Chapter 4

Development Alternatives

In the previous chapter, aviation facilities required to satisfy airside and landside demand through the planning period of the master plan were identified. In addition, various Federal Aviation Administration (FAA) standards that apply to airfield design were discussed. The next step in the planning process is to evaluate reasonable ways these facilities can be provided, and the design standards can be met. The purpose of this chapter is to formulate and examine rational development alternatives that address the short-, intermediate-, and long-term planning horizon levels. Because there are several possibilities and combinations, it is necessary to focus on those opportunities that have the greatest potential for success. Each alternative provides a differing approach to meet existing and future facility needs, and these layouts are presented for purposes of evaluation and discussion.

Some airports become constrained due to limited availability of space, while others may be constrained due to adjacent land use development. Careful consideration should be given to the layout of future facilities and impacts to potential airfield improvements at Baraboo-Wisconsin Dells Regional Airport (DLL). Proper planning at this point in the master plan process can ensure the long-term viability of the airport for aviation and economic growth.

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

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

The alternatives presented in this chapter have been formulated as potential means to meet the overall program objectives for the airport in a balanced manner. Through coordination with the Village of Lake Delton, airport tenants and management, the Planning Advisory Committee (PAC), the Wisconsin Department of Transportation (WisDOT) Bureau of Aeronautics (BOA), and the public, an alternative (or combination of alternatives) will be refined and modified into a recommended development concept. The planning considerations and alternatives presented in this chapter can be considered a starting point in the evolution of a recommended concept for the future of DLL. It is important to explain clearly from the start, this alternatives analysis is intended to flesh out development concepts for the purpose of discussion. Each alternative has a purposeful nature but the final development concept often times is a combination of several alternatives or even the addition of new ideas sparked by collaboration with the PAC.

REVIEW OF PREVIOUS AIRPORT PLANS

The current approved Airport Layout Plan (ALP) for DLL was prepared by the BOA in 2013. The existing Airport Layout Drawing (ALD), the overarching proposed development plan within the ALP drawing set, is shown on **Exhibit 4A**. The ALD graphically depicts airside and landside recommendations based on previous airport planning, including:

- Extending Runway 1-19 690 feet to the south for an ultimate length of 5,700 feet.
- Paving and extending Runway 14-32 to an ultimate length of 3,500 feet.
- Constructing a new, larger terminal building.
- Additional development within the hangar area at the southwest corner of the airport.

The 2013 ALP reflects a change in the Runway Design Code (RDC)[1] for both runways: Runway 1-19 is planned to transition from B-II to C-II, while crosswind Runway 14-32 is proposed to change from A-I(s)mall to B-II(s) which includes the conversion of grass to paved surface. The instrument approaches were not planned to go below a 1-mile visibility minimum; consequently, no approach lighting systems or other navigational aids were planned.

The analysis presented in this chapter will consider elements presented on the ALD and in the previous master plan. Since completion of the last plan, the FAA has made significant modifications to the design standards as outlined in the previous chapter. As such, some elements of the previous plan may carry over to this master plan and others may be changed or removed from further consideration, while other elements have already been implemented, such as widening Runway 1-19 from 75 feet to 100 feet.

NO-ACTION/NON-DEVELOPMENT ALTERNATIVE

The Village of Lake Delton is charged with managing the airport for the economic benefit of the community and region. In some cases, alternatives may include a “no-action” option; however, for DLL, this would effectively reduce the quality of services being provided to the public and would negatively

[1] A Runway Design Code (RDC) is a designation that signifies the design standards to which a runway is built. RDCs are comprised of the Aircraft Approach Category (AAC) and Airplane Design Group (ADG) of the critical design aircraft, as well as the runway visibility minimums based on instrument approach capabilities. RDCs are described in detail in Chapter Three.

RUNWAY END COORDINATES

RUNWAY	EXISTING LATITUDE	EXISTING LONGITUDE
1	43-30-56.1570N	89-46-18.3020W
19	43-31-45.0560N	89-46-07.9250W
14	43-31-26.28N	89-46-36.00W
32	43-31-07.44N	89-46-09.22W

RUNWAY END COORDINATES

RUNWAY	ULTIMATE NORTH	ULTIMATE EAST
1	43-30-56.1570N	89-46-18.3020W
19	43-31-45.0560N	89-46-07.9250W
14	43-31-24.62"N	89-46-34.28"W
32	43-31-01.08"N	89-45-59.37"W

RUNWAY SAFETY AREA (RSA)

RUNWAY SAFETY AREA DIMENSIONS

	RUNWAY	WIDTH	LENGTH BEYOND RUNWAY END
EXISTING	1-19	150'	300'
	14-32	120'	240'
ULTIMATE	1-19	500'	1000'
	14-32	150'	300'

RUNWAY OBJECT FREE AREA (OFA)

RUNWAY OBJECT FREE AREA DIMENSIONS

	RUNWAY	WIDTH	LENGTH BEYOND RUNWAY END
EXISTING	1-19	500'	300'
	14-32	250'	240'
ULTIMATE	1-19	800'	1000'
	14-32	500'	300'

RUNWAY APPROACH SURFACES

RUNWAY APPROACH SURFACE DIMENSIONS

	RUNWAY	BASE	LENGTH	OUTER WIDTH	SLOPE
EXISTING	1	500'	3400'	1520'	34:1
	19	500'	3400'	1520'	34:1
	14	250'	2000'	650'	20:1
	32	250'	2000'	650'	20:1
ULTIMATE	1	500'	3400'	1520'	34:1
	19	500'	3400'	1520'	34:1
	14	500'	2000'	900'	20:1
	32	500'	2000'	900'	20:1

RUNWAY DATA

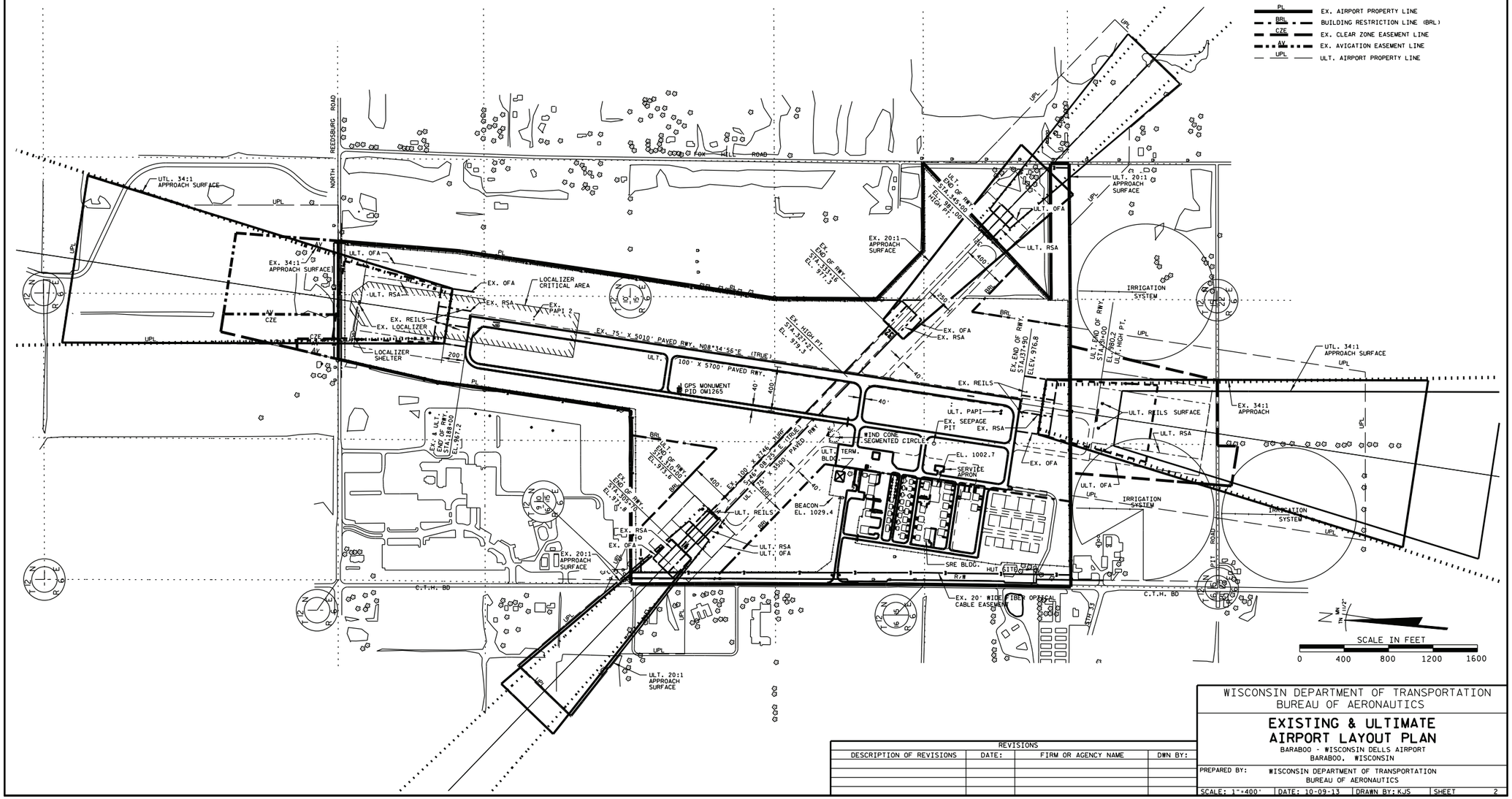
	RUNWAY 1-19 EXISTING	RUNWAY 1-19 ULTIMATE	RUNWAY 14-32 EXISTING	RUNWAY 14-32 ULTIMATE
RUNWAY DIMENSIONS	75' X 5010'	100' X 5700'	100' X 2708'	75'X 3500'
EFFECTIVE GRADIENT (IN %)	.19	.16	.2	.21
PAVEMENT STRENGTH* (LBS. SINGLE WHEEL)	26.0	60.0	TURF	12.5
RUNWAY LIGHTING	HIRL	HIRL		MIRL
RUNWAY MARKING	NP	NP		BASIC
RWY VISIBILITY MINIMUMS	1 MILE	1 MILE	VISUAL	1 MILE
APPROACH SLOPE (DESIGN)	20:1/34:1	20:1 / 34:1	20:1	20:1
APPROACH SLOPE (ACTUAL)	27:1/18.3:1	20:1/34:1		
WIND COVERAGE 10.5 KNOTS	85.2	85.2	90.5	90.5
ALL WEATHER 13 KNOTS	93.3	93.3	94.3	94.3

* VALUES GIVEN ARE GROSS AIRCRAFT WEIGHT IN 1000 LBS. SINGLE (S), DUAL (D) & DUAL TANDEM (DT) GEAR AIRCRAFT

T-TRANSPORT BU- BASIC UTILITY GU- GENERAL UTILITY

LEGEND

- PL — EX. AIRPORT PROPERTY LINE
- BRL — BUILDING RESTRICTION LINE (BRL)
- CZE — EX. CLEAR ZONE EASEMENT LINE
- AV — EX. AVIGATION EASEMENT LINE
- UPL — ULT. AIRPORT PROPERTY LINE



REVISIONS			
DESCRIPTION OF REVISIONS	DATE:	FIRM OR AGENCY NAME	DWN BY:

WISCONSIN DEPARTMENT OF TRANSPORTATION
BUREAU OF AERONAUTICS

EXISTING & ULTIMATE AIRPORT LAYOUT PLAN

BARABOO - WISCONSIN DELLS AIRPORT
BARABOO, WISCONSIN

PREPARED BY: WISCONSIN DEPARTMENT OF TRANSPORTATION, BUREAU OF AERONAUTICS

SCALE: 1"=400' | DATE: 10-09-13 | DRAWN BY: KJS | SHEET 2

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affect the aviation facility's ability to meet FAA design standards, as well as the region's ability to support aviation needs. The ramifications of a no-action alternative extend into impacts on the economic well-being of the region: **an analysis of the economic benefit of the airport, completed in 2016, found that DLL generates approximately $13.2 million in annual economic impact and supports 98 jobs**. If facilities are not maintained and improved so the airport can provide accommodate regional aviation demand for both leisure and business travelers, or if delays become unacceptable or aircraft storage is not available, aviation activities and business may shift elsewhere. Moreover, the no-action alternative is inconsistent with the long-term goals of both the FAA and WisDOT, which include enhancing local and interstate commerce. Therefore, a no-action alternative is not considered further in this master plan.

As of fall 2023, two local airports within 15 miles of DLL have faced the threat of closure. As other facilities cease to operate, the users of those airports must relocate their aircraft and patronage. While the fate of either facility is unknown at this time, the situation highlights the chance that DLL may become one of very few – if not the only – aerodrome within the Wisconsin Dells region. This reinforces the futility of evaluating a no-action alternative for the airport.

The purpose of this master plan is to examine aviation needs at DLL over the course of the next 20 years in keeping with local, state and national goals and objectives. Therefore, this master plan will examine the needs of the existing airport and present a program of needed capital improvement projects to cover the scope of the plan. The airport is a transportation facility and economic asset for the region. It can accommodate existing and future demand and should be developed accordingly in order to support the interests of residents and businesses that rely on it. Ultimately, the final decision regarding development rests with the Village of Lake Delton, WisDOT, and the FAA on an individual project basis. The analysis to follow considers airside and landside development alternatives which include an array of facility demands, including safety, capacity, access, and efficiency.

AIRSIDE ALTERNATIVES

Development alternatives are generally categorized and organized into two functional areas: airside and landside. The airside alternatives consider development options for runways, taxiways, navigational aids, lighting and marking aids, etc., which require the greatest commitment of land area to meet the physical layout of an airport and the required airfield safety standards. The design of the airfield also defines minimum set-back distances from the runway and object clearance standards. These criteria are defined first to ensure the fundamental needs of DLL are met. The landside alternatives are related to terminal services, hangars, and aircraft parking aprons, as well as utilization of remaining property to provide revenue support for the airport and benefit the economic development and well-being of the region. This section focuses on the airside facilities.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas must be examined individually, and then as a whole, to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors must be evaluated to determine if the investment in DLL will meet the needs of the surrounding area, both during and beyond the planning period of this master plan.

AIRSIDE PLANNING CONSIDERATIONS

Various planning considerations are evaluated with solutions presented in the alternatives. These considerations are the result of the findings of the aviation demand forecasts and facility requirements evaluations, as well as input from DLL tenants and management, the PAC, and the public. In addition to these considerations, the runway should continue to meet applicable FAA design standards for the RDC identified for each runway. Runway 1-19 is planned to meet C-II-2400 standards, while Runway 14-32 is planned to meet B-II(s)-5000 standards; however, Runway 14-32 may remain an A-I(s) turf runway with visual-only approaches if justification and funding mechanisms are not found sufficient for conversion to a paved surface. The latter decision will ultimately be up to the Village of Lake Delton, especially if federal or state grants are not provided.

Furthermore, the *Wisconsin State Airport System Plan* (SASP), updated in 2013, set its own standard for certain elements for airports within the state. Exhibit 1D in Chapter One identified DLL as a "Medium General Aviation (GA)" airport from the SASP and determined it has two deficiencies: an instrument approach procedure with visibility minimums as low as ¾-mile, and an approach lighting system to support the instrument approach procedure.

Table 4A presents a summary of the primary planning considerations related to the airside alternatives analysis. Landside planning considerations are outlined later in the chapter.

TABLE 4A | Airside Planning Considerations

#	Non-Standard/Deficient Condition	Proposed Action(s) to be Evaluated
1	Runway 1-19, at 5,010 feet long, is insufficient to safely satisfy some business jet aircraft.	Extend Runway 1-19 up to 6,000 feet.
2	Runway 14-32 has FAA safety areas that extend over a fence and outside airport property.	Adjust location of Runway 14-32 to restore safety areas to airport control.
3	Available instrument approach procedures restrict operations in poor weather conditions.	Consider reduced instrument approach minimums and the related impact they have.
4	Visual approach aids are deficient in meeting design standards.	Upgrade PAPI-2s to PAPI-4s and install MALSR approach lighting system.
5	Weather aids are deficient in meeting design standards.	Install supplemental wind cones at runway ends and segmented circle around primary wind cone.

Source: Coffman Associates analysis

Consideration #1 – Runway 1-19 Length

The primary runway at DLL – Runway 1-19 – is currently 5,010 feet long and 100 feet wide. The existing width meets RDC C-II-2400 standards; however, the length is insufficient to safely accommodate some of the turbine-powered aircraft, particularly during hot weather conditions and/or when aircraft operate with heavier loads.[2] The current ALP for DLL includes extending the runway 690 feet south for a total length of 5,700 feet. An FAA-approved analysis for establishing adequate runway length was completed in the previous chapter and found that an extension of just 490 feet, to an ultimate length of **5,500 feet**, would be sufficient to accommodate an increase in jet activity at the airport, including the Cessna Citation Excel/XLS (the existing critical design aircraft) and the Embraer Legacy 500 (the ultimate critical design aircraft).

[2] Runway length requirements specific to DLL for common business aircraft are presented in the previous chapter on Exhibit 3B.

Despite the findings of the analysis, aircraft operators that currently use the airport expressed concern over the length and provided support for extending the runway up to **6,000 feet**. This support was presented in the previous chapter and can be found in **Appendix B** of this study. It should be noted that **any** runway extension projects would require justification in the form of 500 annual operations by the aircraft or group of aircraft for which the runway length is designed. Constraints including private farmland to the south and Reedsburg Road and private residences to the north provide challenges to any runway extension options. Varying extension options, as well as any associated mitigation strategies for these roadways and adjacent land uses, will be explored in this chapter.

Consideration #2 – Non-Standard Obstructions in Runway 14-32 Safety Areas

The FAA mandates obstruction clearances for various imaginary and real safety surfaces that surround aircraft movement areas, such as runways and taxiways. For example, Runway 14-32 has safety areas that conflict with the airport perimeter fence and extend beyond airport property on the north end. The runway safety area (RSA) and runway object free area (ROFA)[3] for the turf runway should be kept entirely within airport property and free of obstacles not fixed by location, such as runway edge lighting. To best mitigate this non-standard condition, the boundaries of Runway 14-32 are planned to shift along the runway's centerline at varying distances in each alternative, which will bring all FAA safety areas within airport property and free of obstacles.

Consideration #3 – Improved Instrument Approach Procedures

Currently, the airport has four approved instrument approach procedures for pilots to use during low visibility and/or poor weather conditions. Runways 1 and 19 are both served by a global positioning system (GPS) approach and Runway 1 also has an instrument landing system (ILS) localizer (LOC) approach. The airport also has a "circling" approach which guides pilots to "circle around to land" on either Runway 1 or 19. The lowest visibility minimum available between these procedures is 1-mile. Both airport users and the SASP recommend implementing an instrument approach procedure having a lower visibility minimum at DLL: the SASP standard is ¾-mile, while anything lower than ½-mile cannot be accomplished without the FAA installing additional guidance equipment. Therefore, the alternatives presented will consider maintaining 1-mile approaches to Runway 1-19, while considering the opportunities and costs associated with lower minimums to ¾-mile and ½-mile approach procedures.

Runway 14-32 is currently a "visual only" runway (VIS): no instrument approach procedures are available. Two of the four airside alternatives presented explore the option of paving the runway, which introduces the possibility of acquiring a GPS non-precision approach on one or both ends of the runway. Due to the fact that the visual and 1-mile runway protection zones are the same dimensions, only 1-mile approaches will be presented for Runway 14-32.

[3] FAA design standards regarding safety areas, including the runway safety area (RSA) and runway object free area (ROFA) are described in detail in Chapter Three: Facility Requirements.

Consideration #4 – Improved Visual Approach Aids

Runways 1 and 19 are both equipped with a two-box (light) precision approach path indicator (PAPI-2) system. A PAPI is a series of lights that provides vertical guidance to pilots to determine their location relative to an established glide path to the runway. PAPI-2 systems are adequate for smaller airports with relatively low jet activity. FAA Advisory Circular (AC) 150/5300-13B, *Airport Design*, recommends a four-box system (PAPI-4) for runways that regularly serve multi-engine and jet operations. Ideally, a PAPI should be located 1,000 feet from a runway threshold. Each alternative presented will reflect the upgrade of both PAPI-2s to PAPI-4s, as well as the location adjustment of each system in relation to any runway changes.

Runways 1 and 19 are also equipped with runway end identifier lights (REILs). These pairs of synchronized, directional flashing lights provide rapid identification of a runway threshold for up to 20 miles. FAA AC 150/5300-13B, *Airport Design*, recommends the use of an approach lighting system (ALS) whenever a runway is equipped with an instrument approach with visibility minimums down to ¾-mile; an ALS is required on approaches below ¾-mile. The SASP recommends that Medium GA airports, such as DLL, be equipped with a medium-intensity approach lighting system with sequenced flashers (MALSF). A MALSF is an economical and space-saving approach lighting aid that enhances visual recognition of the runway end for non-precision approaches. MALSF systems are becoming less common, however, and the FAA recommends that approaches below ¾-mile visibility be equipped with a MALSR, which is a MALSF with an extended line of sequenced flashing lights called runway alignment indicator lights (RAILs). Each of these options has land requirements associated with its implementation: a MALSF requires an area measuring 1,600 feet long by 400 feet wide, while the MALSR requires the same area as the MALSF plus an additional 1,000 feet in length and 25 feet in width for the RAIL portion. This area ensures that the lights are free of obstacles and unobstructed to pilots approaching the runway. While a MALSF could be an option, the alternatives suggest MALSRs as the preferred approach lighting system and may be planned for one or both Runway 1 and 19.

Consideration #5 – Improved Weather Communication Aids

Weather communication devices provide pilots with information about the existing conditions at the airport. The airport already has an on-site weather station and a primary lighted wind cone; however, the FAA states in *Airport Design* that supplemental wind cones adjacent to the end of a runway may be provided in situations where viewing the primary wind cone is difficult. This is often the case, especially when considering a runway extension. Supplemental wind cones should be placed outside the ROFA and approximately 1,000 feet from the runway threshold.

A segmented circle provides a visual indication of airport operations, such as active landing direction and traffic patterns. Typically, a segmented circle is collocated with an airport's primary wind cone. It is recommended, though not required, that an accurate segmented circle be installed according to FAA design standards found in AC 150/5340-5, *Segmented Circle Airport Marker System*.

Each alternative presented in this chapter will include supplemental wind cones and a segmented circle.

HOLDING POSITION SEPARATION

Holding position markings are placed on taxiways leading to runways. At non-towered airports, it is standard procedure for pilots to stop short of the markings before moving onto the active runway. For Runway 1-19, holding position marking lines are situated 195 feet from the runway centerline, which is just below the ARC B-II-5000 design standard of 200 feet; the design standard for RDC C-II-2400 is 250 feet. Therefore, the holding position marking should be relocated to 250 feet from the runway in the ultimate condition.

The parallel taxiway at DLL also intersects turf Runway 14-32. With an RDC of A-I(s)-VIS, the holding position markings should be located 125 feet from the centerline. This standard also applies to RDC B-II(s)-5000, the ultimate condition for Runway 14-32 should it become a paved surface. The markings on the parallel taxiway are 165 feet north of and 180 feet south of the centerline. Thus, the holding position markings exceed the applicable design standard. It should be noted that any taxiway constructed parallel to Runway 14-32 should also have holding position markings located at least 125 feet from centerline.

SAFETY AREA DIMENSION CHANGES

A nonspecific yet critical consideration which will be evaluated throughout the alternatives process is the impact of runway design codes on FAA safety areas. For example, the safety area dimensions associated with Runway 1-19 would substantially increase in size if the runway transitions from B-II to C-II design standard. Same holds for the possible transition for Runway 14-32 if it transitions from A-I(s) to B-II(s). The impacts of these RDC changes are presented in **Table 4B**.

TABLE 4B | Design Standards Based on RDC

	Existing Condition		Ultimate Condition	
	Rwy 1-19	Rwy 14-32	Rwy 1-19	Rwy 14-32
Runway Design Code (RDC)	**B-II-5000**	**A-I(s)-VIS**	**C-II-2400**	**B-II(s)-5000**
Runway Safety Area (RSA)				
Length Beyond Departure End	300	240	1,000	300
Length Prior to Threshold	300	240	600	300
Width	150	120	500	150
Runway Object Free Area (ROFA)				
Length Beyond Departure End	300	240	1,000	300
Length Prior to Threshold	300	240	600	300
Width	500	250	800	500
Runway Object Free Zone (ROFZ)				
Length Beyond Departure End	200	200	200	200
Length Prior to Threshold	200	200	200	200
Width	400	250	400	300
Note: All dimensions are in feet.				

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

As shown on **Exhibit 4B**, the consequences of this transition – before any runway extensions or instrument approaches are improved – result in considerably larger safety areas. Just as with the safety areas of Runway 14-32, any safety areas associated with Runway 1-19 that change due to a shift from RDC B-II to C-II and a surface extension will have to be entirely owned by the airport to ensure proper maintenance and adherence to design standards. Each alternative will discuss these impacts individually based on the proposed improvements.

Runway Visibility Zone (RVZ)

The RVZ is an area formed by imaginary lines connecting the line-of-sight points of intersecting runways at an airport without an airport traffic control tower. The purpose of the RVZ is to facilitate coordination among aircraft and between aircraft and vehicles that are operating on active runways. Having a clear line of sight allows departing and arriving aircraft to verify the locations and actions of other aircraft and vehicles on the ground that could create a conflict. Within the RVZ, any point five feet above the runway centerline must be mutually visible with any other point five feet above the centerline of the crossing runway. The RVZ at DLL associated with Runways 1-19 and 14-32 is depicted on **Exhibit 4B**. Currently, there are no restrictions within the RVZ at the airport. As construction and rehabilitation projects occur, consideration should be given to maintaining a positive sight picture within the RVZ.

Runway Protection Zones (RPZs)

An RPZ is a trapezoidal area that is centered on the extended runway centerline and typically begins 200 feet from the runway end. In other instances, an RPZ may be located partially over a runway, as is the case with displaced thresholds. There are two RPZs for each runway: an approach surface and a departure surface. Many times, the smaller departure RPZ of one runway can be collocated within the larger approach RPZ of the opposite runway. Displaced thresholds and declared distances are two reasons this may not occur.

Also shown on **Exhibit 4B**, there are currently approximately 16.9 acres of land uses within all four current runway RPZs that are not currently controlled by the airport. The majority of these land uses are to the south and west and include farmland and residential uses, the latter of which is considered "incompatible." It is incumbent upon the airport sponsor, through planning studies such as this master plan, to examine options to meet RPZ land use compatibility standards. However, if land uses with an RPZ predate the 2012 FAA guidance on RPZ land use compatibility, then mitigating any incompatible land uses may not be a high priority. The 2012 RPZ guidance indicates that any new incompatible land uses within the RPZ must be reviewed and approved by the FAA. The most common ways that new incompatibilities are introduced to an RPZ are:

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

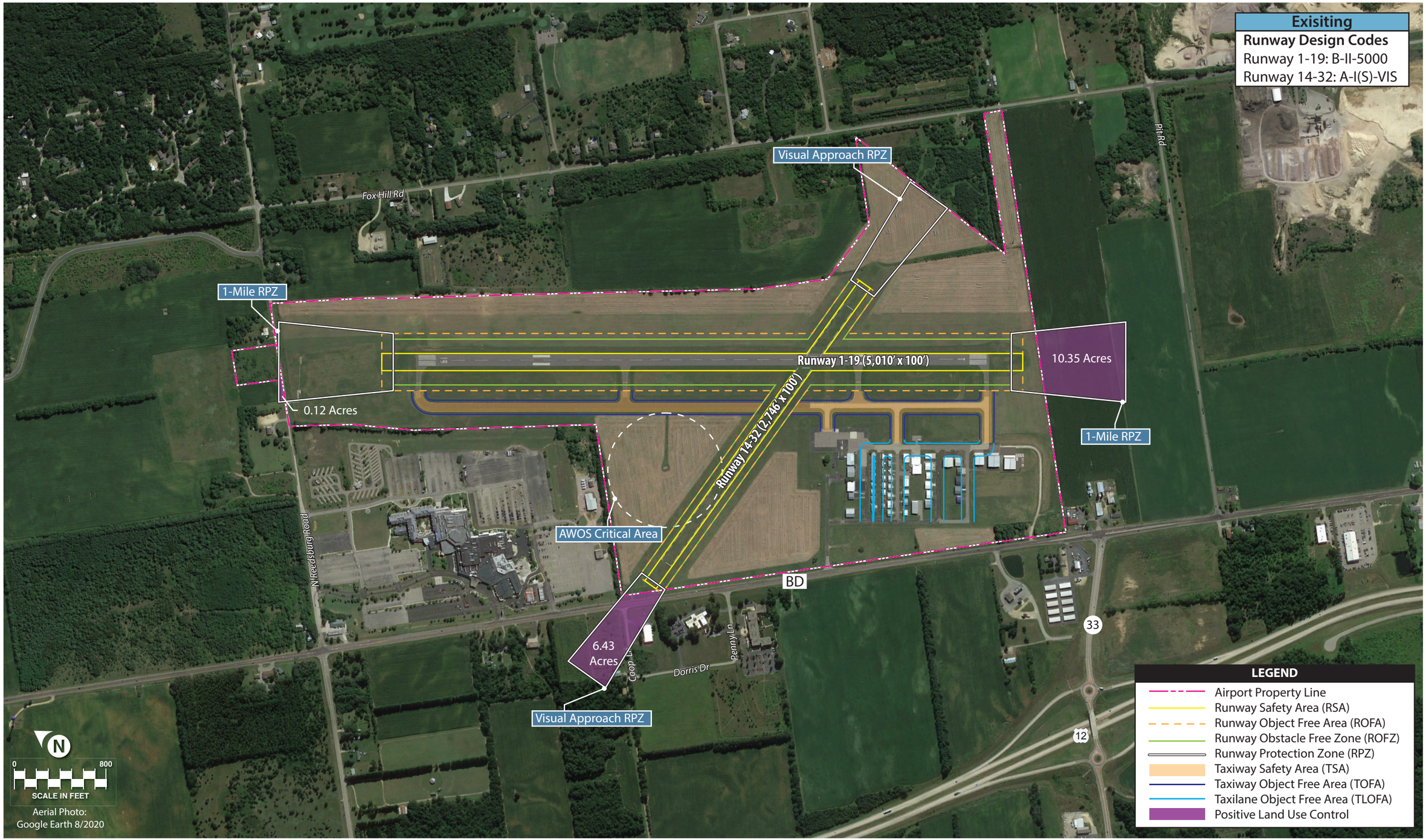


Exhibit 4B
EXISTING AND ULTIMATE SAFETY AREAS

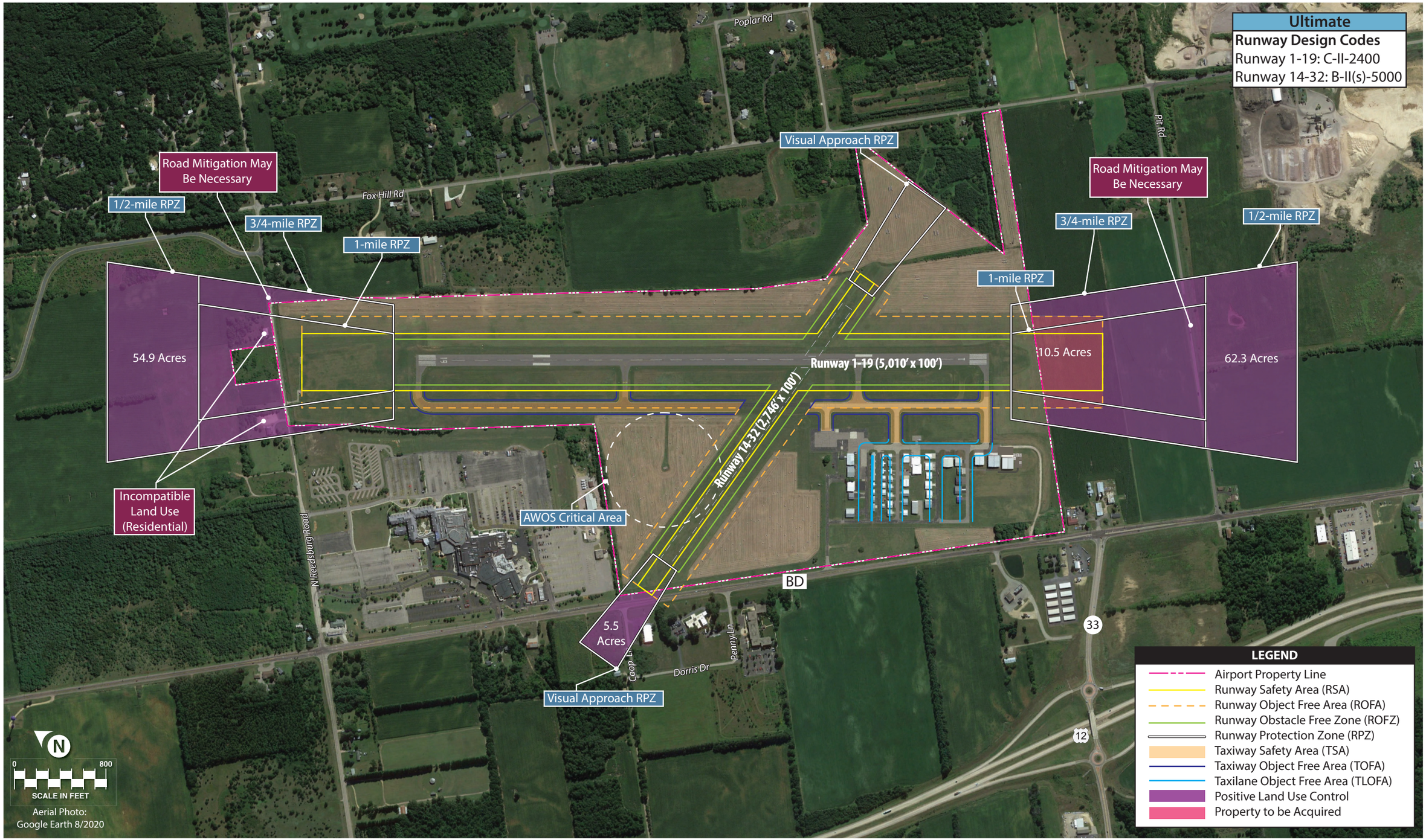


Exhibit 4B continued
EXISTING AND ULTIMATE SAFETY AREAS

The exhibit shows that, by upgrading the RDC of Runway 1-19 from B-II to C-II and lowering the instrument visibility minimums to ½-mile, the amount of uncontrolled land uses within the runway RPZs increase to approximately 123 acres, without considering any extension to the runway. **Table 4C** lists the dimensions related to each approach RPZ based on the RDC and visibility minimum for each runway.

TABLE 4C | Approach Runway Protection Zone (RPZ) Dimensions

		RPZ Dimensions		
RDC	**Visibility Minimum**	**Length**	**Inner Width**	**Outer Width**
Runway 1-19				
B-II	1-mile	1,000	500	700
	¾-mile	1,700	1,000	1,510
	½-mile	2,500	1,000	1,750
C-II	1-mile	1,700	500	1,010
	¾-mile	1,700	1,000	1,510
	½-mile	2,500	1,000	1,750
Runway 14-32				
A-I(s)	VIS-only	1,000	250	450
B-II(s)	VIS-only	1,000	250	450
	1-mile	1,000	250	450

Note: All dimensions are in feet.

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

There are various techniques an airport sponsor may use to establish positive control over land uses outside the airport property that fall within an RPZ. Airport owner control over RPZs may be achieved through simple ownership of the land; establishing sufficient interest in the property through easements, deed restrictions, etc.; regulate land use (zoning) containing the RPZ; or exercising eminent domain over the property. Ultimately, the FAA will not approve or disapprove a preferred alternative, but rather will evaluate whether an acceptable level of alternatives analysis has been completed before the airport owner makes the decision to allow or reject the land uses within the proposed RPZs.

Declared Distances

The purpose of declared distances is to provide an equivalent set of safety areas (RSA, ROFA, ROFZ, and RPZ) according to design standards at constrained airports where it is otherwise impracticable to meet standards. Applying declared distances is an option that allows for modifications to the published operational runway length without changing the physical dimensions of the surface. Declared distances are applicable only in the direction of operations (i.e., an aircraft departing or arriving on Runway 19 is not impacted by declared distances of Runway 1). The declared distances are:

- *Takeoff Run Available (TORA)* – the runway length declared available and suitable for the ground roll of a departing aircraft;
- *Takeoff Distance Available (TODA)* – the TORA plus the length of any remaining runway and/or stopway beyond the far end of the TORA;
- *Accelerate-Stop Distance Available (ASDA)* – the runway plus stopway length declared available for the acceleration and deceleration of an aircraft that is aborting takeoff; and
- *Landing Distance Available (LDA)* – the runway length declared available and suitable for landing.

In its current form, declared distances would have to be applied to Runway 1 to prevent the residential properties to the north from falling within the departure RPZ. Applying a modified TORA of 4,505 feet to Runway 1 would bring the departure RPZ off the homes; no other changes to operational lengths on Runway 1 would have to be made.

Displaced Thresholds

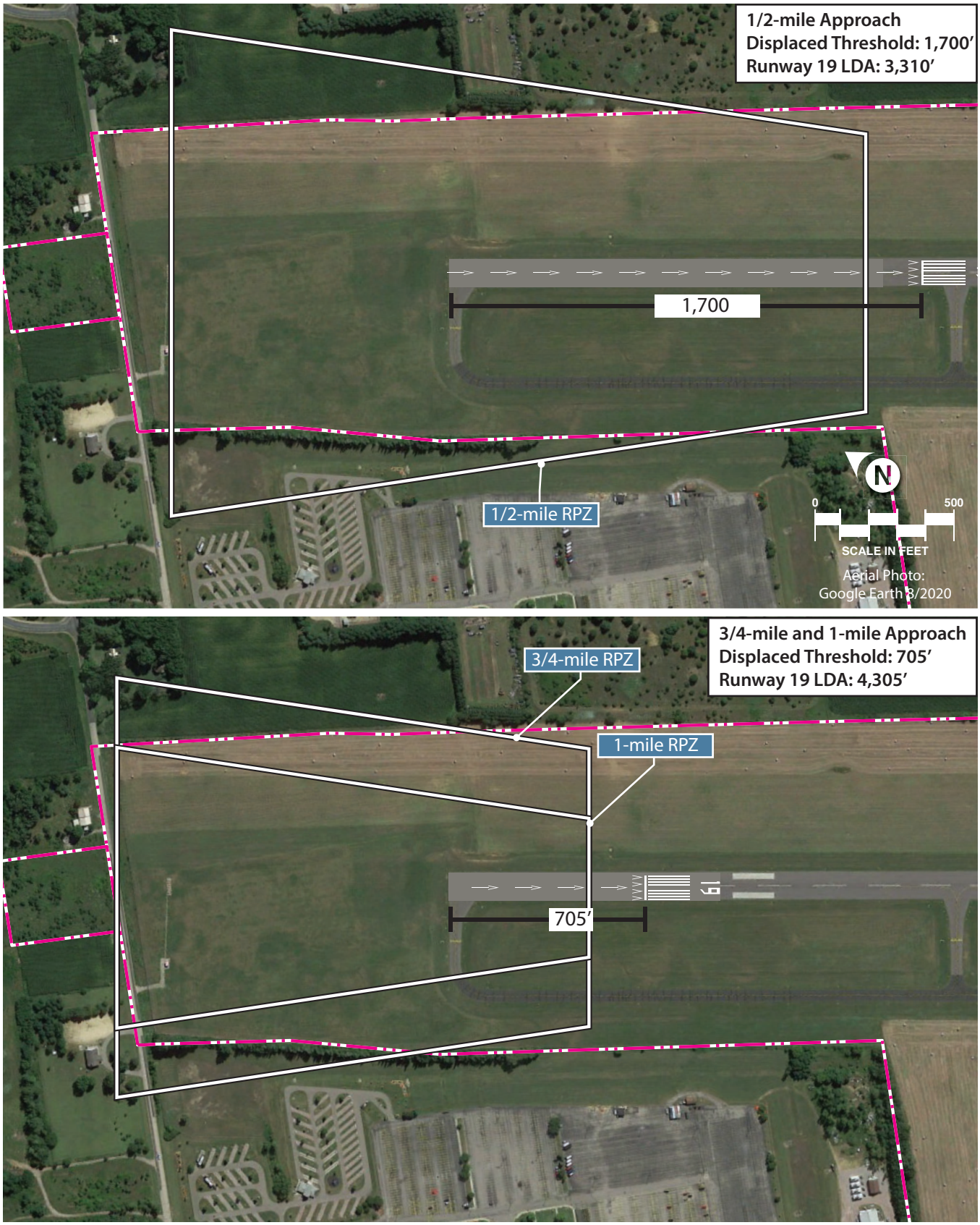
A common method for mitigating incompatible land uses within safety areas and/or RPZs involves the use of displaced thresholds. A displaced threshold is a threshold located at a point on a runway other than the beginning of the surface. Displacement of a threshold reduces the length of runway available for landing but has no impact on departure operations. Generally, a displaced threshold is used to relocate an RPZ so as to avoid incompatible land uses, to shift the location of a safety area within airport property, or both.

Exhibit 4C presents three situations where a displaced threshold could be used on Runway 19 as a means to withdraw the RPZ from local homes while meeting RPZ needs for associated lower approach visibility minima. Each situation avoids the need to acquire residential properties to the north and east. Because the dimensions of approach RPZs change with the visibility minimum of the available instrument approach, **Exhibit 4C** shows the displaced threshold required for 1-mile, ¾-mile, and ½-mile instrument approaches. As the exhibit shows, a 1,700-foot displaced threshold would be required for the lowest possible instrument approach (½-mile), resulting in a landing distance of 3,310 feet available on Runway 19. Both the ¾-mile and 1-mile approaches would require the same displaced threshold: a 705-foot displaced threshold which results in an available landing distance of 4,305 feet. It should be noted that these landing distances are for existing runway dimensions and do not consider any runway extension to the south; therefore, any additional runway length beyond the current pavement end could be added to increase these landing distances.

It should be noted that – while avoiding relocating local residents shows consideration towards airport neighbors and is generally good practice – situations such as those existing at DLL may favor acquiring the relatively few properties within safety areas, as opposed to significantly reducing the available runway pavement at the airport. The FAA expects airport sponsors (i.e., the Village of Lake Delton) to take "appropriate action, to the extent reasonable" to mitigate incompatible land uses within an RPZ. When other mitigation techniques have been exhausted, the airport sponsor may have the option of assuming liability, with the approval of the FAA. Therefore, the alternatives presented do not include displaced thresholds and assume that the few properties which may fall within any conflicting RPZ would be acquired by the airport over time.

AIRSIDE ALTERNATIVE 1

The first airside development alternative, shown on **Exhibit 4D**, considers the airport remaining a B-II facility, as defined by the current critical design aircraft, the Cessna Citation Excel/XLS. While not likely, it is prudent to assess improvements to the airfield in its current designation. Runway 14-32 is maintained as a turf runway in this alternative but is shifted along its centerline 120 feet to the southeast, which



LDA: Landing Distance Available
Note: Displaced thresholds shown do not include any runway extensions. Any extension to the runway surface to the south could potentially increase the landing distance available (LDA) for Runway 19

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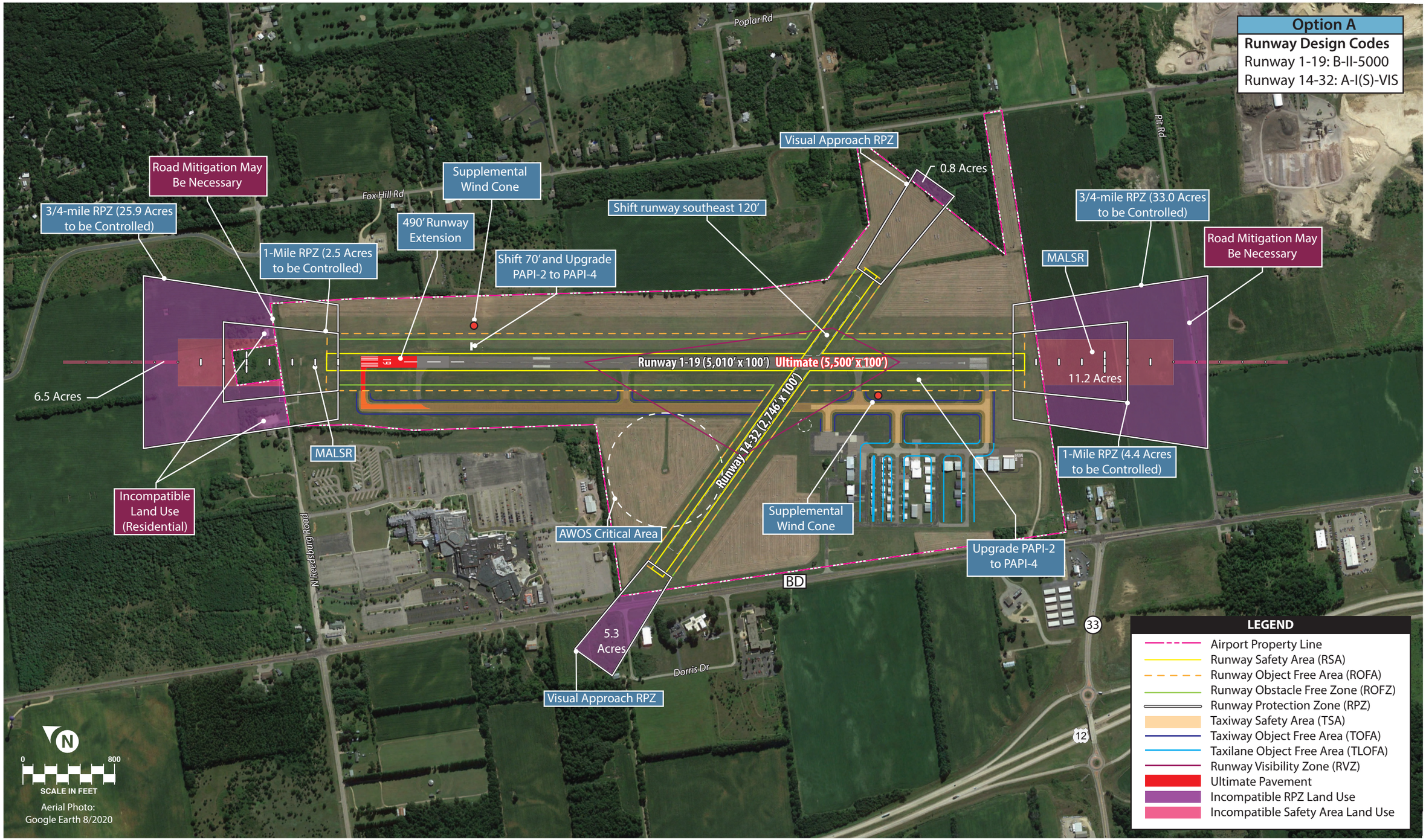
Option A
Runway Design Codes
Runway 1-19: B-II-5000
Runway 14-32: A-I(S)-VIS
Poplar Rd
Fox Hill Rd
Pitt Rd
Road Mitigation May Be Necessary
3/4-mile RPZ (25.9 Acres to be Controlled)
1-Mile RPZ (2.5 Acres to be Controlled)
Supplemental Wind Cone
490' Runway Extension
Shift 70' and Upgrade PAPI-2 to PAPI-4
Shift runway southeast 120'
Visual Approach RPZ
0.8 Acres
3/4-mile RPZ (33.0 Acres to be Controlled)
MALSR
Road Mitigation May Be Necessary
Runway 1-19 (5,010' x 100') Ultimate (5,500' x 100')
Runway 14-32 (2,746' x 100')
6.5 Acres
11.2 Acres
MALSR
1-Mile RPZ (4.4 Acres to be Controlled)
Incompatible Land Use (Residential)
AWOS Critical Area
Supplemental Wind Cone
Upgrade PAPI-2 to PAPI-4
N Reedsburg Road
BD
5.3 Acres
Dorris Dr
Visual Approach RPZ
33
12
LEGEND
Airport Property Line
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
Taxiway Safety Area (TSA)
Taxiway Object Free Area (TOFA)
Taxilane Object Free Area (TLOFA)
Runway Visibility Zone (RVZ)
Ultimate Pavement
Incompatible RPZ Land Use
Incompatible Safety Area Land Use
N
0
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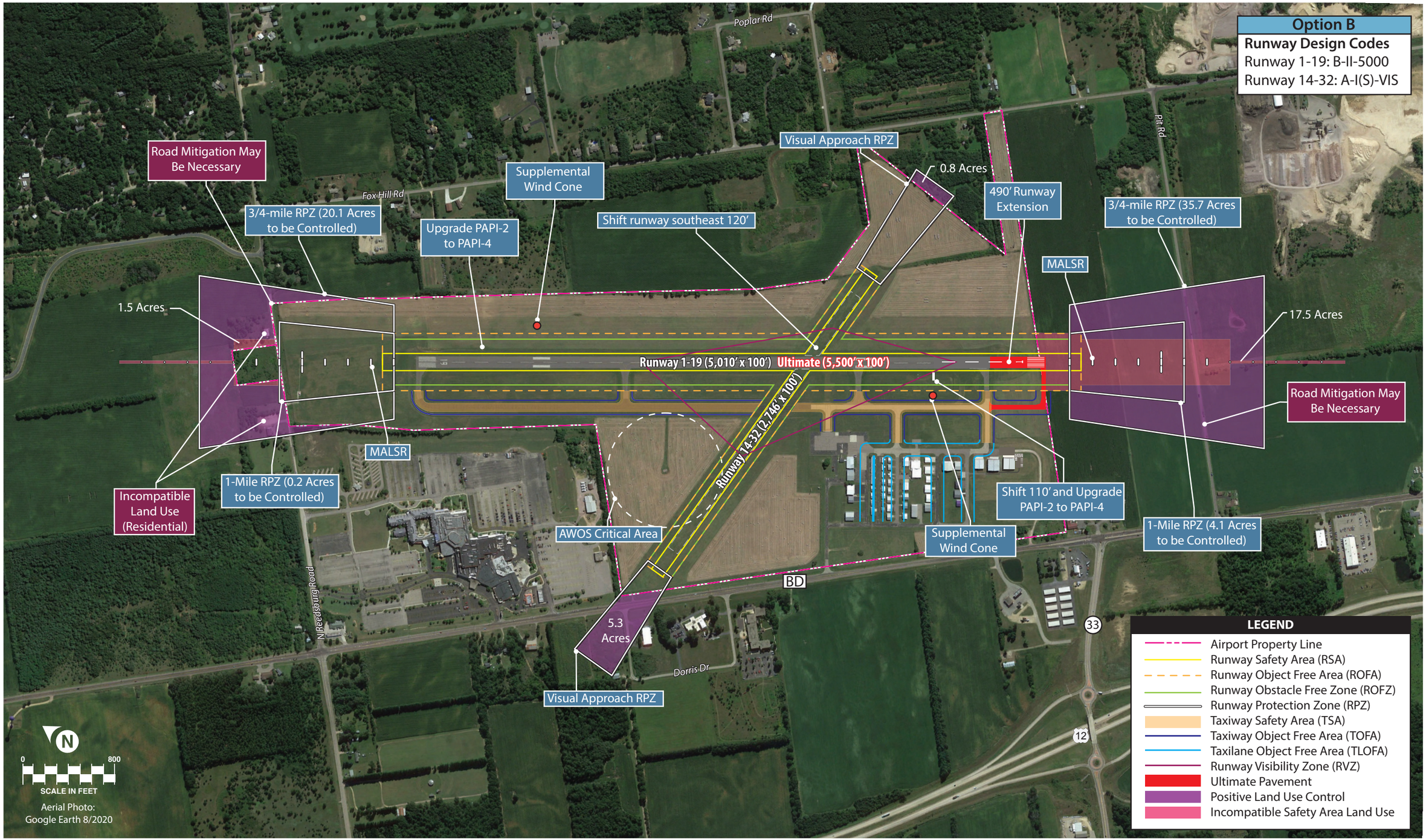
SCALE IN FEET
Aerial Photo:
Google Earth 8/2020


Option B
Runway Design Codes
Runway 1-19: B-II-5000
Runway 14-32: A-I(S)-VIS
Poplar Rd
Fox Hill Rd
Pitt Rd
Road Mitigation May Be Necessary
3/4-mile RPZ (20.1 Acres to be Controlled)
Upgrade PAPI-2 to PAPI-4
Supplemental Wind Cone
Shift runway southeast 120'
Visual Approach RPZ
0.8 Acres
490' Runway Extension
3/4-mile RPZ (35.7 Acres to be Controlled)
MALSR
1.5 Acres
17.5 Acres
Runway 1-19 (5,010' x 100') Ultimate (5,500' x 100')
Runway 14-32 (2,746' x 100')
Road Mitigation May Be Necessary
MALSR
1-Mile RPZ (0.2 Acres to be Controlled)
Incompatible Land Use (Residential)
AWOS Critical Area
Shift 110' and Upgrade PAPI-2 to PAPI-4
Supplemental Wind Cone
1-Mile RPZ (4.1 Acres to be Controlled)
N Reedsburg Road
BD
5.3 Acres
Dorris Dr
Visual Approach RPZ
33
12
0
800
SCALE IN FEET
Aerial Photo:
Google Earth 8/2020
LEGEND
Airport Property Line
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
Taxiway Safety Area (TSA)
Taxiway Object Free Area (TOFA)
Taxilane Object Free Area (TLOFA)
Runway Visibility Zone (RVZ)
Ultimate Pavement
Positive Land Use Control
Incompatible Safety Area Land Use

brings the RSA and ROFA of the runway entirely within airport property and off the perimeter fence. This change adjusts the location of the RPZs to approximately 6.1 acres of land that are outside the airport property. If possible, this land should be controlled by the airport in one manner or another.

This alternative presents two options for extending Runway 1-19 to 5,500 feet, the minimum length required based on analyses completed in the previous chapter.

Option A – North Extension

In this option, a 490-foot extension is shown to extend north from the end of Runway 19. This would shift the existing 1-mile approach RPZ over the two residential properties on the north side of Reedsburg Road; any increases in the RPZ size due to reduced instrument approach minimums would also extend over these homes. The parallel taxiway is extended the same distance north to provide an entrance to the new runway threshold. The PAPI would then have to shift 70 feet north to conform to FAA design standards. Roughly 17.7 acres of land would need to be acquired to accommodate MALSRs on both runways in this option.

Option B – South Extension

The 490-foot runway extension in this option is planned to the south and would require the acquisition of approximately 17.5 acres of farmland to accommodate the extension of the runway and taxiway surfaces, related safety areas, and a proposed MALSR. An advantage of this alternative is the avoidance of displacing residents north of the airport. The PAPI would be relocated 110 feet south to meet the FAA standard of 1,000 feet of distance from the runway threshold.

In both options, the RPZs associated with Runway 1-19 extend far beyond the airport property. At the lowest possible instrument approach minimums, roughly 58.9 acres of land area within the largest RPZs would have to be positively controlled through either property acquisition or the establishment of an avigation easement.

AIRSIDE ALTERNATIVE 2

Presented on **Exhibit 4E**, Airside Alternative 2 explores the impacts and improvements associated with an upgraded airport reference code (ARC) from B-II to C-II based on the ultimate critical design aircraft, the Embraer Legacy 500. This alternative carries forward the relocation of Runway 14-32, keeping it a turf strip along with the 490-foot extension to Runway 1-19. The new pavement is planned to the south and provides a total length of 5,500 feet on the primary runway. A MALSR is shown on both ends of Runway 1-19 with the south ALS possibly conflicting with Pit Road. Furthermore, the increased sizes of the FAA safety areas require much more land acquisition than in the previous alternative: 26.7 acres of new land must be owned by the airport to maintain control of these safety areas and the area enveloping the ALS. While the previous alternative optioned an extension to the north, the increased safety area dimensions associated with RDC C-II would require the relocation of the ILS localizer antenna and the rerouting of Reedsburg Road with any extension.

Even with no extension to the north, the change from B-II to C-II increases the dimensions of the RPZs associated with Runway 1-19. Consequently, one of the residential properties north of the airport falls within the 1-mile approach RPZ and both residential properties fall within the ¾-mile and ½-mile approach RPZs. This non-standard condition could be mitigated by acquiring the properties or displacing the Runway 19 threshold, as discussed earlier. In total, approximately 114.9 acres of land under the ½-mile approach RPZs (and the RPZs associates with Runway 14-32) should be positively controlled by the airport; this area could be reduced with higher instrument approach procedures.

AIRSIDE ALTERNATIVE 3

The third airside alternative (**Exhibit 4F**) presents an option to extend Runway 1-19 as far as the FAA safety areas permit without rerouting any roads or applying declared distances. This results in an extension to the south of 720 feet, resulting in a total runway length of 5,730 feet. Approximately 32.2 acres of land will need to be acquired in order to keep the surfaces and safety areas under airport control. The PAPI system for Runway 1 would need to be relocated 340 feet south to adhere to design standards. With the runway extension to the south, as well as the proposed MALSR, Pit Road becomes a conflict and may have to be mitigated, possibly by rerouting the road, impacting local residents and requiring an environmental assessment. This is expanded upon further in subsequent chapters if this option is pursued.

This airside alternative and Airside Alternative 4 both present the option of paving Runway 14-32. Airside Alternative 3 presents the runway as having an RDC of B-I(s), drawing justification from the wind coverage analysis completed in the previous chapter. FAA AC 150/5300-13B, *Airport Design*, recommends a crosswind runway when the primary runway cannot provide more than 95 percent wind coverage for a given RDC. At DLL, Runway 1-19 provides coverage for a 10.5-knot crosswind (RDC A-I and B-I) roughly 93.7 percent of all weather conditions; therefore, having a second runway may be justified. Paving the crosswind runway adds the benefit of opening operations to smaller GA aircraft that cannot operate from a grass runway.

RDC B-I(s) also allows for a shorter runway-to-taxiway separation distance to a planned parallel taxiway. This taxiway could allow additional landside development alternatives (discussed later) and prevent the need for pilots to “taxi back” on an active runway; the need to taxi back could increase the chances of an accident. An additional benefit of keeping the runway reserved for B-I(s) aircraft is that the safety area dimensions (including RPZs) would be the same as if the runway was still turf, so the runway could be planned to 3,150 feet. The FAA design width of B-I(s) runways is 60 feet; thus, it is possible that any additional width desired by the airport would have to be funded locally. (Funding of projects is discussed further in Chapter Six.) A set of REILs and PAPI-2 visual approach aids are also shown in Airside Alternative 3 to aid in identifying the runway and provide guidance to the surface during landing. Furthermore, having a paved runway and taxiway would require either light- or medium-intensity edge lighting, as well as non-precision runway markings.

The RPZs associated with this alternative could extend a maximum of 118.8 acres beyond the airport property and should be controlled by one or more methods discussed previously.

Runway Design Codes
Runway 1-19: C-II-2400
Runway 14-32: A-I(s)-VIS

1/2-mile RPZ (50.2 Acres to be Controlled)
Road Mitigation May Be Necessary
3/4-mile RPZ (21.5 Acres to be Controlled)
Supplemental Wind Cone
Upgrade PAPI-2 to PAPI-4
Shift runway southeast 120'
Visual Approach RPZ
0.8 Acres
Supplemental Wind Cone
MALSR
Road Mitigation May Be Necessary
1/2-mile RPZ (58.6 Acres to be Controlled)
3/4-mile RPZ (28.9 Acres to be Controlled)
1.1 Acres
Runway 1-19 (5,010' x 100')
Ultimate (5,500' x 100')
Runway 14-32 (2,746' x 100')
MALSR
490' Runway Extension
25.6 Acres
Incompatible Land Use (Residential)
1-Mile RPZ (10.7 Acres to be Controlled)
AWOS Critical Area
Shift 110' and Upgrade PAPI-2 to PAPI-4
1-Mile RPZ (12.4 Acres to be Controlled)
5.3 Acres
Visual Approach RPZ
Poplar Rd
Fox Hill Rd
Pitt Rd
N Reedsburg Road
Dorris Dr
BD
33
12

LEGEND
- Airport Property Line
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Taxiway Safety Area (TSA)
- Taxiway Object Free Area (TOFA)
- Taxilane Object Free Area (TLOFA)
- Runway Visibility Zone (RVZ)
- Ultimate Pavement
- Positive Land Use Control
- Incompatible Safety Area Land Use

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Aerial Photo: Google Earth 8/2020

Runway Design Codes
Runway 1-19: C-II-2400
Runway 14-32: B-I(s)-5000

1/2-mile RPZ (50.2 Acres to be Controlled)
Road Mitigation May Be Necessary
3/4-mile RPZ (21.5 Acres to be Controlled)
Supplemental Wind Cone
Upgrade PAPI-2 to PAPI-4
Pave Runway and Shift 120' Southeast
Visual /1-mile Approach RPZ
REILs
4.1 Acres
720' Runway Extension
Road Mitigation May Be Necessary
1/2-mile RPZ (59.2 Acres to be Controlled)
3/4-mile RPZ (28.9 Acres to be Controlled)
MALSR
Install PAPI-2
150'
Runway 1-19 (5,010' x 100') Ultimate (5,730' x 100')
Runway 14-32 (2,746' x 100') Ultimate (3,150' x 60')
30.7 Acres
1.5 Acres
Incompatible Land Use (Residential)
MALSR
1-Mile RPZ (10.7 Acres to be Controlled)
AWOS Critical Area
Install PAPI-2
REILs
Shift 340' and Upgrade PAPI-2 to PAPI-4
Supplemental Wind Cone
1-Mile RPZ (12.2 Acres to be Controlled)
5.3 Acres
Visual /1-mile Approach RPZ
Poplar Rd
Fox Hill Rd
Pitt Rd
N Reedsburg Road
Coop Ln
Penny Ln
Dorris Dr
BD
33
12

LEGEND
- Airport Property Line
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Taxiway Safety Area (TSA)
- Taxiway Object Free Area (TOFA)
- Taxilane Object Free Area (TLOFA)
- Runway Visibility Zone (RVZ)
- Ultimate Pavement
- Positive Land Use Control
- Incompatible Safety Area Land Use

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Aerial Photo: Google Earth 8/2020

AIRSIDE ALTERNATIVE 4

Airside Alternative 4, illustrated on **Exhibit 4G**, seeks to provide a 6,000-foot runway to satisfy local users who have claimed a need for a longer runway (**Appendix B**). This alternative also plans for paving Runway 14-32, but with an RDC of B-II(s) to accommodate larger GA aircraft.

To obtain a 6,000-foot operational length for takeoffs and landings on Runway 1-19, declared distances must be applied in conjunction with pavement extensions. This avoids rerouting roads and relocating the ILS localizer antenna. The runway extensions are comprised of a 400-foot extension to the north and a 990-foot extension to the south, providing a total runway surface of 6,400 feet. When applying declared distances, only 6,000 feet would be available for landing (LDA) and aborted takeoff (ASDA) events on Runway 1, while the full 6,400 feet would be usable for both TORA and TODA declared distanced (takeoff operations). The entire runway would also be usable for takeoff distances – TORA and TODA – on Runway 19, while the accelerate-stop and landing distances available would be 6,110 feet. With the extension to the south, the PAPI would need to be relocated 650 feet south to remain compliant with FAA design standards. Just as Airside Alternative 3, the south expansion and MALSR would present Pit Road as a conflict that would have to be mitigated.

When considering the impacts of paving Runway 14-32 and the RDC changing to B-II(s), the immediate consequence is the increased safety area dimensions, which are the same as those currently in place on Runway 1-19. This would require additional shifting of the runway along its centerline, relocating the runway 300 feet from its current location toward the southeast to keep the RSA and ROFA within airport property. FAA design standards for B-II(s) runways allow for a 75-foot width. With the safety area constraints and the residential land uses to the southeast, a total surface of 3,000 feet is planned in this alternative. The parallel taxiway for Runway 14-32 must be located 240 feet from the runway centerline, which would require the relocation of the primary wind cone. The addition of a segmented circle is shown with the wind cone, as are REILs and PAPI-2 systems on Runway 14-32. The new runway and taxiway surfaces would also require new edge lighting and markings.

This alternative impacts the most amount of land beyond the current property line. Approximately 37.6 acres of land acquisition would be needed to maintain direct control over runway and taxiway safety areas, as well as the ALS lanes, while 122.2 acres situated within the largest of the RPZs would need to be positively controlled.

AIRSIDE SUMMARY

The section above outlined planning considerations for DLL and four alternatives designed to address them. The primary issues include extending primary Runway 1-19 with restrictions on both ends; paving crosswind Runway 14-32; upgrading airport aids; and improving instrument approach visibility minimums. While extending a runway may seem simple, it is crucial to consider any and all consequences of changing local roads and land uses, as well as impacts on existing residential properties. For this reason, it is important for the PAC, airport/city management, and the public to offer their feedback so that the best course of action is selected.

LANDSIDE ALTERNATIVES

Landside issues are related to those facilities necessary or desired for the safe and efficient parking and storage of aircraft; movement of pilots and passengers to and from aircraft; airport support facilities; and other similar uses. To maximize airport efficiency, it is important to locate facilities together that are intended to serve similar functions. The best approach to landside facility planning is to consider the development to be like that of a community, with land use planning as the guide.

The following section describes the landside alternatives as they relate to considerations detailed below. Variations of hangar developments are presented to help visualize what future facility developments could look like. The alternatives provide potential development plans aimed at meeting the needs of general aviation through the 20-year planning period and beyond.

The alternatives presented are not the only reasonable options for development. In some cases, a part of one alternative could be intermixed with another, and some development concepts could be replaced with others. The overall intent of this exercise is to outline basic development concepts to spur collaboration for a final recommended plan. The final recommended plan only serves as a guide for the airport, which will aid the Village of Lake Delton in the strategic planning of airport property. Airport operators and/or developers often change their plans to meet the needs of specific users. The goal in analyzing landside development alternatives is to focus future development so that airport property can be maximized, and aviation activity can be protected.

LANDSIDE PLANNING CONSIDERATIONS

Landside planning considerations, which are summarized in **Table 4D**, will focus on strategies to improve efficiency and separate activity levels while improving user services and experience. Landside facility development at DLL is exclusively on the southwest side of the airport and includes a terminal building, aprons, and an assortment of hangars. Each of these areas will be addressed in the landside alternatives below.

TABLE 4D | Landside Planning Considerations

#	Landside Component	Existing Condition	Proposed Action(s) to be Evaluated
1	Terminal Building	Terminal size is approximately 1,320 square feet (sf).	Consider expansion/new terminal with additional FBO/GA amenities.
2	Aircraft Hangars	Total hangar space is adequate, but T-hangars are not meeting demand.	Increase capacity of hangars overall but focus on smaller GA hangars.
3	Apron Area	Total apron area is approximately 10,800 square yards (sy).	Increase apron area to at least 12,600 sy to accommodate future demand.
4	Vehicle Parking	Approximately 35 total parking spaces are available.	Increase total vehicle parking to at least 74 spaces.

Source: Coffman Associates analysis

Runway Design Codes
Runway 1-19: C-II-2400
Runway 14-32: B-II(s)-5000

DECLARED DISTANCES	Runway	
	1	19
TORA	6,400′	6,400′
TODA	6,400′	6,400′
ASDA	6,000′	6,110′
LDA	6,000′	6,110′

TORA, TODA - 6,400′
LDA, ASDA - 6,000′
1/2-mile RPZ (54.3 Acres to be Controlled)
3/4-mile RPZ (25.2 Acres to be Controlled)
1-Mile RPZ (12.6 Acres to be Controlled)
Supplemental Wind Cone
Visual /1-mile Approach RPZ
REILs
4.2 Acres
Paved Runway and Shift 300′ Southeast
Road Mitigation May Be Necessary
Supplemental Wind Cone
3/4-mile RPZ (28.9 Acres to be Controlled)
5.0 Acres
Upgrade PAPI-2 to PAPI-4
Install PAPI-2
240′
990′ Runway Extension
Runway 1-19 (5,010′ x 100′) Ulltimate (6,400' x 100')
Runway 14-32 (2,746′ x 100′)–Ulltimate (3,000'x75')
32.6 Acres
Install PAPI-2
MALSR
400′ Runway Extension
Shift 650′ and Upgrade PAPI-2 to PAPI-4
MALSR
Incompatible Land Use (Residential)
Road Mitigation May Be Necessary
AWOS Critical Area
REILs
Relocated Segmented Circle/Wind Cone
1/2-mile RPZ (59.4 Acres to be Controlled)
1-Mile RPZ (29.8 Acres to be Controlled)
Visual /1-mile Approach RPZ
BD
4.3 Acres
LDA, ASDA - 6110′
TORA, TODA - 6,400′
Poplar Rd
Fox Hill Rd
Pit Rd
N Reedsburg Road
Coop Ln
Dorris Dr
Penny Ln
33
12

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SCALE IN FEET
Aerial Photo: Google Earth 8/2020

LEGEND
- Airport Property Line
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Taxiway Safety Area (TSA)
- Taxiway Object Free Area (TOFA)
- Taxilane Object Free Area (TLOFA)
- Runway Visibility Zone (RVZ)
- Ultimate Pavement
- Positive Land Use Control
- Property to be Acquired

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Consideration #1 – Terminal Building

The terminal building at DLL is approximately 1,320 square feet (sf) in size, including non-passenger spaces such as administration offices and operational/FBO areas. The terminal facility will need to be replaced or expanded and remodeled due to age as well as growth in airport activity. The increase in jet operations at DLL, as well as increased use of the terminal and facilities by transient and local operators, has put a strain on the service capacity of the building. A new terminal will allow for increased capacity and increased efficiency for airport staff, while providing a sophisticated image in which the Village of Lake Delton and the Wisconsin Dells region, as a whole, can take pride. Analysis completed in the previous chapter determined that 3,100 sf of space is adequate to meet long-term demand. The alternatives show options to "expand and remodel" or "demo and build" a new terminal.

Consideration #2 – Aircraft Hangars

In the previous chapter, it was determined that DLL has a need for additional hangar space over the next 20 years. Although virtually all of that demand involves T-hangar development for smaller aircraft, all types of hangar sizes should be considered throughout the planning period, including T-hangars, executive/box hangars, and large-span conventional hangars. This is particularly relevant considering the possible influx of based aircraft tenants should one or both of the nearby airports cease to operate, as discussed previously. It is important to ensure the airport's ability to provide ample parking for all types of aircraft that the airport serves, as well as space for additional aviation specialty businesses – such as flight schools and maintenance facilities – to operate.

Consideration #3 – Apron Area

An analysis completed in the previous chapter revealed that the 10,800-square-yard (sy) apron is inadequate to serve projected aviation demand over the long term. This is partially due to the self-serve fuel facility adjacent to the ramp, as well as an understanding that some of the main ramp area is used for aircraft movement. Using planning criteria and processes established by the FAA, it was determined that approximately 12,600 sy of total apron space would fulfill future demand. The alternatives presented below reflect development of aprons at DLL dedicated to transient aircraft, as well as based aircraft tenants.

Consideration #4 – Vehicle Parking

Vehicle parking at the airport is limited in its current capacity. There are approximately 35 parking spaces at the terminal building, including those used by employees and rental car companies; there are no dedicated parking areas for any other general aviation facilities. While pilots can and do park their vehicles in/around their hangars, this practice increases the chances of an accident on an aircraft movement area. It is recommended that automobiles and airplanes be kept separate; options to expand vehicle parking at the airport are presented in the alternatives.

BUILDING RESTRICTION LINE (BRL)

On each landside alternative, consideration is also given to the Building Restriction Line (BRL). Federal Aviation Regulation (FAR) Part 77 establishes standards and notification requirements for objects that affect navigable airspace, including the BRL. The BRL is the Part 77 transitional surface at an airport and provides guidance on the height of structures relative to the distance from the runway centerline and the instrument approach visibility minimums established at the airport. The BRL is derived from a formula which uses the lowest available instrument approach minimum for a specific runway and the desired building height; a 35-foot height is commonly utilized. The standard sets a location to which structures within the BRL should not exceed the allowable height of the BRL at that location.

Currently, the airport has a 1-mile approach as its lowest visibility minimum. Therefore, a 35-foot BRL is set 495 feet from the Runway 1-19 centerline. No building closer than 495 feet should exceed 35 feet. If an instrument approach is established with a ¾-mile or lower visibility minimum, then the 35-foot BRL would be located 745 feet from the runway centerline. Runway 14-32 also determines the location of the BRL relative to the runway: as a turf runway with visual-only operations, a 35-foot BRL would be located 370 feet from the centerline. If paved and equipped with a 1-mile GPS approach, the BRL would increase in distance to 495 feet. **Table 4E** lists the specific conditions and distances from each runway centerline.

TABLE 4E | BRL Dimensions

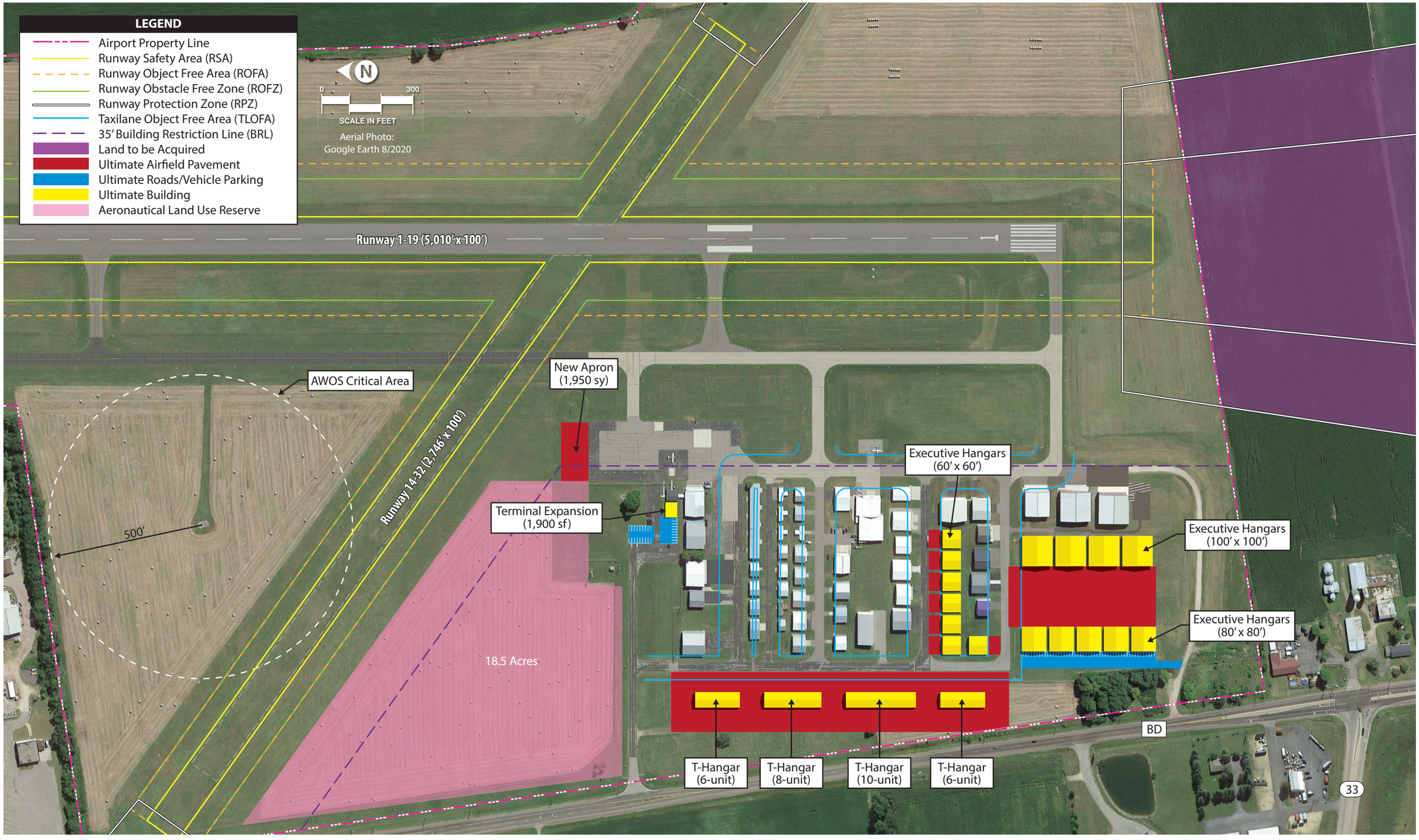
Condition & Approach	Distance from Centerline (feet)
Runway 1-19	
Visibility Minimums > ¾-mile	495
Visibility Minimums ≤ ¾-mile	745
Runway 14-32	
Turf Surface, Visual (VIS)	370
Paved Surface, Visual (VIS)	370
Paved Surface, 1-mile	495

Source: FAR Part 77

The landside alternatives presented display the BRL for each runway. The Runway 1-19 BRL is set at 745 feet for each alternative to reflect the likelihood of a ¾-mile instrument approach on at least one runway end. The first two landside alternatives consider maintaining Runway 14-32 as a turf runway; the BRL in these alternatives is set at 370 feet. The last landside alternative considers the impact of paving Runway 14-32 and obtaining a 1-mile non-precision instrument approach. It should be noted that a structure can exceed the BRL height if an FAA obstruction analysis results in a favorable determination.

LANDSIDE ALTERNATIVE 1

Presented on **Exhibit 4H**, the first landside alternative provides a conservative plan of growth to meet the deficiencies established in the previous chapter. A variety of new aircraft hangars, totaling approximately 133,600 square feet (sf) is proposed, which would bring the airport's total aircraft storage space to 286,650 sf. This includes four T-hangar buildings located along the far west taxilane; additional taxilane construction would be required to access the west side units. To conform to FAA taxilane object free area (TLOFA) design standards for airplane design group (ADG) I – which generally includes small, single-engine piston aircraft – the hangars are planned outside the 79-foot-wide safety area of the taxilane. These units would add 30 new T-hangar positions to the airport. Additional hangar space includes:


LEGEND
Airport Property Line
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
Taxilane Object Free Area (TLOFA)
35' Building Restriction Line (BRL)
Land to be Acquired
Ultimate Airfield Pavement
Ultimate Roads/Vehicle Parking
Ultimate Building
Aeronautical Land Use Reserve
N
0
300
SCALE IN FEET
Aerial Photo:
Google Earth 8/2020
Runway 1-19 (5,010' x 100')
AWOS Critical Area
New Apron
(1,950 sy)
Runway 14-32 (2,746' x 100')
500'
Terminal Expansion
(1,900 sf)
18.5 Acres
Executive Hangars
(60' x 60')
Executive Hangars
(100' x 100')
Executive Hangars
(80' x 80')
T-Hangar
(6-unit)
T-Hangar
(8-unit)
T-Hangar
(10-unit)
T-Hangar
(6-unit)
BD
33

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- Four 100' x 100' (10,000 sf) large-span conventional hangars
- Five 80' x 80' (6,400 sf) conventional hangars
- Seven 60' x 60' (3,600 sf) box hangars

This alternative also presents the option of expanding and remodeling the existing terminal building. Roughly 1,900 sf of additional space is shown, with growth extending westward into the vacant yard adjacent to the current building, resulting in a future terminal size of 3,220 sf, which is adequate to accommodate future aviation activity. The terminal ramp would be enlarged by approximately 1,950 square yards (sy) to the north, for a total ramp area of 12,750 sy for itinerant traffic. Vehicle parking adjacent to the terminal building is also expanded. An additional 18.5 acres of future aeronautical land use is shown for development opportunities in the space north of the airport access road.

LANDSIDE ALTERNATIVE 2

Landside Alternative 2, shown on **Exhibit 4J**, provides for a total of 146,184 sf of new hangar space at DLL, almost doubling the current hangar capacity. The west taxilane now serves a row of box and conventional hangars, while the T-hangar facilities are planned in the southwest corner of the airport. This alternative provides 10 more additional T-hangar spots than the previous alternative and also adds a row of rectangular hangars, sized for small piston GA aircraft, bringing the total smaller aircraft storage positions at the airport to 50. Other hangar configurations planned include:

- One 100' x 125' (12,500 sf) large-space conventional hangar
- Five 80' x 80' (6,400 sf) conventional hangars
- Five 60' x 60' (3,600 sf) box hangars
- Seven 50' x 50' (2,500 sf) box hangars
- One 65' x 80' (5,200 sf) conventional hangar

The 5,200-sf hangar shown is located in the existing terminal building's location; it is a planned duplicate of the current FBO hangar. Consequently, a new 3,300-sf terminal building is planned at the northwest corner of the main ramp, adjacent to the airport memorial. An expanded parking lot is also shown adjacent to the new terminal; vehicle access to the apron could be maintained in its current location. The main ramp is expanded by approximately 3,500 sy in a manner that is reflected in the current ALP. The 18.5 acres of aeronautical land reserve from the previous alternative is carried forward in this option.

LANDSIDE ALTERNATIVE 3

The third landside development alternative, seen on **Exhibit 4K**, reflects the greatest growth potential of DLL and considers a paved Runway 14-32 with a parallel taxiway. This allows for the redevelopment of a section of the existing hangar facilities that do not currently meet FAA TLOFA design standards and provides additional hangar development north of the airport access road. The north hangar area could consist entirely of T-hangars – segregating low and high aviation activity levels – and includes 10 buildings, providing a total of 82 T-hangar units. This area also includes its own self-serve 100LL fuel pump and dedicated parking lot. Additional hangar development planned in this alternative includes:

- Three 100' x 100' (10,000 sf) large-span conventional hangars
- Four 80' x 80' (6,400 sf) conventional hangars
- Five 70' x 70' (4,900 sf) box hangars
- Three 40' x 50' (2,000 sf) box hangars
- Two 62' x 260' (16,120 sf) 4-unit rectangular hangars

The two 4-unit rectangular hangar facilities are planned in the area currently occupied by smaller T-hangar and box hangar units, which would be removed. A new 200-foot-wide apron would be constructed westward from the main ramp to the opposite taxilane. Current occupants could be relocated to the newer northern hangars. The expanded ramp would provide additional space for transient aircraft, as well as maneuverability for aircraft stored in the north line of hangars adjacent to the airport access road. The apron expansion from the previous alternative is carried forward in this option; an apron expansion to the north would risk interfering with the new parallel taxiway's safety area (TSA and TOFA), and therefore is not considered. Approximately 6.2 acres of land along the west edge of the airport adjacent to County Highway BD is reserved for future aeronautical development.

The terminal building in this alternative is shown in its existing location, but demolished and reconstructed as a modern, 3,500-sf facility. Due to the footprint of the new terminal, the access gate to the terminal apron would have to be shifted to the north. An expanded parking lot is also shown to accommodate demand beyond 20 years.

LANDSIDE SUMMARY

The landside alternatives presented seek to accommodate an array of aviation activities that either currently occur or could be expected to occur at DLL in the future. There is demand for new facilities at the airport, and with an increase in operations by larger turbine aircraft, airport management and the Village will need to determine how to develop its property in an organized and thoughtful way. Each of the development options considers a long-term vision which could, in some cases, extend beyond the 20-year scope of this master plan. Nevertheless, it is beneficial to provide a long-term vision for the airport for future generations.

SUMMARY

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

LEGEND

- Airport Property Line
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Taxilane Object Free Area (TLOFA)
- 35′ Building Restriction Line (BRL)
- Land to be Acquired
- Ultimate Airfield Pavement
- Ultimate Roads/Vehicle Parking
- Ultimate Building
- Pavement to be Removed
- Aeronautical Land Use Reserve

N

0 300

SCALE IN FEET

Aerial Photo:
Google Earth 8/2020

Runway 1-19 (5,010′ x 100′)

AWOS Critical Area

Runway 14-32 (2,746′ x 100′)

500′

18.5 Acres

New Apron
(3,500 sy)

New Terminal
(3,300 sf)

Executive Hangar
(65′ x 80′)

Executive Hangars
(50′ x 50′)

Executive Hangar
(100′ x 125′)

T-Hangars
(10-unit)

Rectangular Hangars
(5-unit)

Executive Hangars
(80′ x 80′)

Executive Hangars
(60′ x 60′)

BD

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LEGEND

- Airport Property Line
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Taxiway Object Free Area (TOFA)
- Taxilane Object Free Area (TLOFA)
- 35' Building Restriction Line (BRL)
- Runway Visibility Zone (RVZ)
- Land to be Acquired
- Ultimate Airfield Pavement
- Ultimate Roads/Vehicle Parking
- Ultimate Building
- Aeronautical Land Use Reserve

N

0 300

SCALE IN FEET

Aerial Photo:
Google Earth 8/2020

Runway 1-19 (5,010' x 100')

Ultimate (3,000'x75')

Runway 14-32 (2,746'x100')

AWOS Critical Area

500'

New Apron
(3,500 sy)

New Terminal
(3,500 sf)

Rectangular Hangar
(4-unit)

T-Hangar
(8-unit)

Executive Hangars
(70' x 70')

Executive Hangars
(80' x 80')

Executive Hangars
(100' x 100')

T-Hangar
(10-unit)

Redevelop
Hangar Area

6.2 Acres

Executive Hangars
(50' x 40')

BD

100LL
Self-Serve

T-Hangar
(6-unit)

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Four airside and three landside development alternatives have been presented. On the airside, considerations include extending Runway 1-19 and paving Runway 14-32; upgrading airport fixtures and aids; and improving instrument approach capabilities. Several of these airfield improvements would require a combination of land acquisition and positive control techniques to ensure adherence to FAA standards in the long term. For the landside, alternatives were presented that include new hangar development and a larger terminal building. As the airport's fleet mix transitions to include more jets and turboprops, it will be important to clearly delineate development areas for facilities to accommodate those aircraft. Segregating turbine aircraft from smaller piston aircraft operators contributes to operational safety and presents a more organized and efficient airport.

After the various stakeholders collaborate with the consultant team, a final ultimate alternative, the "Recommended Development Concept," will be produced. The Recommended Development Concept is a combination of both airside and landside elements and presents a single, unified approach to how the airport may look through the 20-year planning horizon. The following chapters will present elements of the Recommended Development Concept, provide a logical schedule of development projects with cost estimates, and discuss the various funding sources available, with the goal of making DLL a thriving aviation facility for years to come.

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