle

- ✈ Landside Improvements
  - A1: Property acquisition – 19 acres for terminal redevelopment
  - A2: Design and construct replacement shade "T" type hangars and associated taxilanes on airport's east side
  - A3: Remove existing hangars and terminal building on Airport's east side
  - A5: Design and construction new aircraft parking apron
  - A6: Remove and replace AvGAS fuel storage and delivery system
  - A7: Design and construct new entrance road, auto parking, and security fencing
  - A8: Design and construct new terminal building
  - A11: Design and construct new 100' x 100' common/box hangar
  - A12: Design and construct new 10 unit nested T-hangar
  - A13: Design and construct new 10 unit nested T-hangar
  - A14: Design and construct new 80' x 80' common/box hangar

PHASE II INCLUDES THE FOLLOWING PROJECTS:

- ✈ Airfield Improvements
  - B1: Install visual approach lighting aids (PAPIs and REILs) to both ends of Runway 17/35
  - B4: Relocate AWOS
  - B5: Design and construction parallel taxiway extension north to Runway 17 end
  - B6: Design and install medium intensity taxiway lights (MITL) along taxiway extension

- ✈ Landside Improvements
  - B2: Design and construct apron expansion
  - B3: Design and construct new 80' x 80' common/box hangar

PHASE III INCLUDES THE FOLLOWING PROJECTS:

- ✈ Landside Improvements
  - C1 and C2: Design and construct 60’ x 60’ common/box hangars and associated taxilane and ramp areas
  - C3: Design and construct 60’x 40’ common/box hangars and associated taxilane and ramp areas
  - C4: Design and construct 80’ x 40’ common/box hangar and associated taxilane and ramp area

PROJECT COST ESTIMATES

Opinions of probable costs for individual projects are based on unconstrained funding and have been prepared for improvements identified to meet facility requirements. Since these probable costs are based on current year dollars, they are intended for planning purposes only and should not be used or construed as construction cost estimates. Formalized opinions of probable costs will be developed as part of each project’s scoping process during the design and engineering. It is important to note that market demand, not occurrence within a specific time frame, will drive facility need. Additionally, the project list is flexible and evolving. For example, if a project is slated for year three of the Phasing Plan, this does not mean it needs to occur during this time. Project importance changes over time which may allow certain items to move up or down in the priority order.

TABLE 5-1
PHASE I (0-5 YEARS) DEVELOPMENT COSTS
RALPH M. HALL MUNICIPAL AIRPORT

	Project Type	Local Funding	State/Federal Funding	Total Cost	TXDOT Program Source
A1	Acquire Land Adjacent to and East of the Airport (approx. 19 acres)	$179,000	$1,611,000	$1,790,000	AIP
A2	Construct two New 10-unit Shade T-Hangars (northern units) and Associated Taxilane	$114,000	$1,026,000	$1,140,000	AIP/Hangar Program
A3	Remove existing hangars and structures on east-side of airport	$20,000	$180,000	$200,000	AIP/Hangar Program
A4	Construct 25' Parallel Taxiway 225' from Runway Centerline with airport signs and centerline striping (From the AWOS to the Runway 35 End)	$75,000	$675,000	$750,000	AIP
A5	Construct new Terminal Area Apron (400' x 200')	$76,000	$684,000	$760,000	AIP
A6	Remove and Replace underground AvGAS Fuel Storage Tank with Above Ground 12,000 Gallon Tank and 24-Hour Credit System	$87,500	$262,500	$350,000	AIP/Fuel Program
A7	Construct New Airport Entrance Road, Auto Parking, and Security Fence	$48,000	$432,000	$480,000	AIP
A8	Construct new Terminal Building (approx. 3,000 ft^2)	$225,000	$225,000	$450,000	Terminal Program
A9	Reconstruct, Widen, and Re-stripe Runway 17/35. (Width will increase 15' and Reconstruction will correct Line of Sight Deficiency)	$204,000	$1,836,000	$2,040,000	AIP
A10	Install LED MIRL on Reconstructed Runway and Upgrade Electrical Vault, Rotating Beacon, and Lighted Windsock and Segmented Circle	$94,000	$846,000	$940,000	AIP
A11	Construct 100' x 100' Box Hangar	$75,000	$675,000	$750,000	AIP/Hangar Program
A12	Construct New 10-unit Nested T-Hangar with Bi-Fold Doors (southern unit) and Associated Taxilane	$66,000	$594,000	$660,000	AIP/Hangar Program
A13	Construct New 10-unit Nested T-Hangar with Bi-Fold Doors (center unit) and Associated Taxilane	$70,000	$630,000	$700,000	AIP/Hangar Program
A14	Construct 80' x 80' Box Hangar and Associated Taxilane/Ramp	$37,500	$337,500	$375,000	Hangar Program
	PHASE I TOTAL	**$1,371,000**	**$10,014,000**	**$11,385,000**	

TABLE 5-2
PHASE II (6-10 YEARS) DEVELOPMENT COSTS
RALPH M. HALL MUNICIPAL AIRPORT

	Project Type	Local Funding	State/Federal Funding	Total Cost	TXDOT Program Source
B1	Install PAPI-4 and REILs to serve each Runway End	$54,000	$486,000	$540,000	AIP
B2	Expand Apron North	$51,000	$459,000	$510,000	AIP
B3	Construct one 80 x 80 Box Hangar and Associated Taxilane/Ramp	$91,000	$819,000	$910,000	Hangar Program
B4	Relocate AWOS	$10,000	$30,000	$40,000	AWOS
B5	Extend parallel taxiway north to Runway 17 end	$45,000	$405,000	$450,000	AIP
B6	Install medium intensity taxiway lights (MITL) along full length of parallel taxiway	$20,000	$180,000	$200,000	AIP
	PHASE II TOTAL	**$291,000**	**$2,559,000**	**$2,850,000**	

TABLE 5-3
PHASE III (11-20 YEARS) DEVELOPMENT COSTS
RALPH M. HALL MUNICIPAL AIRPORT

	Project Type	Local Funding	State/Federal Funding	Total Cost	TXDOT Program Source
C1	Construct three 60' x 60' Box Hangars and Associated Taxilane/Ramp	$150,000	$550,000	$700,000	Hangar Program
C2	Construct two 60' x 40' Box Hangars and Associated Taxilane/Ramp	$90,000	$420,000	$510,000	Hangar Program
C3	Construct one 60 x 40 Box Hangar and Associated Taxilane/Ramp	$50,000	$210,000	$260,000	Hangar Program
C4	Construct one 80 x 40 Box Hangar and Associated Taxilane/Ramp	$70,000	$315,000	$385,000	Hangar Program
	PHASE III TOTAL	**$360,000**	**$1,495,000**	**$1,855,000**	
	TOTAL	**$2,022,000**	**$14,068,000**	**$16,090,000**	

Source: Costs reflect current 2013 dollars and should be used for planning purposes only. Engineering/design and construction costs are inclusive.
* If airport owned, hangars are funded at a 90%/10% cost share through NPE up to $600,000. The Airport Sponsor is responsible for 100% of the remaining balance. If privately owned, 100% of the cost is private or third party funding.

Other likely future projects for the airport over the course of the long-term development include:

TABLE 5-4
LONG-TERM PROJECTS
ROCKWALL MUNICIPAL AIRPORT

Project Type	TXDOT Grant Program
Rehabilitate Runway 17/35 (3,373' x 60')	AIP
Rehabilitate Parallel Taxiway and Connectors (3,373' x 25')	AIP
Rehabilitate Terminal Apron (600' x 200')	AIP
Rehabilitate Airport Entrance Road	AIP
Rehabilitate or Upgrade Airport Beacon	AIP
Install Above-ground Jet-A fuel Tank (12,000 gallons, as demand warrants)	Fuel Program
Install fencing and controlled access gates around new terminal areas east and west	AIP
Institute Airport Minimum Standards and Rules and Regulations.	AIP
Update Airport Master Plan	AIP
Update Height Hazard Zoning Map and associated ordinance to coincide with runway changes	AIP

To supplement the information provided by the project list and project development cost estimates, a Phasing Plan graphic has been prepared. This graphic, represented in **Figure 5-1**, indicates the suggested phasing for improvements for both short-term and long-term projects throughout the next 10-years. It is set up as a color coded system to easily identify projects as they are listed and itemized in **Tables 5-1, 5-2,** and **5-3**.

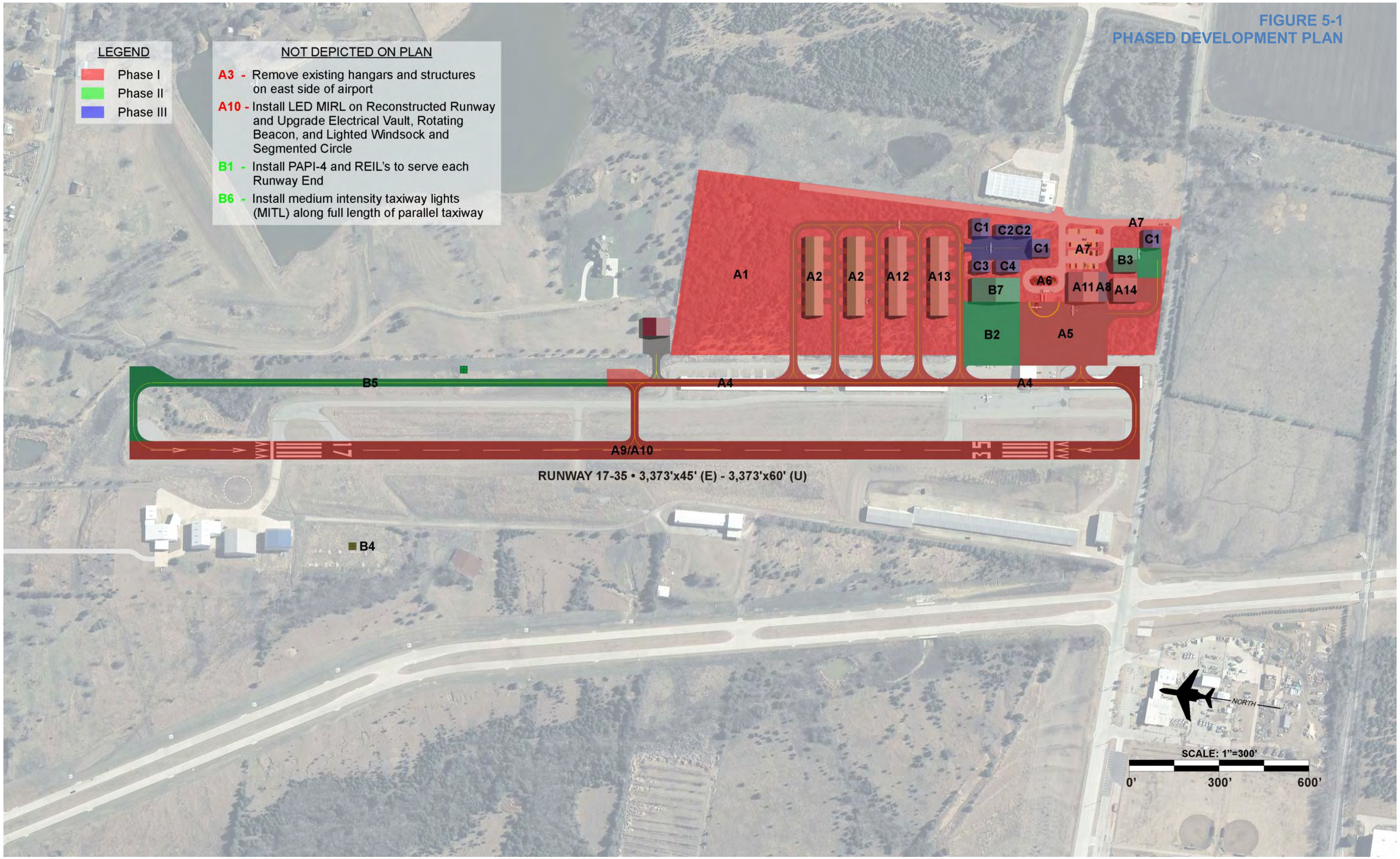
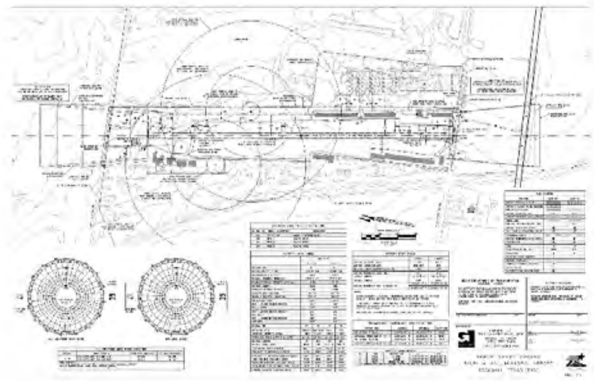


FIGURE 5-1
PHASED DEVELOPMENT PLAN
LEGEND
Phase I
Phase II
Phase III
NOT DEPICTED ON PLAN
A3 - Remove existing hangars and structures on east side of airport
A10 - Install LED MIRL on Reconstructed Runway and Upgrade Electrical Vault, Rotating Beacon, and Lighted Windsock and Segmented Circle
B1 - Install PAPI-4 and REIL's to serve each Runway End
B6 - Install medium intensity taxiway lights (MITL) along full length of parallel taxiway
A1
A2
A2
A12
A13
C1
C2
C2
C1
C3
C4
A7
A7
C1
B3
A6
A11
A8
A14
B7
B2
A5
B5
A4
A4
A9/A10
RUNWAY 17-35 • 3,373'x45' (E) - 3,373'x60' (U)
B4
NORTH
SCALE: 1"=300'
0'
300'
600'



CHAPTER SIX: AIRPORT PLANS

INTRODUCTION

A set of Airport Layout Plan (ALP) drawings has been prepared for the Ralph M. Hall Municipal Airport, which graphically depicts the existing and proposed facilities for the Airport through the 20-year planning program as recommended and approved by the local airport sponsor. The set includes: Airport Layout Drawing (ALD), Airport Airspace Drawing, Runway Inner Portion of the Approach Surface Drawing, Terminal Area Plan, Land Use Drawing, and Airport Property Map.

AIRPORT LAYOUT DRAWING

A scaled single-page drawing depicting existing and ultimate airport development based on proposed land, facilities and equipment recommended for the short and long-term operation and development of the Airport. In addition, the ALD displays separation and clearance distances for future unrestricted development of the Airport and navigational aid (NAVAID) facilities. The layout is the result of a series of analyses and discussions with the airport sponsors and airport users to determine the optimum plan to yield a safe and cost-effective facility. The proposed improvements include projects needed to meet the projected aviation demands of the airport service area throughout the 20-year planning period.

INNER PORTION OF THE RUNWAY APPROACH SURFACE DRAWING

Large-scale drawing showing the plan and profile views of the inner most portions of the approach surfaces and Runway Protection Zones. The plans are designed to identify current and potential structures (roadways, powerlines, trees, etc.) in relation to the existing and ultimate runway threshold. This drawing aids in determining the clearance or violation of close-in objects based on top elevations as they are encountered along the extended runway centerline and within the approach surfaces. Each violation and/or obstruction is identified, with appropriate future mitigation recommendations.

TERMINAL AREA PLAN

This is a large-scale drawing of the terminal area showing the ultimate construction of facilities to meet future terminal area requirements. The primary features of this plan include improvements to and new development of facilities and equipment. The ultimate design for the terminal area provides an adequate and functional layout for aircraft parking and maneuvering, hangar and building development, and other types of airport-related development planned for the Airport. Additionally, the plan will provide adequate separation and clearances for future unrestricted development of all terminal facilities and equipment.

LAND USE DRAWING

A single-page drawing, at the same scale as the ALD, showing all on-airport land uses to include: aeronautical purposes (runways/taxiways/safety areas), terminal use, business park development, commercial use development, and light/heavy industrial use.

AIRPORT PROPERTY DRAWING

A single-page drawing, Property Map, showing an overlay of all relevant tracts of existing airport fee-simple property and aviation/avigation easement interests including the size (acres), date (grant agreement) and existing ownership status of proposed airport property acquisition. Properties recommended for the ultimate build-out based on the recommendations of the master plan will be included along with existing ownership, type of ultimate ownership by the Airport, total acreage in the parcel, and ultimate acreage needed for airport development and safety.

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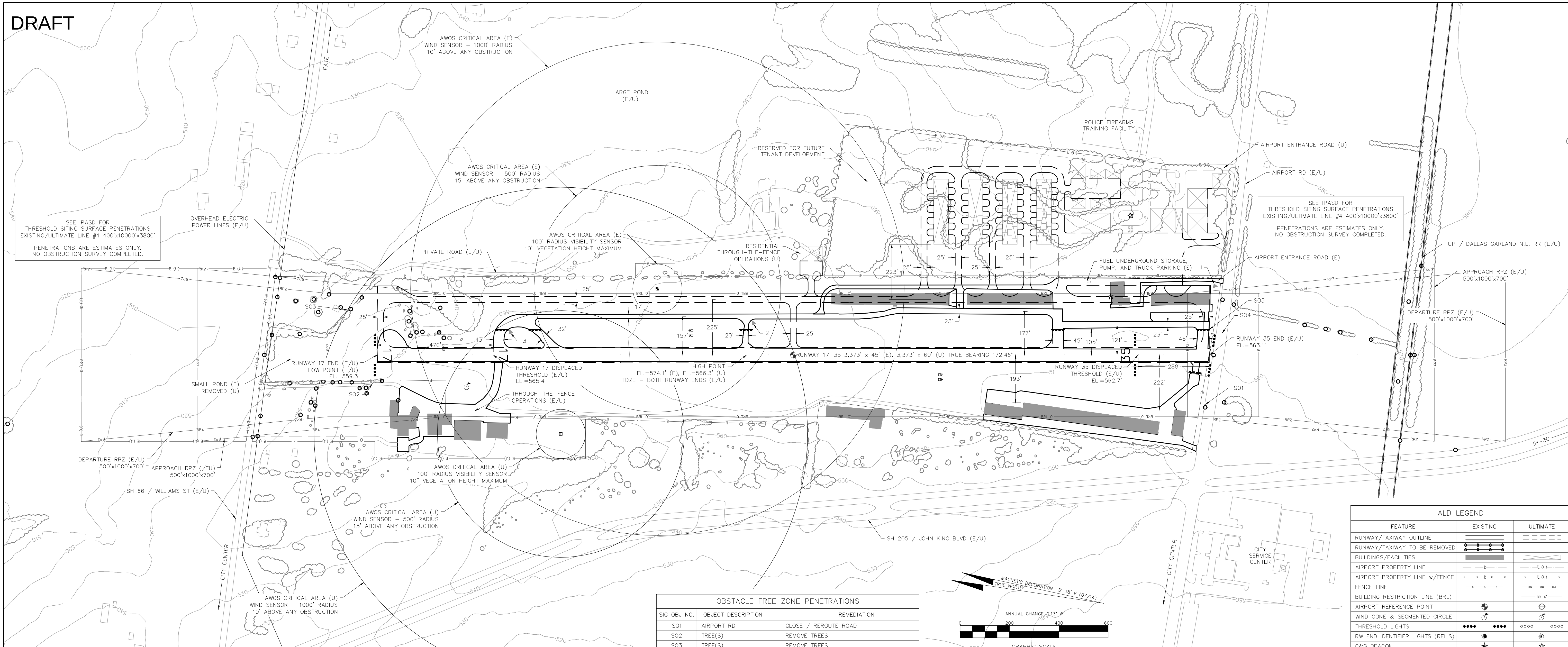


OBSTACLE FREE ZONE PENETRATIONS		
SIG OBJ NO.	OBJECT DESCRIPTION	REMEDIATION
S01	AIRPORT RD	CLOSE / REROUTE ROAD
S02	TREE(S)	REMOVE TREES
S03	TREE(S)	REMOVE TREES
S04	TREE(S)	REMOVE TREES
S05	RUNWAY HOLD POSITIONS	RELOCATE WITH PARALLEL TAXIWAY PROJECT

RUNWAY DATA TABLE

	RW 17-35			
	EXISTING		ULTIMATE	
RUNWAY ARC	B-I		B-I	
DESIGN AIRCRAFT & ARC	CESSNA 421/B-I		CESSNA 421/B-I	
BALANCED FIELD LENGTH	2323'		2323'	
RUNWAY LENGTH & WIDTH (ft.)	3373' X 45'		3373' X 60'	
PAVEMENT DESIGN STRENGTH (1000 lbs.)	12 SW		30 SW	
RUNWAY LIGHTING	NONE		MIRL	
PERCENT EFFECTIVE GRADIENT	0.44%		0.21%	
PERCENT WIND COVERAGE	98.52%		98.52%	
MAXIMUM ELEVATION ABOVE MSL	574.10'		566.30'	
RW SURFACE TYPE	ASPH		ASPH	
RSA – LENGTH BEYOND RW END	240'		240'	
RSA – WIDTH	120'		120'	
OFA – LENGTH BEYOND RW END	240'		240'	
OFA WIDTH	400'		400'	
OFZ – LENGTH BEYOND RW END	200'		200'	
OFZ WIDTH	400'		400'	
RUNWAY END	17	35	17	35
APPROACH TYPE	GPS	GPS	GPS	GPS
APPROACH VISIBILITY MINIMA	1 MILE	1 MILE	1 MILE	1 MILE
THRESHOLD SITING SURFACE & SLOPE	#4 20:1	#4 20:1	#4 20:1	#4 20:1
RUNWAY MARKING	NPI	NPI	NPI	NPI
RUNWAY VISUAL AIDS	NONE	NONE	PAPI-2L	PAPI-2L
TOUCHDOWN ZONE ELEVATION	574.10'	574.10'	566.30'	566.30'
FAR PART 77 APPROACH CATEGORY	A(NP)	A(NP)	A(NP)	A(NP)
FAR PART 77 APPROACH SURFACE SLOPE	20:1	20:1	20:1	20:1
TAKE-OFF RUN AVAILABLE (TORA)	2632'	2830'	3133'	3373'
TAKE-OFF DISTANCE AVAILABLE (TODA)	2632'	2830'	3133'	3373'
ACCELERATE STOP DISTANCE AVAIL. (ASDA)	3107'	3133'	3133'	3373'
LANDING DISTANCE AVAILABLE (LDA)	2637'	2844'	2663'	3084'

AIRPORT DATA TABLE

	EXISTING	ULTIMATE
AIRPORT ELEVATION (MSL)	574.1'	566.3'
AIRPORT NAVIGATION AIDS	NDB, GPS	GPS
MEAN MAX TEMP (HOTTEST MONTH °F)	96°F	96°F
AIRPORT REFERENCE CODE (ARC)	B-I	B-I
TAXIWAY MARKING	STD W/℄ REF	STD W/℄ REF
TAXIWAY LIGHTING	NONE	NONE
AIRPORT REFERENCE POINT COORDINATES	32°55'50.14" N 96°26'07.75" W	32°55'50.14" N 96°26'07.75" W

NOTES

DATUM COORDINATE SYSTEMS – HORIZONTAL DATUM NAD 1983 (STATE PLAN ZONE 2 – TEXAS NORTH CENTRAL (FIPS 4202), VERTICAL DATUM NAVD88.

A VERTICALLY-GUIDED SURVEY MEETING ALL THE REQUIREMENTS OF FAA ADVISORY CIRCULARS 150/5300-16, 17, AND 18 WAS NOT COMPLETED AS A PART OF THIS PROJECT.

CONTOUR AND BASEMAP DATA RECEIVED FROM THE CITY OF ROCKWALL.

NO CAUTION ZONE LIGHTS ARE INSTALLED

RUNWAY END COORDINATES AND ELEVATIONS

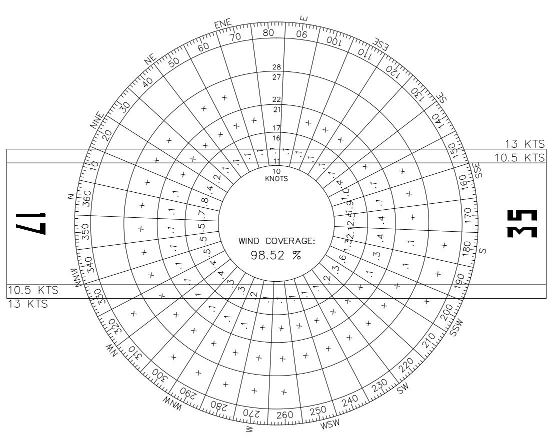
RUNWAY END	LATITUDE	LONGITUDE	ELEVATION
END OF RWY 17 (E/U)	32°56'06.68" N	96°26'10.31" W	559.3'
DISPLACED THRESHOLD OF RWY 17	32°56'02.07" N	96°26'09.59" W	565.4'
END OF RWY 35 (E/U)	32°55'33.60" N	96°26'05.12" W	563.1'
DISPLACED THRESHOLD OF RWY 35	32°55'36.44" N	96°26'05.56" W	562.7'

AIRFIELD MONUMENTS

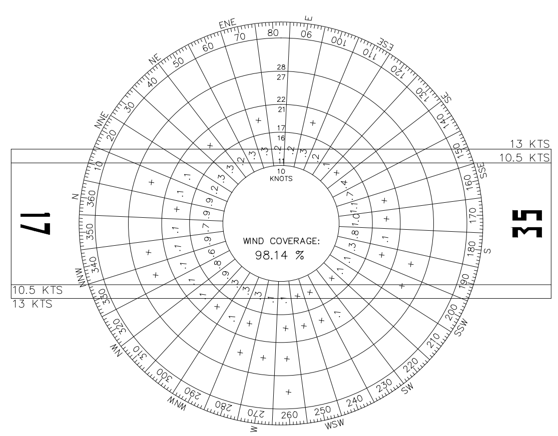
NO.	TYPE	DESIGNATION	LAT.	LONG.
1	PACS	N 1495	32°55'33.75" N	96°26'01.83" W
2	SACS	BOREN	32°55'51.90" N	96°26'06.46" W
3	SACS	BOREN AZ MK	32°56'01.51" N	96°26'08.40" W
ALL COORDINATES AND ELEVATIONS HORIZONTAL NAD 83, VERTICAL NAVD 88.				

ALD LEGEND

FEATURE	EXISTING	ULTIMATE
RUNWAY/TAXIWAY OUTLINE		
RUNWAY/TAXIWAY TO BE REMOVED		
BUILDINGS/FACILITIES		
AIRPORT PROPERTY LINE	℄	℄ (U)
AIRPORT PROPERTY LINE w/FENCE	℄	℄ (U)
FENCE LINE		xu xu xu
BUILDING RESTRICTION LINE (BRL)		BRL 0'
AIRPORT REFERENCE POINT		
WIND CONE & SEGMENTED CIRCLE		
THRESHOLD LIGHTS		
RW END IDENTIFIER LIGHTS (REILS)		
C&G BEACON		
VGSI		
HOLD POSITION AND SIGN		
ASOS/AWOS		
PACS AND SACS MARKERS		
GROUND CONTOURS	1620	
SIGNIFICANT OBJECT LOCATION		
TREES/BRUSH		
NONDIRECTIONAL BEACON (NDB)		



ALL WEATHER WIND ROSE



IFR WIND ROSE

ALL WEATHER WIND ROSE ANALYSIS			
RUNWAY	WIND VELOCITY	AWWR WIND COVERAGE	IFR WIND COVERAGE
17-35	10.5 KNOTS (ARC A-I AND B-I)	97.12%	96.43%
WIND SOURCE: NATIONAL CLIMATIC DATA CENTER – McKINNEY NATIONAL AIRPORT 78,643 OBSERVATIONS, 1998-2008, STATION #72254			

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DAVID FULTON, DIRECTOR, AVIATION DIVISION — DATE

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(972) 377-8380 FAX

PLH — APRIL 2015
DESIGNED BY — DATE

JAH — APRIL 2015
DRAWN BY — DATE

AIRPORT LAYOUT DRAWING
RALPH M. HALL MUNICIPAL AIRPORT
ROCKWALL, TEXAS (F46)

Texas Department of Transportation
Aviation Division

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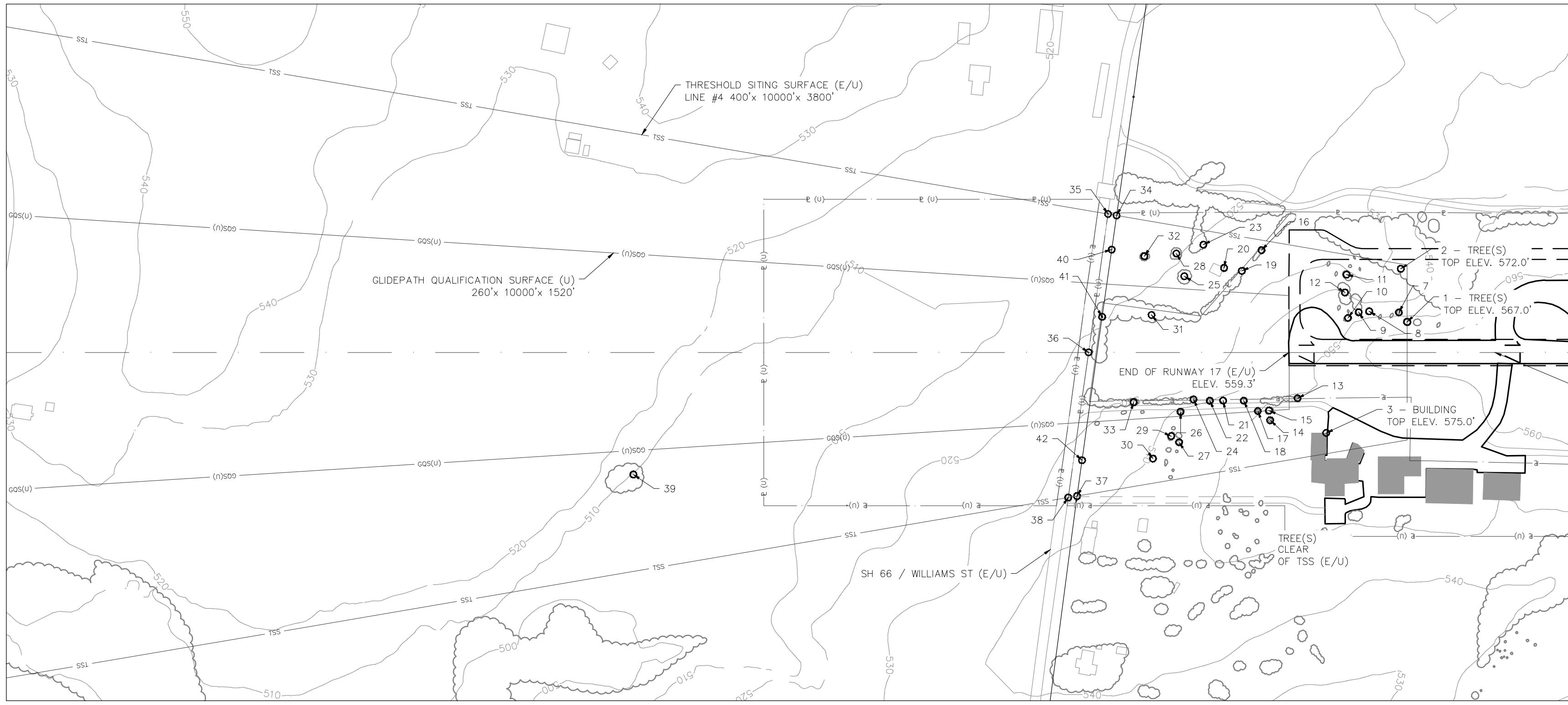
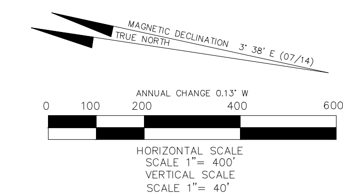
RUNWAY 17 – PLAN VIEW



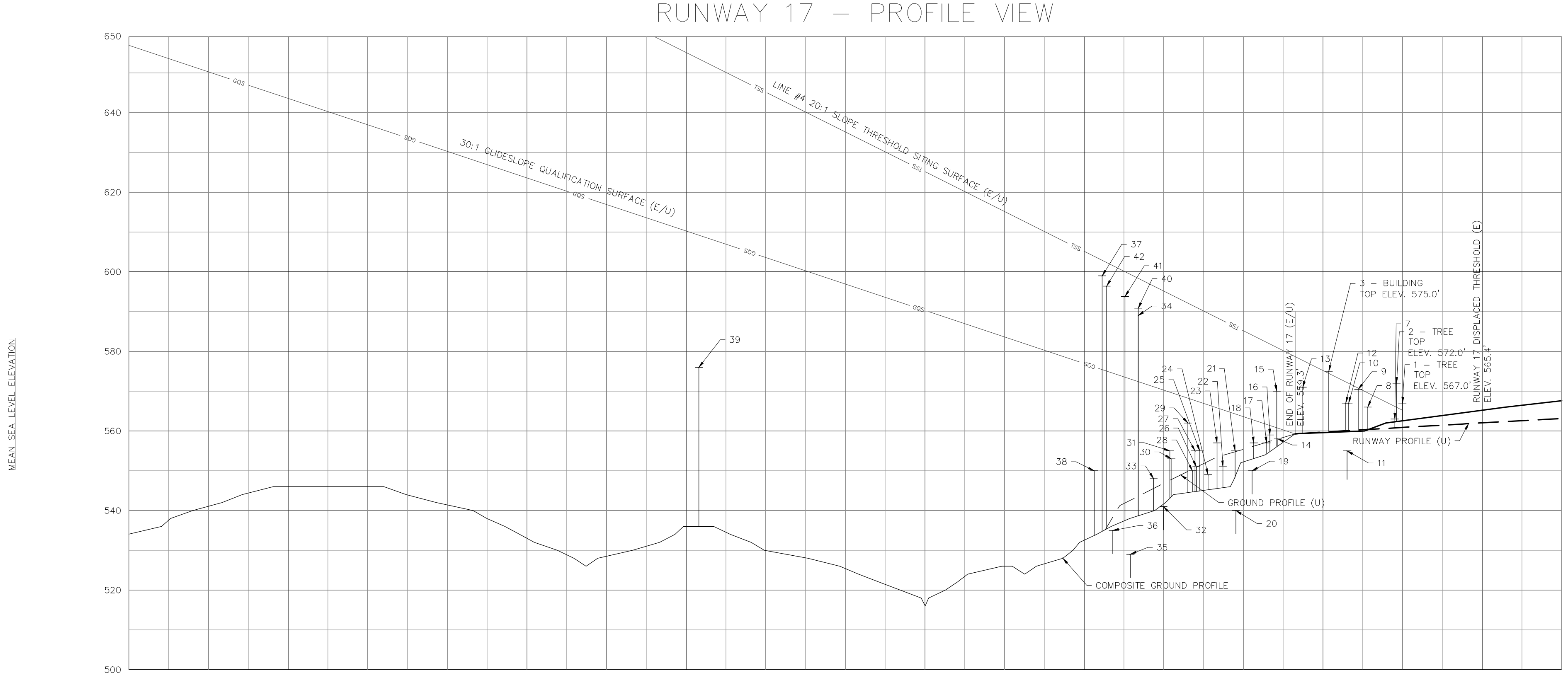


PENETRATIONS TO THRESHOLD SITING SURFACE								
NO.	OBJECT DESCRIPTION	LATITUDE (N)	LONGITUDE (W)	DISTANCE FM RW END	OFFSET FM RW C/L*	TOP ELEVATION**	AMT OF PENETRATION	REMEDIATION
1	TREE(S)	32°56'04.13"	96°26'09.09"	–270'	70' L	567.0'	1.6'	REMOVE TREE(S)
2	TREE(S)	32°56'04.43"	96°26'07.70"	–159'	92' L	572.0'	1.1'	REMOVE TREE(S)
3	BUILDING	32°56'05.61"	96°26'12.32"	–83'	184' R	575.0'	0.3'	REMOVE BUILDING

* OFFSETS FROM CENTERLINE ARE DESCRIBED RIGHT OR LEFT OF THE RUNWAY CENTERLINE AS SEEN BY A PILOT APPROACHING THE RUNWAY TO LAND
** ELEVATIONS ADJUSTED UPWARD 15' FOR PUBLIC ROADWAY, 17' FOR INTERSTATE HIGHWAY, 23' FOR RAILROADS

NO OBSTRUCTION SURVEY COMPLETED. CONTOUR AND ELEVATION DATA FROM CITY OF ROCKWALL AND OTHER READILY AVAILABLE INFORMATION.

RUNWAY 17 – PROFILE VIEW



IPASD LEGEND		
FEATURE	EXISTING	ULTIMATE
RUNWAY/TAXIWAY OUTLINE		
RUNWAY/TAXIWAY TO BE REMOVED		
BUILDINGS/FACILITIES		
AIRPORT PROPERTY LINE		
AIRPORT PROPERTY LINE w/FENCE		
THRESHOLD SITING SURFACE	TSS	TSS (U)
FENCE LINE		
THRESHOLD LIGHTS		
RW END IDENTIFIER LIGHTS (REILS)		
GROUND CONTOURS		
SIGNIFICANT OBJECT PLAN VIEW		
SIGNIFICANT OBJECT PROFILE VIEW		
TREES/BRUSH		

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IPASD RUNWAY 17
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ROCKWALL, TEXAS (F46)

Aviation Division

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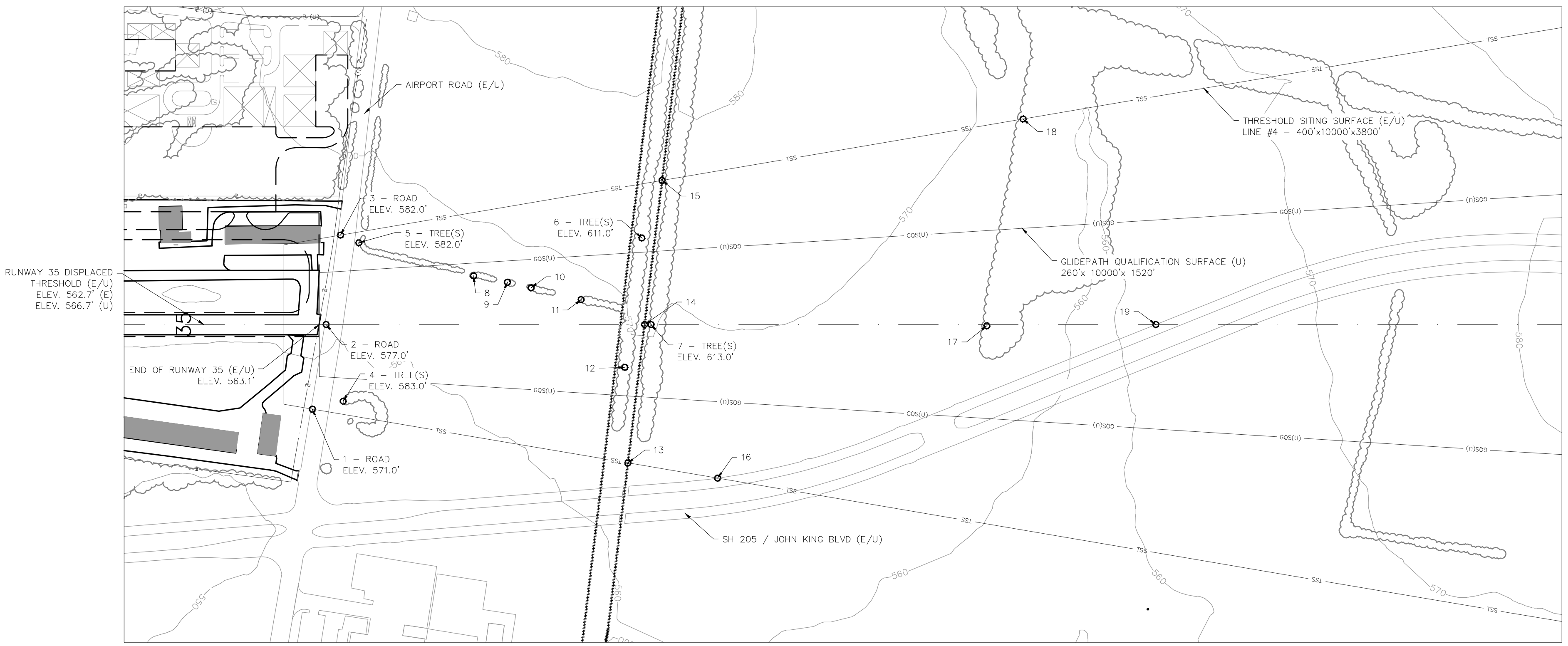
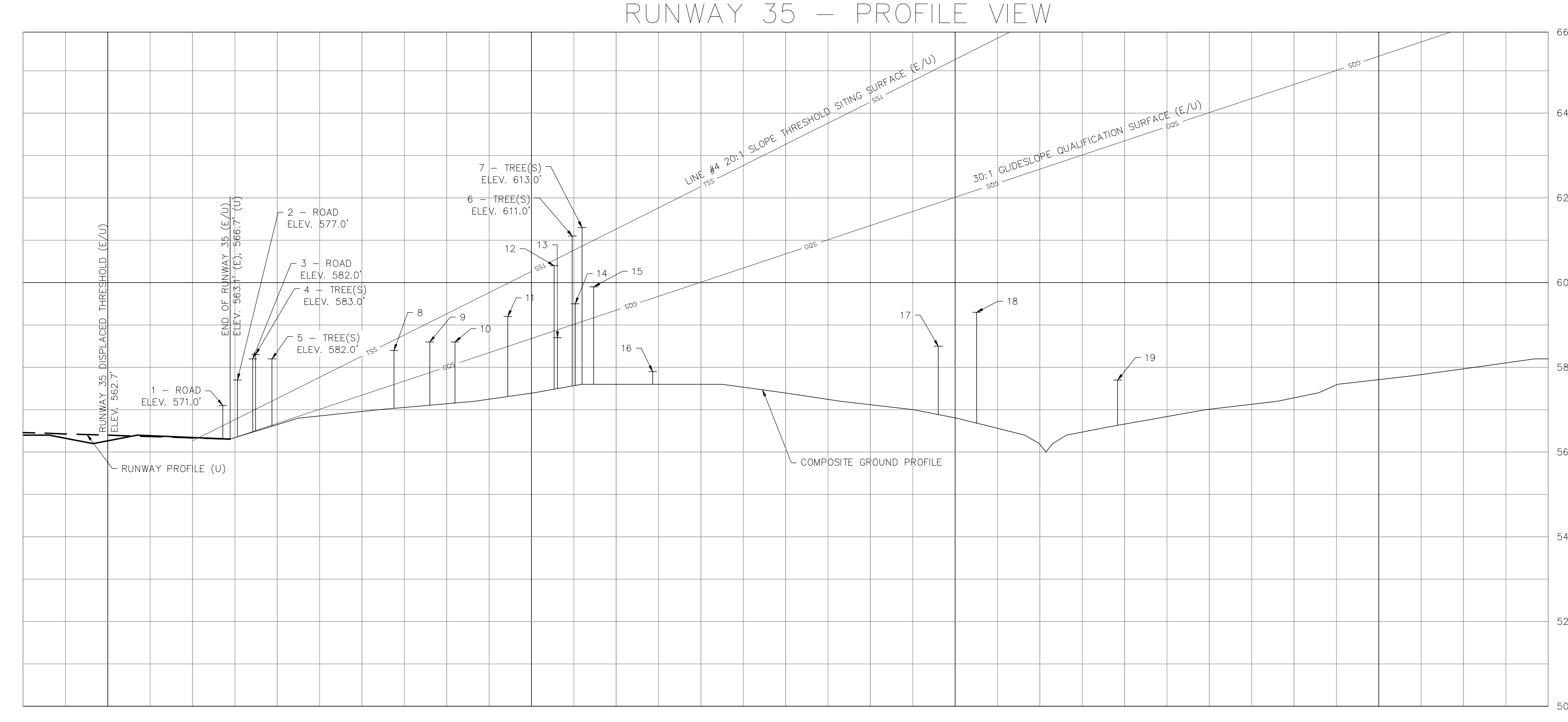
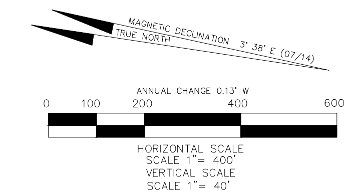
RUNWAY 35 – PLAN VIEW



RUNWAY 35 – PROFILE VIEW





PENETRATIONS TO THRESHOLD SITING SURFACE

NO.	OBJECT DESCRIPTION	LATITUDE (N)	LONGITUDE (W)	DISTANCE FM RW END	OFFSET FM RW C/L*	TOP ELEVATION**	AMT OF PENETRATION	REMEDIATION
1	AIRPORT RD	32°55'33.50"	96°26'07.61"	–18'	212' L	571.0'	4.8'	REMOVE/RELOCATE ROAD
2	AIRPORT RD	32°55'33.44"	96°26'05.09"	17'	C/L	577.0'	9.0'	REMOVE/RELOCATE ROAD
3	AIRPORT RD	32°55'33.37"	96°26'02.43"	53'	224' R	582.0'	12.2'	REMOVE/RELOCATE ROAD
4	TREE(S)	32°55'32.77"	96°26'07.26"	60'	192' L	583.0'	12.8'	REMOVE TREE(S)
5	TREE(S)	32°55'32.90"	96°26'02.58"	99'	205' R	582.0'	9.9'	REMOVE TREE(S)
6	TREE(S)	32°55'25.97"	96°26'01.35"	807'	217' R	611.0'	3.5'	REMOVE TREE(S)
7	TREE(S)	32°55'25.46"	96°26'03.84"	831'	C/L	613.0'	4.3'	REMOVE TREE(S)

* OFFSETS FROM CENTERLINE ARE DESCRIBED RIGHT OR LEFT OF THE RUNWAY CENTERLINE AS SEEN BY A PILOT APPROACHING THE RUNWAY TO LAND
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RUNWAY/TAXIWAY OUTLINE		
RUNWAY/TAXIWAY TO BE REMOVED		
BUILDINGS/FACILITIES		
AIRPORT PROPERTY LINE		
AIRPORT PROPERTY LINE w/FENCE		
THRESHOLD SITING SURFACE		
FENCE LINE		
THRESHOLD LIGHTS		
RW END IDENTIFIER LIGHTS (REILS)		
GROUND CONTOURS		
SIGNIFICANT OBJECT PLAN VIEW		
SIGNIFICANT OBJECT PROFILE VIEW		
TREES/BRUSH		

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PLH — DESIGNED BY — APRIL 2015 — DATE
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IPASD RUNWAY 35
RALPH M. HALL MUNICIPAL AIRPORT
ROCKWALL, TEXAS (F46)

Texas Department of Transportation
Aviation Division

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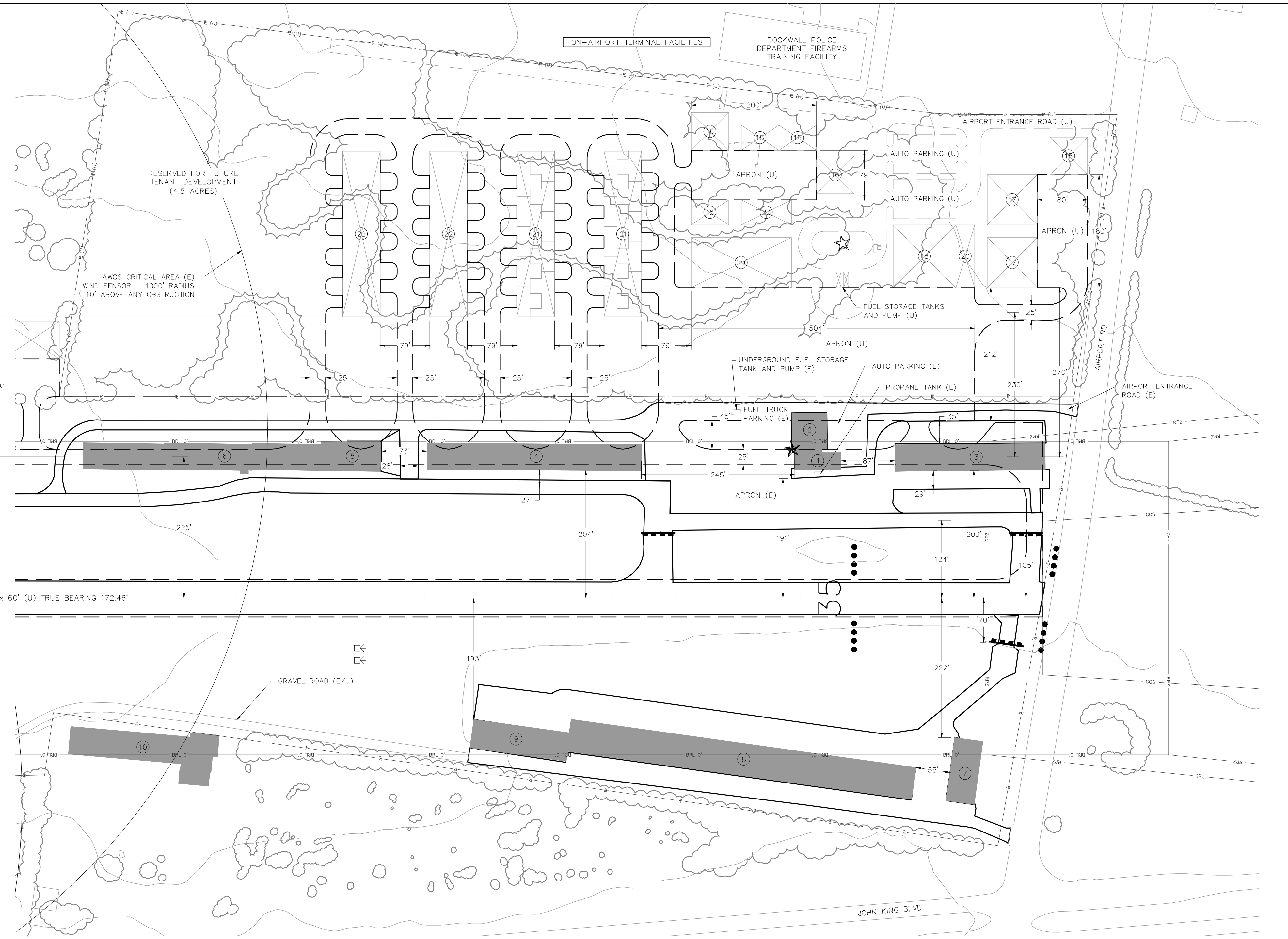
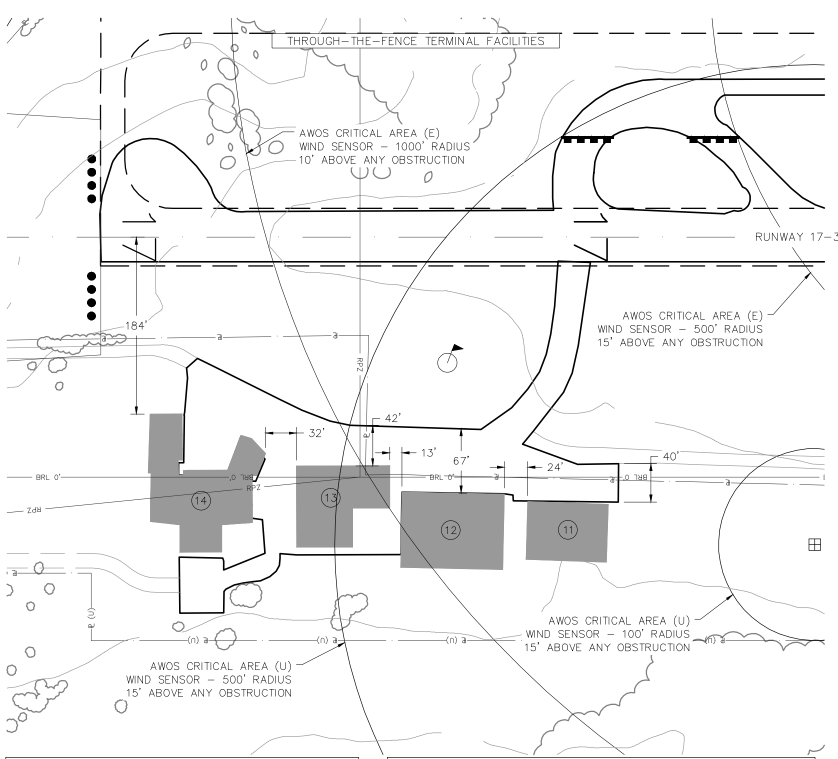
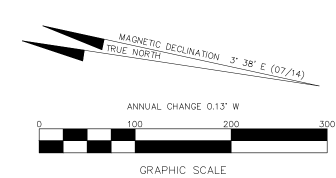




BUILDING TABLE			
BUILDING NUMBER	DESCRIPTION		TOP ELEVATION
	EXISTING	ULTIMATE	
1*	TERMINAL BUILDING	–	–
2*	HANGAR	–	–
3*	HANGAR	–	–
4*	HANGAR	–	–
5*	HANGAR	–	–
6*	HANGAR	–	–
7	HANGAR	–	–
8	HANGAR	–	–
9	HANGAR	–	–
10	TTF HANGAR	–	–
11	TTF HANGAR	–	–
12	TTF HANGAR	–	–
13	TTF HANGAR	–	–
14	TTF HANGAR	–	–
15	–	60'x40' HANGAR	–
16	–	60'x60' HANGAR	–
17	–	80'x80' HANGAR	–
18	–	100'x100' HANGAR	–
19	–	160'x80' HANGAR	–
20	–	TERMINAL BLDG	–
21	–	10-UNIT T-HGR	–
22	–	SHADE HANGAR	–
23	–	80'x40' HANGAR	–

*TO BE REMOVED

ALD LEGEND		
FEATURE	EXISTING	ULTIMATE
RUNWAY/TAXIWAY OUTLINE		
RUNWAY/TAXIWAY TO BE REMOVED		
BUILDINGS/FACILITIES		
AIRPORT PROPERTY LINE		
AIRPORT PROPERTY LINE w/FENCE		
FENCE LINE		
BUILDING RESTRICTION LINE (BRL)		BRL 0'
AIRPORT REFERENCE POINT		
WIND CONE & SEGMENTED CIRCLE		
THRESHOLD LIGHTS		
RW END IDENTIFIER LIGHTS (REILS)		
C&G BEACON		
VGSI		
HOLD POSITION AND SIGN		
ASOS/AWOS		
PACS AND SACS MARKERS		
GROUND CONTOURS		
SIGNIFICANT OBJECT LOCATION		
TREES/BRUSH		
NONDIRECTIONAL BEACON (NDB)		



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TERMINAL AREA DRAWING
RALPH M. HALL MUNICIPAL AIRPORT
ROCKWALL, TEXAS (F46)

Texas Department of Transportation
Aviation Division

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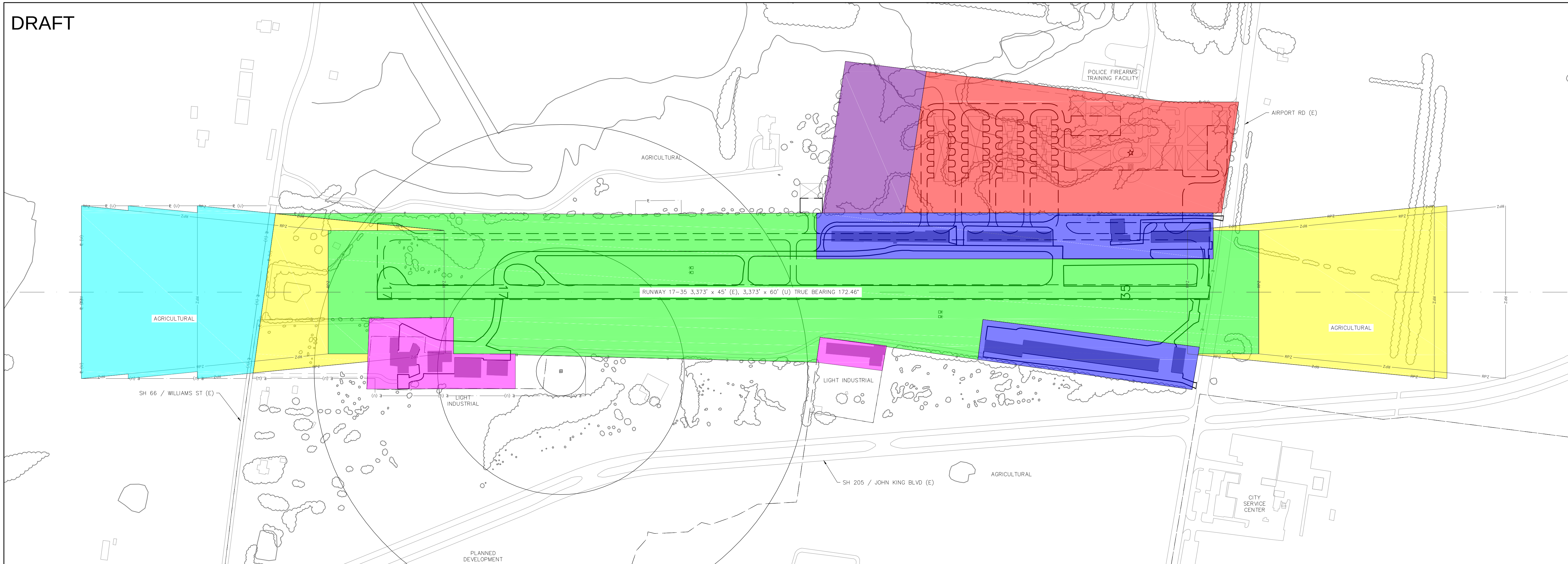

LEGEND

- AIRPORT OPERATIONS PROTECTED AREA
- TERMINAL DEVELOPMENT (E)
- RUNWAY PROTECTION AREA
- TERMINAL DEVELOPMENT (U)
- THROUGH–THE–FENCE HANGAR AREA
- AVIGATION ESEMENT (U)
- FUTURE TENANT DEVELOPMENT AREA

MAGNETIC DECLINATION 3° 37' E (06/12)
TRUE NORTH

ANNUAL CHANGE 0° 7'W

0 200 400 600

GRAPHIC SCALE
1" = 400'

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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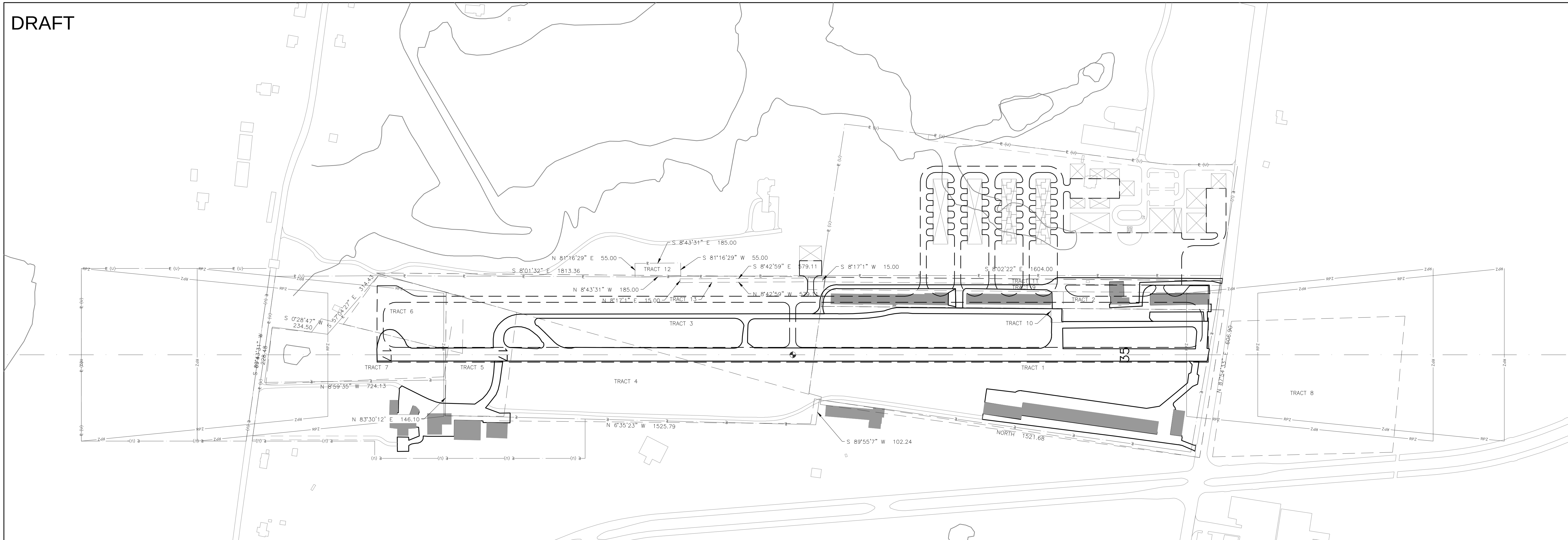
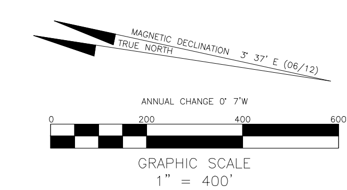
ROCKWALL, TEXAS (F46)

Texas Department of Transportation
Aviation Division

DRAFT





AIRPORT PROPERTY DATA TABLE						
TRACT	ACRES	TITLE	GRANTOR/REMARKS	COUNTY RECORD VOL./PAGE	DATE	FUNDING
1	17.99	FEE SIMPLE	ROY L. COLE	VOL. 53 / PG. 47	10/20/55	
2	4.40	FEE SIMPLE	DALROCK CORPORATION	VOL. 169 / PG. 51	10/09/67	
3	9.60	FEE SIMPLE	ROY L. COLE	VOL. 53 / PG. 48	10/01/55	
4	7.76	FEE SIMPLE	W.L. DUDLEY & CATHERINE DUDLEY	VOL. 53 / PG. 250	1/17/56	
5	2.84	FEE SIMPLE	ROY L. COLE	VOL. 53 / PG. 48	10/20/55	
6	1.75	FEE SIMPLE	WILLIAM A. CURFMAN & GLADYS CURFMAN	VOL. 87 / PG. 525	4/21/69	
7	3.70	FEE SIMPLE	WILLIAM A. CURFMAN & GLADYS CURFMAN	VOL. 87 / PG. 526	4/21/69	
8	9.04	EASEMENT	F.B. ATHEY & RUBY ATHEY	VOL. 87 / PG. 381	6/20/69	
9	1.92	EASEMENT	CITY OF ROCKWALL	VOL. XX / PG. 627	10/09/64	
10	0.14	EASEMENT	CITY OF ROCKWALL	VOL. XX / PG. 627	10/09/64	
11	0.77	EASEMENT	HAROLD B. YOUNGER & ROBERT H. BURKS	VOL. 71 / PG. 140	10/02/64	
12	0.234	EASEMENT	MICHAEL L. PEOPLES	VOL. 5118 / PG. 239	1/18/11	
13	0.199	EASEMENT	RALPH M. HALL MUNICIPAL AIRPORT	VOL. 5118 / PG. 239	7/20/11	

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13A CHANGE 1 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.

DAVID FULTON, 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.

SIGNATURE DATE

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

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PLH	APRIL 2015
DESIGNED BY	DATE
JAH	APRIL 2015
DRAWN BY	DATE

PROPERTY MAP
RALPH M. HALL MUNICIPAL AIRPORT
ROCKWALL, TEXAS (F46)

Texas Department of Transportation
Aviation Division

ALTERNATIVE ANALYSIS: 5,000-FOOT RUNWAY NORTH EXTENSION

This White Paper describes the alternative analysis for a 1,000-foot runway extension to the north of the current Runway 17 end at the Ralph M. Hall Municipal Airport. The City and Airport Advisory Committee, in an effort to explore all expansion options at the Ralph M. Hall Municipal Airport, requested that Garver complete a two dimensional (2D) evaluation for this potential runway expansion beyond the 4,000-foot option currently shown in the Airport Development Plan and on an Airport Layout Drawing (ALD) under review by TxDOT.

Extending Runway 17-35 1,000-feet to the north will impact a number of other existing pieces of infrastructure and future plans for some of these facilities. **Figure A** depicts the runway extension along with a future full-length parallel taxiway and maintains the Runway Design Code (RDC) of B-I-5000. This RDC defines the runway to serve aircraft weighing 12,500 pounds or less but with the length capability to support larger aircraft operations into the airfield. The RDC B-I-5000 parameters maintain the runway width of 60-feet and apply an Object Free Area width of 400-feet that extends 240-feet beyond the runway end. The future parallel taxiway to this new Runway 17 end would be 35-feet wide and offset 225-feet centerline to centerline from Runway 17-35 to the east to match the existing ALD. The Runway Protection Zone (RPZ) sized for these conditions would have dimensions, as shown on **Figure A**, of 500’ (inner width), 700-feet (outer width), and 1,000-feet of depth.

The immediate 2D impacts from this runway expansion option include the relocation of Texas State Highway 66 (SH66), burial or relocation of the Oncor electrical transmission line that runs along SH66, the 15 acre stock tank encompassed by approximately 60 percent of the future RPZ area, and extension of the parallel taxiway for the full runway length. The taxiway extension is needed to prevent aircraft operators back-taxiing on the runway for more than half its length during approximately 70-80 percent of airfield operations. This is a dangerous situation mitigated with the full-length parallel taxiway. Coordination with Oncor for the requirements of electrical transmission line burial or rerouting will be required. The specific requirements for this issue and future costs have not been determined by this evaluation. The concern with the stock tank is its location on runway centerline and within the future RPZ. It is a bird attractant particularly for waterfowl. This wildlife attractant is far too close to the runway end and would have to be drained / filled with appropriate materials.

Rerouting SH66 is required by this option. The future SH66 alignment in Figure A was reproduced based on a TxDOT schematic dated 1-25-2013, prepared by Halff Associates, Inc. and is in compliance with the most recently updated FAA Advisory Circular (AC) 150/5300-13A, Airport Design and September 2012 FAA Program Guidance Letter regarding property uses within RPZs. The proposed relocation of SH66 for the Runway 17-35 1,000-foot extension to the north was designed to meet TxDOT design standards for 4% superelevation based on low speed urban streets with the design speed of 45 miles per hour (mph). This design speed matches the proposed speed on the currently approved preferred layout for future TxDOT improvements.

On the west side, the proposed SH66 relocation comes off the future SH66 4-lane section and is aligned to cross John King Boulevard at a 15 degree skew angle. The intersection of relocated SH66 and John King Boulevard is shown with the same lane configuration as the currently preferred TxDOT improvements designed by Halff Associates. The proposed relocation stays completely out of the central portion of the runway protection zone and travels along the northern edge of the future RPZ. On the east side, the proposed relocation ties into the 6-lane future TxDOT alignment with a curve designed to minimize property impacts.

With the runway extension to 5,000-feet, consideration should be given to widening the runway to 75-feet, increasing the weight bearing capacity to 30,000 pounds (SWG), and revising the RDC to B-II-5000 or 4000 dependent on the instrument approach procedures to the new Runway 17 end. Figure B depicts the changes associated with this RDC change while maintaining the SH66 realignment to accommodate the RDC B-I-5000 conditions depicted in Figure A. A change to the new RDC brings into play a number of additional factors to consider. Key in reference to the current standards depicted on the ALD undergoing TxDOT review is a revision to the parallel taxiway offset from 225-feet to 240-feet. This change would require some revisions to the currently planned terminal redevelopment on the east side of the runway. A logical progression from this runway expansion is consideration of better instrument approach procedure visibility minimums and a transition from a non-vertically guided approach to a vertically guided approach. The RPZ depicted on Figure B depicts the new RPZ to accommodate a vertically guided instrument approach with ¾- mile visibility minimums and lower minimum descent altitude. The RPZ size, 1,000’ (inner width), 1,700-feet (outer width), and 1,510-feet of depth, will expand anticipated property acquisition well beyond that shown in Figure A. The RPZ property acquisition increases from approximately 13 acres to nearly 49 acres. This in turn pushes the proposed SH66 realignment further to the north. The smaller RPZ can be maintained by applying the RDC of B-II-5000 standards with 1-mile visibility minimums and allows the SH66 realignment option to remain as shown in Figure A.

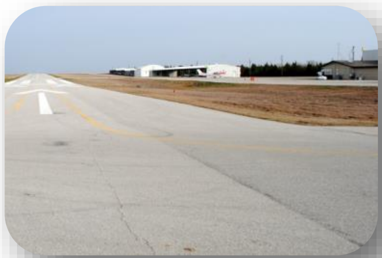
An alternative to realignment of SH66 to consider is to employ the currently approved improvement plans for SH66 and build the runway extension and associated parallel taxiway, and safety areas over the top of these proposed improvements. This option would need to span the SH66 improvements and create a tunnel for auto travel and the adjacent Oncor electrical transmission line.

A 2-D evaluation of this development option to extend the runway 1,000-feet to the north indicates the physical limits of the improvements would encompass approximately nine (9) acres. This is an area that encompasses only the runway and taxiway extensions and associated runway/taxiway safety areas. It has approximate dimensions of 350-feet wide and 1,300-feet beyond the existing Runway 17 end. The area needed for fill encompasses a wider and longer area due to the topography and acceptable grades for the fill to feather back down to the existing ground level.

The span of tunnels to accommodate vehicular traffic, as proposed, along SH66 will require a minimum tunnel length of approximately 575-feet. The width of this tunnel section would have to be approximately 120-feet accommodating the Oncor transmission line and the proposed improvements for SH66. The minimum height for the proposed improvements is 16-feet.

Terrain in this part of Rockwall County is challenging. The runway extension of 1,000-feet to the north encounters falling topography on both sides of SH66. The volume of fill required to accomplish the runway extension is approximately 380,000 cubic yards. The volume encompassed by SH66 and Oncor electrical transmission line tunnel is approximately 40,000 cubic yards. No survey or accurate topography data was gathered in this estimate of fill. This fill amount was based on the topography available on the City of Rockwall webpage as provided during the development of the Airport Layout Plan. The method of calculation used is call the end area volume method. No computer modeling was used to complete the volume calculations. More accurate surveyed data would be required.

As additional consideration in this option includes the requirement to drain and fill the approximately 15 acre Greenes Lake. This lake encompasses nearly 60 percent of the future RPZ. Greenes Lake would need to be drained and filled to eliminate the close-in hazard associated with birds, particularly migrating waterfowl, for approaching aircraft to the new runway end. No calculations have been completed for the volume of fill required for this effort as adequate topography and survey data is unavailable.



ALTERNATIVE ANALYSIS: SOUTHERN RUNWAY EXTENSION

This White Paper describes the alternative analysis for expanding Runway 17-35 at the Ralph M. Hall Municipal Airport from the current dimensions of 3,373' x 45' with each option analyzed based on a southern runway extension. Following a meeting with Congressman Ralph M. Hall, the Federal Aviation Administration (FAA), Texas Department of Transportation Aviation Division (TxDOT), Rockwall Economic Development Corporation (REDC), and the City of Rockwall, Garver completed an analysis for airfield expansion options to the south. Each option requires runway widening and for the runway centerline to be moved to the east to keep hangars on the west-side of the airport outside of safety areas. The first option expands the runway to a length of 4,000 feet while the second option extends the runway 1,000 feet further for a full length of 5,000 feet. Each of these options maintains the existing runway alignment. An additional option was developed that offered a runway realignment as the ultimate solution. **Table 1** provides a matrix summary of the impacts analyzed during this evaluation based on the various runway lengths and development constraints to existing and proposed infrastructure including the railroad, powerline, proposed industrial development, and rerouting of John King Boulevard.

TABLE 1
SOUTH RUNWAY EXPANSION MATRIX
RALPH M. HALL MUNICIPAL AIRPORT

RUNWAY PHYSICAL LENGTH (FEET)	RUNWAY OPERATIONAL LENGTH (FEET)	CLOSE RAILROAD		BURY POWERLINE		NEW TENANT DEVELOPMENT IMPACT		JOHN KING BOULEVARD IMPACT		TOTAL PROJECT COST
		Yes	No	Yes	No	Yes	No	Yes	No	
3,373 – Existing	Varied: Declared Distances*		X		X		X		X	$4.25 Million
3,373 – Future	Varied: Declared Distances #		X	X			X		X	$5.25 Million
4,000	4,000	X		X		X		X		$9.0 – 13.0 Million
5,000	5,000	X		X		X		X		$12.5 – 20.6 Million
5,000 Realigned	5,000 Realigned	X		X			X		X	$17.5 Million

* See Existing Declared Distance Exhibit in Airport Development Plan Figure 4-1. Runway 17 LDA = 2,655'; TORA, TODA, and ASDA = 3,125'. Runway 35 LDA = 2,791'; TORA, TODA, and ASDA = 3,125'.
# Runway 17 LDA (+470'), TODA, TORA, and ASDA = 3,125; Runway 35 LDA = 3,038 (+247'), TORA, TODA, and ASDA = 3,373' (+248')

Each option maintained the northern runway end in place or in close proximity except for movement of the runway centerline to the east to accommodate runway reconstruction to meet design standards and elimination of existing hangars from the future runway object free area (OFA). This movement of the runway centerline to the east now brings into play the FAA/TxDOT design standards involving land use within the runway protection zone (RPZ). In order to move both Texas State Highway 66 (SH66) and Oncor's transmission line beyond the RPZ would require approximately 3,500 feet of realignment and a minimum of 35 acres. Twelve acres is encompassed by the RPZ and the remaining 23 acres is used for SH66 and the Oncor transmission line realignment.

The current TxDOT improvement plans for SH66 do not include the airport's plans. In meeting with both TxDOT Highway Division and Oncor fall of 2012 it was determined that the SH66 realignment might be possible as the plans are still in an early stage with construction of the improvements still some years away. Changing the alignment of Oncor's transmission lines is also achievable but costly. The 15 acre Greenes Lake will likely impact the realignment of both SH66 and the transmission line as the required routing is along the top and downslope of the dam to this lake and will require significant fill to achieve this realignment. On the western end terrain falls away nearly 45 feet and then rises approximately 32 feet back to the top of Greenes Lake dam. The cost estimates provided in **Table 2** do not account for draining and filling of Greenes Lake if deemed necessary by SH66 and Oncor transmission line realignment design. However, this option would be preferable for airport operations as it would eliminate a wildlife attractant in the approach path to the Runway 17 end.

TABLE 2
NORTH RUNWAY PROTECTION ZONE COMPLIANCE
RALPH M. HALL MUNICIPAL AIRPORT

PRELIMINARY COST ESTIMATES				
PROJECT	**PROJECT DESCRIPTION**	**LOCAL COST**	**TXDOT/FAA COST**	**TOTAL COST**
PROPERTY ACQUISITION	SH66 and Transmission Line Realignment	$175,000	1,575,000	$1,750,000
	Runway 17 RPZ	$80,000	$720,000	$800,000
PROPERTY ACQUISITION TOTAL		**$255,000**	**$2,295,000**	**$2,550,000**
SH66	Realignment – 3,500 feet	$380,000	$3,420,000	$3,800,000
ONCOR TRANSMISSION LINE	Realignment – 3,500 feet	$450,000	$4,050,000	$4,500,000
PROJECT TOTAL COSTS		**$830,000**	**$7,470,000**	**$8,600,000**

A modification of standards is recommended and will need to be coordinated and requested from the FAA through TxDOT. The modification of standards would include allowing the incompatible RPZ land use of SH66 and the transmission line within the approach RPZ for Runway 17 to remain while meeting all other safety area standards.

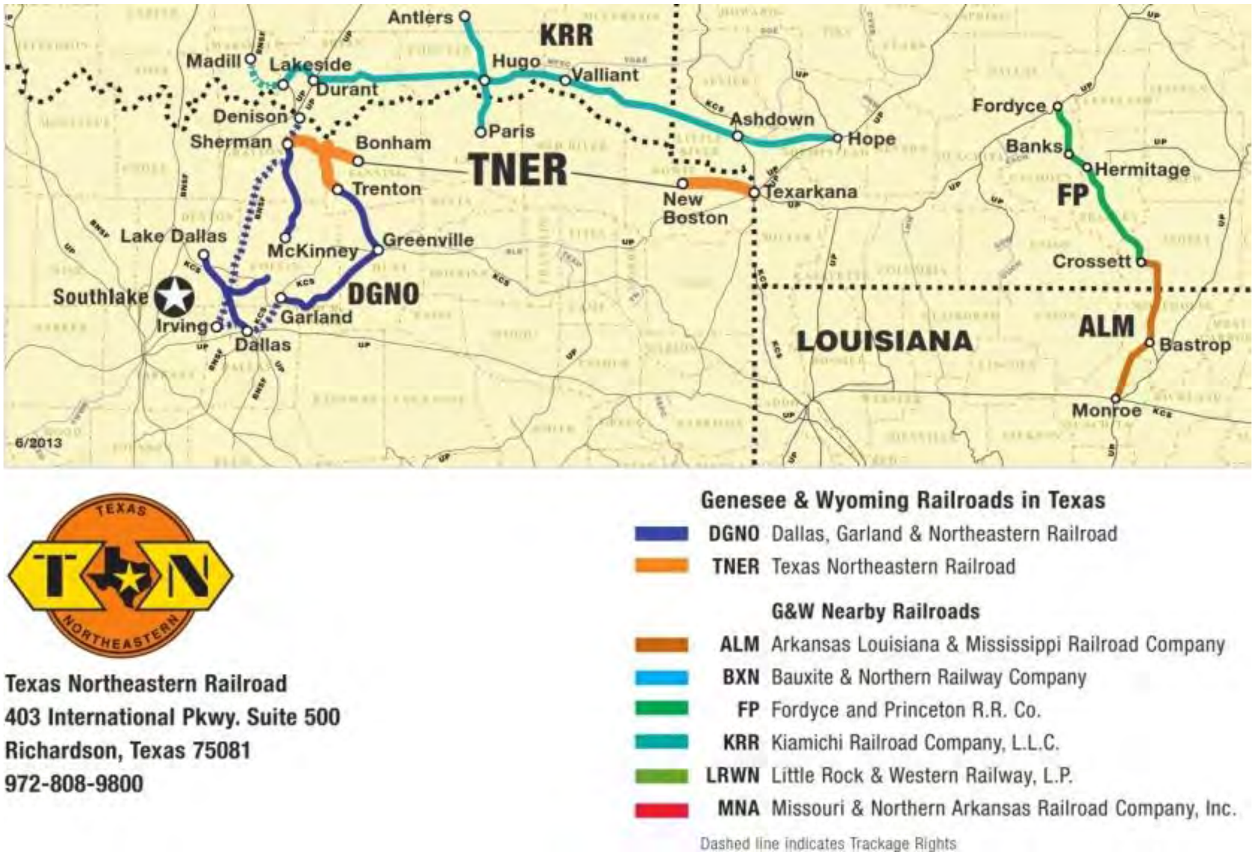
Each of the runway expansion options are impacted by the Oncor electrical transmission lines on the north that currently requires a displaced threshold of approximately 470 feet. If the Oncor lines remain, declared distances should be implemented based on airspace obstructions. An additional existing issue in calculating declared distances is the available safety areas beyond the Runway 17 end. As runway improvements are completed the recovery of the required 240 feet of safety areas beyond the runway end will be accomplished. If the Oncor lines are removed as an obstruction either by relocation or lowering the displacement is eliminated the departure surface obstruction is removed on the northern runway.

Dallas, Garland & Northeastern Railroad

Beyond the considerations for the runway RPZs and the modification of standards, each of these options requires closure, reroute, or realignment of the rail line south of the airport owned by Genesee & Wyoming Inc. (G&W). This rail line, the Dallas, Garland & Northeastern Railroad (DGNO), is an industrial line that runs from Garland through Rockwall and Greenville terminating in Trenton, Texas approximately 60 miles north of Rockwall. Despite the termination of the DGNO line at Trenton the rail line continues north as Texas Northeastern Railroad (TNER) also owned and operated by G&W. The TNER line connects from Dallas up to Sherman through Bonham and then in Bell, Texas offers a spur that travels south to Trenton where it joins the DGNO. This situation is depicted on the **Figure A** obtained from the G&W webpage.

The optimal option for mitigating the rail line would be closure of approximately 1,500 feet of rail line just west of John King Boulevard to the east side of the anticipated relocation/realignment of Airport Road. This will maintain rail access on DGNO to all the current industrial clients in Rockwall west of the airport. For all points east of Rockwall on the DGNO, access can be maintained by rerouting rail cars along the TNER and/or other rail lines to Trenton where they join the DGNO to their destination. Future negotiations with G&W will need to be entered to affect this rail closure/removal and determine the cost and feasibility of this action for airport improvements. These potential additional costs have not been determined and are not included in the cost breakdown in the following tables.

FIGURE A
GENESEE & WYOMING RAIL LINE LOCATIONS
RALPH M. HALL MUNICIPAL AIRPORT



Option One: 4,000' x 60' – DGNO Closure

Extending Runway 17-35 627 feet to the south will impact a number of existing pieces of infrastructure. **Figure B** depicts an overview of the runway extension along with a future full-length parallel taxiway and maintains the Runway Design Code (RDC) of B-I-5000. This RDC defines the runway to serve aircraft weighing 12,500 pounds or less but with length capable of supporting some limited operations by larger aircraft. The RDC B-I-5000 standards define the runway width to be 60 feet and apply an Object Free Area (OFA) width of 400 feet that extends 240 feet beyond the runway end. The future parallel taxiway is depicted to be 25 feet wide and offset 225 feet centerline to centerline from Runway 17-35. The Runway Protection Zone (RPZ) sized for these conditions would have dimensions, as shown on **Figure B**, of 500 feet (inner width), 700 feet (outer width), and 1,000 feet of depth.

The immediate impacts from this runway expansion option include property acquisition, the realignment of Airport Road (2,700 linear feet), realignment of a segment of John King Boulevard (2,700 linear feet), and extension of the parallel taxiway for the full runway length.

Property needed for the 4,000 foot option includes acquisition for the runway and taxiway extensions and, Airport Road and John King Boulevard rerouting. Total property acquisition for this option is approximately 60 acres. Acquisition of fee simple property for the runway, taxiway, and associated safety areas is estimated at 35 acres. This property includes parcels north and south of the rail line, property encompassed by the rail along its existing alignment, and a small parcel that falls west of John King Boulevard. Almost seven acres along John King Boulevard could be used for hangar development. The Airport Road reroute will need approximately four acres for the road and standard right-of-way of 60 feet. Approximately 14 acres of property lies between the Airport Road realignment and property required for the runway and taxiway extension. This property is set aside for terminal expansion to be depicted on the Airport Layout Plan.

Currently, Airport Road traverses the south side of the Airport through the existing runway safety area (RSA), obstacle free zone (OFZ), and runway OFA between the runway end and the beginning of the RPZ. Extending the runway dictates removal of a portion of Airport Road and realignment outside of the RPZ at a point where it will no longer be an obstruction. The realignment ensures that it meets FAA/TxDOT standards while maintaining vehicular access to the east side of the airport from John King Boulevard and the City’s central business district. If Airport Road were not realigned vehicular traffic would be forced to travel approximately one mile east of the Airport, one mile north of Interstate Highway 30 (IH30), and then back west on Airport Road almost another mile to the terminal area as it exists today and is planned for in the future.

Rerouting John King Boulevard was reviewed from three different impacts. With the new southern runway end as proposed all of the potential airspace surfaces come into play since they would no longer be grand-fathered like the existing conditions. These include the approach surface, threshold siting surface and departure surface. As depicted in **Figure B** with the runway extension John King Boulevard is an obstruction to the departure surface. By design standards the first scenario involves John King Boulevard being rerouted beyond the departure surface. At its current location the road is an approximate seven foot obstruction to the departure surface. This is based on estimated runway end and existing roadway elevations. In order to remove this condition it requires a realignment of approximately 2,700 feet of this divided four-lane arterial route and this is the realignment included in the option cost estimates. This alignment takes it beyond the departure surface out to approximately 600 feet from the proposed runway end before angling back towards the southwest corner of the future RPZ and rejoining the existing road alignment north of IH30. Property acquisition of approximately seven acres from various owners will be required just for the rerouting of John King Boulevard in this option. Most of this property is open fields; however, there is a small 1/2-acre parcel in the southeast corner of the City’s Service Center that would be converted to use by John King Boulevard.

If the FAA/TxDOT accepts the obstruction to the departure surface, the next level of realignment involves rerouting John King Boulevard outside of the RPZ. This option requires approximately 1,300 linear feet of rerouting beyond the RPZ. This option maintains FAA/TxDOT standard clearances for the approach surface and threshold siting surface (TSS) despite the departure surface obstruction.

The final option is the shortest and is predicated on FAA/TxDOT accepting the obstruction to the departure surface and allowing a portion of John King Boulevard to traverse through the RPZ but remain beyond the central portion of the RPZ. The central portion of the RPZ encompasses the 500 foot wide center portion of the RPZ leaving small pie-shaped pieces along both outer edges. The length of road realignment in this scenario is approximately 1,100 feet.

Preliminary construction costs have been developed for the major project items discussed above specific to the John King Boulevard realignment beyond the departure surface and are presented in the **Table 3** with the anticipated cost breakdown based on funding source.

TABLE 3
OPTION ONE: 4,000 FOOT RUNWAY – RAIL CLOSURE
RALPH M. HALL MUNICIPAL AIRPORT

PRELIMINARY COST ESTIMATES				
PROJECT	PROJECT DESCRIPTION	LOCAL COST	TXDOT/FAA COST	TOTAL COST
PROPERTY ACQUISITION	Runway and Taxiway Extension and Associated Safety Areas (RSA/OFA/RPZ)	$300,000	2,700,000	$3,000,000
	Airport Road Realignment and Future Terminal Development	$100,000	$900,000	$1,000,000
	John King Boulevard Realignment	$50,000	$450,000	$500,000
	G&W Railroad – 1,500 feet	$30,000	$270,000	$300,000
PROPERTY ACQUISITION TOTAL		**$480,000**	**$4,320,000**	**$4,800,000**
RUNWAY	Reconstruct and Widen – 3,373' x 60'; Eliminate Line-of-Sight; Recover Northern RSA	$240,000	$2,160,000	$2,400,000
TAXIWAY	Full-length parallel – 3,373' x 25'; Offset 225 feet	$110,000	$990,000	$1,100,000
RUNWAY/TAXIWAY	Extension – 627 feet	$100,000	$900,000	$1,000,000
AIRPORT ROAD	Realign – 2,600 feet	$180,000	$1,620,000	$1,800,000
JOHN KING BOULEVARD	Realign – 2,700 feet	$270,000	$2,430,000	$2,700,000
PROJECT TOTAL COSTS		**$900,000**	**$8,100,000**	**$9,000,000**

Option Two: 5,000' x 75' – DGNO Closure

Expansion of the runway to 5,000 feet in total length requires some more significant impacts as depicted on **Figure C**. This runway length brings the southern runway end in closer proximity with IH30. It also requires lengthier realignments Airport Road and John King Boulevard.

The immediate impacts from the 5,000 foot runway option, as depicted on **Figure C**, include increasing the RDC to B-II-5000 design standards for the airport, property acquisition, the realignment of Airport Road (3,800 linear feet), realignment of a segment of John King Boulevard (3,200 linear feet), and extension of the parallel taxiway for the full runway length.

With the runway extension to 5,000 feet, a change in the airport's design category is recommended in order to meet FAA/TxDOT design standards. The new design standards will be based on the RDC of B-II-5000. Shifting from B-I-5000 brings into play several improvements that include: runway width, pavement weight bearing capacity, safety area widths, and instrument approach procedures (IAP).

Design standards for the runway indicate a need for widening the runway to 75 feet. With the anticipated larger aircraft operating at the airport by the increase in length and width, the weight bearing capacity of all major airport pavements needs to increase to 30,000 pounds for aircraft with single wheel gear (SWG) loading. As the RDC changes, so too does the size of the RSA and OFA. The RSA width will increase from 120 to 150 feet while the distance from the runway end will remain 240 feet. The OFA width will increase 100 feet from 400 to 500 feet and retain the distance from the runway end of 240 feet. The increase in the RSA size does not affect any significant changes; however, the increase in OFA size impacts the location of the runway centerline based on the assumption of offsetting the runway centerline to the east far enough to keep the west-side hangars outside of the OFA.

A change to the new RDC brings into play a change in the design standards for the parallel taxiway. The parallel taxiway offset will increase from 225 to 240 feet. Additionally, the taxiway width shifts from 25 to 35 feet. These changes require revisions to the currently planned terminal redevelopment on the east side of the runway.

A logical progression to the more capable runway is consideration of improved instrument approach procedures (IAP) with lower minimum descent altitudes/decision heights and visibility minimums as well as a transition from a non-vertically guided approach to a vertically guided approach. The RPZ depicted on **Figure C** continues to be the RPZ sized for the non-vertically guided non-precision IAP with minimums similar to the current IAPs. In order to accommodate a vertically guided instrument approach with ¾-mile visibility minimums and/or lower minimum descent altitude/decision height, the RPZ size would increase to 1,000 feet (inner width), 1,510 feet (outer width), and 1,700 feet of depth. This will expand the anticipated RPZ property acquisition from approximately 13 acres to nearly 49 acres and pushes the southern RPZ boundary out to the IH30 and John King Boulevard intersection. If this RPZ were applied based on anticipated IAP improvements the location of IH30 and John King Boulevard within the RPZ will not meet FAA/TxDOT design standards. As a result, the smaller RPZ, based on IAPs similar to the existing ones, has been maintained.

Property needed for the 5,000 foot option includes acquisition for the runway and taxiway extensions, and Airport Road and John King Boulevard rerouting. Total property acquisition for this option is approximately 110 acres. Acquisition of fee simple property for the runway, taxiway, and associated safety areas is estimated at 53 acres. This property includes parcels north and south of the existing DGNO location, property encompassed by the DGNO along its existing alignment, and parcels west of John King Boulevard for the future RPZ. Approximately 35 acres of property lies east of the runway and taxiway improvements south of Airport Road. Airport Road reroute will need approximately nine acres for the road and standard right-of-way of 60 feet. The remaining property can be used for planned terminal expansion or airport industrial park. Realignment of John King Boulevard will need approximately ten acres.

As with the 4,000 foot option, Airport Road traverses the south side of the airport through the existing RSA, OFZ, and OFA between the runway end and the beginning of the RPZ. Extending the runway dictates removal of a portion of Airport Road and realignment outside of the RPZ at a point where it will not become an obstruction. The realignment, 3,700 feet, as depicted in **Figure C** ensures that it meets FAA/TxDOT standards while maintaining vehicular access to the east side of the airport from John King Boulevard and the City's central business district. Due to the runway length and RPZ size, the area where a rerouted Airport Road joins John King Boulevard is in close proximity to IH30 and creates an unsafe operating environment for vehicular traffic if the runway were extended any further.

In this option, John King Boulevard was rerouted to maintain clearances for the departure surface, approach surface, and threshold siting surface. At its current location the road is an approximate 11 foot obstruction to the departure surface based on planned runway end and roadway elevations. In order to remove this condition it requires a realignment of approximately 3,200 feet of this divided four-lane arterial route. This alignment takes it beyond the departure surface out to approximately 950 feet from the runway end before angling back and rejoining the existing road alignment immediately north IH30. Property acquisition of approximately ten acres from various owners will be required for rerouting John King Boulevard in this option. Most of this property is open fields; however, there is a small metal building on one of the parcels that will have to be removed.

Based on the proposed realignment of John King Boulevard and connecting it back into the existing alignment prior to IH30 5,000 feet of runway is the longest available to the airport without realignment of the runway. Any more runway length extended to the south will not allow the reroute of John King Boulevard to connect back north of IH30.

Figures B and **C** depict airport improvements based on this rail closure for both the 4,000 and 5,000 foot options. **Table 4** provides a preliminary cost breakdown for this option.

TABLE 4
OPTION TWO: 5,000 FOOT RUNWAY – RAIL CLOSURE
RALPH M. HALL MUNICIPAL AIRPORT

PRELIMINARY COST ESTIMATES				
PROJECT	**PROJECT DESCRIPTION**	**LOCAL COST**	**TXDOT/FAA COST**	**TOTAL COST**
PROPERTY ACQUISITION	Runway and Taxiway Extension and Associated Safety Areas (RSA/OFA/RPZ)	$360,000	$3,240,000	$3,600,000
	Airport Road Realignment and Future Terminal Development	$240,000	$2,160,000	$2,400,000
	John King Boulevard Realignment	$70,000	$630,000	$700,000
	G&W Railroad – 1,500 feet	$30,000	$270,000	$300,000
PROPERTY ACQUISITION TOTAL		**$700,000**	**$6,300,000**	**$7,000,000**
RUNWAY	Reconstruct and Widen – 3,373' x 75'; Eliminate Line-of-Sight; Recover Northern RSA	$370,000	$3,330,000	$3,700,000
TAXIWAY	Full-length parallel – 3,373' x 35'; Offset 240 feet	$140,000	$1,260,000	$1,400,000
RUNWAY/TAXIWAY	Extension – 1,627 feet	$160,000	$1,340,000	$1,600,000
AIRPORT ROAD	Realign – 3,700 feet	$260,000	$2,340,000	$2,600,000
JOHN KING BOULEVARD	Realign – 3,200 feet	$320,000	$2,880,000	$3,200,000
PROJECT TOTAL COSTS		**$1,250,000**	**$11,150,000**	**$12,500,000**

The following analysis of the 4,000 and 5,000 foot options has been completed with a reroute of the DGNO rail line versus the simplest solution of rail closure across the area encompassed by airport improvements.

Option One: 4,000' x 60' – DGNO Realignment

The runway extension, RDC, associated safety areas, RPZ, and IAPs are all maintained from the 4,000 foot option with the DGNO closure previously discussed. **Figure D** depicts an overview of the runway extension along with a future full-length parallel taxiway and DGNO realignment.

The immediate impacts from this runway expansion option are similar to the previous 4,000 foot option and are highlighted on **Figure E**. Realignment of the DGNO rail line (8,300 linear feet) is the major change in this option.

Additional property needed for this 4,000 foot option includes approximately 23 acres of fee simple property allowing for the DGNO redevelopment along the 120 foot right-of-way. With this addition to the 4,000 foot option, the total property acquisition is approximately 90 acres.

Figure E depicts the proposed reroutes for both John King Boulevard and Airport Road in similar fashion to those shown in **Figure B**. The reroute of Airport Road is slightly different as it traverses along the outer boundary of the RPZ before joining in with John King Boulevard.

The 8,300 foot DGNO reroute (Figure D/E) ensures RSA, OFA, and RPZ standards are met. Although DGNO is in the current RPZ it is an incompatible land use and with the runway extension and establishment of a new runway end the standards must be met by the rail line realignment beyond the RPZ. With the proposed DGNO realignment the approach surface, departure surface, and threshold siting surfaces are all maintained clear of penetrations or obstruction. Concerning issues with the proposed realignment include: adequate tangent length between "S" curves, track location with respect to existing industrial facilities on the west end tie-ins, and soil conditions. The 120 foot DGNO right-of-way is maintained as the proposed realignment passes between industrial facilities; however, the alignment cuts across two industrial complex properties during its initial departure from the existing alignment. A part of the property needed comes from these two industrial tenants.

Preliminary construction costs have been developed for the major project items discussed above specific to the John King Boulevard realignment beyond the departure surface and are presented in **Table 5** with the anticipated cost breakdown based on funding source.

TABLE 5
OPTION ONE: 4,000 FOOT RUNWAY – WITH RAIL REALIGNMENT
RALPH M. HALL MUNICIPAL AIRPORT

PRELIMINARY COST ESTIMATES				
PROJECT	**PROJECT DESCRIPTION**	**LOCAL COST**	**TXDOT/FAA COST**	**TOTAL COST**
PROPERTY ACQUISITION	Runway and Taxiway Extension and Associated Safety Areas (RSA/OFA/RPZ)	$300,000	2,700,000	$3,000,000
	Airport Road Realignment and Future Terminal Development	$100,000	$900,000	$1,000,000
	John King Boulevard Realignment	$50,000	$450,000	$500,000
	G&W Railroad Realignment	$175,000	$1,575,000	$1,750,000
PROPERTY ACQUISITION TOTAL		**$625,000**	**$5,625,000**	**$6,250,000**
RUNWAY	Reconstruct and Widen – 3,373' x 60'; Eliminate Line-of-Sight; Recover Northern RSA	$240,000	$2,160,000	$2,400,000
TAXIWAY	Full-length parallel – 3,373' x 25'; Offset 225'	$110,000	$990,000	$1,100,000
RUNWAY/TAXIWAY	Extension – 627 feet	$100,000	$900,000	$1,000,000
AIRPORT ROAD	Realign – 2,700 feet	$180,000	$1,620,000	$1,800,000
JOHN KING BOULEVARD	Realign – 2,700 feet	$270,000	$2,430,000	$2,700,000
G&W RAILROAD	Realign – 8,300 feet	$420,000	$3,780,000	$4,200,000
PROJECT TOTAL COSTS		**$1,320,000**	**$11,880,000**	**$13,200,000**

Option Two: 5,000’ x 75’ – DGNO Realignment

The runway extension, RDC, associated safety areas, RPZ, and IAPs are all maintained from the 5,000 foot option with the DGNO closure previously discussed. **Figure F** depicts an overview of the runway extension along with a future full-length parallel taxiway and DGNO rail realignment.

Property needed for this 5,000 foot option is similar for the runway and taxiway extensions, and Airport Road and John King Boulevard rerouting. The DGNO realignment in this option will require approximately 42 acres of fee simple property allowing for the DGNO redevelopment and 120 foot right-of-way. Total property acquisition for this option is approximately 155 acres.

Figure G depicts the proposed reroutes for both John King Boulevard and Airport Road in similar fashion to those shown in **Figure C**.

The DGNO 15,300 foot reroute in this option ensures RPZ standards are maintained. With the proposed rail realignment the approach surface and threshold siting surfaces are maintained clear of penetrations or obstruction. The DGNO realignment is clear of the departure surface on the west side and along the extended runway centerline; however, terrain rises east of the Airport and the future rail alignment is an approximately three foot obstruction to the departure surface. This could be mitigated through the runway extension and DGNO realignment design process. Other concerning issues with the proposed DGNO realignment include: adequate tangent length between “S” curves, track location with respect to existing industrial facilities on the west tie-in, soil conditions along the length of the realignment, possible utility corridor conflicts along IH30, and the proximity of the IH30/John King Boulevard intersection as well as the Airport Road reroute location. The 120 foot right-of-way for the rail is maintained as the proposed realignment passes between industrial facilities; however, the alignment cuts across two industrial complex properties near the departure from the existing alignment at the west end. Part of the property needed for the rail line realignment comes from these two industrial tenants. Additional items not factored into the rail alignment include the total amount of cut/fill required and any other environmental or utility corridor considerations. These items can be factored into a more detailed engineering analysis if the project moves forward.

Preliminary construction costs have been developed for the major project items discussed above and are presented in **Table 6** with the anticipated cost breakdown based on funding source.

TABLE 6
OPTION TWO: 5,000 FOOT RUNWAY – WITH RAIL REALIGNMENT
RALPH M. HALL MUNICIPAL AIRPORT

PRELIMINARY COST ESTIMATES				
PROJECT	**PROJECT DESCRIPTION**	**LOCAL COST**	**TXDOT/FAA COST**	**TOTAL COST**
PROPERTY ACQUISITION	Runway and Taxiway Extension and Associated Safety Areas (RSA/OFA/RPZ)	$360,000	$3,240,000	$3,600,000
	Airport Road Realignment and Future Terminal Development	$240,000	$2,160,000	$2,400,000
	John King Boulevard Realignment	$70,000	$630,000	$700,000
	G&W Railroad Realignment	$280,000	$2,520,000	$2,800,000
PROPERTY ACQUISITION TOTAL		**$950,000**	**$8,550,000**	**$9,500,000**
RUNWAY	Reconstruct and Widen – 3,373' x 75'; Eliminate Line-of-Sight; Recover Northern RSA	$370,000	$3,330,000	$3,700,000
TAXIWAY	Full-length parallel – 3,373' x 35'; Offset 240 feet	$140,000	$1,260,000	$1,400,000
RUNWAY/TAXIWAY	Extension – 1,627 feet	$160,000	$1,340,000	$1,600,000
AIRPORT ROAD	Realign – 3,800 feet	$260,000	$2,340,000	$2,600,000
JOHN KING BOULEVARD	Realign – 3,200 feet	$250,000	$1,750,000	$2,500,000
G&W RAILROAD	Realign – 15,300 feet	$880,000	$7,120,000	$8,800,000
PROJECT TOTAL COSTS		**$2,060,000**	**$17,140,000**	**$20,600,000**

Runway Realignment Option

John King Boulevard is an important thoroughfare in Rockwall and one that only recently had construction finalized at the IH30 intersection. In an effort to mitigate any realignment of John King Boulevard and since the entire runway will likely be reconstructed an analysis was completed to determine the distance the runway would need to be moved to the east to avoid realignment of John King Boulevard.

For the 4,000 foot option runway centerline would need to move approximately 225 feet east. This places the runway nearly in the location of the future parallel taxiway as previously proposed and the parallel taxiway then is 225 feet east of there and encounters a number of hurdles with property ownership, terrain, and fill required. Shifting the future parallel taxiway to the west side of the runway alleviates these issues as it would be aligned nearly where the runway was previously. Future terminal redevelopment/expansion could occur along John King Boulevard between the closed DGNO rail line and current location of Airport Road.

When applying this concept to the 5,000 foot option the runway centerline shifts approximately 500 feet east. This shift carries the runway centerline over the central portion of the 19 acre parcel to the east of the airport. Runway centerline would then cross directly over the home located north of this 19 acre parcel and require significant fill to accomplish. This option would not appear to be feasible even if the future parallel taxiway were shifted to the west side of the runway.

If the entire runway is to be reconstructed the possibility exists to realign the runway. A minor adjustment in the runway's alignment as depicted in **Figure H** allows for the elimination of realigning John King Boulevard completely. The runway alignment shifts from the current north-south alignment to an approximate magnetic bearing of 165 degrees. This accommodates elimination of the line-of-sight issue as well. Runway realignment allows for the rerouting the DGNO rail line and is more easily developed based on rail line closure.

As the runway alignment is rotated about the Runway 17 end it shifts the east-side parallel taxiway beyond existing property limits. The taxiway OFA imposes on the existing police firing range and consumes most of the 19 acre parcel east of the airport for runway and taxiway development. This leaves no room for terminal redevelopment on the east side of the airfield. The parallel taxiway could be shifted to the west side which then impacts the private through-the-fence hangars on the northwest side of the field putting them partially inside of the taxiway OFA. This would indicate a need to be relocated to the south or to the southwest or southeast areas based on the runway realignment. An alternative to relocation of these hangars is to realign the runway and taxiway system slightly to move the taxiway OFA back to the east and not impact these hangars. Details of this option are shown in **Figure I**.

Maintaining the southwest corner of the realigned southern runway end's RPZ at the edge of John King Boulevard the runway alignment can be rotated slightly back to the east at the northern end to move the taxiway OFA east keeping the private hangars outside of the future taxiway OFA. This shifts the north runway end to a point such that the runway and parallel taxiway now straddle the existing northern runway end. This option attempts to maintain approach, threshold siting, and departure surface clearances on the south end and the existing obstruction conditions on the north end. The minor obstructions to the departure surface can be mitigated during the coordinated design of the runway reconstruction/extension and the DGNO reroute. The DGNO obstruction to the approach surface should be mitigated in the design process. The approach surface obstruction at the IH30 overpass for John King Boulevard will remain in place with only minor mitigation based on design. Mitigation of this obstruction is provided via the clearance of the threshold siting surface.

However, this option depicted in **Figure H** may require that the northern RPZ now meet the FAA's compatible use policy and require moving the northern runway end south such that SH66 and the Oncor transmission lines are no longer in the RPZ. If along this alignment the northern RPZ were moved south of SH66 and the Oncor electrical transmission lines (existing and planned) the length of runway is limited to approximately 4,725 feet as depicted in **Figure J**. This places the southern RPZ as close as possible to the IH30 frontage road east of John King Boulevard maintaining the size as previously discussed. In turn, this makes any obstruction encountered by IH30 worse and may cause an increase in the IAP minimums. Almost all of the private through-the-fence hangars could be maintained in place. Only a portion of the northernmost hangar is within the future RPZ while the rest fall outside of it. Access to the runway and taxiway environment for these hangars would be gained via development of a new taxilane from the southern end of this hangar development to the future northern runway end. These hangars may obstruct the departure, threshold siting, and approach surface; however, the southern hangar is already equipped with an obstruction light at its peak above the door.

If the northern RPZ can be maintained with SH66 and the Oncor lines crossing through it, then the runway can be extended to a length longer than 5,000 feet. With the northern RPZ maintained as indicated and the southern RPZ placed as close to the IH30 frontage road as possible, the total runway length could be approximately 5,600 feet. Extending the runway to this length would put it into a new RDC. The next RDC defined would be the C-II category. This upgrade comes with increased safety areas and RPZ sizes that could not be met between SH66 and IH30 for this runway length, alignment options, and RDC. The RPZ size increases similar to that previously discussed in the IAP upgrade description and the RSA/OFA lengths beyond the runway ends is lengthened to 1,000 feet.

An advantage to this option is that it now opens an approximately 15 acre parcel that would lay between John King Boulevard and the new runway/taxiway system that could be designated for terminal redevelopment or for commercial clients who need access to both the airfield and landside with quick access to IH30. On the east side of the airfield a 40 acre parcel across from the City's Animal Control facility could be available for terminal redevelopment or commercial development. If the direction is for commercial/industrial development the 40 acre parcel is attractive as it would have access to the airfield, the eastern leg of the DGNO rail line, and be in close proximity to IH30.

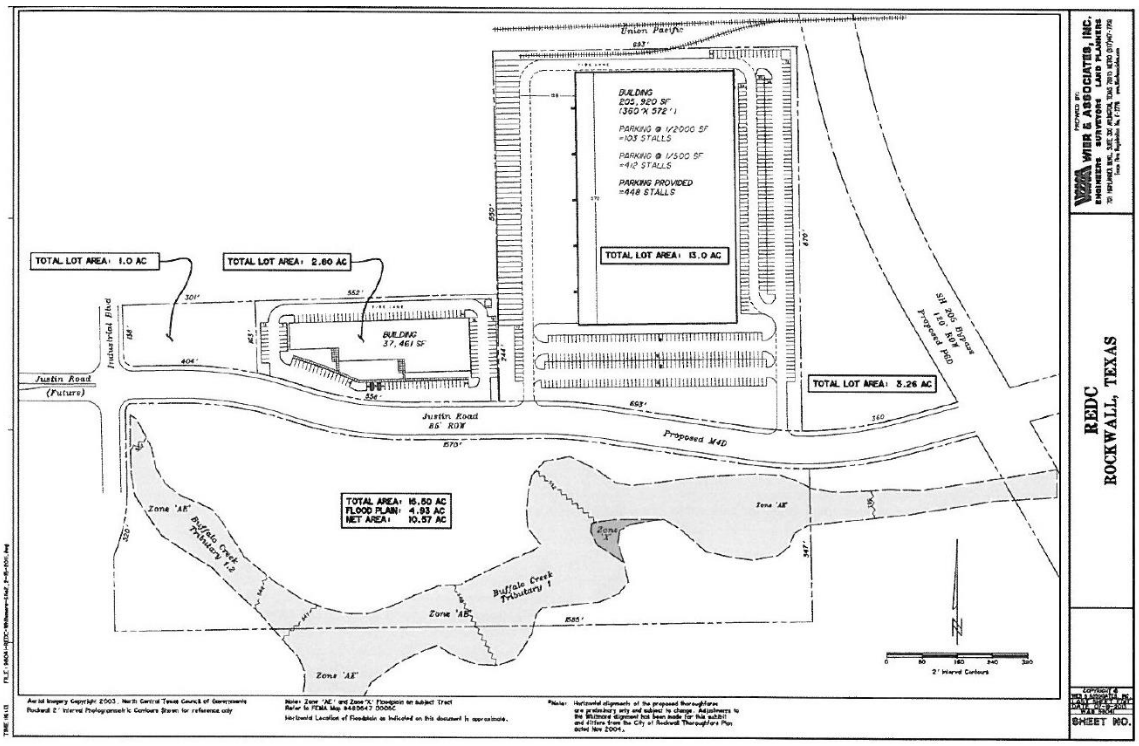
PRELIMINARY COST ESTIMATES				
PROJECT	**PROJECT DESCRIPTION**	**LOCAL COST**	**TXDOT/FAA COST**	**TOTAL COST**
PROPERTY ACQUISITION	Runway and Taxiway Extension and Associated Safety Areas (RSA/OFA/RPZ)	$560,000	$5,040,000	$5,600,000
	G&W Railroad – 1,500 feet	$30,000	$270,000	$300,000
PROPERTY ACQUISITION TOTAL		**$590,000**	**$5,310,000**	**$5,900,000**
RUNWAY	Construct– 4,725' x 75'; Eliminate Line-of-Sight; Recover Northern RSA	$680,000	$6,120,000	$6,800,000
TAXIWAY	Full-length parallel – 4,725' x 35'; Offset 240 feet	$340,000	$3,060,000	$3,400,000
RUNWAY/TAXIWAY TOTAL COSTS		**$1,020,000**	**$9,180,000**	**$12,500,000**
TOTAL COSTS		**$1,610,000**	**$14,490,000**	**$16,100,000**

New Industrial Tenant Development

During the southern runway expansion evaluation, the REDC entered into an agreement for a new commercial tenant on property west of John King Boulevard and south of the DGNO rail line. This tenant will require rail spur use from the DGNO line as indicated on **Figure K** below. On the south side of this development Justin Road is extended from Industrial Boulevard to John King Boulevard providing vehicular access to this property and the future industrial tenant.

Based on the proposed layout for this new tenant it negatively impacts any runway improvement or expansion option proposed in this White Paper except for the options to maintain the runway at its current alignment and length or the realignment option that still requires the DGNO closure but may still allow for the rail spur as depicted on **Figure K**.

FIGURE K
NEW INDUSTRIAL DEVELOPMENT
RALPH M. HALL MUNICIPAL AIRPORT



Source: Weir & Associates

GLOSSARY/ACRONYMS

TERMS:

Advisory Circular (AC): A series of external FAA publications consisting of all non-regulatory material of a policy, guidance, and informational nature.

Air Cargo: All commercial air express and air freight with the exception of air-mail and air parcel post.

Air Carrier: A commercial operator providing for the transport of passengers or property by aircraft for compensation or hire utilizing aircraft with greater than 30 seats and certificated in accordance with Federal Aviation Regulations (FAR) Parts 121 or 127.

Aircraft Mix: The numerical or percentage breakdown of aircraft into categories based on aircraft engine and weight.

Aircraft Operation: Any aircraft arrival or departure including touch-and-go operations.

Aircraft Type: A distinctive model of aircraft, as designated by the manufacturer.

Airline: A scheduled air carrier certificated by the Federal Aviation Administration under Part 121 of the Federal Aviation Regulations.

Airline Operations: Takeoffs and landings performed by aircraft operated by Part 121 or 127 airlines on scheduled and non-scheduled flights.

Airport: A landing area regularly used by aircraft for receiving or discharging passengers or cargo.

Airport Service Area: The geographic area that generates demand for aviation services at an airport.

Airport Surveillance Radar (ASR): A navigation instrument used to control air traffic within the immediate airport traffic areas.

Airspace: The area above the ground in which aircraft travel. It is divided into corridors, routes, and restricted zones for the control and safety of traffic.

Air Taxi: The transport of people or property for compensation or hire by a commercial operator (not an air carrier) in an aircraft having a maximum seating capacity of 30 or less and certified under Federal Aviation Regulations Part 135.

Ambient: The sum total of existing environmental conditions for any given impact category.

Ambient Air Quality: The existing quality of the air.

Aquatic: Growing or living in or upon water.

Approach Surface: An imaginary inclined surface longitudinally centered on the extended centerline of a runway, extending outward and upward from the runway. It has a shallower gradient than the corresponding glide slope.

Apron: An area on an airport designated for the parking, loading, fueling, or servicing of aircraft.

Aviation Easement: A form of limited property right purchase that establishes legal land-use control prohibiting incompatible development of areas required for airports or aviation-related purposes.

Based Aircraft: Aircraft stationed at the airport on a permanent basis.

Beacon: See rotating beacon.

Biotic Community: Recognizable assemblages of vegetation and wildlife organisms generally functioning as a unit.

Building Restriction Line (BRL): An imaginary line that identifies suitable building area locations on airports. The BRL is also dependent upon the Runway Visibility Zone (RVZ) and ATCT line-of-sight capabilities.

Capacity: The airport operating level, expressed as the number of aircraft movements that can occur at an airport over a specified time period.

Circling Approach: A descent used in an approved procedure to an airport for a circle to land maneuver.

Commercial Aviation: Aircraft activity licensed by state or federal authority to transport passengers and/or cargo on a scheduled or non-scheduled basis.

Community: A city, group of cities, or a Metropolitan Statistical Area receiving scheduled air service by a certificated route air carrier at an airport.

Commuter Airline: Commercial operators that operate aircraft with a maximum of 60 seats, and that provides scheduled service, or that carriers mail; commuters may be either air taxis or certified air carriers.

Condemnation: Proceedings under which a property interest may be forcibly acquired; government may condemn land through the power of eminent domain; an individual may apply inverse condemnation to obtain just compensation for a property interest taken by government without prior agreement.

Conical Surface: A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet and extending to a height of 350 feet above the airport elevation.

Critical Aircraft: The most demanding category or family of aircraft that performs 500 annual itinerant operations at an airport (Also referred to as the design aircraft).

Critical Habitat: An entire habitat or portion thereof, having any constituent element that is necessary to the normal needs or survival of an endangered or threatened species.

Decibel (dB): A unit of measurement used to describe sound pressure level. It is a dimensionless unit, which is commonly expressed as one-tenth of the logarithm of the ratio between two power levels, one of which is nominally a reference level. The human auditory response to a given increase in sound pressure is approximately proportional to the increase in sound pressure in comparison to the pressure already present.

Displaced Threshold: Actual touchdown point on specific runways designated due to obstructions that make it impossible to use the actual physical runway end.

Distance Measuring Equipment (DME): An airborne instrument that indicates the distance the aircraft is from a fixed point, usually a VOR station.

Draft Environmental Impact Statement: FAA's initial evaluation of the environmental impact of a proposed action when coordinated pursuant to Section 102(20Cc)) of NEPA is initiated.

Ecology: The science or study of the relationship between an organism and its environment.

Ecosystem: An ecological community together with its physical environment, considered as a unit.

Effective Runway Gradient: The maximum difference between runway centerline elevations divided by the runway length, expressed as a percentage.

Eminent Domain: Right of the government to take property from the owner, upon compensation, for public facilities or other purposes in the public interest.

Endangered Species: Those species in danger of extinction throughout all or a significant portion of their range.

Enplanement: A term applying to passengers and cargo which board a departing aircraft.

Enroute Airways: The route a flight follows from departure point to destination.

Express: Property transported under published air express tariffs.

Fauna: A collective term for the animal species present in an ecosystem.

Fixed Base Operator (FBO): A private enterprise engaged in services related to general aviation, such as fuel sales, aircraft maintenance, aircraft storage, aircraft rental and sales, flight instruction, and crop dusting.

Flora: A collective term for the plant species present in an ecosystem.

Floodplain: An area that would be inundated by storm-water runoff that occurs under a given recurrent frequency flood condition.

Fleet Mix: See Aircraft Mix.

Flight Service Station (FSS): FAA facility used for pilot briefings on weather, airports, altitudes, routes, and other flight planning data.

General Aviation (GA): All aviation activities except those performed by commercial air carrier or military.

General Aviation Aircraft: All civil aircraft except those owned by and classified as air carriers.

General Obligation Bond: A form of public indebtedness backed by the full faith and credit of the municipality or other appropriate public body.

Glide Slope (GS): Electronic vertical guidance provided the pilot while on the final approach to landing; usually an angle between two degrees and three degrees and intersecting the runway at the touch down area.

Global Positioning System (GPS): Satellite-based navigation capabilities utilizing a minimum of four (4) of 26 satellites orbiting the earth.

Horizontal Surface: A horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway and connecting the adjacent arcs by tangent lines.

IFR Conditions: Weather conditions below the minimum prescribed for flight under VFR.

Indirect Source: A facility, building, structure, or installation which attracts mobile air pollution source activity that results in emissions of a pollutant for which there is a national standard.

Instrument Landing System (ILS): A landing approach system that establishes a course and a descent path to align an aircraft with a runway for final approach.

Instrument Flight Rules (IFR): Rules that govern flight procedures when ceiling and visibility are below 1,000 feet and three miles respectively.

Instrument Approach: A landing approach using electronic aids and made without visual reference to the ground.

Itinerant Operations: Arrivals and departures of aircraft to or from an area greater than 20 miles from the airport. Itinerant operations may involve an aircraft based at the airport or an aircraft from another airport.

Local Area Augmentation System (LAAS): Intended to compliment Wide Area Augmentation System (WAAS) by meeting Category II/ III instrument approach requirements, as well as provide users with all weather surface navigation, surface navigation, and surface surveillance/ traffic management system capabilities.

Localizer (LOC): An electronic instrument that is part of an ILS and emits radio signals which provide the pilot with course guidance to the runway centerline.

Local Operations: Operations performed by aircraft that (1) operate in the local traffic pattern or within sight of the tower; (2) are known to be departing for or arriving from +/- light in local practice areas located within a 20 mile radius of the control tower; and (3) execute simulated instrument approaches or low passes at the airport.

Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR): A facility by which the pilot is provided visual reference t the instrument runway during transition from instrument to visual flight.

Microwave Landing System: An instrument landing system using VHF radio signals to guide the aircraft's approach instead of the VHF system still widely used. The microwave system provides for fewer ground reflections, takes up less space, and uses small aerials.

Minimum Descent Altitude (MDA): The lowest altitude, expressed in feet above MSL, to which descent is authorized on final approach or during circling-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided.

Middle Marker (MM): An electronic beacon that indicates a position approximately 3,500 feet from the landing threshold.

Military Operations: An operation by military aircraft.

Missed Approach: A prescribed procedure to be followed by aircraft that cannot complete an attempted landing at an airport.

Nautical Mile: A measure of lineal distance equal to one minute of a great circle at the equator and is the length of one minute of latitude (6,076.1155 feet). To convert to statute miles, multiply by 1.150779.

NAVAID: Any navigational aids, such as PAPI, MALS, REIL, etc.

Noise Contour: A line connecting points of equal noise exposure.

Non-precision Approach Procedure: A standard instrument approach procedure in which no electronic glide slope is provided.

Non-scheduled Service: Revenue flights that are not operated in regular scheduled service such as charter flights and all non-revenue flights incident to such flights.

Object Free Area (OFA): An area on the ground centered on the 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 gound maneuvering purposes.

Obstacle Free Zone (OFZ): The OFZ is the airspace below 150 feet (45m) above the established airport elevation and along the runway and extended runway centerline that is required to be 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 protection for aircraft landing or departing from the runway, and for missed approaches.

Operation: Any airborne arrival or departure of an aircraft at or from an airport. "Touch-and-go" practice landings are considered as two operations.

Origination: The initial enplanement of any passengers and cargo; total originations include all enplanements except transfers and stop-overs.

Outer Marker (OM): An electronic beacon that indicates a position at which aircraft will intercept the ILS glide path.

Parts 25 and 121 Criteria: Those applicable portions of the Federal Aviation Regulations within which criteria for operational takeoff flight paths are defined.

Part 77: The applicable portions of Federal Aviation Regulations which define obstructions to air navigation.

Peak Hour: Represents that highest number of operations or passengers during the busiest hour of an average day of a peak month.

Precision Approach Path Indicator (PAPI): A lighting system providing for visual flight path, within the airport approach zone, so that an approaching pilot can establish a positive controlled descent (also VASI).

Precision Instrument: The term used to describe an approach using both horizontal and vertical guidance. This term also describes the runway with this type of approach and the markings on the runway.

Primary Runway: That runway which provides the best wind coverage, etc.; this runway receives the most usage at an airport.

Primary Surface: A surface longitudinally centered on a runway. When the runway has a hard surface, the primary surface extends 200 feet beyond each runway end; but when there is no hard surface, or planned hard surface, the primary surface ends at the end of the runway. The width of the primary surface of a runway will be that width prescribed in FAA Part 77 for the most precise existing or planned approach to that runway end.

Revenue Bonds: A form of public indebtedness backed by the revenue generated by the facility for which the debt was incurred.

Rotating Beacon: A visual NAVAID displaying flashes of white and/or colored light used to indicate the location of an airport.

Runway (RW): A defined area on an airport prepared for landing and takeoff of aircraft.

Runway Protection Zone (RPZ): An area off the runway end to enhance the protection of people and property on the ground.

Runway Safety Area: A defined surface surrounding the runway prepared or suitable for reducing the risk of damage o aircraft in the event of an overshoot, undershoot, or excursion from the runway.

Runway Visibility Zone (RVZ): An acceptable runway profile permits any two points five feet (1.5m) above the runway centerline to be mutually visible for the entire runway length. Hence, a clear line-of-sight between the ends of the of intersecting runways is recommended. Finally, the RVZ is an area formed by the imaginary lines connecting the two runways' visibility points.

Scheduled Service: Transport service performed by a commercial operator on a regular basis.

Segmented Circle: An airport aid identifying the traffic pattern direction.

Socioeconomic: Data pertaining to the population and economic characteristics of a region.

Special Use Airspace: Airspace of defined dimensions, within which flight of aircraft, while not wholly prohibited, is subject to restrictions or to hazards that may exist to non-participating aircraft.

Straight-In Approach: A descent in an approach procedure in which the final approach course alignment and descent gradient permits authorization of straight-in landing minimums.

Student Activity: Any aviation activity by student pilots.

Taxiway (TWY): A defined area on an airport prepared for the surface movement of aircraft to and from the runway.

Terminal Airspace: The controlled airspace normally associated with aircraft departure and arrival patterns to or from airports within a terminal control system.

Terminal Building: That building on an airport which is used in making the transition between surface and air transportation.

T-Hangar: A T-shaped aircraft storage building that provides economical shelter for a single aircraft.

Threshold: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

Tie Downs: An area on an airport specifically designed for the outdoor storage of aircraft.

Total Operations: The total of all operations (domestic and international) performed at an airport.

Touch-and-Go Operations: An aircraft operation for practice or testing purposes characterized by a landing touch down and then continuing takeoff without stopping.

Traffic Pattern: The flow of traffic that is prescribed for aircraft landing at, taxiing on, or taking off from an airport.

Transition Surface: An imaginary surface extending to the sides of the approach surface and inclined at a specified gradient 90 degrees to the extended centerline of the runway. Any object penetrating this surface would be an obstruction to air navigation.

Turnaround: A pavement area designed for turning around or holding aircraft at the end of a runway when a full parallel taxiway is not provided.

UNICOM: A ground radio communications station that provides pilots with pertinent airport information at specific airports.

Visual Approach Slope Indicator (VASI): A lighting system providing a visual flight path, within the airport approach zone, so that an approaching pilot can establish a more positive controlled descent (also PAPI).

Vector: A heading issued to an aircraft to provide navigational guidance by radar.

Visual Flight Rules (VFR): Rules under which aircraft are operated by visual reference to the ground, and fly on a “see and be seen” principle.

Very High Frequency Omni-Directional Range (VOR): Air navigation aid that provides bearing information to aircraft.

Wide Area Augmentation System (WAAS): Planned as a GPS augmentation by providing users with the use of GPS for all phases of flight from the en route environment to Category 1 precision instrument approaches. Thereby, providing more direct routing of aircraft, saving time, fuel, and money.

Wind Cone (Sock): Conical wind direction indicator.

Wind Coverage: Refers to orientation of runway in relationship to direction of prevailing winds (concerns usability of runway for takeoffs and landings).

Wind Rose: A diagram indicating the prevalence of winds from various directions, at a specific place.

Wind Tee: A visual device used to advise pilots about wind direction.

ACRONYM

AC: Advisory Circular
ADF: Automatic Direction Finder
AGL: Above Ground Level
AIP: Airport Improvement Program
ASR: Airport Surveillance Radar
ALP: Airport Layout Plan
ALS: Approach Lighting System
ARFF: Aircraft Rescue and Fire Fighting
ARTCC: Air Route Traffic Control Center
ASDA: Accelerate – Stop Distance Available
ASV: Annual Service Volume
ATC: Air Traffic Control
ATCT: Air Traffic Control Tower
AWOS: Automated Weather Observing System
BRL: Building Restriction Line
BWR: Bucher, Willis & Ratliff Corporation
CAT: Category
CWY: Clearway
dB: Decibel
DME: Distance Measuring Equipment
DNL: Day/Night Average Sound Level
DOT: Department of Transportation
FAA: Federal Aviation Administration
FAR: Federal Aviation Regulation
FIS: Federal Inspection Service
FBO: Fixed Base Operator
FSS: Flight Service Station
FTZ: Foreign Trade Zone
GA: General Aviation
GPS: Global Positioning System
GVGI: Generic Visual Slope Indicator
GS: Glide Slope
HIRL: High Intensity Runway Lights
HUD: U.S. Department of Housing and Urban Development
IFR: Instrument Flight Rules
ILS: Instrument Landing System
IMC: Instrument Meteorological Conditions
INM: Integrated Noise Model
KHz: Kilohertz
LAAS: Local Area Augmentation System
LDA: Landing Distance Available
LIRL: Low Intensity Runway Lights
LOC: Localizer
MALSF: Medium Intensity Approach Lighting System
MALSR: Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MDA: Minimum Descent Altitude
MHz: Megahertz
MIRL: Medium Intensity Runway Lights
MITL: Medium Intensity Taxiway Lights
MM: Middle Marker
MOA: Military Operations Area
MSA: Metropolitan Statistical Area
MSL: Mean Sea Level

NAVAID: Navigational Aid
NDB: Non-directional Beacon
NOS: National Ocean Survey
NPI: Non-precision Instrument
NPIAS: National Plan of Integrated Airport System
NWS: National Weather Service
OAG: Official Airline Guide
OC: Obstruction Chart
OFA: Object Free Area
OFZ: Obstacle Free Zone
OM: Outer Marker
OPBA: Operations Per Based Aircraft
PAPI: Precision Approach Path Indicators
PIR: Precision Instrument
PLASI: Pulsating Light Approach Slope Indicator
RAIL: Runway Alignment Indicator Lights
REIL: Runway End Identifier Lights
RNAV: Area Navigation
RPZ: Runway Protection Zone
RVR: Runway Visibility Range
RVZ: Runway Visibility Zone
RW: Runway
SSALF: Simplified Short Approach Light System with sequenced Flasher Lights
SSALR: Simplified Short Approach Light System with RAIL
TACAN: Tactical Air Navigation
TAP: Terminal Area Plan
TCA: Terminal Control Area
TERPS: Terminal Instrument Procedures
TVOR: Terminal Very High Frequency Omni Range
TW: Taxiway
UHF: Ultra-High Frequency
USGS: United States Geological Survey
VASI: Visual Approach Slope Indicator
VFR: Very High Frequency
VMC: Visual Meteorological Conditions
VOR: VHF Omni-Directional Range
WAAS: Wide Area Augmentation System