RYAN AIRFIELD
TUCSON AIRPORT AUTHORITY

Chapter 4

AIRPORT DEVELOPMENT ALTERNATIVES

Chapter Four

Airport Development Alternatives

Prior to formulating a development program for Ryan Airfield, it is important to consider development potential and constraints at the airport. The purpose of this chapter is to consider the actual physical facilities which are needed to accommodate projected demand and meet the program requirements as previously defined in Chapter Three, Aviation Facility Requirements.

In this chapter, a number of airport development alternatives are considered for the airport. For each alternative, different physical facility layouts are presented for the purposes of evaluation. The ultimate goal is to develop the underlying rationale which supports the final recommended master plan development concept. Through this process, an evaluation of the highest and best uses of airport property is made while considering local development goals, physical and environmental constraints, and appropriate federal airport design standards.

Any development proposed by a master plan evolves from an analysis of projected needs. Though the needs were determined by the best methodology available, it cannot be assumed that future events will not change these needs. Therefore, to ensure flexibility in planning and development to respond to unforeseen needs, the landside alternatives consider the maximum development potential of airport property.

The alternatives presented in this chapter have been developed to meet

the overall program objectives for the airport in a balanced manner. Through coordination with the Tucson Airport Authority (TAA), the Planning Advisory Committee (PAC), and the public, the alternatives (or combination thereof) will be refined and modified as necessary to develop the recommended development concept. Therefore, the alternatives presented in this chapter can be considered a beginning point in the development of the recommended concept for the future development of Ryan Airfield.

REVIEW OF PREVIOUS PLANNING DOCUMENTS

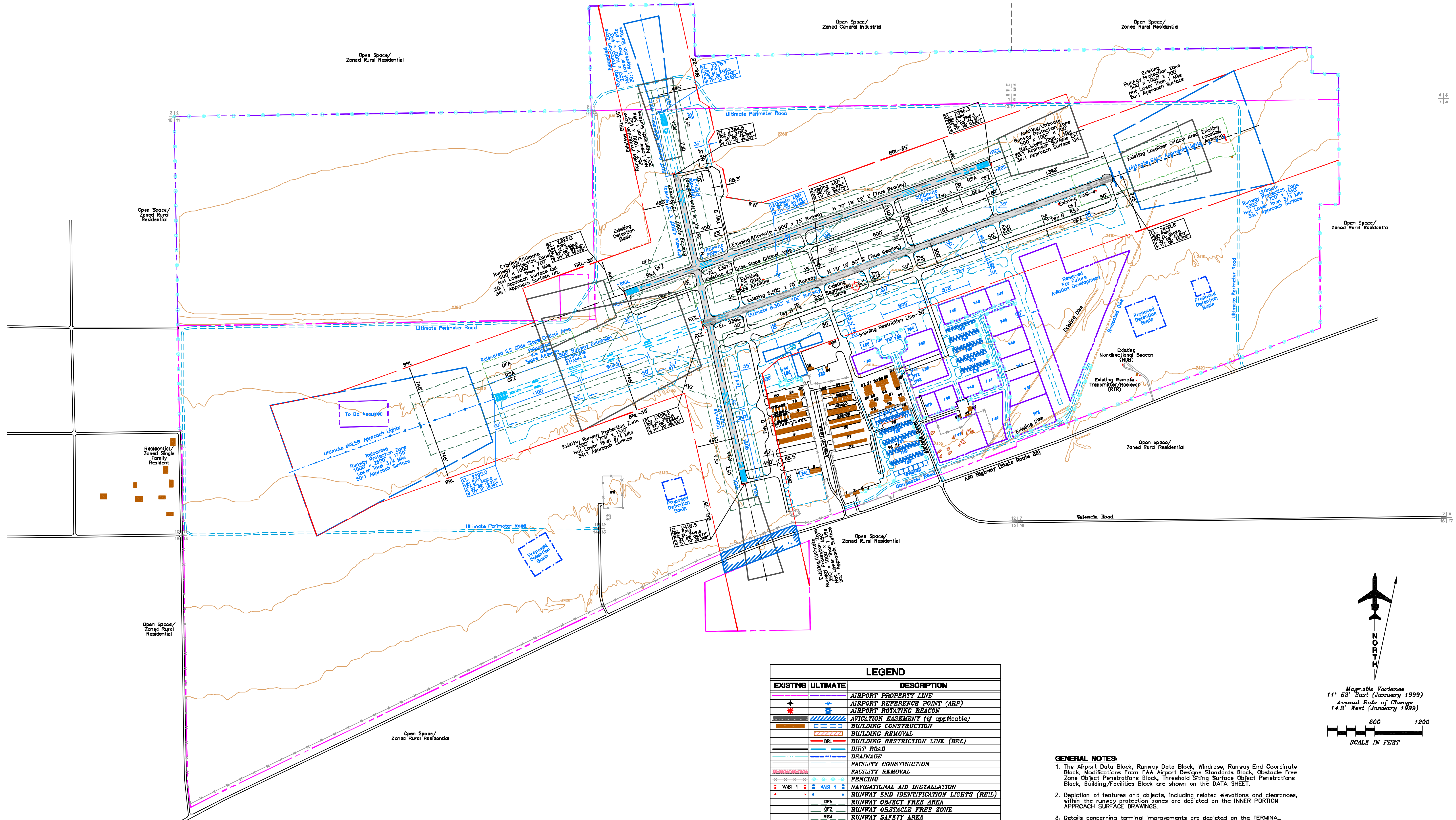
The most recent planning document prepared for Ryan Airfield was the *Ryan Airfield Airport Master Plan* completed in June 1999. The master plan study recommended the continued development of the existing airport into the long-term horizon.

Recommended airfield developments included upgrading the primary runway design standards to serve ARC D-II aircraft, improving instrument approach minimums with use of Global Positioning System (GPS) technology, taxiway circulation improvements, the construction of a helicopter landing area, and land acquisitions for the protection of the runway approaches. Since these recommendations, the TAA has constructed new taxiways and resurfaced other taxiways to improve taxiway circulation. Adjacent land has been acquired to protect the runway approaches and to allow for future development opportunities. In addition, Runway 6R now has a published GPS instrument approach.

Landside development recommended in the previous master plan study included the establishment of a terminal focal point on the flightline, locations for various hangar developments, expansion areas for a potential flight school, access and service road circulation improvements, and expansion plans for fuel storage facilities and the maintenance facility. Since the previous master plan, several new aircraft storage hangars have been constructed to the east of the airport administration building, and the north apron has been expanded to provide additional aircraft parking positions. The airport layout plan (ALP) drawing shown on **Exhibit 4A** depicts the airside and landside improvements recommended in the previous master plan.

NON-DEVELOPMENT ALTERNATIVES

Non-development alternatives include the "No Action" or "Do Nothing" alternative, transferring service to an existing airport, or developing an airport at a new location. Several previous planning efforts have also considered these alternatives. All have resulted in the same conclusion: continue to develop the existing airport site to meet the general aviation needs of the Tucson metropolitan area.



LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT (if applicable)
		BUILDING CONSTRUCTION
		BUILDING REMOVAL
	BRL	BUILDING RESTRICTION LINE (BRL)
		DIRT ROAD
		DRAINAGE
		FACILITY CONSTRUCTION
		FACILITY REMOVAL
		FENCING
VASI-4	VASI-4	NAVIGATIONAL AID INSTALLATION
		RUNWAY END IDENTIFICATION LIGHTS (REIL)
	OFA	RUNWAY OBJECT FREE AREA
	OFZ	RUNWAY OBSTACLE FREE ZONE
	RSA	RUNWAY SAFETY AREA
		RUNWAY THRESHOLD LIGHTS
	RVZ	RUNWAY VISIBILITY ZONE
		SEGMENTED CIRCLE/WIND INDICATOR
		SECTION CORNER
		TOPOGRAPHIC CONTOURS
		WIND INDICATOR (Lighted)

GENERAL NOTES:

1. The Airport Data Block, Runway Data Block, Windrose, Runway End Coordinate Block, Modifications From FAA Airport Designs Standards Block, Obstacle Free Zone Object Penetrations Block, Threshold Siting Surface Object Penetrations Block, Building/Facilities Block are shown on the DATA SHEET.
2. Depiction of features and objects, including related elevations and clearances, within the runway protection zones are depicted on the INNER PORTION APPROACH SURFACE DRAWINGS.
3. Details concerning terminal improvements are depicted on the TERMINAL AREA DRAWING.
4. Recommended land uses are depicted on the AIRPORT LAND USE DRAWING.
5. Building Restriction Line (BRL) is established in accordance with F.A.R. Part 77 criteria. Location utilizes 35 foot vertical object height. BRL location may vary in accordance with runway object free area, runway protection zone, naviad critical areas, and areas required for terminal instrument procedures.

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Exhibit 4A
1999 AIRPORT LAYOUT PLAN

NO ACTION

In analyzing and comparing the advantages and disadvantages of various development alternatives, it is important to consider the consequences of no future development at Ryan Airfield. The "no-build" or "do-nothing" alternative essentially considers keeping the airport in its present condition and not providing for any type of expansion or improvement to the existing facilities (other than general airfield, pavement, and administration building maintenance projects). The primary result of this alternative, as with any growing air transportation market, would be the eventual inability of the airport to satisfy the increasing demands of the airport service area. The growth of activity at Ryan Airfield is partially a result of the growing economy and population of the Tucson metropolitan area, as well as growth within the general aviation industry as a whole. Air travel is the fastest means to cover long distances, and it provides businesses the capability to expand their markets nationally and globally. It provides tourists the means to maximize their vacation experience within the time available. It can be argued that the airlines provide the most successful form of mass transportation in the United States today.

Ryan Airfield's role as a general aviation reliever to Tucson International Airport is one of the most important components to the Tucson metropolitan area air transportation system. The airport's forecasts and analysis indicate future needs for improvements throughout the facility. The airport's runway system will need to be upgraded to accommodate future use by an expanding corporate aircraft fleet that includes very light jet aircraft. Hangar development at Ryan Airfield will also be crucial as the demand for aircraft storage units will continue to be strong into the future.

Faced with continual growth in air traffic activity, the runway system may not be able to efficiently accommodate air traffic, and delays would increase. Following the no-build alternative would not allow for airfield capacity improvements or improvements which are needed to meet new Federal Aviation Administration (FAA) design standards for instrument approaches and safety areas.

Following the no-build alternative would also not support the private businesses that have made investments at Ryan Airfield. As these businesses grow, the airport will need to be able to accommodate the infrastructure needs of new hangars, expanded apron areas, and automobile parking needs. Each of the businesses on the field provides jobs for local residents, interjects economic revenues into the community, and pays taxes for local government operations.

By owning and operating Ryan Airfield, the TAA is charged with the responsibility of developing aviation facilities necessary to accommodate aviation demand and to minimize operational constraints. Flexibility must be programmed into airport development to assure adequate capacity should market conditions change unexpectedly. While these objectives may not be all-inclusive, they should provide a

point of reference in the alternatives evaluation process.

In essence, the no-build alternative is inconsistent with the long-term goals of the Arizona Department of Transportation – Aeronautics Division and the FAA, which are to enhance local and interstate commerce. This alternative, if pursued, would affect the long-term viability of the airport and its services to the Tucson area.

TRANSFERRING AVIATION SERVICES

Transferring services to another airport, existing or new, is one that will typically be favored by many residing close to an existing airport. Relocating an airport, however, is very complex and expensive.

In addition to the major financial investment, the development of a new general aviation reliever airport also takes a commitment of extensive land area. The location for a new site is usually undeveloped. As a result, the potential for impacts to wildlife habitat and cultural resources is higher than at an existing site which still has development capability.

A new airport also requires the duplication of investment in airport facilities, supporting access, and infrastructure that are already available at the existing airport site. A new airport site would require the construction of an entirely new airfield, landside support facilities, as well as ground access. In addition, utilities such as water, sewer, electricity, and gas would have to be extended to a new site.

The economic realities of relocating to a new airport must also be considered. The construction of a new general aviation airport can require a financial commitment of several million dollars. Virtually the entire cost of this development is financed by taxes, rates, and charges that are being paid by air travelers and the aviation industry as a whole. While it is appropriate that the airport user pay for aviation facilities and its operation, the airport proprietor still has a duty to be fiscally responsible.

The high costs associated with new airport development will continue to limit the number of new major facilities that the aviation industry and the public can absorb. Therefore, it is prudent to maximize existing public investment to meet future needs before abandoning that investment simply to duplicate it elsewhere.

The alternative of relocating services to another airport in the Tucson area has also been considered. The closest general aviation airport with similar capabilities is Marana Regional Airport (AVQ) in Marana, Arizona, located approximately 21 statute miles northwest of downtown Tucson, and 16 nautical miles north of Ryan Airfield. AVQ is anticipated to experience similar growth patterns to Ryan Airfield over the planning period. To accommodate this growth, AVQ has developed its own plan for airfield and landside development. Taking on Ryan's projected demand would tax the capabilities of AVQ's

plan. In addition, AVQ is located at a relatively greater distance from the Ryan Airfield service area, which encompasses the south and west sides of the metropolitan area. Due to these factors, it is concluded that transferring aviation services from Ryan Airfield to AVQ is not feasible.

In summary, the development of a new airport or upgrade of an existing airport to replace Ryan Airfield would be more expensive, more time-consuming, provide less convenient service, and could potentially create a direct cost burden on the local tax base. The size and magnitude of the facilities required for a full replacement of Ryan Airfield would dictate extensive airfield, landside, and building construction, as well as infrastructure development. The distance from Tucson to any other general aviation airport would result in higher costs and inconvenience to existing airport users.

Given the major investment in the existing facilities at Ryan Airfield, relocation to another location is not prudent or feasible at this time since the existing airport has the capability to accommodate future demands with far less additional capital.

AIRSIDE DEVELOPMENT CONSIDERATIONS

The purpose of this section is to identify and evaluate various airside development considerations at Ryan Airfield to meet program requirements set forth in Chapter Three. Airfield facilities are, by nature, the focal point of an airport complex. Because of their primary role and the fact that they physically dominate airport land use, airfield facility needs are often the most critical factor in the determination of viable airport development alternatives. In particular, the runway system requires the greatest commitment of land area and defines minimum building set-back distances from the runways and object clearance standards. These criteria, depending upon the areas around the airport, must be defined first in order to ensure that the fundamental needs of the airport are met. Therefore, airside requirements will be considered prior to detailing land use development alternatives.

The issues to be considered in this analysis are summarized on **Exhibit 4B**. These issues are the result of the findings of the Aviation Demand Forecasts and Aviation Facility Requirements evaluations, and they include input from PAC and TAA staff.

AIRFIELD CAPACITY

A finding in the aviation facility requirements chapter indicated that the forecast operational demand would reach levels over 55 percent of the Ryan Airfield annual service volume (ASV) in the long-term planning horizon. This would generate an estimated 1,900 hours of total annual delay assuming the long-term planning horizon operational levels are achieved.

While the projected demand level should remain well below the airport's ASV, three potential methods of improving airfield capacity were analyzed: improving taxiway circulation by adding exit taxiways, a dual-parallel taxiway, and additional holding aprons; and constructing a third parallel runway for small (less than 12,500 pounds) aircraft.

The capacity analysis revealed that high-speed exit taxiways on Runway 6R-24L are needed to maximize capacity on that runway. The primary advantage of high-speed exit taxiways is that they allow aircraft to exit a runway at higher speeds compared to right-angled exit taxiways. Additional exit taxiways on the parallel and crosswind runways would also help to improve airfield capacity. A dual-parallel taxiway for Runway 6R-24L and additional holding aprons would help reduce taxiway congestion and improve the overall flow of the airfield. The alternatives to follow will consider each of these methods to improve airfield capacity.

Since the long-term forecast operational levels do not exceed the forecast ASV for Ryan Airfield, taxiway improvements should be adequate in mitigating aircraft delay issues. However, should operational levels exceed the projections of this master plan, a third parallel runway should be considered to ensure that the airfield capacity would be adequate to meet these higher than expected operational levels. The potential third parallel runway (Runway 6L-24R) would be aligned north of the existing Runway 6L-24R (ultimately 6C-24C), partially on land owned by the TAA, and land northeast of existing airport property that would need to be acquired.

RUNWAY LENGTH

The facility requirements indicated the primary runway should be planned with a runway length of 8,300 feet to accommodate 75 percent of large aircraft at 90 percent useful load. This recommended runway length is consistent with the FAA runway length requirements contained in FAA AC 150/5325-4A, *Runway Length Requirements for Airport Design*.

Three alternatives can be considered for the runway extension: place the entire extension on the Runway 6R end, place the entire extension on the Runway 24L end, or split the extension between each end. Since land currently owned by the TAA is available for the entire 2,800-foot extension on the Runway 6R end, it is neither necessary nor practical to consider placing the extension on the Runway 24L end or splitting the extension.

It has also been recommended that Runway 15-33 be extended by 800 feet to an ultimate length of 4,800 feet. At this length, the crosswind runway would have adequate length to serve 100 percent of small airplanes with less than 10 passenger seats. There is adequate land available north and south of Runway 15-33 to split the extension. The location of Ajo Highway south of Runway 33 would prevent the full extension to the south, and a land acquisition would be required to allow for the full extension to the north of Runway 15.

Runway 6L-24R (4,900 feet) currently exceeds its recommended design

AIRSIDE CONSIDERATIONS

- Meet ARC D-II design standards for Runway 6R-24L
- Extend Runway 6L-24R to 5,005 feet
- Meet ARC B-II design standards for Runway 6L-24R
- Extend Runway 15-33 to 4,800 feet
- Meet ARC B-I (small airplane exclusive) design standards for Runway 15-33
- Establish instrument approaches to each runway end utilizing GPS technology
- Taxiway circulation and runway exits
- Protection of runway approaches
- Future land acquisition needs
- Construct airport perimeter service road
- Locations for helipad
- Extend Runway 6R-24L to 8,300 feet and widen to 100 feet
- A third parallel runway to increase airport capacity

LANDSIDE CONSIDERATIONS

- Locations for aircraft storage hangar development
- Locations for revenue support development
- Vehicle parking locations
- Road circulation
- Expansion of aprons
- Flight school expansion areas

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Exhibit 4B
KEY PLANNING ISSUES

length of 4,800 feet. However, it has been recommended by TAA staff that a 105-foot extension to at least 5,005 feet of Runway 6L-24R would improve the runway's versatility for high operational periods and during construction periods for the primary Runway 6R-24L. The 105-foot extension would also result in the existing and ultimate runway threshold entrance taxiways to meet separation standards. There is adequate land both east and west of Runway 6L-24R for the full 105-foot extension.

The potential third parallel runway would primarily serve as a training runway exclusively for small aircraft. The recommended runway length for this type of use is 4,800 feet. The airfield alternatives analysis will propose a location for this 4,800-foot third parallel runway.

AIRPORT REFERENCE CODE (ARC) DESIGNATION

The design of airfield facilities is based, in part, on the physical and operational characteristics of aircraft using the airport. The FAA utilizes the Airport Reference Code (ARC) system to relate airport design requirements to the physical (wingspan) and operational (approach speed) characteristics of the largest and fastest aircraft conducting 500 or more itinerant operations annually at the airport. While this can at times be represented by one specific make and model of aircraft, most often the airport's ARC is represented by several different aircraft which collectively conduct more than 500 annual itinerant operations at the airport.

The FAA uses the 500 annual itinerant operations threshold when evaluating the need to develop and/or upgrade airport facilities to ensure that an airport is cost-effectively constructed to meet the needs of those aircraft that are using, or have the potential to use, the airport on a regular basis. It should be recognized that aircraft that are outside the ARC design of the airport may still operate there. This is due to these aircraft not meeting the 500 annual itinerant operations threshold.

At Ryan Airfield, the majority of based aircraft fall within ARC A-I and B-II. However, the mix of transient aircraft is more diverse and includes aircraft in ARCs C-I, C-II, and D-I. Aircraft in ARCs C-II and D-I are the most demanding aircraft to operate at the airport currently (due to their higher approach speeds and wider wingspans); however, these aircraft currently conduct less than 500 annual itinerant operations at the airport. Therefore, at this time, the most demanding approach category for the airport is Approach Category B. The wingspans of the most demanding aircraft fall within Airplane Design Group (ADG) II.

The current critical aircraft at Ryan Airfield fall within ARC B-II design standards. The potential exists in the future for increased use of the airport by business turbojet aircraft, which fall within ARC D-II. This follows with the national trend of increased business and corporate use of turbojet

aircraft, strong sales and deliveries of turboprop and turbojet aircraft, and expanded fractional ownership programs for these aircraft. Local factors that might also contribute to the increased use of these more demanding aircraft include the expansion of the Tucson metropolitan area, which will result in more transient business jet operators utilizing the less congested Ryan Airfield instead of Tucson International Airport. Casinos in the southwestern part of Tucson with close proximity to Ryan Airfield should also attract transient jet aircraft activity.

Common business jet and turboprop aircraft have higher approach speeds than the current critical aircraft operating at the airport; however, most of these aircraft have similar wingspans to the existing critical aircraft operating at the airport. The higher approach speeds of these aircraft are expected to have the potential of changing the critical aircraft designation for the airport. Ultimately, the airport is expected to accommodate aircraft within ARC D-II. One of the most notable effects of the ARC D-II design standards is that Runway 6R-24L will need to be widened from 75 feet to 100 feet. Having this extra width will make operations safer for aircraft with faster landing and takeoff speeds.

Runways 6L-24R and 15-33 are used primarily by smaller aircraft conducting training operations. The most demanding aircraft anticipated to use Runway 6L-24R in the future fall within ARC B-II design standards. Runway 15-33 will continue to be used by small aircraft (ARC B-I small aircraft exclusively) for training operations through the planning period.

Table 4A summarizes the ultimate (ARC D-II) design standards for Runway 6R-24L, Runway 6L-24R (ARC B-II), Runway 15-33 (ARC B-I small aircraft exclusive), and the potential third parallel runway (ARC B-I small aircraft exclusive). Each of these design standards are met in the proposed airfield alternatives.

PRECISION INSTRUMENT APPROACH

The facility requirements analysis indicated a need for improved instrument approach capabilities at Ryan Airfield. **Table 4A** indicates the ultimate visibility minimums for each runway. Runway 6R is currently equipped with an instrument landing system (ILS) approach which provides both vertical and course guidance to pilots. This precision instrument approach is available for use in visibility conditions down to a minimum of one mile. To achieve ½-mile visibility minimums to Runway 6R will require the installation of an approach lighting system. The typical equipment recommended is a medium intensity approach lighting system with runway alignment indicator lights (MALSR). The MALSR lighting system is depicted on each of the airfield alternatives.

TABLE 4A
Airfield Safety and Facility Dimensions (in feet)

	Ultimate Runway 6R-24L	Ultimate Runway 6L-24R	Ultimate Runway 15-33/ Potential Third Parallel
Airport Reference Code (ARC)	D-II	B-II	B-I (small aircraft)
Approach Visibility Minimums	½ Mile Each End	One Mile Each End	One Mile Each End
Runway			
Length	8,300	5,005	4,800
Width	100	75	75
Runway Safety Area (RSA)			
Width	500	150	150
Length Beyond Runway End	1,000	300	300
Object Free Area (OFA)			
Width	800	500	500
Length Beyond Runway End	1,000	300	300
Obstacle Free Zone (OFZ)			
Width	400	400	250
Length Beyond Runway End	200	200	200
Precision Obstacle Free Zone (POFZ)			
Width	800	N/A	N/A
Length Beyond Runway End	200	N/A	N/A
Runway Centerline To:			
Hold Line	275	200	125
Parallel Taxiway Centerline	425	240	240
Edge of Aircraft Parking Apron	500	250	250
Runway Protection Zone (RPZ)			
Inner Width	1,000	500	250
Outer Width	1,750	700	450
Length	2,500	1,000	1,000
Obstacle Clearance	50:1	20:1	20:1
Taxiways			
Width	35	35	35
Safety Area Width	79	79	79
Object Free Area Width	131	131	131
Taxiway Centerline To:			
Parallel Taxiway/Taxilane	105	105	105
Fixed or Moveable Object	65.5	65.5	65.5
Taxilanes			
Taxilane Centerline To:			
Parallel Taxilane Centerline	97	97	97
Fixed or Moveable Object	57.5	57.5	57.5
Taxilane Object Free Area	115	115	115

Source: FAA Advisory Circular (AC) 150/5300-13, *Airport Design*; 14 CFR Part 77, *Objects Affecting Navigable Airspace*

It was also determined in the facility requirements that a Global Navigation Satellite System Landing System (GLS) approach is desirable to provide Runway 24L with precision instrument approach capabilities. The GLS utilizes GPS technology, which limits the amount of costly on-site navigation equipment needed at the airport. Like an ILS system, a GLS would require the installation of an approach lighting system to achieve ½-mile visibility minimums. Therefore, a MALSR lighting system is also shown on each of the airfield alternatives on the Runway 24L end.

HELIPAD

Helicopter training is currently conducted at Ryan Airfield primarily utilizing crosswind Runway 15-33 for approach. To segregate helicopter operations from fixed-wing operations to the extent possible, helipad positions are considered in the airfield alternatives. Two different helipad layouts are proposed in the alternatives. The first type includes a helipad for approaches and helicopter parking spaces adjacent to a landside facility that would have ground vehicular access. The second layout would be a helicopter training helipad, which would not have parking positions or any landside facilities. Each of these helipad layouts are proposed to be located at a minimum of 2,500 feet from the centerline of any runway so that simultaneous helicopter/fixed-wing operations may be conducted. Having the ability to conduct these operations simultaneously without interruption to the runway system will also benefit the airport's ASV.

AIRPORT PERIMETER SERVICE ROAD

A paved airport perimeter service road is proposed to provide service and emergency vehicles access to all areas of the airfield. The airfield alternatives show proposed alignments for this perimeter service road, which should encompass all airfield facilities. The perimeter service road would be closed to public traffic by use of security gates, which would limit access to authorized personnel.

LAND ACQUISITIONS

When considering different alternatives for airfield expansion, it is common that ultimate facilities and safety areas may extend beyond current airport property boundaries. In these cases, it is recommended that land beyond current airport property boundaries that may be needed for future projects or for the protection of runway approaches is acquired through fee simple acquisition.

This airfield alternative analysis considers fee simple acquisition of two sections of land that can be identified on each airfield alternative exhibit by blue dashed lines. Both land acquisitions are along the northern edge of the existing property line. The parcel located north of the Runway 15 end encompasses approximately 79.8 acres and would be needed to protect the ultimate Runway 15 RPZ from inadequate land uses and for the construction of an airport perimeter service road. The second land acquisition consideration is a 39.5 acre parcel north of the Runway 24R end. This acquisition would be needed for the potential construction of a third parallel runway as well as an airport perimeter service road. Each of these land acquisitions were previously proposed in the 1999 master plan.

SEGMENTED CIRCLE/LIGHTED WIND INDICATORS

The airport is currently equipped with a segmented circle and lighted wind indicator near midfield of the airport

to aid pilots in determining appropriate traffic patterns and wind direction and intensity. These navigation aids currently fall within the Runway 6R-24L object free area (OFA). It is defined in AC 150/5300-13, *Airport Design*, that the OFA should be cleared of objects protruding above the runway safety area edge elevation. Therefore, the segmented circle and lighted wind indicator should be relocated so that they lay completely outside the OFA. Each airfield alternative depicts the segmented circle and lighted wind indicator relocated north of Runway 6L-24R (6C-24C on Airfield Alternative 3). This is a central location on the airfield and would be highly visible to pilots operating in local airspace.

AIRSIDE ALTERNATIVES

AIRFIELD ALTERNATIVE 1

The proposed airside configuration of Airfield Development Alternative 1 is shown on **Exhibit 4C**. This alternative closely follows the 1999 Master Plan and incorporates the following:

1. Extension of Runway 6R by 2,800 feet to the west. This runway extension would include the extension of Taxiway B and the construction of a holding apron where Taxiway B meets the end of Runway 6R.

2. Widen Runway 6R-24L to 100 feet.

3. Extension of Runway 15-33 and Taxiway D 800 feet to the north.

4. Extension of Runway 6L-24R and Taxiway A 105 feet to the east.

5. Construction of a dual parallel taxiway south 105 feet south of the centerline of Taxiway B.

6. Construction of a helipad with helicopter parking spaces and a hangar facility north of Ajo Highway and southeast of the airfield.

As it was discussed in the airside development considerations section of this chapter, a 105-foot extension to Runway 6L-24R would improve the runway's overall versatility. Along with the extension to the Runway, Taxiway A would also be extended 105 feet resulting in the construction of a new entrance taxiway to the Runway 24R threshold. This would create parallel entrance taxiways with a separation distance of 105 feet. The ADG II parallel taxiway separation standard is 105 feet. Therefore, this and each subsequent airfield alternative proposes a 105-foot Runway 6L-24R and Taxiway A extension to meet this parallel taxiway separation standard.

This alternative proposes a number of exit taxiway improvements for each runway. Three high-speed exit taxiways are proposed for Runway 6R. These high-speed exits are spaced so that they are capable of being utilized

by a high percentage of aircraft in approach categories A to D. A single high-speed exit is proposed for Runway 24L, at a location where it will allow small aircraft to exit the runway quickly. Runway 6L-24R would also have two high-speed exits constructed at about the midpoint of the runway. At this location, a high percentage of small aircraft will be able to exit. A single right-angled exit is shown 1,600 feet from the ultimate Runway 15 threshold. This will allow aircraft to exit the runway before crossing the parallel runways.

Holding aprons are proposed at each runway end. These holding aprons will help reduce taxiway congestion, while providing a location for preflight engine run-ups.

The location of the helipad facility, southeast of the airfield and the landside facilities, would allow for simultaneous approach operations to each parallel runway and the helipad. This location would also be located near areas of proposed landside development, which would keep it within close proximity to airport maintenance and fueling facilities. The helipad could also be readily expandable to the east to provide additional helipads and parking spaces.

Airfield Alternative 1 and each subsequent airfield alternative show the proposed realignment of West Valencia Road. This is the result of a study conducted by the Pima County Regional Transportation Authority. The realignment would not shift the intersection of West Valencia Road and Ajo Highway and should not have an effect on the flow of traffic to and from the airport.

AIRFIELD ALTERNATIVE 2

The proposed airside configuration of Airfield Alternative 2 is shown in **Exhibit 4D**. The following projects proposed in Airfield Alternative 2 differ from Airfield Alternative 1:

1. Extension of Runway 6R-24L by 2,800 feet to the west. The ultimate extension would include the extension of Taxiway B and the construction of holding aprons.

2. Split 800-foot extension of Runway 15-33, including a 400-foot extension of both the 15 and the 33 ends. Splitting the extension could ultimately be a disadvantage as it generates two separate construction projects. This will increase construction costs by necessitating the relocation of both runway end thresholds and extensions to both taxiway ends as opposed to one.

3. Extension of Runway 6L-24R by 105 feet to the west.

4. Construction of a helicopter training helipad southwest of the airfield.

This airfield alternative has a few taxiway circulation differences from the previous airfield alternative. This alternative looks at extending Taxiway A from the Runway 6L end to the ul-

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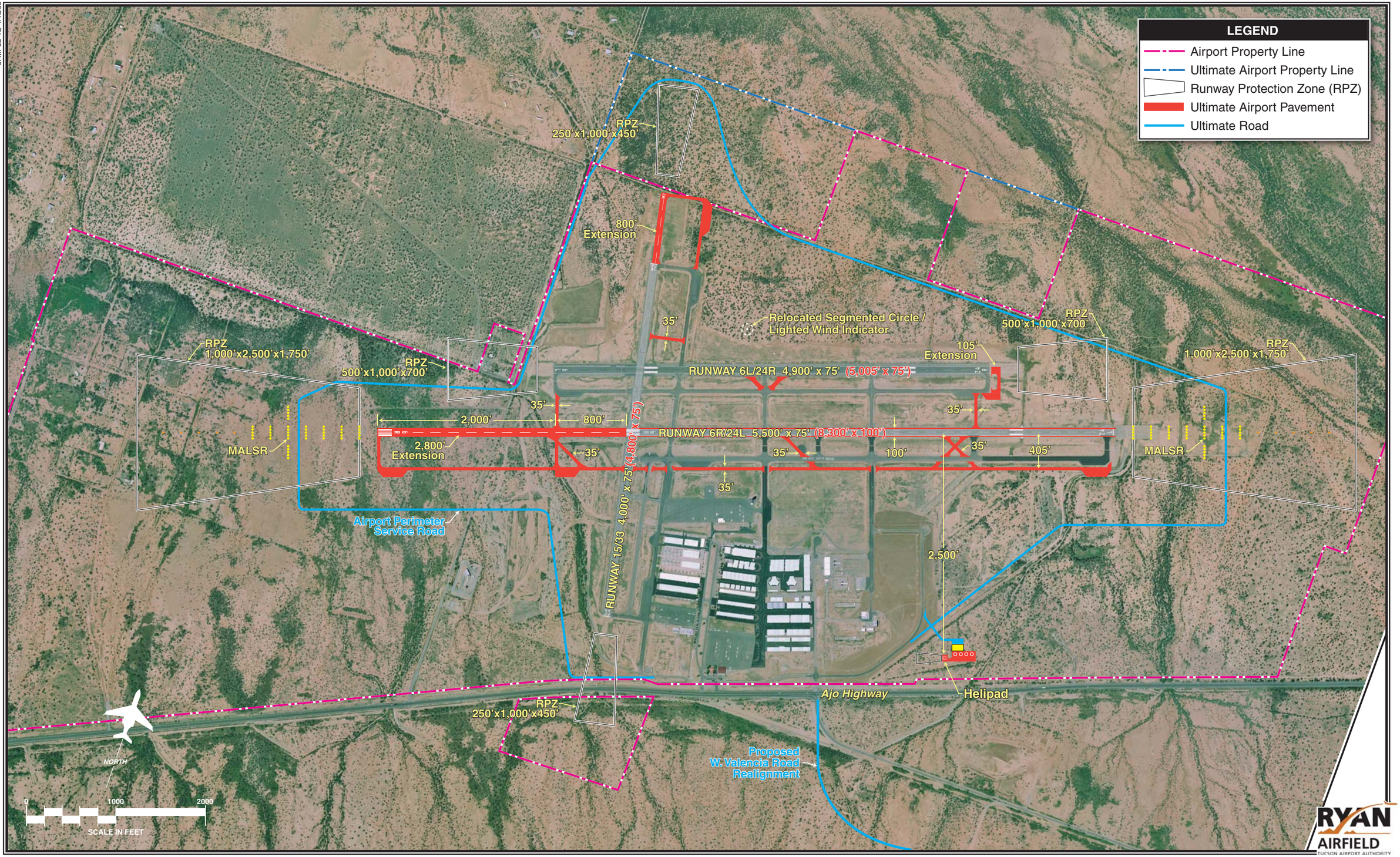

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Exhibit 4C
AIRFIELD ALTERNATIVE 1

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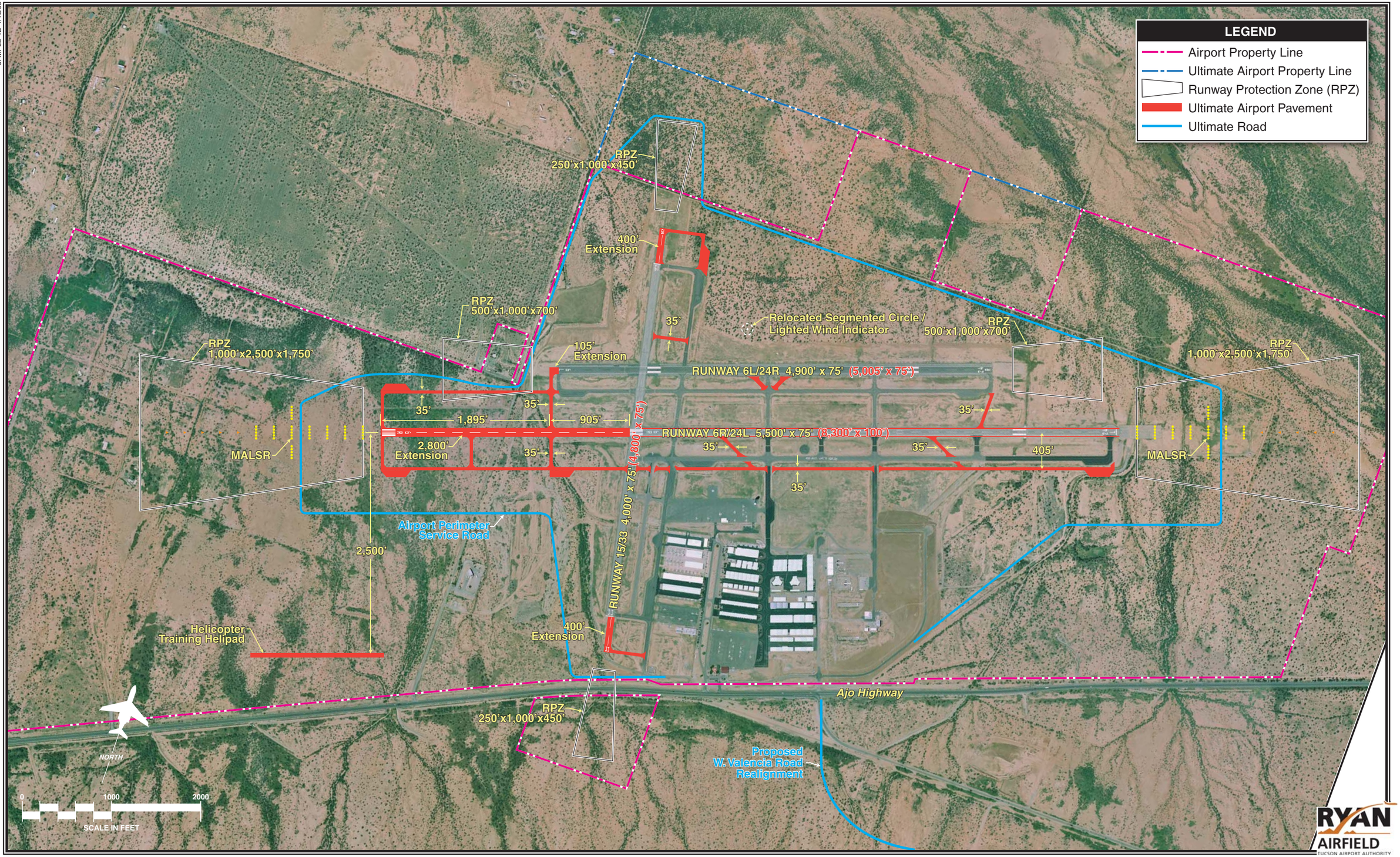

Exhibit 4D
AIRFIELD ALTERNATIVE 2

timate Runway 6R end. This could help reduce taxiway congestion on Taxiway B by providing an alternate route to the Runway 6R threshold. A disadvantage of this would be that Taxiway A would lay within the Runway 6L RPZ.

FAA AC 150/5300-13, *Airport Design*, states that the function of the RPZ is "to enhance the protection of people and property on the ground" through owner control of the RPZ and maintaining the RPZ clear of incompatible objects. While the FAA design standards do not specifically prohibit a runway or taxiway from extending through an RPZ, the FAA desires that runways and taxiways be located outside the RPZ.

High speed exit taxiways are still considered for Runway 6R at locations for all aircraft types. Runway 24L would not be served by high speed exits but would continue to use the existing right-angled exits. This would create higher runway occupancy times when Runway 24L is in use due to aircraft not being able to exit the runway quickly. A right-angled exit is considered 1,000 feet from the ultimate Runway 6R threshold, which would serve only a small percentage of aircraft.

The helipad considered in this airfield alternative would be located southwest of the airfield and would have dimensions of 1,500 feet long and 50 feet wide. This helipad proposal would be used exclusively by helicopters for training purposes. This location would allow for simultaneous approaches by fixed wing aircraft to the parallel runways and helicopters operating on the training helipad. This facility would not provide helicopter parking spaces or any landside facilities.

AIRFIELD ALTERNATIVE 3

The proposed airside configuration of Airfield Alternative 3 is shown in **Exhibit 4E**. The following projects proposed in Airfield Alternative 3 differ from the previous airfield alternatives:

1. Construction of a third parallel runway (Runway 6L-24R). Runway 6L-24R would have a length of 4,800 feet and a width of 75 feet to conform to ARC B-II design standards. Existing Runway 6L-24R would be renamed Runway 6C-24C.

2. Construction of a full-length parallel taxiway for potential third parallel Runway 6L-24R.

3. Construction of a helipad and supporting landside facilities southwest of airfield adjacent Ajo Highway.

This airfield alternative differs only slightly from Airfield Alternative 2. The most obvious difference is the addition of a third parallel runway. This runway would alleviate capacity issues that go beyond what is projected in this master plan. Ultimate Runway 6L-24R would be used exclusively by small aircraft for training operations.

This airfield alternative proposes a helipad with helicopter parking spaces as well as support landside facilities.

Its location will allow for future expansion of the helipad and parking area if the demand rises. A disadvantage of this location is that it is secluded from other landside facilities, specifically fuel storage facilities. If this location is selected as the most desirable, it may need to have its own fuel storage capabilities.

LANDSIDE DEVELOPMENT CONSIDERATIONS

The purpose of this section is to identify and evaluate various viable landside development alternatives at Ryan Airfield to meet program requirements set forth in Chapter Three. While the airfield is comprised of facilities where aircraft movement occurs (runways, taxiways, ramps) other "landside" functions occur outside of this area. The primary functions to be accommodated on the landside of Ryan Airfield include terminal services, aircraft storage hangar development, aircraft parking aprons, revenue support, flight school facilities expansion, and automobile parking and access. The interrelationship of these functions is important to defining a long-range landside layout for general aviation uses at the airport. Runway frontage should be reserved for those uses with a high level of airfield interface or need of exposure. Other uses with lower levels of aircraft movements or little need for runway exposure can be planned in more isolated locations.

Landside development considerations are summarized on **Exhibit 4B**. The following sections briefly describe proposed landside facility improvements.

TERMINAL SERVICES

Currently, a combination of the TAA and several specialty operators located at Ryan Airfield provide a variety of terminal services. Typical services that are provided at a general aviation airport include passenger waiting areas, a pilot's lounge and flight planning area, concessions, management, storage, and various other needs. The facility requirements analysis indicated that through the long-term planning horizon, Ryan Airfield will need an additional 6,800 square feet of terminal service area. The landside alternatives analysis will identify potential locations for fixed base operator (FBO) development to meet the projected terminal service needs. The FBO facilities depicted on the landside alternative exhibits vary in size from 8,500 to 15,000 square feet to allow for their cross-utilization as aircraft storage facilities and a terminal service provider.

AIRCRAFT STORAGE HANGARS

The facility requirements analysis indicated a need for the development of various types of aircraft storage hangars. This includes single aircraft storage facilities such as T-hangars, box hangars, and shade hangars, executive conventional hangars which typically are used for the storage of larger multiengine turboprop and business jet aircraft, and clearspan conventional hangars for accommodating several

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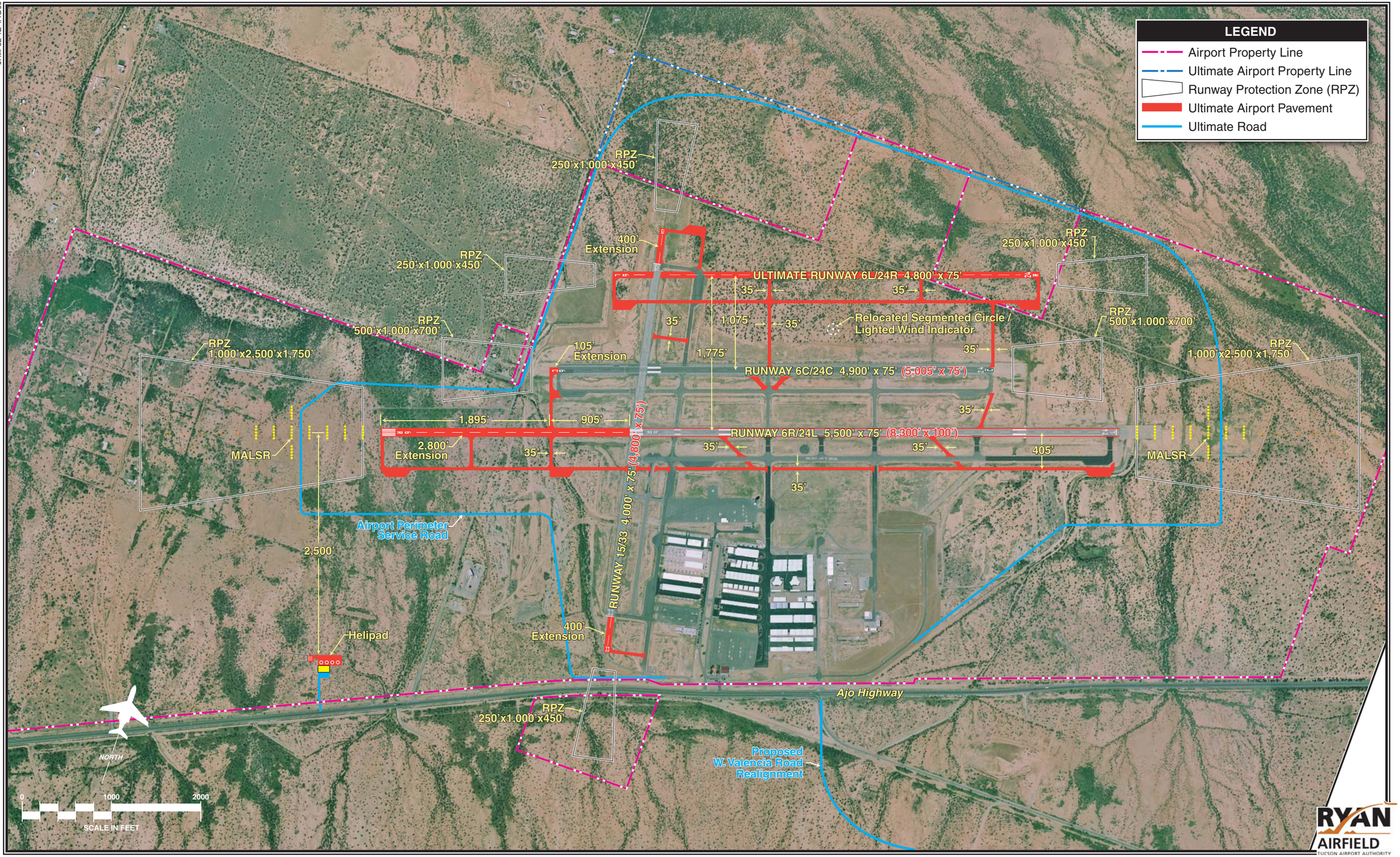

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Exhibit 4E
AIRFIELD ALTERNATIVE 3

aircraft simultaneously. Limited utility services are needed for these areas. Typically, this involves electricity, but may also include water and sanitary sewer.

AIRCRAFT PARKING APRON

As the number of transient and based aircraft increase through the planning period it will be important to provide adequate aircraft parking positions. It will be particularly important as turboprop and jet aircraft operations increase at Ryan Airfield that there is adequate parking for these larger, heavier aircraft. The landside alternative analysis will identify potential locations for aircraft parking apron expansion.

AUTOMOBILE PARKING

As based aircraft and operations at Ryan Airfield grow, automobile parking spaces will need to be increased. The existing automobile parking spaces at the airport are located adjacent to the restaurant/airport administration building and along Aviator Lane. Future areas of automobile parking expansion will be examined in each landside alternative.

FLIGHT SCHOOL FACILITIES EXPANSION

Areas for expansion of the flight school facilities will need to be considered in the landside alternatives analysis. While the airport is currently without a flight training operation, historically the flight school presence at Ryan Airfield has been cyclical. Therefore it is important to plan for the presence of a flight school in the future. Expansion needs for a potential flight school include a larger facility for classrooms and offices, aircraft parking spaces, and automobile parking.

REVENUE SUPPORT

The landside alternatives to follow consider options for the TAA to reserve parcels of land for aviation development, which will serve as revenue support for the airport. Aviation developments include but are not limited to hangar development, FBOs, and aviation specialty operators.

LANDSIDE ALTERNATIVES

LANDSIDE ALTERNATIVE 1

The layout for Landside Alternative 1 is depicted on **Exhibit 4F**. This landside alternative focuses hangar development to the east side of the terminal area with FBO development at the north end of Airfield Drive. The two 15,000 square foot FBO facilities would be located adjacent a 34,500 square yard apron that would serve a range of small single engine aircraft to larger turboprop and business jet aircraft. South of the FBO facilities are two 2.0 acre aviation development parcels that would be reserved for additional specialty operators or other aviation-related businesses. A 7,800-square-yard automobile parking lot would serve each of these facilities. An advantage of this layout is that it

allows for the expansion of the apron to the north, and it centralizes the terminal services along the flight line. The expansion area for the flight school facility is located in the southwest corner of the terminal area. The proposed layout of the flight school area includes a 15,000 square foot facility with adjacent automobile parking, and an 18,000 square yard aircraft parking apron expansion. A 1.8 acre parcel of land would be reserved for any future expansion of flight school facilities.

Several aviation development parcels are located along the south end of Airfield Drive adjacent to the existing airport maintenance facilities. These parcels range in size from 1.0 acre to 2.0 acres. A 2.5 acre business park is located in the same area. Business park occupants would not have direct access to the airfield facilities, but would have good visibility from Ajo Highway to the south. A disadvantage of the layout of these parcels is that it limits expansion possibilities of the airport maintenance facility. An additional 13.2 acre aviation development parcel is located east of the proposed hangar development area. This parcel would be reserved for an aviation-related business that would need a large area of land for its facilities, or for additional hangar development.

The bulk of future hangar development would be located north of the business park and east of the FBO development area. This landside alternative proposes a total of 10 T-hangar facilities that would provide approximately 190 aircraft storage positions; 35 box hangar facilities ranging in size from 2,500 square feet to 3,600 square feet; one shade hangar facility that would provide 32 positions; eight executive conventional hangars ranging in size from 3,600 square feet to 5,850 square feet; and 25 5,625 square foot conventional hangars. A disadvantage of the hangar development area is if hangars are constructed along the flight line, it may limit apron expansion possibilities in the future.

A helicopter terminal area is also shown on Landside Alternative 1 southeast of the proposed business park. This helicopter terminal area includes a helipad, helicopter parking spaces, a terminal building, and automobile parking. This location is carried over from the airfield alternatives, so that this potential helipad location can be visualized along with potential landside development.

LANDSIDE ALTERNATIVE 2

The layout for Landside Alternative 2 is depicted on **Exhibit 4G**. In this alternative, a single 15,000 square foot FBO facility is located at the north end of Airfield Drive. The adjacent 21,950 square yard apron adjacent to the FBO facility would be considerably smaller than the apron proposed in Landside Alternative 1. A 2,000 square yard automobile parking lot would accompany the FBO facility.

Two 2.1 acre aviation development parcels are located to the south of the FBO facility. These parcels would be available for additional FBO or specialty operator development. These parcels are large enough for the

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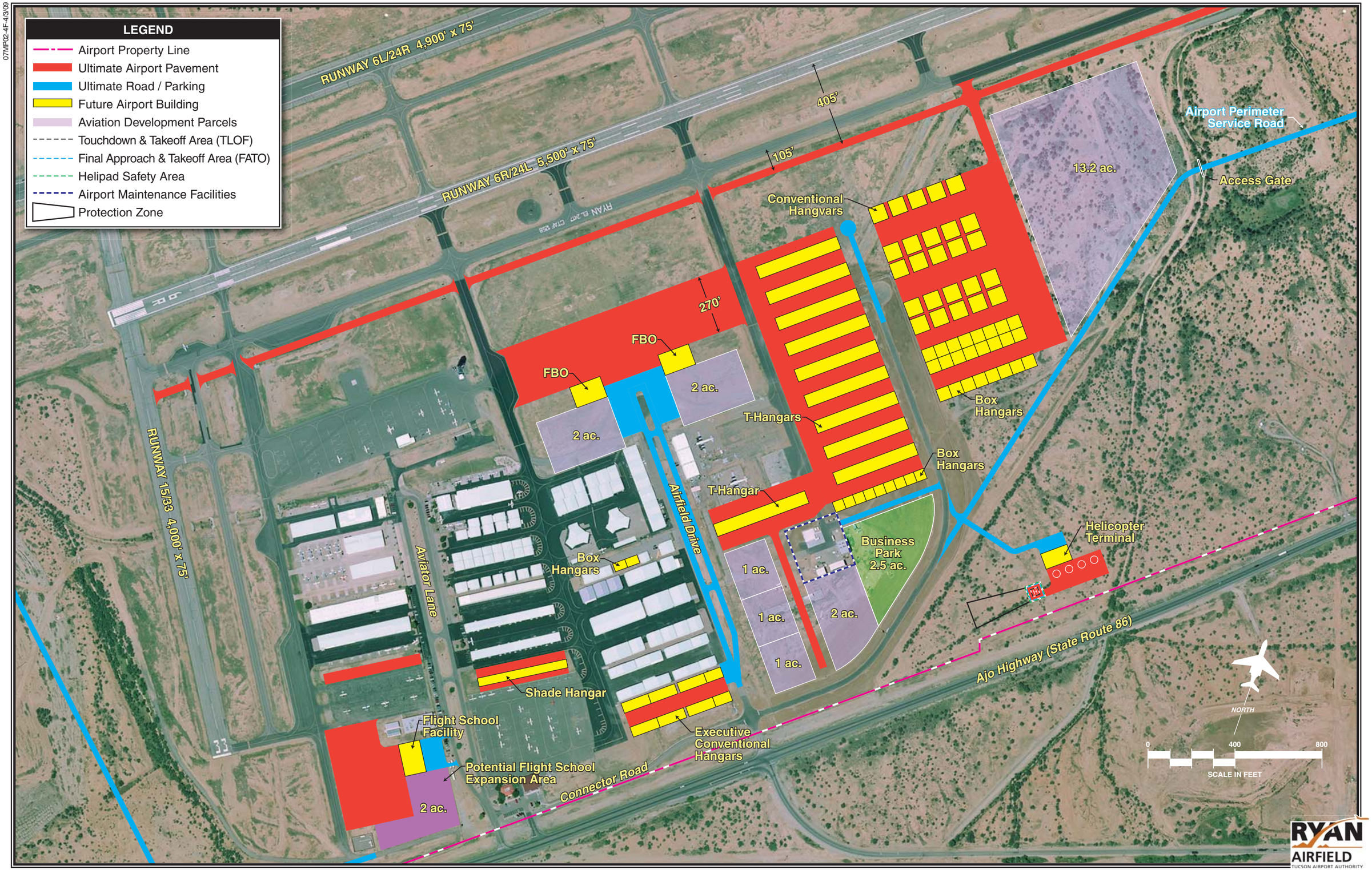

Exhibit 4F
LANDSIDE ALTERNATIVE 1

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LEGEND

- Airport Property Line
- Ultimate Airport Pavement
- Ultimate Road / Parking
- Future Airport Building
- Aviation Development Parcels
- Airport Maintenance Facilities

RUNWAY 6L/24R 4,900' x 75'

RUNWAY 6R/24L 5,500' x 75'

RUNWAY 15/33 4,000' x 75'

405'

105'

320'

T-Hangars

Access Gate

Airport Perimeter Service Road

Shade Hangars

FBO

2.1 ac.

2.1 ac.

3.4 ac.

3.4 ac.

2.7 ac.

Conventional Hangars

Box Hangars

Box Hangars

2 ac.

T-Hangars

Conventional Hangars

1.5 ac.

1.3 ac.

1.3 ac.

1.3 ac.

2.1 ac.

AVIATOR LANE

AIRFIELD DRIVE

Flight School Facility

T-Hangar

Executive Conventional Hangars

CONNECTOR ROAD

AJO HIGHWAY (STATE ROUTE 86)

NORTH

0 400 800

SCALE IN FEET

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Exhibit 4G
LANDSIDE ALTERNATIVE 2

construction of a hangar facility, apron area, and automobile parking. Several other aviation development parcels are located in the terminal area. These parcels, ranging in size from 1.3 acres to 3.4 acres, would be available for hangar, FBO, or specialty operator development.

This alternative shows a similar layout for flight school facilities expansion as Landside Alternative 1. The layout closely follows the 1999 ALP proposal with a 14,000 square foot facility, automobile parking, and a 19,225-square-yard aircraft parking apron expansion.

Proposed hangar development in this alternative would provide significantly more hangar positions than Landside Alternative 1. This alternative proposes 12 T-hangar facilities that would provide approximately 242 total positions; two shade hangar positions providing 68 positions; 74 box hangars ranging in size from 3,000 square feet to 5,625 square feet; nine executive conventional hangars ranging in size from 3,600 square feet to 6,075 square feet; and nine conventional hangars ranging in size from 4,500 square feet to 10,000 square feet. The location of several of the shade hangar and T-hangar facilities could ultimately impede apron expansion in the future, especially in areas adjacent to the proposed FBO facility.

The airport maintenance facilities would remain in their present location in this alternative with a small section of land immediately south of the existing facilities reserved for future expansion needs. A new access road to these facilities would be constructed to the east.

LANDSIDE ALTERNATIVE 3

The layout for Landside Alternative 3 is depicted on **Exhibit 4H**. This alternative most closely resembles the layout for landside facilities presented on the 1999 ALP. The main focus of the landside facilities would be to develop the terminal area's central hub around FBO facilities and a large 50,800 square yard apron. A 6,700-square-yard automobile parking lot would serve the FBO facilities.

This landside development alternative gives more focus to aviation development parcels. There are a total of 14 aviation development parcels proposed in the terminal area ranging in size from 1.1 acre to 3.5 acres. These parcels give more flexibility to the TAA and developers when it comes to the layout of facilities within the given parcels. A 6.6 acre business park is located south of the existing airport maintenance facility. This area would serve as a center for businesses on the airport that would not need immediate airfield access. A flight school expansion area is shown adjacent to the existing flight school facilities. This development parcel encompasses the same development area proposed in the previous landside alternatives. Again, the advantage of showing a parcel as opposed to the layout of facilities is to allow for flexibility.

Hangar development in this landside alternative is much more limited compared to the previous landside

alternatives. This is due to the increased focus on aviation development parcels. However, it is anticipated that several of the aviation development parcels would be utilized for the construction of hangar facilities. Hangar storage units depicted on Landside Alternative 3 include seven T-hangar facilities proposed east of the FBO development area that would provide approximately 119 storage positions; one shade hangar that would provide 32 storage positions; 10 2,500-square-foot box hangars; and one 6,000-square-foot conventional hangar. The hangar facilities on this alternative are shown to be located away from the flight line. This is to allow for easier expansion of the apron and to provide for additional locations for FBO and specialty operator development.

SUMMARY

The process utilized in assessing 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.

These alternatives present an ultimate configuration of the airport that would need to be able to be developed over a long period of time. The next phase of the Master Plan will define a reasonable phasing program to implement a preferred master plan development concept over time.

Upon review of this chapter by the TAA, the public, and the PAC, 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 preferred master plan development concept 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 for flexibility in the plan to meet activity growth beyond the 20-year planning period.

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

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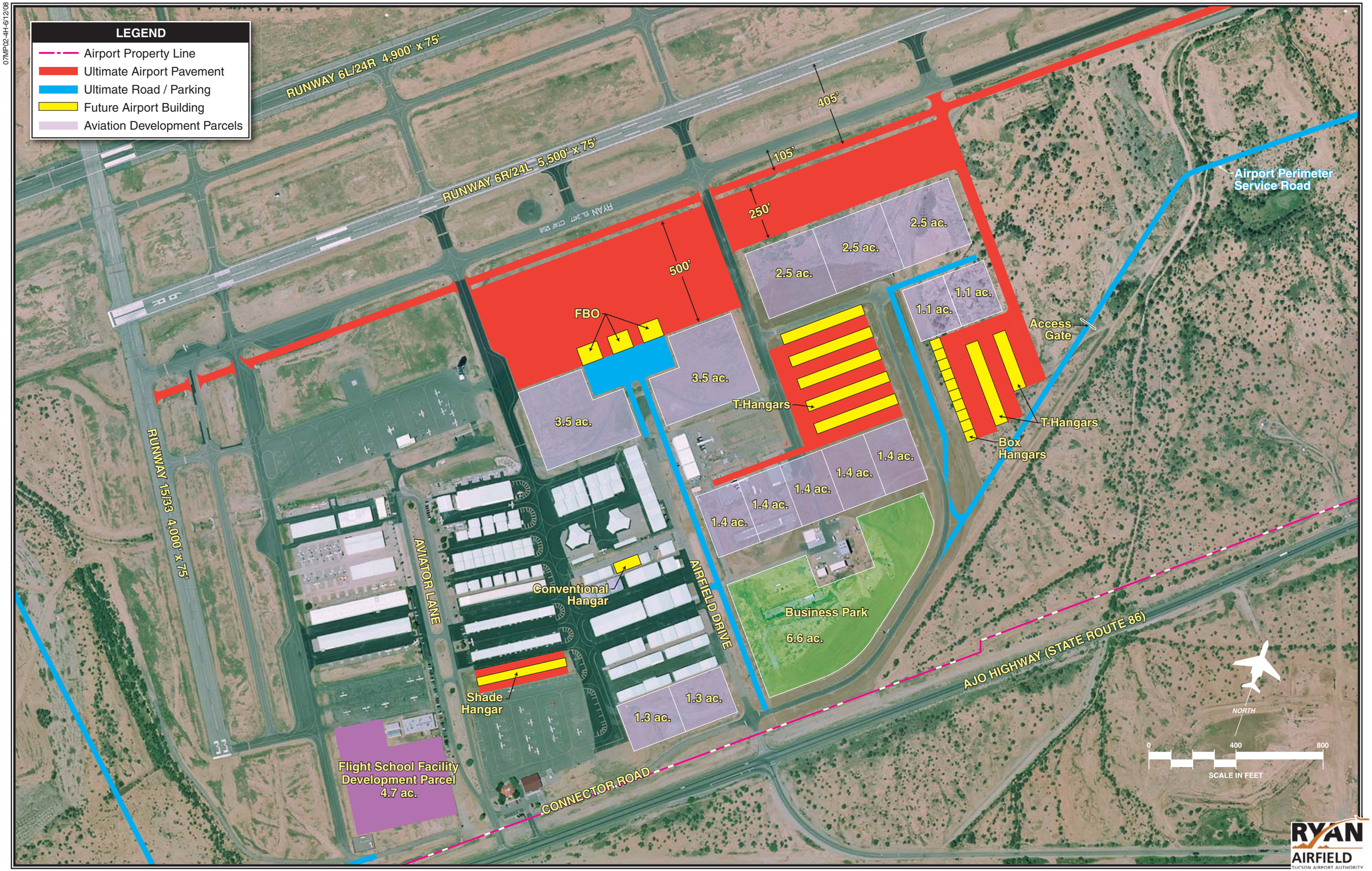

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Exhibit 4H
LANDSIDE ALTERNATIVE 3