San Marcos

Municipal Airport

Airport Master Plan

SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

AIRPORT MASTER PLAN

FINAL REPORT

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San Marcos, Texas

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Chapter One
INVENTORY

Inventory

This inventory of existing conditions at San Marcos Municipal Airport provides an overview of the airport, its facilities, and its role in regional and national aviation systems. An analysis of demographics and economic trends in this increasingly active technology corridor will further supply a basis from which to forecast future facility needs.

This information is developed, in part, from on-site investigations of the airport, including interviews with airport management, airport tenants, representatives of various government agencies, and local and regional economic agencies. Reliable information is also obtained from existing studies and regulatory information. These include the **San Marcos Municipal Airport Master Plan** (November, 1992), and the 1993 **Texas Aeronautical Facilities Plan** (TAFP). City planning and zoning documents were also utilized.

- This chapter evaluates the following information relating to the airport and surrounding area:
- Airport setting, including locale, history, climate, jurisdiction, other airports, and previous studies.
- Physical inventories and descriptions of facilities and services now provided by the airport.
- An overview of existing plans, studies, and trends to determine their potential influence on the development and implementation of the airport master plan.
- Background information pertaining to the City of San Marcos, the Austin-San Marcos MSA, and the surrounding unincorporated areas of Caldwell

and Hays Counties. Analysis of these areas will not only include evaluation of recent local development, but also proposed future development that may impact the airport.

- Population and socioeconomic information which will provide an indication of the market and potential development, including general aviation trends for the I-35 Corridor, which may impact the airport.

AIRPORT SETTING

The following narrative describes the setting of the San Marcos Municipal Airport and places the airport with regard to locale, history, climate, and other physical and geographic characteristics. The San Marcos Municipal Airport is also discussed within a jurisdictional context.

LOCATION

The City of San Marcos, Texas, is located along the I-35 corridor in south central Texas. Refer to **Exhibit 1A, Location Map.** Just 31 miles south of Austin, the state capital and booming high tech center, and 50 miles north of San Antonio, the city of San Marcos is situated at the midway point of regional growth. For this reason the I-35 corridor between San Antonio and Austin is one of the most rapidly expanding regional economies in the nation. Three of the ten largest cities in the United States and over 70 percent of the Texas population are within 200 miles of San Marcos.

San Marcos has long been known for its natural springs and clear, clean rivers. Situated at the foothills of the Texas hill country, San Marcos is a favorite Texas recreation destination. San Marcos is also home to Southwest Texas State University.

San Marcos lies at the junction of Highway I-35 and Texas State Highway 80. I-35 is the major north-south freeway in the state and the major interstate artery linking the United States and trading partners Canada and Mexico. Highway 80 connects to State Highway 183, the main highway to the coastal bend region and Corpus Christi, Texas.

The San Marcos Municipal Airport is contained entirely within the corporate limits of the City of San Marcos. It is located on the eastern edge of the city, east of I-35 and the San Marcos River. State Highway 80 carries east-west traffic south of the airport. Texas State Highway 21 (locally Airport Highway) T-intersects 80 and parallels the western portion of the airport.

The original main airport entrance off Airport Highway provides ground access to the Gary Job Corps Training Center, located directly south of the airport. What was formerly a secondary road now is the main access road to the airport and most of the facilities located on the airfield. Highway 21 also marks the county line between Hays County and Caldwell County. County Road 283, (locally called William Pettus Road) runs east-west and intersects Airport Highway north of the airport. William Pettus Road, in turn, is intersected by Farm-to-Market (FM) Road 1984, completing the ring of the airport as it

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Exhibit 1A
LOCATION MAP

intersects with Highway 80 several miles west of Martindale, Texas. The unincorporated small residential community of Reedville is located off FM1984.

AIRPORT HISTORY

The San Marcos Municipal Airport has an origin shared with many county and municipal air facilities in Texas and throughout the United States. The San Marcos Airport began as Gary Army Airfield for World War II training needs. After the war, the Army Airfield gave the property to the Army and became Gary Army Air Field, or Camp Gary.

Camp Gary provided army aviation training until the 1960's. In 1966 the military training site was split. The Army Defense Department deeded the airfield to the city of San Marcos. The southern half of the airport property, which contained the training and housing facilities, was transferred to the United States Department of Labor. As part of the Johnson administration "Great Society" initiatives a jobs corps center was established and has remained as the Gary Jobs Corp Center.

CLIMATE

Weather conditions play an important role in the planning and development of an airport, as well as its daily operations. Temperature determines air density and, hence, influences landing distances and runway length requirements. Knowledge of wind patterns allows best runway alignment. Cloud cover percentages and frequency of other climatic conditions, likewise, determine the need for navigational aids and lighting.

San Marcos is located in south central Texas, influenced by both the warm, moist air coming northward from the Gulf of Mexico and the subtropical latitude. In this part of Texas heat and humidity go hand-in-hand. With summer daytime temperatures well into the nineties and often surpassing 100 degrees, the average daily temperature and humidity (over 24 hours) for July and August is 85 degrees F and 70 percent (as interpolated from reporting data for Austin and San Antonio).

High surface temperatures create areas of convection activity, generating the sporadic summer afternoon thunder-showers. Summer evenings are often punctuated by the thunder and high energy winds of thunderstorms driven eastward by westerly winds aloft and fueled by the moist Gulf air. Annual precipitation for the area averages 31.43 inches of precipitation per year. Less than one inch falls in the form of snow, with the highest monthly snowfall typically occurring during January. May is the wettest month of the year with an average of 4.5 inches of rain.

Wind patterns for the central Texas area are typically from the south/southeast during the spring, summer, and fall months and from the north/northwest in the winter months. For this reason Runway 17 is the most favorable runway orientation.

Average wind speeds for this area are 9.1 miles per hour (mph). Recorded periods of high winds are usually

associated with frontal conditions. The Texas "Blue Norther" which may occur during any month of the year, can bring high winds (up to 50 mph) from the north and abrupt drops in temperature. Tropical Gulf depressions are sporadic and known to bring extended periods of heavy rains and high winds.

OTHER AREA AIRPORTS

There are a number of other public airports providing various degrees of service to the region. **Exhibit 1B, Regional Airspace** indicates those airports within a forty nautical mile (nm) radius. San Marcos Airport is also included for immediate comparison purposes. The public airports within range of San Marcos Municipal Airport that impact or compete for activity are listed as follows. The discussion includes information regarding associated city, distance from San Marcos Municipal Airport, longest runway, annual operations and the number of based aircraft:

San Marcos Municipal Airport:
Longest runway: 6,330 feet
Annual Operations: 103,295
Based aircraft: 227

San Marcos offers full service with both Jet A and 110LL fuel sales, flight instruction, aircraft maintenance, aircraft rental, and tie-down and hangaring services. A general aviation terminal is attended regularly. Three published instrument approaches are available for instrument flying requirements, including a precision approach using an Instrument Landing System (ILS).

Austin-Bergstrom International:
Associated City: Austin
Distance from HYI: 20 miles
Long runway: 12,200 feet
Annual operations: 186,819 of which 100,200 were Air Carrier operations
Based aircraft: 113

The National Plan of Integrated Airport Systems (NPIAS) classifies Austin-Bergstrom International as a primary commercial service airport. Austin-Bergstrom replaced the Austin Robert Mueller Airport as the primary commercial airport for the Austin and surrounding Central Texas area.

Austin-Bergstrom Airport is equipped with two parallel north-south runways, with the longest runway being 12,200 feet long. Austin-Bergstrom is served by an airport traffic control tower and provides approach control services for the area. Austin-Bergstrom has ten published instrument approaches that are provided with an array of instrument approach aids, including precision instrument landing system (ILS) approaches. Austin-Bergstrom serves as an international airport with customs landing rights. Some general aviation operations occur here, providing flight instruction, tie down operations, aircraft rental and sales, and fuel sales.

Georgetown Municipal Airport:
Associated City: Georgetown
Distance from HYI:48 miles
Long runway: 5,000 feet
Annual operations: 86,870
Based aircraft: 150

Georgetown Airport is classified as a reliever facility by the NPIAS. George-

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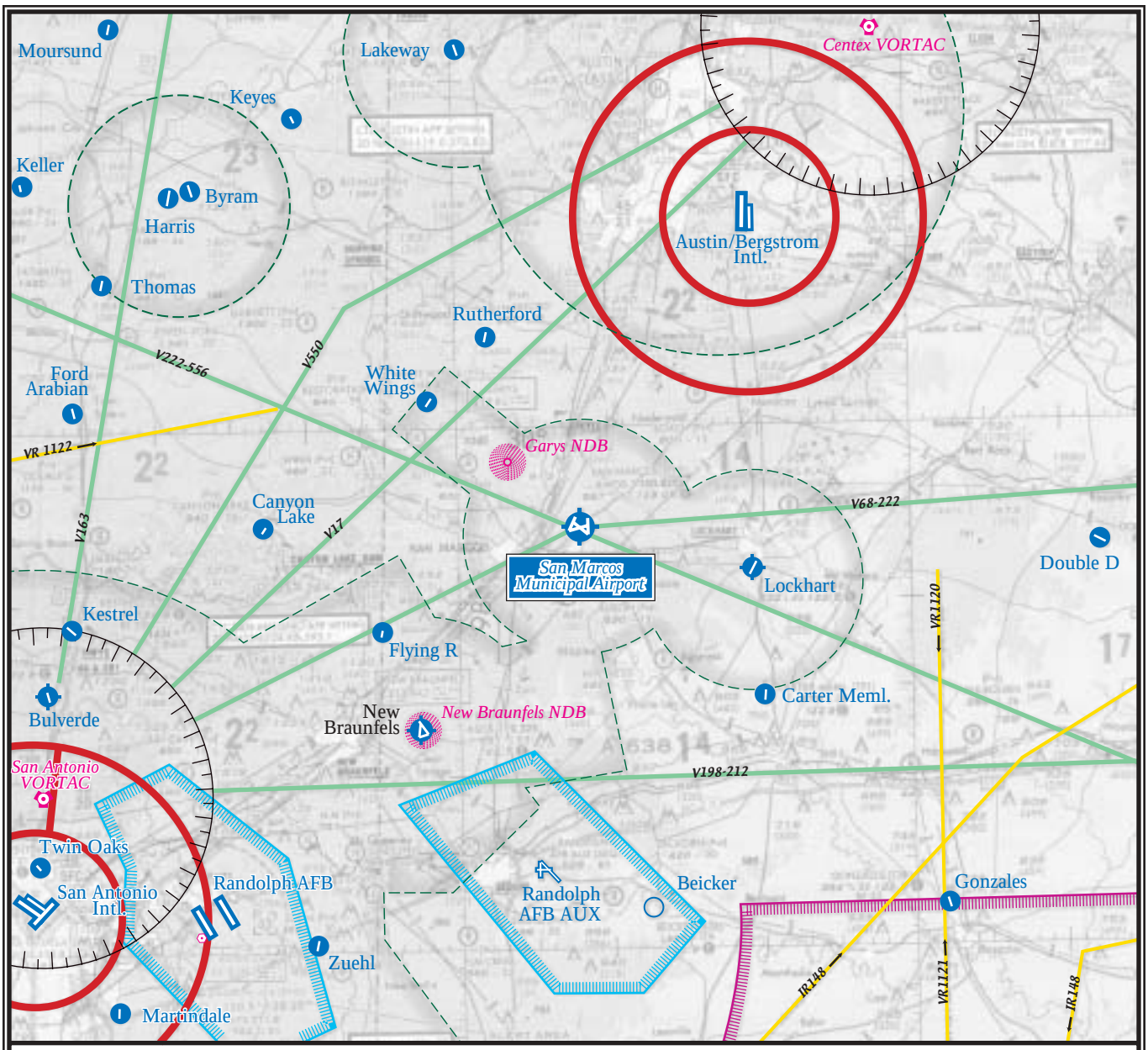

LEGEND

- Airport with other than hard-surfaced runways
- Airports with hard-surfaced runways 1,500 ft. to 8,069 ft.
- Airports with hard-surfaced runways greater than 8,069 ft. or some multiple runways less than 8,069 ft.
- VORTAC
- VOR/DME
- Non-Directional Radiobeacon (NDB)
- Compass Rose
- Victor Airways
- Military Training Routes
- Military Operations Area (MOA)
- Prohibited, Restricted, Warning, and Alert Areas
- Class C Airspace
- Class E Airspace with floor 700' above surface

Source: Dallas-Ft. Worth Sectional Aeronautical Chart
National Oceanic and Atmospheric Administration (NOAA)
Effective Date: September 9, 1999

NORTH

NOT TO SCALE

San Marcos MUNICIPAL AIRPORT

Exhibit 1B
AREA AIRSPACE

town has five published instrument approaches, using NDB and GPS navaids. It serves a large general aviation aircraft base with fuel sales, aircraft rental, flight instruction, maintenance, and tie-down and hangaring services.

New Braunfels:
Associated City: New Braunfels,
Distance from HYI: 21 miles
Long runway: 5,300 feet
Annual operations: 23,500
Based aircraft: 95
New Braunfels

New Braunfels Airport is very similar in size and origin to San Marcos with 3 runways. It is classified as General Aviation airport in the NPIAS. New Braunfels has seven published instrument approaches, using NDB, VOR, and GPS navaids. It has a general aviation terminal that serves a large general aviation aircraft base. The airport offers both Jet A and 110LL fuel sales, aircraft rental, flight instruction, and tie-down and hangaring services.

Lockhart:
Associated City: Lockhart
Distance from HYI: 15 miles
Long runway: 4,000 feet
Annual operations: 11,680
Based aircraft: 47

Lockhart Airport is a GA municipal airport with a single north-south asphalt runway. It serves the general aviation public with 110 LL fuel sales, flight instruction, aircraft rental, tie-down, and published GPS instrument approaches for both runways 18 and 36.

Carter Memorial:
Associated City: Luling
Distance from HYI: 20 miles
Long runway: 2,800 feet
Annual operations: 2,080
Based aircraft: 8

The Carter Memorial Airport has two runways. Runway 17-35 is 2,800 feet and asphalt. Runway 4-22 is turf, 2,000 feet in length, and in poor condition. No fuel is available. There is no regularly attended facility or published instrument approach.

JURISDICTIONAL SETTING

As a city owned public facility the San Marcos Municipal Airport is managed by the City's representative, the Airport Manager. It is the manager's responsibility to secure the facilities for their safe and efficient use. In 1970, the City of San Marcos passed an ordinance amending the City Code to create an Airport Commission.

The San Marcos Airport Commissioners are appointed for two year terms. The Airport Commission serves as an advisory board to the City Council, making recommendations on the following:

- The selection of all fixed base operators and other lessees;
- The terms, conditions, duties, responsibilities, consideration and other lease arrangements concerning airport property;
- All matters affecting airport management;

- Methods and matters in recruiting and creating interest in the municipal airport; and
- Planning, developing, and expanding airport services.

The San Marcos Airport Commission is composed of nine members appointed by the City Council. Each year the Airport Manager submits a budget to the City Manager for inclusion in the City's annual budget. In October 1999 the City Council, upon recommendation by the Commission, approved budgeting to update the Airport Master Plan.

PREVIOUS STUDIES

AIRPORT MASTER PLAN

The most recent airport master plan update (November, 1992) presented a variety of scenarios which suggested a number of changes at San Marcos Municipal Airport to accommodate increased traffic and use by larger corporate aircraft. The recommended development plan, as depicted in the Airport Layout Plan (ALP) calls for:

- improvement to Runway 12/30, extending it 560 feet to a length of 6,200' (ultimately another 1,000' to 7,200') southeast and increasing the weight allowance to 60,000 lbs.;
- extension of all runways for 300' of safety area overrun;
- rehabilitation of the concrete parking ramp;
- rehabilitation of the historic control tower;
- construction of new T-hangars;
- land acquisition for runway extensions;
- installation of DME on the localizer;
- extension of the parallel taxiway for 12-30;
- installation of lighting for taxiways;
- construction of a ramp access road; and
- various landside improvements, including a new general aviation terminal facility.

NPIAS/TAFP CLASSIFICATION

The San Marcos Municipal Airport is classified in the FAA's **National Plan of Integrated Airport Systems (NPIAS)** as a reliever airport. The reliever status is based upon at least 50 based aircraft and location in a major metropolitan area. Reliever airports across the country have an average of 207 based aircraft and account for 29 percent of the nation's total active aircraft. Reliever airports are located in major metropolitan areas and serve to provide pilots with an attractive alternative to using congested commercial service airports. The San Marcos reliever status is based upon a level of 227 based aircraft and 35,000 local operations of a 103,295 total operations according to the Airport Master record, effective January 1, 2000.

The **Texas Aeronautical Facilities Plan (TAFP)** recognizes the FAA's classification of the San Marcos Municipal Airport as a reliever airport to the Austin and San Antonio metropolitan areas. The **TAFP** further categorizes San Marcos Municipal Airport in its system plan as a general aviation transport airport. According to

the **TAFP**, the minimum design standards for a general aviation transport airport include a 5,000 foot by 100 foot runway, 30,000 pound single gear wheel (SWL) pavement strength, medium intensity runway lighting, full parallel taxiway, precision approach capability, and terminal services.

AIRPORT FACILITIES

This section presents a description of the existing facilities at the San Marcos Municipal Airport. For ease of reference, the section is presented as follows:

- Airside Facilities
- Landside Facilities

AIRSIDE FACILITIES

Airside facilities are those facilities needed for the safe and efficient movement of aircraft including **runways, taxiways, airport lighting, and navigational aids**. In most cases, airside facilities dictate the types and levels of aviation activity capable of operating at an airport. A depiction of the airside facilities at the airport is provided on **Exhibit 1C, Airside Facilities**. **Table 1A** below summarizes key airside facility data for the airport, especially as regards runways and navigational information.

Runways

The airport is served by four runways. **Primary runway 12-30** is oriented southeast to northwest and is 5,603 feet long and 150 feet wide. This runway is asphalt and is strength-rated at 60,000 pounds single wheel gear loading (SWL). **Runway 17-35** is oriented in a north/south manner and is 5,440 feet long and 100 feet wide. The asphalt runway is strength-rated at 20,000 pounds single wheel gear loading (SWL). **Runway 4-22** is oriented northeast to southwest and is 5512 feet long and 100 feet wide. The asphalt runway is strength-rated at 15,000 pounds single wheel gear loading (SWL). **Runway 8-26** is the longest of the four runways and is oriented east to west. It is 6,330 feet long and 100 feet wide. The asphalt runway is strength-rated at 80,000 pounds single wheel gear loading (SWL).

Taxiways

The taxiway system at San Marcos Municipal Airport is identified on **Exhibit 1C, Airside Facilities.** The taxiways are generally in good condition and paved with asphalt.

Taxiway A is 550 feet long and 50 feet wide, directly accessing Runways 4 and 8. Taxiway A also serves to route traffic onto Runway 4. Portions of Runway 4, in turn, are used to taxi to Runway 12 and for connection to Runway17 at the north end.

Taxiway B is 950 feet long by 30 feet wide. Taxiway B routes traffic from the central ramp area, and across Runway 8-26, to Taxiway C.

Runway 12-30 is also served by Taxiway C, a full length 4,900 foot, 30-foot wide parallel taxiway for Runway 12-30. The parallel taxiway centerline lies approximately 625 feet west of the

runway centerline. Aircraft departing Runway 12 exit Taxiway C onto Runway 4, then proceed northeast to the Runway 12 threshold.

Taxiway D connects the intersection of Runways 8-22 and 12-30 to the main ramp area. Taxiway D is 550 feet long by 40 feet wide.

TABLE 1A
Airside Facilities Data
San Marcos Municipal Airport

	Runway 17-35	**Runway 4-22**	**Runway 12-30**	**Runway 8-26**
Runway Length (feet)	5,442	5,512	5,603	6,330
Runway Width (feet)	100	100	150	100
Runway Surface	Asphalt	Asphalt	Asphalt	Asphalt
Surface Condition	Good	Good	Good	Good
Runway Markings	Basic	Basic	Precision Instrument	Non-Precision
Runway Traffic Pattern	Left	Left	Left	Left
Runway Load Bearing Strength (lbs.): Single Wheel (SWL)	20,000	15,000	60,000	80,000
Runway and Taxiway Lighting	None	None	MIRL	MIRL
Approach Aids				
Approach Slope Indicator	None		VASI-4L (30)	
Runway End	None	None	-	REIL
Approach Lighting	None	None	MALSR (12)	None
Visual Aids	Rotating Beacon Lighted Windcone AWOS-3 Segmented Circle			
Navigational Aids	None	None	ILS, GPS (12) NDB (12)	None

PAPI-Precision Approach Path Indicator
VASI-Visual Approach Slope Indicator
REIL-Runway End Identification Lights
MALSR-Medium Intensity Approach Lighting with RAIL
MIRL-Medium Intensity Runway Lighting
RAIL- Runway Alignment Indicator Lights
ILS-Instrument Landing System
GPS-Global Positioning System
NDB-Nondirectional Radio Beacon

Sources: Airport Facility Directory; South Central U.S. (20 April 2000); FAA 5010-1 Airport Master Record (20 April 2000), U.S. Terminal Procedures, South Central (February 24, 2000).

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LEGEND

	Existing Airport Property Line
A	Taxiway Designation
REIL	Runway End Identifier Lights
VASI	Visual Approach Slope Indicator
ILS	Instrument Landing System

0 1200 2400

SCALE IN FEET

NORTH

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Exhibit 1C
AIRSIDE FACILITIES

Taxiway E connects Runway 12 and the ramp. Taxiway E is 550 feet long by 40 feet wide and is located at the eastern end of the airport ramp area near the Confederate Air Force hangar.

Taxiway F connects Taxiway C with the joint thresholds of Runways 30 and 35.

Taxiway J connects Runway 17 to Runway 4-22 and is 2,100 feet long and 50 feet wide.

Airfield Lighting

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

Identification Lighting: The location of the airport at night is universally indicated by the rotating beacon. A rotating beacon displays alternating flashes of white and green lights to identify the airport. The location of the rotating beacon on the south side of the airport is indicated on **Exhibit 1C**.

Runway and Taxiway Lighting: Runway and taxiway lighting utilize light fixtures placed near the pavement edge to define the lateral limits of the pavement. This lighting is essential for safe operations during night and/or times of low visibility in order to maintain safe and efficient access to and from the runway and aircraft parking areas. **Medium intensity runway lights (MIRL)** are provided on Runways 8-26 and 12-30. At San Marcos Municipal the runway lighting systems are controlled through a **pilot controlled lighting system (PCL)** which allows pilots to increase the intensity of various airfield lighting systems from the aircraft with the use of the aircraft's radio transmitter. San Marcos Municipal Airport users have options for low, medium, and high intensity lights by microphone keying 3, 5, or 7 times respectively.

Runway End Identification Lights (REILs) provide rapid and positive identification of the approach end of a runway. REILs are typically used on runways without more sophisticated approach lighting systems. The REIL systems consists of two synchronized flashing lights, located laterally on each side of the runway facing the approach aircraft. REILs are installed on Runway 8-26. The REIL system on Runway 26 is currently inoperable.

Taxiways are lighted per FAA requirements, with centerlines marked by reflectors. Directional signs are lighted providing way finding for local and itinerant night traffic.

Approach Lighting: Approach lighting is installed for the purpose of directing the aircraft to the end of the active runway. Approach lighting can aid in both visual and instrument landings. At San Marcos Municipal Airport the four box VASI to the left of the approach end of Runway 30 aids in visual approaches. The lights indicate vertical alignment to aircraft on final approach.

Runway 12 is equipped with Medium Intensity Approach Lighting System (MALSR) with Runway Alignment Indicator Lights. This system allows

verification of the aircraft's relative vertical position with respect to Runway 12 in conditions of poor visibility. Loss of this lighting aid increases visibility minimums required for instrument landings.

Other Airport Aids

Although San Marcos Municipal Airport is not equipped with an air traffic control tower, it is served by the UNICOM frequency for pilot-to-pilot and air-to-ground communication. An automated weather observing system (AWOS-3) is a recent addition to the airport facilities. AWOS -3 provides an automated weather briefing over a discrete frequency for pilot inflight service. A remote communication outlet (RCO) transmitter-receiver has also been added, allowing direct communication with Air Traffic Control (ATC) services in Austin.

LANDSIDE FACILITIES

Landside facilities are those ground based facilities providing support to the operation of aircraft. They are essential to the aircraft and pilot/passenger handling functions. These include the general aviation terminal and administration building, aircraft storage areas, maintenance hangars, aircraft parking apron, and fueling facilities. The existing landside facilities are depicted on **Exhibit 1D, Landside Facilities**.

TERMINAL FACILITY

The airport general aviation terminal facility is located on the south side of the airport, just off the entry road (Airport Drive). The terminal is approximately 3,000 square feet in size and houses the administration office and the Berry Aviation main offices in a tri-pod building arrangement. The facility provides space for airport admini-stration, a conference room, storage space, restrooms, flight planning, lobby, weather data machine, and telephone.

AIRCRAFT APRON AREAS

With over 2.6 million square feet (59 acres)of aircraft apron, the San Marcos Municipal Airport has an abundance of space for aircraft tie down, and aircraft maneuvering.

As previously mentioned, the airport was developed to meet the critical needs of World War II air combat. At one time the entire apron surface area consisted of flight line. In answer to the needs of this high volume of aircraft and fueling operations, the apron was surfaced with concrete rather than asphalt, as concrete weathered fueling operations much more successfully.

Apron surface conditions vary from good to poor. Areas along part of the north apron edge, which is also the continuation of Taxiway C, have been recently resurfaced. Some other areas

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Exhibit 1D
LANDSIDE FACILITIES

have large cracks with grass and weed outcrops, and are in need of sealing. A recent engineering study of the pavement conditions have determined which concrete panels have the greatest need of replacement. Replacement of a majority of these has greatly improved the airport appearance and operating capabilities.

Located south of and parallel to Runway 8-26 the main apron area is 500 feet wide and accommodates transient parking for the terminal, Gafford Aero, Gryphon Aviation, McKee Aviation and Avionics, Southwest Texas Aviation, and the on-field general aviation and maintenance facilities.

The east apron area is angled off the main area to parallel Runway 12-30. It is home to the Central Texas Wing of the Confederate Air Force hangar and a new T-hangar facility.

AIRCRAFT HANGAR FACILITIES

Hangar facilities at San Marcos Municipal Airport consist of shade hangars, T-hangars and conventional and executive hangar facilities. The shade hangar facility, located on the main apron, has 14 lease spaces. Currently thirteen are leased. Three neighboring, new private T-hangars have eight units each. Currently 21 are leased or leases are pending. The number of units capable of being leased in this area is 38.

The airport also owns three other older T-hangars: A, B, and C, located between the terminal and the apron T-hangars, south of the apron. Building A contains six spaces which are all currently leased. Building B has nine spaces which are all leased. Building C has ten spaces, all of which are leased. The total number of units available in this area is 25. **Exhibit 1D, Landside Facilities** provides the location of these facilities.

Seven new executive hangar storage facilities lie directly southeast of the Berry Aviation hangar. There are three new executive hangars between the terminal and the C group of T-hangars. The San Marcos Municipal Airport also contracts commercial hangar leases to the following based operations.

Berry Aviation hangars are located west of the terminal area. Berry Aviation is a full service executive and corporate charter operations, as well as air cargo service. Berry also offers aircraft sales, leasing and line service. Its charter fleet consists of 16 Metroliners, while storing 25 other aircraft, including 2 Beech KingAirs, a Mitsubishi MU-2, and a Merlin.

McKee Avionics and Aviation Service provides sales, full line discount fuel service, and repair and installation of avionics. McKee operates at 1838 Airport Drive east of the lease T-hangars A, B, and C location.

Southwest Texas Aviation is located between the terminal area to the west and T-hangars A, B, and C to the east. Southwest Texas leases a commercial hangar at 1813 Airport Drive and owns the newer hangar at 1815. Southwest Texas Aviation specializes in Mooney modifications and provides general aircraft maintenance and service.

Gryphon Aviation provides full time professional flight training and aircraft

management and leasing. Gryphon leases space east of the new T-hangars on the apron and just west of the Confederate Air Force operations. The address is 2049 Airport Drive.

Gafford Aero

Gafford Aero is the oldest operation on the field. Gafford offers airframe and engine maintenance and is located in T-hangar area A at the west end.

Confederate Air Force

San Marcos Municipal Airport is also home to the famed Central Texas Wing of the Confederate Air Force which leases the hangar at the east end of the operations area 2249 Airport Drive. Vintage military fighter and attack aircraft of the 1939 - 1945 era are on display. The annual air show, *A Gathering of Memories*, which features these aircraft, attracts thousands of visitors from all over the state. The CAF hangar also houses a museum of WWII artifacts.

UTILITIES

The availability and capacity of the utilities serving the airport are important factors in determining the development potential and level of service to existing and future users. The following information is supplied to better determine the San Marcos Airport's ability to provide service to its users.

The airport is supplied water via the City of San Marcos system. The airport maintains the old military sanitary sewer and storm sewer systems. Due to the unavailability of metal for pipe during the time of construction, the sanitary sewer system was constructed of tile. A system of this age and type construction is believed to still be serviceable, yet subject to leakage. Likewise the storm sewer system is of World War II vintage and has failed in specific locations. Potential drainage problems could eventually arise that inhibit airport operations and development.

Electrical service is provided to the airport by Pedernales Electric Cooperative (PEC). The airport is not currently served with three-phase electricity. Natural gas is not currently supplied to the airport.

ROADS

The airport is served by a main road which accesses all available ground services, including the terminal, hangars, and parking areas. After the split of property from the Gary Job Corps Center, the road centerline was used to locate the property line and place the fence dividing each property. Since this resulted in a single driving lane on either side of the fence, road was hastily laid to allow sufficient width for two way traffic. The road is in serviceable condition, but needs resurfacing in several locations.

AREA AIRSPACE AND AIR TRAFFIC CONTROL

The FAA Act of 1958 established the FAA as the responsible agency for the

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

AIRSPACE STRUCTURE

To ensure a safe and efficient airspace environment for all aspects of aviation, the FAA has established an airspace structure that regulates and establishes procedures for aircraft using the National Airspace System. The U.S. airspace structure provides for categories of airspace and identifies them as Classes A, B, C, D, E, and G.

Class A airspace is high level controlled airspace and includes all airspace from 18,000 feet mean sea level (MSL) to Flight Level 600 (approximately 60,000 feet MSL). Class B airspace is controlled airspace surrounding high activity commercial service airports (i.e. DFW International Airport). Class C airspace is controlled airspace surrounding lower activity commercial service and some military airports (i.e. Austin-Bergstrom International Airport). Class D airspace is controlled airspace surrounding low activity commercial service and general aviation airports with an airport traffic control tower (ATCT).

All aircraft operating within Class A, B, C, and D airspace must be in constant contact with the air traffic control facility responsible for that particular airspace sector. Class E airspace is controlled airspace surrounding an airport that encompasses all instrument approach procedures and low altitude federal airways. The use of magenta coloring indicates that the floor of the Class E airspace is 700 feet above ground level (AGL). Blue shading indicates a floor of 1200 feet AGL and is found adjacent to Class G airspace. Only aircraft conducting instrument flights are required to be in contact with air traffic control when operating in Class E airspace. Class G airspace is uncontrolled airspace.

San Marcos Municipal Airport is located within Class E airspace. Airspace in the vicinity of San Marcos Municipal Airport is depicted on **Exhibit 1B, Regional Airspace**.

TERMINAL AREA AND ENROUTE NAVIGATION

Navigational aids are electronic devices that transmit radio frequencies which can be translated by pilots of properly equipped aircraft into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying to or from the airport include:

- **instrument landing system (ILS)**,
- **very high frequency omni-directional range (VOR)** facility,

- **nondirectional radio beacon (NDB)**, and
- a **global positioning system (GPS).**

The **instrument landing system (ILS)** is an approach and landing aid designed to identify the exact alignment of the runway approach path. The ILS systems are installed to allow approaches during periods of poor visibility. San Marcos Municipal Airport has a published ILS approach to Runway 12.

ILS systems provide three functions: 1) guidance, provided vertically by a glide slope beacon, and horizontally by a localizer beacon; 2) range, furnished by marker beacons; and 3) visual alignment, supplied by the approach lighting system and runway edge lights.

The localizer (LOC) antennas for each approach is located beyond the far end of a runway. The localizer antenna for Runway 12 is situated on an extended centerline, 1,350 feet southeast of the Runway 30 threshold. The antenna emits very high frequency (VHF) signals that provide the pilot with course deviation left or right of the runway centerline and the degree of deviation. The ultra high frequency (UHF) glide slope (GS) transmitter for Runway 12 is located approximately 1,150 feet northeast of the Runway12 landing threshold. The transmitter provides a signal indicating whether the aircraft is above or below the desired glide path.

To further assist the ILS approach, an initial approach fix, usually a transmitted signal intersection, has been established with the Gary NDB. Also, outer and middle markers have been established to aid pilots in determining their progress along the approach. The Runway 12 ILS approach has a 3.0 degree glide slope that intercepts the initial approach fix at a distance of 5.5 nautical miles and 2,445 feet above the threshold. The approach intercepts the GARYS locator/outer marker at 5.1 nautical miles from the middle marker at 2,445 feet above the threshold. The middle marker is 0.5 nautical miles from the runway threshold, and serves as the missed approach point.

The **VOR** provides azimuth readings to pilots of properly equipped aircraft by transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility to provide distance as well as direction information to the pilot. In addition, military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. A VORTAC provides distance and direction information to civil and military pilots. Although there is no instrument approach associated with a VOR at San Marcos, navigation between and utilizing VORs is extremely important. The VOR airway system is described below.

There are several VOR facilities located in the region which can be utilized by pilots flying to or from San Marcos Airport. Area VOR facilities that are available for navigational purposes in the San Marcos Airport vicinity are:

Randolph VOR (RND) . . . 112.30 Mhz
Centex VORTAC (CWK) . 112.80 Mhz
San Antonio VORTAC
(SAT) . . . . . 116.80 Mhz
Stonewall VORTAC
(STV) . . . . . 113.80 Mhz

Exhibit 1B depicts the location of these VOR facilities in relation to San Marcos Airport.

The **NDB** transmits nondirectional radio signals whereby the pilots of properly equipped aircraft can determine the bearing to or from the NDB facility and then "home" or track to or from the station. The San Marcos Airport is served by the GARYS NDB, which is located northwest of the centerline of Runway 12 and is described previously in this section. An instrument approach is published for the GARYS NDB for Runway 12. A nonprecision approach, the NDB Runway 12 approach allows a descent from 2,700 feet at the GARYS NDB to the end of Runway 12, 5.5 nm away.

Exhibit 1B depicts the location of several other nearby NDB's as identified below:

New Braunfels(BAZ) . . . . . 212 Mhz
Alamo(AN) . . . . . 368 Mhz

A **Global Positioning System (GPS)** is an additional navigational aid for enroute flight to an airport. GPS was initially developed by the United States Department of Defense for military navigation around the world. Increasingly, over the last few years, GPS has been utilized for civilian aircraft. GPS uses satellites placed in orbit around the globe to transmit electronic signals which properly equipped aircraft use to determine altitude, speed, and navigational information. GPS allows pilots to directly navigate to any airport in the country and are not required to navigate using a specific navigational facility.

The FAA is proceeding with a program to gradually replace all traditional enroute navigational aids with GPS over the next decade. The FAA phase-out schedule for traditional navigational includes: VORs between 2005 and 2010, and NDBs between 2000 and 2005. Currently, the San Marcos Municipal Airport is served by a GPS approach to Runway 12.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC)

The FAA has established 21 Air Route Traffic Control Centers (ARTCC) in the continental United States to control aircraft operating under instrument flight rules (IFR) within controlled airspace and while in the enroute phase of flight. An ARTCC assigns specific routes and altitudes along federal airways to maintain separation and orderly air traffic flow. Centers use radio communication and long range radar with automatic tracking capability to provide enroute air traffic services. Typically, the ARTCC splits its airspace into sectors and assigns a controller or team of controllers to each sector. As an aircraft travels through the ARTCC, one "hands off" control to another. Each sector guides the aircraft using discrete radio frequencies.

Houston ARTCC is responsible for enroute control of all aircraft operating

under IFR and participating VFR aircraft arriving and departing the San Marcos Municipal Airport.

LOCAL AIR TRAFFIC CONTROL

Although San Marcos Municipal Airport is not served by an airport traffic control tower (ATCT), pilots can broadcast their intention and position on the common traffic advisory frequency (CTAF) channel 123.05 Mhz. Although flights originating and ending at San Marcos Municipal Airport operate in Class E airspace, Austin-Bergstrom Airport and San Antonio International are regulated within Class C airspace. Aircraft operating within either Class C airspace are controlled by Austin or San Antonio approach/ departure control.

AREA LAND USE AND ZONING

The San Marcos Municipal Airport consists of 1,356 acres of land. The airport is shown on the City of San Marcos Future Land Use Maps as Public/Institutional zoning. Six to seven hundred acres are leased for agriculture, predominantly corn, cotton, and hay. Another 124 acres of land south of the entry is reserved for non aviation use and has been designated by City ordinance to be a Foreign Trade Zone (FTZ). The FTZ was created to entice industry and trade through duty free trade. Since that time the North American Free Trade Agreement (NAFTA) has lowered tariff barriers with neighboring countries. This may affect the future ability of the FTZ to attract trade.

Although the San Marcos Municipal Airport is located entirely within the corporate limits of San Marcos, other jurisdictions may also be affected by any proposed changes. The airport boundaries lie predominantly within Caldwell County. The northwest area of the airport, acquired to control instrument takeoff and landing features for Runway 12-35, lies within Hays County, as does the City of San Marcos. The small residential community of Reedville is situated directly southeast of the airport and Runway 12. Another small subdivision lies across from the Jobs Corps, south of Arnold Drive.

The Gary Job Corps Center occupies the buildings lying south of the airport property and within the airport environment. It is one of the 110 Job Corps facilities run by the United States Department of Labor, begun in 1964 to train and educate "at risk" youth from ages 16 to 24.

Review of existing and future zoning and land use plans indicate that the area surrounding the airport, which is unincorporated, will remain primarily agricultural.

HEIGHT ZONING

Use of the existing properties and planned future uses of land near the San Marcos Airport include height and obstruction considerations. Vernon's Revised Statutes for the State of Texas regarding the use of state funds for airport improvement require establish-

ment of an Airport Hazard Zoning Ordinance. This ordinance is established to regulate and restrict the heights of structures and objects of natural growth around the airport to enhance safety of aircraft in flight and objects on the ground. Also, the ordinance considered the potential conflicts an obstruction could pose on existing and future approach minimums at the airport. The City of San Marcos enacted height hazard zoning legislation on September 27, 1984.

The language of the height zoning ordinance borrows from Federal Aviation Regulation (F.A.R.) Part 77, **Objects Effecting Navigable Airspace**. F.A.R. Part 77 assigns three-dimensional imaginary areas to the runway in accordance with the type of aircraft and approach minimums being served. These imaginary surfaces emanate from the runway centerline and are dimensioned to protect approaching and departing aircraft from potential hazard of obstructions.

SOCIOECONOMIC CHARACTERISTICS

A variety of historical and forecast socioeconomic data, related to San Marcos and the Austin - San Marcos MSA, was collected for use in various elements of this master plan. This information is essential in determining aviation service level requirements, as well as forecasting the number of based aircraft and aircraft activity at the airport. Aviation forecasts are normally related to the population base, economic strength of the region, and the ability of the region to sustain a strong economic base over an extended period of time.

POPULATION

An integral element of consideration when planning for future airport needs is the population. An understanding of demographic changes will determine, not only airport facility size, but also facility type. These factors underlie the economic base that, likewise, is needed to support future airport requirements.

Due to its location along the growing I-35 corridor, consideration and analysis of population figures includes the City of San Marcos, Hays and Caldwell Counties, and the Austin-San Marcos MSA. Historical population data presented in **Table 1B** was obtained from **The Complete Economic and Demographic Data Source** (**CEDDS 1998**) by Woods and Poole Economics, Inc. and the city of San Marcos. As indicated on the table, the population for the City of San Marcos has increased at an average annual growth rate of 2.71 percent between 1970 and 1999. In more basic terms, the population for the city has more than doubled, increasing by 22,050 residents over the last 29 years.

This growth rate outpaced that of the State of Texas by 0.8 percent, following the trend of the city of Austin which grew at a significant rate of 3.31 percent as averaged over the same twenty nine year period. Outpacing even this fast-paced trend, the combined Austin - San Marcos MSA grew at a fast-paced 3.64 percent over twenty-nine years, from 402,939 to 1.35 million people. The population doubled from 1970 to 1990 and then almost equaled that same growth increment in half the time, growing by approximately 300,000 by 1999.

TABLE 1B Historical Population						
Area	1970	1980	1990	1999	% Increase/ yr.	29 Year Change
Austin-San Marcos MSA						
Population	402,939	589,651	850,638	1,135,686	3.64%	732,747
Hays County						
Population	27,985	41,125	65,755	91,123	4.15%	63,138
Caldwell County						
Population	21,256	23,775	26,312	33,193	1.55%	11,937
City Populations						
San Marcos	18,860	23,420	28,743	40,910	2.71%	22,050
Austin	251,808	345,496	465,622	647,698	3.31%	395,890
Lockhart	6,489	7,953	9205	12,639	2.33%	6,150
New Braunfels	17,859	22,402	27,334	38,404	2.68%	20,545
State Population						
Texas	11,258,480	14,337,820	17,046,580	19,406,190	1.90%	5,720,581

Source: County and MSA from Woods & Poole, CEDDS 2000; City Populations from Texas Water Development Board, 2002 State Water Plan

According to Texas State Comptroller of/ Public Accounts reports, as the baby boom generation grows out of the prime child bearing years, population growth will continue but at a slower rate.

EMPLOYMENT

Analysis of the regional and local employment base can provide valuable insight to the overall well-being of the community. In most cases, the community make-up and health is significantly impacted by the availability of jobs, variety of employment opportunities, and types of wages provided by local employers. **Table 1C** indicates employment statistics for the Austin-San Marcos MSA.

Regional Employment

The region fared well in the nineties, coming out of the statewide economic slump, based in large part in the real estate and construction industries. Virtually every sector of the economy experienced growth. The sectors showing greatest gains were the **manufacturing, trade, services, and government sectors**, which represent over 80 percent of the total employment picture. Likewise, both construction and real estate sectors showed good recovery in the last half of the nineties.

Manufacturing

The manufacturing industry has remained a stable force in the economy,

contributing 11 percent of regional jobs. Manufacturing in the region is geared toward the technology and semi-conductor industries. Six of the top ten manufacturers in the region are engaged in the high tech industry. These high tech manufacturers include Motorola, International Business, Advanced Micro Devices, Dell General, and Texas Instruments, Inc.

TABLE 1C Total Employment (Thousands)	1970	1980	1990	1999	2000	% Annual Increase
	184,372	322,969	514,414	786,484	812,785	5.25%
FARM EMPLOYMENT	7,308	7,388	7,269	8,018	8,110	0.36%
AGRICULTURAL SERVICES, OTHER	863	1,549	4,082	8.,549	8,899	8.38%
MINING	1,330	3,413	5,546	4,968	5,135	4.77%
CONSTRUCTION	10,804	19,184	21,157	47,299	48,115	5.29%
MANUFACTURING	15,269	32,669	51,792	84,454	86,502	6.16%
TRANSPORT, COMM. & PUBLIC UTIL	5,113	8,961	14,826	24,371	25,182	5.65%
WHOLESALE TRADE	6,023	9,804	16,274	27,554	28,453	5.50%
RETAIL TRADE	28,477	52,405	80,761	127,314	131,343	5.41%
FINANCE, INS. & REAL ESTATE	12,826	30,741	44,467	65,103	67,369	5.89%
SERVICES	40,133	69,068	148,44	255,294	268,177	6.77%
FEDERAL CIVILIAN GOVT	7,085	9,241	13,234	9,807	9,789	1.12%
FEDERAL MILITARY GOVT	7,719	6,209	7,504	3,149	3,148	-3.05%
STATE AND LOCAL GOVT	41,422	72,337	99,062	120,604	122,563	3.81%

Source: County and MSA from Woods & Poole, CEDDS 2000

Trade

Wholesale and retail trade employs approximately 160,000 people in the Austin-San Marcos MSA. This sector represents 19.5 percent of total employment. Wholesale trade and retail trade have increased annually at 5.4 and 5.5 respectively. Over the first ten year period the retail trade posted a 5 percent yearly increase. The second and third ten year periods, however, indicate growth of 6.4 and 6.1 percent respectively. According to the State of Texas Comptroller's office this coincides with anticipated increases followed by slowing as trade competition from Mexico becomes a factor in the economy. Wholesale trade accounted for 22,430 new jobs over thirty years and retail trade accounted for 102,866 over the same period.

Services

The services industry remains the strongest of the employment sectors for the Austin-San Marcos MSA. Continued expansion is forecast, driven by the area's rapid population growth. The services sector posted the highest growth rate among the various employment sectors with a 6.6 percent annual increase. Between 1990 and 1994, 91 percent of the employment increases within the services area were divided between the business services and health services areas. Over the thirty year time frame the services

industry added 228,044 jobs to the economy.

Government

The government sector has long been a stabilizing force in the regional economy with the Texas state government and various federal offices located within the Austin area. Statistics indicate that the combined governments sectors represents the second largest portion of the MSA economy, making up 33 percent of the total job economy and 135,500 of the total number of jobs. Data also indicate that, while local and state government numbers are increasing at 3.8 percent per year, federal civilian employment is steady at a slow 1.1 percent, with military government jobs in decline by 3 percent per year.

Overall MSA employment increased from 1990 to 2000 by a huge 63 percent, fueling the population growth. Economic trends indicate strong, but slowing economic expansion.

City of San Marcos

The City of San Marcos lies at the heart of the trade and transportation corridor along Interstate 35. Employment is at a record high for the region with unemployment levels some of the lowest in the state hovering around 2.8 percent. Within a fifty mile radius can be found some twenty four colleges and universities providing an excellent workforce from which to select. Southwest Texas State University and the Gary Job Center are among the city's largest employers, employing close to 3,000 workers.

The top twenty employers in the city of San Marcos are shown in **Table 1D** below. The four high employment sectors of trade, service, government, and services are represented. Of the twenty high employers the government sector represents the largest sector at 44 percent with Southwest Texas State University being the largest employer with 2,238. The trade sector is the next largest sector represented. The factory and outlet malls, combined with the Wal-mart Supercenter employ 2,500 workers. The manufacturing and services sectors split the number of remaining jobs among the top twenty with 3,437 jobs between them. In contrast with the MSA and its high tech manufacturing economy, San Marcos manufacturers align more closely with the construction industry. Of the six manufacturers in the San Marcos top twenty, one is a manufacturer of high tech digital photographic systems.

PER CAPITA PERSONAL INCOME

Table 1E, Per Capita Personal Income (PCPI), compares the per capita personal income (adjusted to $1992) for Hays and CaldwellCounties, the Austin-San Marcos MSA, and the United States between 1970 and 2000.

As illustrated by the table, the Austin-San Marcos PCPI started in 1970 with a $2,000 lower per capita income than the US average. Thirty years later the PCPI of the Austin-San Marcos MSA comes very close to that of the national average. The growth in PCPI for the

MSA over the thirty year period was 2.43 percent per year, while the nation's adjusted PCPI averaged 1.96 percent in annual growth. In the year 2000 the average worker earns $23,609 in the Austin-San Marcos MSA, $18,834 in Hays County, and $15,570 in Caldwell County as compared with the national average of $24,205.

The two counties mirror the rate of growth in the PCPI over the same time period. However, the income levels remain much lower.

TABLE 1D
Largest Employers
City of San Marcos

Company Name	Employees
Southwest Texas State University	2,238
Prime Outlets	1,400
San Marcos CISD	970
Hays County	600
Tanger Factory Outlet Stores	600
Texas Education Foundation	600
Central Texas Medical Center	552
Hunter Industries	500
City of San Marcos	500
Wal-Mart Supercenter	500
Chartwell's	400
Thermon Manufacturing	310
HEB Foods	300
San Marcos Treatment Center	293
HEB Distribution Center	260
Butler Manufacturing	250
Chatleff Controls	250
Aquarena Resort and Conf. Center	200
Sac-N-Pac Stores, Inc.	200
Pixel Magic	197

Source: City of San Marcos Convention and Visitor's Bureau

TABLE 1E INCOME PER CAPITA (1992 $)	1970	1980	1990	1999	2000	% Annual Increase
MSA	$11,781	$16,020	$18,897	$23,180	$23,609	2.43%
Hays	$9,045	$12,455	$14,620	$18,520	$18,834	2.56%
Caldwell	$7,660	$11,387	$12,882	$15,248	$15,570	2.48%
USA	$13,797	$17,149	$20,603	$23,811	$24,205	1.96%

Source: County and MSA from Woods & Poole, CEDDS 2000

SUMMARY

The information discussed on the previous pages provides a foundation upon which the remaining elements of the planning process will be constructed. Information on current airport facilities and utilization will serve as a basis, with additional analysis and data collection, for the development of forecasts of aviation activity, and facility requirement determinations.

DOCUMENT SOURCES

A variety of different documents were referenced in the inventory process. The following listing reflects a partial compilation of these sources. The listing does not include the data provided directly by the staff at San Marcos Municipal Airport, or airport drawings which were referenced for information. An on-site inventory was also used to review the condition of facilities for the master planning effort.

Airport Facility Directory, Southwest U.S., U.S. Department of Commerce, National Oceanic and Atmospheric Administration, April 20,2000 Edition.

The Complete Economic and Demographic Data Source (CEDDS) Woods and Poole Economics, 2000.

San Marcos Municipal Airport Master Plan; City of San Marcos, Texas Comprehensive Plan, Updated 1998.

National Plan of Integrated Airport System (NPIAS), US Department of Transportation, Federal Aviation Administration, 1994-1998.

San Antonio Sectional Aeronautical Chart, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, May 2000.

San Marcos Convention and Visitor's Bureau.

Texas Airport System Plan, Texas Department of Transportation, Aviation Division, 1999.

U.S. Terminal Procedures, Southcentral Volume 3 of 4, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 20 April, 2000 Edition.

The following Web pages were also visited for information during the preparation of the inventory:
as
FAA 5010 Data, Area Airports
http://www.airnav.com/
http://www.nasao.org/
FAA Information
http://www.gcrl.com/

San Marcos Chamber of Commerce Community Web site:
http://www.sanmarcostexas.com

State of Texas Comptrollers Office
http://www.cpa.state.tx.us.ecodata/...ctktmsa.html

Chapter Two
AVIATION DEMAND FORECASTS

Forecasts

The purpose of this chapter is to examine the existing and potential aviation demand for aviation activity at San Marcos Municipal Airport (HYI). The proper planning of a facility of any type must begin with a definition of the demand that may occur over a specified period. Projections of specific aviation demand elements will be used to determine the types and sizes of facilities required to meet the aviation demands of the San Marcos and southern Austin metropolitan area over the next 20 years.

Air transportation is a unique industry that has experienced wide fluctuations in growth and recession. For this reason, it is important that from time to time an airport evaluate their current position and examine future demand trends and potential. This holds especially true today given limited public funding mechanisms and increased traveler needs.

The primary objective of this planning effort is to define the magnitude of change that can be expected over time. Because of the cyclical nature of the economy, it is virtually impossible to predict with certainty year-to-year fluctuations in activity when looking as far as 20 years into the future. However, a trend can be established which delineates long-term growth potential. While a single line is often used to express the anticipated growth, it is important to remember that actual growth may fluctuate above and below this line. The point to remember about forecasts is that they serve only as guidelines, and planning must remain flexible to respond to unforeseen facility needs. This is because aviation activity is affected by many external influences,

as well as by the types of aircraft used and the nature of available facilities.

Recognizing this, it is intended to develop a Master Plan for San Marcos Municipal Airport that will be demand-based rather than time-based. As a result, the reasonable levels of activity potential that are derived from this forecasting effort will be related to the planning horizon levels rather than dates in time. These planning horizons will be established as levels of activity that will call for consideration of the implementation of the next step in the Master Plan program. This will be further described in subsequent chapters of this Master Plan.

Although publically owned and operated, an airport is, in many ways, very similar to the private business environment. Airports provide much needed services to the community and have to recognize their position and establish well planned goals in order to better serve the community. Marketing efforts and facility development are matched to goals so that the airport can best serve the community.

In order to fully assess current and future aviation demand for San Marcos Municipal Airport, an examination of several key factors is needed. These include: national and regional aviation trends, historical and forecast socioeconomic and demographic information of the area and competing transportation modes and facilities. Consideration and analysis of these factors will ensure a comprehensive outlook for future aviation demand at the San Marcos Municipal Airport.

LOCAL SOCIOECONOMIC FEATURES

The local socioeconomic conditions provide an important baseline consideration for preparing aviation demand forecasts. While in most cases local socioeconomic variables such as population, employment and income cannot be relied upon to indicate the growth or decline of aviation demand, these factors can provide an important indicator for understanding the dynamics of the community and in particular the trends in economic growth.

For this study, socioeconomic variables for the city of San Marcos, Hays and Caldwell Counties, and the Austin-San Marcos metropolitan statistical area (MSA) have been considered. The Austin-San Marcos MSA consists of Bastrop, Caldwell, Hays, Travis, and Williamson Counties. Information specific to individual cities was obtained from the Texas Water Development Board and the City of San Marcos, while County and MSA information was gathered from Woods and Poole CEEDS 2000.

POPULATION

Table 2A summarizes historical and forecast population estimates for area cities, Hays and Caldwell County, and the Austin-San Marcos MSA. As shown in the table, each segment has experienced population growth over the decade. The City of San Marcos has experienced the largest percentage growth, increasing four percent

annually between 1990 and 1999. Over this period, the City of San Marcos has experienced an increase of 12,172 residents, growing from 28,738 in 1990 to 40,910 in 1999.

The city of Austin has also experienced significant population growth. The growth can be primarily attributed to the infusion of jobs in the high technology industry. Austin has grown at an average annual rate of 3.74 percent since 1990, increasing by 258,048 residents. The Austin-San Marcos MSA population has increased by 285,048 residents since 1990, growing at an average annual rate of 3.26 percent. Population for Hays and Caldwell Counties have increased at a slightly slower rate at 3.69 and 2.61 percent annually.

TABLE 2A
Socioeconomic Forecasts

	HISTORICAL		*FORECAST*		
	1990	**2000**	**2005**	**2010**	**2020**
Austin-San Marcos MSA					
Population	850,638	1,178,470	1,306,212	1,448,998	1,741,058
Employment	514,414	786,484	932,827	1,050,498	1,276,408
PCPI	$18,897	$23,180	$25,516	$27,358	$30,881
Hays County					
Population	65,755	97,589	105,924	118,260	143,407
Employment	25,834	43,523	52,106	59,020	71,746
PCPI	$14,620	$18,520	$20,270	$21,672	$24,264
Caldwell County					
Population	26,312	32,194	35,098	38,265	44,711
Employment	8,934	11,387	13,347	14,980	18,502
PCPI	$12,882	$15,248	$17,025	$18,523	$21,888
City Populations					
San Marcos	28,738	34,733	45,349	49,787	65,172
Austin	465,622	656,562	716,335	784,972	973,832
Lockhart	9,205	11,615	13,957	15,513	19,105
New Braunfels	27,334	36,494	44,306	50,207	65,417

Source: U.S. Census Bureau; Woods & Poole, CEDDS 2000; Texas Water Development Board, 2002 State Water Plan; Texas State Data Center.

Population projections for the area indicate continued growth. The Austin-San Marcos MSA is projected to reach 1,741,058 residents by 2020, while Hays and Caldwell Counties are projected to reach 143,407 48,624 residents respectively. Population for the City of San Marcos is expected to increase at a slower annual percentage rate (2.24 percent) over the next 20 years,

reaching 65,172 by 2020. The City of Austin is projected to reach 973,832 residents by 2020, growing at an average annual rate of 1.96 percent.

EMPLOYMENT

Historical and forecast employment data for the Austin-San Marcos MSA and Hays and Caldwell Counties is also presented in **Table 2A**. Total employment for the MSA and both counties have increased at a greater average annual rate than population between 1990 and 1999. Over the period, employment in the MSA increased by 4.83 percent annually compared to the 3.26 percentage increase in population. Hays County employment increased at an average annual rate of 5.97 percent, more than two percent higher than the county's average annual population growth.

Employment forecasts for the MSA and both Hays and Caldwell Counties indicate a slower, more moderate growth, increasing at an annual average rate of 2.33 percent, 2.41 percent, and 2.34 percent respectively by 2020.

PER CAPITA PERSONAL INCOME (PCPI)

Table 2A compares per capita personal income (adjusted to $1992) for the MSA, Hays County, and Caldwell County. The Austin-San Marcos MSA had an adjusted PCPI of $23,180 in 1999. Hays and Caldwell County adjusted PCPI was somewhat lower at $18,520 and $15,248 respectively. Although the MSA maintains a higher adjusted PCPI, Hays County experienced a greater average annual growth since 1990 increasing at 2.66 percent annually compared to the MSA growth rate of 2.3 percent. Through the year 2020, the Hays County adjusted PCPI is expected to increase at 1.29 percent annually reaching $24,264, while the MSA is projected to grow at 1.38 percent annually reaching $30,881.

FORECASTING APPROACH

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

The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include trend line projections, correlation/regression analysis, and market share analysis.

Trend line projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical demand data, then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in

uch the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

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

In regression analysis, values for the aviation demand in question (i.e. based aircraft), the dependent variable, are projected on the basis of one or more other indicators, the independent variable. Historical values for all variables are analyzed to determine the relationship between the independent and dependent variables. These relationships may then be used, with projected values of the independent variable, to project corresponding values of the dependent variable.

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

It is important to note that one should not assume a high level of confidence in forecasts that extend beyond five years. Facility and financial planning usually require at least a ten-year preview, since it often takes more than five years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

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

The following forecast analysis examines each of the aviation demand categories for expected at San Marcos Municipal Airport over the next twenty years. These include commercial airline potential, general aviation and military activity. Each segment will be examined individually and then collectively to provide an understanding of the overall aviation activity at San

Marcos Municipal Airport through 2020.

GENERAL AVIATION

General aviation is defined as the portion of civil aviation which encompasses all facets of aviation except commercial and military operations. To determine the types and sizes of facilities that should be planned to accommodate general aviation activity, certain elements of this activity must be forecast. These indicators of general aviation demand include:

- Based Aircraft
- Based Aircraft Fleet Mix
- Local and Itinerant Operations
- Annual Instrument Approaches
- Aviation Peaking Activity

NATIONAL TRENDS

By most statistical measures, general aviation recorded its fifth consecutive year of growth. Following more than a decade of decline, the general aviation industry was revitalized with the passage of the General Aviation Revitalization Act in 1994 (federal legislation which limits the liability on general aviation aircraft to 18 years from the date of manufacture). This legislation sparked an interest to renew the manufacturing of general aviation aircraft due to the reduction in product liability and a renewed optimism for the industry. The high cost of product liability insurance was a major factor in the decisions by many American aircraft manufacturers to slow or discontinue the production of general aviation aircraft.

According to the General Aviation Manufacturers Association (GAMA), aircraft shipments and billings grew for the fifth consecutive year in 1999, following fourteen years of annual declines. In the first three quarters of 1999, general aviation aircraft manufacturers shipped a total of 1,692 aircraft, 13.4 percent higher than the same period in1998. Shipments of piston aircraft and jets were up 10.8 and 26.2 percent, respectively. Turboprop shipments increased 14.8 in 1998 and 8.6 percent through the first three quarters of 1999.

Both the number of active pilots and student pilot starts were up in 1998. Total active pilot numbers increased by 3.5 percent in 1999 over 1998, eclipsing the 0.3 percent gain the previous year. For 1999, student pilot starts increased for the third consecutive year, increasing by 4.4 percent over 1998. These student pilots are the future of general aviation and are one of the key factors impacting the future direction of the general aviation industry. Since most pilot training activities are conducted using general aviation aircraft, the increases in new pilot starts and increases in advanced training discussed above are one of the primary reasons for the resurgence in general aviation over the past years. These increases combined with the increases in piston-powered aircraft shipments and aircraft production are tangible evidence of the resurgence of the industry and that many of the industry initiated programs to revitalize

general aviation have begun to yield substantive results.

Manufacturer and industry programs and initiatives continue to revitalize the general aviation industry. Notable initiatives include the "No Plane, No Gain" campaign sponsored by GAMA and the National Business Aviation Association (NBAA), "Project Pilot" sponsored by the Aircraft Owners and Pilots Association (AOPA), the "Learn to Fly" campaign sponsored by the National Air Transportation Association (NATA), and "GA Team 2000", which is sponsored by more than 100 industry organizations and has the goal of 100,000 annual student pilot starts by the year 2000. The "No Plane, No Gain" campaign is a program promoting the cost effectiveness of using general aviation aircraft for business and corporate uses. "Project Pilot" and "Learn to Fly" are programs promoting training of new pilots.

The general aviation industry is also launching new programs to make aircraft ownership easier and more affordable. The New Piper Aircraft company has created Piper Financial Services (PFS) to offer competitive interest rates and/or leasing of Piper aircraft. The Experimental Aircraft Association offers financing for kit built airplanes through a private lending institution.

General aviation activity at towered airports increased for the third consecutive year in 1999, up 5.2 percent over 1998. For the three year period, operations at towered airports were up 13.4 percent. The largest gain was in local (training) operations, up 6.5 percent in 1999. Itinerant operations were up 4.3 percent. Since 1996, local operations are up 17.4 percent and itinerant operations up 10.7 percent. The gain in local operations coincides with the gains in student pilot starts. General aviation growth is not limited to strictly to general aviation airports, three of the top 10 airports showing the fastest growth in general aviation operations are large hub commercial service airports (Dallas/Fort Worth, Minneapolis/St. Paul and Covington/ Cincinnati), signifying the change in the general aviation fleet to include larger, more sophisticated turboprop and turbojet aircraft which require air traffic services and airport facilities similar to commercial air carriers.

Instrument operations at towered airports and general aviation aircraft handled at en route traffic control centers increased 4.8 percent and 1.9 percent, respectively, in 1999. Instrument operations have increased five of the past six years, with activity gains totaling 17.4 percent over the period. The number of general aviation aircraft handled at enroute traffic control centers increased for the eighth consecutive year in 1999. These increases accompany the expanding fleet of sophisticated turboprop and turbojet aircraft in the general aviation fleet and the expansion in use of these aircraft for business/corporate uses.

The most notable trend in general aviation is the continued strong use of general aviation aircraft for business and corporate uses. For 1998 (the most current year of data), business and corporate use of general aviation aircraft represented 23.9 percent of

general aviation activity. These uses accounted for 21.2 percent of general aviation activity in 1997.

The most striking industry trend is the continued growth in fractional ownership programs. Fractional ownership programs allow businesses and individuals to purchase an interest in an aircraft and pay for only the time that they use the aircraft. This has allowed many businesses and individuals, who might not otherwise, to own and use general aviation aircraft for business and corporate uses. The five major companies in this industry are Executive Jets' Netjets, Bombardier's Flexjet, Raytheon's Travel Air, Flight Options and TAB aviation. Between 1993 and 1998, these companies expanded their fleet and shareholders by 65.2 percent and 66.1 percent, respectively. In 1999, the fractional jet fleet totaled 329 and shareholders totaled 1,567. Since 1993, Executive Jet has ordered 368 new aircraft and is purportedly the single largest nonmilitary purchaser of aircraft.

While the fractional jet ownership industry is rapidly expanding, new attention has been given the regulatory oversight of the industry. Presently, fractional jet providers operate under Federal Aviation Regulation (FAR) Part 91 which governs general aviation aircraft. Industry pressure is for fractional ownership providers to operate under FAR Part 135 which govern commercial operations for air carriers, air taxi and air charter companies. Part 135 operators believe the fractional ownership providers benefit from the less restrictive FAR Part 91 standards. The FAA commissioned a formal rulemaking committee to analyze regulatory requirements for the industry. Their report, released in Spring 2000, recommended that fractional ownership providers operate under a new subpart of FAR 91. The FAA is now reviewing this proposal. A formal rulemaking proposal could be made within a year.

The fractional ownership providers are concerned about a move to regulate them as FAR Part 135 operators. FAR Part 135 standards would restrict the number and type of airports which could be operated at by requiring longer runways and airports with approved weather reporting. If these providers were required to operate under FAR Part 135, fractional would not be treated as private owners in foreign countries, and the fractionals would be governed by international bilateral agreements.

Exhibit 2A depicts the FAA forecast for active general aviation aircraft in the United States. The FAA forecasts general aviation active aircraft to increase at an average annual rate of 0.9 percent over the 13 year planning period for general aviation aircraft. General aviation aircraft are projected to increase from 204,710 in 1998 to 230,995 in 2011.

Turbine-powered aircraft are projected to grow faster than all other segments of the national fleet and grow at 3.2 percent annually through the year 2011. Turbojet aircraft are projected to provide the largest portion of this growth and grow at 4.9 percent annually. Turboprop aircraft are

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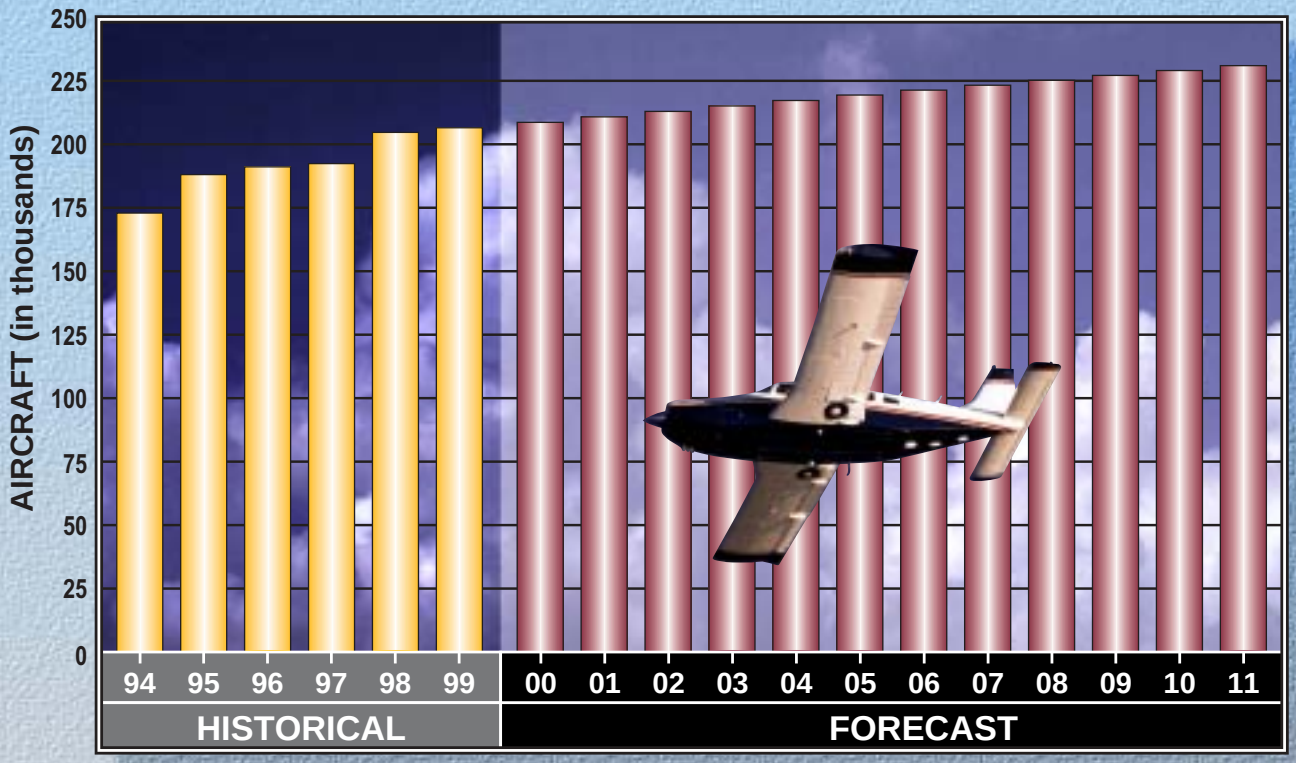
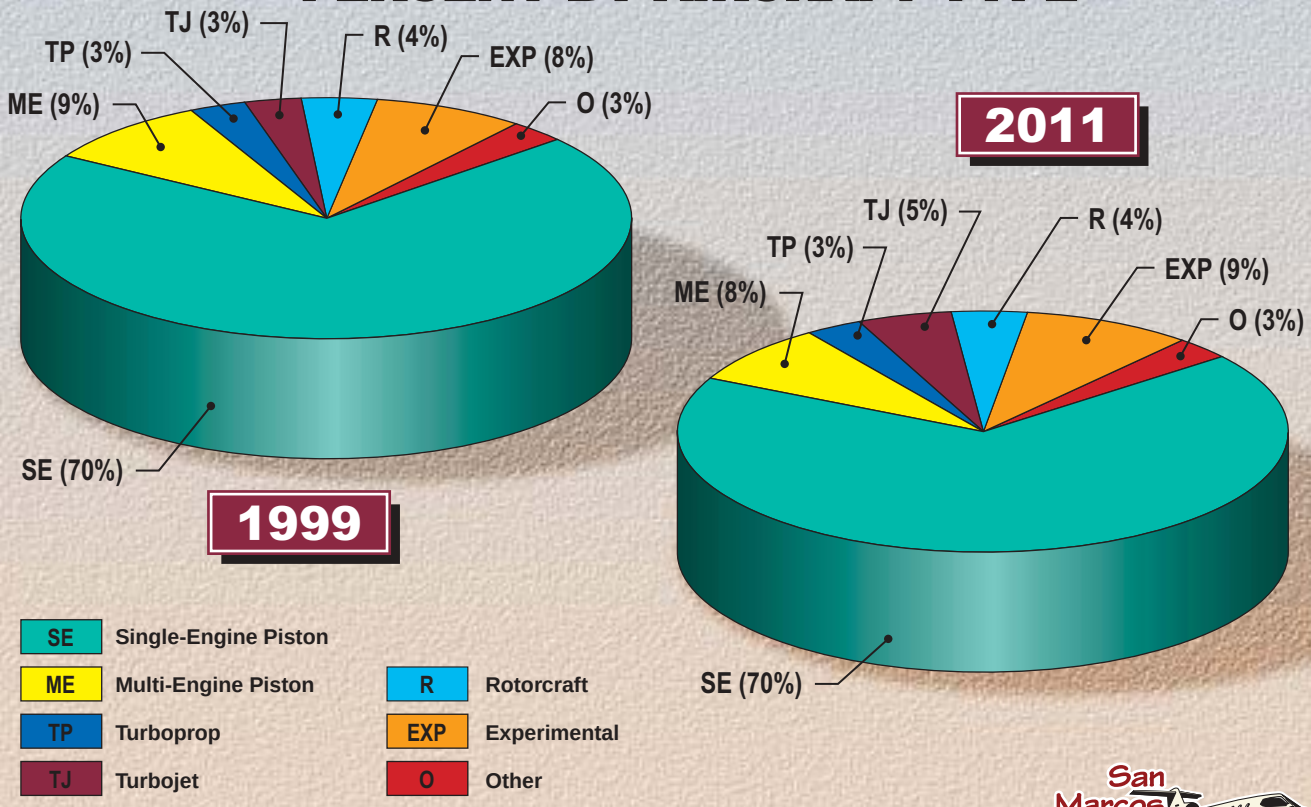
ACTIVE GENERAL AVIATION AIRCRAFT



Source: FAA Aviation Forecasts, FY 2000-2011

PERCENT BY AIRCRAFT TYPE



San Marcos MUNICIPAL AIRPORT

Exhibit 2A
U.S. ACTIVE GENERAL AVIATION
AIRCRAFT FORECASTS

projected to grow at 1.2 percent annually, The strong growth projected for the turbojet aircraft is the result of the strong U.S. and worldwide economy, growth in the fractional ownership industry, new product offerings (which include both new entry level aircraft and long range global jets) and a shift from commercial air travel to corporate/business air travel by many business travelers and corporations.

Although the general aviation active fleet is projected to increase at less than one percent annually, general aviation hours flown are forecast to increase by 1.7 percent annually over the twelve year planning period. The total pilot population is projected to grow at 2.1 percent annually through the planning period.

GENERAL AVIATION USER SURVEYS AND SERVICE AREA

The initial step in determining the general aviation demand for an airport is to define its generalized service area for the various segments of aviation the airport can accommodate. The airport service area is determined primarily by evaluating the location of competing airports, their capabilities and services, and their relative attraction and convenience. Also, to aid in identifying the generalized service area for San Marcos Municipal Airport, a general aviation user survey was conducted. With this information, a determination can be made as to how much aviation demand would likely be accommodated by a specific airport. It should be recognized that aviation demand does not necessarily conform to political or geographical boundaries.

The airport service area is an area where there is a potential market for airport services. Access to general aviation airports, commercial air service, and transportation networks enter into the equation that determines the size of a service area, as well the quality of aviation facilities, distance, and other subjective criteria.

As in any business enterprise, the more attractive the facility is in services and capabilities, the more competitive it will be in the market. As the level of attractiveness expands, so will the service area. If an airport's attractiveness increases in relation to nearby airports, so will the size of the service area. If facilities are adequate and rates and fees are competitive at San Marcos Municipal Airport, some level of general aviation activity might be attracted to the airport from surrounding areas.

General Aviation User Survey

In order to obtain a profile of local general aviation users and their preferences, a general aviation user survey was conducted with the results presented in **Table 2B**. The survey was sent to San Marcos Municipal Airport tenants and from a search of aircraft owners living in the area (provided by FAA database). In all, approximately 350 surveys were sent out and 56 responses were received

(22.4 percent response rate). Of the responses, a total of 26 indicated that they base at least one aircraft at San Marcos Municipal Airport.

TABLE 2B
Aircraft Owner Survey Results

Total Surveys Sent - approximately 350

Total Survey Responses - 56

Response Rate = 16%

Respondents Based @ San Marcos Municipal Airport - 26

Total Based Aircraft of Respondents - 30

Respondents Considering Upgrade or Purchase of Another Aircraft in Next Five Years - 8

Primary Use of Aircraft and Operation Estimates

Business	Pleasure	Flight Instruct	Other
21.9%	75.8%	0.8%	1.5%

Monthly Operations at San Marcos by These Aircraft = 439

Average Operations for Each Aircraft per Month = 15

Percentage Touch-and-Go Operations per Aircraft per Month = 13

Primary Reasons for Basing at San Marcos (Priority with 1 being highest)

Convenience	Aircraft Hangar Facilities	FBO/Terminal Services	Lower Aircraft Storage Costs	Runway Length	Navigational Aids
2.5	3.5	5.2	3.5	4.3	4.2

Current Aircraft Storage Use

Tie-down	T-hangar	Individual Hangar	Multi-aircraft Hangar
1	14	9	3

Preferred Aircraft Storage

Tie-down	T-hangar	Individual Hangar	Multi-aircraft Hangar
1	4	9	0

Improvements Necessary at San Marcos Airport (Priority with 1 being highest)

Runway/ Taxiway	Airport/ FBO Services	Aircraft Apron	Hangars	Terminal Building	Navigational Aids
3.0	4.8	4.9	4.3	6.0	4.2

The majority of respondents indicated several preferences which led them to base at the airport or has kept them at the airport. As indicated in the table, overwhelmingly, the highest priority for basing at the airport was for convenience (lived or worked closer to the airport). The next two highest priorities were the airport's availability of hangars and the lower cost for aircraft storage hangars (both 3.5). The

lowest ranked category was for the FBO/terminal facilities (5.2).

The questionnaire also asked those surveyed what improvements were necessary at the airport. This question also asked for a priority ranking with "1" as highest. Responses generally indicated satisfaction with the facility, although many comments indicated need to improve airport pavement areas including the main ramp and Runways 4-22 and 12-30. Many responses indicated a need for an airport traffic control tower (ATCT) to improve safety of operations. Other responses included the desire for a restaurant at the airport, additional instrument approaches, and better taxiways (routing).

Airport Service Area

The determination of future based aviation demand for San Marcos Municipal Airport begins with a review of the local based aircraft service area. The local airport service area is defined by the proximity of other airports and the facilities and services that they currently provide to general aviation aircraft.

As previously mentioned, San Marcos Municipal Airport is designated as a reliever airport by the FAA. The designation indicates that the airport serves to provide general aviation services near a large metropolitan area so that the general aviation activity will be minimized at the larger commercial service airport. As a reliever airport, San Marcos Municipal is designed to accommodate all general aviation activity.

Defining the service area, or aviation demand pool for San Marcos can be a nebulas task. The recent closure of Austin Mueller and shift of aviation activity to Austin Bergstrom as well as the closure of Austin's only general aviation airport, Austin Executive, has directly impacted San Marcos. In the last two years, based aircraft at San Marcos has increased by 103 aircraft, nearly doubling. Although the brunt of the closures is likely over, it is very likely that San Marcos will continue to attract aircraft from owners living in Austin.

The only other reliever airport in the Austin area is the Georgetown Municipal Airport which is located 29 miles north of Austin Bergstrom. Georgetown is a very active general aviation airport and is somewhat limited in providing for a large amount of aviation facilities. The Texas Department of Transportation (TxDOT), Aviation Division, has studied the feasibility of constructing a new reliever airport in Pflugerville which is located in the northeastern portion of the Austin metropolitan area. The study was stopped once Pflugerville decided not to proceed with the development of an airport. Georgetown, and potentially Pflugerville, are situated to accommodate aviation demand in north Austin. San Marcos is situated to accommodate aircraft owners in the mid to southern portions of Austin who elect not to base their aircraft at Bergstrom due to high activity levels by large aircraft. Results from the survey

indicated that a minimum of 12 aircraft owners residing in Austin base 14 aircraft at San Marcos.

For San Marcos Municipal Airport, however, the primary service area can be expected to defined by the aviation demand of San Marcos and smaller surrounding communities. San Marcos' primary competition are the airports at Lockhart and New Braunfels. These airports, however, do not currently provide comparable aviation facilities or have the development potential as San Marcos, especially for larger corporate aircraft. The survey indicated at least one aircraft owner residing in Lockhart bases two aircraft at San Marcos.

Thus, the general aviation service area for the San Marcos Municipal Airport can be generally described as the city of San Marcos extending north into central Austin. The service area can be expected to extend east, west, and south approximately 30 miles.

Based Aircraft Forecasts

The number of based aircraft is the most basic indicator of general aviation demand. By first developing a forecast of based aircraft, the growth of the other indicators can be projected based upon this growth and other factors characteristic to San Marcos Municipal Airport and the area it serves. The rationale for forecasting general aviation activity is presented below.

The first method for forecasting based aircraft for San Marcos Municipal Airport included a trend line projection. Considering based aircraft at the airport between 1980 and 2000, the time series provided a "r" value of 0.81. As previously mentioned that an "r" value of greater than 0.9 indicates a strong correlation. The time series projection yields 207 aircraft for 2005, 239 aircraft for 2010, and 303 aircraft for 2020. The trend line projection indicates a decrease in aircraft in 2005 due to the large increase in aircraft in 2000. A trend line is developed utilizing regression which attempts to level the high and low points, drawing a line through the middle. Several other regression analyses were conducted comparing based aircraft with the socioeconomic elements presented earlier. None of these provided adequate correlations, or an "r" value of any significance. This is due to the strong growth of the area's socioeconomic categories with sporadic levels of based aircraft.

The next forecasting method compared San Marcos based aircraft with active general aviation aircraft in the United States since 1980. **Table 2C** presents historical based aircraft at San Marcos and active general aviation aircraft in the U.S.

As indicated in the table, San Marcos' share of U.S. active aircraft has steadily increased over the last 20 years, with a slight downturn experienced in 1992. The greatest increase was experienced in the year 2000 due to aircraft owners leaving the Austin area and basing at San Marcos.

Two projections considering San Marcos' market share of U.S. active aircraft were developed. First, a constant share projection was made

which considered the airport based aircraft would maintain the existing market share. The constant share projection yields 271 aircraft by 2020.

TABLE 2C
Market Share of U.S. Active Aircraft

Year	San Marcos Based Aircraft	U.S. Active Aircraft	Market Share of U.S. Active
1980	51	210,300	0.0243%
1985	100	210,200	0.0476%
1992	86	191,629	0.0449%
1998	124	204,710	0.0606%
2000	227	208,655	0.1088%
Constant Share Projection			
2005	239	219,415	0.109%
2010	250	229,070	0.109%
2020	271	248,380	0.109%
Increasing Share Projection			
2005	263	219,415	0.120%
2010	298	229,070	0.130%
2020	373	248,380	0.150%

The constant share forecast appears to be somewhat conservative in light of past trends. Although the large increase in 2000 is not likely to be repeated in such a short period of time, it is very likely that the airport's market share will continue to increase. Between 1980 and 1998, the airport experienced an increase of 0.04 percent. As Austin continues to grow, and San Antonio residents continue to shift to the north, the San Marcos Municipal Airport will be an attractive alternative for aircraft owners. Thus, an increasing market share projection reaching 0.17 percent was developed. This growth rate represents the same growth experienced over the last 20 years. The increasing market share projection yields 373 based aircraft at San Marcos by 2020.

Another forecast method utilized is to compare the airport's based with resident population. **Table 2D** presents historical and forecast based aircraft per 1,000 city of San Marcos residents.

TABLE 2D Based Aircraft vs. Population Projections			
Year	**San Marcos Based Aircraft**	**San Marcos Population**	**Aircraft per 1,000 Population**
1980	51	42,483	1.20
1992	86	29,720	2.89
1998	124	39,491	3.14
2000	227	42,500	5.34
Constant Share Projection			
2005	243	45,439	5.34
2010	266	49,787	5.34
2020	348	65,172	5.34
Decreasing Share Projection			
2005	241	45,439	5.3
2010	259	49,787	5.2
2020	319	65,172	4.9

As indicated in the table, San Marcos has experienced a general increase in based aircraft since 1980. Not shown on this table, however, is based aircraft in 1985 which was 100. This figure was not used due to lack of population information for the city of San Marcos for 1985. This indicates that the airport experienced a trend similar to the national trend.

The early to mid 1980's witnessed a surge of aircraft ownership, while the late 1980's and early 1990's experienced a general decrease due to a slowing economy and aircraft liability law changes. In 1998, however, based aircraft climbed back to 124 which follows national trends of increased aircraft manufacturing and the steady increase in aircraft ownership. In 2000, based aircraft increased by 103, nearly doubling which can be directly related to the shift of Austin's airports and the closing of Austin Executive Airport.

San Marcos Municipal based aircraft per 1,000 city of San Marcos residents has fluctuated between a low of 1.20 in 1980 to a high of 5.34 in 2000. This trend is very similar to that experienced at general aviation airports across the country as the economy and legislation suppressed aircraft ownership in the late 80's. However, the trend has since reversed itself as new legislation has opened the doors to aircraft production and the economy has been strong.

Two forecasts were produced using the ratio of based aircraft per 1,000 city of San Marcos residents. First, a constant

share forecast considered that the airport's based aircraft per 1,000 San Marcos residents will remain at 5.34. This would likely occur if aviation growth remains constant with population growth of the area. This projection yields 348 based aircraft at San Marcos by 2020.

Generally, based aircraft per 1,000 residents follows a decreasing trend. This decreasing trend typically indicates that aircraft ownership does not maintain the same growth rates of the local population. A decreasing trend forecast, as presented in **Table 2D** indicates 319 based aircraft at the airport by 2020.

Due to the significant influence of the Austin aviation demand has on San Marcos, another forecast considering aircraft ownership per 1,000 residents in the Austin-San Marcos MSA was developed. As with the previous forecast, two projections were considered, a constant and decreasing ratio of based aircraft per 1,000 residents. Following the constant share ratio of 0.195 as presented in **Table 2E**, the airport would have 340 aircraft by 2020. The decreasing ratio projection yields 296 based aircraft.

TABLE 2E
Based Aircraft vs. Population Projections

Year	San Marcos Based Aircraft	Austin-San Marcos MSA Population	Aircraft per 1,000 Population
1980	51	589,651	0.086
1985	100	758,504	0.132
1992	86	901,854	0.095
1998	124	1,105,918	0.112
2000	227	1,164,320	0.195
Constant Share Projection			
2005	255	1,306,212	0.195
2010	283	1,448,998	0.195
2020	340	1,741,058	0.195
Decreasing Share Projection			
2005	248	1,306,212	0.19
2010	268	1,448,998	0.185
2020	296	1,741,058	0.17

A summary of historical and forecast based aircraft is illustrated on **Exhibit 2B**. The projections depicted on the exhibit illustrate an envelope of potential based aircraft at San Marcos over the next 20 years. Given the lack of a true reliever airport within the city of Austin, it is very likely that San Marcos will be increasingly utilized by aircraft owners in the Austin area. This holds especially true if the city of Austin continues to grow southerly. For this reason, the lower end of the planning envelope does not represent an adequate tool for the city to plan for facilities, and will likely position the airport in a position of playing "catch-up" to meet demand.

A combination of projections including the increasing market share of U.S. active aircraft and the constant share of aircraft per 1,000 MSA residents projection appears to be the most reasonable for the purposes of this Master Plan. These projections are somewhat optimistic, but they allow for consideration of limited facilities in the southern MSA, and the limited facility availability at Georgetown, Lockhart, and New Braunfels. In order to develop a plan which will allow the City to develop facilities based upon demand, the following planning horizon activity milestones have been established for based aircraft:

- Short Term - 250
- Intermediate Term - 280
- Long Term - 375

BASED AIRCRAFT FLEET MIX PROJECTION

Knowing the aircraft fleet mix expected to utilize the airport is necessary to properly plan facilities that will best serve the level of activity and the type of activities occurring at the airport. The existing-based aircraft fleet mix is comprised of single and multi-engine piston-powered aircraft and also includes business turboprop and turbojet aircraft.

As detailed previously, the national trend is toward a larger percentage of sophisticated turboprop, jet aircraft, and helicopters in the national fleet. Growth within each based aircraft category at the airport has been determined by comparison with national projections (which reflect current aircraft production) and consideration of local economic conditions. The projected trend of based aircraft at San Marcos Municipal includes a growing number of single and multi-engine aircraft and turboprop aircraft. However, strong growth in business turbojet aircraft is projected for the airport through the planning period, consistent with national trends. The based aircraft fleet mix projection for San Marcos Municipal Airport is summarized in **Table 2F**.

Currently, single engine aircraft compose the largest segment of aircraft at San Marcos. Future based aircraft mix will continue to be dominated by

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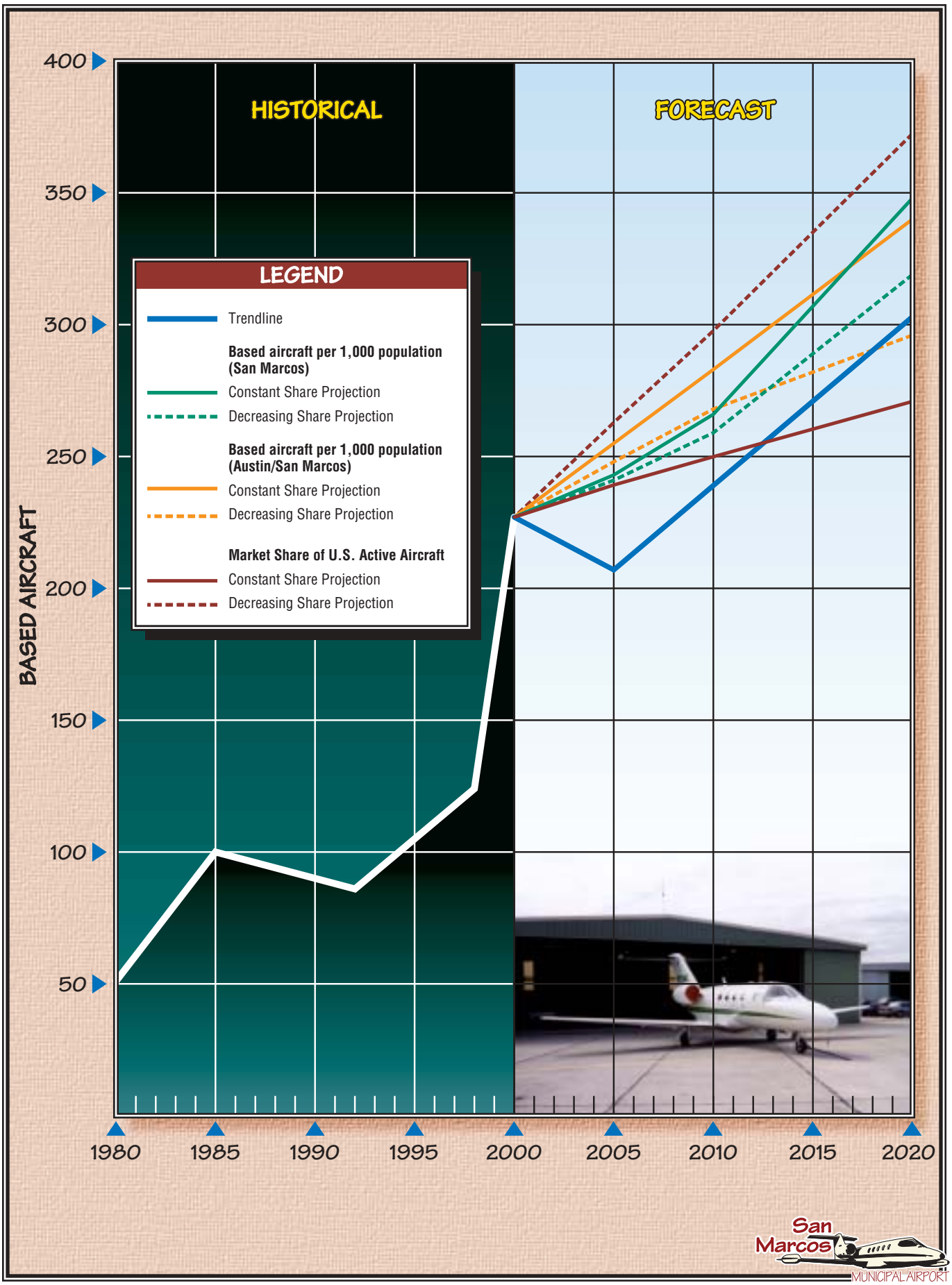


San Marcos MUNICIPAL AIRPORT

Exhibit 2B
BASED AIRCRAFT FORECASTS

single engine aircraft, but with an increasing percentage of turbine aircraft. As Austin continues to grow to the south and the Bergstrom International Airport continues to experience increases in operations by large aircraft, it is very likely that corporate aircraft will find San Marcos Municipal an attractive alternative. For this reason, both turboprop and turbojet aircraft mix percentages have been forecast to increase, while single engine based aircraft percentages are forecast to decrease.

TABLE 2F
Fleet Mix Forecast

	EXISTING		FORECAST					
Type	**2000**	**%**	**Short Term**	**%**	**Inter. Term**	**%**	**Long Term**	**%**
Single Engine	189	83.26%	200	80.00%	217	77.50%	285	76.00%
Multi-Engine	10	4.41%	13	5.50%	17	6.00%	26	7.00%
Turboprop	22	9.69%	28	11.00%	34	12.00%	45	12.00%
Jet	4	1.76%	6	2.50%	8	3.00%	11	3.00%
Helicopter	2	0.88%	3	1.00%	4	1.50%	8	2.00%
Totals	227	100.00%	250	100.00%	280	100.00%	375	100.00%

ANNUAL OPERATIONS

There are two types of operations at an airport: local and itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of the airport, or which executes simulated approaches or touch-and-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations. Typically, itinerant operations increase with business and commercial use since business aircraft are used primarily to carry people from one location to another.

Due to the absence of an airport traffic control tower, actual operational counts are not available for San Marcos Airport. Instead, only general estimates of aircraft operations based on observations are made periodically. Historical aircraft operations for the airport are recorded by the FAA on the 5010-1, Airport Master Record Form. Operational estimates have been estimated by airport management for the FAA in the past.

As shown in **Table 2G**, general aviation operations are estimated to total approximately 101,200. Of this total, approximately 36,800 are estimated as itinerant and approximately 64,400 as local operations.

TABLE 2G General Aviation Operations Forecast					
Year	**Itinerant**	**Local**	**Total**	**Based Aircraft**	**Ops per Based**
1980	11,400	18,600	30,000	51	588
1985	26,562	43,338	69,900	100	699
1992	17,480	28,520	46,000	86	535
1998	21,717	35,433	57,150	124	461
2000	36,800	64,400	101,200	227	446
GENERAL AVIATION OPERATIONS FORECAST					
Short Term	50,000	75,000	125,000	250	500
Inter. Term	56,000	84,000	140,000	280	500
Long Term	75,000	112,500	187,500	375	500

Projections of annual operations have been developed by examining the number of operations per based aircraft. Typically, operations per based aircraft can range between 300 and 1,000 at airports similar to San Marcos Municipal Airport. Airports with higher training operations (local operations) will have a higher operation per based aircraft ratio, whereas airports with a higher percentage of transient aircraft operations will have a lower ratio.

In attempts to quantify more reliably than simply estimating airport operations, TxDOT established an on-going operations monitoring system. The goal of this program was to ultimately establish a model which will provide more accurate counts. TxDOT's model indicates that for airports similar to San Marcos, annual operations typically equate to 492 operations per based aircraft. Thus, for planning purposes, annual operations per based aircraft will be forecast at 500 operations per based aircraft for each associated planning horizon.

The FAA projects an increase in aircraft utilization and the number of general aviation hours flown. This projected trend supports future growth in annual operations at San Marcos Municipal Airport. **Table 2G** presents operational forecasts for each associated planning horizon. As indicated in the table, general aviation operations at San Marcos Municipal Airport are forecast to reach 187,500 by the long term. Approximately 66 percent of these operations, or 112,500 annual operations are forecast to be local.

AIR TAXI

The San Marcos Municipal Airport is base to Berry Aviation. This business operates as a fixed base operator (FBO) providing general aviation services, but also operates a fleet of 16 Metroliners for aircraft charter services. Berry Aviation has contracts to carry military personnel to and from military installations across the country, casino

charters, and sports team charters (specifically with the NCAA Big XII conference). The majority of Berry Aviation's charters operate from locations on the east and west coasts, however, the charter needs of the Big XII contract are met from the San Marcos location.

Berry Aviation operates its charter operations under the rules specified under Federal Air Rules (F.A.R.) Part 135. As a Part 135 operator, Berry Aviation must adhere to specific guidance set forth in the legislation in order to carry passengers for hire. As mentioned, Berry operates 16 Merlin Metro 19 passenger seat aircraft. Discussions with Berry Aviation indicate a desire to acquire larger aircraft to meet its Big XII contractual needs. Berry staff indicated a desire to acquire the Emb120 or Saab340 aircraft. These airplanes can carry up to 34 passengers.

Airport operational estimates indicate that air taxi operations totaled 250 in 2000. Future operational estimates considered an increase in air taxi operations reaching 1,000 by the long term. The increase can be expected as Berry Aviation continues to expand its operation and other general aviation charter operators locate at San Marcos.

MILITARY ACTIVITY

Projecting future military utilization of an airport is particularly difficult since local missions may change with little notice. However, existing operations and aircraft mix may be confirmed for their impact on facility planning. As indicated by the FAA TAF document, historically military operations have accounted for only 2,000 itinerant operations annually. Military operations consist of a range of helicopter (Chinook), turboprop (military version of the King Air), and small trainer jet activity.

Military aircraft utilize San Marcos typically for flight training operations (instrument approaches) or for fueling stopovers. The airport is an attractive stop for aircraft transitioning the area from NAS Kingsville or Fort Hood. For planning purposes these operations have been forecast to reach 6,000 annually (5,000 itinerant and 1,000 local) by the long term. To plan for this increase will aid in determining facility needs such as an air traffic control tower.

PEAKING CHARACTERISTICS

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

- **Peak Month** - The calendar month when peak passenger enplanements or aircraft operations occur.

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

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

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

Without an airport traffic control tower, adequate operational information is not available to directly determine peak general aviation operational activity at the airport. Therefore, peak period forecasts have been determined according to trends experienced at similar airports.

Typically, the peak month for activity at general aviation airports approximates 10 to 15 percent of the airport's annual operations. For planning purposes, peak month operations have been estimated as 13 percent of annual operations. Based on peaking characteristics from similar airports, the typical busy day was determined by multiplying the design day by twenty percent of weekly operations during the peak month, or 1.4. Design hour operations were determined using 20 percent of the design day operations. The general aviation peaking characteristics are summarized in **Table 2H**.

TABLE 2H
Peak Operations Forecasts

	2000	Short Term	Inter. Term	Long Term
Annual Operations	103,300	129,300	145,500	194,500
Peak Month	13,429	16,809	18,915	25,285
Busy Day	627	784	883	1,180
Design Day	448	560	631	843
Design Hour	90	112	126	169

ANNUAL INSTRUMENT APPROACHES

An instrument approach as defined by the FAA is "an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude." To qualify as an instrument approach at San Marcos Municipal Airport, aircraft must land at San Marcos Municipal Airport after following one of the published instrument approach procedures.

Annual instrument operations for San Marcos are only available from FAA sources for 1991 through 1994. Over the period, annual instrument approaches (AIA's) steadily increased from 190 in 1991 to 378 in 1994. It can be reasonably assumed that this increase continued through the 1990's.

Generally, AIA's can be expected to reach two percent of annual itinerant operations. In 1992 (only operational statistics available for the period at San Marcos), AIA's reached 1.54 percent of annual itinerant operations. Future AIA projections have been made at two percent of annual itinerant operations. Thus, AIA's have been projected to reach 1,600 by the long term. **Table 2J** presents AIA forecasts for the planning period.

TABLE 2J
Annual Instrument Approaches (AIA) Projections
San Marcos Municipal Airport

Year	AIA's	Itinerant Operations	Ratio
1991	190	N/A	-------
1992	269	17,480	1.54%
1993	352	N/A	-------
1994	378	N/A	-------
1996	257	N/A	-------
1997	563	N/A	-------
1998	463	21,717	2.13%
1999	440	39,076	1.13%
2000	338	36,800	0.92%
PLANNING HORIZON FORECASTS			
Short Term	1,046	52,300	2.00%
Intermediate	1,170	58,500	2.00%
Long Range	1,600	80,000	2.00%

SUMMARY

This chapter has outlined the various aviation demand levels anticipated for the next 20 years at San Marcos Municipal Airport. Long term growth at the airport will be influenced by many factors including the local economy, the need for a viable aviation facility in the immediate area and trends in general aviation at the national level.

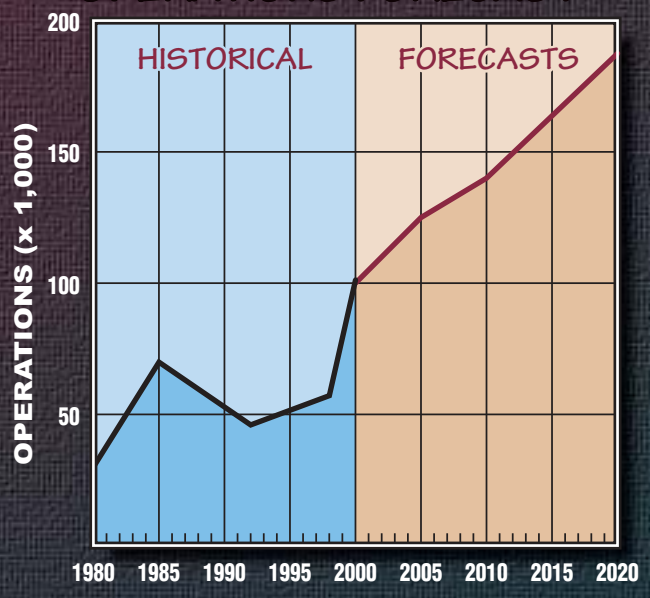
The next step in the master planning process will be to assess the capacity of existing facilities, their ability to meet forecast demand, and to identify changes to the airfield and/or landside facilities which will create a more functional aviation facility. The aviation demand forecasts for San Marcos Municipal Airport through the long term planning horizon are summarized on **Exhibit 2C**.

00MP03-2C-8/27/01

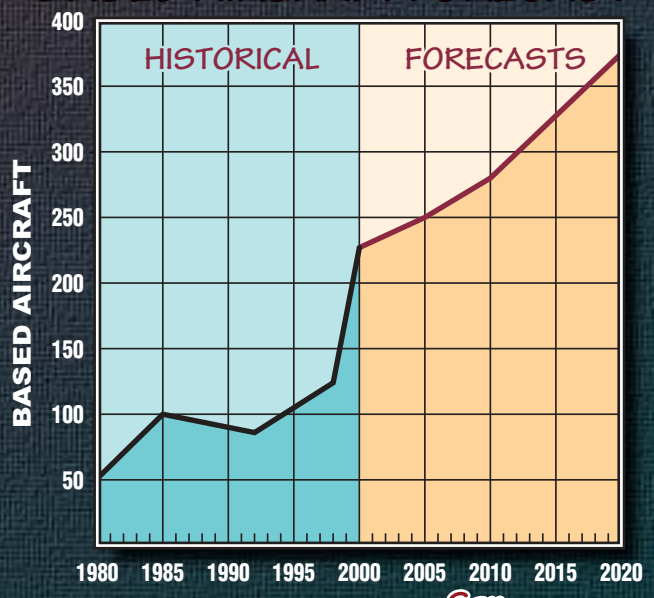
SUMMARY OF AVIATION ACTIVITY PLANNING HORIZONS

	Historical	Forecasts		
CATEGORY	**1999**	**Short Term**	**Intermediate Term**	**Long Term**
Annual Operations				
Itinerant				
AirTaxi	276	300	500	1,000
General Aviation	36,800	50,000	56,000	75,000
Military	2,000	3,000	4,000	5,000
Total Itinerant	*39,076*	*53,300*	*60,500*	*81,000*
Local				
General Aviation	64,400	75,000	84,000	112,500
Military	0	1,000	1,000	1,000
Total Local	*64,400*	*76,000*	*85,000*	*113,500*
Total Operations	***103,476***	***129,300***	***145,500***	***194,500***
AIAs	**440**	**1,050**	**1,150**	**1,370**
Based Aircraft				
Single Engine	189	200	217	285
Multi-engine	10	13	17	26
Turboprop	22	28	34	45
Jet	4	6	8	11
Helicopter	2	3	4	8
Total Based Aircraft	***227***	***250***	***280***	***375***

OPERATIONS FORECAST



BASED AIRCRAFT FORECAST



San Marcos MUNICIPAL AIRPORT

Exhibit 2C
FORECAST SUMMARY

Chapter Three
AIRPORT FACILITY REQUIREMENTS

Facility Requirements

An updated set of planning horizon milestones of aviation demand for San Marcos Municipal Airport were established in the previous chapter. These activity milestones include aircraft operations, based aircraft, fleet mix, annual instrument approaches and peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capability to accommodate future demand.

In this chapter, existing components of the airport are evaluated so that the capacities of the overall system are identified. Once identified, the existing capacity is compared to the planning horizon milestones to determine where deficiencies currently exist or may be expected to materialize in the future. Once deficiencies in a component are identified, a more specific determination of the approximate sizing and timing of the new facilities can be made.

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

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

Landside facilities are needed for the interface between air and ground transportation modes. This includes components for commercial service and general aviation needs such as:

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

AIRFIELD REQUIREMENTS

Airfield requirements include the need for those facilities related to the arrival and departure of aircraft. The adequacy of existing airfield facilities at San Marcos has been analyzed from a number of perspectives, including airfield capacity, runway length, runway pavement strength, airfield lighting, navigational aids and pavement markings.

AIRFIELD CAPACITY

A demand/capacity analysis measures the capacity of the airfield facilities (i.e. runways and taxiways) in order to identify a plan for additional development needs. The capacity of the airfield is affected by several factors including airfield layout, meteorological conditions, aircraft mix, runway use, aircraft arrivals, aircraft touch-and-go activity, and exit taxiway locations. An airport's airfield capacity is expressed in terms of its annual service volume. Annual service volume is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year.

Pursuant to FAA guidelines detailed in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, the annual service volume of an intersecting runway configuration normally exceeds 230,000 operations. Parallel runway configurations can provide even greater annual service volumes of up to 300,000 annual operations.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)* indicates that improvements should be considered when operations reach 60 percent of the airfield's annual service volume (ASV). Thus, once the airport reaches the intermediate term operational level, the airfield's ASV will exceed the 60 percent threshold. FAA also suggests that airports implement capacity enhancing projects once operations reach 80 percent of the airport's ASV. The airport will reach 80 percent of the airport's ASV at 184,000 operations, which would occur before the long term planning horizon.

The most typical and effective enhancement to airfield capacity is the construction of a parallel runway. Construction of a parallel runway would provide for an ASV of approximately 300,000 operations. Many airports plan and build a small parallel runway specifically designed for small aircraft and touch-and-go activity. These runways relieve the primary runway as local operations typically dominate airport activity at general aviation airports. Other capacity enhancements include construction of additional taxiways and improved navigational instrumentation. For San Marcos Airport, construction of additional exit taxiways would provide congestion relief as aircraft could be expedited from the runway. Navigational aid improvements, including GPS improvements and better minimums to

additional runways would provide some relief during poor weather conditions.

The construction of a parallel runway provides the best capacity increase to an airfield system. This process, however, is a very costly and a potentially time consuming measure. Furthermore, TxDOT will require that the project be justified in order to receive funding assistance.

For planning purposes, however, consideration will be given to the construction of a parallel runway for the ultimate planning period. Analysis in the next chapter will determine if the construction of a parallel runway is feasible.

RUNWAY ORIENTATION

The airport is served by four runways. Primary Runway 12-30 is oriented in an northwest-southeast direction; Runway 8-26 is oriented east-west; Runway 4-22 is oriented southwest-northeast; and Runway 17-35 is oriented north-south.

For the operational safety and efficiency of an airport, it is desirable for the primary runway of an airport's runway system to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off (defined as a crosswind).

FAA design standards specify that additional runway configurations are needed when the primary runway configuration provides less than 95 percent wind coverage at specific crosswind components. The 95 percent wind coverage is computed on the basis of crosswinds not exceeding 10.5 knots for small aircraft weighing less than 12,500 pounds and from 13 to 20 knots for aircraft weighing over 12,500 pounds.

Wind data specific to the San Marcos Municipal Airport is not available. Thus, weather data for the nearby Austin area between 1988 and 1997 was collected to determine wind coverage for the airport. This data is graphically depicted on the wind rose on **Exhibit 3A**.

As depicted on the exhibit, only Runway 17-35 provides over 95 percent wind coverage for all crosswind components. Primary Runway 12-30 provides nearly 95 percent coverage, at 93.18 percent for 10.5 knot crosswinds and exceeds 95 percent for higher components. Crosswind Runway 4-22 provides 88.81 percent and Runway 8-26 provides 84.86 percent for 10.5 knot crosswinds. The coverages indicate that winds are predominantly from the north/ northwest or south/southeast. Combined coverage of all four runways is 100 percent for all crosswind components.

As discussed in the first chapter, San Marcos was originally constructed and utilized by the United States armed forces as a training facility during World War II. Similar facilities were constructed throughout the country, especially in the South and Southwest. Construction of these facilities typically followed a “cookie cutter” approach where three or four runways were built to accommodate nearly all wind conditions.

Although it would be ideal for the City to maintain all runways at San Marcos, maintenance costs may prove to be prohibitive. FAA and TxDOT typically will not provide funding sources for the maintenance of more than two runways (or three runways if two are parallel) at a general aviation airport unless crosswind components justify their funding.

As previously mentioned, Runway 17-35 can singularly accommodate all cross-wind components. Primary Runway 12-30 provides over 93 percent coverage for 10.5 knots, and more than 97 percent at 13 knots. Analysis of dual runway configurations presented in **Table 3A** indicates that only two dual runway combinations fail to provide greater than 95 percent crosswind coverage (combinations of Runways 4-22 and 8-26 and Runways 8-26 and 12-30).

TABLE 3A
Dual Runway Configuration Wind Coverage (10.5kts.)
San Marcos Municipal Airport

Runway	4-22	8-26	12-30	17-35
4-22	----	90.88	97.72	98.77
8-26	90.88	----	94.18	99.53
12-30	97.72	94.18	----	99.42
17-35	98.77	99.53	99.42	----

The combination of Runways 12-30 and 17-35 provide the highest crosswind coverage for 10.5 knots at 99.42 percent. As clearly indicated in the table, any dual runway combinations containing Runway 17-35 provides the best coverages. Dual runway combinations containing primary Runway 12-30 exceed 95 percent for 10.5 knots except for Runway 8-26. All three runway configuration combinations provide greater than 95 percent coverage for all crosswind components.

Although the wind coverage suggests that one runway orientation, Runway 17-35 would be adequate for all crosswind components, providing a crosswind runway is beneficial when the primary runway must be closed for any reason, particularly construction, maintenance, or emergencies. The availability of a crosswind runway can allow the airport to remain in operation during these periods.

Analysis in the next chapter will consider the potential for ultimately closing at least one runway. The analysis will consider wind coverage as well as other factors such as convenience to the terminal area, utility, function, and development potential.

PHYSICAL PLANNING CRITERIA

The selection of appropriate FAA and TxDOT design standards for the development and location of airport

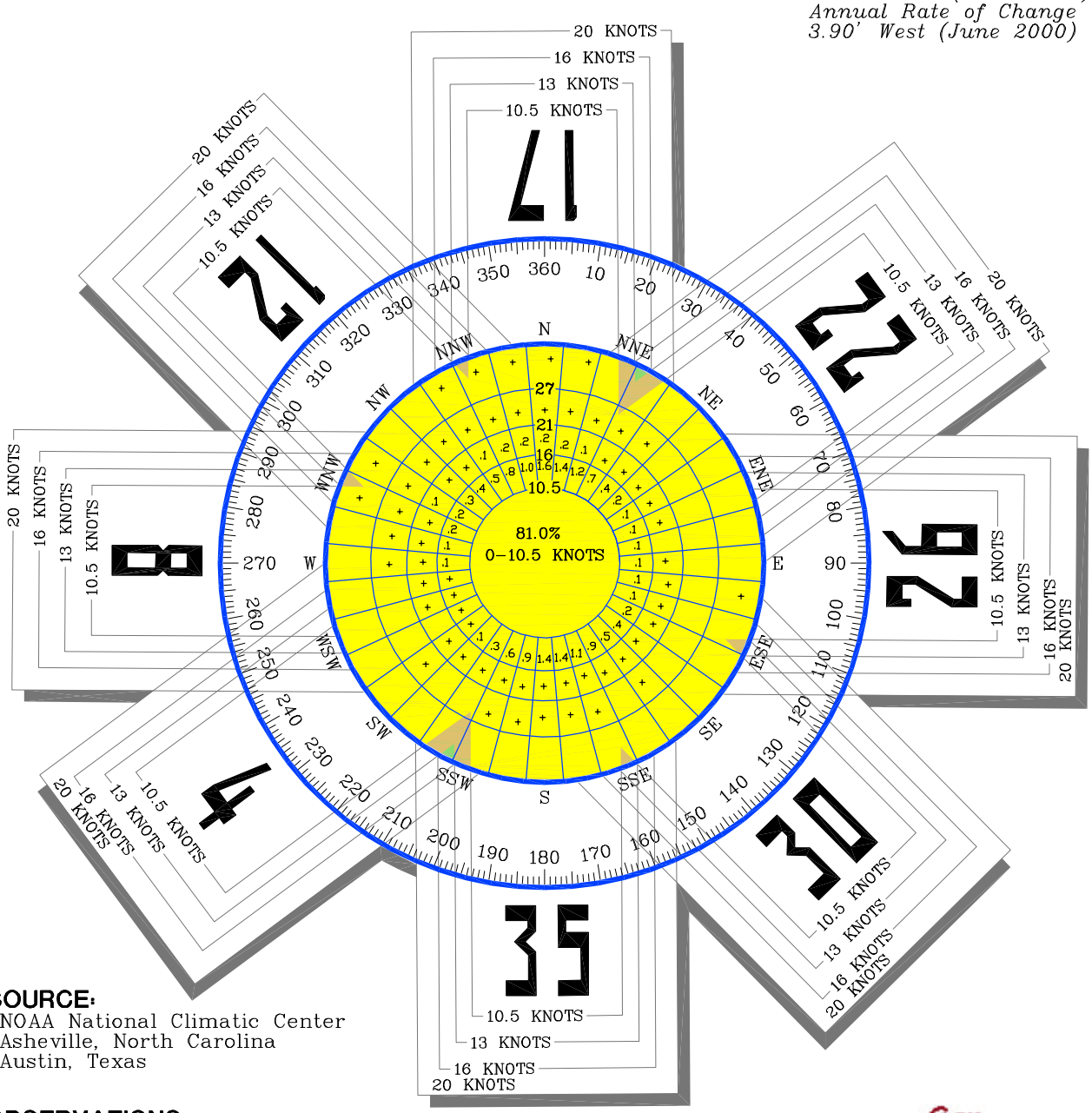
00MP03HY13A–10/11/00

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 4–22	*88.81%*	*94.45%*	*98.84%*	*99.77%*
Runway 8–26	*84.86%*	*91.17%*	*98.08%*	*99.62%*
Runway 12–30	*93.18%*	*97.17%*	*99.54%*	*99.95%*
Runway 17–35	*97.89%*	*99.14%*	*99.83%*	*99.96%*
Runways Combined	*100%*	*100%*	*100%*	*100%*

NORTH

Magnetic Variance
06° 02' East (June 2000)
Annual Rate of Change
3.90' West (June 2000)



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Austin, Texas

OBSERVATIONS:
83,143 All Weather Observations
1988 – 1997

San Marcos MUNICIPAL AIRPORT

Exhibit 3A
WIND ROSE

facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use the airport. Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. These standards must be determined now since the relocation of these facilities will likely be extremely expensive at a later date.

The most important characteristics in airfield planning are the approach speed and wingspan of the critical design aircraft anticipated to use the airport now or in the future. The critical design aircraft is defined as the most demanding category of aircraft which conducts 250 or more operations per year at the airport.

The FAA has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This code, referred to as the airport reference code (ARC), has two components: the first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group (ADG) and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways, taxilanes, and landside facilities.

According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

Category A: Speed less than 91 knots.
Category B: Speed 91 knots or more, but less than 121 knots.
Category C: Speed 121 knots or more, but less than 141 knots.
Category D: Speed 141 knots or more, but less than 166 knots.
Category E: Speed greater than 166 knots.

The airplane design group (ADG) is based upon the aircraft's wingspan. The six ADG's used in airport planning are as follows:

Group I: Up to but not including 49 feet.
Group II: 49 feet up to but not including 79 feet.
Group III: 79 feet up to but not including 118 feet.
Group IV: 118 feet up to but not including 171 feet.
Group V: 171 feet up to but not including 214 feet.
Group VI: 214 feet or greater.

Exhibit 3B depicts typical aircraft within each ARC.

CRITICAL DESIGN AIRCRAFT

In order to determine airfield facility requirements, an ARC should first be determined, then appropriate airport design criteria can be applied. This begins with a review of the type of aircraft using and expected to use San Marcos Municipal Airport.

San Marcos Municipal Airport is currently used by a wide variety of general aviation aircraft, ranging from small single engine aircraft, small and medium sized helicopters, general aviation business aircraft, and military aircraft.

General aviation aircraft using the airport include small single and multi-engine aircraft (which fall within approach categories A and B and ADG I) and business turboprop and jet aircraft (which fall within approach categories B, C, and D and ADGs I and II).

The most demanding based aircraft is currently a Citation 525 (business jet), a Beech King Air 200, and the Swearingen Metro aircraft operated by Berry Aviation. The Metro and Citation fall in ARC B-I, while the Beech King Air 200 is a B-II aircraft. The airport is also currently utilized by transient corporate aircraft ranging from smaller Lear and Citation jets to the Gulfstream models III and IV (C-II/D-II) on an infrequent basis.

Based corporate aircraft fall within ARC B-II are estimated to conduct more than 250 operations annually. Itinerant general aviation aircraft range up to ARC D-II (G-IV). Based upon the higher approach speeds of common business jets (such as the Citation 525 based at the airport), business aircraft within ARC B-II comprise the current critical design aircraft at the airport. In the future, it can be expected the full range of business jets will operate at the airport on a more frequent basis. Ultimate planning should consider ARC D-II as the critical aircraft to properly plan for the full range of business jets under 75,000 pounds. Primary Runway should be planned to accommodate all aircraft up to ARC D-II. The remaining crosswind runways should be planned, at a minimum to accommodate ARC B-II aircraft.

The design of taxiway and apron areas should consider the wingspan requirements of the most demanding aircraft to operate within that specific functional area on the airport. Transient general aviation apron and aircraft maintenance and repair hangar areas should consider ADG II requirements to accommodate typical business jet aircraft. T-hangar and small conventional hangar areas should consider ADG I requirements as these commonly serve smaller single and multi-engine piston aircraft.

RUNWAY LENGTH

The determination of runway length requirements for an airport are based on five primary factors: airport elevation; mean maximum temperature of the hottest month; runway gradient (difference in elevation of each runway end); critical aircraft type expected to use the airport, and stage length of the longest nonstop trip destinations. Aircraft performance declines as each of these factors increase.

For calculating runway length requirements at HYI, the airport elevation is 597 feet above mean sea level (MSL) and the mean maximum temperature of the hottest month is 94.7 degrees Fahrenheit (July). For Runway 12-30 the overall difference in runway end elevations is 20 feet.

00-MP-03-3B-7/21/00

A-I

Beech Baron 55
Beech Bonanza
Cessna 150
Cessna 172
Piper Archer
Piper Seneca

B-I
less than 12,500 lbs.

Beech Baron 58
Beech King Air 100
Cessna 402
Cessna 421
Piper Navajo
Piper Cheyenne
Swearingen Metroliner
Cessna Citation I

B-II
less than 12,500 lbs.

Super King Air 200
Cessna 441
DHC Twin Otter

B-I, II
over 12,500 lbs.

Super King Air 300
Beech 1900
Jetstream 31
Falcon 10, 20, 50
Falcon 200, 900
Citation II, III, IV, V
Saab 340
Embraer 120

A-III, B-III

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

C-I, D-I

Lear 25, 35, **55**
Israeli Westwind
HS 125

C-II, D-II

Gulfstream II, **III**, IV
Canadair 600
Canadair Regional Jet
Lockheed JetStar
Super King Air 350

C-III, D-III

B 727-200
B 737-200
B 737-300, 400, 500
DC-9
Fokker 70, 100
MD-80
A320

C-IV, D-IV

B-757
B-767
DC-8-70
DC-10
MD-11
L1011

D-V

B-747 Series
B-777

Note: Aircraft pictured is identified in bold type.

San Marcos MUNICIPAL AIRPORT

Exhibit 3B
AIRPORT REFERENCE CODES

Using the specific data for San Marcos Municipal Airport described above, runway length requirements for the various classifications of aircraft that may operate at the airport were examined using the FAA Airport Design computer program Version 4.2D which groups general aviation aircraft into several categories, reflecting the percentage of the fleet within each category and useful load (passengers and fuel) of the aircraft. **Table 3B** summarizes FAA recommended runway lengths for San Marcos Municipal Airport.

TABLE 3B
Runway Length Requirements
San Marcos Municipal Airport

AIRPORT AND RUNWAY DATA	
Airport elevation	597 feet
Mean daily maximum temperature of the hottest month	94.7 F
Maximum difference in runway centerline elevation	20 feet
Length of haul for airplanes of more than 60,000 pounds	1,000 miles
Dry runways	
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	2,800 feet
95 percent of these small airplanes	3,300 feet
100 percent of these small airplanes	4,000 feet
Small airplanes with 10 or more passengers seats	4,500 feet
Large airplanes of 60,000 pounds or less	
75 percent of business jets at 60 percent useful load	5,000 feet
75 percent of business jets at 90 percent useful load	7,300 feet
100 percent of business jets at 60 percent useful load	6,000 feet
100 percent of business jets at 90 percent useful load	9,500 feet
Airplanes of more than 60,000 pounds	6,200 feet

REFERENCE: FAA's airport design computer software utilizing Chapter Two of AC 150/5325-4A, **Runway Length Requirements for Airport Design**, no changes included.

As mentioned previously, the current critical design aircraft for Runway 12-30 fall within ARC C-II. This is based upon a 250 operational level by typical corporate aircraft, depicted in **Table 3C**, that now use the airport. Ultimate planning will be considered for all corporate general aviation aircraft up to ARC D-II. The appropriate FAA runway length planning category for aircraft

within ARC D-II is "100 percent of large airplanes at 60 percent useful load". The performance requirements of the critical aircraft can further refine the runway length requirements. However, stage length requirements for typical business jet aircraft, up to ARC D-II, are considered to be the ultimate determining factor for runway length. The average maximum range of 2,846 nm has been calculated from five of the most popular business jet aircraft, including the Canadair 601, Cessna Jet (J1), Gulfstream IV, Learjet 45, and Hawker 125-800XP. From this a typical stage length of 1,000 miles has been used to calculate the runway length requirement. As shown in the table, the FAA recommends a runway length of 6,000 feet to serve this category of aircraft with a median stage length value of 1,000 miles. Runway 8-26 is currently the only runway at HYI providing at least 6,000 feet.

Analysis specific to individual business jet aircraft has been completed to determine if the length of primary Runway 12-30 would be adequate for the range of business jets currently or forecast to operate at HYI. **Table 3C** presents this analysis. These business jets could typically be expected to stage, or refuel, at cities within a 1,000 mile radius of San Marcos, enabling aircraft to reach cities such as Denver, Phoenix, Tampa, and Miami.

TABLE 3C
Business Jet Runway Length Requirements

	Runway Length Required for (in feet)		
Aircraft Type	**Take-off @ 95 F**	**Landings on Dry Runway**	**Landings on Contaminated Runway**
BAe 125-800	7,800	5,000	7,000
Canadair Challenger CL600	6,900	5,500	7,000
Cessna 550	5,500	2,900	6,000
Cessna 650	6,000	5,300	6,100
G-IV	7,000	5,400	6,200
Hawker 125-700/800	*8,000*	4,000	6,000
Hawker 1000	*7,500*	5,000	5,600
Israel Aircraft Industries			
- Astra SPX	*7,000*	5,000	5,000
- Westwind	*7,300*	3,500	*7,000*
Lear			
- 35	6,000	3,400	*7,000*
- 55	*7,300*	3,200	6,400

As indicated in the table, a range of runway lengths is required by business jet aircraft. Aircraft such as the Lear 55 requires 7,300 feet for take-off at 95 degrees. Other aircraft which operate at HYI, such as the G-IV require at least 7,000 feet.

Future planning for Runway 12-30 should consider providing up to 7,000 feet. This length would better situate the San Marcos Municipal Airport to serve the range of business jet aircraft on a regular basis.

In order to fully accommodate ARC B-II aircraft, the appropriate planning category for the crosswind runways is "small airplanes with 10 or more passenger seats." As shown in **Table 3B**, a runway length of 4,500 feet is recommended for this category. All crosswind runways currently exceed this minimum requirement. TxDOT Polices and Standards indicates that a crosswind runway should have a length of at least 80 percent of the primary runway length. If Runway 12-30 were extended to 7,000 feet, at least one crosswind runway should be at least 5,600 feet long. Alternative analysis, to be conducted in the next chapter, will consider extending Runway 12-30 up to 7,000 feet and ensure that at least one crosswind runway provide 5,600 feet.

RUNWAY WIDTH

Runway width is based upon the planning ARC for each runway. For ARC D-II, the FAA specifies a runway width of 100 feet. TxDOT's Policies and Standards indicates that a Transport Airport should provide a runway width of 100 feet. The existing width of Runway 12-30, at 150 feet, exceeds FAA and TxDOT requirements. All other crosswind runways are currently 100 feet wide, exceeding this minimum requirement.

While consideration could be given to reducing the width of Runway 12-30 to 100 feet (ARC D-II) and the crosswind runways to 75 feet (ARC B-II), the cost to reconstruct these runways at 100 and 75 feet (which would require relocating all the existing runway lighting) would need to be compared to the cost to reconstruct them at 100 and 75 feet. It should also be noted that maintaining a crosswind runway at a width of 100 feet will better suite the runway to accommodate the airport's traffic when the primary runway is closed.

RUNWAY PAVEMENT STRENGTH

The most important feature of airfield pavement is its ability to withstand repeated use by aircraft of significant weight. At the airport, this includes a wide range of general aviation aircraft ranging from small single-engine aircraft to business jet aircraft.

Runway 12-30 presently has a single wheel loading (SWL) strength of 60,000 pounds. Runway 4-22 has a pavement strength rating of 15,000 pounds SWL; Runway 8-26 has 80,000 pounds SWL; and Runway 17-35 has 20,000 pounds SWL. TxDOT's Policies and Standards indicates a minimum pavement strength of 30,000 pounds SWL for general aviation transport and reliever airports. These pavement strengths ratings are sufficient to serve the expected mix of aircraft to use the airport through the planning period.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some

taxiways are necessary simply to provide access between the aprons and runways, whereas other taxiways become necessary as activity increases at an airport to provide safe and efficient use of the airfield.

Presently, Runway 12-30 is the only runway served with a full length taxiway. The majority of Runway 8-26 is served by the main apron taxiway serving as a quasi-parallel taxiway. Future taxiway planning should consider the needs of primary runway and at least one crosswind runway. According to FAA and TxDOT standards, both the primary and a crosswind runway should be served with a parallel taxiway to enhance operational safety and efficiency. Analysis to be conducted in the next chapter will consider taxiway layouts providing the airport with enhanced safety and efficiency.

Taxiway width is determined by the ADG of the most demanding aircraft to use the taxiway. As mentioned previously, the most demanding aircraft presently using airport falls within ADG II. According to FAA design standards, the minimum taxiway width for ADG II is 35 feet. Taxiways at HYI range between 30 feet wide and 50 feet wide. Taxiways B and C are only 30 feet wide. These taxiways should be widened to at least 35 feet, although 40 feet would be preferred.

Design standards for the separation distances between runways and parallel taxiways are based primarily on the ARC for that particular runway and the type of instrument approach capability. ARC CD-II design standards specify a runway/taxiway separation distance of 400 feet since the runway is served by a precision ILS approach. Presently, Taxiway C meets the minimum runway/taxiway separation criterion. Future parallel taxiways will need to be planned at a minimum of 400-foot runway to taxiway centerline separation.

Holding aprons provide an area for aircraft to prepare for departure off the taxiway and allow aircraft to bypass other aircraft which are ready for departure. Only Runways 8 and 4 are served with holding aprons. Facility planning should include developing additional holding aprons at each runway end, especially the primary runway, to improve efficiency during departures for all aircraft using the airport.

NAVIGATIONAL AIDS AND INSTRUMENT APPROACH PROCEDURES

A number of electronic navigational aids are in place to assist pilots in locating and landing at San Marcos Municipal Airport. The Runway 12 ILS, Randolph VOR, Centex, San Antonio, and Stonewall VORTACs, Loran-C and global positioning system (GPS) navigational aids assist pilots landing at the airport during poor weather conditions when following instrument approach procedures established by the FAA.

The advent of global positioning system (GPS) technology can ultimately provide the airport with the capability of establishing new instrument approaches at minimal cost since there is not a requirement for the installation

and maintenance of costly ground-based transmission equipment at the airport. As mentioned previously, the FAA is proceeding with a program to transition from existing ground-based navigational aids to a satellite-based navigation system utilizing GPS technology. Currently, GPS is certified for en route guidance and for use with instrument approach procedures. The initial GPS approaches being developed by the FAA provide only course guidance information. By the year 2003, it is expected that GPS approaches will also be certified for use in providing descent information for an instrument approach. This capability is currently only available using an instrument landing system.

GPS approaches fit into three categories, each based upon the desired visibility minimum of the approach. The three categories of GPS approaches are: precision, non-precision with vertical guidance and non-precision. To be eligible for a GPS approach, the airport landing surface must meet specific standards as outlined in FAA AC 150/5300-13, *Airport Design*, Appendix 16, Change 6. At the time this chapter was written, the new standards were in draft form and had not been finalized. Based upon this draft circular, only Runway 12 meets the requirements for a precision approach since it is equipped with the required approach lighting system, runway markings and runway edge lighting. It should be expected that the ILS approach will eventually be replaced by GPS as the FAA transitions to GPS as the sole means for navigation.

Runway 12 is equipped with a straight-in instrument approach procedure utilizing the instrument landing system (ILS). Runway 12 is also served by a GPS and NDB approach. Facility planning should include providing an additional precision GPS approach from the south to complement approach capability to Runway 12.

Since instrument approaches can be established at the airport using GPS, which does not require the installation of costly ground-based navigational aids, instrument approach capability can be planned for each end of the crosswind runway. Since the primary runway is expected to provide precision approach capability to each runway end, only limited approach capability would be required to each end of the crosswind Nonprecision approaches with visibility minimums of at least greater than one mile should be planned for each end of the crosswind runway.

AIRFIELD SAFETY STANDARDS

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

The OFA is defined as "a two dimensional ground area surrounding runways, taxiways, and taxilanes which is clear of objects except for objects

whose location is fixed by function." The runway safety area (RSA) is defined as "A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway." The OFZ is defined as a "defined volume of airspace centered above the runway centerline whose elevation is same as the nearest point on the runway centerline and extends 200 feet beyond each runway end."

The FAA has proposed a change to FAA AC 150/5300-13, Airport Design, to address new requirements for the transition to global positioning system (GPS) navigation. Draft Change 6 has proposed the precision object free (POFA) standards for all runways having or expected to have precision approaches. For San Marcos Municipal Airport, this is applicable to Runway 12 which is served by the existing instrument landing system (ILS) precision approach. This standard would not apply to any other runway ends at this time since they are not served by a precision instrument approach.

The FAA expects these areas to be under the control of the airport and free from obstructions. As noted previously, the critical aircraft for Runway 12-30 currently falls within ARC B-II. In the future this is expected to transition to ARC D-II. At a minimum ARC B-II design standards are applicable to the crosswind runway, however, consideration will be given in the next chapter for the crosswind runway to meet ARC C-II standards. This would better situate the airport for times when the primary runway is closed for any reason.

A review of the existing aerial photography reveals that both runways comply with RSA, OFA and OFZ standards. The next chapter, Airport Development Alternatives, will examine RSA, OFA and OFZ standards considering each potential runway extension alternative.

LIGHTING AND MARKING

Currently, there are a number of lighting and pavement markings aids serving pilots and aircraft using HYI These lighting and marking aids assist pilots in locating the airport during night or poor weather conditions, as well as assist in the ground movement of aircraft.

Runway markings are designed according to the type of instrument approach available on the runway. FAA AC 150/5340-1F, *Marking of Paved Areas on Airports*, provides the guidance necessary to design an airport's markings. Runway 12-30 is equipped with precision runway markings. Runway 8-26 is marked with nonprecision markings, while Runways 4-22 and 17-35 are equipped with basic markings. The precision markings on Runway 12-30 will be sufficient. The crosswind runway should provide nonprecision markings to support a GPS approach.

Taxiway and apron areas also require marking to assure that aircraft remain on the pavement. Yellow centerline stripes are currently painted on all taxiway and apron surfaces at the

airport to provide this guidance to pilots. Besides routine maintenance, these markings will be sufficient through the planning period.

The airport is equipped with a rotating beacon to assist pilots in locating the airport at night. The existing rotating beacon is adequate and should be maintained in the future.

Runway lighting systems provide critical guidance to pilots during nighttime and low visibility operations. Only Runways 12-30 and 8-26 are equipped with medium intensity runway lighting (MIRL). These systems are sufficient for the existing and planned approaches and should be maintained through the planning period. TxDOT and FAA criteria indicate that the crosswind runway at HYI should provide MIRL.

Effective ground movement of aircraft at night is enhanced by the availability of taxiway lighting. All taxiways, except Taxiway J are equipped with medium taxiway lighting. These lighting systems are sufficient and should be maintained through the planning period.

Lighted directional signs are installed at the airport. This signage identifies runways, taxiways, and apron areas. These aid pilots in determining their position on the airport and provide directions to their desired location on the airport. These lighting aids are sufficient and should be maintained through the planning period.

San Marcos Municipal Airport is equipped with pilot controlled lighting (PCL). PCL allows pilots to control the intensity of runway and taxiway lighting using the radio transmitter in the aircraft. PCL also provides for more efficient use of runway and taxiway lighting energy use.

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, visual glideslope indicators are commonly provided at airports. Presently, a visual approach slope indicator (VASI-4) is available at the Runway 30 end. This lighting aid is sufficient and should be maintained in the future. Planning should include the installation of a PAPI-4 on Runway 12 and both ends of the crosswind runway.

Approach lighting systems provide the basic means to transition from instrument flight to visual flight for landing. Runway 12 is equipped with medium intensity approach lighting system with runway alignment lighting (MALSR). The MALSR is required for the existing ILS approach minimums to Runway 12 and is sufficient for a transition to a precision GPS approach in the future. As mentioned previously, the development of a precision GPS approach (Category I minimums) should be considered for Runway 30. In this case, a MALSR would be required for Runway 30.

Runway identification lighting provides the pilot with a rapid and positive identification of the runway end. The most basic system involves runway end identifier lights (REILs). While REILs are not specifically required for the existing visual approaches or future GPS approaches, REILs would enhance

the safety of nighttime operations to each runway end (without a more extensive approach lighting system) by providing pilots with the ability to identify these runway ends and distinguish this lighting from other lighting on the airport and in the approach areas. REILs are presently installed at end of Runway 8 and 26. REILs should be planned for both ends of the crosswind runway. If Runway 30 is upgraded to a MALSR, the REIL would not be required, however, consideration should be given to installing REILs until a precision GPS approach is approved for the runway.

HELIPAD

There is no designated helipad at the airport. Future facility planning should include providing a helipad with a separate tiedown position to accommodate the parking needs of transient and based helicopter parking. This should also include installing edge lighting on the helipad for easier identification of the helipad at night. Proper markings should be maintained through the planning period.

AIR TRAFFIC CONTROL TOWER

The establishment of a new FAA funded air traffic control tower follows a two-phase process as detailed in *FAA Handbook 7031.2C, Airway Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services*. The first phase involves identifying possible candidacy through an analysis of annual operation levels. The second phase involves a cost-benefit analysis of the tower location over a 15-year time frame. To be identified as a possible candidate for a new air traffic control tower, the sum of the following formula must be greater than or equal to one. The formula is as follows:

AC +	AT +	GAI +	GAL +	MI +	ML =	X
38,000	90,000	160,000	280,000	48,000	90,000	

Where:

AC = Air Carrier Operations
AT = Air Taxi Operations
GAI = General Aviation Itinerant Operations
GAL = General Aviation Local Operations
MI = Military Itinerant Operations
ML = Military Local Operations

Using forecast activity data prepared in Chapter Two, it is expected that San Marcos Municipal Airport would qualify as a possible candidate for an air traffic control tower due to levels of air traffic at the airport. At short term planning horizon activity levels, the sum of the formula above is 0.65. For the intermediate term the sum is 0.75. At long term planning horizon levels, the sum 0.99.

While it may be difficult to qualify for an FAA-funded airport traffic control tower, the FAA does share ATCT staffing costs through the contract tower program. The development of an ATCT is available through the airport improvement program. The The city of San Marcos should closely follow the development of these programs to determine their eligibility for inclusion in either program.

OTHER FACILITIES

The airport has several lighted wind cones and a segmented circle which provides pilots with information about wind conditions and local traffic patterns. These facilities are required when an airport is not served by a 24-hour ATCT. These facilities are sufficient and should be maintained in the future.

An automated weather observation system (AWOS) is an important component to airfield operations as it notifies pilots of local weather conditions. This system should be maintained through the planning period and upgraded as needed. A summary of the airfield facility requirements is presented on **Exhibit 3C**.

F.A.R. Part 139 Certification Requirements

F.A.R. Part 139, "Certification and Operations: Land Airports Serving Certain Air Carriers", as amended, prescribes the rules governing the certification and operation of land airports which serve any scheduled or unscheduled passenger operations of an air carrier that is conducted with an aircraft having a seating capacity of more than 30 passengers. [A Notice of Proposed Rulemaking issued by the Federal Aviation Administration on June 21, 2000 would extend certification requirements to airports serving scheduled air carrier operations in aircraft with 10-30 seats].

Under the new rulemaking which will likely become law, four categories of certification will be established. The first three categories generally deal with scheduled air carrier airports. The proposed law, however, includes the requirement for airports served by unscheduled charter operations utilizing aircraft with 30 or more passenger seats to be certificated under Part 139 as a Class IV airport.

While San Marcos Municipal Airport currently does not maintain a Part 139 certificate, consideration needs to be given to the requirements for a Part 139 certificate if operations are initiated by Berry Aviation with greater than 30 seats. Currently, Berry Aviation operates unscheduled 19-seat aircraft charter operations from San Marcos. It is estimated that charter operations totaled 250 in 2000. As previously discussed, Berry Aviation is considering upgrading its charter operation at San Marcos Municipal to include either a Saab 340 or Emb120, both with greater than 30 passenger seats. The following sections describes the requirements necessary for San Marcos Municipal to meet Class IV Part 139 certification requirements.

Airport Certification Manual Requirements

Under FAR Part 139, a certificated airport must complete (and maintain) an airport certification manual (ACM) which outlines their compliance under each provision of the regulation. The compliance level required is dependent on the airport's design standards and the size and frequency of the scheduled aircraft service. These standards are based upon the latest airport design standards as published by the FAA.

Runway 12-30 and associated taxiways would be anticipated to be available for charter operation use; therefore, all of the paved surfaces associated with the runway/taxiway system would require compliance under Part 139. Runways and taxiways identified for air carrier (scheduled or unscheduled aircraft with greater than 30 passenger seats) usage would be required to maintain safety areas in compliance with Part 139. It is anticipated that minimal additional costs would be incurred to upgrade signage and lighting. However, a significant cost would be expected to comply with airport rescue and firefighting, as outlined in the following paragraphs.

Airport Rescue And Firefighting

Airport rescue and firefighting (ARFF) standards are based upon the size of aircraft and their respective frequency of service (a minimum of five daily departures by the largest category of aircraft). Under the proposed rulemaking, however, all airports certificated under Part 139 would be required to provide appropriate ARFF coverage meeting at least minimum ARFF requirements designated under Index A. ARFF Index A requirements are as follows:

One vehicle carrying at least 500 pounds of sodium-based dry chemical or halon 1211 or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of aqueous film forming foam (AFFF) to total 100 gallons, for simultaneous dry chemical and AFFF foam application.

ARFF facilities must be in a location that allows a response within three (3) minutes from the time of the alarm, and at least one required ARFF vehicle shall reach the midpoint of the farthest runway serving air carrier aircraft and begin application of foam, dry chemical, or halon 1211.

Since San Marcos Municipal Airport does not have any dedicated ARFF facilities or equipment, a facility would need to be constructed, a vehicle purchased, and provisions made for manning the facility. It is estimated that the associated cost of constructing a new facility and acquiring appropriate equipment would range between $500,000 - $1,000,000, plus annual costs of $200,000 to $350,000 to maintain adequate personnel and required training.

Understanding that the new ARFF Index A requirements at a small airport could be prohibitive, the FAA has indicated that they will analyze the requirements of each airport on a case-by-case basis. It is possible that the FAA would allow a compromise for San Marcos if, for example, ARFF services could be provided on a "on-call" basis by

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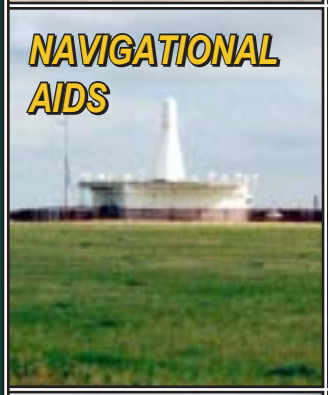
	EXISTING	SHORT-TERM	ULTIMATE
RUNWAYS	**Runway 12-30** 5,603' x 150' 60,000# SWL **Runway 4-22** 5,512' x 100' 15,000# SWL **Runway 8-26** 6,330' x 100' 80,000# SWL **Runway 17-35** 5,442' x 100' 20,000# SWL	**Runway 12-30** 6,000' x 150' **Crosswind Runways** Same	**Runway 12-30** 7,000' x 150' **Crosswind Runway(s)** 5,600' x 100' 30,000# SWL
TAXIWAYS	**Runway 12-30** Full Parallel Taxiway Four Exits **Runway 8-26** Four Exits **Runways 4-22 & 17-35** Two Exits	**Runway 12-30** Same **Crosswind Runways** Same	**Runway 12-30** Add: Northerly Exits **Crosswind Runway(s)** Full Length Parallel Taxiway Four Exits
 NAVIGATIONAL AIDS	VOR, NDB, GPS, AWOS **Runway 12-30** ILS - 12 GPS - 12 NDB - 12 **All Crosswind Runways** None	VOR, NDB, GPS, AWOS **Runway 12-30** Same **Crosswind Runways** Same	ATCT, GPS, AWOS **Runway 12-30** Add: CAT I GPS - 30 **Crosswind Runway(s)** GPS
LIGHTING & MARKING	Rotating Beacon MITL **Runway 12-30** MIRL, Precision Marking MALSR - 12 • VASI-4L **Runway 8-26** REIL Nonprecision Marking **Runways 4-22 & 17-35** No Lighting Basic Marking	Rotating Beacon MITL **Runway 12-30** Add: REIL - 30 **Runway 8-26** Same **Runways 4-22 & 17-35** Same	Rotating Beacon MITL **Runway 12-30** Add: MALSR - 30 PAPI-4 **Crosswind Runway(s)** MIRL REIL Nonprecision Marking PAPI-2

San Marcos MUNICIPAL AIRPORT

Exhibit 3C
AIRFIELD FACILITY REQUIREMENTS

a nearby City or county fire station. It is likely, however, that the FAA would require that the local agency personnel be equipped with the appropriate training and equipment necessary to accommodate ARFF needs of the specific aircraft and operational environment of the airport. Thus, even if full Index A ARFF requirements may not be required on-airport, upgrading local fire department personnel and equipment and maintaining annual training would be costly.

Additional Costs To Complete The Certification Process

The ACM which the airport is required to prepare contains the following information:

- General Information
- Organization and Management
- Airport Information
- Maintenance and Inspection Program
- Operational Safety
- Hazardous Materials
- Aircraft Rescue and Firefighting
- Snow and Ice Control
- Airport Emergency Plan
- Wildlife Hazard Management
- Maintenance of Certification Manual

There are several categories under the Maintenance and Inspection Program which will need to be addressed, including: personnel, equipment, and procedures; recordkeeping; safety standards and maintenance procedures; and airport condition reporting. Furthermore, the safety standards and maintenance procedures include the following: pavement areas; pavement maintenance procedures; safety areas; safety area maintenance procedures; marking and lighting; traffic and wind direction indicators; and obstruction removal, marking, and lighting. Under the current "limited" certificate, an airport has been required to address the following seven items:

- Inspection Authority
- Airport Certification Specifications
- Personnel
- Paved/Unpaved Areas
- Safety Areas
- Marking and Lighting
- Airport Condition Reporting

While much of the information necessary to complete the certification manual will be available to the Airport Manager, considerable time and effort will need to be expended in preparing and organizing the information, outlining daily reporting responsibilities, updating emergency plans, and ensuring that the airport meets all of the safety and security requirements under Part 139.

Self-Inspection Program

Under Part 139, the certificate holder shall maintain sufficient qualified personnel to comply with the requirements of the certification manual. To comply with these requirements, at least one person may need to be added to City of San Marcos staff to conduct Part 139 self-inspection of the airport facilities on a daily basis. This person must be trained in the identification of deficiencies and the necessary reporting techniques to report those deficiencies. The costs outlined

below reflect the addition of one new staff member.

Snow And Ice Control

It is difficult to determine at this time if additional equipment will be necessary for snow and ice control. However, the snow and ice control plan prepared by the airport will need to address prompt removal of snow and ice and notification procedures to air carriers when a portion of the movement area is unavailable. No additional costs are anticipated.

Hazardous Materials

Under Part 139, each certificate holder that serves a cargo handling agent shall establish and maintain procedures for the protection of persons and property on the airport during the handling and storing or any material regulated by the hazardous materials regulations, that is, or intended to be, transported by air. In addition, the certificate holder shall establish and maintain standards acceptable to the FAA Administrator for the protection against fire and explosions in storing, dispensing, and otherwise handling fuels, lubricants, and oxygen on the airport. These standards shall cover facilities, procedures, and personnel training. Since aircraft fuels and lubricants are available at San Marcos Municipal Airport, this section would be required under Part 139. This would involve the development of airport rules and regulation regarding the handling, storage, and dispersement of fuels and lubricants on the airport. In addition, the airport operator would be responsible for conducting quarterly inspections of firms and individuals handling, storing and dispersing fuels and lubricants at the airport. Records of these inspections must be kept for a minimum of twelve (12) months.

Airport Emergency Plan

The airport emergency plan is designed to minimize the possibility and extent of personal injury and property damage on the airport in various emergency situations. The plan would require the airport and supporting medical facilities to review the plan once every twelve (12) months. As a Class IV airport, however, a full-scale airport emergency exercise would not need to be done.

Ground Vehicles

The airport is required to limit the access of ground vehicles in movement areas to those vehicles necessary for airport operations. This would require that all personnel operating ground vehicles on the movement and safety areas be trained in the proper operation and safety procedures on the airport. Any incident or accident involving an airport ground vehicle shall be documented and made available to the FAA Administrator upon request.

Obstructions

Each certificate holder shall ensure that each object in each area within its authority which exceeds any of the heights or penetrates the imaginary surfaces described in Part 77, is either removed, marked, or lighted. The

necessary requirements shall be determined by an approved FAA Aeronautical Study.

Protection of Navaids/ Public Protection

The airport would need to be fenced, with gate control. Additional costs are anticipated for protection of navaids or public protection.

Wildlife Hazard Management

The certificated airport shall provide an ecological study to the FAA Administrator when any incident or accident occurs on or near the airport involving birds or other wildlife. This study shall examine the event, the species and numbers involved, location of incident/accident, and a description of the wildlife hazard to air carrier operations. If a wildlife hazard management plan is determined necessary, according to the FAA Administrator, a plan shall be submitted to the FAA Administrator for approval prior to the implementation. This plan will designate those personnel responsible for its implementation and the action to be taken. If any incidents or accidents occur involving birds or other wildlife, the airport could be required to implement a wildlife hazard management plan.

Summary

The cost of ARFF equipment and facilities are eligible for federal participation under the Airport Improvement Program (with a 10 percent local match). In addition, the cost for removing (or lighting) obstructions is also eligible. While no costs have been estimated for pavement or safety areas, these items would also be eligible for federal reimbursement, if improvements or upgrades are deemed necessary.

While the information presented is very preliminary, it provides a relative magnitude of the representative costs associated with upgrading San Marcos Municipal Airport to fulfill the requirements of a Part 139 certificate.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacities of the various components of each area were examined in relation to projected demand to identify future landside facility needs.

GENERAL AVIATION FACILITIES

Aircraft Storage Hangars

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

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is in more sophisticated (and consequently more expensive) aircraft. Therefore, many hangar owners prefer hangar space to outside tiedowns. This is evident at San Marcos Municipal Airport as approximately 15 based aircraft are located on outside tiedowns. Some of these owners of these aircraft would prefer to be in a hangar, however, with the dramatic increase in based aircraft at HYI, hangar spaces are not readily available.

Future hangar requirements for the airport are summarized on **Exhibit 3D**. As indicated on the exhibit, additional hangars will be needed to accommodate projected based aircraft. A planning standard of 1,200 square feet for single-engine aircraft and 2,500 feet for multi-engine aircraft were used to determine aircraft storage hangar requirements. Total hangar area was increased 15 percent to account for future aircraft maintenance and repair needs.

Presently, aircraft storage and maintenance and repair needs are being met through the use of the eight conventional hangars, 62 T-hangars, fourteen shade hangars, and numerous smaller "corporate" clearspan hangars. T-hangars are used for small single and multi-engine storage while most business jets and turboprop aircraft are located in the corporate hangars. In the future it is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types. The alternatives analysis will examine the options available for hangar development at the airport and determine the best location for each type of hangar facility. Analysis, to be conducted later, will determine wether existing fee structures for existing leases of airport hangar facilities is adequate. The financial analysis will consider both existing and future lease structures.

Aircraft Parking Apron

A parking apron should be provided for at least the number of locally-based aircraft that are not stored in hangars, as well as transient aircraft. Approximately 100 tiedowns are available for transient and based aircraft at the airport. Although the majority of future based aircraft were assumed to be stored in an enclosed hangar, a number of based aircraft will still tiedown outside.

Total apron area requirements were determined by applying a planning criterion of 700 square yards per transient aircraft parking position and 570 square yards for each locally-based aircraft parking position. Transient business jet positions were determined by applying a planning criterion of 1,600 square yards for each transient business jet positions. The results of this analysis are presented on **Exhibit 3D**.

Based upon the planning criteria above and assumed transient and based aircraft users, it appears that the existing apron area will be more than adequate to meet future aviation demand projections. This however, can be misleading as the majority of activity

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AIRCRAFT STORAGE HANGARS

	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
T-hangar/Shade Hangar Positions	76	100	130	200
Conventional/Corporate Hangar Positions	±180	140	140	165
T-hangar Area (s.f.)	95,000	120,000	156,000	240,000
Conventional/Corporate Hangar Area (s.f.)	165,300	280,000	279,000	330,000
Maintenance Area (s.f.)	50,000	60,000	65,300	85,500
Total Hangar Area (s.f.)	310,300	460,000	500,300	655,500

APRON AREA

	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Transient Positions	----	53	62	79
Locally-Based Aircraft Postions	----	15	10	10
Total Positions	±100	68	72	89
Total Apron Area (s.y.)	300,000	60,500	65,700	89,600

TERMINAL SERVICES AND VEHICLE PARKING

	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Terminal Building Space (s.f.)	±2,500	6,200	8,100	10,000
Total Parking Spaces	±200	130	156	268
Total Parking Area (s.f.)	±50,000	52,000	62,400	107,200

San Marcos MUNICIPAL AIRPORT

Exhibit 3D
LANDSIDE REQUIREMENTS

is centered now at the western portion of the airport. The main terminal apron can become somewhat congested. Future planning should consider ways to alleviate this congestion to ensure adequate space availability at the terminal building. Also, much of the apron on the eastern portion of the flight line, near the CAF is old and needs to be refurbished or replaced.

GENERAL AVIATION TERMINAL FACILITIES

General aviation terminal building space is required for waiting passengers, a pilot's lounge and flight planning, concessions, management, storage, and various other needs. Presently, space is available in the general aviation terminal building to accommodate these needs. Future terminal requirements have been determined and are shown on **Exhibit 3D**.

It should be noted that the general aviation facilities provided at HYI will be the first thing a business traveler will see which represents the city of San Marcos. Consideration of a first class general aviation passenger transfer facility should always be weighed when the airport's role is to accommodate business travelers. According to the analysis presented on **Exhibit 3D**, the existing general aviation terminal building is undersized to meet existing demand. Future planning will consider expansion of the existing facility or the construction of a new building. It should be noted that not all terminal space is required to be provided at the main terminal building. Spaces provided at other airport FBO's will serve passenger needs as well.

General aviation vehicular parking demands have also been determined for San Marcos Municipal Airport. Space determinations were based on an evaluation of the existing airport use as well as industry standards. Terminal automobile parking spaces required to meet general aviation itinerant and FBO operator demands were calculated by multiplying design hour itinerant passengers by the industry standard of 1.9 in the short term, increasing to 2.5 for the ultimate term as corporate operations increase.

The parking requirements of aircraft owners should also be considered. Although some owners prefer to park their vehicle in their hangar, safety can be compromised when automobile and aircraft movements are intermixed. For this reason, separate parking requirements which consider one half of based aircraft at the airport were applied to general aviation automobile parking space requirements. Parking requirements are summarized on **Exhibit 3D**.

The airport currently provides a 48 space automobile parking lot adjacent the terminal building. Additional parking lots are provided adjacent airport FBO's. Most of these parking lots are gravel or broken asphalt and are in poor condition. Future automobile parking needs should consider paved surfaces adjacent to the airport FBOs, with dedicated paved parking lots for based aircraft owners. If the airport were to be certified under F.A.R. Part 139, security issues would

need to be enacted that would discourage mixing of aircraft and automobile traffic.

Aircraft Wash Facility

Presently, a number of airports are constructing or considering the development of an aircraft owner maintenance facility to meet tougher environmental requirements for hazardous material handling and disposal. These areas typically provide for the collection of used aircraft oil and other hazardous materials and provide a covered area for aircraft washing and light maintenance. The development of a similar facility at San Marcos Municipal Airport could reduce environmental exposure and provide an additional revenue source which could be used to amortize development costs.

SUPPORT FACILITIES

Aviation Fuel Storage

The city of San Marcos owns and operates two above-ground storage tanks for Jet-A and one 100LL Avgas storage. Fuel storage totals 24,000 gallons and includes 12,000 gallons for Jet-A fuel and 12,000 gallons for Avgas fuel in separate tanks. Berry Aviation owns and operates two 10,000 gallon storage tanks, one for Jet A and one for 100LL.

Fuel storage requirements are typically based upon maintaining a two week supply of fuel during an average month, however, more frequent deliveries can reduce the fuel storage capacity requirement.

Future Avgas and Jet-A storage requirements for the airport based upon a two week supply during the peak month will likely exceed the existing storage capacities. It is anticipated that additional Jet-A fuel storage will be needed through the planning period. Avgas storage is anticipated to be adequate until intermediate term planning horizon activity levels. Facility planning will consider the installation of another two 12,000 gallon storage tanks, one for Jet A fuel and one 12,000 gallon storage tank for Avgas fuel. The construction of the new tanks could be by the City or a FBO.

Automobile Access

The airport is provided direct access from State Highway 21 (Airport Highway) to the west by Airport Drive. Airport Drive is a two-lane, asphalt road until it reaches the terminal building parking lot. As it continues east, it becomes a one-lane road and continues to the apron adjacent the CAF. Airport Drive is aligned in somewhat a circuitous manner. Analysis to be conducted in the next chapter will consider providing a more direct road and will attempt to provide better access in the eastern portion of the terminal area.

Airport Drainage And Sanitary Sewer

As discussed in the first chapter, the airport is served by an antiquated sanitary sewer and drainage system originally constructed by the military. The sanitary sewer is constructed of tile. The City has recently begun study

of the sewer and drainage systems at San Marcos. Initial findings indicate that the existing system is serviceable but in the need of repairs. Capital improvement projects, to be presented later, will discuss funding needs to repair the systems.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet potential aviation demands projected for San Marcos Municipal Airport through the long term planning horizon. The next step is to develop a direction for development to best meet these projected needs. The remainder of the master plan will be devoted to outlining this direction, its schedule, and costs.

Chapter Four
AIRPORT DEVELOPMENT ALTERNATIVES

Airport Development Alternatives

Prior to defining the development program for the airport it is important to consider development potential and constraints. In this chapter a series of airport development scenarios are considered for the airport to satisfy the projected demand through the planning period. Alternatives will also identify the highest and best uses for airport property, taking into consideration existing physical constraints and appropriate federal design standards, where appropriate. The alternatives analysis is an important step in the planning process since it provides the underlying rationale for the final master plan recommendations.

Any development proposed for a master plan is evolved from an analysis of projected needs for a set period of time. Though the needs were determined by the best methodology available, it cannot be assumed that future events will not change these needs. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands through the planning period.

The possible combination of alternatives can be endless, so some intuitive judgement must be used to identify the alternatives which have the greatest potential for implementation. The evaluation of alternatives is a process of deciding which options are most compatible with the goals and objectives of the city of San Marcos, airport users, and nearby residents. After the evaluation process, a selected airport concept can be transformed into a realistic development plan.

While the focus of the analysis summarized in this chapter is

identifying future development options for San Marcos Municipal Airport, it is also important to consider the impacts of alternatives to developing the airport to meet future demands. These include: 1) no future development at the airport (no action alternative); 2) transferring aviation demand to another airport; and 3) construction at a new airport site.

DO-NOTHING ALTERNATIVE

The do-noting, or "no action" alternative essentially considers keeping the airport in its present condition and not providing for any type of improvement to the existing facilities to accommodate future demand. The primary results of this alternative would be the inability of the airport to satisfy the projected aviation demands of the airport service area as well as experience additional economic growth through the development of viable parcels of land.

The airport's aviation forecasts and the analysis of facility requirements indicated a potential need for runway extension(s), runway closure(s), accommodations to meet Federal Air Rules (F.A.R.) Part 139, new instrument approach procedures, and expanded terminal and hangar facilities. Without these improvements to the airport facilities, regular and potential users of the airport would be constrained from taking maximum advantage of the airport's air transportation capabilities.

The unavoidable consequences of the "no action" alternative would involve the airport's inability to attract potential airport users and expand economic development in the city of San Marcos. It will be imperative that the airport plan facilities to meet F.A.R. Part 139 standards. Within the near future, new Federal rulemaking will require the airport to meet F.A.R. Part 139 standards to accommodate Berry Aviation's operation. Also, corporate aviation plays a major role in the transportation of business leaders. Thus, an airport's facilities are often the first impression many corporate officials will have of the community. If the airport does not have the capability to meet terminal, hangar, apron, or airfield needs of the potential users, the airport's capabilities to accommodate businesses that rely on air transportation will be diminished.

As detailed in Chapter Two, **Aviation Demand Forecasts**, corporate aviation is becoming an increasing larger portion of total general aviation activity. Even if additional F.A.R. Part 139 operators do not base at San Marcos, the airport will require additional improvements to serve its primary users including Berry Aviation and other corporate general aviation users. Without regular maintenance and additional improvements, potential users and business for the local area could be lost. To propose no further development at the airport would be inconsistent with local community goals to expand the economic development of the city of San Marcos.

TRANSFER AVIATION SERVICES

Transferring aviation services to another airport essentially considers limiting development at San Marcos Municipal Airport and relying on other airports to serve aviation demand for the local area. There is one commercial service and three general aviation airports within 30 nautical miles of San Marcos Municipal Airport.

Austin Bergstrom International Airport is located 20 miles north/northeast of San Marcos. Bergstrom, a former military air base, is now served by several major commercial carriers and most commercial cargo carriers. After closure of Austin Mueller and Executive airports, general aviation aircraft within the city of Austin had very few options left. San Marcos Municipal and Georgetown Municipal Airports are the only remaining relievers to Austin Bergstrom International Airport. Some general aviation aircraft have based at Bergstrom, however, relatively high lease rates have caused the majority of general aviation aircraft look to other Austin area airports. As detailed in the aviation forecasts, San Marcos based aircraft has nearly doubled since the closure of Austin Mueller and Executive Airports. Given the operation and function of Bergstrom, it is very likely that general aviation aircraft will continue to base at other airports including San Marcos.

The remaining three airports located at New Braunfels, Lockhart, and Lulimg would not pose any benefits for transfer. New Braunfels would provide the nearest matching facilities, but is limited by a 5,300-foot runway. Lockhart and Carter Airports currently provide significantly less utility and facilities.

Considering that comparable aviation facilities are not readily available to accommodate the demand from San Marcos Municipal Airport, it cannot be expected that these airports could fulfill the role that San Marcos Municipal Airport provides to the local and extended regional area. With the facilities in place at San Marcos Municipal Airport, it would not be prudent to consider shifting demand to another local airport to fulfill the long term aviation needs of the San Marcos area. Shifting demand would further hamper economic growth in the San Marcos area and would serve as a significant inconvenience to airport users. In fact, transferring demand would actually be a detriment to the city of San Marcos, the aviation community, and the state aviation system as a whole. As new industries in the community begin to emerge and existing businesses expand, there will be a need for a highly functional airport. This role is not easily replaced by another area airport.

CONSTRUCTION OF A NEW AIRPORT SITE

The alternative of developing an entirely new airport facility to meet the aviation needs of the local area can also been considered. This would essentially consider abandoning the existing airport site and replacing the existing facilities with comparable facilities in a new location.

Development at a new airport site could have some advantages. A new airport site could be chosen which could more centrally locate the airport to the airport service area. However, this will likely require moving it further from the downtown area and Interstate 35 which reduces the existing convenience of the airport, especially for corporate air travelers.

The development of a new airport is generally considered when an airport reaches capacity and it is cost prohibitive to expand the existing facility. San Marcos Municipal Airport encompasses over 1,000 acres, with much presently undeveloped. The facility needs evaluation did not indicate that the airport would be severely congested. Therefore, at the present time the capacity of the existing airport has not been reached. It is reasonable to assume that at some point in the future, the existing airport site could be maximized.

Constructing an entirely new airport can be a very difficult and costly action, requiring a tremendous financial commitment of funds for land acquisition, site preparation and the construction of new airport facilities. The closing of the existing airport site would mean a loss of the substantial public and private investments in the existing facility which may only be partially recovered through the sale of the existing airport. This could put a significant burden on existing tenants of the airport to replace existing facilities. From social, political and environmental standpoints, extensive justification would be needed to follow this alternative. A detailed and lengthy study process, beyond the scope of this Master Plan, would need to be completed to prepare sufficient justification of the need for a new facility, its benefits, and its costs.

Extensive environmental review on both the state and federal levels would be necessary as well. This would definitely involve the development of an Environmental Assessment, and quite possibly an Environmental Impact Statement (EIS), before final site approval could be given.

The public sentiment towards new airports in the last few years has been very negative, primarily because a new airport normally requires the acquisition of several large parcels of privately-owned land. Furthermore, the development of a new airport similar to San Marcos Municipal Airport would likely take 10 to 15 years to become a reality and cost over $100 million. The potential exists for significant environmental impacts associated with disturbing a large land area when developing a new airport site.

With continued improvement, San Marcos Municipal Airport should be capable of accommodating the project aviation demands of the San Marcos area through the planning period of this Master Plan. The airport should be developed in response to those demands. The airport has the potential to continue to develop as a quality airport that could greatly enhance the economic development of the community. Therefore, it is necessary to consider a series of development alternatives for the airport to satisfy projected demands and to improve the ability of the airport to foster additional

economic growth for the City of San Marcos.

AIRPORT DEVELOPMENT OBJECTIVES

It is the overall objective of this effort to produce a balanced airside and landside complex to serve forecast aviation demands. Before defining and evaluating specific alternatives, however, airport development objectives should be considered. The City of San Marcos provides the overall guidance for the operation and development of the San Marcos Municipal Airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of its users. With this in mind, the following development objectives have been defined for this planning effort:

- Develop an attractive, efficient, and safe aviation facility in accordance with federal and state safety regulations.

- Develop facilities to efficiently serve F.A.R. Part 139, corporate, and other general aviation users and encourage increased use of the airport.

- Provide sufficient airside and landside capacity through additional facility improvements that will meet the long term planning horizon level of demand of the area.

- Develop a plan environmentally compatible and acceptable to the local area residents.

- Target local economic development through the development of available property.

The remainder of the chapter will describe various development alternatives for the airside and landside facilities. Within each of these areas, specific facilities are required or desired as generally depicted on **Exhibit 4A**. Although each area is treated separately, planning must integrate the individual requirements so that they complement one another.

AIRFIELD ALTERNATIVE CONSIDERATIONS

Airfield facilities are, by nature, the focal point of the airport complex. Because of their primary role and the fact that they physically dominate airport land use, airfield facility needs are often the most critical factor in the determination of viable airport development alternatives. In particular, the runway system requires the greatest commitment of land area and often imparts the greatest influence of the identification and development of other airport facilities. Furthermore, aircraft operations dictate the FAA and TxDOT design criteria that must be considered when looking at airfield improvements. These criteria, depending upon the areas around the airport, can often have a significant impact on the viability of various alternatives designed to meet airfield needs. The following describes in detail the specific requirements considered in the development of the airfield alternatives to follow.

RUNWAY ORIENTATION

Once a military airfield, San Marcos Municipal currently operates four runways. The longest is Runway 8-26 providing 6,330 feet. Runway 12-30 is the airport's primary runway being served by an instrument landing system (ILS) on Runway 12. Runway 12-30 provides 5,603 feet operational length.

Analysis provided in the previous chapter indicated that the airport's current configuration provides more than adequate wind coverage. Due to costs associated with maintaining the pavements of all four runways, it has been recommended that at least one runway be closed. Wind analysis indicates that Runway 17-35 provides the best wind coverage, followed by Runway 12-30. It should be noted that wind analysis does not fully quantify runway usage. Each pilot will choose a runway first based on winds. If crosswinds are not excessive, a pilot may choose a runway based on its location, limiting taxi times. Although Runway 4-22 provides the least wind coverage of the four existing runways, it still provides adequate crosswind coverage nearly 85 percent of the time.

The decision to close any runway at the airport must consider first wind coverage, but should also consider other factors such as location, distance from terminal facilities, cost to maintain, etc. The goal is to ultimately provide the pilot with the best airfield configuration for wind and convenience, while providing the City with an airfield which is affordable to maintain. Balancing these factors will best serve both airport users and the City of San Marcos. Each alternative discussion will detail the positive and negative aspects of keeping each runway.

RUNWAY LENGTH

Analysis in the previous chapter indicated that the runway system provides adequate length for small airplanes, but falls short of the requirements for the full range of business aircraft which are forecast to operate at the airport. The analysis also indicated that a longer runway length would be required to accommodate charter and business jet aircraft.

The airport is currently home to four business jets. Berry Aviation, a corporate charter operator, currently operates 16 Metroliners. The airport is also home to a Beech King Air. Based aircraft currently fall within FAA design category of airport reference code (ARC) B-II. The airport also serves many other transient business jets up to the Gulfstream IV (G-IV) aircraft. The G-IV is a ARC D-II aircraft.

Analysis in the previous chapter indicated that the primary runway should ultimately be 7,000 feet to accommodate the full range of corporate and charter aircraft forecast to base or use the airport on a regular basis. The alternatives will consider extensions to 7,000 feet for each runway.

The previous chapter also indicated that at least one crosswind runway be planned for 5,600 feet. This length would exceed the needs of ARC B-II aircraft, but would better situate the airport for periods when the primary runway is closed. If a third runway is

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AIRFIELD CONSIDERATIONS

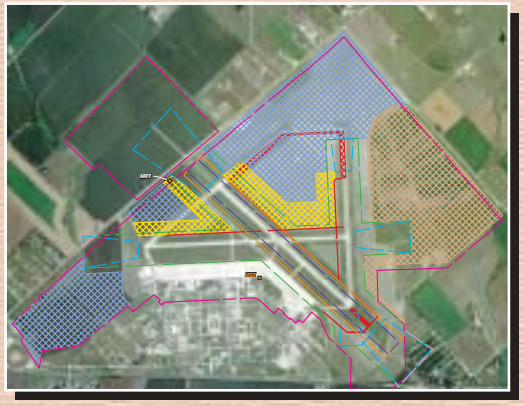
- Runway safety area standards
- Extension of runway(s) to meet critical aircraft needs
- Closure of runway(s)
- F.A.R. Part 139 requirements
- Additional instrument approaches
- Improvements providing increased capacity for the long term

GENERAL AVIATION CONSIDERATIONS

- Evaluate optimum location for ATCT
- Provide optimum locations for ARFF
- Provide area for new storage hangar development
- F.A.R. Part 139 requirements

LAND USE CONSIDERATIONS

- Identify highest and best use of airport property
- Specify areas needed for aviation purposes
- Ensure adequate property is available for development beyond scope of this plan
- Indicate areas which can be developed for non-aviation purposes
- Provide the city with a land use plan which will aid the City, airport users, and the community in meeting economic goals
- Provide methods for achieving compatible land uses in areas surrounding the airport.



San Marcos MUNICIPAL AIRPORT

Exhibit 4A
ALTERNATIVE
DEVELOPMENT CONSIDERATIONS

maintained, a 4,000 foot length is adequate. This runway could be utilized specifically for training operations and operations by small aircraft exclusively. Keeping a third runway at a shorter length would be less expensive than maintaining three at current lengths.

RUNWAY WIDTH

Runway 12-30 is currently 150 feet wide, while the other runways are 100 feet wide. FAA and TxDOT standards call for a width of 100 feet to meet ARC D-II standards. If Runway 12-30 were kept as the primary runway, however, it could be more costly to narrow the runway and move the runway lights as opposed to maintaining it at 150 feet. A benefit/cost analysis will need to be done at the time of the next maintenance project to determine if it should be narrowed, especially if this runway is to be extended. The selected crosswind runway should be maintained at a width of 100 feet. If a third runway is kept, it could be reduced to 75 feet to serve small aircraft exclusively. This could be done by simply maintaining and marking the center 75 feet of the runway.

RUNWAY PAVEMENT STRENGTH

All four runways are constructed of asphalt. Runway 8-26 provides the greatest single wheel gear loading (SWL) strength at 80,000 pounds. Runway 12-30 is strength rated at 60,000 pounds SWL. Runways 4-22 and 17-35 provide much less strength rated at 15,000 pounds SWL and 20,000 pounds SWL, respectively.

In order to accommodate corporate and charter general aviation aircraft, the primary runway at the airport should be strength rated at least 75,000 pounds dual wheel gear loading (DWL). The strength of Runways 8-26 and 12-30 are adequate to meet this requirement. Runways 4-22 and 17-35 would need to be strengthened if either were chosen as the primary or crosswind runway. If a third runway is kept, it should be maintained at 12,500 pounds SWL.

RUNWAY SAFETY AREAS

The design of airfield facilities includes both the pavement areas to accommodate landing and ground operations of aircraft as well as imaginary safety areas to protect aircraft operational areas and keep them free of obstructions would could affect the safe operation of aircraft at the airport The imaginary safety areas include the: runway safety area (RSA) and object free area (OFA).

The FAA defines the OFA as "a two dimensional ground area surrounding runways, taxiways, and taxilanes which is clear of objects except for objects whose location is fixed by function (i.e. airfield lighting)." The RSA is defined as "a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway."

Furthermore, the FAA has placed a higher significance on maintaining adequate RSAs at all airports due to

recent aircraft accidents. Under Order 5200.8, effective October 1, 1999, the FAA established a Runway Safety Area Program. The Order states, "The goal of the Runway Safety Area Program is that all RSAs at federally obligated airports and all RSAs at airports certificated under 14 CFR part 139 shall conform to the standards contained in Advisory Circular 150/5300-13 Airport Design, to the extent practical". Under the Order, each regional airports division of the FAA is obligated to collect and maintain data on the RSA for each runway at federally obligated airports. The FAA is in the process of visually inspecting the RSAs at each federally obligated airport. In Texas, TxDOT has been given the responsibility to administer and inspect the RSAs at the state's general aviation airports.

As mentioned in Chapter Three, all runway ends currently conform to FAA's design criteria for RSA. The RSA for a C/D-II runway extends 250 feet each side of the runway centerline and 1,000 feet beyond each runway end. The OFA extends 400 feet each side of the runway centerline and 1,000 feet beyond each runway end. FAA standards require these areas to be under the control of the airport to ensure that these areas are kept clear of objects which could be hazardous to aircraft operations. The RSA for a B-II runway is 150 feet wide and extends 300 feet beyond the ends of the runway. The OFA for a B-II runway is 500 feet wide extending 300 feet beyond the runway ends.

RUNWAY PROTECTION ZONES/ INSTRUMENT APPROACHES

Another consideration is the FAA requirement for cleared approaches. The runway protection zone (RPZ) is a trapezoidal area centered on the runway typically beginning 200 feet beyond the runway end. The RPZ is a two-dimensional area and has no associated approach surface. FAA design standards limit the types of development within the RPZ to development which is compatible to aircraft operations. FAA design standards limit residential and other types of development which can cause the congregation of people on the ground. Typically, compatible development includes agricultural land uses, golf courses (although consideration is being given to limiting golf course development due to bird strike considerations) or surface parking lots and roadways.

The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses in order to enhance the protection of approaching aircraft as well as people and property on the ground. The dimensions of the RPZ vary according to the visibility minimums serving the runway and, in some instances, the type of aircraft operating on the runway.

The FAA and TxDOT does not necessarily require the fee simple acquisition of the RPZ area, but recommends that airports maintain positive control over development

within the RPZ. It is preferred that the airport own the property through fee simple acquisition, however, avigational easements (providing control of designated airspace within the RPZ) can be pursued if fee simple purchase is not possible. It should be noted, however, avigation easements can often cost as much as 80 percent of the land value and may not fully prohibit incompatible land uses from the RPZ. Also, the area encompassed by the RPZ envelopes the required RSA, OFA, and areas needed for installation of approach lighting systems, all of which would be required to be located on property owned in fee simple.

The RPZ for Runway 12 is for lower than three quarters of a mile visibility because of the existing ILS approach. This RPZ has an inner width (also known as the primary surface) of 1,000 feet, outer length of 1,750 feet, and an overall length of 2,500 feet. No other runway is currently served by an instrument approach, thus current runway protection zones are for visual conditions.

Future planning will include additional instrument approaches. The primary runway should provide at least one approach with lower than three quarters of a mile visibility, while the opposite end should consider at least one mile visibility. The crosswind runway(s) should be planned for GPS approaches providing not lower than one mile visibility.

It is important to note that for any approach providing lower than one mile visibility the RPZ's inner width increase from 500 feet to 1,000 feet. Federal Air Regulation (F.A.R.) Part 77 establishes the height and hazard criteria for facility development both on and off airport. F.A.R. Part 77 has established a primary surface which is equal to the inner width of the RPZ. The primary surface is an area which can have no facility development unless the facility is fixed by navigational function (eg. lighting, ILS antenna, signage, etc). F.A.R. Part 77 further requires that obstacles be placed to the side of the primary surface at a seven-foot lateral to one-foot horizontal increasing slope. For example, a ten foot obstacle would need to be at least 570 feet to the side of runway centerline (500 feet for the primary surface, then out 70 feet for the seven to one slope). This slope is called the transitional surface and is what is used to define the building restriction line (BRL).

Typically, airports such as San Marcos Municipal Airport set the building restriction line at 35 feet. Thus, planning for the primary runway should consider that the BRL would be 745 feet to either side of runway centerline. For the crosswind runway(s), the BRL should be planned at 495 feet to the side of centerline for a visual or not lower than one mile visibility approach.

TAXIWAYS

The taxiway system at San Marcos Municipal Airport is adequate to meet current operational needs. As aviation demand increases and a need to develop aviation facilities is realized, additional taxiways will be needed to enhance operational efficiencies. Details of specific taxiway improvements will be discussed with each alternative.

LANDSIDE ALTERNATIVE CONSIDERATIONS

The primary landside facilities to be accommodated at San Marcos Municipal Airport include aviation related facilities such as the terminal spaces, aircraft storage and maintenance hangars, aircraft parking apron, and parcels specifically designed to accommodate businesses requiring airfield access. Also, specific consideration needs to be given to F.A.R. Part 139 requirements and the location of an airport traffic control tower (ATCT). The prime focus on F.A.R. Part 139 requirements will be the construction and operation of an aircraft rescue and firefighting (ARFF) station. The interrelationship of these functions is important to defining a long term landside layout for the airport.

To a certain extent landside uses should be grouped with similar uses or uses that are compatible. Other functions should be separated, or at least have well defined boundaries for reasons of safety, security, and efficient operation. Finally, each landside use must be planned in conjunction with the airfield, as well as ground access that is suitable to the function.

Runway frontage should be reserved for those uses with a high level of airfield interface, or need for exposure. Other uses with lower levels of aircraft movements, or little need for runway exposure can be placed in more isolated locations.

In addition to the functional capability of the airport, the proposed development concept should provide a first class appearance for San Marcos Municipal Airport. Consideration to aesthetics should be given to the entryway as well as public areas when arranging the various activity areas. Architecturally pleasing buildings and landscaping, as well as corporate aircraft found in the high activity areas should be featured in these areas when possible.

Typically, airports face development constraints of one degree or another because of their basic function, causing the alternatives analysis to focus upon specific layouts of landside facilities. Only half of available property at the airport is developed. Since the growth of aviation facilities at the airport is expected to absorb only a limited amount of the existing land area which is available, it is possible to consider alternate land uses at the airport to include aviation-related commercial development and non-aviation related commercial development.

The airport planning efforts should maximize existing property in an efficient manner that will serve demand well beyond the 20-year planning period as well as provide flexibility for marketing and development. The plan should also consider development of property which will aid in the community's economic growth and financial viability of the airport itself. Maximizing the use of airport property will provide the airport with the financial means to be self sufficient and the community with an "economic engine".

In order to provide a functional facility which meets all potential development needs, areas best suited for specific

development should be identified. First, essential development elements to serve airfield, passenger airline, and general aviation needs must be considered which includes support functions such as airport maintenance, ARFF, and fuel storage. Then areas for other land uses can be considered such as aviation-related commercial development.

As a result of the many options available for developing land at San Marcos Municipal Airport, the airport is open to planning efforts which maximize existing property in an efficient manner. Because of this, the landside alternatives to follow will indicate land use areas. Attention will be given to providing areas to accommodate long term demand and provide economic development opportunities for the airport and local community.

Following a review of the development alternatives by the Planning Advisory Committee, the public, and city officials a land use plan will be developed which defines the highest and best uses for property at San Marcos Municipal Airport considering functional needs, regulatory requirements and development potential and needs.

LAND USE CONSIDERATIONS

The primary landside functions to be accommodated at San Marcos Municipal Airport include: general aviation terminal area, terminal support, general aviation storage and service facilities, ATCT, ARFF, and aviation related and non-aviation related commercial development.

Considering only landside development, all facilities lie on the south side of the airport. The terminal area has been developed to primarily align with Runways 8-26 and 12-30. This development is concentrated in the western portion of the airfield.

The airport has an abundance of property on the north and east sides of the airport. It is reasonable to assume that much of the property immediately to the east of the existing terminal area and on the north side of the airport will be needed to meet aviation demand for the next twenty years. Some property will not be needed within the scope of this plan for aviation facilities, but should be reserved for aviation facilities in the future. The remaining property, not planned for use in this plan or reserved for aviation facilities in the future can be developed for non-aviation purposes. Non-aviation purposes could include light industrial or all forms of commercial uses.

TERMINAL AREA FACILITIES

The orderly development of the airport terminal area can be the most critical, and probably the most difficult development to control on the airport. A terminal area development approach of taking the path of least resistance can have a significant effect on the long term viability of an airport. Allowing development without regard to a functional plan could result in a haphazard array of buildings and small ramp areas, which will eventually preclude the most efficient use of the valuable space along the flight line.

Planning for activity in the terminal area can be divided into three areas. The high activity area is the area providing aviation services on the airport. The aircraft parking apron provides for outside storage of aircraft and circulation of aircraft. The airport terminal building and large conventional hangars housing corporate aviation departments or storing a large number of aircraft would be considered a high activity use. A conventional hangar structure in the high activity area should be a minimum of 10,000 square feet. The best location for high activity areas is along the flight line near midfield for ease of access to all areas of the airfield.

The medium activity use defines the next level of airport use and primarily includes smaller corporate aircraft that may desire their own conventional hangar storage on the airport. A conventional hangar structure in the medium activity use area should be at least 50 by 50 feet or a minimum of 2,500 square feet. The best location for medium activity use is off the immediate flight line but readily accessible. Parking and utilities such as water and sewer should also be provided in this area.

Low activity use defines the area for storage of smaller single and twin engine aircraft. Low activity users are personal or small business aircraft owners who prefer individual space in shade or T-hangars for aircraft storage. Low activity area should be located in less conspicuous areas. This use category will require electricity but generally does not require water or sewer utilities.

In addition to the functional compatibility of the terminal area, the proposed development concept should provide a first class appearance to San Marcos Municipal Airport. Consideration to aesthetics should be given to the entryway as well as public areas when arranging the various activity areas.

Ideally, terminal area facilities at general aviation airports should follow a linear configuration parallel to the primary runway. The linear configuration allows for greater depth maximizing space available for aircraft parking apron while providing ease of access to terminal facilities from the airfield. The terminal area has been developed parallel to both runways were applicable.

AIRPORT TRAFFIC CONTROL TOWER

The previous chapter indicated that long term operational levels will still fall short of providing full justification for grant in aid from the FAA to build an ATCT. The benefit-cost ratio needed for full funding from the FAA is one (1.0). Current operational estimates yields a benefit-cost ratio of 0.65. Long term operations would yield a benefit-cost ratio of 0.99. TxDOT, however, has a program to provide 50 percent matching funds for the construction of control towers.

FAA has initiated a program for partially funding the operational cost based on the benefit-cost ratio. For ratios under 1.0, FAA could provide funding in the amount of the difference

between the existing benefit-cost ratio and 1.0, or 100. For example, the FAA would provide 65 percent operational funding for current operations. In the long term, however, if funding for the construction of a tower can be secured from TxDOT, the city could receive full staffing costs for operating the tower from the FAA. The alternatives illustrated in the next section will depict alternative locations for the construction of an ATCT.

ARFF FACILITIES

As detailed in the previous chapter, new rulemaking under F.A.R. Part 139 will likely require San Marcos Municipal Airport to provide ARFF services as a Category IV airport. This need will be prompted by the use of the airport by Berry Aviation.

Due to this requirement, alternative analysis must consider the construction of an ARFF facility on or adjacent to the airport. As discussed in the previous chapter, ARFF services do not necessarily have to be located on the airport. It is possible that a station could be constructed near the airport and be shared with the city/county. This location could serve both community and airport needs.

The new rulemaking will require that San Marcos ARFF meet "Index A" standards. "Index A" includes aircraft less than 90 feet in length and requires one vehicle carrying at least the following:

1) 500 pounds of sodium-based dry chemical or halon 1211; or
2) 450 pounds of potassium-based dry chemical and water with a commensurate quantity of Aqueous Film Forming Foam (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF foam application.

The ARFF vehicle would need to be stored in a location that would permit adequate response time to an emergency under requirements of Part 139. Regulations require that at least one vehicle must be capable of reaching the mid-point of the farthest runway within three minutes. If the station is located off-airport, the ARFF vehicle may need to be moved to the airport during operations bound by Part 139 requirements.

LAND USE COMPATIBILITY

Land use compatibility, both on and off airport has become a significant factor in airport planning. As detailed previously, aviation demand projections are utilized to outline the specific facilities required to meet the projected demand. In most cases, airport plans are focused on the development of areas within the bounds of airport property. The key to the long term success of an airport, however, can also rely on proper planning of areas surrounding the airport.

Due to a lack of proper planning, many airports across the country have been surrounded with areas not necessarily compatible with airport operations. The best land use for areas immediately surrounding an airport is open or agricultural. A good use for areas near

an airport is commercial or industrial uses which can serve as a "buffer" zone. Uses which place large congregations of people near the airport for extended periods of time or uses which would be sensitive to operational noise are the least desirable near the airport.

Often times, communities have bowed to developmental pressures to allow uses such as residential, schools, or other uses which are not ideal in close proximity to an airport. In some cases, these airports have become significantly constrained or limited in providing facilities necessary to meet demand because of these conflicting land uses.

The San Marcos Airport is currently situated with most properties surrounding the airport utilized for agricultural purposes. Sparse residential development, however, has occurred near the airport. Future planning should consider local planning and zoning measures that will ensure the long term viability of the airport.

San Marcos Municipal Airport lies approximately eight miles east of the downtown business district. The airport is within the corporate limits of the city, however, most areas, beyond the airport boundary, lie outside of city control in Hays and Caldwell counties.

The most effective means of controlling areas outside of airport proper is to have controlling interest and/or jurisdictional control over the zoning and planning of these properties. This would require the full purpose annexation of areas surrounding the airport. Annexation can have both positive and negative attributes.

Obviously, full purpose annexation would allow the city to effectively control land use zoning and planning, however, the city would be required to provide city services to the annexed areas. These services would be costly. The primary benefit associated with full purpose annexation is complete jurisdictional authority over zoning and land use planning.

It should be noted, however, that zoning and land use planning measures can change. There is no guarantee that if current City leaders choose to protect the airport with appropriate zoning and planning measures that future leaders will follow suit. This has been the case far to often with airports across the country.

Other measures short of full purpose annexation are at the disposal of the city to attempt to ensure adequate zoning and land use control. Limited purpose annexation would not require the immediate full purpose annexation of an area, but would provide the city with authority for land use regulation. This option has unclear procedural requirements which could be substantial, including a requirement to fully annex the area within two years. Another option is the Joint Airport Zoning Board currently in place. The joint zoning board is authorized under state law to regulate land through multi-jurisdictional cooperation. The negative aspect of this alternative is that the City representation is outnumbered by other jurisdictions which may hinder adequate controlling measures from being implemented.

The city has another option to fully regulate land uses (with regard to airport compatibility) for specific areas near the airport without the need for full purpose annexation if the city population reaches or exceeds 45,000. Currently, the city's population falls short of this threshold. The city could either wait until population growth reaches the threshold or act through full purpose annexation to envelop areas which will bring the population to the threshold. If near term planning is needed, annexation would likely be required which could be costly in terms of new services to be provided.

A final option is to allow the areas around the airport to remain unincorporated. It is unlikely that county land would be developed for significant residential areas due to the lack of services available from the county. The city could attempt to work with the surrounding jurisdictions to ensure that airport compatibility planning is considered. This method leaves the city with the least amount of control, but would not prohibit any future moves towards one of the aforementioned options available. It will be incumbent upon the city to proceed with a measure which meets the goals of both the citizens of San Marcos and the aviation community.

AIRPORT DEVELOPMENT ALTERNATIVES

The remainder of this chapter will detail airport development alternatives. Most planning efforts segregate airfield and landside elements within the alternative analysis. For this plan, however, it is necessary to first identify airfield configuration options available and then select an airfield configuration before a detailed landside concept can be developed. The goal of this analysis is to present alternative airfield scenarios and landside development areas which would correspond with the specified airfield configuration. Detailed landside facility development, such as hangar areas, will be presented in the next chapter once an airfield orientation is selected. Each alternative, however, will depict a potential ATCT and ARFF site.

AIRPORT ALTERNATIVE 1

The first alternative considers maintaining Runway 12-30 as the primary runway in the future. To serve in this role, extension potentials were examined. As previously mentioned, planning should consider providing 7,000 feet operational length on the primary runway.

As depicted on **Exhibit 4B,** Runway 12-30 is currently limited from providing 7,000 feet given existing airport boundaries. **Exhibit 4B** depicts Runway 12-30 at 6,400 feet, providing full RSA and OFA within airport property. State Highway 21 to the northwest and Reedville to the southeast pose extension constraints to Runway 12-30. This extension alternative would require, at a minimum the acquisition of approximately 14 acres of avigation easements in Reedville for the RPZ.

The city may choose to extend Runway 12-30 to 7,000 feet, however, this would significantly increase development costs. Either State Highway 21 would

have to be re-routed, or the city would need to acquire the properties in Reedville. Both of these choices would be extremely expensive and would outweigh the benefits of the extra 600 feet.

Alternative 1 considers maintaining Runway 8-26 in it present form as the ultimate crosswind, or secondary runway. This alternative also proposes maintaining up to 4,000 feet of Runway 17-35 for the use by small aircraft or as a training runway. The city could choose to maintain less for training purposes. The minimum length needed would be 3,300 feet. This alternative also considers the closure of Runway 4-22.

Several taxiway improvements are included in Alternative 1 both aimed at operational efficiency and the ultimate development of aviation facilities on the north side of the airport. As depicted on **Exhibit 4B**, new parallel taxiways are proposed on the north side of Runway 8-26, east side of Runway 12-30, and west side of Runway 17-35. These new taxiways would serve as a development guide for a north side flightline. Obviously, the existing parallel taxiway serving the south side of Runway 12-30 would need to be extended with the runway.

As previously discussed, the proposed layout in Alternative 1 would allow for the development of aviation facilities on the north side of the airfield. The yellow hatched areas depicted on **Exhibit 4B** indicate areas that could be developed for aviation facilities and services. These areas are primarily located adjacent to and nearest the runway/taxiway system. The aviation reserve areas depicted on the exhibit are more than adequate to meet aviation demand forecast for the planning period.

The remainder of airport property can be utilized to bolster revenue sources for the airport. The blue hatched areas on the exhibit depict areas which would be ideal for the development of commercial or industrial uses. The area south of the existing airport entrance road could be developed for the Foreign Trade Zone, while the areas north could be developed as suited for private enterprises. Obviously, these areas would need to be served by water, electricity, and sewer.

Alternative 1 proposes locating the ATCT on existing ramp, east of the new T-hangars. This location would provide controllers good view of all runways and taxiways. Alternative 1 also proposes the construction of an ARFF station adjacent State Highway 21, west of Runway 12. If this site were chosen, airfield access roads would need to be constructed which would allow for the passage of ARFF equipment.

AIRPORT ALTERNATIVE 2

The second development scheme proposes maintaining Runway 17-35 as the airport's primary runway. As depicted on **Exhibit 4C**, existing airport property bounds could provide adequate space for the extension of Runway 17-35 to 7,000 feet, including the northern RSA and OFA. To the south, however, approximately 19 acres of property would need to be acquired (in fee) from the Gary Job Corps to effectively control adequate areas for

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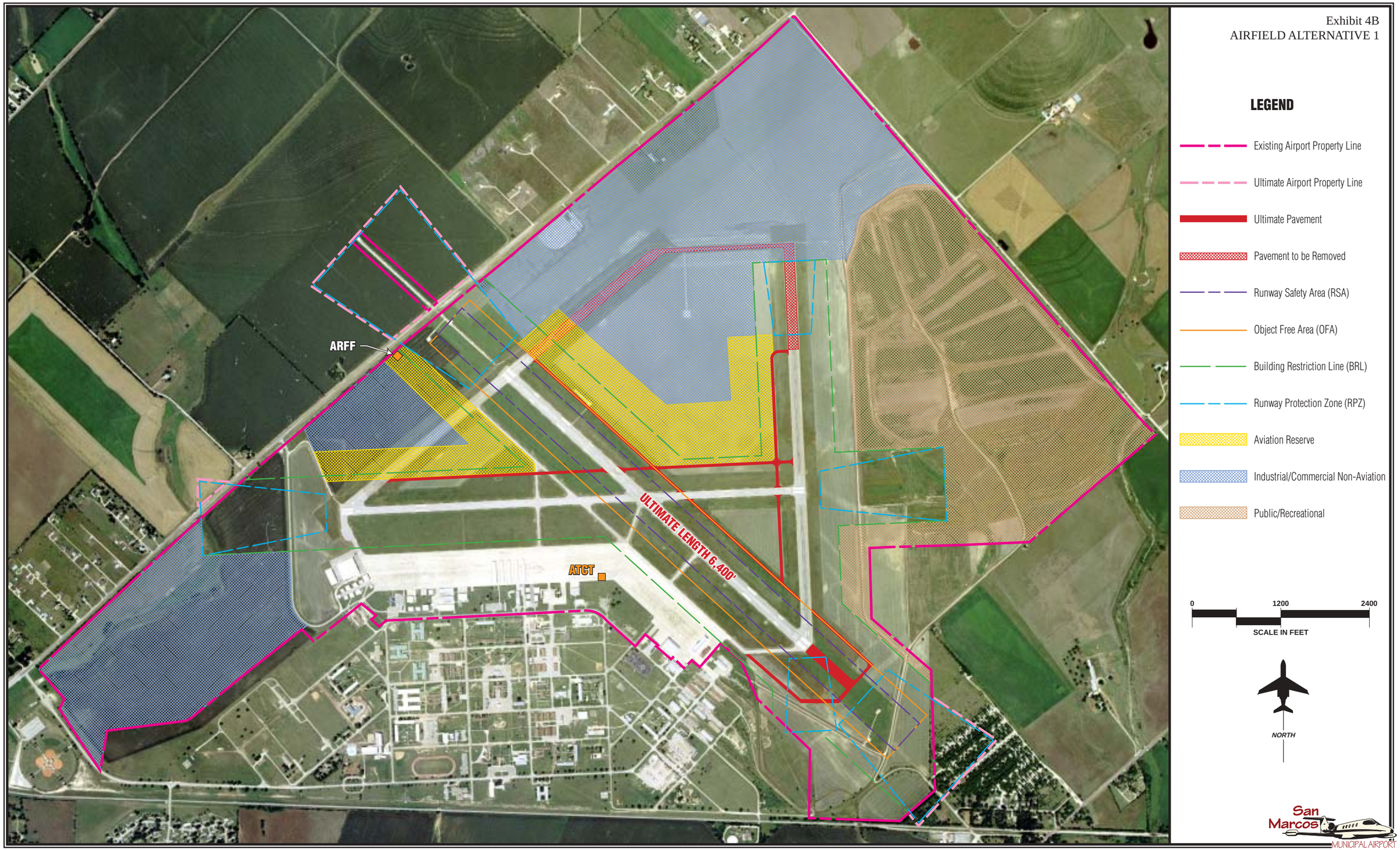

Exhibit 4B
AIRFIELD ALTERNATIVE 1

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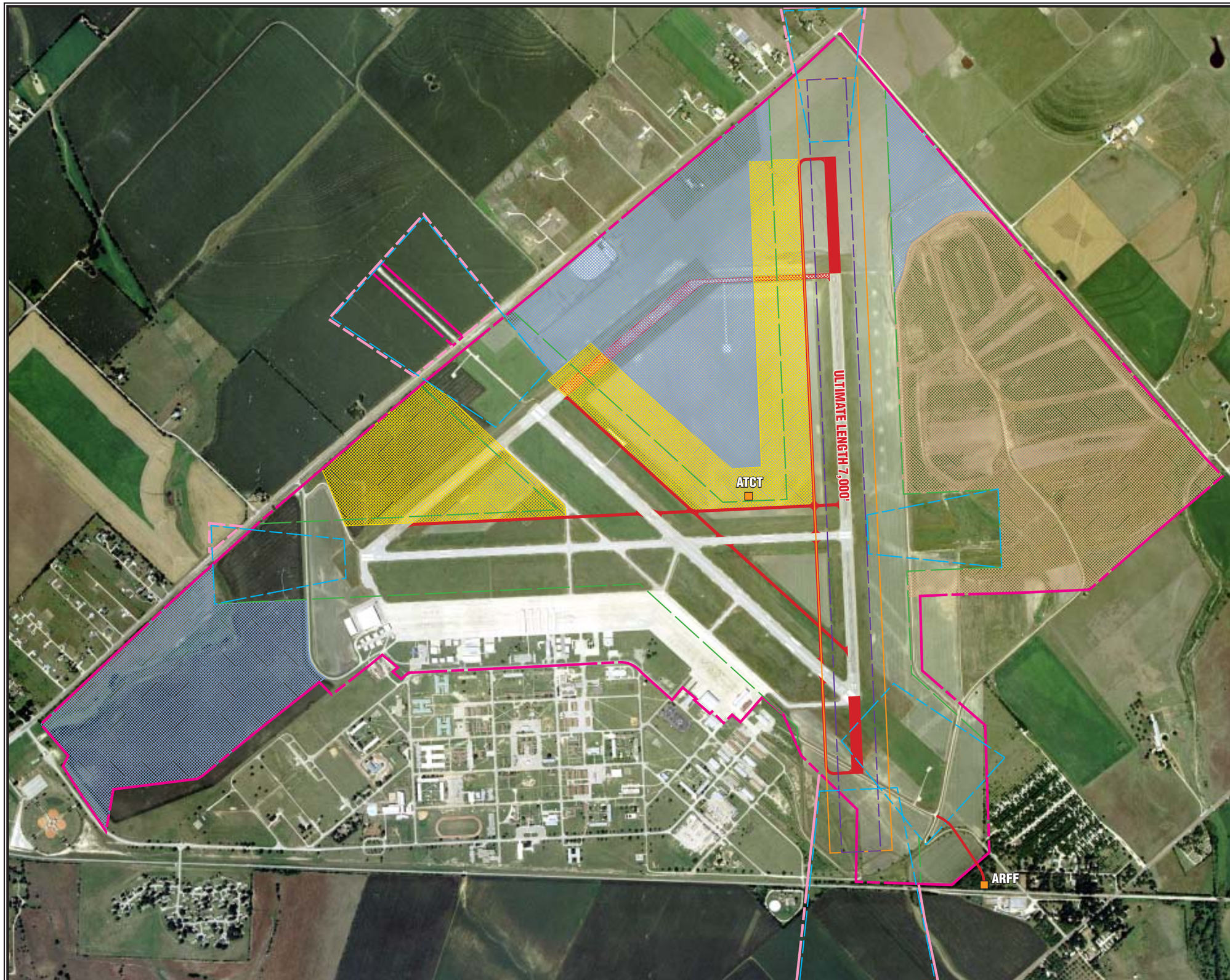
Exhibit 4C
AIRFIELD ALTERNATIVE 2



LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- Ultimate Pavement
- Pavement to be Removed
- Runway Safety Area (RSA)
- Object Free Area (OFA)
- Building Restriction Line (BRL)
- Runway Protection Zone (RPZ)
- Aviation Reserve
- Industrial/Commercial Non-Aviation
- Public/Recreational

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RSA and OFA. This alternative considers implementing a precision approach to Runway 35 and a visual or not lower than one mile approach to Runway 17. This alternative would require a minimum of 44 acres of property to the south and approximately 10 acres north to be acquired as avigation easement for the ultimate RPZ's.

Alternative 2 considers maintaining Runway 12-30 and Runway 8-26 as crosswind, or secondary runways and the closure of Runway 4-22. Ultimately, either Runway 8-26 or 12-30 could be closed if maintenance costs become prohibitive. Obviously, closure of Runway 8-26 would be the best choice when considering winds or instrument approach capabilities. Runway 8-26, however, provides more convenience than Runway 12-30. It is anticipated, however, that the overall good condition of pavements on both of these runways will not necessitate significant rehabilitation or reconstruction maintenance costs within the near future. Thus, if this alternative is selected, a decision on which runway would ultimately be closed could come after further study.

Similar to the previous alternative, Alternative 2 depicts the layout of new parallel taxiways on the north side of Runway 8-26 and 12-30, and on the west side of Runway 17-35. This layout considers the ultimate layout of three runways. If this alternative is chosen and the city opts to keep only two runways, one of the planned parallel taxiways would not need to be constructed.

The proposed development of Runway 17-35 as the airport's primary runway would spur the need to develop a new flightline along the runway. As depicted on **Exhibit 4C**, adequate area on the west side of the runway is available to develop an abundance of aviation facilities.

Consideration was given to the development of aviation facilities on the east side of Runway 17-35, however, previous use of the property may prohibit this potential. The area east of Runway 17-35 was utilized previously by the military as a landfill. Tests have been conducted in the area which indicates that there may be some environmental risks associated with development. Development would require additional environmental investigation. It is likely that development in this area would be extremely costly. The west side of the runway will be adequate for facility development well beyond the scope of this master plan. For these reasons, the area east of Runway 17-35 has been planned for open or recreational uses.

Alternative 2 also provides ample space for the development of non-aviation related development. As with the previous alternative, the area south of the airport entrance road could be developed for a Foreign Trade Zone. Other areas north of planned aviation reserve and at the northeastern corner of the airport could be developed for commercial or industrial purposes.

This alternative proposes two new locations for the ATCT and ARFF station. As depicted on **Exhibit 4C**,

this alternative proposes the construction of an ATCT north of the eastern portion of Runway 8-26. This location would provide adequate controller view of all movement areas. The ARFF station proposed in this alternative is southeast of airport property in Reedville. This location could be shared with Reedville, Caldwell County, and the airport. The exhibit depicts the construction of an access roadway so that ARFF equipment can access the airport. This location may not lend to adequate ARFF response times and could require the ARFF unit to be placed on stand-by at the airport during each charter operation.

AIRPORT ALTERNATIVE 3

The next airport alternative considers maintaining Runway 8-26 as the airport's primary runway. As depicted on **Exhibit 4D**, Runway 8-26 could be extended 400 feet west and 300 feet east while maintaining adequate RSA and OFA on existing airport property. Consideration was given to fully extending 700 feet east, however, concern with prior landfill use of this area could be costly. The eastern RPZ would be fully on airport property, however, approximately 69 acres west of State Highway 21 would need to be acquired (at least in easement) for the RPZ. The RPZ west of the runway considers a precision approach. If a lessor approach is implemented, a smaller RPZ would be required, and thus, less property acquisition.

As depicted on the exhibit, maintaining Runway 8-26 as the primary runway, including the implementation of a precision approach, will place the BRL atop Berry Aviation's main hangar. It is very likely that a precision approach would not be approved for Runway 8-26 (either end) unless Berry Aviation's facilities are removed, as they could be a flight hazard.

Alternative 3 considers maintaining Runway 12-30 as the airport's secondary runway and the closure of both Runway 4-22 and 17-35. The southernmost portion of Runway 17-35 could be utilized as a taxiway. This alternative proposes new parallel taxiways on the north sides of both Runway 8-26 and 12-30.

This alternative considers the development of aviation facilities on the north side of the runways, between the western intersection of the runways, and west of the existing terminal area. Developing aviation facilities west of the existing terminal area as depicted would require the construction of a new airport entrance road. **Exhibit 4D** depicts the construction of a new road which meet the existing road south of the terminal building. These areas will be more than adequate for aviation facility development to meet projected demand.

Non-aviation related development potential is greater in Alternative 3 than both previous alternatives. As depicted, closing both Runway 4-22 and 17-35 leaves a large parcel of land available for non-aviation purposes. The construction of a new entrance road to the south would segregate aviation and non-aviation uses. This area could be developed for the Foreign Trade Zone.

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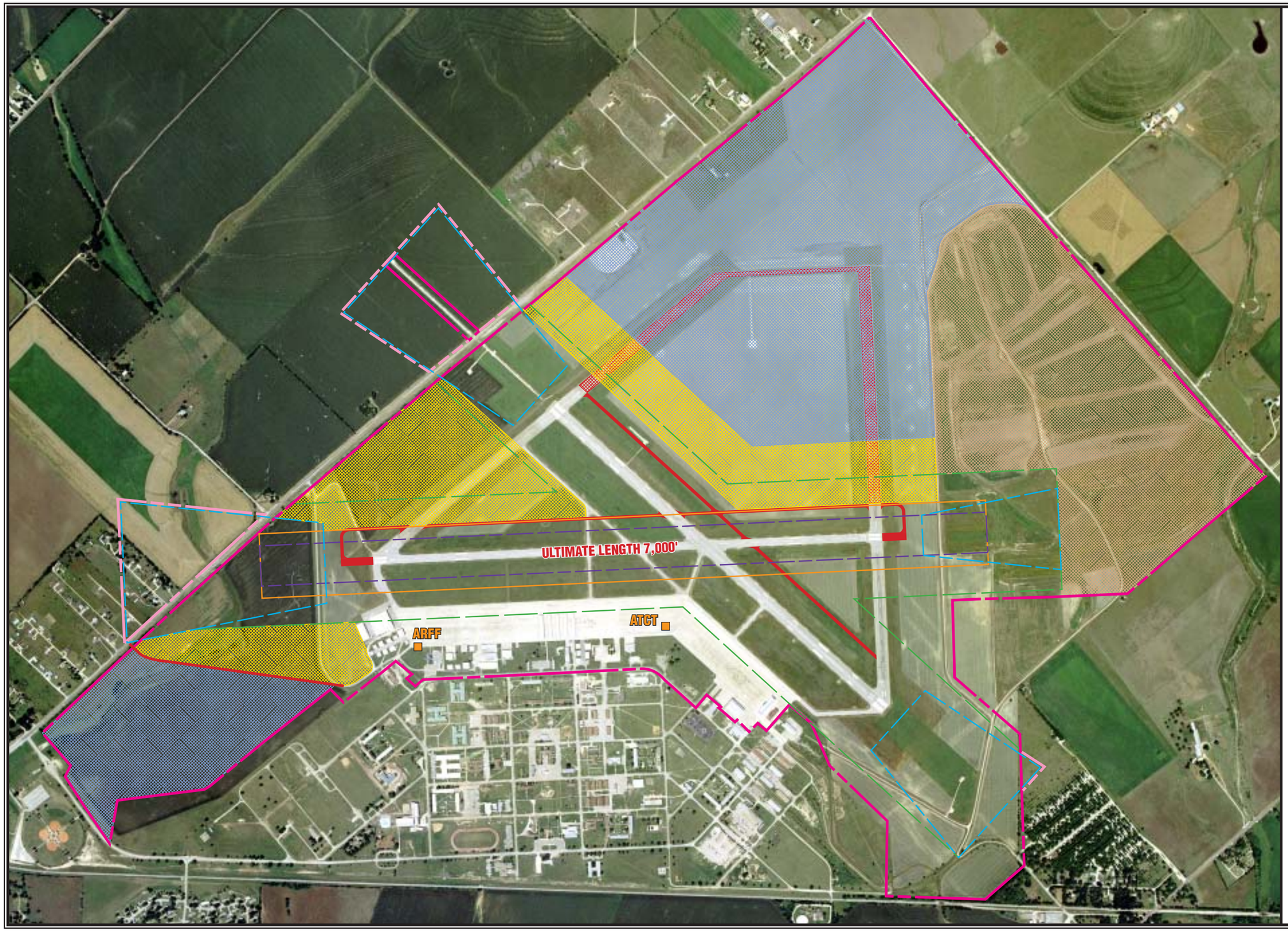

Exhibit 4D
AIRFIELD ALTERNATIVE 3

LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- Ultimate Pavement
- Pavement to be Removed
- Runway Safety Area (RSA)
- Object Free Area (OFA)
- Building Restriction Line (BRL)
- Runway Protection Zone (RPZ)
- Aviation Reserve
- Industrial/Commercial Non-Aviation
- Public/Recreational

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Alternative 3 considers the construction of an ATCT in the same location as Alternative 1. This site would provide adequate controller view of all movement areas. Alternative 3 considers the construction of an ARFF facility on airport, adjacent and west of the airport terminal building. This location would be ideal to serve short term needs given the location of Berry Aviation and good airfield access for this location.

AIRPORT ALTERNATIVE 4

The last airport development alternative considers maintaining Runway 4-22 as the airport's primary runway. As depicted on **Exhibit 4E**, adequate property is available to extend the runway 7,000 feet and maintain adequate RSA, OFA, and precision RPZ for Runway 4 on existing airport property. Approximately 17 acres of property would need to be acquired north of the airport for the Runway 22 RPZ.

Similar to the previous alternative, implementing a precision approach on Runway 4 would likely require the removal of Berry Aviation facilities. This alternative faces greater challenges in that Berry's facilities would be located within the primary surface of the runway. It is highly unlikely that any approach providing lower than one mile to Runway 4-22 would be approved unless Berry's facilities were relocated.

Similar to Alternative 2, this alternative also considers maintaining both Runway 8-26 and 12-30, at least in the near term. Due to maintenance costs, this alternative considers the closure of Runway 17-35. Runway 12 is depicted to maintain its precision approach, with Runways 8, 22, 26, and 30 all providing nonprecision approaches.

To provide operational efficiency a new parallel taxiway on both sides of Runway 4-22 would ultimately be needed. The parallel taxiway depicted on the east side of the runway would serve existing terminal facilities and the west side would be developed for proposed development of aviation facilities on the west side of the runway.

This alternative also proposes new parallel taxiways on the north side of Runways 8-26 and 12-30. Portions of Runway 17-35 are proposed to be utilized as taxiways for Runways 8-26 and 12-30.

Aviation related development reserve proposed in this alternative is located on both sides of Runway 4-22, and north of Runways 8-26 and 12-30. Adequate areas would be available for facility development. The RSA, OFA, and approach clearance to Runway 4 would require the construction of a new airport entrance road as depicted.

This alternative, however, would leave the airport with the least non-aviation development potential of all proposed alternatives. The Runway 4 precision RPZ would significantly reduce property available for Foreign Trade Zone development south of the entrance road. A small area northwest and a parcel east of the runways could be developed for commercial or industrial purposes.

Alternative 4 considers the construction of an ATCT on the west side of Runway 4-22. This location would provide good controller view of all movement areas. The ARFF station proposed in this alternative is adjacent and north of the existing airport entrance road.

AIRPORT DEVELOPMENT ALTERNATIVE SUMMARY

Each of the four proposed alternatives outlined in the previous section provides positive and negative attributes. In some cases, pieces of one alternative can be readily exchanged with another, yielding yet another option. Thus, the analysis provided by no means is an exhaustive list of developmental options, but they do provide adequate information for the formation of a recommended concept. **Table 4A** presents a summary of proposed alternatives and compared and contrasts the positive attributes of each alternative.

SUMMARY

The process utilized in assessing the airside and landside development alternatives involved a detailed analysis of short and long term requirements as well as future growth potential. Current airport design standards were considered at each stage of development.

Upon review of this report by the Planning Advisory Committee, the public, and city officials a final Master Plan concept can be formed. The resultant plan will represent an airside facility that fulfills safety and design standards and a landside complex that can be developed as demand dictates.

The proposed development plan for the airport must represent a means by which the airport can grow in a balanced manner, both on the airside as well as the landside, to accommodate forecast demand. In addition, it must provide (as all good development plans should) for flexibility in the plan to meet activity growth beyond the long term planning period.

The remaining chapters will be dedicated to refining the basic concept into a final plan with recommendations to ensure proper implementation and timing for a demand-based program.

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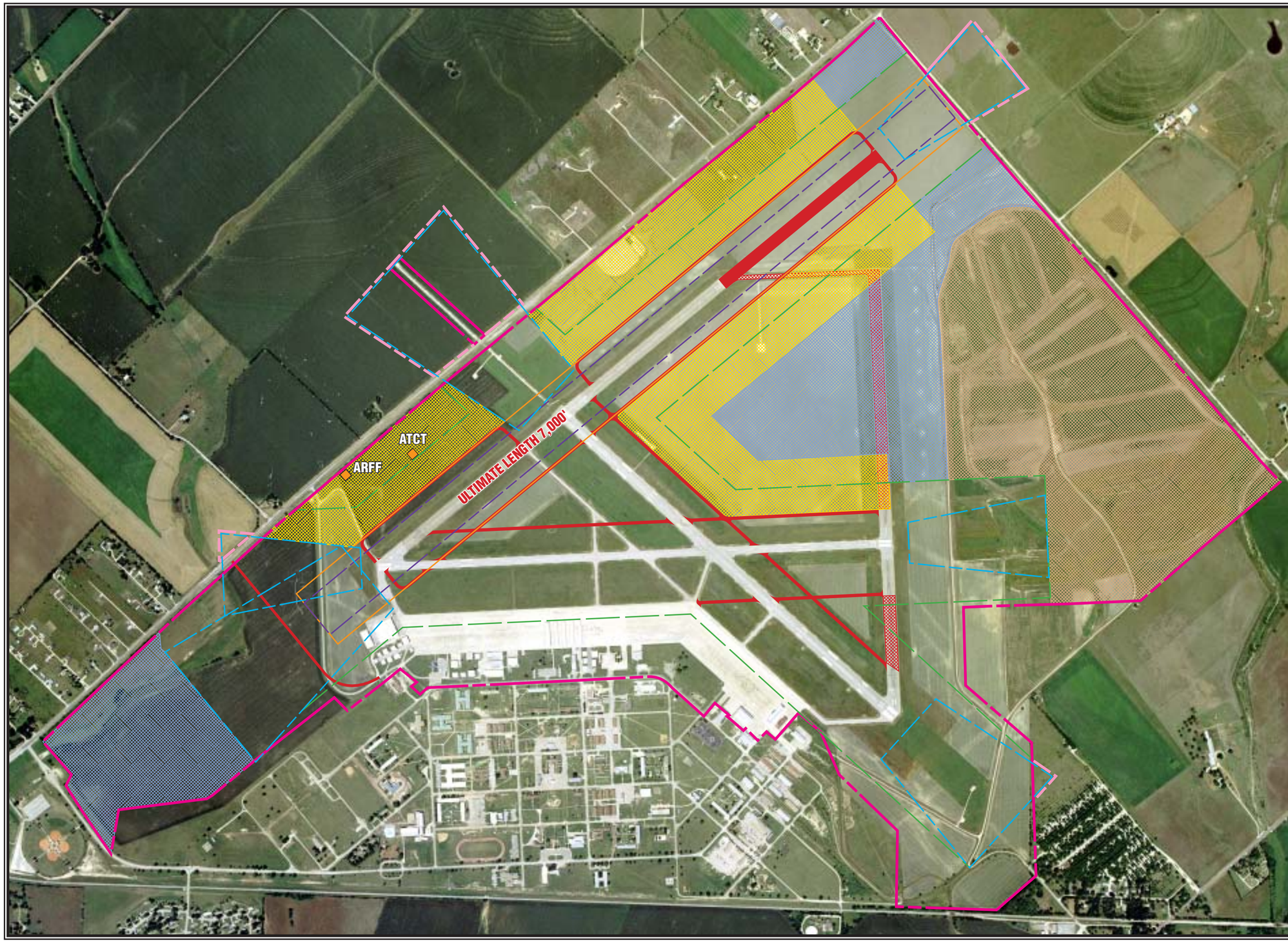

Exhibit 4E
AIRFIELD ALTERNATIVE 4

LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- Ultimate Pavement
- Pavement to be Removed
- Runway Safety Area (RSA)
- Object Free Area (OFA)
- Building Restriction Line (BRL)
- Runway Protection Zone (RPZ)
- Aviation Reserve
- Industrial/Commercial Non-Aviation
- Public/Recreational

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TABLE 4A
Airport Development Alternative Summary
San Marcos Municipal Airport

	ADVANTAGES	DISADVANTAGES
Alternative 1	• Runway 12-30 current primary runway • Portion of Runway 17-35 kept for small aircraft/training use • Easy to implement over time • ATCT best location as sun not factor in controller view • ARFF could be shared; good access with SH 21 • Large aviation and non-aviation development potential	• Runway 12-30 only 6,400 feet • Require acquisition of property in Reedville • Maintenance cost of three runways
Alternative 2	• Runway 17-35 best wind coverage runway • Airport is provided north and south precision approaches • ARFF could be shared with multiple jurisdictions • ATCT centrally located • Large aviation and non-aviation development potential	• Runway 17-35 far from current terminal area • Maintaining three runways would be costly • Fee simple property acquisition south (Gary Job Corps) required • ARFF far from existing terminal; may require ARFF vehicle to move on airport for each charter operation • ATCT view will be mainly into sun
Alternative 3	• Runway 8-26 closest to existing terminal • Two runways closed requiring less maintenance cost • ARFF on airport • ATCT good view limited sun • Largest non-aviation development potential • New airport entrance road • Easy to develop over time	• Runway 8-26 not best for wind coverage • Best wind coverage runway (17-35) closed • Need to acquire easement west of airport for RPZ • May require relocation of Berry Aviation facilities if precision approach implemented • ARFF costs may not be shareable
Alternative 4	• Extension of Runway 4-22 can be achieved mostly within existing airport bounds • Three Runways provide good wind coverage • ATCT good view of all movement areas • ARFF services could be shared with other jurisdictions	• Would require relocation of Berry Aviation facilities • Property easements need to be acquired north • Two parallel taxiways would be need for Runway 4-22 • Not easy to develop over time, require large financial commitments in short time spans • Least amount of non-aviation development potential

Chapter Five
AIRPORT PLANS

Airport Plans

The airport master planning process has evolved through several analytic efforts in the previous chapters. These efforts intended to analyze future aviation demand, establish airside and landside needs, and evaluate options for the future development of the airport and its facilities. In the previous chapter, several development alternatives were analyzed to explore different options for the future growth and development of the San Marcos Municipal Airport. The development alternatives were refined into a single recommended concept for the master plan after meeting with the Planning Advisory Committee (PAC) which provided feedback to the consultant. It is expected that this concept will be further refined after the final review meeting with the PAC. This chapter describes, in narrative and graphic form, the recommended direction for the future use and development of San Marcos Municipal Airport(HYI).

RECOMMENDED CONCEPT

The recommended master plan concept incorporates many elements from many of the alternatives presented in earlier chapters. This finalized concept provides for both anticipated facility needs over the next twenty years as well as for some facility needs beyond this planning period. The following sections summarize specific airside and landside recommendations included in the final concept is shown on **Exhibit 5A**

AIRFIELD DESIGN STANDARDS

The FAA and TxDOT-Aviation Division has established design criteria to define the physical dimensions of runways and taxiways and the imaginary surfaces surrounding them which protect the safe operation of aircraft at the airport. These design standards also define the separation criteria for the placement of landside facilities. As discussed previously, FAA and TxDOT design criteria primarily centers around the airport's critical design aircraft. The critical aircraft is the most demanding aircraft or family of aircraft which will conduct 250 or more operations (take-off or landing) per year at the airport. Factors included in airport design include an aircraft's wingspan and approach speed, and in some cases, the runway approach visibility minimums. The Federal Aviation Administration (FAA) has established the Airport Reference Code (ARC) to relate these factors to airfield design standards.

San Marcos Municipal Airport is presently used by a wide range of general aviation aircraft. These include single and multi-engine aircraft which fall into ARC A-I and B-I categories. In addition, larger business turboprop and turbojet aircraft that fall within approach categories B, C, and D and ADGs I and II use the airport. Analysis conducted in **Chapter Three**, **Facility Requirements**, concluded that San Marcos Municipal's current critical design aircraft are business aircraft such as the Citation 525 (a business jet), a Beech King Air 200, and the Swearingen Metro aircraft operated by Berry Aviation. The airport is home to at least one of each of these aircraft.

In addition to these based aircraft, the airport is used by transient corporate aircraft on an infrequent basis that fall within the C-II/D-II categories.

The Master Plan anticipates that turbojet aircraft use, particularly business jet aircraft use, would increase in the future consistent with national trends and FAA forecasts. It is anticipated that the airport will be increasingly utilized by businesses and fractional ownership groups who wish to conduct business in the San Marcos area. For planning purposes the ARC D-II category should be considered the critical aircraft.

Therefore, this Master Plan projects that larger business aircraft (i.e. Gulfstream IV) in category D-II will become the critical aircraft for airport design over the next twenty years. The plan will be put forth in a manner which outlines a facility development program to adjust to these critical aircraft. To safely accommodate these aircraft at San Marcos Municipal Airport in the future, Runway 12-30, the primary runway, is ultimately planned to conform to ARC D-II design standards. Runway 17-35 is also planned to ultimately comply with ARC D-II standards. Runway 8-26, as a crosswind runway, is being planned to meet ARC B-II standards. Runway 4-22 will be closed. **Table 5A** depicts airfield design standards for San Marcos Municipal Airport.

The design of taxiway and apron areas must also consider the critical aircraft identified for San Marcos Municipal. The primary consideration is given to the wingspan of the most demanding aircraft to operate at the airport. The

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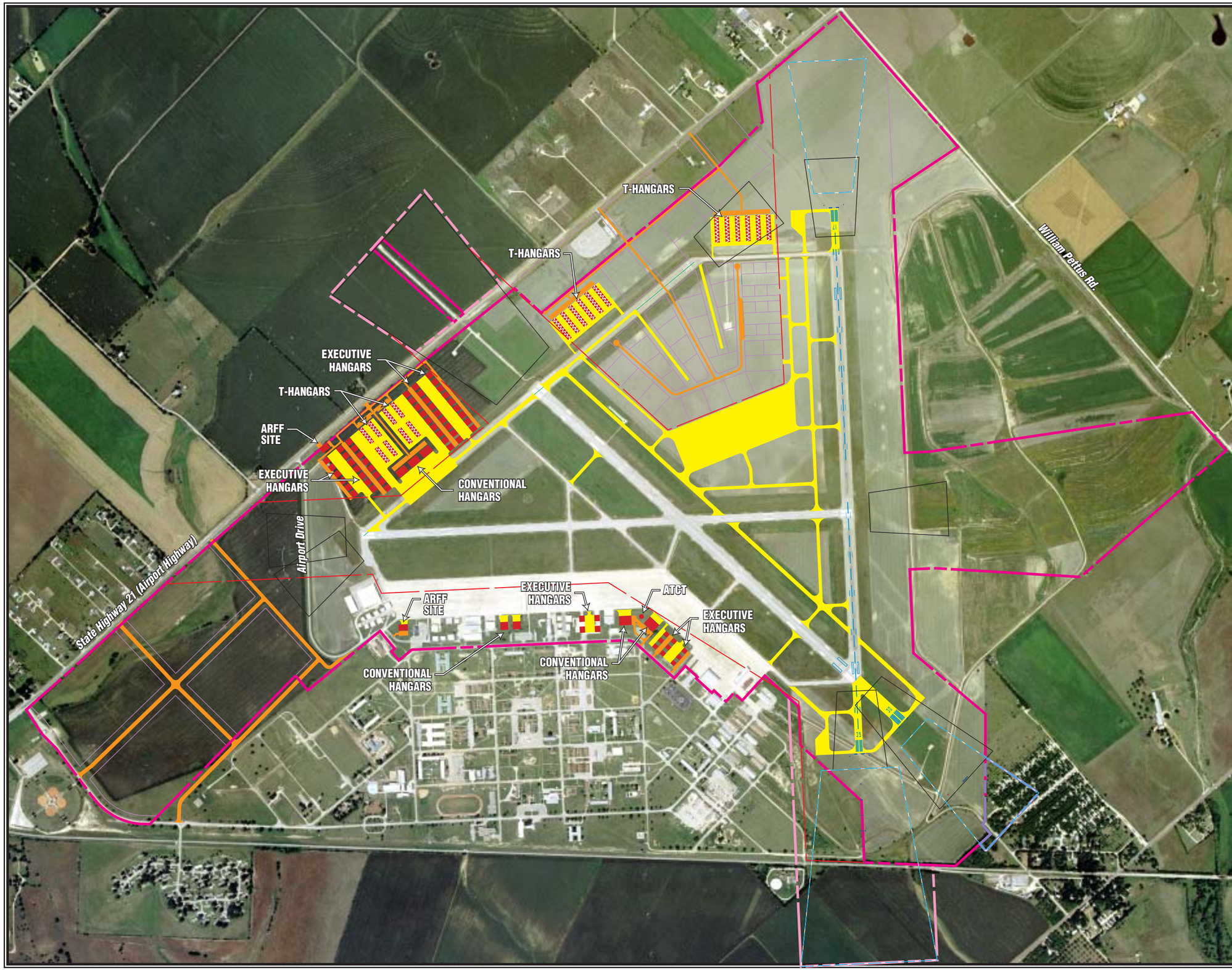
Exhibit 5A
RECOMMENDED
MASTER PLAN CONCEPT



LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- Ultimate Easement
- Existing Runway Protection Zone
- Ultimate Runway Protection Zone
- Building Restriction Line
- Ultimate Taxiway/Apron/Runway Extension
- Ultimate Roads/Parking
- Ultimate Buildings
- Lease Parcels

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TABLE 5A
Airfield Planning Design Standards (Ultimate)
San Marcos Municipal Airport

	Runway 17-35	Runway 12-30	Runway 8-26
DESIGN STANDARDS			
Airport Reference Code (ARC)	***D-II***	***D-II***	***B-II***
Runways			
Length (ft.)	7,000	6,400	5,600
Width (ft.)	100	150	100
Pavement Strength (lbs.)			
Single Wheel (SWL)	30,000	60,000	80,000
Dual Wheel (DWL)	100,000	75,000	n/a
Shoulder Width (ft.)	10	10	10
Runway Safety Area			
Width (ft.)	500	500	150
Length Beyond Runway End (ft.)	1,000	1,000	300
Object Free Area			
Width (ft.)	800	800	500
Length Beyond Runway End (ft.)	1,000	1,000	300
Obstacle Free Zone			
Width (ft.)	400	400	400
Length Beyond Runway End (ft.)	200	200	200
Taxiways			
Width (ft.)	40	40	40
OFA (ft.)	131	131	131
Centerline to Fixed or Movable Object (ft.)	66	66	66
Runway Centerline to:			
Parallel Taxiway Centerline (ft.)	400	400	300
Aircraft Parking Area (ft.)	500	500	400
Building Restriction Line (ft.)			
20 ft. Height Clearance	640	640	390
35 ft. Height Clearance	745	745	495
Runway Protection Zones			
Inner Width (ft.)	1,000	1,000	500
Outer Width (ft.)	1,750	1,750	700
Length (ft.)	2,500	2,500	1,000
Approach Slope	50:1	50:1	20:1

parallel and connecting taxiways, transient apron areas, and aircraft maintenance areas have all been designed to accommodate aircraft within airplane design group (ADG) II wherever appropriate.

AIRFIELD

The recommended concept, shown in **Exhibit 5A**, includes an extension of runways 12-30 and 17-35. Runway 12-30, the airport's current primary runway will need to be extended to meet the requirements of aircraft based at the airport and those aircraft that are beginning to use the airport on a regular basis. To fully meet the needs of general aviation aircraft, the runway should be extended to 6,400 feet. This 800-foot extension would be the maximum amount allowable without requiring significant residential acquisition to the southeast.

Ultimately, Runway 17-35 is planned to be reconstructed and extended to become the airport's primary runway. The planned extension will be split between the both ends of the runway for a new total length of 7,000 feet. This runway length provides the best wind coverage, and will have greater total length. It should be noted that TxDOT will require specific justification for the extension before funding is provided. This length will ensure that the airport will be capable of accommodating all projected aircraft activity most of the year. During extreme hot conditions, some aircraft may need to leave with less fuel or payload, however, 7,000 feet should not be a limiting factor in any aircraft owner's decision to base or operate at San Marcos Municipal Airport.

These new lengths will better serve the airport during hot days and for heavy aircraft loads. There are aircraft that currently operate at the airport that are restricted by the current runway lengths; in particular, the Gulfstream IV previously identified as a future critical aircraft.

By maintaining a second runway at least 80 percent of that provided by the primary runway, the airport will continue to handle the majority of traffic even in times while the primary runway is closed due to routine maintenance, or emergencies. In addition, the additional length will allow the airport to operate in a two runway configuration boosting the overall capacity of the field.

Both runway extensions will result in the runway protection zones (RPZs) extending beyond existing airport property. This will require the city to obtain property rights, either in the form of an aviation easement or in fee. The FAA and TxDOT would prefer fee simple acquisition of properties in the RPZ, but avigation easements are acceptable. Avigation easements give the City the rights of certain airspace over a given property. The height is determined in such a manner that approach and departures will not be obstructed by the erection of any structure.

The master plan concept calls for the fee simple acquisition of approximately 75 acres on the south end of Runway 17-35. This parcel of land encompasses the

new expanded RPZ. On the north end of Runway 12-30, 268 acres north of State Highway 21 (Airport Highway) will also be acquired by the airport. While only 57 of the total acres are covered by the RPZ, acquiring the entire parcel of land will aid in protecting airport airspace and position the airport for future growth. The extension of Runway 12-30 to the southeast will require the acquisition of an easement. Approximately 13 acres of property on the southeast end of airport property fall within shifted RPZ for the runway.

All four runways are currently served by a collection of partial parallel, entrance/exit, and connecting taxiways. The recommended plan calls for completion of full-length parallel taxiways for Runways 12-30 and 17-35. In addition, both of these runways will receive several new exit taxiways. Runway 8-26 currently has adequate taxiways.

Runway 4-22 is planned to be closed and converted for use as a taxiway. This new taxiway will be used for access to the new General Aviation area on the northwest side of the field to be developed in the intermediate planning horizon. It will also provide access to the new North GA area to be developed in the long range planning horizon.

The closure of Runway 4-22 could be forced by two factors. The primary reason is the prohibitive cost of continuing to maintain a fourth runway. The runway currently has poor wind coverage. Secondly, areas for future development may become limited, and by closing this runway a large parcel of land will be made available for development of hangars, taxiways, and new business opportunities. This especially holds true if Austin continues to remain without a reliever airport.

Analysis in previous chapters indicated that plans should be made to upgrade the instrument approach capabilities of the airport. Currently Runway 12 is equipped with an instrument landing system (ILS) providing Cat I minimums (one half mile visibility and 200-foot cloud ceilings). This approach will be adequate for the future.

Plans call for a GPS CAT I approach to provide Runway 35 with a precision approach in the future. In order to achieve CAT I minimums to Runway 35 a medium intensity approach light system with runway end alignment lights (MALSR) similar to the one in service on Runway 12 would need to be installed.

Airfield lighting recommendations include installing lighted airfield direction signs, hold signs, and distance to go signs on the airfield. In addition, medium intensity taxiway lights (MITL) are recommended along all new taxiway construction. Lighted signs providing directional information to pilots should also be installed as appropriate.

LANDSIDE

The recommended concept calls for extensive landside development on the north side of the airport. The recommended plan shows the

development of two new general aviation areas, one on the northwest side of the airport, and one on the north side between Runways 17-35 and 12-30. As discussed earlier, the development of this area requires the closing of Runway 4-22. The area shown on the plan provides room for approximately 200 T-Hangars, numerous executive hangars, and several FBOs.

To support these new general aviation areas access from Airport Highway would need to be upgraded. In addition, several roadways and parking facilities will be necessary to provide access to the businesses and private hangars.

The recommended concept indicates the development of the northwest area to be developed first. This area would provide for up to three new FBO or other special business, a large number of T-Hangars, and executive hangars. These facilities would be provided with adequate apron area and taxiway access.

A second, much larger general aviation area is also included in the recommended plan to be located on the north side of the airport. This development focuses primarily on providing parcels of land for the development of private conventional and executive hangars. There is also room for several FBOs with a large ramp area. This facility will be well positioned to take advantage of the shift to Runway 17-35 as the primary runway for San Marcos.

While much of the development planned for the airport will be taking place on the north side of the airport, there are several areas on the south side for development. On the southeast side several parcels of land will be developed for executive hangars. The apron immediately in front of these hangars is slated for some major rehabilitation/ replacement to ensure its usability for many years to come.

Two ARFF sites have been considered for development, one adjacent to the existing terminal building and one in the planned development on the northwest side of the airport. This facility will be required for Part 139 compliance. The final improvement planned for this area is the construction of a new Air Traffic Control Tower (ATCT). This improvement is a safety and efficiency upgrade recommended at larger airports such as San Marcos.

COMPATIBLE LAND USE PLANNING

Currently, most land use surrounding the airport is compatible land uses as agricultural and industrial/institutional uses. There are pockets of low density residential areas to the west and north and a small residential community southeast of Runway 12-30.

A prime concern is the lack of developmental authority over lands adjacent the airport. Most areas near the airport are within Hays or Caldwell Counties, and outside the City of San Marcos corporate limits. Earlier discussion provided benefits and "costs" associated with ways for the City to incorporate areas near the airport specifically to provide some method of

controlling adjacent land use development.

Airports across the country are under significant pressure from encroachment by growing communities. Environmental concerns, especially noise complaints, are taking a toll on airport proprietors as they are finding it difficult to effectively manage and operate an airport in the face of stern opposition. This is not the case at San Marcos at this time.

Without effective control over land use development, however, developmental pressures could negatively effect the long term viability of the airport. As part of the City's grant agreements with the State and FAA, the City must assure that compatible land uses are maintained. For this reason, the City make every effort to maintain adequate control over the development of areas adjacent to the airport.

The City already has the option of utilizing the Joint Airport Zoning Board to influence compatible land uses. This method can be effective in maintaining compatible uses, however, does not provide the City with absolute authority, and thus, full developmental control. If this method does not work, the City should consider annexation. The extent of annexation will rest solely on the discretion of the City leaders, however, an area of one square mile around the airport should provide sufficient controlling land use authority to ensure adequate compatible land uses near the airport.

AIRPORT LAYOUT PLAN SET

Per FAA and TxDOT requirements, an official Airport Layout Plan (ALP) has been developed for San Marcos Municipal Airport and can be found at the end of this chapter. The ALP drawing graphically presents the existing and ultimate airport layout. The ALP is used by FAA and TxDOT to determine funding eligibility for future development projects.

The ALP was prepared on a computer aided drafting (CAD) system for future ease of use. The computerized plan set provides detailed information of existing and future facility layout on multiple layers that permits the user to focus in on any section of the airport at a desirable scale. The plan can be used as base information for design, and can be easily updated in the future to reflect new development and more detail concerning existing conditions as made available through design surveys.

A number of related drawings, which depict the ultimate airspace and landside development, will be included with the ALP once the draft master plan concept detailed in this chapter is finalized. The following provides a brief discussion of the additional drawings to be included with the ALP:

F.A.R. PART 77 AIRSPACE PLAN

To protect the airspace around the airport and approaches to each runway

end from hazards that could affect the safe and efficient operation of aircraft arriving and departing the airport, standards contained in Federal Aviation Regulations (F.A.R.) Part 77, Objects Affecting Navigable Airspace, have been established for use by local authorities to control the height of objects near the airport. The Part 77 Airspace Plan included in this master plan is a graphic depiction of this regulatory criterion. The Part 77 Airspace Plan is a tool to aid local authorities in determining if proposed development could present a hazard to the airport and obstruct the approach path to a runway end. This Airspace Plan can be a critical tool for the airport agency's use in planning against future development limitations. This may result in the control by easement or in fee simple purchase for the purpose of protecting the future role of the airport.

This could especially be true in the instance of San Marcos as the city looks to the future in support of the anticipated Part 139 operations which rely heavily on the best navigational technology, affording the most precise approaches at the lowest cloud ceiling heights and runway visibility minimums available. To this purpose the following discussion will describe those approach surfaces that make up the recommended F.A.R. Part 77 operations at San Marcos Municipal Airport.

F.A.R. Part 77 Imaginary Surfaces

The Part 77 Airspace Plan assigns three-dimensional imaginary areas to each runway. These imaginary surfaces emanate from the runway centerline and are dimensioned according the visibility minimums associated with the approach to the runway end and size of aircraft to operate on the runway. The Part 77 imaginary surfaces include the primary surface, approach surface, transitional surface, horizontal surface, and conical surface. Part 77 imaginary surfaces are described in the following paragraphs.

- PRIMARY SURFACE

The primary surface is an imaginary surface longitudinally centered on the runway. The primary surface extends 200 feet beyond each runway end. The elevation of any point on the primary surface is the same as the elevation along the nearest associated point on the runway centerline. Under Part 77 regulations, the primary surface for the future approaches to Runways 12-30 and Runways 17-35 is 1,000 feet wide. For all others (Runways 8-26 and 4-22) the primary surface remains 500 feet wide.

- APPROACH SURFACE

An approach surface is also established for each runway. The approach surface begins at the same width as the primary surface and extends upward and outward from the primary surface end and is centered along an extended runway centerline. The approach surface for the approach to Runway 12 extends 50,000 feet from the end of the primary surface at an upward slope of 50 to 1 to a width of 16,000 feet. Runway 30, at the opposite end, is

proposed for visual approach only, and extends 5,000 feet from the end of the primary surface at an upward slope of 20 to 1 to a width of 1,500 feet. For Runways 8-26 the approach surfaces remain as before, extending 5,000 feet from the end of the primary surfaces at an upward slope of 20 to 1 to a width of 1,500 feet. For Runway 17, the new approach surface extends 10,000 feet from the end of the primary surface at an upward slope of 34 to 1 to a width of 3,500 feet. For Runway 35 the new approach surfaces extend 10,000 feet from the end of the primary surface at an upward slope of 50 to 1 to a width of 16,000 feet.

- TRANSITIONAL SURFACE

Each runway has a transitional surface that begins at the outside edge of the primary surface at the same elevation as the runway. The transitional surface also connects with the approach surfaces of each runway. The surface rises at a slope of seven to one up to a height which is 150 feet above the highest runway elevation. At that point, the transitional surface is replaced by the horizontal surface.

- HORIZONTAL SURFACE

The horizontal surface is established at 150 feet above the highest elevation of the runway surface. Having no slope, the horizontal surface connects the transitional and approach surfaces to the conical surface at a distance of 10,000 feet from the end of the primary surfaces of each runway.

- CONICAL SURFACE

The conical surface begins at the outer edge of the horizontal surface. The conical surface then continues for an additional 4,000 feet horizontally at a slope of 20 to 1. Therefore, at 4,000 feet from the horizontal surface, the elevation of the conical surface is 350 feet above the highest airport elevation.

INNER PORTION OF THE APPROACH SURFACE PLAN

The Inner Portion of the Approach Surface Plan is a scaled drawing of the runway protection zone (RPZ), runway safety area (RSA), obstacle free zone (OFZ), and object free area (OFA) for each runway end. A plan and profile view of each RPZ is provided to facilitate identification of obstructions that lie within these safety areas. Detailed obstruction and facility data is provided to identify planned improvements and the disposition of obstructions.

TERMINAL AREA PLAN

The terminal area plan provides greater detail concerning landside improvements and at a larger scale than on the ALP. There will be two Terminal Area Plans developed for San Marcos Municipal Airport, an existing south terminal area plan and a north terminal area plan.

ON-AIRPORT LAND USE PLAN

The objective of the On-Airport Land Use Plan is to coordinate uses of the airport property in a manner compatible with the functional design of the airport facility. Airport land use planning is important for the orderly development and efficient use of available space. There are two primary considerations for airport land use planning: first, to secure those areas essential to the safe and efficient operation of the airport; and, second, to determine compatible land uses for the balance of the property which would be most advantageous to the airport and community. The plan depicts the recommendations for ultimate land use development on the airport. When development is proposed it should be directed to the appropriate land use area depicted on this plan.

PROPERTY MAP

The Property Map provides information on the acquisition and identification of all land tracts under the control of the airport.

SUMMARY

The recommended master plan concept has been developed in conjunction with the Planning Advisory Committee (PAC), the City of San Marcos, and the local citizens and is designed to assist the city, and the aviation department, in making decisions on future development and growth of the San Marcos Municipal Airport. This plan provides the necessary development to accommodate and satisfy the anticipated growth over the next twenty years, and beyond.

Flexibility will be very important to future development at the airport. Activity projected over the next twenty years may not occur as predicted. The plan has attempted to consider demands that may be placed on the airport even beyond the twenty year planning horizon to ensure that the facility will be capable of handling a wide range of circumstances. The recommended plan provides the city with a general guide that if followed can maintain the airport's long term viability and allow the airport to continue to provide air transportation services to the region.

AIRPORT LAYOUT PLANS
FOR
SAN MARCOS MUNICIPAL AIRPORT
SAN MARCOS, TEXAS
Prepared for the

City of San Marcos

INDEX OF DRAWINGS

1. COVER SHEET
2. AIRPORT DATA
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4. AIRPORT AIRSPACE DRAWING
5. RUNWAY 12 AND RUNWAY 35 APPROACH PROFILES DRAWING
6. APPROACH PROFILES DRAWING
7. INNER PORTION OF RUNWAY 12 APPROACH SURFACE DRAWING
8. INNER PORTION OF RUNWAY 30 APPROACH SURFACE DRAWING
9. INNER PORTION OF RUNWAY 17 APPROACH SURFACE DRAWING
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11. INNER PORTION OF RUNWAY 8-26 APPROACH SURFACE DRAWING
12. INNER PORTION OF RUNWAY 4-22 APPROACH SURFACE DRAWING
13. SOUTH TERMINAL AREA DRAWING
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15. AIRPORT LAND USE DRAWING
16. AIRPORT PROPERTY MAP

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CH 7 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION AND AN FAA FORM 7460-1 SUBMITTED PRIOR TO ANY CONSTRUCTION ON AIRPORT PROPERTY

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CH 7 PLUS THE CONDITIONS/COMMENTS IN LETTER DATED:

DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE

Larry D. Johnson — November 13, 2002
DRAWN BY — DATE

James M. Harris — November 13, 2002
CHECKED BY — DATE

COVER SHEET
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

SHEET 1 OF 16

Coffman Associates-LD3 H:\-layout\.dwg Wednesday November 13 2002 9:40am

SAN MARCOS MUNICIPAL AIRPORT DATA

OWNER: *San Marcos, Texas*	CITY: *San Marcos, Texas*	COUNTY: *CALDWELL*
AIRPORT NPIAS CODE: *RELIEVER*		GPS APPROACH: *YES*
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH: *97 ° F (July)*		

		EXISTING	ULTIMATE
AIRPORT SERVICE LEVEL		General Aviation	*Same*
AIRPORT REFERENCE CODE		C–II	*D–II*
DESIGN AIRCRAFT		KING AIR/METROLINER	*GULF STREAM IV*
AIRPORT ELEVATION		597.0 MSL	*Same*
AIRPORT REFERENCE POINT (ARP)	*Latitude*	29° 53' 37.019" N	*29° 53' 32.28" N*
O.C. 502 COORDINATES (NAD 83)	*Longitude*	97° 51' 52.881" W	*97° 51' 43.956" W*
AIRPORT INSTRUMENT APPROACHES		ILS CAT–I (12) NDB (12) GPS (12)	*ILS CAT–I (12)* *NDB (12)* *GPS CAT–I (12)* *GPS CAT–I (35)* *GPS (17)*
AIRPORT and TERMINAL NAVIGATIONAL AIDS		ROTATING BEACON NDB Localizer/Glideslope (12)	*ROTATING BEACON* *NDB, ATCT* *Localizer/Glideslope (12)*

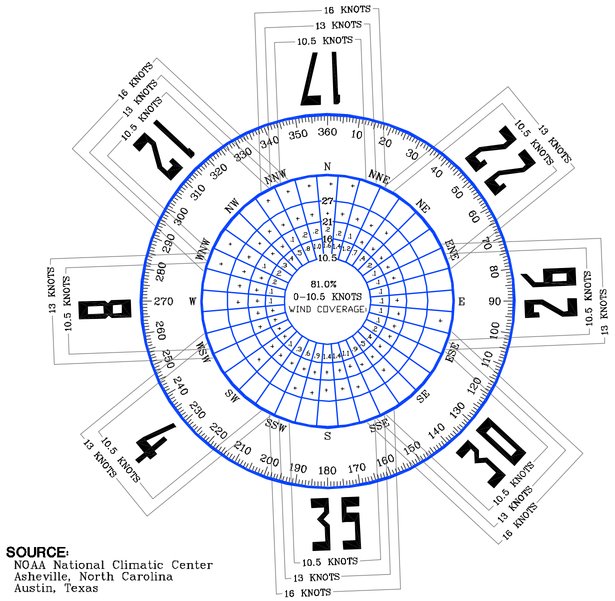
RUNWAY END COORDINATES (NAD 83)

San Marcos Municipal Arpt OC 502		EXISTING	ULTIMATE
RUNWAY 4	*Latitude*	29° 53' 30.521" N	*TO BE CLOSED*
	Longitude	97° 52' 37.160" W	
RUNWAY 22	*Latitude*	29° 54' 4.938" N	*TO BE CLOSED*
	Longitude	97° 51' 48.571" W	
RUNWAY 8	*Latitude*	29° 53' 30.495" N	*SAME*
	Longitude	97° 52' 37.498" W	
RUNWAY 26	*Latitude*	29° 53' 32.848" N	*SAME*
	Longitude	97° 51' 25.640" W	
RUNWAY 12	*Latitude*	29° 53' 49.316" N	*SAME*
	Longitude	97° 52' 12.101" W	
RUNWAY 30	*Latitude*	29° 53' 11.587" N	*29° 53' 6.201" N*
Ultimate 800' Extension	*Longitude*	97° 51' 25.458" W	*97° 51' 18.801" W*
RUNWAY 17	*Latitude*	29° 54' 6.063" N	*29° 54' 11.583" N*
Ultimate 558' Extension	*Longitude*	97° 51' 27.908" W	*97° 51'28.144" W*
RUNWAY 35	*Latitude*	29° 53' 12.233" N	*29° 53' 2.340" N*
Ultimate 1000' Extension	*Longitude*	97° 51' 25.605" W	*97° 51' 25.182" W*

1. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datun (NAV–83), Vertical Datum (NGVD–29), USGS Base Maps and Runway Elevations (NAVD–88).

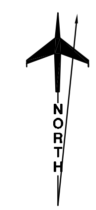
ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots
Runway 4–22	*89.43%*	*94.86%*	*N/A*
Runway 8–26	*84.82%*	*91.15%*	*N/A*
Runway 12–30	*92.54%*	*96.83%*	*99.47%*
Runway 17–35	*97.96&*	*99.17%*	*99.84%*
Runways Combined	*99.99%*	*100%*	*100%*



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Austin, Texas

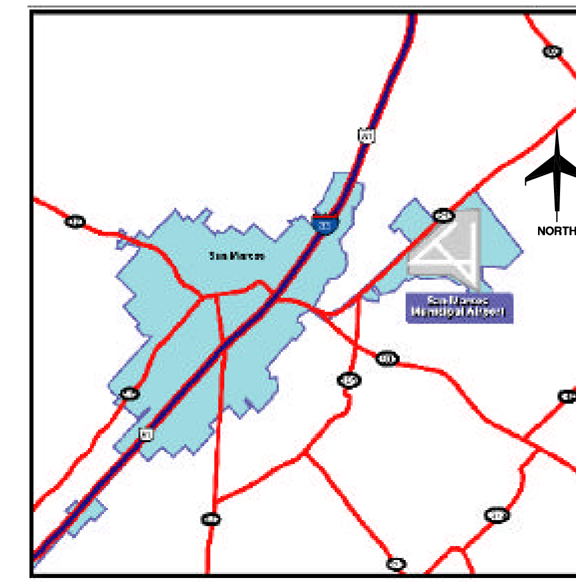
OBSERVATIONS:
83,143 All Weather Observations
1988 – 1997



Magnetic Declination
5.851° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)

VICINITY MAP

LOCATION MAP



RUNWAY DATA

RUNWAY DATA	RUNWAY 12-30		RUNWAY 8-26		RUNWAY 17-35		RUNWAY 4-22
	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	TO BE CLOSED
AIRCRAFT APPROACH CATEGORY–DESIGN GROUP	C–II	*D–II*	B–II	*Same*	B–II	*D–II*	B–II
RUNWAY WIND COVERAGE 15 MPH (13 KNOTS)	97.17%	*Same*	91.17%	*Same*	99.14%	*Same*	94.45%
F.A.R. PART–77 RUNWAY CATEGORY	Precision, Visual	*Same*	Visual/Visual	*Same*	Visual/Visual	*Nonprecision/Precision*	Visual/Visual
RUNWAY DIMENSIONS	5603' x 150'	*6403' x 150'*	6330' x 100'	*Same*	5442' x 100'	*7,000' x 100'*	5512' x 100'
RUNWAY GEODETIC AZIMUTH (OC 502)	132.87°/312.88°	*Same*	87.85°/267.86°	*Same*	177.87°/357.87°	*Same*	50.90°/230.91°
RUNWAY BEARING (True Bearing)	132.87°	*Same*	87.85°	*Same*	177.87°	*Same*	50.90°
RUNWAY LIGHTING	MIRL	*Same*	MIRL	*Same*	None	*MIRL*	None
RUNWAY SAFETY AREA (RSA)	7603' x 500'	*8403' x 500'*	6930' x 150'	*Same*	6042' x 150'	*9,000' x 500'*	6112' x 150'
RUNWAY OBSTACLE FREE ZONE (OFZ)	6003' x 400'	*6803' x 400'*	6730 x 400'	*Same*	5842' x 400'	*7,400' x 400'*	5912' x 400'
RUNWAY OBJECT FREE AREA (OFA)	7603' x 800'	*8403' x 800'*	6930' x 500'	*Same*	6042' x 500'	*9,000' x 800'*	6112' x 500'
RUNWAY EFFECTIVE GRADIENT	0.35%	*0.3%*	0.13%	*Same*	0.38%	*0.33%*	0.17%
RUNWAY MAXIMUM ELEVATION (Above MSL)	593.1 MSL	*Same*	589.4 MSL	*Same*	594.4 MSL	*597.0 MSL*	597.0 MSL
RUNWAY PAVEMENT MATERIAL	Asphalt	*Same*	Asphalt	*Same*	Asphalt	*Same*	Asphalt
RUNWAY PAVEMENT SURFACE TREATMENT	None	*None*	None	*Same*	None	*None*	None
RUNWAY PAVEMENT STRENGTH (in thousand lbs.)[1]	60 (S)	*Same*	80 (S)	*Same*	20 (S)	*60(S), 75(D)*	15 (S)
TAXIWAY WIDTH	Varies 35'–50'	*Same*	Varies 35'–50'	*Same*	Varies 35'–50'	*Same*	Varies 35'–50'
TAXIWAY LIGHTING	None	*MITL*	None	*MITL*	None	*MITL*	None
TAXIWAY MARKING	Centerline, Signage	*Same*	Centerline, Signage	*Same*	Centerline, Signage	*Same*	Centerline, Signage
TAXIWAY SURFACE MATERIAL	Asphalt	*Same*	Asphalt	*Same*	Asphalt	*Same*	Asphalt
TAXIWAY SAFETY AREA WIDTH	79'	*Same*	79'	*Same*	79'	*Same*	79'
TAXIWAY OBJECT FREE AREA WIDTH	131'	*Same*	131'	*Same*	131'	*Same*	131'
TAXIWAY HOLDING POSITION MARKING/SIGN	250'	*Same*	250'	*Same*	150'	*250'*	150'

RUNWAY END DATA

RUNWAY END DATA	RUNWAY 12		RUNWAY 30		RUNWAY 8		RUNWAY 26		RUNWAY 17		RUNWAY 35		TO BE CLOSED	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	RUNWAY 4	RUNWAY 22
RUNWAY THRESHOLD DISPLACEMENT	None	*None*	None	*None*	None	*None*	None	*None*	None	*None*	None	*None*	None	None
RUNWAY APPROACH VISIBILITY MINIMUMS	1/2 mile	*Same*	Visual	*Same*	Visual	*Same*	Visual	*Same*	Visual	*1 mile*	Visual	*1/2 mile*	Visual	Visual
F.A.R. PART–77 APPROACH SLOPE	50:1/40:1	*Same*	20:1	*Same*	20:1	*Same*	20:1	*Same*	20:1	*34:1*	20:1	*50:1/40:1*	20:1	20:1
RUNWAY SAFETY AREA (Beyond Runway End)	1000'	*1000'*	1000'	*1000'*	300'	*Same*	300'	*Same*	300'	*1000'*	300'	*1000'*	300'	300'
RUNWAY OBJECT FREE AREA (Beyond Runway End)	1000'	*1000'*	1000'	*1000'*	300'	*Same*	300'	*Same*	300'	*1000'*	300'	*1000'*	300'	300'
RUNWAY TOUCHDOWN ZONE ELEVATION	593.1 MSL	*Same*	583.1 MSL	*580.0 MSL*	589.4 MSL	*Same*	586.9 MSL	*Same*	594.4 MSL	*597.0 MSL*	582.1 MSL	*580.0 MSL*	593.1 MSL	597.0 MSL
RUNWAY MARKING	Precision	*Same*	Precision	*Same*	Nonprecision	*Same*	Nonprecision	*Same*	Basic	*Precision*	Basic	*Precision*	Basic	Basic
TAKEOFF RUN AVAILABLE (TORA)	5603'	*6403'*	5603'	*6403'*	6330'	*Same*	6330'	*Same*	5442'	*7000'*	5442'	*7000'*	None	None
TAKEOFF DISTANCE AVAILABLE (TODA)	5603'	*6403'*	5603'	*6403'*	6330'	*Same*	6330'	*Same*	5442'	*7000'*	5442'	*7000'*	5512'	5512'
ACCELERATE–STOP DISTANCE AVAILABLE (ASDA)	5603'	*6403'*	5603'	*6403'*	6330'	*Same*	6330'	*Same*	5442'	*7000'*	5442'	*7000'*	5512'	5512'
LANDING DISTANCE AVAILABLE (LDA)	5603'	*6403'*	5603'	*6403'*	6330'	*Same*	6330'	*Same*	5442'	*7000'*	5442'	*7000'*	5512'	5512'
ELECTRONIC NAVIGATIONAL AIDS	CAT–I ILS GPS NDB LOC/GS	*CAT–I ILS* *CAT–I GPS* *NDB* *LOC/GS*	None	*None*	None	*None*	None	*None*	None	*GPS*	None	*CAT–I GPS*	5512' None	5512' None
RUNWAY VISUAL NAVIGATIONAL AIDS	MALSR	*SAME*	VASI–4	*Same*	REIL	*Same*	REIL	*Same*	None	*REIL*	None	*MALSR* *REIL*	None	None

[1] Pavement strengths are expressed in Single (S), Dual (D), wheel loading capacities.

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300–13 CH 7 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION AND AN FAA FORM 7460–1 SUBMITTED PRIOR TO ANY CONSTRUCTION ON AIRPORT PROPERTY

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300–13 CH 7 PLUS THE CONDITIONS/COMMENTS IN LETTER DATED:

DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY: Coffman Associates Airport Consultants www.coffmanassociates.com

Mike W. Dmyterko	*November 13, 2002*
DESIGNED BY	DATE
Larry D. Johnson	*November 13, 2002*
DRAWN BY	DATE
James M. Harris	*November 13, 2002*
CHECKED BY	DATE

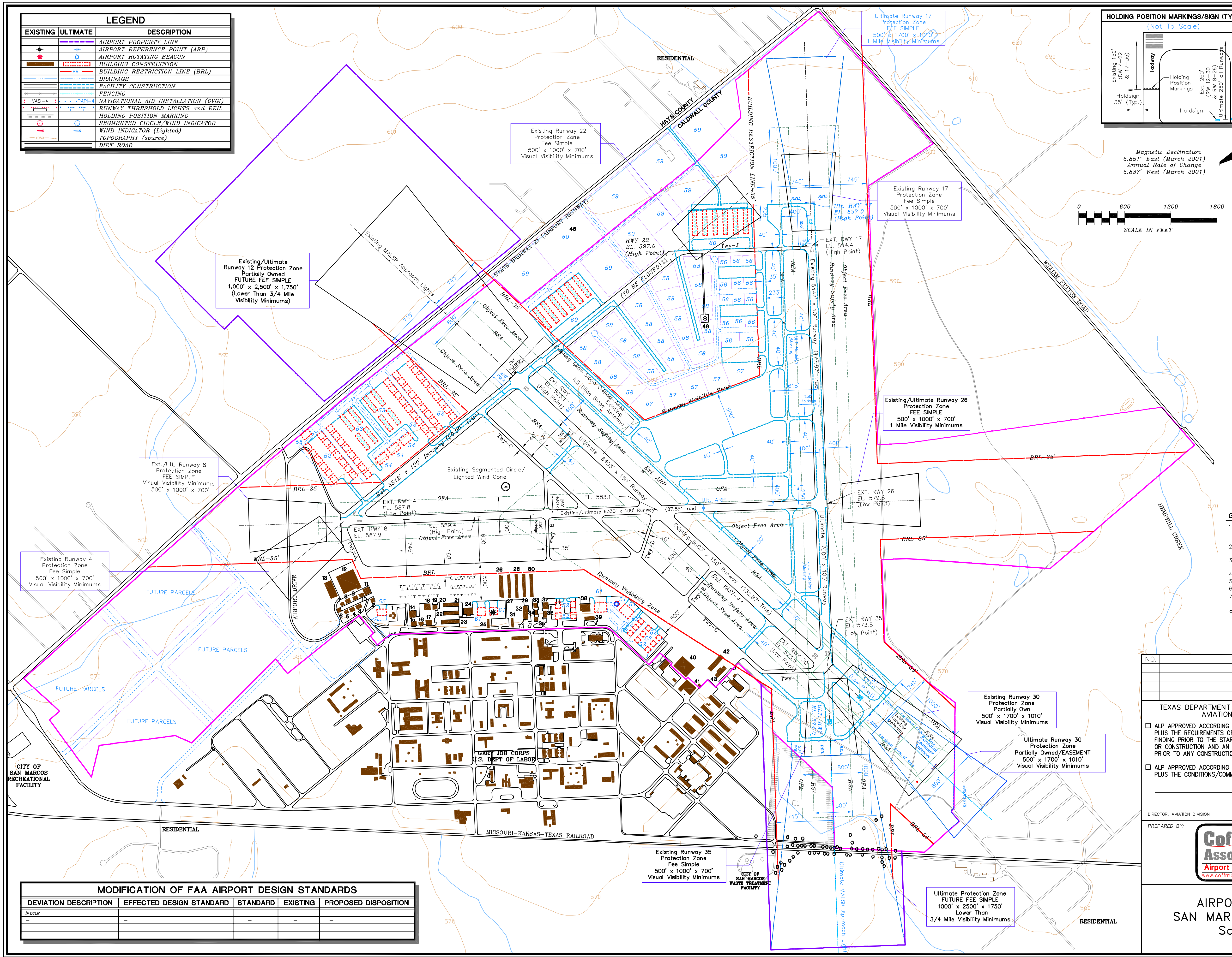
AIRPORT DATA
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation Aviation Division

SHEET 2 OF 16

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		BUILDING CONSTRUCTION
	BRL	BUILDING RESTRICTION LINE (BRL)
		DRAINAGE
		FACILITY CONSTRUCTION
		FENCING
VASI-4	PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
		RUNWAY THRESHOLD LIGHTS and REIL
		HOLDING POSITION MARKING
		SEGMENTED CIRCLE/WIND INDICATOR
		WIND INDICATOR (Lighted)
1080		TOPOGRAPHY (source)
		DIRT ROAD



HOLDING POSITION MARKINGS/SIGN (TYP)

(Not To Scale)

BUILDINGS/FACILITIES

EXISTING	DESCRIPTION	ELEVATION
1	GENERAL TERMINAL BUILDING	–
2	EXECUTIVES HANGAR	596 MSL
3	EXECUTIVES HANGAR	–
4	EXECUTIVES HANGAR	–
5	EXECUTIVES HANGAR	–
6	EXECUTIVES HANGAR	–
7	EXECUTIVES HANGAR	–
8	EXECUTIVES HANGAR	–
9	EXECUTIVES HANGAR	–
10	EXECUTIVES HANGAR	–
11	EXECUTIVES HANGAR	604 MSL
12	BERRY AVIATION HANGAR	605 MSL
13	BERRY AVIATION HANGAR	612 MSL
14	SOUTHWEST TEXAS AVIATION #1	615 MSL
15	EXECUTIVES HANGAR	–
16	EXECUTIVES HANGAR	–
17	EXECUTIVES HANGAR	–
18	SOUTHWEST TEXAS AVIATION #2	597 MSL
19	HANGAR	601 MSL
20	GAFFORD AERO	596 MSL
21	T-HANGAR "A"	596 MSL
22	T-HANGAR "B"	–
23	T-HANGAR "C"	–
24	McKEE AIRCRAFT	606 MSL
25	CIVIL AIR PATROL	594 MSL
26	SHADE HANGAR	–
27	T-HANGAR	–
28	T-HANGAR	–
29	T-HANGAR	–
30	T-HANGAR	–
31	CIVIL AIR PATROL	601 MSL
32	HANGAR	–
33	EXECUTIVES HANGAR	–
34	EXECUTIVES HANGAR	–
35	EXECUTIVES HANGAR	–
36	EXECUTIVES HANGAR	–
37	EXECUTIVES HANGAR	–
38	GRYPHON AVIATION	598 MSL
39	BUILDING	–
40	CONFEDERATE AIR FORCE	625 MSL
41	PORTABLE HANGAR	–
42	T-HANGAR	603 MSL
43	HANGAR	–
44	FUEL STORAGE	–
45	S.W.T.S.U. TRAINING FACILITY	–
46	DECOMISSIONED VORTAC	–

ULTIMATE BUILDINGS/FACILITIES

ULTIMATE	DESCRIPTION
51	AIR TRAFFIC CONTROL TOWER (ATCT)
52	RESERVED EXECUTIVE HANGARS AREA
53	RESERVED T-HANGARS AREA (Nested, 10 unit)
54	RESERVED FIXED BASE OPERATION HANGARS AREA (FBO)
55	AIRPORT RESCUE and FIREFIGHTING (ARFF)
56	CORPORATE PARCELS
57	FBO PARCELS SPECIALTY OPERATOR
58	COMMERCIAL/INDUSTRIAL AVIATION RELATED PARCELS
59	COMMERCIAL/INDUSTRIAL NON-AVIATION RELATED PARCELS
60	RESERVED T-HANGARS AREA (14 units)
61	RESERVED CONVENTIONAL HANGARS AREA

GENERAL NOTES:

1. Depiction of features and objects, including related elevations and clearances, within the runway protection zones are depicted on the INNER PORTION OF RUNWAY APPROACH SURFACE DRAWING.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA DRAWING.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE DRAWING.
4. As of August, 2001 there are no Obstacle Free Zone (OFZ) Object Penetrations.
5. As of August, 2001 there are no Threshold Siting Surface Object Penetrations.
6. Runway elevation, length and coordinates are from jccbi.gov/datasheet (ADS).
7. A 7480 notice of landing area proposal would need to be completed to close Runway 4-22.
8. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAD-83), Vertical Datum (NGVD-29), USGS Base Map and Runway Elevations (NAVD-88).

MODIFICATION OF FAA AIRPORT DESIGN STANDARDS

DEVIATION DESCRIPTION	EFFECTED DESIGN STANDARD	STANDARD	EXISTING	PROPOSED DISPOSITION
None	–	–	–	–
–	–	–	–	–

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

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DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY: Coffman Associates Airport Consultants www.coffmanassociates.com

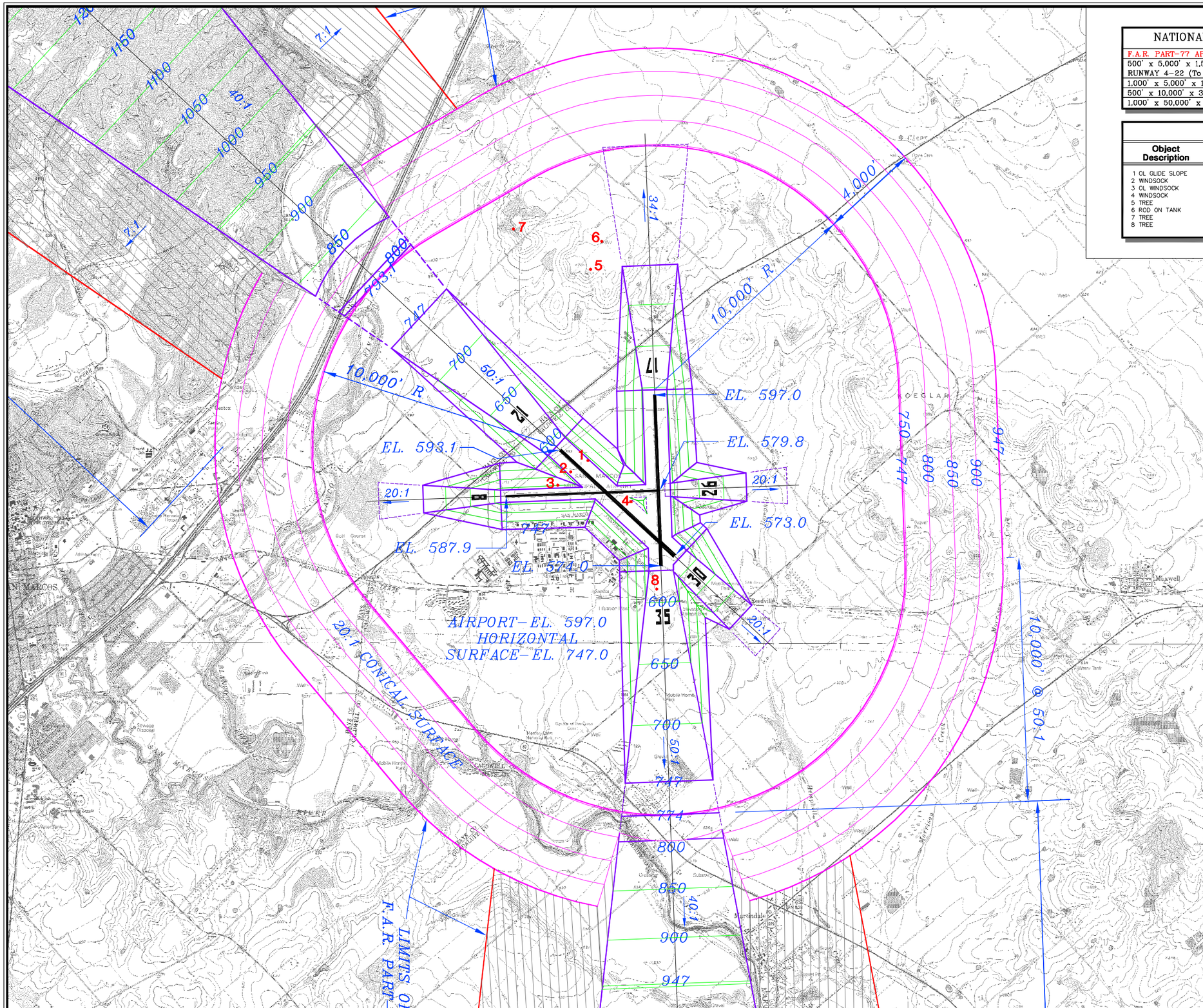
Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE

Larry D. Johnson — November 13, 2002
DRAWN BY — DATE

James M. Harris — November 13, 2002
CHECKED BY — DATE

AIRPORT LAYOUT DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation Aviation Division



NATIONAL OCEAN SERVICE OBSTRUCTION CHART (2nd Edition)

F.A.R. PART–77 APPROACH SURFACE	SLOPE	NOS OC 502	ULTIMATE
500' x 5,000' x 1,500' Visual Approach RUNWAY 4–22 (To Be Closed)	20:1	Runway 4, 8, 17, 22, 26, 35	Runway 8, 22
1,000' x 5,000' x 1,500' Visual Approach	20:1	Runway 30	Runway 30
500' x 10,000' x 3,500' NonPrecision Approach	34:1	Runway 15, 33	Runway 17
1,000' x 50,000' x 16,000' Precision Approach	50:1/40:1	Runway 12	Runway 12, 35

OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1 OL GLIDE SLOPE	629 MSL	Primary Surface	591 MSL	38'	"NO ACTION"
2 WINDSOCK	608 MSL	Primary Surface	591 MSL	17'	TO BE OBST. LIGHTED
3 OL WINDSOCK	614 MSL	7:1 Transitional Surface	600 MSL	14'	"NO ACTION"
4 WINDSOCK	596 MSL	Primary Surface	580 MSL	16'	TO BE OBST. LIGHTED
5 TREE	748 MSL	HORIZONTAL SURFACE	747 MSL	1'	TRIM
6 ROD ON TANK	763 MSL	HORIZONTAL SURFACE	747 MSL	16'	TO BE OBST. LIGHTED
7 TREE	749 MSL	HORIZONTAL SURFACE	747 MSL	2'	TRIM
8 TREE	613 MSL	50:1 Approach Surface	588 MSL	24'	REMOVE

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surface, unless otherwise noted.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the AIRPORT AIRSPACE DRAWING, sheet 4A of these plans.
3. Depiction of features and objects within the outer portion of the approach surfaces, is illustrated on the APPROACH SURFACE PROFILES DRAWING, sheets 5 and 6 of these plans.
4. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the INNER PORTION OF THE APPROACH SURFACE DRAWING, sheets 7, 8, 9, 10, 11 and 12 of these plans.
5. Additional obstruction data is illustrated on National Ocean Survey document OC 502, AIRPORT OBSTRUCTION CHART.
6. Existing zoning ordinance for this airport was adopted on September 17, 1984.
7. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAV–83), Vertical Datum (NGVD–29), USGS Base Maps and Runway Elevations (NAVD–88).

NORTH

Magnetic Variance
5.857° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)

0 2000 4000 6000
SCALE IN FEET

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

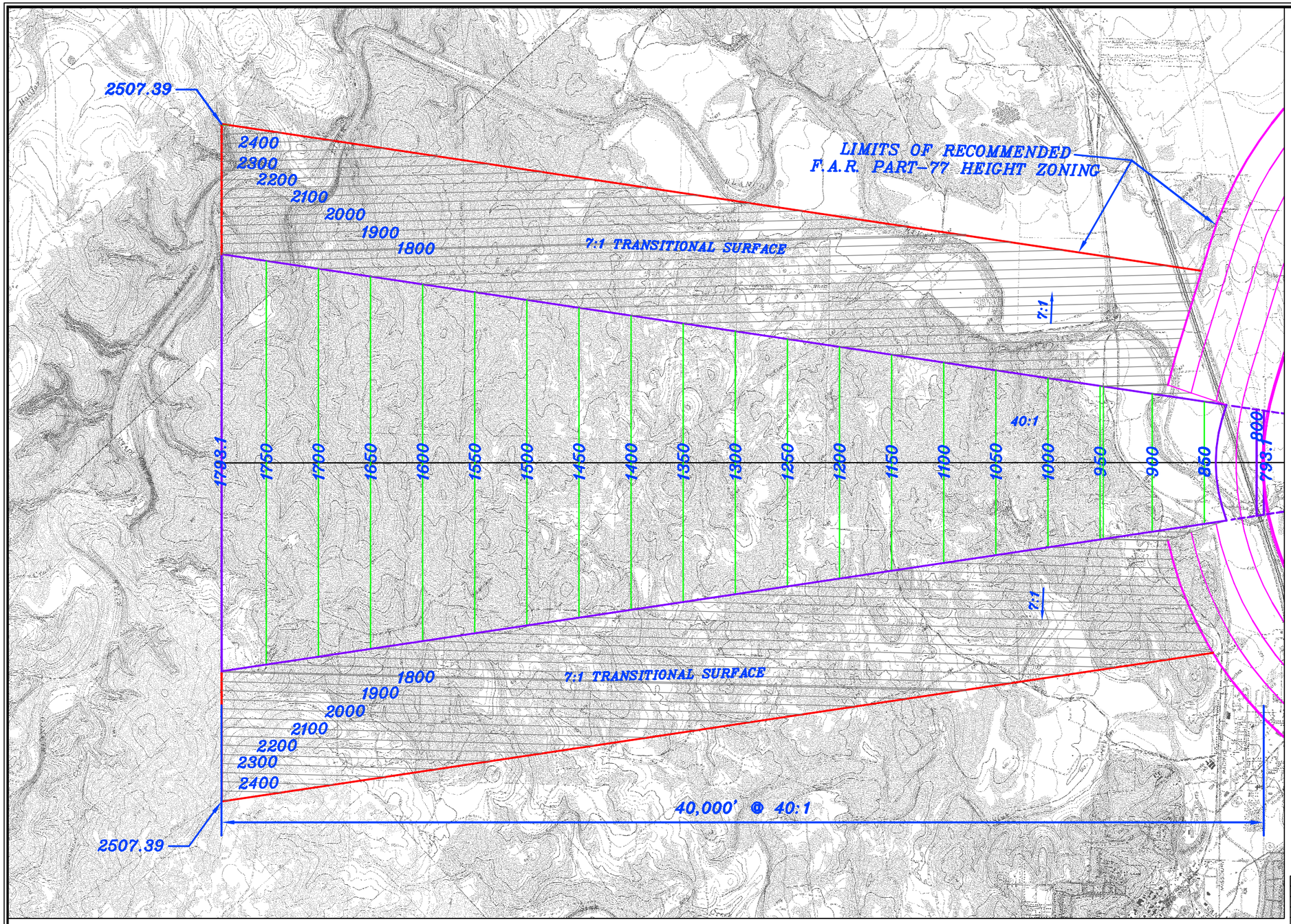
Mike W. Dmyterko	DESIGNED BY	November 13, 2002 DATE
Larry D. Johnson	DRAWN BY	November 13, 2002 DATE
James M. Harris	CHECKED BY	November 13, 2002 DATE

AIRPORT AIRSPACE DRAWING
FAR PART 77 INNER SURFACES
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

SHEET 4A OF 16

Coffman Associates–LDJ HYL–8777.dwg Thursday April 18 2002 2:46pm



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6. Existing zoning ordinance for this airport was adopted on September 17, 1984.
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SOUTH

Magnetic Variance
5.85° East (March 2001)
Annual Rate of Change
5.83' West (March 2001)

0 2000 4000 6000
SCALE IN FEET

NO.	REVISIONS	BY	CHK'D	DATE

OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
None Found	-	-	-	-	-

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE

Larry D. Johnson — November 13, 2002
DRAWN BY — DATE

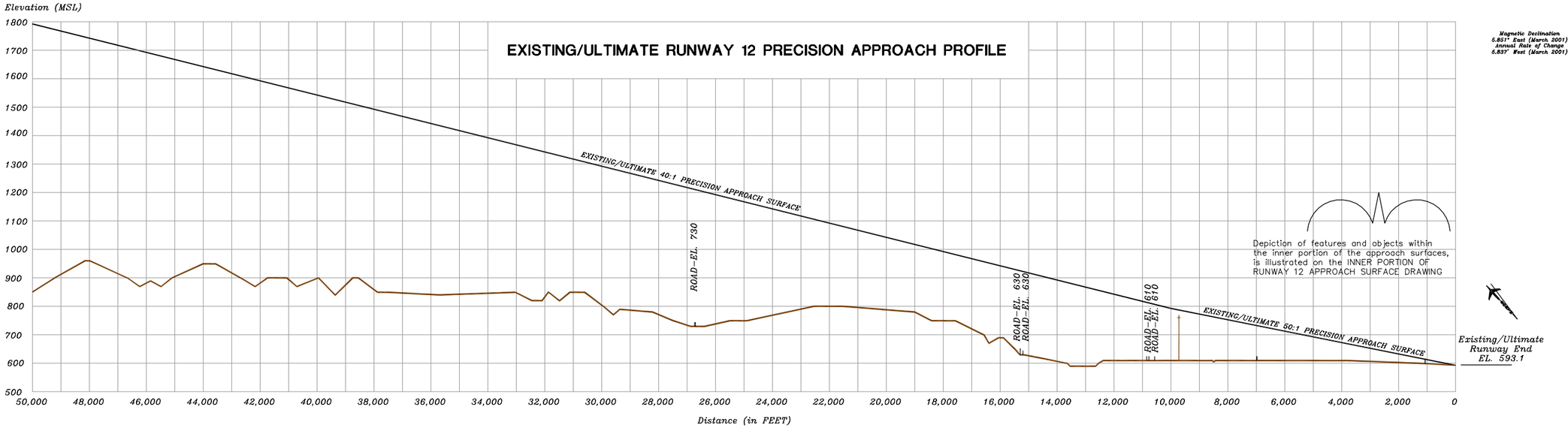
James M. Harris — November 13, 2002
CHECKED BY — DATE

AIRPORT AIRSPACE DRAWING
RUNWAY 12 PRECISION APPROACH FAN
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

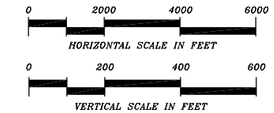
Texas Department of Transportation
Aviation Division

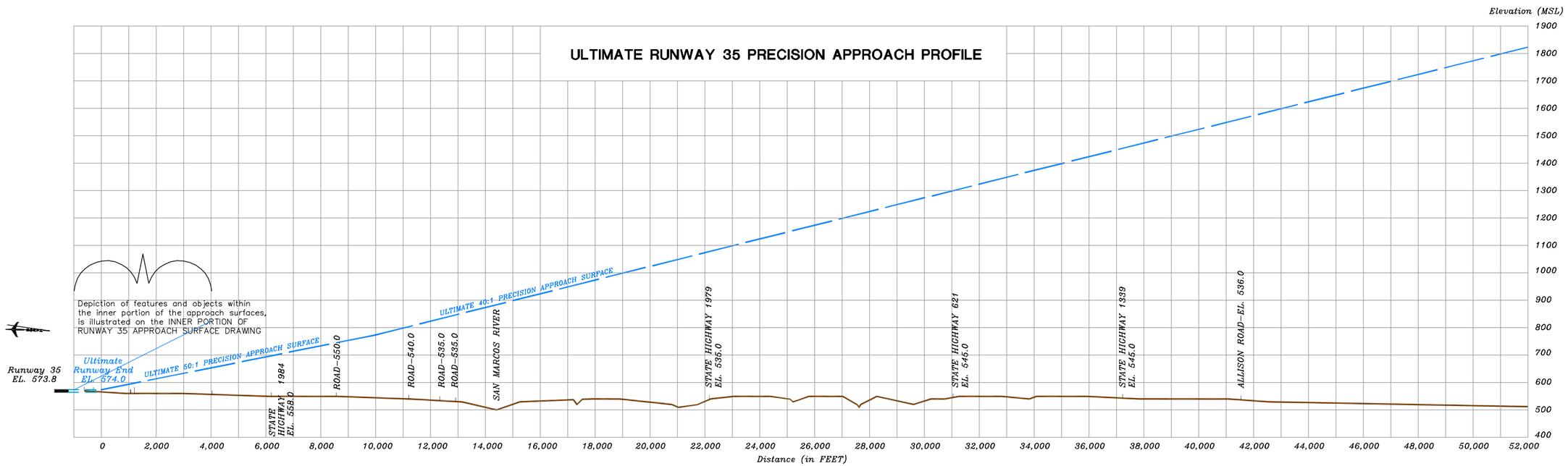
SHEET 4B OF 16

Coffman Associates-LDJ H:\-8PT77.dwg Thursday April 18 2002 2:48pm



Magnetic Declination
5.851° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)





RUNWAY 12 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWING					

RUNWAY 35 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWING					

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6. Existing zoning ordinance for this airport was adopted on September 17, 1984.
7. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAV-83), Vertical Datum (NGVD-29), USGS Base Maps and Runway Elevations (NAVD-88).

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

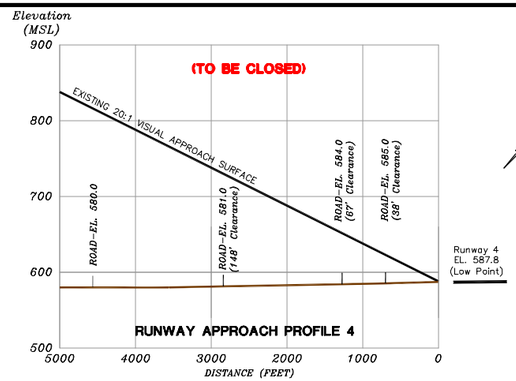
Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE
Larry D. Johnson — November 13, 2002
DRAWN BY — DATE
James M. Harris — November 13, 2002
CHECKED BY — DATE

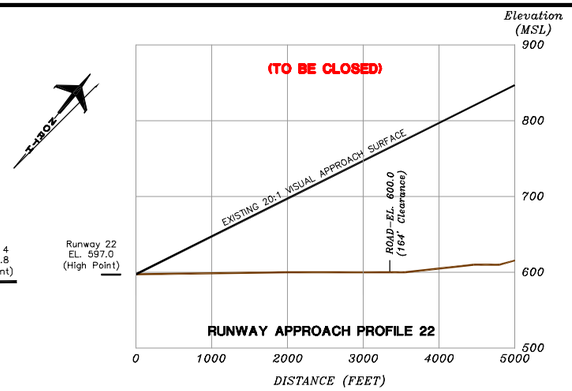
RUNWAY 12 AND RUNWAY 35
APPROACH PROFILES DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

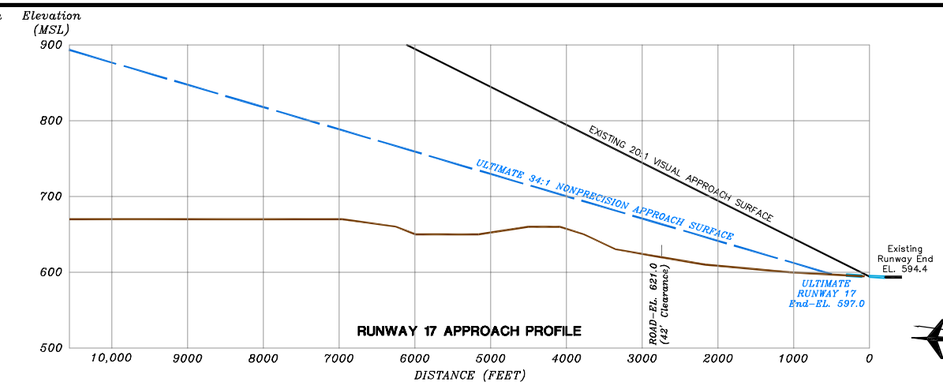
Texas Department of Transportation
Aviation Division

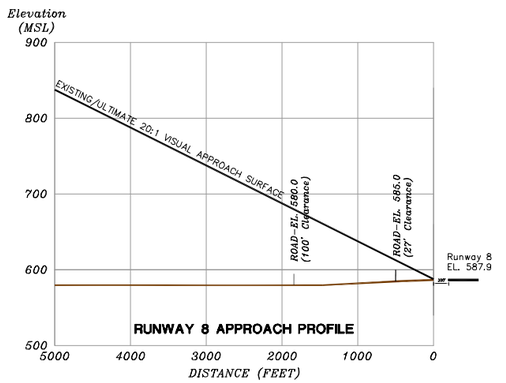
SHEET 5 OF 16

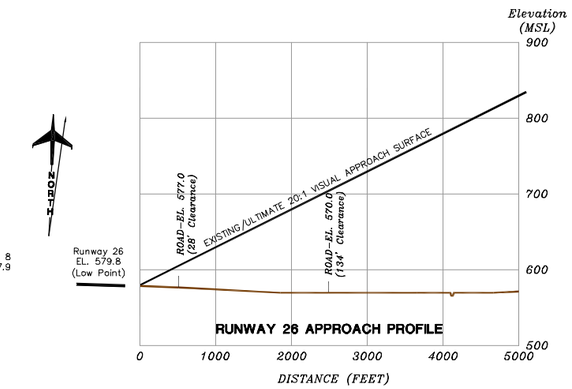
Coffman Associates-LD1 HYI-Apvol.dwg Wednesday November 13 2002 9:46am

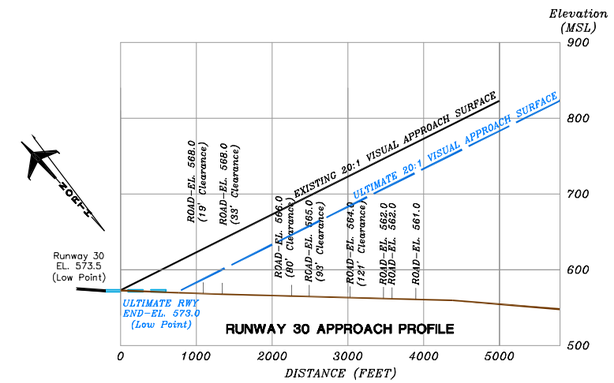


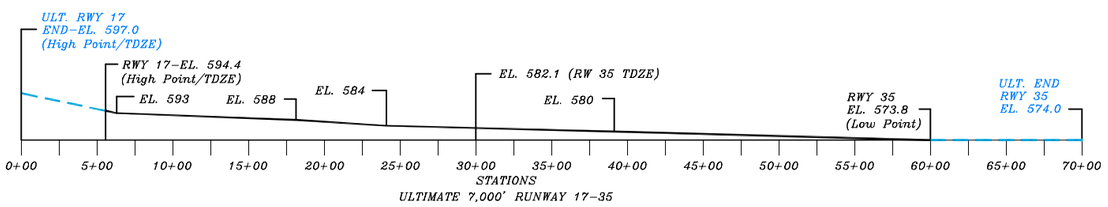


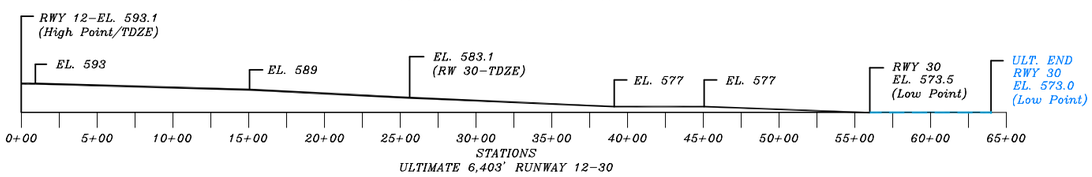


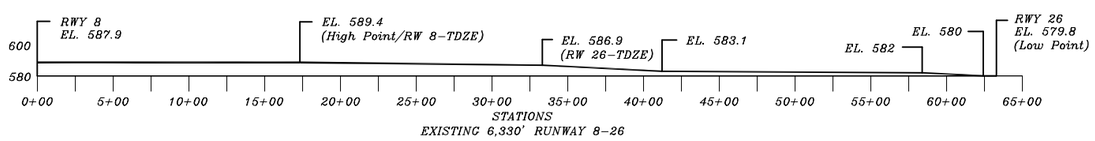


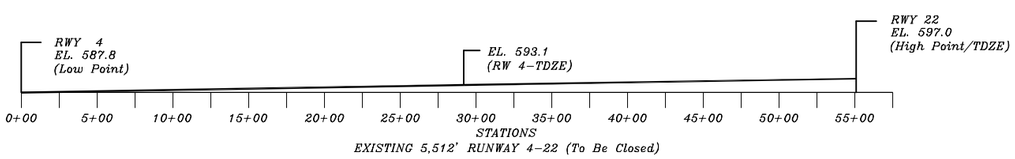












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5. Additional obstruction data is illustrated on National Ocean Survey document OC 502, AIRPORT OBSTRUCTION CHART.
6. Existing zoning ordinance for this airport was adopted on September 17, 1984.
7. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAV-83), Vertical Datum (NGVD-29), USGS Base Maps and Runway Elevations (NAVD-88).

Magnetic Declination
5.861° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

0 100 200 300
VERTICAL SCALE IN FEET

RUNWAY 4 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS					

RUNWAY 22 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS					

RUNWAY 8 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS					

RUNWAY 26 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS					

RUNWAY 17 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS					

RUNWAY 30 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
SEE INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS					

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY:

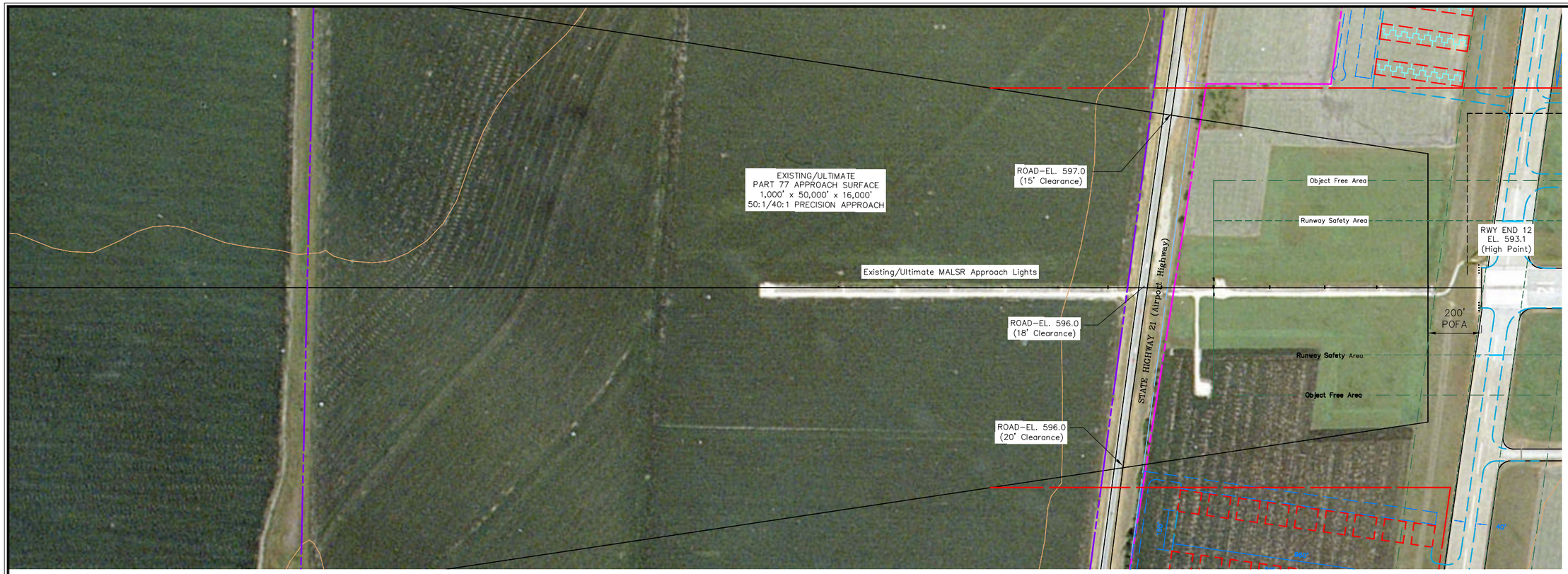
Coffman Associates
Airport Consultants
www.coffmanassociates.com

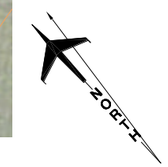
Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE
Larry D. Johnson — November 13, 2002
DRAWN BY — DATE
James M. Harris — November 13, 2002
CHECKED BY — DATE

APPROACH PROFILES DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

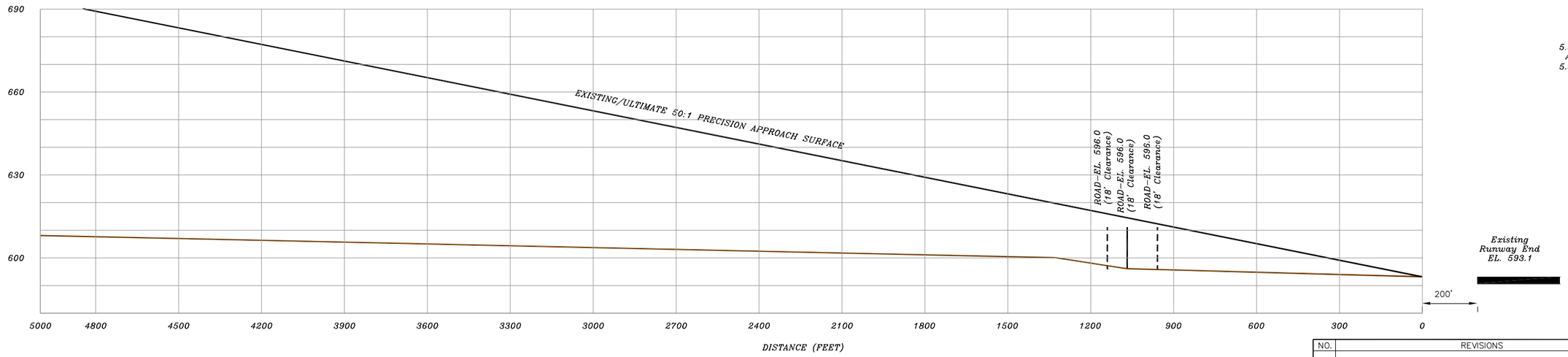
Texas Department of Transportation
Aviation Division

Coffman Associates-LD3 H:\-layout\.dwg Wednesday November 13 2002 9:40am





Magnetic Declination
5.851° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)



OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
NONE FOUND	–	–	–	–	–

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads or private roads, 15' for noninterstate roads, 17' for interstate roads, and 23' for railroad. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated AIRPORT AIRSPACE DRAWING. Additional obstruction data is illustrated on National Ocean Survey document OC 502, AIRPORT OBSTRUCTION CHART.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the AIRPORT AIRSPACE DRAWING, sheet 4.
3. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAD–83), Vertical Datum (NGVD–29), USGS Base Maps and Runway Elevations (NAVD–88).

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CH 7 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION AND AN FAA FORM 7460–1 SUBMITTED PRIOR TO ANY CONSTRUCTION ON AIRPORT PROPERTY

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CH 7 PLUS THE CONDITIONS/COMMENTS IN LETTER DATED:

DIRECTOR, AVIATION DIVISION DATE

AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE DATE

NO.	REVISIONS	BY	CHK'D	DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE

Larry D. Johnson — November 13, 2002
DRAWN BY — DATE

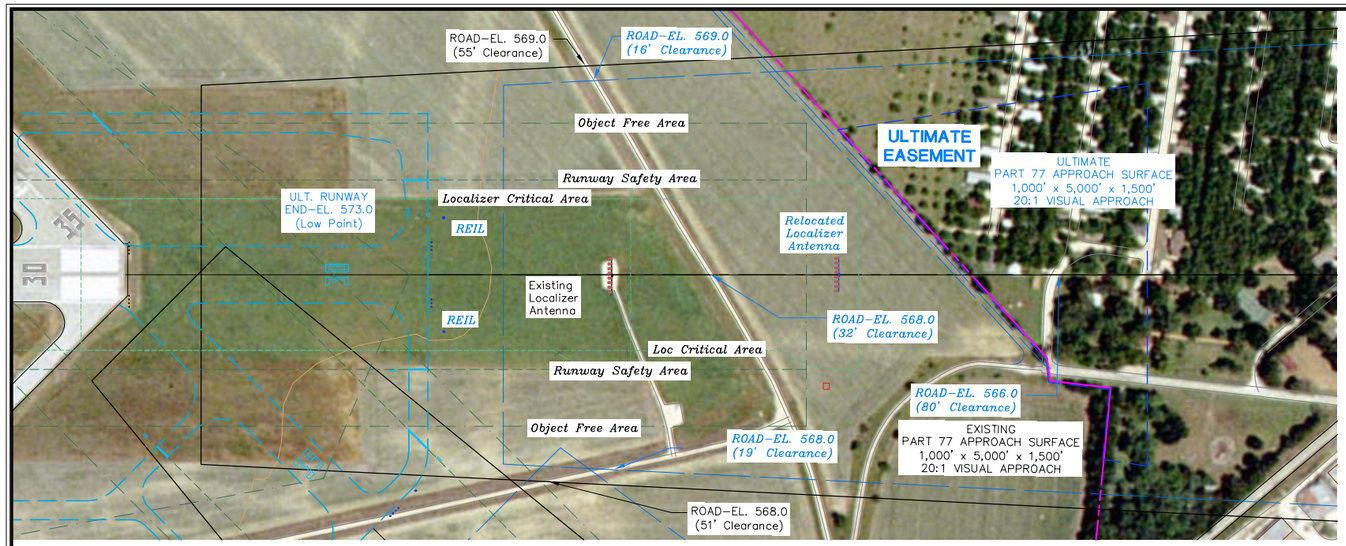
James M. Harris — November 13, 2002
CHECKED BY — DATE

INNER PORTION OF RUNWAY 12
APPROACH SURFACE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

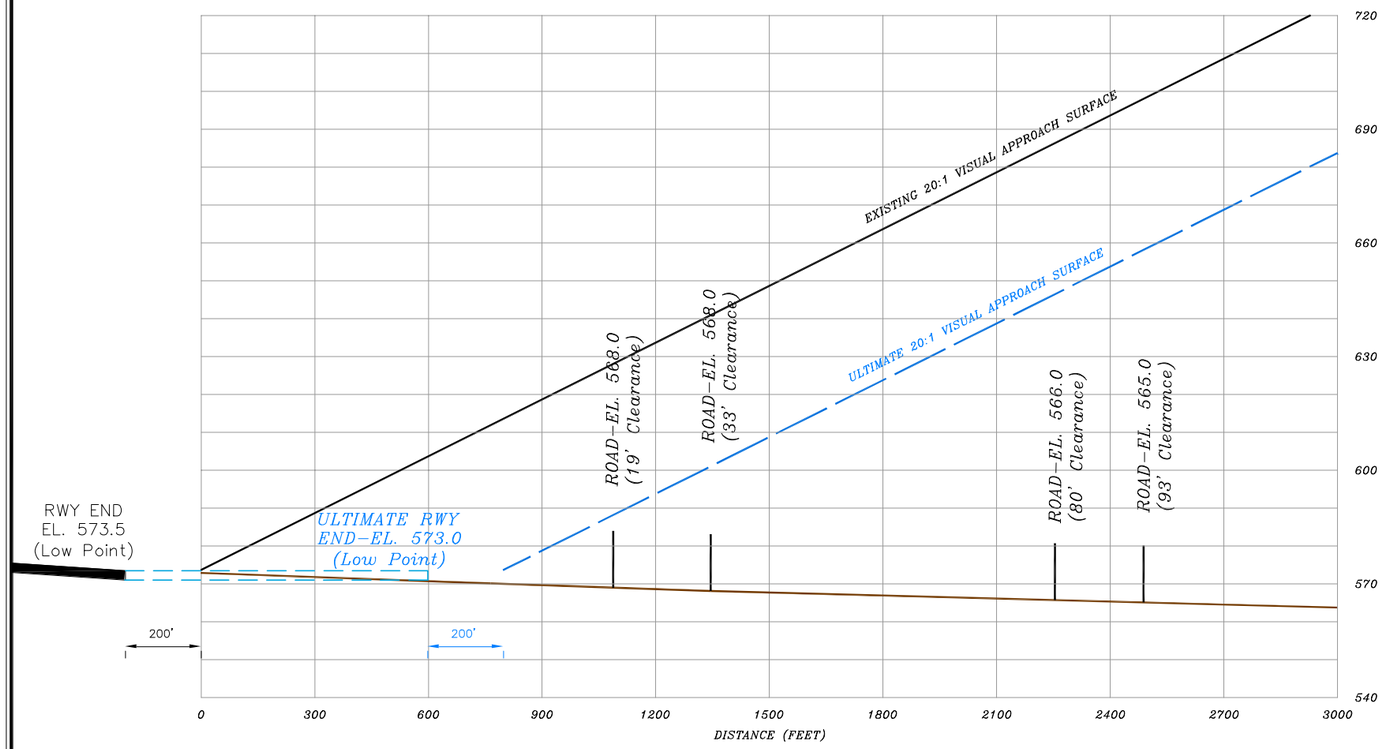
Texas Department of Transportation
Aviation Division

SHEET 7 OF 16

Coffman Associates–LDJ HYI–lau.dwg Friday April 19 2002 8:31am



RUNWAY 30



OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
– NONE FOUND	–	–	–	–	–

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads or private roads, 15' for noninterstate roads, 17' for interstate roads, and 23' for railroad. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated AIRPORT AIRSPACE DRAWING. Additional obstruction data is illustrated on National Ocean Survey document OC 502, AIRPORT OBSTRUCTION CHART.
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Magnetic Declination
5.851° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300–13 CH 7 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION AND AN FAA FORM 7460–1 SUBMITTED PRIOR TO ANY CONSTRUCTION ON AIRPORT PROPERTY

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DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

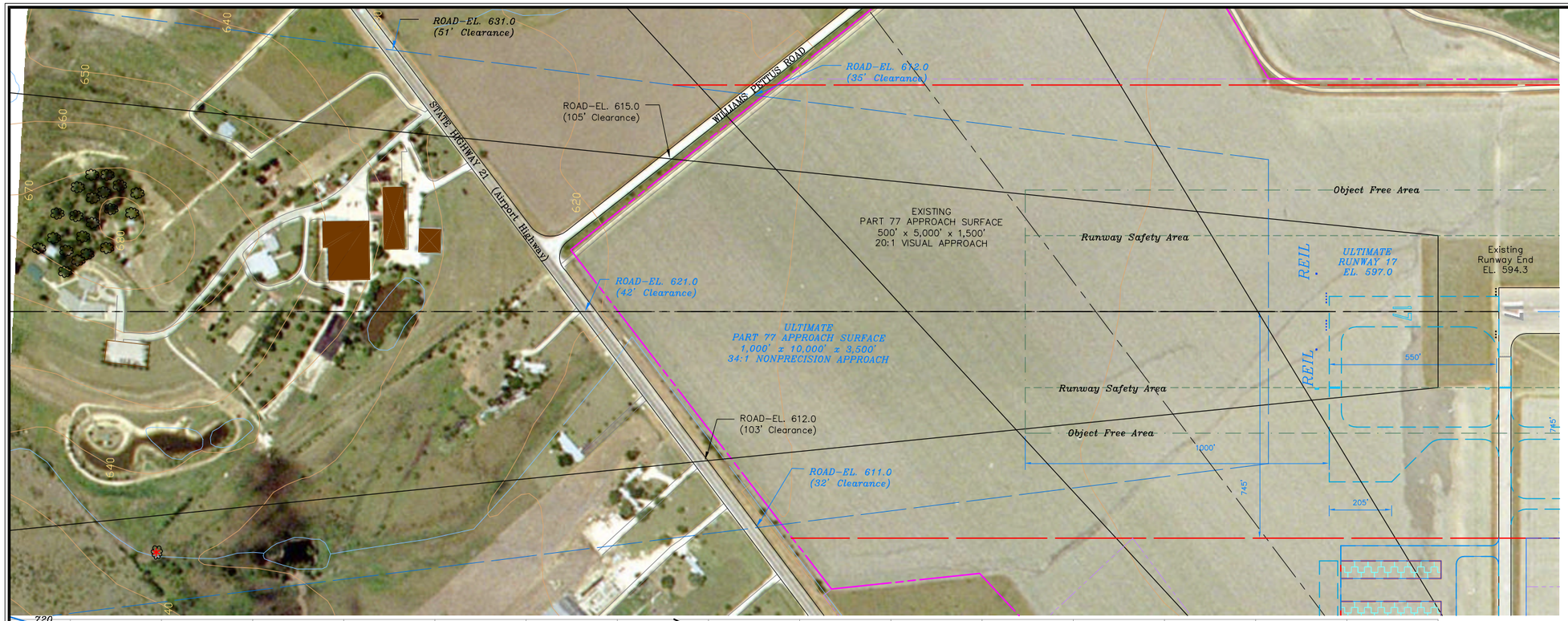
Mike W. Dmyterko	November 13, 2002	DESIGNED BY — DATE
Larry D. Johnson	November 13, 2002	DRAWN BY — DATE
James M. Harris	November 13, 2002	CHECKED BY — DATE

INNER PORTION OF RUNWAY 30
APPROACH SURFACE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

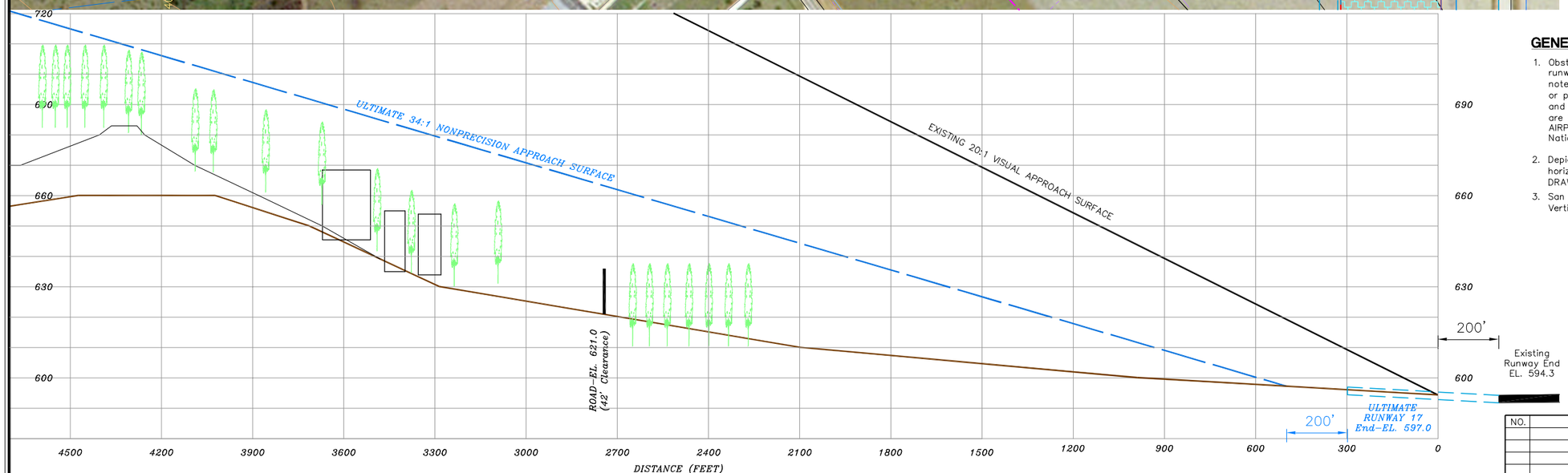
SHEET 8 OF 16

Coffman Associates–LDJ H:\t-tas.dwg Friday April 19 2002 8:31am



NORTH

Magnetic Declination
5.851° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)



GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads or private roads, 15' for noninterstate roads, 17' for interstate roads, and 23' for railroad. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated AIRPORT AIRSPACE DRAWING. Additional obstruction data is illustrated on National Ocean Survey document OC 502, AIRPORT OBSTRUCTION CHART.
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RUNWAY 17 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
NONE FOUND	–	–	–	–	–

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300–13 CH 7 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION AND AN FAA FORM 7460–1 SUBMITTED PRIOR TO ANY CONSTRUCTION ON AIRPORT PROPERTY

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DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

PREPARED BY:

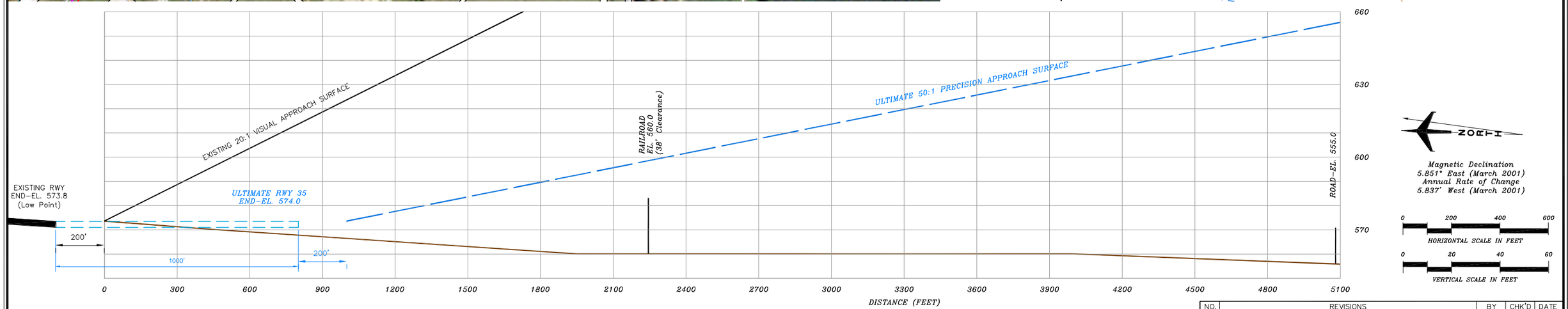
Coffman Associates
Airport Consultants
www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE
Larry D. Johnson — November 13, 2002
DRAWN BY — DATE
James M. Harris — November 13, 2002
CHECKED BY — DATE

INNER PORTION OF RUNWAY 17
APPROACH SURFACE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

Coffman Associates–DJ H11–bsa.dwg Friday April 19 2002 8:31am



OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
– None Found	–	–	–	–	–

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt roads or private roads, 15' for noninterstate roads, 17' for interstate roads, and 23' for railroad. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated AIRPORT AIRSPACE DRAWING. Additional obstruction data is illustrated on National Ocean Survey document OC 502, AIRPORT OBSTRUCTION CHART.
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AVIATION DIVISION

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DIRECTOR, AVIATION DIVISION DATE

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE DATE

NO.	REVISIONS	BY	CHK'D	DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002
DESIGNED BY — DATE

Larry D. Johnson — November 13, 2002
DRAWN BY — DATE

James M. Harris — November 13, 2002
CHECKED BY — DATE

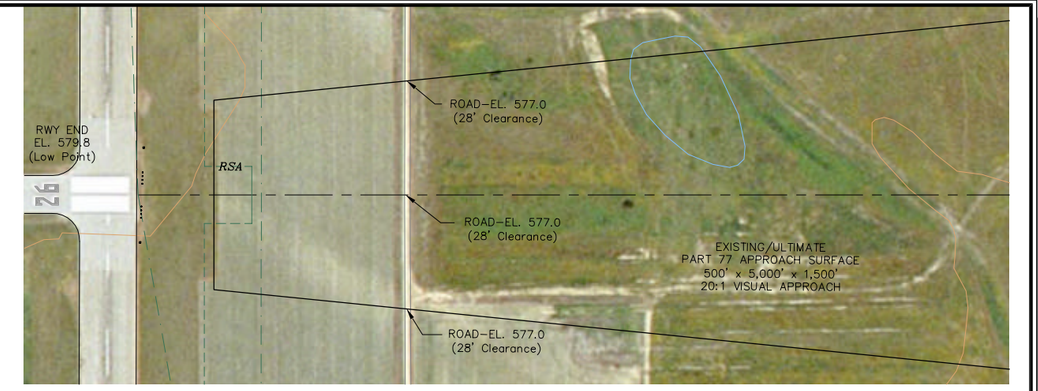
INNER PORTION OF RUNWAY 35 APPROACH SURFACE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

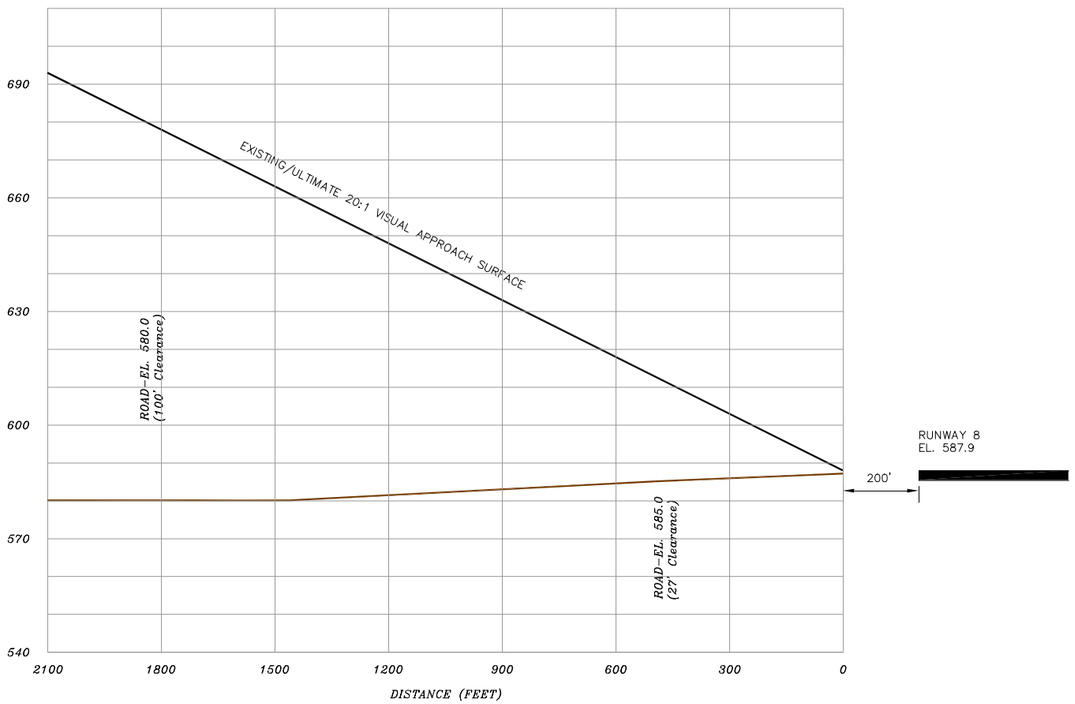
SHEET 10 OF 16

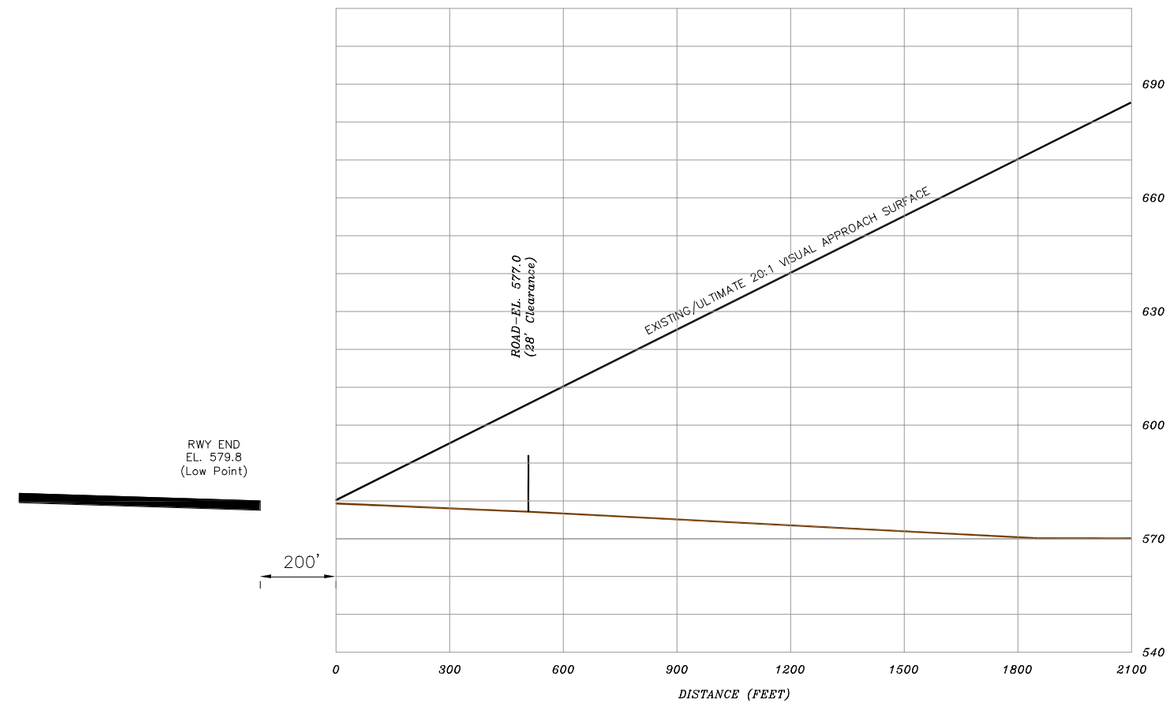
Coffman Associates–LDJ H:\t-las.dwg Friday April 19 2002 8:31am

RUNWAY 8



RUNWAY 26





RUNWAY 8 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
NONE FOUND	–	–	–	–	–

RUNWAY 26 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
NONE FOUND	–	–	–	–	–

GENERAL NOTES:

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TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE — DATE

NO.	REVISIONS	BY	CHK'D	DATE

PREPARED BY: Coffman Associates Airport Consultants www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002 — DESIGNED BY — DATE
Larry D. Johnson — November 13, 2002 — DRAWN BY — DATE
James M. Harris — November 13, 2002 — CHECKED BY — DATE

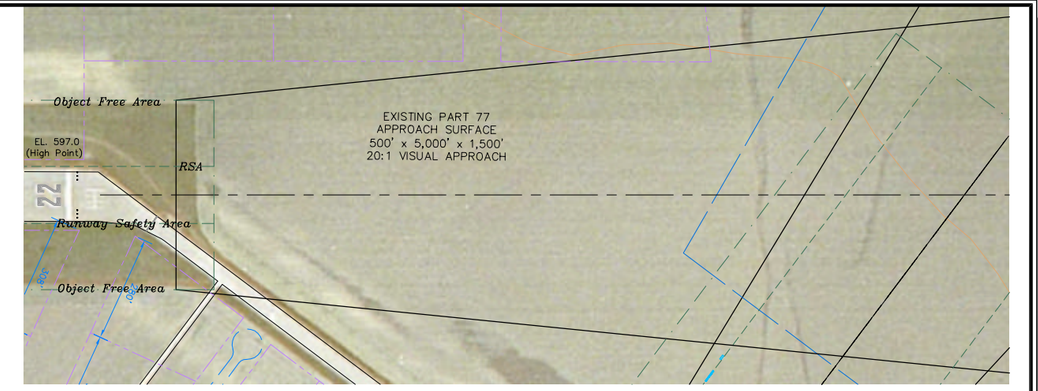
INNER PORTION OF RUNWAY 8–26
APPROACH SURFACE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation Aviation Division

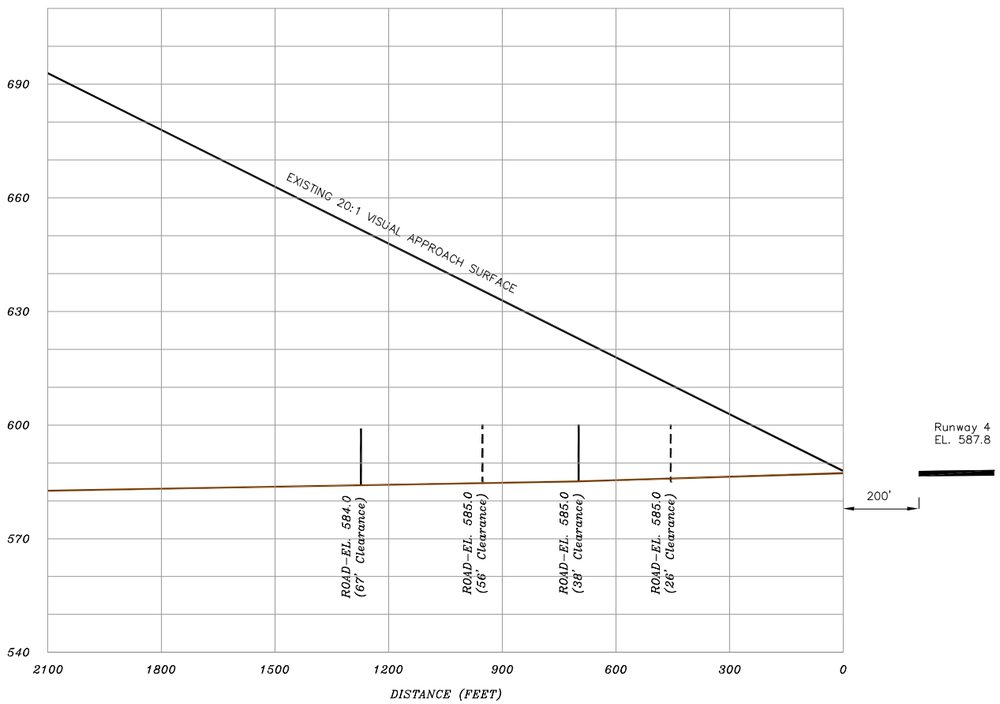
SHEET 11 OF 16

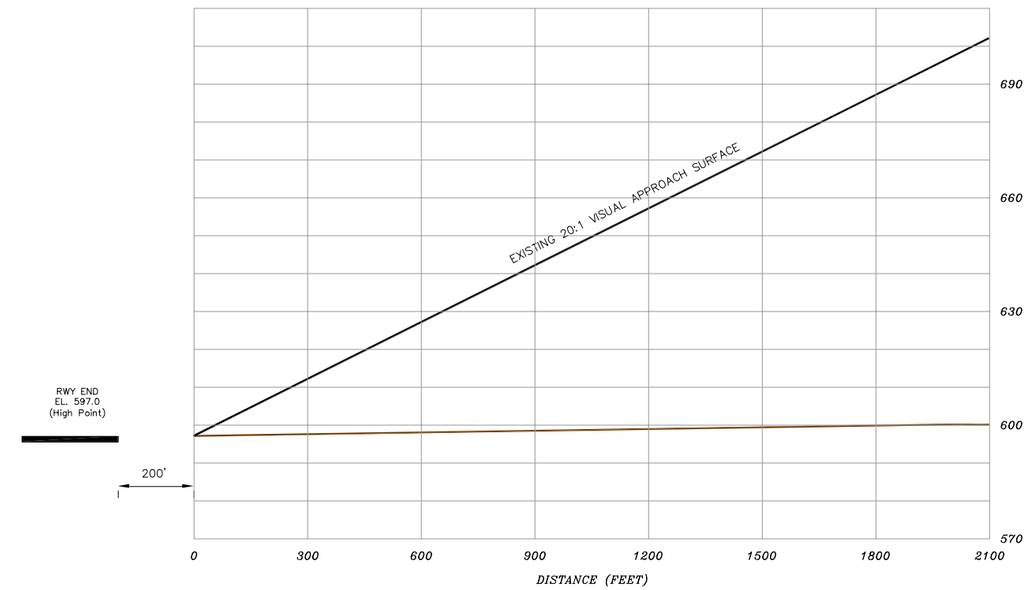
Coffman Associates–LDJ h:\t–tas.dwg Friday April 19 2002 8:31am

RUNWAY 4 (TO BE CLOSED)



RUNWAY 22 (TO BE CLOSED)





RUNWAY 4 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
NONE FOUND	–	–	–	–	–

RUNWAY 22 OBSTRUCTION TABLE

Object Description	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
NONE FOUND	–	–	–	–	–

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NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

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SIGNATURE — DATE

PREPARED BY: Coffman Associates Airport Consultants www.coffmanassociates.com

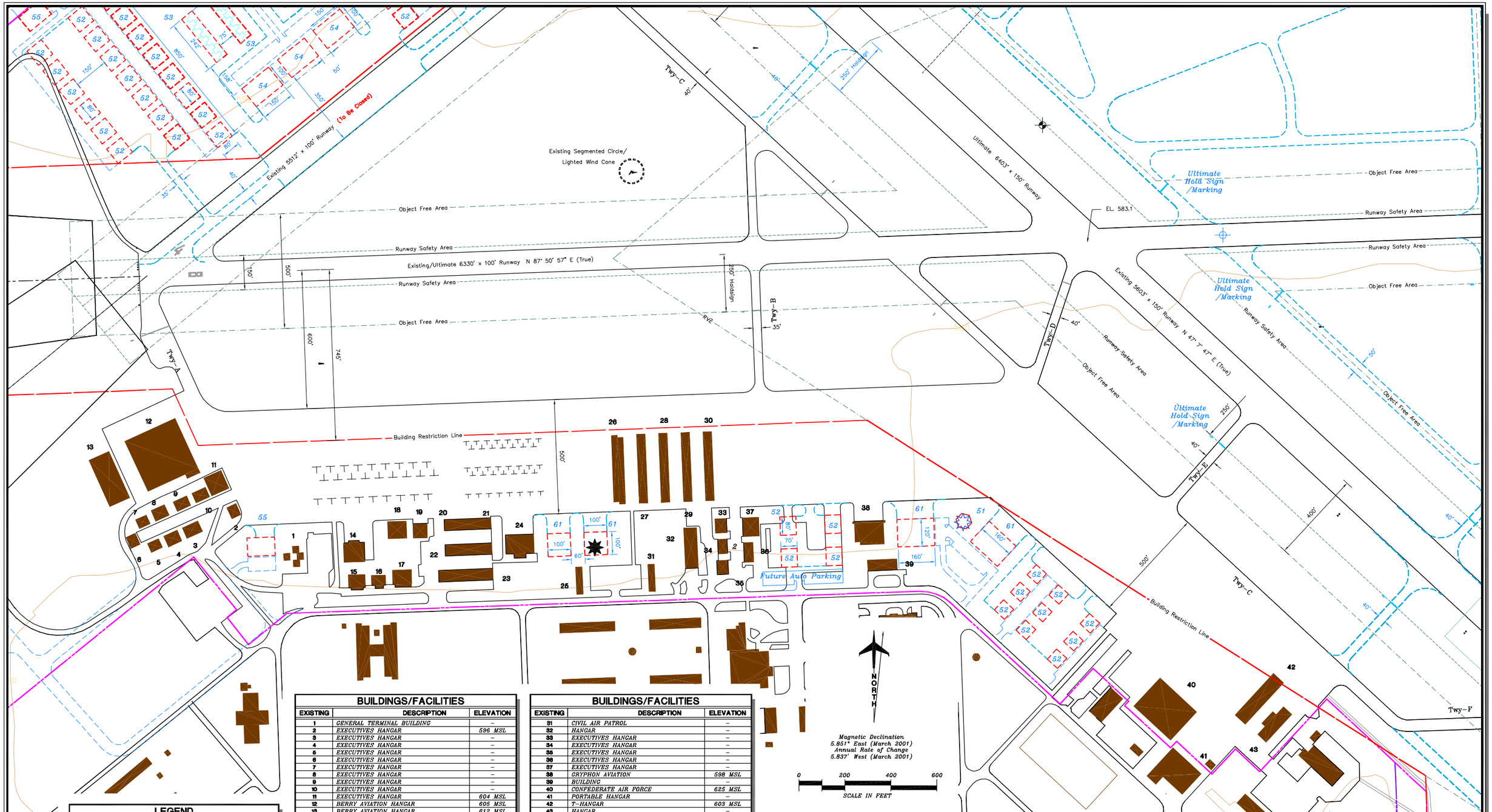
Mike W. Dmyterko — November 13, 2002 — DESIGNED BY — DATE
Larry D. Johnson — November 13, 2002 — DRAWN BY — DATE
James M. Harris — November 13, 2002 — CHECKED BY — DATE

INNER PORTION OF RUNWAY 4–22
APPROACH SURFACE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation Aviation Division

SHEET 12 OF 16

Coffman Associates–LDJ h:\t–tas.dwg Friday April 19 2002 8:31am



LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		BUILDING CONSTRUCTION
	BRL	BUILDING RESTRICTION LINE (BRL)
		DRAINAGE
		FACILITY CONSTRUCTION
		FENCING
VASI-4	PAPI-4	NAVIGATIONAL AID INSTALLATION (CVGI)
		RUNWAY THRESHOLD LIGHTS and REIL
		HOLDING POSITION MARKING
		SEGMENTED CIRCLE/WIND INDICATOR
		WIND INDICATOR (Lighted)
1080		TOPOGRAPHY (source)
		DIRT ROAD

BUILDINGS/FACILITIES

EXISTING	DESCRIPTION	ELEVATION
1	GENERAL TERMINAL BUILDING	–
2	EXECUTIVES HANGAR	596 MSL
3	EXECUTIVES HANGAR	–
4	EXECUTIVES HANGAR	–
5	EXECUTIVES HANGAR	–
6	EXECUTIVES HANGAR	–
7	EXECUTIVES HANGAR	–
8	EXECUTIVES HANGAR	–
9	EXECUTIVES HANGAR	–
10	EXECUTIVES HANGAR	–
11	EXECUTIVES HANGAR	604 MSL
12	BERRY AVIATION HANGAR	605 MSL
13	BERRY AVIATION HANGAR	612 MSL
14	SOUTHWEST TEXAS AVIATION #1	615 MSL
15	EXECUTIVES HANGAR	–
16	EXECUTIVES HANGAR	–
17	EXECUTIVES HANGAR	–
18	SOUTHWEST TEXAS AVIATION #2	597 MSL
19	HANGAR	601 MSL
20	GAFFORD AERO	596 MSL
21	T-HANGAR "A"	596 MSL
22	T-HANGAR "B"	–
23	T-HANGAR "C"	–
24	McKEE AIRCRAFT	606 MSL
25	CIVIL AIR PATROL	594 MSL
26	SHADE HANGAR	–
27	T-HANGAR	–
28	T-HANGAR	–
29	T-HANGAR	–
30	T-HANGAR	601 MSL

BUILDINGS/FACILITIES

EXISTING	DESCRIPTION	ELEVATION
31	CIVIL AIR PATROL	–
32	HANGAR	–
33	EXECUTIVES HANGAR	–
34	EXECUTIVES HANGAR	–
35	EXECUTIVES HANGAR	–
36	EXECUTIVES HANGAR	–
37	EXECUTIVES HANGAR	–
38	GRYPHON AVIATION	598 MSL
39	BUILDING	–
40	CONFEDERATE AIR FORCE	625 MSL
41	PORTABLE HANGAR	–
42	T-HANGAR	603 MSL
43	HANGAR	–
44	FUEL STORAGE	–

1. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAV-83), Vertical Datum (NGVD-29), USGS Base Maps and Runway Elevations (NAVD-88).

ULTIMATE BUILDINGS/FACILITIES

ULTIMATE	DESCRIPTION
51	AIR TRAFFIC CONTROL TOWER (ATCT)
52	RESERVED EXECUTIVE HANGARS AREA
53	RESERVED T-HANGARS AREA (Nested, 10 unit)
54	RESERVED FIXED BASE OPERATION HANGARS AREA (FBO)
55	AIRPORT RESCUE and FIREFIGHTING (ARFF)
61	RESERVED CONVENTIONAL HANGARS AREA

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

☐ ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CH 7 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION AND AN FAA FORM 7460-1 SUBMITTED PRIOR TO ANY CONSTRUCTION ON AIRPORT PROPERTY

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DIRECTOR, AVIATION DIVISION DATE

AIRPORT SPONSOR

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SIGNATURE DATE

PREPARED BY:

Coffman Associates
Airport Consultants
www.coffmanassociates.com

Mike W. Dmyterko — November 13, 2002
DESIGNED BY DATE

Larry D. Johnson — November 13, 2002
DRAWN BY DATE

James M. Harris — November 13, 2002
CHECKED BY DATE

SOUTH TERMINAL AREA DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

SHEET 13 OF 16

Coffman Associates-LDJ HTT-Joplin.dwg Wednesday, November 13, 2002 9:46am

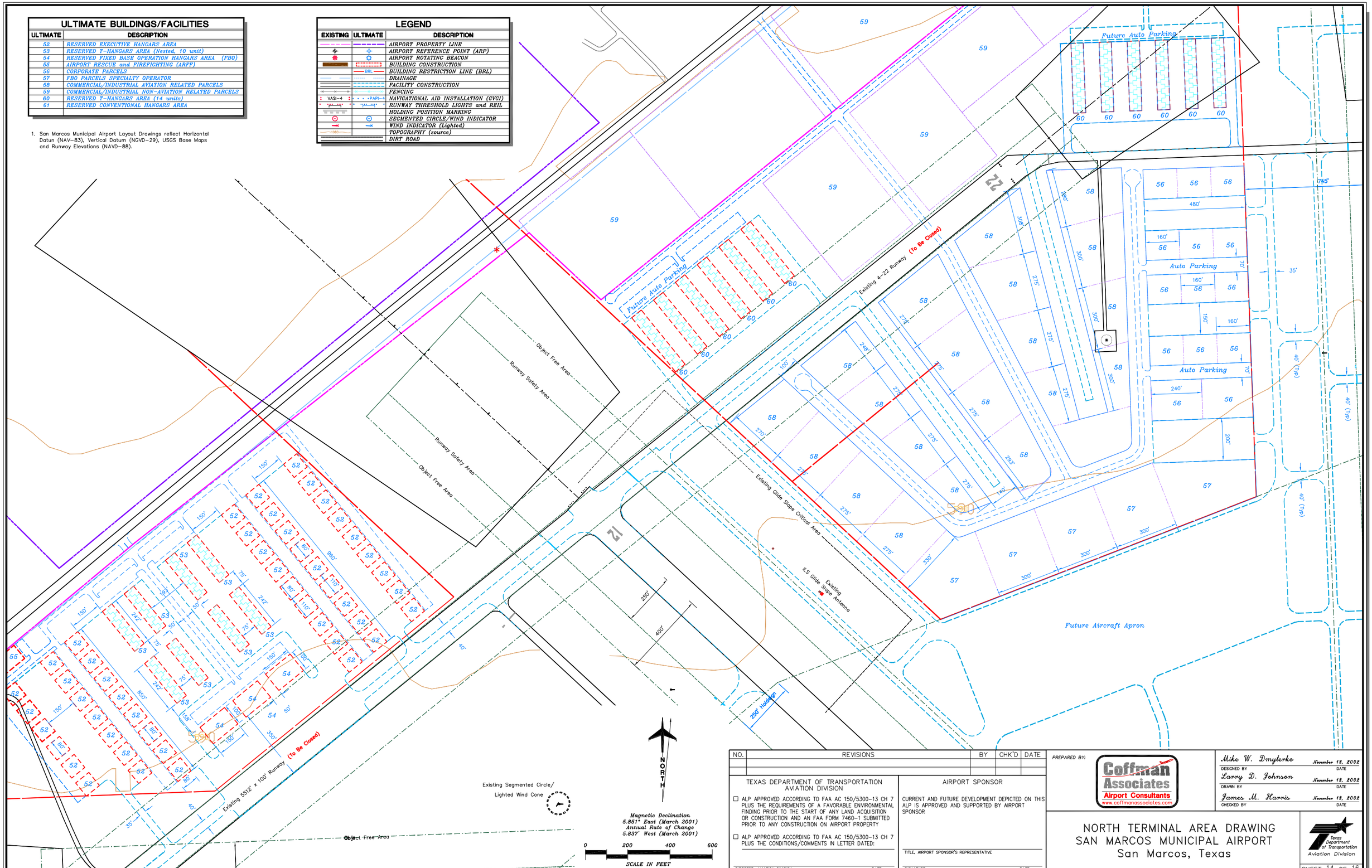
ULTIMATE BUILDINGS/FACILITIES

ULTIMATE	DESCRIPTION
52	RESERVED EXECUTIVE HANGARS AREA
53	RESERVED T-HANGARS AREA (Nested, 10 unit)
54	RESERVED FIXED BASE OPERATION HANGARS AREA (FBO)
55	AIRPORT RESCUE and FIREFIGHTING (ARFF)
56	CORPORATE PARCELS
57	FBO PARCELS SPECIALTY OPERATOR
58	COMMERCIAL/INDUSTRIAL AVIATION RELATED PARCELS
59	COMMERCIAL/INDUSTRIAL NON-AVIATION RELATED PARCELS
60	RESERVED T-HANGARS AREA (14 units)
61	RESERVED CONVENTIONAL HANGARS AREA

1. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAV-83), Vertical Datum (NGVD-29), USGS Base Maps and Runway Elevations (NAVD-88).

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		BUILDING CONSTRUCTION
	BRL	BUILDING RESTRICTION LINE (BRL)
		DRAINAGE
		FACILITY CONSTRUCTION
		FENCING
VASI-4	PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
		RUNWAY THRESHOLD LIGHTS and REIL
		HOLDING POSITION MARKING
		SEGMENTED CIRCLE/WIND INDICATOR
		WIND INDICATOR (Lighted)
1080		TOPOGRAPHY (source)
		DIRT ROAD



NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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DIRECTOR, AVIATION DIVISION DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

SIGNATURE DATE

PREPARED BY: Coffman Associates Airport Consultants www.coffmanassociates.com

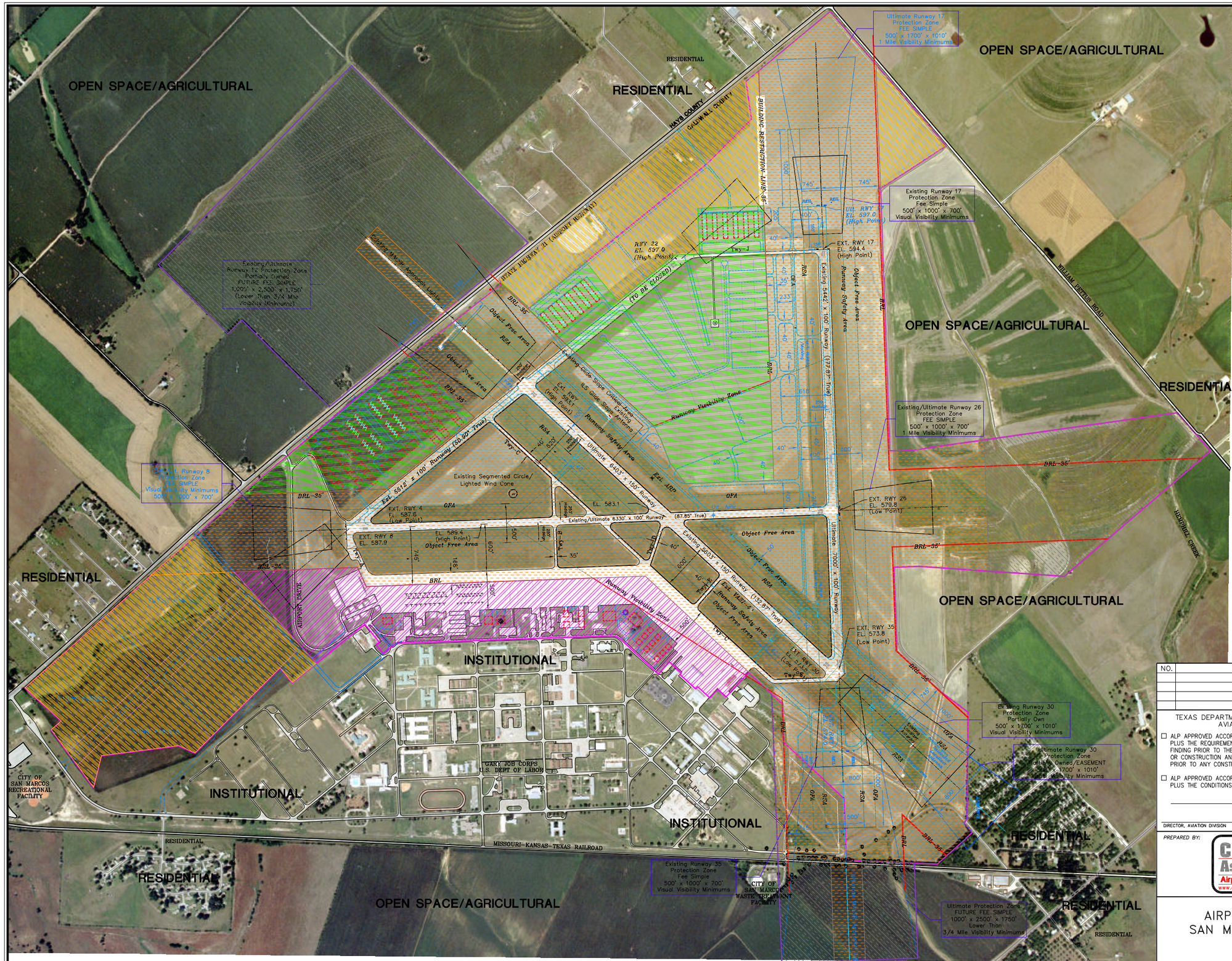
Mike W. Dmyterko November 13, 2002
DESIGNED BY DATE
Larry D. Johnson November 13, 2002
DRAWN BY DATE
James M. Harris November 13, 2002
CHECKED BY DATE

NORTH TERMINAL AREA DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation Aviation Division

SHEET 14 OF 16

Coffman Associates-LDJ H:\TI-layout.dwg Wednesday November 13 2002 9:46am



ON-AIRPORT LAND USE LEGEND

- AIRFIELD OPERATIONS
- INDUSTRIAL/COMMERCIAL (AVIATION RELATED)
- GENERAL AVIATION TERMINAL
- AVIATION RESERVED
- OPEN/AGRICULTURAL

1. San Marcos Municipal Airport Layout Drawings reflect Horizontal Datum (NAV-83), Vertical Datum (NGVD-29), USGS Base Maps and Runway Elevations (NAVD-88).

NORTH

Magnetic Declination
5.851° East (March 2001)
Annual Rate of Change
5.837' West (March 2001)

0 600 1200 1800
SCALE IN FEET

NO.	REVISIONS	BY	CHK'D	DATE

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Airport Consultants
www.coffmanassociates.com

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DESIGNED BY — DATE

Larry D. Johnson — *November 13, 2002*
DRAWN BY — DATE

James M. Harris — *November 13, 2002*
CHECKED BY — DATE

AIRPORT LAND USE DRAWING
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

SHEET 15 OF 16

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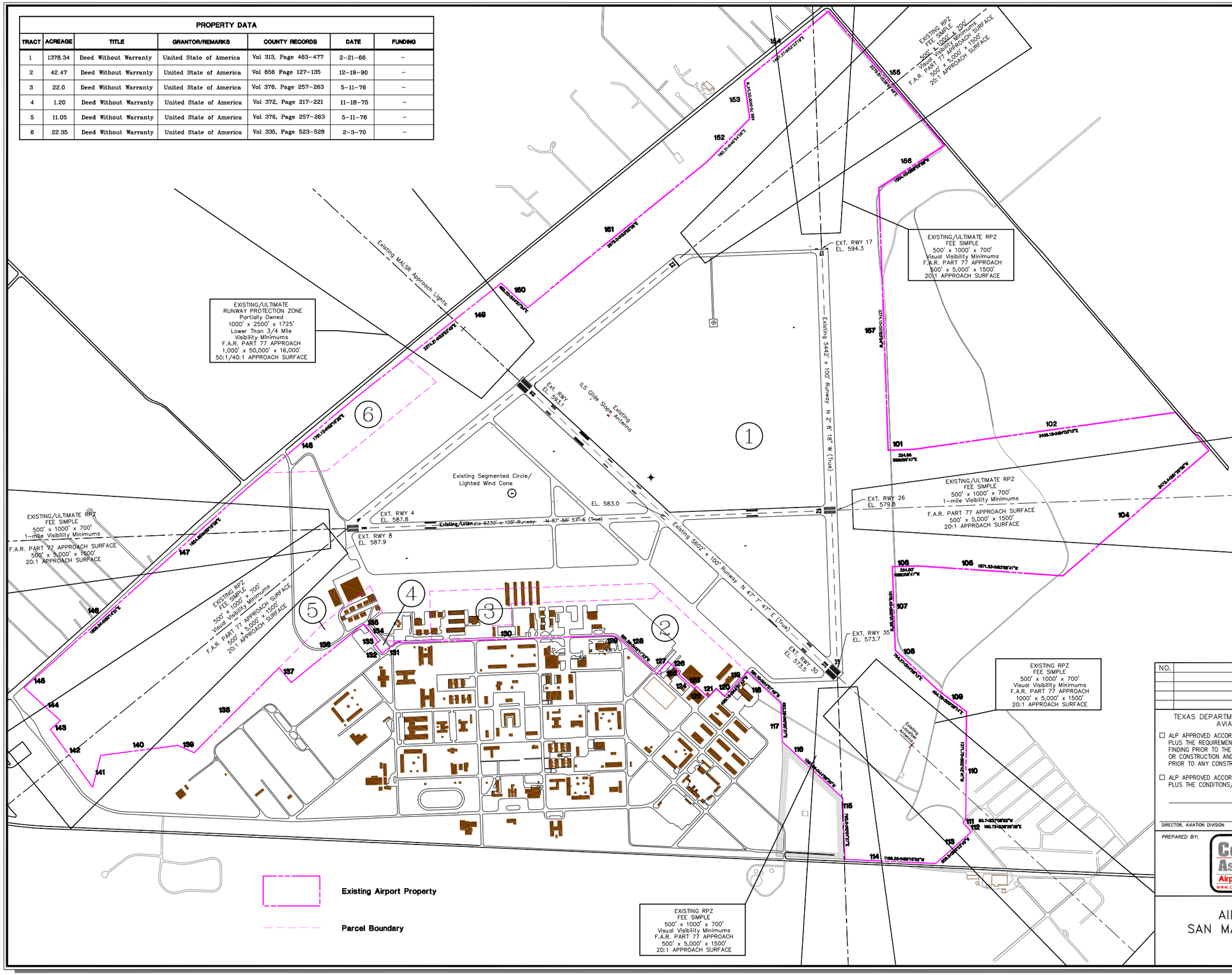
PROPERTY DATA

TRACT	ACREAGE	TITLE	GRANTOR/REMARKS	COUNTY RECORDS	DATE	FUNDING
1	1378.34	Deed Without Warranty	United State of America	Vol 313, Page 463–477	2–21–66	–
2	42.47	Deed Without Warranty	United State of America	Vol 856 Page 127–135	12–19–90	–
3	22.0	Deed Without Warranty	United State of America	Vol 376, Page 257–263	5–11–76	–
4	1.20	Deed Without Warranty	United State of America	Vol 372, Page 217–221	11–18–75	–
5	11.05	Deed Without Warranty	United State of America	Vol 376, Page 257–263	5–11–76	–
6	22.35	Deed Without Warranty	United State of America	Vol 335, Page 523–528	2–3–70	–



AIRPORT PROPERTY LINE

LINE	DISTANCE/BEARING	CHORD	RADIUS
101	324.95 < S 89° 56'47" E		
102	3406.18 < N 84° 03'10" E		
103	652.45 < S 38° 47'45" E		
104	2473.4 < S 51° 29'55" W		
105	1871.23 < N 83° 58'41" W		
106	324.90 < N 89° 58'47" W		
107	1076.45 < S 00° 01'55" W		
108	754.27 < S 44° 58'13" E		
109	454.79 < S 50° 58'14" E		
110	1371.70 < S 02° 42'41" W		
111	60.7 < S 37° 08'52" W		
112	160.72 < S 38° 29'38" E		
113	609.5 < S 50° 23'45" W		
114	1169.25 < N 85° 16'02" W		
115	790.0 < N 0° 01'27" E		
116	1061.69 < N 44° 58'20" W		
117	493.29 < N 0° 00'37" E		
118	591.15 < N 44° 57'49" W		
119	430.16 < S 44° 51'42" W		
120	145.46 < N 44° 54'53" W		
121	150.04 < S 45° 00'42" W		
122	210.10 < N 44° 58'04" W		
123	39.18 < S 45° 01'16" W		
124	271.80 < N 45° 14'52" W		
125	25.38 < N 45° 18'13" E		
126	210.31 < N 45° 12'43" W		
127	210.99 < S 44° 57'59" W		
128	651.59 < N 45° 11'33" W		
129		138.72 < N 67° 33'08" W	182.33' R
130	2758.90 < N 89° 54'43" W		
131	215.80 < S 53° 05'48" W		
132	150.08 < N 36° 09'03" W		
133	52.94 < N 53° 06'46" E		
134	259.92 < N 36° 53'24" W		
135	35.93 < N 36° 52'00" W		
136	1200.0 < S 53° 03'18" W		
137	247.76 < N 36° 56'42" W		
138	1546.72 < S 47° 03'33" W		
139	230.0 < N 63° 55'21" W		
140	1000.0 < S 84° 45'39" W		
141	422.10 < S 16° 06'39" W		
142	921.56 < N 34° 08'21" W		
143	171.44 < N 51° 17'39" E		
144	632.57 < N 45° 36'44" W		
145		446.55 < N 50° 48'41" E	1509.2' R
146	1809.04 < N 50° 14'01" E		
147	1624.85 < N 50° 18'09" E		
148	1791.12 < N 52° 16'32" E		
149	2374.21 < N 53° 53'45" E		
150	465.22 < S 44° 57'54" E		
151	2975.0 < N 53° 02'06" E		
152	780.31 < N 46° 54'06" E		
153	489.76 < N 06° 05'54" W		
154	1407.37 < N 52° 23'19" E		
155	2279.81' < S 38° 42'48" E		
156	1004.43 < S 59° 03'28" W		
157	3374.15 < S 0° 03'04" W		

NO.	REVISIONS	BY	CHK'D	DATE

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

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Mike W. Dmyterko — November 13, 2002
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Larry D. Johnson — November 13, 2002
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James M. Harris — November 13, 2002
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AIRPORT PROPERTY MAP
SAN MARCOS MUNICIPAL AIRPORT
San Marcos, Texas

Texas Department of Transportation
Aviation Division

SHEET 16 OF 16

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San Marcos
MUNICIPAL AIRPORT

Chapter Six
FINANICAL PLAN

Financial Plan

The analyses completed in previous chapters evaluated development needs at the airport over the next twenty years and beyond based on forecast activity and operational efficiency. However, the most critical element of the master planning process is the application of basic economic, financial, and management rationale to each development item so that the feasibility of each item contained in the plan can be assured. The purpose of this chapter is to provide financial management information and tools which will help make the master plan achievable and successful.

The presentation of the financial plan and its feasibility has been organized into three sections. First, the airport development schedule is presented in narrative and graphic form. Secondly, capital improvement funding sources on the federal, state, and local levels are identified and discussed. Finally, the chapter presents a cash flow analysis which analyzes the financial feasibility of the recommended capital improvement program (CIP).

AIRPORT DEVELOPMENT SCHEDULES AND COST SUMMARIES

Once the specific needs and improvements for the airport have been established, the next step is to determine a realistic schedule and costs for implementing the plan. This section will examine the overall cost of each item in the development plan and present a development schedule. The recommended improvements are grouped and divided by planning horizon, short term, intermediate term, and long term. **Table 6A** summarizes the key milestones for each of the three planning horizons.

TABLE 6A
Planning Horizon Milestone Summary
San Marcos Municipal Airport

	2000	Short Term	Intermediate Term	Long Term
ANNUAL OPERATIONS				
Itinerant				
Air Taxi	276	300	500	1,000
General Aviation	36,800	50,000	56,000	75,000
Military	2,000	3,000	4,000	5,000
Total Itinerant	39,076	53,300	60,500	81,000
Local				
General Aviation	64,400	75,000	84,000	112,500
Military	0	1,000	1,000	1,000
Total Local	64,400	76,000	85,000	113,500
Total Operations	**103,476**	**129,300**	**145,500**	**194,500**
BASED AIRCRAFT				
Single Engine	189	200	217	285
Multi-Engine	10	13	17	26
Turboprop	22	28	34	45
Jet	4	6	8	11
Helicopter	2	3	4	8
Total Based Aircraft	**227**	**250**	**280**	**375**
Total AIA's	**N/A**	**1,050**	**1,150**	**1,370**

The short term planning horizon contains items of high priority, and those that should be considered as the airport begins to approach the milestones identified for the short term.

As short term horizon activity levels are reached, it will be time to program for the intermediate term based upon the next activity milestones. Similarly, when the intermediate term milestones are reached, it will be time to program for the long term activity milestones.

As a master plan is a conceptual document, implementation of these capital projects should only be undertaken after further refinement of their design and costs through architectural and engineering analyses.

The cost estimates presented in this chapter have been increased to allow for engineering any other contingencies that may arise on the project. Capital costs presented here should be viewed only as estimates subject to further

refinement during design. Nevertheless, these estimates are considered sufficiently accurate for performing the feasibility analyses in this chapter. Cost estimates for each of the development projects listed in the capital improvement plan are listed in current (2001) dollars. **Exhibit 6A** presents the proposed capital program for San Marcos.

SHORT TERM IMPROVEMENTS

The Texas Department of Transportation's (TxDOT) Aviation Division is the source for federal and state grant funding for the City of San Marcos. Due to the large number of requests from airports across the state and limited funding available, TxDOT's grant process will generally only provide an airport with intermittent funding assistance. This is to say that TxDOT may provide funding for a project the current fiscal year, but may not provide additional assistance for several years thereafter. For this reason, development projects for the short term have been planned according to priority needs. These projects have been assigned specific years, however, as funding for these projects is requested, there is potential for many of these projects to be funded in a single year's grant.

The short term planning horizon capital improvement program centers around the real immediate needs of the airport.

Projects in the short term include the preparation of an Airport Certification Manual (ACM) and airport signage as a prerequisite for F.A.R. Part 139 certification. The plan also includes the complete rehabilitation or replacement of approximately 20 acres of airport concrete ramp pavement at the east end of the ramp.

Another project identified in the short term is lengthening primary runway 12-30 to 6,400 feet to better serve corporate aircraft. This project would also include the construction of access taxiways and repairs or reconstruction to the existing runway. Extension of the runway will require specific justification by TxDOT.

The planned extension would shift the runway protection zone (RPZ) southeast, beyond existing airport bounds. The shifted RPZ would ultimately overlay a residential area to the southeast. Although it is recommended that property in a RPZ be acquired fee simple, the plan will consider acquiring avigation easements only. Avigation easements are rights to the airspace above the property which restrict the land owner from erecting any structure which is taller than the agreed height. The area recommended for easement acquisition is approximately 13 acres.

The construction of an airport traffic control tower (ATCT) has been identified for the short term to enhance operational safety and efficiency at the airport. It is anticipated that funding for the tower construction will come from TxDOT and for staffing and operations from the FAA. ATCT operational costs could either be partially or fully funded by the FAA, depending upon review of specific operations at the airport at the time of

the tower construction. To be fully funded, the airport needs to meet the benefit/cost ratio specified by the FAA (1.0). Any ratio lower than 1.0 could be funded as a percentage thereof. For example, a ratio of 0.60 could attract 60 percent funding assistance from the FAA.

The final projects to be completed in the short term is the addition of an Airport Rescue Firefighting Facility (ARFF) including the acquisition of an ARFF vehicle and perimeter fencing. These facilities are also requirements for Part 139 certification.

Short term projects graphically depicted on Exhibit 6B have been estimated at $7.3 million total cost. Of that total, approximately $650,000 will be required to be provided by the City.

INTERMEDIATE TERM IMPROVEMENTS

Intermediate term improvements consider meeting a higher threshold of aviation activity demand.

In this time frame development will begin in the northwestern portion of the airport property between the ends of Runway 12-30 and 8-26. It is envisioned that maintenance costs of Runway 4-22 and additional hangar space requirements will drive the need to close the runway. After Runway 4-22 is closed an improved portion will be used as a taxiway providing access to this new area of general aviation development. As planned, this area would include three FBO/Specialty shops, eighty T-Hangars, and 48 executive hangars. It is planned that the city will lease the unimproved lots to private developers. This would significantly lower the cost to the City while still providing substantial annual income.

In addition, several areas have been identified in the existing terminal area on the southeast side of the airport for additional executive and conventional hangar development. As planned, there would be a total of four conventional hangars and sixteen executive hangars in this area. Once again, it is planned that private developers would be responsible for the construction of the hangars.

In order to protect safe approaches in the future, property acquisition of areas in the Runway 12 and future Runway 35 RPZs has been planned. The area off the end of Runway 12 on the north side of the airport, encompassing approximately 270 acres. The full 270 acres is not required for the RPZ, however, this tract of land would ensure safe and efficient flight to the airport's only instrument landing system (ILS) approach. The second area planned for acquisition is on the south side of the airport, south of Runway 35. This parcel of land is approximately 75 acres. Acquiring this property would allow for the ultimate plans of extending and making Runway 17-35 the primary runway.

Finally, a new airport entrance road will be constructed during this planning horizon.

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Project		Total Cost	TxDOT Share	Local Share
SHORT TERM PROGAM (0-5 YEARS)				
2001/02	Upgrades for Part 139 Certification	$350,000	$300,000	$50,000
2002/03	Repair/Replace approx 20 acres concrete	1,000,000	900,000	100,000
2003/04	Lengthen Rwy 12-30 800 ft & taxiways	2,000,000	1,800,000	200,000
2003/04	Easement for Rwy 30 RPZ	32,500	29,250	3,250
2004/05	Airport Control Tower Installation*	1,500,000	1,350,000	150,000
2005/06	Airport Rescue Firefighting Facility*	1,200,000	1,080,000	120,000
2005/06	ARFF Equipment	300,000	270,000	30,000
2005/06	Install Perimeter Fencing/Access Gates	950,000	855,000	95,000
SHORT TERM TOTAL		**$7,332,500**	**$6,584,250**	**$748,250**
INTERMEDIATE TERM PROGRAM (6-10 YEARS)				
1.	Property Acquisition off Runway 35 end for RPZ	$165,000	$148,500	$16,500
2.	Property Acquisition off Runway 12	870,000	130,000	740,000
3.	Construct New Airport Entrance Road	210,600	0	210,600
4.	Construct Apron area for Exec Hangars on Southeast	555,000	499,500	55,500
5.	Construct Northwest Apron area for Hangars	4,400,000	3,960,000	440,000
6.	Construct Apron area for FBOs on Northwest	600,000	540,000	60,000
7.	Construct Roads/Parking for Northwest GA area	1,100,000	0	1,100,000
INTERMEDIATE TERM TOTAL		**$7,900,600**	**$5,278,000**	**$2,622,600**
LONG TERM PROGRAM (11-20 YEARS)				
1.	Reconstruct Runway 17-35	$5,400,000	$4,860,000	$540,000
2.	Pavement Preservation Runway 12-30 & Taxiways	533,000	479,700	53,300
3.	Install MALSR on Runway 35	350,000	350,000	0
4.	Construct New Taxiways Rwy 17-35 & 12-30	896,000	806,400	89,600
5.	Construct New Ramp for North GA Area	6,400,000	5,760,000	640,000
6.	Construct New Taxiways/Roads for North GA Area	4,900,000	4,410,000	490,000
LONG TERM TOTAL		**$18,479,000**	**$16,666,100**	**$1,812,900**
TOTAL PROGRAM COSTS		**$33,712,100**	**$28,528,350**	**$5,183,750**

* Assumes FAA Discretionary Fund Assistance

San Marcos MUNICIPAL AIRPORT

Exhibit 6A
CAPITAL IMPROVEMENT PROGRAM

Projects included in the intermediate term have been estimated to cost $7.9 million as presented on Exhibit 6A.

LONG TERM IMPROVEMENTS

The long term planning horizon includes the largest share of projects and costs. It is important to note that many of the projects included here could be shifted to earlier periods as demand warrants.

Long term projects include the reconstruction and extension of Runway 17-35. The resultant runway would be 7,000 feet long and would serve as the airport's primary runway. Runway 12-30 and it's associated taxiways will need pavement preservation work. This will help to maintain the pavement and ensure its use for years into the future.

As long term operations forecasts are reached, additional taxiways would be needed for access to the north side development area between Runways 12-30 and 17-35. These new taxiways would also ease traffic flow and increase the hourly capacity of the airport as a whole. As planned, Runway 17-35 would receive a full length parallel taxiway on the west side of the existing runway. Runway 12-30 would also receive a full length parallel taxiway. This taxiway would be located on the northeast side of the runway. These taxiways would position the airport for future development in the area between Runways 17-35 and 12-30 as shown on **Exhibit 6B**.

The final improvement listed in the long term program is the installation of a MALSR on Runway 35. This item is needed to support the GPS instrument approach for the runway. This improvement will greatly enhance the airports usability and capacity in poor weather.

Total long term projects costs have been estimated at $18.5 million.

CAPITAL IMPROVEMENTS FUNDING

Financing capital improvements at the airport will not rely solely on the financial resources of the airport. Capital improvements funding is available through various grant-in-aid programs on both the State and Federal levels. The following discussion outlines key sources of funding for capital improvements at the San Marcos Municipal Airport.

FEDERAL GRANTS

Through Federal legislation over the years, various grant-in-aid programs have been established to develop and maintain a system of public airports across the United States. The purpose of this system of and its federally based funding is to maintain national defense and to promote interstate commerce. The most recent legislation affecting the federal funding was enacted in early 2000, and is entitled the **Wendell H. Ford Aviation Investment and Reform Act for the 21st Century** or AIR-21.

The source for AIR-21 funds is the Aviation Trust Fund. The Aviation Trust Fund was established in 1970 to provide funding for aviation capital investment programs (aviation development, facilities and equipment, and research and development). The Trust Fund also finances the operation of the FAA. It is funded by user fees, taxes on airline tickets, aviation fuel, and various aircraft parts.

Funds are distributed from the Trust Fund each year by the FAA from appropriations by Congress. A portion of the annual distribution is to primary commercial service airports, based upon enplanement levels. Under AIR-21 the distribution for fiscal year 2000 is a minimum of $650,000 to each commercial service airport. In the remaining years of AIR-21, however, the minimum entitlement can increase to $1.0 million annually. This higher funding is dependent upon Congress appropriating the amounts authorized by AIR-21 each year. New to this Bill is the inclusion of general aviation entitlement funds. Each general aviation airport is now eligible to receive up to $150,000 annually in entitlement funds depending upon the airport's activity. Being a general aviation airport, San Marcos will be eligible for the $150,000.

The remaining AIP funds are distributed by the FAA based upon the priority of the project for which they have requested Federal assistance through discretionary apportionments.

As previously mentioned, the airport could expect FAA funding assistance in the future. TxDOT, under the block grant program aids general aviation airports only. Commercial service, or Part 139 funding assistance will likely have to come from FAA. FAA will likely funnel discretionary grants for Part 139 upgrades through the TxDOT block grant program. Other FAA funding assistance such as ATCT staffing would come directly from the FAA.

STATE FUNDING PROGRAM

The State of Texas participates in the federal State Block Grant program. Under the State Block Grant Program, the FAA annually distributes general aviation State apportionment and discretionary funds to TxDOT. The State then distributes grants to state airports. In compliance with TxDOT's legislative mandate that it "apply for, receive, and disburse" Federal funds for general aviation airports, TxDOT acts as the agent of the local airport sponsor. Although these grants are distributed by TxDOT, they contain all Federal obligations.

The State of Texas also distributes funding to general aviation airports from the Highway Trust Fund. These funds are appropriated each year by the State Legislature. Once distributed, these grants contain State obligations only.

The establishment of a capital improvement program (CIP) for the State entails first identifying the need, then establishing a ranking, or priority system. Identifying all State airport project needs allows the TxDOT to establish a biennial program and budget for development costs. The most

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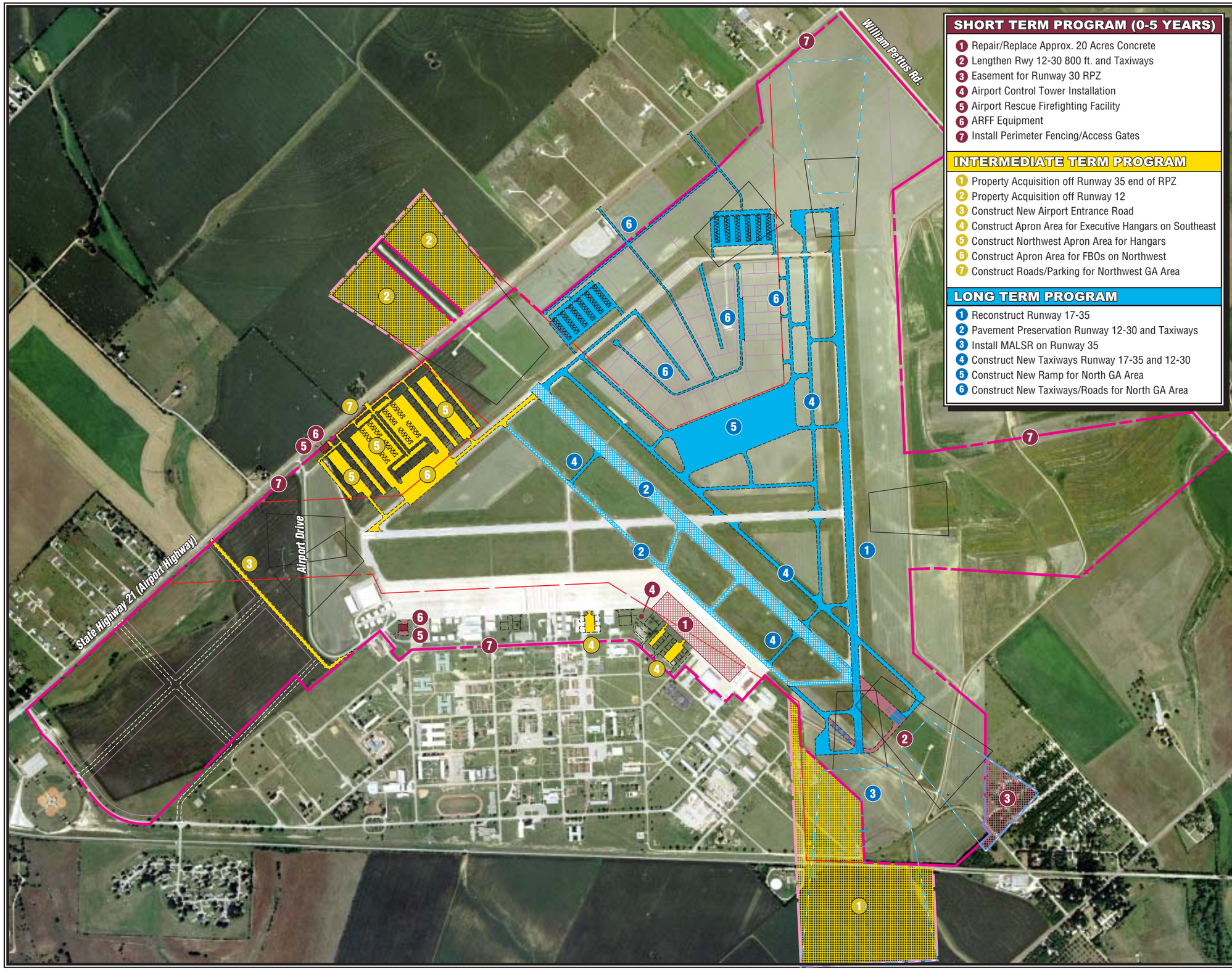
Exhibit 6B
DEVELOPMENT STAGING PROGRAM



SHORT TERM PROGRAM (0-5 YEARS)

1. Repair/Replace Approx. 20 Acres Concrete
2. Lengthen Rwy 12-30 800 ft. and Taxiways
3. Easement for Runway 30 RPZ
4. Airport Control Tower Installation
5. Airport Rescue Firefighting Facility
6. ARFF Equipment
7. Install Perimeter Fencing/Access Gates

INTERMEDIATE TERM PROGRAM

1. Property Acquisition off Runway 35 end of RPZ
2. Property Acquisition off Runway 12
3. Construct New Airport Entrance Road
4. Construct Apron Area for Executive Hangars on Southeast
5. Construct Northwest Apron Area for Hangars
6. Construct Apron Area for FBOs on Northwest
7. Construct Roads/Parking for Northwest GA Area

LONG TERM PROGRAM

1. Reconstruct Runway 17-35
2. Pavement Preservation Runway 12-30 and Taxiways
3. Install MALSR on Runway 35
4. Construct New Taxiways Runway 17-35 and 12-30
5. Construct New Ramp for North GA Area
6. Construct New Taxiways/Roads for North GA Area

LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- Ultimate Easement
- Existing Runway Protection Zone
- Ultimate Runway Protection Zone
- Building Restriction Line
- Lease Parcels
- Short Term Program
- Intermediate Term Program
- Long Term Program

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NORTH

San Marcos MUNICIPAL AIRPORT

recent TxDOT CIP, **Aviation Improvement Program 2001-2003**, assumed that approximately $32 million annual Federal AIP and $17 million State funds would be available.

The TxDOT Biennial program establishes a project priority system based upon the following objectives (in order of importance):

- enhance safety
- preserve existing facilities
- bring airport up to standards
- upgrade facilities to aid airport in providing for larger aircraft with longer stage lengths
- improve airport capacity
- new airport construction to provide new access to a previously unserved area
- new airports to provide capacity relief to existing airports

Each airport project for the San Marcos Airport must be identified and programmed into the State CIP and compete with other airport projects in the State for Federal and State funds.

In Texas, airport development projects that meet the TxDOT's discretionary funds eligibility requirements receive 90 percent funding from the AIP State Block Grant program. Eligible projects include airfield and apron facilities. However, revenue generating improvements such as fuel facilities, utilities, and hangars are not eligible for AIP funding.

TxDOT has also established a program to help airports maintain, and in some circumstances fund new airport pavements and miscellaneous projects. The Routine Airport Maintenance Program (RAMP) is an annual funding source to airports. With RAMP, TxDOT will provide a 50 percent funding match for projects up to $60,000. The program was initially designed to help airports maintain airside and landside pavements, but has recently been expanded to include construction of new facilities. Examples of new facility construction projects fundable under RAMP include: constructing an airport access road, paving the airport public parking lot, installing security fencing, replacing rotating beacon, etc. These funds are available to general aviation airports on an annual basis.

Newer programs included in TxDOT funding mechanism includes terminal building and ATCT funding. TxDOT has funded terminal building construction on a 50-50 basis up to a $400,000 total project cost. TxDOT has recently considered upgrading the total cost allowance on a case by case basis. TxDOT also will be funding the construction of ATCT, likely one to two per year. The amount of funding available is yet to be determined.

Recent legislation aimed to construct a new general aviation reliever airport in the Austin area failed. The remnants of that bill have been put forward in House Bill 2522 and Senate Bill 1617 recently. These new bills would direct TxDOT to establish and maintain a new general aviation airport in the central Texas area. It is possible that San Marcos could be named as the new Central Texas Regional Airport. If San Marcos is transferred to TxDOT for daily operation, TxDOT would assume responsibility for many of the day to day

and capital expenses shown in this master plan. At this time it is unclear whether these bills will pass or if any further changes will be made. The city and airport commission should remain informed on the progress of these bills.

FAA FACILITIES AND EQUIPMENT PROGRAM

The Airway Facilities Division of the FAA administers the national Facilities and Equipment (F&E) Program. This annual program provides funding for the installation and maintenance of various navigational aids and equipment for the national airspace system and airports. Under the F&E program, funding is provided for FAA air traffic control towers, en route navigational aids such as a VOR, and on-airport navigational aids (such as PAPIs and approach lighting systems). As activity levels and other development warrant, the airport may be considered by the FAA Airways Facilities Division for the installation and maintenance of navigational aids through the F&E program. This plan assumes financial assistance from the F&E program for the MALSR for Runway 35.

LOCAL SHARE FUNDING

The balance of project costs, after consideration has been given to the various grants available, must be funded through airport resources. Usually, this is accomplished through the use of airport earnings and reserves, to the extent possible, with the remaining costs financed through obligation bonding mechanisms.

The airport is owned and operated by the city of San Marcos with support from revenues generated by the collection of various rates and charges from general aviation sources. These revenues are generated specifically by airport operations. There are, however, restrictions on the use of revenues collected by the airport. All receipts, excluding bond proceeds or related grants and interest, are irrevocably pledged to the punctual payment of operating and maintenance expenses, payment of debt service for as long as bonds remain outstanding, or to additions or improvements to airport facilities. **Table 6B** presents historical expenses and revenues for the San Marcos Municipal Airport.

REVENUES

Operating revenues at San Marcos include hangar leases, ground leases, agricultural leases, and city funding. As shown on **Table 6B**, revenues for the past five years have exceeded total expenditures.

The largest revenue center by far for the airport is the operating transfer from Fund 100. In fact, this fund accounts for more than 50 percent of the airport's annual revenue.

The next largest revenue center is warehouse/hangar rentals and lease receipts. This revenue is derived from the rental of City owned T-Hangars and shelters and land leases for privately

TABLE 6B
San Marcos
Historical Revenue and Expenses

Year	FY 95/96	FY 96/97	FY 97/98	FY 98/99	FY 99/00
REVENUES:					
T-Hangar Rental	36,440	39,772	40,968	42,491	36,114
Interest Income	40	1,065	0	2,834	3,669
Shelter Rental	7,600	7,365	7,395	8,375	7,625
Agricultural Lease	21,600	10,800	10,800	10,800	10,800
FBO and Other Leases	12,213	24,685	24,320	28,759	21,254
Fuel Flowage	6,415	14,079	10,943	10,389	17,147
Storage Rental	2,400	1,930	1,945	2,055	1,985
Misc. Revenue	7,951	575	582	310	380
Operating Transfer - Fund 100	69,378	98,769	171,173	58,714	143,631
TOTAL REVENUES	$164,037	$199,040	$268,126	$164,726	$242,605
EXPENDITURES:					
Personnel Expenses	63,572	65,387	70,393	76,872	86,218
Utilities	15,042	14,810	16,799	15,744	17,534
General Expenses	11,393	10,956	10,787	7,537	21,981
General Maintenance	26,290	16,488	14,687	20,000	20,000
Insurance	4,523	3,926	4,550	3,572	3,444
Indirect Cost - Fund 100	14,326	19,798	28,389	30,124	36,716
TOTAL EXPENDITURES	$135,146	$131,365	$145,605	$153,849	$185,893
NET INCOME	**$28,891**	**$67,675**	**$122,521**	**$10,877**	**$56,712**
Transfer to Fund 670 (Capital Improve Fund)	0	9,475	53,918	111,875	51,800

owned hangars and businesses. Currently the City charges a monthly rate of $125 for T-Hangars and $45 for shelters. Unimproved land leased to be developed by the lessee is currently leased at a rate of $0.10 per square foot per year. These leases are for a 20 year term at which time the land and any improvements revert to City ownership. At this time the city leases the property at $0.10 per square foot per month. Finally, the terminal building is leased at a rate of $0.50 per square foot per month.

All of these lease rates appear to be in line with airports of similar size and capacities as San Marcos. Due to the changing nature of the airport being one of only two relievers for the Austin area, facilities required to meet the growing needs will require higher fee structures.

The agricultural lease is put out for competitive bidding. The lease is signed for five years with a five year option agreed upon by both parties. The current lease also includes provisions for the lessee to provide services such as mowing and herbicide application to portions of the airport property.

Fuel flowage fees account for a large amount of revenue for the airport each year. Currently the airport collects four percent of the wholesale cost of all aircraft fuel delivered to the airport.

Other revenues include miscellaneous revenues and interest income.

EXPENSES

Generalized operating expenses for the San Marcos Municipal Airport include personnel services, supplies, building and equipment maintenance, utilities, and other expenses. When considering capital expenditures for airport improvements, the airport has operated with a negative income in the past. Capital expenditures, however, can be expected and should not be considered when trying to identify operating income/losses. These costs generally improve the facility and are always associated with the operation of an airport. By removing these capital expenditures, the airport has operated at a net profit each of the past five years.

As indicated in **Table 6B**, airport operating expenditures have steadily increased over the previous five years. Personnel expenses have been, and will continue to be, the single largest cost center for the airport. These costs include salaries, insurance, and payroll taxes. The "Indirect Cost - Fund 100" comprises the second highest cost for the airport budget. This is the amount collected by the City to recover costs associated with providing payroll, billing, and accounting services to the airport. After personnel and Fund 100 costs there are a variety other smaller costs including; supplies, maintenance, and other charges.

FUTURE CASH FLOW

Revenues

Review of current charges for airport tenants and businesses appears to be adequate to cover airport operating expenses. Existing and future leases should always include provisions for the adjustment of the lease amount due to increases in the consumer price index (CPI) and property values. The typical review period ranges up to five years. It is recommended that all applicable leases include a review of CPI and property value every three years so that necessary adjustments to lease rates can be made.

It is anticipated that revenues will continue to increase with aviation

activity. As more aircraft base at the airport, additional revenues for hangar rent and fuel sales will increase proportionately. Revenues will also be bolstered by transient aircraft activity with increased hangar and fuel fees.

Future revenue projections considered slightly increasing current fee rates for existing hangar and ground leases. New hangar ground leases will need to be established in such a manner that the city will be capable of adjusting costs as needed to keep pace with the CPI.

Obviously, if the city does not fund the construction of new facilities, costs of developing new hangars will be significantly lower than if the city paid for construction. If the city does not construct the proposed hangar facilities, the city's only capital cost would be 10 percent of the taxilane construction (the remaining 90 percent would come from federal or state grants). The city has allowed the development of privately owned hangars in the past. Privately owned facilities offer the city significant savings.

Assuming that the city does not construct the T-hangars, but simply leases the land to private developers, future ground lease rates for the proposed ultimate T-hangar development depicted on the airport layout drawing (ALD) could provide an additional $12,000 annually by the intermediate term of the planning period, and nearly $50,000 annually by the end of the long term planning horizon.

Future proposed hangar development includes the construction of executive and conventional/corporate hangars on the northwest side of the airport. These hangars could house corporate aircraft and additional FBO type businesses. Thus, lease receipts may increase as much as $32,500 annually, dependant upon the number of new businesses attracted to the airport. In addition, the commercial/industrial parcels on the north side of the airport could bring nearly $1 million annually. This figure is dependant on the entire area being fully developed. For planning purposes, 50% development was assumed.

Future revenue projections indicate that future revenues will annually rise at a greater rate than expenses. Analysis presented in **Table 6C** indicate that the City will be capable of obtaining sufficient operating revenues to offset expenses. Future revenue and expense projections have been made for the next five years and for the end of the intermediate and long term horizons. Thus, each planning horizon considers the facilities and services required to meet demand requirements. As shown on **Table 6D**, revenues will begin to outpace expenses by a significant margin in the long term. By fully developing the north aviation area, between the ends of Runway 17-35 and 12-30 the airport may become self-sufficient. In fact, by the end of the long term planning horizon, revenues will outpace expenditures by over $500,000 annually. This number may change depending upon the actual growth in based aircraft, total operations at the airport, and the

TABLE 6C Operating Revenue & Expense Projections San Marcos Municipal Airport					
PLANNING HORIZON	**2001**	**2002**	**2003**	**2004**	**2005**
OPERATING REVENUES					
FBO and other Leases	21,892	22,548	23,225	23,922	24,639
T-Hangar Rental	37,017	37,942	38,891	39,863	40,860
Fuel Flowage Fees	18,000	18,810	19,656	20,541	21,465
Agricultural Lease	10,800	10,800	10,800	10,800	10,800
Shelter Rental	7,739	7,855	7,973	8,093	8,214
Interest Income	3,750	3,750	3,750	3,750	3,750
Storage Rental	2,015	2,045	2,076	2,107	2,138
Misc. Revenue	391	403	415	428	441
Transfer - Fund 100	147,940	152,378	156,949	161,658	166,508
Operating Revenues	**$249,544**	**$256,532**	**$263,736**	**$271,161**	**$278,815**
OPERATING EXPENSES					
Personnel Services	88,805	91,469	94,213	97,039	129,950
Transfer - Fund 100	37,634	38,575	39,539	40,528	41,541
General Expenses	15,000	15,300	15,606	15,918	16,236
General Maintenance	20,200	20,402	20,606	20,812	21,020
Utilities	17,885	18,242	18,607	18,979	19,359
Insurance	3,496	3,548	3,601	3,655	3,710
Operating Expenses	**$183,019**	**$187,536**	**$192,172**	**$196,932**	**$231,817**
OPERATING INCOME/(LOSS) Available for Capital Projects	**$66,525**	**$68,996**	**$71,563**	**$74,229**	**$46,999**

ability of the City to successfully develop the areas on the north side of the airport.

Expenses

Future expenses will vary depending upon the city's desire to construct additional hangars and associated costs of maintaining existing hangars and landside pavements (local share). Future expenses, however, could be significantly higher if additional bonding is obtained. If the city decides to construct additional hangars, it is likely that bonding of these facilities would be necessary. Also, the city could expect maintenance costs and administrative costs associated with operating hangar facilities.

As the airport continues to grow, additional employees may ultimately be

TABLE 6D Operating Revenue & Expense Projections San Marcos Municipal Airport		
PLANNING HORIZON	**INTERMEDIATE** (6-10 Years)	**LONG TERM** (11-20 Years)
OPERATING REVENUES		
FBO and other Leases	42,875	553,662
T-Hangar Rental	64,660	84,003
Fuel Flowage Fees	23,061	33,577
Agricultural Lease	11,880	13,721
Shelter Rental	8,591	9,613
Interest Income	3,750	3,750
Storage Rental	2,237	2,503
Misc. Revenue	482	603
Transfer - Fund 100	182,106	227,924
Operating Revenues	**$339,643**	**$929,355**
OPERATING EXPENSES		
Personnel Services	142,124	177,882
ARFF Expenses	101,510	108,870
Transfer - Fund 100	44,762	53,972
General Expenses	17,237	20,021
General Maintenance	21,659	23,345
Utilities	20,552	23,872
Insurance	3,881	4,342
Operating Expenses	**$351,725**	**$412,304**
OPERATING INCOME/(LOSS)	**($12,082)**	**$517,051**

needed. Personnel expense projections account for the addition of an additional employee in FY 2004-2005. This employee will be primarily needed to comply with FAR Part 139 certification. Future personnel costs have been projected to exceed $175,000 annually by the end of the long term horizon. It is expected that an ARFF facility will be constructed during the intermediate planning horizon. This additional expense, and the ongoing operational costs, will push net revenue into negative numbers temporarily. Withing five years, airport revenues are expected to make up the difference.

SUMMARY

The best means of beginning the implementation of recommendations of

this master plan is to first recognize that planning is a continuous process that does not end with completion of this document. Rather, the ability to continuously monitor the existing and forecast status of airport activity must be provided and maintained. The based issues upon which this master plan is based will remain valid for a number of years. As such, the primary goal is for the airport to evolve into a facility that will beast serve the air transportation needs of the region and to evolve into a self-supporting economic generator for the City of San Marcos.

In this master plan, focusing on the timing of airport improvements was necessary. However the actual need for facilities is more appropriately established by airport activity levels rather than a specified date. For example, projections have been made as to when additional hangars will be needed at the airport. In reality, however, the time frame in which these additional developments will be needed may be substantially different. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate the development on the north side of the airport. Although every effort has been made in this master planning process to conservatively estimate when facility development may be needed, aviation demand will dictate when facility improvements need to be delayed or accelerated.

The real value of a usable master plan is that it keeps the issues and objectives in the mind of the user of the plan so that he or she is better able to recognize change and its effect. In addition to adjustments in aviation demand, decisions made as to when to undertake recommended improvements in this master plan will impact the period that the plan remains valid. The format used in this plan is intended to reduce the need for costly updates. Updating can be done by the user, improving the plan's effectiveness.

In summary, the planning process requires San Marcos Municipal Airport staff and Airport Commission to consistently monitor the progress of the airport in terms of total aircraft operations, total based aircraft, and overall aviation activity. Analysis of aircraft demand is critical to the exact timing and need for new airport facilities. The information obtained from continually monitoring airport activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.

Appendix A
ENVIRONMENTAL EVALUATION

Appendix A
ENVIRONMENTAL EVALUATION

Analysis of the potential environmental impacts of proposed airport development is an important component of the airport master plan process. The primary purpose of the environmental evaluation is to assess the proposed development program for San Marcos Municipal Airport to identify any potential environmental concerns or "red flags" to development.

An important element of this evaluation was coordination with appropriate federal, state, and local agencies to identify potential environmental concerns what should be considered prior to the design and construction of new facilities at the airport. Agency coordination consisted of a letter requesting comments and/or information regarding the potential environmental effects of proposed airport development over the next 20 years. Issues of concern that were identified as part of this process are presented in the following sections. The letters received from the various agencies are included at the end of this chapter.

Any major improvements planned for San Marcos Municipal Airport (i.e. runway extension) will require compliance with the National Environmental Policy Act of 1969, as amended (NEPA). Compliance with NEPA is generally satisfied by the preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS). While this section of the Master Plan is not structured to satisfy NEPA requirements, it is intended to supply a preliminary review of environmental considerations that would need to be analyzed in more detail within the NEPA process.

PROPOSED DEVELOPMENT

As a result of the Master Plan analysis, a number of improvements have been recommended for implementation during the planning period of this Master Plan. The Airport Layout Plan (Chapter Five) illustrates the proposed development for San Marcos Municipal Airport. This following is list of major projects recommended for Redbird Airport.

- Upgrade airport to meet Part 139 Requirements (ARFF, signage, fencing, etc.)
- Construct airport traffic control tower (ATCT)
- Rehabilitate airport pavements
- Extend Runway 12-30 to 6,402 feet
- Reconstruct Runway 17-35 and extend to 7,000 feet
- Develop new parallel, entrance/exit, and access taxiways
- Acquire property to the northwest, south, and north for runway protection zones
- Develop northwest general aviation facilities
- Develop north general aviation facilities
- Develop commercial/industrial properties

ENVIRONMENTAL CONSEQUENCES - SPECIFIC IMPACTS

This environmental evaluation has been prepared using *FAA Order 1050.1D, Policies and Procedures for Considering Environmental Impacts*, and *FAA Order 5050.4A, Airport Environmental Handbook* as guidelines. Several factors are considered in a formal environmental document, such as an EA or EIS, which are not included in an environmental evaluation. These factors include details regarding the project location, historical perspective, existing conditions at the airport, and the purpose and need for the project. This information is available within the Master Plan document. A formal environmental document also includes the resolution of issues/impacts identified as significant during the environmental process. Consequently, this environmental evaluation only identifies potential environmental issues and does address mitigation or the resolution of environmental impacts. The following subsections address each of the specific impact categories outlined by *FAA Order 5050.4A*.

NOISE

Aircraft sound emissions are often the most noticeable environmental effect an airport will produce on the surrounding community. If the sound is sufficiently loud or frequent in occurrence it may interfere with various activities or otherwise be considered objectionable.

To determine the noise related impacts that the proposed development could have on the environment surrounding San Marcos Municipal Airport, noise exposure patterns

were analyzed for both existing airport activity conditions and projected long term activity conditions.

Noise Contour Development

The basic methodology employed to define aircraft noise levels involves the use of a mathematical model for aircraft noise predication. The Yearly Day-Night Average Sound Level (DNL) is used in this study to assess aircraft noise. DNL is the metric currently accepted by the FAA, Environmental Protection Agency (EPA), and Department of Housing and Urban Development (HUD) as an appropriate measure of cumulative noise exposure. These three federal agencies have each identified the 65 DNL noise contour as the threshold of incompatibility, meaning that noise levels below 65 DNL are considered compatible with underlying land uses. Most federally funded airport noise studies use DNL as the primary metric for evaluating noise.

DNL is defined as the average A-weighted sound level as measured in decibels (dB), during a 24-hour period. A 10 dB penalty applies to noise events occurring at night (10:00 p.m. to 7:00 a.m.). DNL is a summation metric which allows objective analysis and can describe noise exposure comprehensively over a large area.

Since noise decreases at a constant rate in all directions from a source, points of equal DNL noise levels are routinely indicated by means of a contour line. The various contour lines are then superimposed on a map of the airport and its environs. It is important to recognize that a line drawn on a map does not imply that a particular noise condition exists on one side of the line and not on the other. DNL calculations do not precisely define noise impacts. Nevertheless, DNL contours can be used to: (1) highlight existing or potential incompatibilities between and airport and any surrounding development; (2) assess relative exposure levels; (3) assist in the preparation of airport environs land use plans; and (4) provide guidance in the development of land use control devices, such as zoning ordinances, subdivision regulations and building codes.

The noise contours for San Marcos Municipal Airport have been developed from the Integrated Noise Model (INM), Version 6.0a. The INM was developed by the Transportation Systems Center of the U.S. Department of Transportation at Cambridge, Massachusetts, and has been specified by the FAA as one of the two models acceptable for federally funded noise analysis.

The INM is a computer model which accounts for each aircraft along flight tracks during an average 24-hour period. These flight tracks are coupled with separate tables contained in the data base of the INM which relate to noise, distances, and engine thrust for each make and model of aircraft type selected.

Computer input files for the noise analysis assumed implementation of the recommended development of the airport as identified on the Airport Layout Drawing.

The input files contain operational data, runway utilization, aircraft flight tracks, and fleet mix as projected in the plan. The operational data and aircraft fleet mix are summarized in **Table A**. For more detailed information of the aviation forecasts for San Marcos Municipal Airport refer to Chapter Two, Aviation Demand Forecasts.

TABLE A
Aviation Forecast Summary
San Marcos Municipal Airport

Type of Operation	1999	Long Term
ITINERANT OPERATIONS		
Single Engine Piston	26,861	39,600
Multi-Engine Piston	6,715	26,400
Turboprop	2,000	4,000
Business Jet	2,000	6,500
Helicopter	1,500	4,500
Total Itinerant	39,076	81,000
LOCAL OPERATIONS		
Single Engine Piston	51,520	90,800
Multi-Engine Piston	12,880	22,700
Total Local	64,400	113,500
Total Operations	103,476	194,500

Other important inputs into the program include the runway use percentages and percentage of day and night operations. Three percent of all operations were assumed to operate during night time hours.

The runway use percentages considered that Runway 12-30 was utilized by the majority of medium and large aircraft, however, all other runways were assumed to be utilized by corporate aircraft to a lesser degree. The ultimate noise contour reflects a higher utilization of the Runway 17-35 by larger aircraft than assumed for the current contour assuming reconstruction/extension occurs. It was assumed that the local, or "touch-and-go" traffic was evenly distributed amongst all runways.

Results of the Noise Analysis

Considering existing operational activity, the 65 DNL noise contour encompasses approximately 367 acres, mostly contained within existing airport property as depicted on **Exhibit A**. A small portion of the contour extends northwest of Runway 12.

00MP03-A-8/27/01

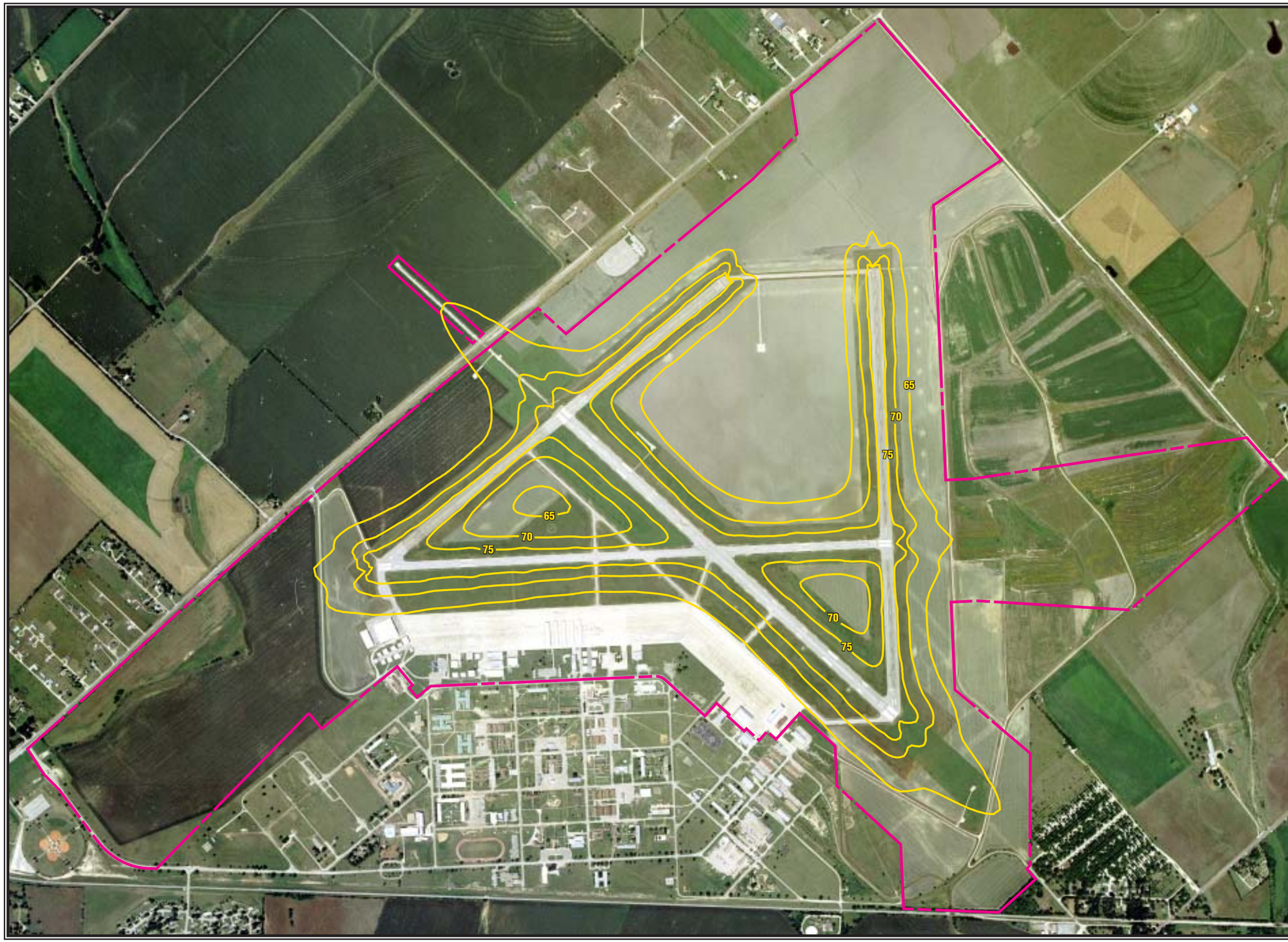

Exhibit A
EXISTING AIRPORT
NOISE EXPOSURE

LEGEND

Existing Airport Property Line

DNL Noise Contour

0 1200 2400

SCALE IN FEET

NORTH

San Marcos MUNICIPAL AIRPORT

Considering projected ultimate operational activity, the 65 DNL noise contour encompasses approximately 331 acres as depicted on **Exhibit B**. The primary reason for the decrease is due to a projected decrease use of the airport by older, louder corporate aircraft.

COMPATIBLE LAND USE

Federal Aviation Regulations (F.A.R.) Part 150 recommends guidelines for planning land use compatibility within various levels of aircraft noise exposure as summarized on **Exhibit C**. As the name indicates, these are guidelines only; F.A.R. Part 150 explicitly states that determinations of noise compatibility and regulation of land use are purely local responsibilities. Based upon the results of the noise modeling efforts, the 65 DNL noise contour is expected to remain on airport.

The primary goal of compatible land use planning is to achieve and maintain compatibility between the airport and its surrounding community. Inherent in this goal is the assurance that the airport can maintain or expand its size and level of operations to satisfy existing and future aviation demand. The protection of the investment in a facility such as an airport is of great importance. At the same time, a person who lives, works, or owns property near an airport should be able to enjoy the location without infringement by noise or other adverse impacts of the airport.

SOCIAL IMPACTS

Social impacts known to result from airport improvement projects are often associated with the relocation of residences and businesses or other community disruptions. Primary development of the proposed improvements at San Marcos Municipal Airport is not expected to result in the relocation or removal of a residence or business.

The proposed land acquisition as a part of airport development is only avigational easement where residences are concerned. The acquisition of easement will not require the displacement of residents or businesses. Other land acquisition should not require the acquisition and relocation of residences. The proposed development and associated land acquisition are not anticipated to divide or disrupt an established community, interfere with orderly planned development, or create a short-term, appreciable change in employment.

FAA Order 5050.4A provides that where the relocation of a residence, business, or farmland is involved, the provisions of the ***Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (URARPAPA)*** must be met. The Act requires that home owners and tenants be offered assistance in finding a new home or new site, and in relocation costs. Relocation assistance includes help in finding a comparable replacement dwelling which meets the FAA's "decent, safe, and sanitary" criteria and in moving costs. Due to the developing nature of the San Marcos and

greater Austin areas and the presence of similar properties or homes, it is expected that homeowners affected by the implementation of the development program would be able to find comparable housing or land within the San Marcos area.

FAA Order 5050.4A also provides that if businesses or farm operations would be relocated as a result of an airport-related project, URARPAPA would again apply. The Act requires that the owner of the business or farm operations also be offered assistance in finding a location and reestablishing the business.

If any projects require acquisition of land, the City of San Marcos will need to comply with ***FAA Advisory Circular 150/5100-17, Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects***. This document describes the process necessary to comply with URARPAPA.

INDUCED SOCIOECONOMIC IMPACTS

Induced socioeconomic impacts address those secondary impacts to surrounding communities resulting from the proposed development, including shifts in patterns of population movement and growth, public service demands, and changes in business and economic activity to the extent influenced by the airport development. According to *FAA Order 5050.4A*, "Induced impacts will normally not be significant except where the area also has significant impacts in other categories, especially noise, land use or direct social impacts."

Significant shifts in patterns of population movement or growth or public service demands are not anticipated as a result of the proposed development. It is expected, however, that the proposed new airport development would potentially induce positive socioeconomic impacts for the community over a period of years. The airport, with expanded facilities and services would be expected to attract additional users. It is expected to encourage tourism, industry, and trade and to enhance the future growth and expansion of the community's economic base. Future socioeconomic impacts resulting from the proposed development would be expected to be primarily positive in nature.

AIR QUALITY

The federal government has established a set of health-based ambient air quality standards (NAAQS) for the following six pollutants: carbon monoxide (CO), nitrogen dioxide (NO_x), sulphur dioxide (SO_x), ozone, lead, and PM10 (particulate matter of 10 microns or smaller). Currently, only airports in nonattainment and maintenance areas must meet the requirements of the General Conformity Rule provided in the Federal Clean Air Act; airports in attainment areas are assumed to conform.

00MP03-B-8/27/01

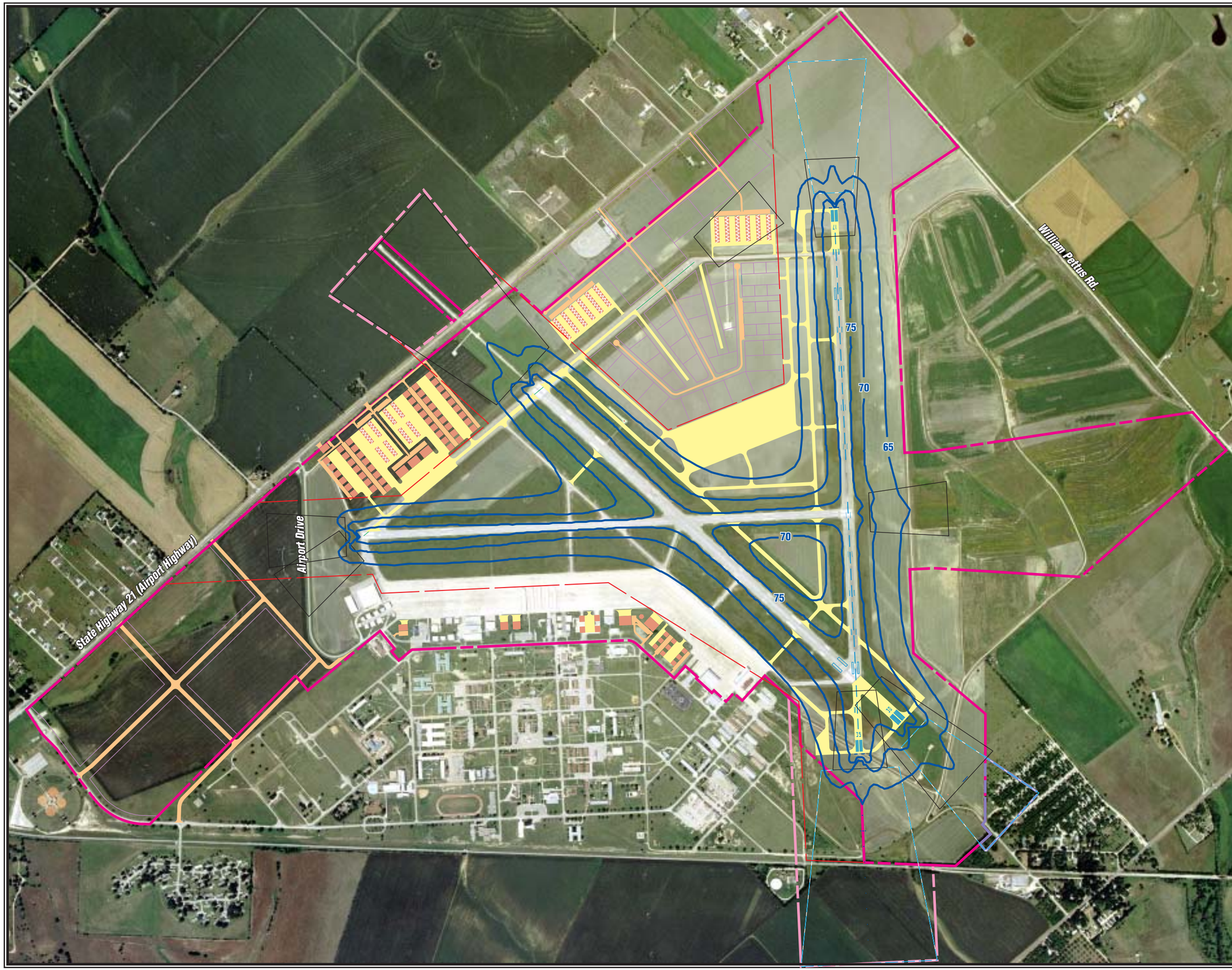

Exhibit B
ULTIMATE AIRPORT
NOISE EXPOSURE

LEGEND

- Existing Airport Property Line
- Ultimate Airport Property Line
- Ultimate Easement
- Existing Runway Protection Zone
- Ultimate Runway Protection Zone
- Building Restriction Line
- Ultimate Taxiway/Apron/Runway Extension
- Ultimate Roads/Parking
- Ultimate Buildings
- Lease Parcels
- Ultimate DNL Noise Contours

0 1200 2400
SCALE IN FEET

NORTH

San Marcos MUNICIPAL AIRPORT

00MP03-C-3/21/01

LAND USE	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
PUBLIC USE						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
COMMERCIAL USE						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

See other side for notes and key to table.

San Marcos MUNICIPAL AIRPORT

Exhibit C

LAND USE COMPATIBILITY GUIDELINES

KEY

Y (Yes)	Land Use and related structures compatible without restrictions.
N (No)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, 35	Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES

1 Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR)of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2 Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

3 Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

4 Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

5 Land use compatible provided special sound reinforcement systems are installed.

6 Residential buildings require a NLR of 25.

7 Residential buildings require a NLR of 30.

8 Residential buildings not permitted.

Source: ***F.A.R. Part 150,*** *Appendix A, Table 1.*

San Marcos MUNICIPAL AIRPORT

Exhibit C (Continued)
LAND USE COMPATIBILITY GUIDELINES

According to correspondence received from the Texas Natural Resource Conservation Commission (TNRCC), Caldwell and Hayes Counties are in attainment for six criteria air pollutants as designated by EPA pursuant to Section 107 of the Clean Air Act, therefore "General Conformity does not apply".

Also, the proposed development plan would result in short -term air emissions resulting from the actual construction activities, although these actions pose no significant impact upon air quality standards. During construction of proposed development items, steps should be taken to minimize the amount of particulate matter (dust) generated, including incidental emissions caused by strong winds, as well as tracking of dirt off the construction sites by machinery and trucks. Permits may be required for ancillary construction facilities such as concrete or asphalt batch plants involved in the improvement projects.

WATER QUALITY

Airport activities can have a major impact on water quality. The Clean Water Act provides the authority to establish water quality standards, control discharges into surface and subsurface waters, develop waste management treatment plans, and issue permits for discharges and for dredged or fill materials.

Construction of the proposed improvements will result in an increase in impermeable surfaces and a resulting increase in surface runoff from both landside and airside facilities. The proposed development might result in short-term impacts on water quality, particularly suspended sediments, during and shortly after precipitation events during the construction phase.

Recommendations established in FAA Advisory Circular 150/5370-10 *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control* should be incorporated in project design specifications to mitigate potential impacts. These standards include temporary measures to control water pollution, soil erosion, and siltation through the use of fiber mats, gravel, mulches, slope drains, and other erosion control methods.

In accordance with Section 402(p) of the *Clean Water Act*, a *National Pollution Discharge Elimination System* (NPDES) General Permit is required from the Environmental Protection Agency. NPDES requirements apply to industrial facilities, including airports and all construction projects that disturb five or more acres of land.

With regard to construction activities, the City of San Marcos and all applicable contractors will need to comply with the requirements and procedures of the NPDES General Permit, including the preparation of a *Notice of Intent* and a *Stormwater Pollution Prevention Plan*, prior to the initiation of project construction activities.

The construction program, as well as specific characteristics of project design, should incorporate *Best Management Practices* (BMPs) to reduce erosion, minimize sedimentation, control non-stormwater discharges, and protect the quality of surface water features potentially affected. BMPs are defined as nonstructural and structural practices that provide the most efficient and practical means of reducing or preventing pollution of stormwater. The selection of these practices at San Marcos Municipal Airport should be based on the site's characteristics and focus on those categories of erosion factors within the contractor's control, including: (1) construction scheduling, (2) limiting exposed areas, (3) runoff velocity reduction, (4) sediment trapping, and (5) good housekeeping practices. Inspections of the construction site and associated reporting may be required.

The construction activities associated with airport development may require a permit issued under Section 404 of the Clean Water Act. A 404 permit would be required for the discharge of dredged or fill material into the waters of the United States, including adjacent wetlands. A jurisdictional delineation (completed by the Corps of Engineers) is required to determine if a permit is required. Prior to any construction activities, the City of San Marcos should obtain a jurisdictional delineation of wetlands and waters of the U.S. from the Corps of Engineers.

Spills, leaks and other releases of hazardous substances into the local environment are often a concern at airports due to fuel storage, fueling activities and maintenance of aircraft. Stormwater flowing over impermeable surfaces may pick up petroleum product residues and, if not controlled, transport them off site.

Also of crucial concern would be spills or leaks of substances that could filter through the soils and contaminate groundwater resources. As growth in aviation activity occurs, additional fuel storage facilities will be necessary. Fuel storage facilities must be designed, constructed and maintained in compliance with Federal, State and local regulations, and must be registered with TNRCC. These regulations include standards for underground storage tank construction materials, the installation of leak or spill detection devices, and regulations for stormwater discharge.

The airport currently has two above ground fuel storage facilities which meet all state and federal requirements.

DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F) LANDS

Paragraph 47e, *FAA Order 5050.4A* provides the following.

> *(7)(a) "Section 4(f) provides that the Secretary shall not approve any program or project which requires the use of any publicly-owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state or local significance, or any land from an historic site of national, state or local significance as determined by the officials having jurisdiction thereof unless there*

is no feasible and prudent alternative to the use of such land and such program includes all possible planning to minimize harm."

(7)(b) "...When there is no physical taking but there is the possibility of use of or adverse impacts to Section 4(f) land, the FAA must determine if the activity associated with the proposal conflicts with or is compatible with the normal activity associated with this land. The proposed action is compatible if it would not affect the normal activity or aesthetic value of a public park, recreation area, refuge, or historic site. When so construed, the action would not constitute use and would not, therefore, invoke Section 4(f) of the DOT Act."

No aspect of the proposed airport development would impact Section 4(f) properties.

HISTORIC, ARCHITECTURAL, ARCHAEOLOGICAL AND CULTURAL RESOURCES

The Texas State Historic Preservation Officer (SHPO) was contacted regarding the potential presence of cultural resources within the area of the proposed development. In their response, the SHPO stated "We do not know of any recorded historic properties within the area outlined on your map. No cultural resource investigations have been conducted in the vicinity. We will need additional information to review any future construction plans under the Antiquities Code of Texas and the National Historic Preservation Act." Once plans become specific and are readied, the City should contact SHPO with specific plans.

BIOTIC COMMUNITIES AND THREATENED AND ENDANGERED SPECIES OF FLORA AND FAUNA

As part of this evaluation, the U.S. Department of the Interior, Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department were contacted to request information regarding potential impacts to threatened or endangered species, species of special concern, or habitat areas of concern.

In their response, the USFWS did not identify any federally-listed threatened or endangered species within Caldwell County. Texas Parks and Wildlife Department indicated that there is a known occurrence of one special species in the general vicinity of the proposed project and five (5) threatened or endangered species associated with the San Marcos River. Included in the letter from Texas Parks and Wildlife was an inclusive list of rare species of plant and animal life known in Hays and Caldwell Counties.

Prior to any development, a biological survey may be needed to evaluate the types of native vegetation to be disturbed by the proposed development and to determine whether any impacts to the above referenced species would be anticipated.

COASTAL MANAGEMENT PROGRAM AND COASTAL BARRIERS

The proposed development of San Marcos Municipal Airport is not located within the jurisdiction of a State Coastal Management Program. The Coastal Zone Barrier resources system consists of undeveloped coastal barriers along the Atlantic and Gulf Coasts. These resources are well outside of the sphere of influence of the airport and its vicinity, and do not apply to the proposed development. This was confirmed by the Texas General Land Office, which indicated that the San Marcos Municipal Airport is not in the Texas Coastal Management Program (CMP) boundary.

WILD AND SCENIC RIVERS

The proposed development of San Marcos Municipal Airport is not located within the vicinity of a designated wild and scenic river. No impacts to wild and scenic rivers is anticipated as a result of the proposed airport development.

WATERS OF THE U.S., INCLUDING WETLANDS

Prior to any development activities, the City of San Marcos should request a jurisdictional delineation from the U.S. Army Corps of Engineers for the development area including the future proposed airport property. This delineation would identify any waters of the U.S., including wetlands and intermittent streams, under jurisdiction of this agency. If the proposed construction could directly or indirectly affect any waters of the U.S., the project might require a U.S. Army Corps of Engineers permit per *Section 404 of the Clean Water Act*.

On-site investigation did not indicate the presence of any wetland areas.

FLOODPLAINS

The TNRCC was contacted regarding floodplain. The following was TNRCC's response: "It has been determined from a review of the information provided that an Application for TNRCC Approval of Floodplain Development Project need not be filed with TNRCC. Our records show that the community is a participant in the National Flood Insurance Program and as such has a Flood Hazard Prevention Ordinance/Court Order. Accordingly, care should be taken to ensure that the proposed construction takes into account the possible Flood Hazard Areas within the community's floodplains. Please notify the community floodplain administrator to ensure that all construction is in compliance with the community's Flood Hazard Prevention Ordinance/Court Order."

FARMLAND

According to correspondence received from the United States Department of Agriculture,"Although this area is prime farmland, the Farmland Protection Policy Act (FPPA), recognizes the airport property as land already converted to nonagricultural uses and as 'farmland already in urban development'. The airport property, runway corridors and right-of-ways (ROW) are not subject to the Farmland Protection Policy Act". Proposed development will not require acquisition of farmland.

ENERGY SUPPLY AND NATURAL RESOURCES

No concern regarding existing energy production facilities or known energy resource supplies was expressed by the agencies for this proposed development. A slight increase in energy demand will likely occur as a result of the proposed project. Additional electricity will be needed for the proposed runway and taxiway extensions, new/relocated navigation lights, the terminal building, hangars and parking areas. In addition to this electric demand, expenditures of manpower, fuel, electricity, chemicals, water and other forms of energy will be necessary to construct the improvements and to provide for maintenance and operation of the facilities.

LIGHT EMISSIONS

The proposed lighting improvements for the airport include the installation of lighted airport guidance and directional signs, and medium intensity runway and taxiway lighting on the planned extensions of both runways and parallel taxiways. It is also anticipated that outdoor lighting would be installed within the automobile parking areas, aircraft parking apron and surrounding all terminal and FBO buildings and hangars. Because of the distance from the airfield to light-sensitive land uses, impacts associated with any new light emissions are not expected to be significant.

SOLID WASTE

Slight increases in the generation of solid waste are anticipated as a result of the proposed development and overall growth in aviation activity. Because landfills can attract birds for feeding, the location of landfills near airports is not desired. Normally, landfills are discouraged within a five miles of a runway end or within 10,000-foot radius of jet airports and a 5,000-foot radius of non-jet airports. There are no landfills located within a five mile radius of the airport.

CONSTRUCTION IMPACTS

Construction activities have the potential to create temporary environmental impacts at an airport. These impacts primarily relate to noise resulting from heavy construction equipment, fugitive dust emissions resulting from construction activities, and potential impacts on water quality from runoff and soil erosion from exposed surfaces.

A temporary increase in particulate emissions and fugitive dust may result from construction activities. The use of temporary dirt access roads would increase the generation of particulates. Dust control measures, such as watering exposed soil areas, will need to be implemented to minimize this localized impact.

Any necessary clearing and grubbing of construction areas should be conducted in sections or sequenced to minimize the amount of exposed soil at any one time. All vehicular traffic should be restricted to the construction site and established roadways.

The provisions contained in *FAA Advisory Circular 150/5370-10, Standards for Specifying Construction of Airports, Temporary Air and Water Pollution, Soil Erosion, and Siltation Control* should be incorporated into all project specifications. During construction, temporary dikes, basins, and ditches should be utilized to control soil erosion and sedimentation and prevent degradation of off-airport surface water quality. After construction is complete, slopes and denuded areas should be reseeded to aid in the vegetation process.

CONCLUSION

Based on the review of correspondence provided by various federal, state and local agencies, potential environmental issues and considerations anticipated as a result of the development and operation of San Marcos Municipal Airport have been identified. As a result of the NEPA process, mitigation measures may be recommended to limit the potential impacts related to a number of these resources including water quality, waters of the U.S., archaeological and cultural resources, and biotic communities and threatened and endangered species of flora and fauna. Please note that as more specific information is gathered through a formal EA process, additional issues may arise.

Appendix B
GLOSSARY AND ABBREVIATIONS

Appendix B
GLOSSARY

Included in the following pages are a number of terms with appropriate definitions to assist the reader in understanding the technical language included in this document.

Air carrier: an operator which: (1) performs at least five round trips per week between two or more points and publish flight schedules which specify the times, days of the week and places between which such flights are performed; or (2) transport mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

Air taxi: An air carrier certificated in accordance with FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

Air traffic control tower (ATCT): a central operations facility in the terminal air traffic control system, consisting of a tower, including an associated IFR room if radar equipped, using air/ground communications and/or radar, visual signaling, and other devices to provide safe and expeditious movement of terminal air traffic.

Air route traffic control center (ARTCC): a facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the enroute phase of flight.

Airport Elevation: the highest point on an airport's usable runway expressed in feet about mean sea level (MSL).

Approach lighting system (ALS): an airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach and landing.

Azimuth: horizontal direction or bearing; usually measured from the reference point of 0 degrees clockwise through 360 degrees.

Base leg: a flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.

Compass locator (LOM): a low power low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

Displaced threshold: a threshold that is located at a point on the runway other than the designated beginning of the runway.

Distance measuring equipment (DME): equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

DNL: day-night noise level. The daily average noise metric in which that noise occurring between 10:00 p.m. and 7:00 a.m. is penalized by 10 times.

Downwind leg: a flight path parallel to the landing runway in the direction *opposite* to landing.

Duration: length of time, in seconds, a noise event such as an aircraft flyover is experienced. (May refer to the length of time a noise event exceeds a specified threshold level.)

Enplaned passengers: the total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and non-scheduled services.

Fixed base operator (FBO): a provider of service to users of an airport. Such services include, but are not limited to, fueling, hangaring, flight training, repair and maintenance.

General aviation: that portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of convenience and necessity, and large aircraft commercial operators.

Glide slope: electrical equipment that emits signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as an ILS, or visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for the visual portion of an instrument approach and landing.

Global positioning system (GPS): a navigational technology based on a constellation of satellites orbiting approximately 11,000 miles above the surface of the earth.

Ground effect: the excess attenuation attributed to absorption or reflection of noise by man-made or natural features on the ground surface.

Instrument approach: a series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority.

Instrument flight rules (IFR): rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.

Instrument landing system (ILS): a precision instrument approach system which normally consists of the following electronic components and visual aids: localizer, glide slope, outer marker, middle marker, and approach lights.

Localizer (LOC): providing horizontal guidance to the runway centerline for aircraft during approach and landing by radiating a directional pattern of radio waves modulated by two signals which, when received with equal intensity, are displayed by compatible airborne equipment as an "on-course" indication, and when received in unequal intensity are displayed as an "off-course" indication.

Localizer type directional aid (LDA): a facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

Medium intensity approach light system with runway alignment lights (MALSR): a 2,400-foot medium intensity approach lighting system (ALS) with runway alignment indicator lights (RAILs). It is an economy ALS system approved for Category I (200-foot cloud ceilings and one-half mile visibility) approaches.

Microwave landing system (MLS): an instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

Missed approach: an instrument approach not completed by landing. This may be due to visual contact not established at authorized minimums or instructions from air traffic control, or other reasons.

Non-directional beacon (NDB): a radio beacon transmitting non-directional signals that a pilot of an aircraft equipped with direction finding equipment can determine his/her bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the instrument landing system market, it is normally called a compass locator.

Nonprecision approach procedure: a standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

Operation: a take-off or a landing.

Outer marker (OM): an ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline indicating to the pilot, that he/she is passing over the facility and can begin final approach.

Precision approach path indicator (PAPI): an airport lighting facility in the terminal area navigation system used primarily under VFR conditions. The PAPI provides visual descent guidance to aircraft on approach to landing through a single row of two to four lights, radiating a high intensity red or white beam to indicate whether the pilot is above or below the required approach path to the runway. The PAPI has an effective visual range of 5 miles during the day and 20 miles at night.

Precision approach procedure: a standard instrument approach procedure in which an electronic glide slope is provided, such as ILS.

Precision instrument runway: a runway having a existing instrument landing system (ILS).

Reliever airport: an airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

Runway end identification lights (REIL): an airport lighting facility in the terminal area navigational system consisting of one flashing white high intensity light installed at each approach end corner of a runway and directed toward the approach zone, which enables the pilot to identify the threshold of a usable runway.

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

Runway Safety Area (RSA): a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

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

Threshold Elevation: the elevation of the runway threshold, expressed in feet above mean sea level (MSL).

Touch-and-Go Operations: aircraft executing simulated approaches or low passes at the airport.

Touchdown Zone: the first 3,000 feet of runway beginning at the threshold.

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

Victor airway: a control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids.

Visual approach: an approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

Visual approach slope indicator (VASI): an airport lighting facility in the terminal area navigation system used primarily under VFR conditions. It provides vertical visual guidance to aircraft during approach and landing, by radiating a pattern of high intensity red and white focused light beams which indicate to the pilot that he/she is above, on, or below the glide path.

Visual flight rules (VFR): rules that govern the procedures for conducting flight under visual conditions. The term **VFR** is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

VOR/Very high frequency omnidirectional range station: a ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

VORTAC/VHF Omnidirectional range/tactical air navigation: a navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.

ABBREVIATIONS

AGL: above ground level

ALS: approach lighting system

ARTCC: air route traffic control center

ATCT: air traffic control tower

DME: distance measuring equipment

DNL: day-night noise level

DW: runway weight bearing capacity for aircraft with dual-wheel type landing gear

DTW: runway weight bearing capacity for aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: fixed base operator

GPS: global positioning system

GS: glide slope

IFR: instrument flight rules (FAR Part 91)

ILS: instrument landing system

LMM: compass locator at middle marker

LOC: ILS localizer

LOM: compass locator at outer marker

MALSR: medium intensity approach lighting system with runway alignment lights

MLS: microwave landing system

MM: middle marker

MSL: mean sea level

NAVAID: navigational aid

NDB: non-directional beacon

OM: outer marker

PAPI: precision approach path indicator

SEL: sound exposure level

SW: runway weight bearing capacity for aircraft with single-wheel type landing gear

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omnidirectional range

VORTAC: (see VOR and TACAN)

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