FACILITY REQUIREMENTS AND ALTERNATIVE DEVELOPMENT ANALYSIS

As detailed in previous sections, an airport contains both airside and landside facilities. Airside facilities consist of the runways, taxiways, approach and departure facilities, navigational aids, lighting, markings, and signage that assist in the ground movement of aircraft. Landside facilities provide the interface between air and ground transportation and include the terminal building, hangars and tiedowns, aircraft parking aprons, automobile parking, and airport support facilities.

Cost-effective, safe, efficient, and orderly development of an airport should rely more upon actual demand than a time-based forecast figure. Thus, in order to develop a plan that is demand-based rather than time-based, a series of planning horizon milestones have been established that take into consideration the reasonable range of aviation demand projections.

It is important to consider that, over time, the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important to plan for these milestones so that airport officials can respond to unanticipated changes in a timely fashion. As a result, these milestones provide flexibility while potentially extending this plan's useful life if aviation trends slow over the period.

The most important reason for utilizing milestones is to allow the airport to develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as the schedule can be slowed or expedited according to actual demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program.

The milestones utilized in the study are:

- Existing Term: 0-10 Years
- Future Term: 11-20 Years
- Ultimate Term: 20+ Years

AIRSIDE FACILITY REQUIREMENTS

RUNWAY SAFETY AREAS

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

It is important that the RSA, ROFA, and ROFZ remain under direct ownership of the airport sponsor to ensure that these areas remain free of obstacles and can be readily accessed by maintenance and safety personnel. The airport should also own or maintain sufficient land use control over RPZs to ensure that the area remains obstacle free. Alternatives to owning RPZs include maintaining positive control through avigation easements or ensuring proper zoning measures are taken to maintain compatible land use.

Existing, future, and ultimate safety areas for Runway 18-36 and Runway 11-29 are depicted on **Exhibit 17**.

Runway Safety Area (RSA)

The RSA is an established surface surrounding a runway that is designed or prepared to increase safety and decrease potential damage if an aircraft undershoots, overshoots, or makes an excursion from the runway. The RSA is centered upon the runway centerline, and its dimensions are based upon the established RDC. The FAA states within AC 150/5300-13B that the RSA must be cleared and graded and cannot contain hazardous surface variations. In addition, the RSA must be drained either by grading or storm sewers and capable of supporting snow removal and ARFF equipment, as well as the occasional passage of aircraft without damaging the aircraft. The RSA must remain free of obstacles, other than those considered fixed by function, such as runway lights.

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program*. The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13B, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

The standard RSA dimensions for existing RDC B-I-5000 for Runway 18-36 are 120 feet wide and extend 240 feet beyond each end of the runway. The future RDC B-II-4000 RSA dimensions are 150 feet wide and extend 300 feet beyond each end of the runway, and for the ultimate RDC C-II-4000 for Runway 18-36, the RSA is 500 feet wide and extends 1,000 feet beyond each runway end. The RSA dimensions for the existing, future, and ultimate RDC B-I(s)-VIS for Runway 11-29 are 120 feet wide and extend 240 feet beyond each runway end of the runway.

At HDE, the RSAs on both ends of Runway 18-36 in the existing and future conditions are fully contained within the airport property. However, it should be noted that there is an elevation change within the existing and future RSA off of the Runway 18 end, with elevation decreasing north of the runway end. This area will need to be filled to meet RSA design standards. When the airport transitions to ultimate RDC C-II-4000, the RSA extends 6.5 acres beyond the airport property at the Runway 18 end. The airport obtained an easement of 12.14 acres beyond the Runway 18 end in 1988, which includes the RSA portion that extends off the airport property; however, an easement does not allow for full property control, and, therefore, the 6.5 acres should be planned to be acquired. Additionally, there is an elevation change within the ultimate RSA off of the Runway 18, with elevation decreasing north of the runway end. Like the existing and future RSA, this area will also need to be filled. The RSA is contained within airport property on Runway 11-29 in the existing, future, and ultimate conditions.

Existing
Runway 18-36 – RDC B-I-5000
Runway 11-29- RDC A-I(small)-VIS

LEGEND
- Airport Property Line
- Existing Easement
- A Taxiway Designator
- B Taxilane Designator
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Uncontrolled RPZ
- AWOS Critical Area

N
0 600
SCALE IN FEET
Photo date: 8/2022

Visual approach RPZ
0.5 Acres
Public Road in RPZ
RSA Overlap
35'-BRL
25'-BRL
Turf Runway 11-29 (2,350' x 300')
18th Ave
500'
1-mile RPZ
Runway 18-36 (4,701' x 75')
Non-standard Hold Bay
Visual approach RPZ
Brewster Road
Direct Access
Airport Access Road
Public Road in RPZ
1.4 Acres
6

Exhibit 17
EXISTING SAFETY AREAS

Future
Runway 18-36- RDC B-II-4000
Runway 11-29- RDC A-I(small)-VIS

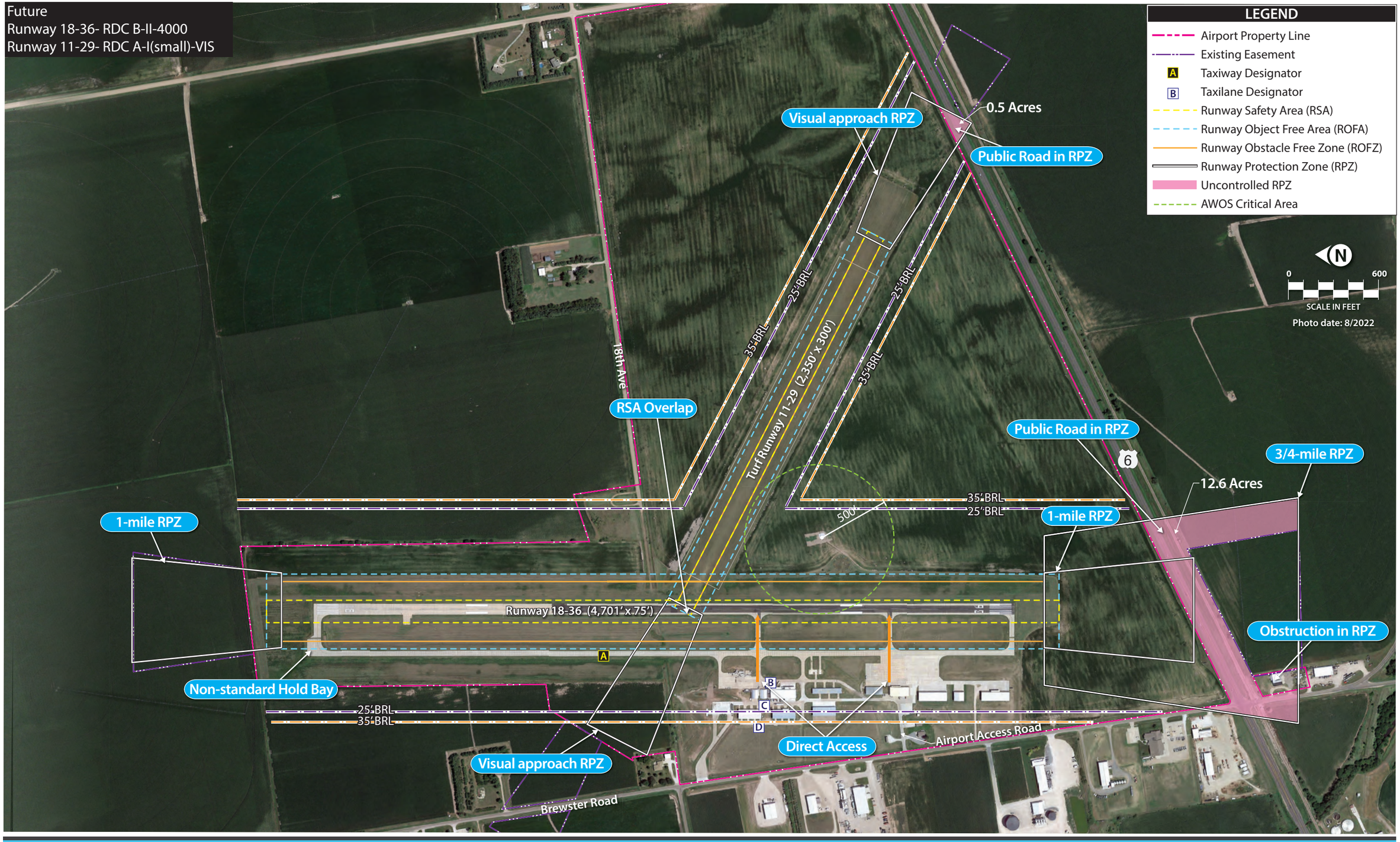
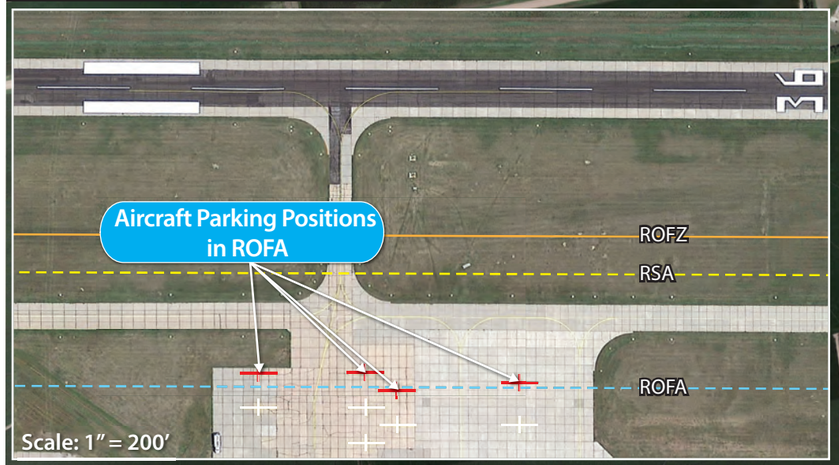


Exhibit 17 continued
FUTURE SAFETY AREAS

Ultimate
Runway 18-36- RDC C-II-4000
Runway 11-29- RDC A-I(small)-VIS



LEGEND
- Airport Property Line
- Existing Easement
- A Taxiway Designator
- B Taxilane Designator
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Uncontrolled RPZ
- Uncontrolled ROFA
- AWOS Critical Area

N
0 600
SCALE IN FEET
Photo date: 8/2022

Visual approach RPZ
0.5 Acres
Public Road in RPZ
RSA Overlap
35'-BRL
25'-BRL
Runway 11-29 (2,350' x 300')
18th Ave
Turf Runway 11-29
6
3/4-mile RPZ
1-mile RPZ
3/4-mile RPZ
6.5 Acres RSA
Wind Cone Obstructs Ultimate ROFA
500'
35' BRL
25'-BRL
1-mile RPZ
0.2 Acres ROFA
12.4 Acres
30 Acres
Runway 18-36 (4,701' x 75')
A
B
C
D
25'-BRL
35'-BRL
Obstruction in RPZ
3.5 Acres ROFA
Non-standard Hold Bay
Visual approach RPZ
Direct Access
Aircraft Parking Positions in ROFA
Public Road in RPZ
Airport Access Road
Brewster Road

Exhibit 17 continued
ULTIMATE SAFETY AREAS

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FAA airport design standards recommend eliminating overlapping RSAs since operations in the overlapping area could present safety concerns with the potential for conflicting movements. Additionally, in the ultimate condition, the holding bay located on the north end of Taxiway A extends into the Runway 18-36 RSA. Options to correct these non-standard conditions will be explored in the forthcoming Airfield Alternatives section.

Runway Object Free Area (ROFA)

The ROFA can be described as a two-dimensional surface area that surrounds all airfield runways. This area must remain clear of obstructions, with an exception for those that are deemed "fixed by function," such as runway lighting systems. This safety area does not have to be level or graded as the RSA does; however, the ROFA must be clear of any penetrations of the lateral elevation of the RSA. Much like the RSA, the ROFA is centered upon the runway centerline, and its size is determined based upon the established RDC.

Existing RDC B-I-5000 ROFA design standards for Runway 18-36 measure 400 feet wide and extend 240 feet beyond the end of each runway. For the future RDC B-II-4000 design standards, the ROFA dimensions increase to 500 feet wide and extend 300 feet beyond the end of each runway. The ultimate RDC C-II-4000 ROFA dimensions increase further to 800 feet wide and extend 1,000 feet beyond the end of each runway. For Runway 11-29, the ROFA dimensions in the existing, future, and ultimate conditions measure 250 feet wide and extend 240 feet beyond the runway end.

The ROFA is fully contained on airport property for both the existing and future conditions on Runway 18-36; however, the ultimate ROFA extends approximately 570 feet beyond the airport's property on the end of Runway 18, encompassing approximately 3.5 acres. Similarly, a small section extends beyond the end of Runway 36, encompassing approximately 0.2 acres of uncontrolled property. It should be noted that there is vegetation that penetrates the ultimate ROFA, which will need to be cleared to meet ROFA design standards. The ROFA is contained within airport property on Runway 11-29 in the existing, future, and ultimate conditions. The airport should consider acquiring the uncontrolled property within the Runway 18-36 ROFA.

As noted on **Exhibit 17**, obstructions are present in the ROFA in the future and ultimate conditions. In the future condition, the hold bay at the Runway 18 end also obstructs the ROFA. When the airport transitions to C-II design standards, additional ROFA obstructions are present, including the wind cone located east of Runway 18-36 close to the Runway 36 end and four aircraft parking positions located on the south apron. The Airfield Alternatives section will include options to correct these non-standard conditions.

Obstacle Free Zones (OFZ*)*

The Runway Obstacle Free Zone (ROFZ) can be defined as a portion of airspace centered about the runway, and its elevation at any point is equal to the elevation of the closest point on the runway centerline. The function of the ROFZ is to ensure the safety of aircraft conducting operations by preventing object penetrations to this portion of airspace. Potential penetrations to this airspace also include taxiing and parked aircraft. Any obstruction within this portion of airspace must be mounted on frangible couplings and be fixed in its position by its function.

The ROFZ extends 200 feet past each end of the runway on the runway centerline. The width of the ROFZ is determined by the established RDC. The ROFZ width for runways accommodating large aircraft is 400 feet, and for runways accommodating small aircraft with approach speeds of 50 knots or more, it is 250 feet. As such, the ROFZ associated with Runway 18-36 measures 400 feet wide, while the width of the ROFZ for Runway 11-29 is 250 feet. These dimensions apply to the existing, future, and ultimate conditions at HDE. There are no known object penetrations of the ROFZ in the existing, future, and ultimate conditions.

Runway Protection Zone (RPZ)

An RPZ is a trapezoidal area centered on the extended runway centerline beginning 200 feet from the end of the runway. This safety area has been established to protect the end of the runway from airspace penetrations and incompatible land uses. The RPZ dimensions are based upon the established RDC and the visibility minimums serving the runway.

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13B, the following land uses are permissible within the RPZ:

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

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

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

AC 150/5190-4B further states that “control is preferably exercised through acquisition of sufficient property interest and includes clearing RPZ areas (and keeping them clear) of objects and activities that would impact the safety of people and property on the ground.” The FAA does recognize that land ownership, environmental, geographical, and other considerations can complicate land use compatibility

within RPZs. Regardless, airport sponsors are to comply with FAA Grant Assurances, including but not limited to Grant Assurance 21, Compatible Land Use. Sponsors are expected to take appropriate measures to "protect against, remove, or mitigate land uses that introduce incompatible development within RPZs." For proposed projects that would shift an RPZ into an area with existing incompatible land uses, such as a runway extension or construction of a new runway, the sponsor is expected to have or secure sufficient control of the RPZ, ideally through fee simple ownership. Where existing incompatible land uses are present, the FAA expects sponsors to "seek all possible opportunities to eliminate, reduce, or mitigate existing incompatible land uses" through acquisition, land exchanges, right-of-first-refusal to purchase, agreement with property owners on land uses, easements, or other such measures. These efforts should be revisited during master plan or ALP updates, and periodically thereafter, and documented to demonstrate compliance with FAA Grant Assurances. If new or proposed incompatible land uses impact an RPZ, the FAA expects the airport to take the above actions to control the property within the RPZ, along with adopting a strong public stance opposing the incompatible land uses.

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

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

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

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

RPZs have further been designated as approach and departure RPZs. The approach RPZ is a function of Aircraft Approach Category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC, and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements that the airport sponsor should pursue. Runway 18-36 and Runway 11-29 do not have any displaced thresholds; therefore, these runways' approach and departure RPZs occur in the same location 200 feet from the end of each runway. For planning purposes, the approach RPZ was used to create the most restrictive condition. The existing, future, and ultimate RPZs at HDE are presented on **Exhibit 17** and detailed in **Table 21**.

TABLE 21 | Existing, Future, and Ultimate RPZs

RPZ	Visibility Minimums	Uncontrolled Acres*	Notes/Incompatibilities
EXISTING CONDITION			
Runway 18	1 mile	0.0	Fully contained within airport property or controlled by easement.
Runway 36	1 mile	1.4	A small portion of the southeast corner of the RPZ is uncontrolled and encompasses Highway 6/34.
FUTURE CONDITION			
Runway 18	1-mile	0.0	Fully contained within airport property or controlled by easement.
Runway 36	¾-mile	12.6	Portion of the future RPZ is uncontrolled and encompasses Highway 6/34 and a building structure.
ULTIMATE CONDITION			
Runway 18	¾-mile	30.0	Portion of the ultimate RPZ is uncontrolled.
Runway 36	¾-mile	12.4	The ultimate RPZ is partially uncontrolled and encompasses Highway 6/34 and a building structure.
EXISTING/FUTURE/ULTIMATE CONDITION			
Runway 11	VIS	0.0	Fully contained within airport property.
Runway 29	VIS	0.5	A small portion of the southeast corner of the RPZ is uncontrolled and encompasses Highway 6/34.
*Acreages are approximations			

Source: Coffman Associates analysis

As detailed in the table, the entire Runway 18 RPZ is fully controlled either through previous property acquisition or easement in the existing and future conditions; however, the RPZ dimensions will increase when the airport transitions to C-II-4000, resulting in uncontrolled property in the ultimate condition. A small southeast corner of the Runway 36 RPZ extends off airport property encompassing 1.4 acres and Highway 6/34 in the existing condition. When the RPZ increases in size in the future and ultimate conditions, additional property becomes uncontrolled and would encompass a building structure.

In the existing, future, and ultimate conditions, the entire Runway 11 RPZ is fully controlled within airport property and a small section of the southeast corner of the Runway 29 RPZ (0.5 acres) extends off airport property. The Runway 29 RPZ also encompasses Highway 6/34.

The FAA recommends that airports have fee simple ownership of RPZ land where feasible. If fee simple acquisition of RPZ land is not feasible, then the airport should pursue acquisition of an avigation easement and implement land use control measures, such as zoning, to protect the airport. In the next section, different options for maintaining control of the RPZs and keeping them free of incompatible uses will be explored.

Building Restriction Line (BRL)

The BRL is a line which identifies suitable and unsuitable building area locations on the airport. The BRL encompasses the RPZs, the OFA, navigational aid critical areas required for terminal instrument procedures, and other areas necessary for meeting airport line-in-sight criteria.

There are two primary factors that contribute to the determination of the BRL: type of runway ("utility" or "other-than-utility") and the capability of the instrument approaches. The BRL is the product of CFR Part 77 transitional surface clearance requirements. These requirements stipulate that no object be located in the primary surface, defined as being 1,000 feet wide for precision and non-precision instrument runways with visibility minimums as low as ¾-mile and 500 feet wide for runways having non-precision instrument approach minimums of greater than ¾-mile. From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizonal feet.

Given that the strength rating for Runway 18-36 is greater than 12,500 pounds, it is classified as an "other than utility" runway under Part 77. The width of the primary surface for other-than-utility visual and non-precision instrument runways having minimums greater than ¾-statute mile is 500 feet (250 feet to each side of runway centerline). The width of the primary surface serving other-than-utility runways having minimums of ¾-statute mile or lower is 1,000 feet (500 feet to each side of runway centerline). Non-precision instrument approaches with not lower than 1-mile visibility minimums are available on both ends of Runway 18-36 in the existing condition; however, the future/ultimate conditions include an approach with visibility minimums down to ¾-mile, resulting in a width increase to 1,000 feet for the primary surface. Crosswind Runway 11-29 is a turf runway and is thus classified as a "utility" runway. Instrument approaches are not planned to this runway; therefore, the width of the primary surface is 250 feet, centered on the runway. From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizonal feet (7:1).

At HDE, the 25-foot and 35-foot BRL are set at a separation distance of 425 feet and 495 feet, respectively, from the Runway 18-36 centerline in the existing condition. As mentioned, if lower visibility minimums are pursued on this runway, the width of the primary surface increases, factoring in the placement of the BRL in the future/ultimate conditions. With a ¾-mile visibility minimum in place, the 25-foot and 35-foot BRL would be placed 675 feet and 745 feet, respectively, from the Runway 18-36 centerline. The 25-foot and 35-foot BRL for crosswind Runway 11-29 would remain at 300 feet and 370 feet from centerline, respectively, throughout the planning period. It is acceptable for structures to be in front of the BRL as long as there are no penetrations to Part 77 imaginary surfaces.

Presently there are no structures exceeding height limitations within the BRL; however, when the airport pursues the ¾-mile approach in the future/ultimate conditions, all existing landside facilities will be located within the BRL. While these buildings are located within the BRL, this does not necessarily mean they are penetrations to Part 77 surfaces. **It should be clearly stated that the BRL is not a standard, but rather a guideline to use when planning vertical infrastructure on the airport.** The FAA may require existing or future structures inside the BRL to be equipped with obstruction lights.

RUNWAY DESIGNATIONS

Currently, HDE is served by primary Runway 18-36, which is oriented in a north-south direction, and crosswind turf Runway 11-29, which is oriented in an east-west configuration. A runway's designation is based upon its magnetic headings, which are determined by the magnetic declination for the area. The magnetic declination in the area is 4° 32' E ± 0° 23', which changes by 0° 5' W per year. Runway 18-36 has a true heading 190°/010°. Adjusting for the magnetic declination, the current magnetic heading of the Runway is 185°/005°. Generally, the runway designations should be that number that is within five degrees of the magnetic heading. As a result, consideration should be given to redesignating the runway as Runway 01-19. Similarly, crosswind Runway 11-29 has a true heading of 126°/306°. Adjusting for the magnetic declination, the current magnetic heading of the runway is 121°/301°, and consideration should be given to updating the designation to Runway 12-30. Any re-designation should be coordinated with the FAA to ensure its necessity and that all appropriate publications are updated. If it is confirmed that the runway should be re-designated, new runway end designation markings can be incorporated concurrently with a future pavement rehabilitation project.

While updating the designation is recommended in this planning study, the runways will continue to be referred to as Runway 18-36 and Runway 11-29 to maintain consistency in discussion and eliminate potential confusion.

RUNWAY ORIENTATION

Key considerations in the runway configurations of an airport involve the orientation for wind coverage and the operational capacity of the runway system. FAA Advisory Circular 150/5300-13B, *Airport Design*, recommends that a crosswind runway be made available when the primary runway orientation provides for less than 95 percent wind coverage for any aircraft forecast to use the airport on a regular basis. **Table 22** details the allowable crosswind component for each RDC.

TABLE 22 | Allowable Crosswind Component by RDC

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

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

According to FAA order 5100.38D, *Airport Improvement Handbook,* only one runway at any NPIAS airport is eligible for on-going maintenance and rehabilitation funding unless the FAA Airport District Office (ADO) has made a specific determination that a crosswind or secondary runway is justified. A runway

that is not a primary runway, crosswind runway, or secondary runway, is an *additional* runway, which is not eligible for FAA funding. It is not unusual for a two-runway airport to have a primary runway and an additional runway, and no crosswind or secondary runway. **Table 23** presents the eligibility requirements for runway types.

Table 23 | Runway Eligibility

For the following runway type:	Must meet all of the following criteria:	And is:
Primary Runway	1. A single runway at an airport is eligible for development consistent with FAA design and engineering standards.	Eligible
Crosswind Runway	1. The wind coverage on the primary runway is less than 95 percent.	Eligible if justified
Secondary Runway	1. There is more than one runway at the airport. 2. The non-primary runway is not a crosswind runway. 3. Either of the following: a. The primary runway is operating at 60 percent or more of its annual capacity. b. FAA has made a specific determination that the runway is required.	Eligible if justified
Additional Runway	1. There is more than one runway at the airport. 2. The non-primary runway is not a crosswind runway. 3. The non-primary runway is not a secondary runway.	Ineligible

Source: FAA Order 5100, AIP Handbook

Exhibit 2, presented previously, details the associated wind coverage. As stated previously, in all weather conditions, no single runway provides 95 percent coverage for wind coverage at 10.5 knots which falls into the ARC A-I/B-I category. At 10.5 knots, Runway 18-36 provides 91.96 percent and Runway 11-29 provides 85.51 percent coverage, respectively. At 13-knot conditions, Runway 18-36 provides 95.72 percent and Runway 11-29 provides 91.73 percent coverage. Since the wind coverage on Runway 18-36 does not exceed the 95 percent threshold, Runway 11-29 is eligible for federal funding as a crosswind runway; therefore, a crosswind runway is justified at HDE and should be maintained throughout the planning period.

RUNWAY LENGTH REQUIREMENTS

Runway length requirements for an airport typically are based on factors including airport elevation, mean daily maximum temperature of the hottest month, critical aircraft type expected to use the airport, and stage length of the longest non-stop trip destination.

Aircraft performance declines as each of these factors increase. Warmer summer temperatures and long stage lengths are the primary factors in determining runway length requirements, especially for turbine aircraft models. For calculating runway length requirements at HDE, the airport's elevation is 2,313 feet above MSL, and the mean maximum temperature of the hottest month (July) is 87.3 degrees Fahrenheit (F).

Using the site-specific data described above, runway length requirements for the various classifications of aircraft that may operate at the airport were examined using FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. The FAA runway analysis groups general aviation aircraft into several categories, reflecting the percentage of the fleet within each category. The runway design should be based upon the most critical aircraft (or group of aircraft) performing at least 500 annual itinerant operations.

Small Aircraft

The first step in evaluating runway length is to determine general runway length requirements for most aircraft operating at the airport. These small aircraft at HDE make up most local operations and a portion of itinerant operations conducted using smaller single engine piston-powered aircraft weighing less than 12,500 pounds.

Table 24 summarizes the FAA's generalized recommended runway lengths determined for HDE. FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, recommends that airports be designed to at least serve 95 percent of small airplanes. The advisory circular further defines the fleet categories as follows:

- **95 Percent of Small Airplane Fleet** – Applies to airports that are primarily intended to serve medium-sized population communities with a diversity of usage and a greater potential for increased aviation activities. This category also includes airports that are primarily intended to serve low-activity locations, small population communities, and remote recreational areas.
- **100 Percent of Small Airplane Fleet** – This type of airport is primarily intended to serve communities located on the fringe of a metropolitan area or a relatively large population community remote from a metropolitan area.

TABLE 24 | Small Airplane Runway Length Requirements

AIRPORT AND RUNWAY DATA	
Airport elevation	2,313 feet
Mean daily maximum temperature of the hottest month	87.3° F
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with less than 10 passenger seats	
95 percent of these small airplanes	4,000 feet
100 percent of these small airplanes	4,600 feet
Small airplanes with 10 or more passenger seats	4,600 feet

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

Based upon these calculations, Runway 18-36, at a length of 4,701 feet, currently exceeds runway length criteria for all small airplanes in the national fleet. Crosswind Runway 11-29, at 2,350 feet, does not meet these recommended standards; however, as an unpaved, utility runway intended to accommodate small aircraft exclusively, its length is considered adequate for the existing, future, and ultimate conditions.

Business Aircraft

While most general aviation activity is conducted by small piston-powered aircraft, HDE is also utilized by business jets and turboprop aircraft (e.g., Beechcraft King Air family of turboprops and Cessna Citation family of business jets) which generally require longer runway lengths. Runway length requirements have been calculated for aircraft weighing more than 12,500, but less than 60,000 pounds, which includes most small- to medium-size business jets. These calculations take into consideration the runway gradient and landing length requirements when contaminated (wet and slippery). Business jets tend to need a greater runway length when landing on a wet surface because of their increased approach speeds. AC 150/5325-4B, provides a methodology for determining runway length for business jets with

similar operating characteristics. The AC provides two separate "family groupings of airplanes," each based upon their representative percentage of aircraft in their national fleet. The first grouping is those business jets that make up 75 percent of the national fleet, and the second group is those making up 100 percent of the national fleet. Runway lengths are further determined by the aircraft's useful load and the airport's conditions. The useful load of an aircraft consists of the passengers, cargo, and useable fuel.

Table 25 presents the results of the runway length analysis for business jets developed following the guidance AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,000 feet is recommended. For 100 percent of the business jet fleet to take off at 60 percent useful load, a runway length of 6,300 feet is recommended. For 100 percent of the business jet fleet to take off at 90 percent useful load, a runway length of 8,900 feet is recommended. Typically, the FAA plans runway length requirements at 60 percent useful load.

TABLE 25 | Business Jet Runway Length Requirements

Airport Elevation	2,313' above mean sea level			
Average High Monthly Temp.	87.3 degrees (July)			
Runway Gradient	0.04%			
Fleet Mix Category	**Raw Runway Length from FAA AC**	**Runway Length with Gradient Adjustment**	**Wet Surface Landing Length for Jets (+15%) ***	**Final Runway Length**
75% of fleet at 60% useful load	5,157'	5,157'	5,500'	5,500'
100% of fleet at 60% useful load	6,248'	6,248'	5,500'	6,300'
75% of fleet at 90% useful load	7,024'	7,024'	7,000'	7,000'
100% of fleet at 90% useful load	8,844'	8,844'	7,000'	8,900'
*Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet conditions				

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

A more specific method to determine runway length requirements for jet aircraft is to examine aircraft flight planning manuals under conditions specific to the airport. Several aircraft were analyzed for takeoff length required with a design temperature of 87.3 °F at a field elevation of 2,313 feet MSL. **Table 26** provides a detailed takeoff length analysis for 42 of the most common business jet and turboprop aircraft in the national fleet. This data was obtained from Ultranav software, which computes operational parameters for specific aircraft based on flight manual data. The analysis includes the maximum takeoff weight (MTOW) allowable and the percent useful load from 60 percent to 100 percent. The figures are shaded in green or orange relative to the current length of Runway 18-36 (4,701 feet), with figures in orange exceeding the current runway length. The analysis shows that during the hottest periods of the year, Runway 18-36 can only accommodate slightly more than half of the business jets at 60 percent useful load, with 16 of the aircraft examined requiring a longer runway to operate. At 70, 80, and 90 percent useful loads, the number of aircraft able to take off at HDE becomes fewer and fewer, and with 100 percent useful load, only seven aircraft can take off at the current runway length. In these conditions, these aircraft must take on lighter payloads of passengers, cargo, fuel, or a combination of each to operate safely at the airport. Due to HDE elevation, there are 10 aircraft at 100 percent shown to be outside the limits (O/L) of the Ultranav software. The software does, however, still provide a well-defined range for runway length at HDE at 100 percent useful load.

Table 26 | Turbine Aircraft Takeoff Length Requirements

		TAKEOFF LENGTH REQUIREMENTS (Feet) - % Useful Load				
Aircraft Name	**MTOW**	**60%**	**70%**	**80%**	**90%**	**100%**
Pilatus PC-12	9,921	2,309	2,505	2,710	2,926	3,152
King Air C90GTi	10,100	2,827	3,034	3,259	3,485	3,711
King Air C90B	10,100	2,955	3,174	3,399	3,642	3,902
Citation CJ3	13,870	3,088	3,316	3,564	3,829	4,130
King Air 200 GT	**12,500**	**3,709**	**3,855**	**4,005**	**4,137**	**4,253**
Citation Sovereign	30,300	3,444	3,587	3,819	4,084	4,365
Citation (525A) CJ2	12,375	3,386	3,650	3,923	3,211	4,525
King Air 350	**15,000**	**3,810**	**3,967**	**4,125**	**4,411**	**4,745**
Citation II (550)	13,300	3,257	3,610	3,994	4,407	4,850
Citation Encore	16,630	3,346	3,678	4,045	4,441	4,883
Citation Bravo	14,800	3,585	3,859	4,174	4,537	4,926
Citation Encore Plus	16,830	3,362	3,705	4,075	4,493	4,950
Citation 560 XL	**20,000**	**3,654**	**3,935**	**4,260**	**4,585**	**4,964**
King Air 1900D	17,120	4,260	4,525	4,843	5,197	5,558
Beechjet 400A	16,300	4,328	4,664	5,020	5,399	5,788
Premier 1A	**12,500**	**4,314**	**4,656**	**5,032**	**5,440**	**5,876**
Hawker 4000	39,500	4,465	4,839	5,242	5,702	6,226
Lear 40	21,000	4,440	4,857	5,338	5,907	6,589
Challenger 300	38,850	4,716	5,160	5,626	6,116	6,627
Gulfstream 280	**39,600**	**4,560**	**5,045**	**5,592**	**6,181**	**6,821**
Falcon 900EX	49,200	4,560	5,080	5,640	6,250	6,840
Global 5000	92,500	4,676	5,198	5,746	6,320	6,921
Gulfstream 450	74,600	4,815	5,312	5,840	6,419	7,022
Falcon 7X	70,000	4,725	5,238	5,790	6,386	7,034
Falcon 2000	35,800	5,022	5,434	5,865	6,331	7,203
Gulfstream 100	24,650	5,262	5,835	6,442	7,044	7,639
Embraer 135	49,604	5,648	6,213	6,416	7,229	7,889
Gulfstream 650	99,600	5,214	5,750	6,348	7,070	7,929
Lear 60	23,500	5,573	6,076	6,644	7,293	7,993
Gulfstream 550	91,000	5,036	5,727	6,502	7,322	8,199
Lear 55	21,500	5,751	6,403	7,110	7,873	8,695
Canadair 601-3A/R (Challenger 601)	**45,100**	**5,610**	**6,260**	**6,990**	**7,810**	**8,720**
Citation X	35,700	4,800	5,234	5,739	6,314	O/L
Citation III	21,500	4,611	5,061	5,550	O/L	O/L
Citation I/SP	11,850	3,059	3,326	3,610	O/L	O/L
Citation VII	23,000	4,825	5,163	5,535	5,944	O/L
Citation (525) CJ1	10,600	3,568	4,000	4,432	4,869	O/L
Falcon 10	18,740	4,060	4,490	O/L	O/L	O/L
Falcon 900A	46,500	4,870	5,540	6,320	7,200	O/L
Gulfstream 200	35,450	5,791	6,482	7,245	8,063	O/L
Hawker 800XP	28,000	4,677	5,106	5,629	O/L	O/L
Hawker 1000	31,000	5,820	6,430	7,110	O/L	O/L

Runway length calculation assumptions: 2,313' MSL field elevation; 87.3° ambient temperature
Critical aircraft are in **bold**
MTOW – Maximum Takeoff Weight
O/L – Out of limits for calculation

Source: Ultranav software

Table 27 presents the runway length required for landing under three operational categories: Title 14 Code of Federal Regulations (CFR) Part 25, CFR Part 135, and CFR Part 91k. CFR Part 25 operations are those conducted by individuals or companies operating their own transport category aircraft (non-commercial). CFR Part 91k includes operations in fractional ownership, which utilize their own aircraft under direction of pilots specifically assigned to said aircraft. CFR Part 135 applies to all for-hire charter

operations. Part 91k and Part 135 rules regarding landing operations require operators to land at the destination airport within 60 percent of the effective runway length. An additional rule allows for operators to land within 80 percent of the effective runway length if the operator has an approved destination airport analysis in the airport's program operating manual. The landing length analysis conducted accounts for both scenarios.

Table 27 | Turbine Aircraft Landing Length Requirements

Aircraft Name	MLW	LANDING LENGTH REQUIREMENTS (Feet)					
		Dry Runway Condition			Wet Runway Condition		
		Part 25	80% Rule	60% Rule	Part 25	80% Rule	60% Rule
Citation I/SP	11,350	2,495	3,119	4,158	2,869	3,586	4,782
Global 5000	78,600	2,782	3,478	4,637	3,199	3,999	5,332
Embraer 135	40,785	2,826	3,533	4,710	3,240	4,050	5,400
Falcon 10	17,640	2,899	3,624	4,832	3,334	4,168	5,557
King Air 350	**15,000**	**2,911**	**3,639**	**4,852**	**NA**	**NA**	**NA**
King Air 1900D	16,765	3,029	3,786	5,048	NA	NA	NA
Gulfstream 280	**32,700**	**3,035**	**3,794**	**5,058**	**3,491**	**4,364**	**5,818**
Falcon 7X	62,400	3,071	3,839	5,118	3,531	4,414	5,885
Citation Sovereign	27,100	2,916	3,645	4,860	3,716	4,645	6,193
Falcon 2000	33,000	3,277	4,096	5,462	3,769	4,711	6,282
Hawker 4000	33,500	3,312	4,140	5,520	3,809	4,761	6,348
Lear 40	19,200	2,987	3,734	4,978	3,814	4,768	6,357
Citation (525) CJ1	9,800	3,031	3,789	5,052	4,097	5,121	6,828
Hawker 1000	25,000	3,017	3,771	5,028	4,153	5,191	6,922
Citation CJ3	12,750	3,096	3,870	5,160	4,214	5,268	7,023
Gulfstream 200	30,000	3,669	4,586	6,115	4,219	5,274	7,032
Canadair 601-3A/R (Challenger 601)	**36,000**	**3,540**	**4,425**	**5,900**	**4,248**	**5,310**	**7,080**
Hawker 800XP	23,350	2,792	3,490	4,653	4,251	5,314	7,085
Falcon 900A	42,000	3,700	4,625	6,167	4,260	5,325	7,100
Citation III	19,000	3,116	3,895	5,193	4,404	5,505	7,340
Falcon 900EX	44,500	3,850	4,813	6,417	4,428	5,535	7,380
Citation VII	20,000	3,285	4,106	5,475	4,456	5,570	7,427
Premier 1A	**11,600**	**3,550**	**4,438**	**5,917**	**4,564**	**5,705**	**7,607**
Citation Encore	15,200	3,134	3,918	5,223	4,699	5,874	7,832
Citation (525A) CJ2	11,500	3,283	4,104	5,472	4,754	5,943	7,923
Citation Encore Plus	15,200	3,137	3,921	5,228	4,775	5,969	7,958
Lear 60	19,500	3,799	4,749	6,332	5,084	6,355	8,473
Gulfstream 550	75,300	2,909	3,636	4,848	5,218	6,523	8,697
Challenger 300	33,750	2,734	3,418	4,557	5,240	6,550	8,733
Gulfstream 650	83,500	3,996	4,995	6,660	5,310	6,638	8,850
Beechjet 400A	15,700	3,793	4,741	6,322	5,580	6,975	9,300
Citation X	31,800	3,946	4,933	6,577	5,633	7,041	9,388
Citation 560 XL	**18,700**	**3,535**	**4,419**	**5,892**	**5,636**	**7,045**	**9,393**
Lear 55	18,000	3,548	4,435	5,913	5,676	7,095	9,460
Gulfstream 450	66,000	3,420	4,275	5,700	5,870	7,338	9,783
Citation Bravo	13,500	3,795	4,744	6,325	5,966	7,458	9,943
Gulfstream 100	20,700	3,307	4,134	5,512	6,332	7,915	10,553
Citation II (550)	12,700	2,646	3,308	4,410	6,394	7,993	10,657
King Air C90GTi	9,600	1,474	1,843	2,457	N/A	N/A	N/A
King Air 200 GT	**12,500**	**1,282**	**1,603**	**2,137**	**N/A**	**N/A**	**N/A**
King Air C90B	9,600	1,439	1,799	2,398	N/A	N/A	N/A
Pilatus PC-12	9,921	2,944	3,680	4,907	N/A	N/A	N/A

Runway length calculation assumptions: 2,313' MSL field elevation; 87.3° ambient temperature
Critical aircraft are in **bold**
MLW – Maximum Landing Weight

Source: Ultranav software

The landing length analysis shows that most of the aircraft analyzed can land during dry conditions under Part 25 and Part 91k, as well as many turbine aircraft operating under Part 25 during wet runway conditions. Most of the fleet operating under Part 135 during both wet and dry conditions are unable to land on the existing runway length. Only eight aircraft operating under the 60 percent rule can land at the current length of runway in dry conditions, and no single aircraft can land during wet conditions, according to the analysis.

Runway Length Summary

HDE's available runway length of 4,701 feet on Runway 18-36 can accommodate most of the current and future aircraft at the airport, including small aircraft, turboprops, and a few of the business jets. The existing, future, and ultimate critical aircraft included in the runway length requirement analysis are shown in bold in the tables. The existing critical aircraft (Citation M2), which has similar operating characteristics as a Premier 1A, and the future critical aircraft (King Air 350 and Citation 560 XL) would need a longer runway (between 4,745 feet and 5,876 feet) to take off with full payloads. The ultimate critical aircraft (Gulfstream G280) would need greater than 5,000 feet to take off with 70 percent or greater useful loads, while the Challenger 600/604 needs at least 5,610 feet to take off at 60 percent useful load. In terms of landing, the existing critical aircraft can land during dry conditions under Part 25 or under the 80 percent rule, and in wet conditions under Part 25. The future aircraft (King Air 350 and Citation 560 XL) can land under the 80 percent rule in dry/wet conditions and under the 80 percent rule in dry conditions, respectively. Similar to the future critical aircraft, the ultimate critical aircraft (Gulfstream G280) requires 4,364 feet to land at maximum landing weight on wet pavement under the 80 percent rule, while the Challenger 600/604 is able to land in wet conditions at HDE only under Part 25.

Justification for any runway extension to meet the needs of business jets would require documentation of 500 annual operations by the aircraft or family of aircraft needing the additional length. This is the minimum threshold required to qualify as the runway's critical aircraft to obtain FAA grant funding assistance. With primary Runway 18-36 planned to transition to C-II as more sophisticated aircraft are anticipated to base and operate at the airport in the future, planning will consider extension options up to 7,000 feet in the alternatives section. This would satisfy the runway length needs for most of the critical aircraft to take off at MTOW. The Challenger 600/604 would be able to take off at up to an 80 percent useful load and land within the 80 percent rule for part 135 operations. Additionally, the Citation 560 XL would also be subject to landing weight limitations when operating under Part 135.

Turf Runway 11-29 has a length of 2,350 feet and is used exclusively by small aircraft. The current length of the turf runway is adequate for these types of aircraft; however, extension options will be examined in the Alternatives section for discussion purposes.

RUNWAY WIDTH

Runway width design standards are based primarily on the airport's critical aircraft but can also be influenced by the visibility minimums of published instrument approach procedures. Runway 18-36 is 75 feet wide, which exceeds the existing RDC B-I-5000 design standard of 60 feet but meets the future

design standard (RDC B-II-4000). In the ultimate condition, Runway 18-36 is recommended to be widened to 100 feet to meet RDC C-II-4000 design standards. Runway 11-29 is 300 feet wide, which exceeds the RDC A-I(s) design standard of 60 feet; however, this width should be maintained for the duration of the planning period, if feasible, for the added safety it provides. It should be noted that if the turf runway were ever to be relocated or paved in the future, it should be planned to meet the design standard of 60 feet.

RUNWAY PAVEMENT STRENGTH

Airport pavements must be able to withstand repeated operations by aircraft of significant weight; therefore, the strength rating of a runway is an important consideration in facility planning. While runways are assigned a specific strength rating, it does not preclude aircraft weighing more than the published strength rating from using the runway. All federally obligated airports must remain open to the public, and it is typically up to the pilot of the aircraft to determine if a runway can support their aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. On the other hand, the airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway, typically for 20 years. According to the FAA publication, *Airport/Facility Directory*, "Runway strength rating is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights in excess of the published figures." The directory goes on to say that those aircraft exceeding the pavement strength should contact the airport sponsor for permission to operate at the airport.

As detailed in the Inventory section, a recent pavement evaluation determined that the strength rating for Runway 18-36 is 30,000 pounds for aircraft with single wheel main landing gear configuration (SWL). This strength is sufficient for all small aircraft and some light turbine aircraft, including the Beechcraft King Air family of aircraft and smaller business jets. The ultimate critical aircraft, the Gulfstream G280 and Challenger 600/604, have maximum takeoff weights ranging between 39,600 pounds and 48,300 pounds on dual wheel main landing gear (DWL) configuration. An evaluation of the pavement strength should be made to determine the existing runway's DWL strength. If it is found to be less than 50,000 pounds DWL, it is recommended that the runway be strengthened to accommodate these aircraft when they begin to operate more frequently.

RUNWAY/TAXIWAY SEPARATION

The design standard for the separation between runways and parallel taxiways is a function of the critical aircraft and the instrument approach visibility minimum. The separation standard for existing RDC B-I with not lower than 1-mile visibility minimums is 225 feet from the runway centerline to the parallel taxiway centerline. When the airport transitions to an RDC B-II with not lower than ¾-mile visibility minimums in the future condition, the separation increases to 240 feet from the runway centerline to the parallel taxiway centerline. In the ultimate RDC C-II-4000 condition, the runway to taxiway separation increases to 300 feet, centerline to centerline.

Currently, parallel Taxiway A is separated from Runway 18-36 by 300 feet, exceeding the requirement for the existing and future condition. In the ultimate condition this separation meets the design standard for C-II-4000, and therefore should be maintained.

HOLDING POSITION SEPARATION

Holding position markings are placed on taxiways leading to runways. When approaching the runway, pilots should stop short of the holding position marking line. FAA design standards call for hold lines to be 200 feet from runway centerline for B-I and B-II runways with approach minimums no lower than 1-mile or not lower than ¾-mile, and 250 feet from runway centerline for C-II runways with approach minimums not lower than ¾-mile. The FAA also recommends that hold lines be parallel with the runway so that a pilot is fully perpendicular to the runway with a clear, unobstructed view of the entire runway length.

At HDE, all hold lines leading to Runway 18-36 are 200 feet from the runway centerline, which meets both the existing and future condition. When the airport transitions to the ultimate C-II-4000 condition, the holding position markings should be relocated meet the design standard of 250 feet.

AIRCRAFT PARKING APRON SEPARATION

According to FAA AC 150/5300-13B, aircraft parking positions should be located to ensure that aircraft components (tail, wingtip, nose, etc.) do not:

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

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

There are two designated aircraft parking areas at HDE, both located on the west side of Runway 18-36. The first apron is located adjacent to Holdrege Aviation and includes a total of eight marked aircraft tiedown parking positions. The second apron is located north of Wells Flying Service and provides three aircraft parking positions.

Figure 9 depicts these aprons, along with the existing, future, and ultimate ROFA, TOFA, and TLOFA (TOFA and TLOFA standards are described in greater detail in the next section). As pictured in the graphic, the existing aircraft parking positions are clear of the TOFA and TLOFA; however, there are four parking positions located within the ultimate ROFA. As described previously, aircraft parked in this area would become obstructions to the ROFA; therefore, these marked positions should be removed/relocated.

Figure 9 – Apron Separation

TAXIWAYS

The taxiway system of an airport functions primarily to facilitate aircraft movements to and from the runway system. While some taxiways are constructed to simply provide access from the apron to the runway, other taxiways are constructed to increase the allowable frequency of aircraft operations as air traffic increases. The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the Airplane Design Group (ADG) of the critical aircraft. As determined previously, the applicable ADG for Runway 18-36 under the existing condition is ADG I; and under the future and ultimate conditions, it is ADG II. **Table 28** presents the various taxiway design standards related to ADG I and ADG II.

TABLE 28 | Taxiway Dimensions and Standards

STANDARDS BASED ON WINGSPAN	*ADG I*	*ADG II*
Taxiway Protection		
Taxiway Safety Area width (feet)	49	79
Taxiway Object Free Area width (feet)	89	124
Taxilane Object Free Area width (feet)	79	110
Taxiway Separation		
Taxiway Centerline to:		
Fixed or Movable Object (feet)	44.5	62
Parallel Taxiway/Taxilane (feet)	70	101.5
Taxilane Centerline to:		
Fixed or Movable Object (feet)	39.5	55
Parallel Taxilane (feet)	64	94.5
Wingtip Clearance		
Taxiway Wingtip Clearance (feet)	20	22.5
Taxilane Wingtip Clearance (feet)	15	15.5
STANDARDS BASED ON TDG	*TDG 1A*	*TDG 2A**
Taxiway Width Standard (feet)	25	35
Taxiway Edge Safety Margin (feet)	5	7.5
Taxiway Shoulder Width (feet)	10	15

ADG: Airplane Design Group
TDG: Taxiway Design Group
* Based on the Beechcraft King Air 200/300/350

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

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the main gear width (MGW) and cockpit to main gear (CMG) distance of the critical aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards based on usage.

The current taxiway design for Runway 18-36 is TDG 1A. In the future and ultimate condition, the TDG is 2A, which supports aircraft such as the Beechcraft King Air 200/300/350. As such, the taxiways supporting Runway 18-36 should be at least 35 feet wide. Currently, most taxiways are 35 feet wide, meeting the design standard, with the exception of the 50-foot-wide connector to Runway 18 and the 30-foot-wide taxiway that connects to the main apron. The 30-foot taxiway connector should be planned to meet the 35-foot width. The 50-foot-wide taxiway connector leading to Runway 18 should maintained at its existing width, if feasible, with the understanding that the FAA may not participate in funding pavement maintenance on the additional width.

Taxiway Design Considerations

FAA AC 150/5300-13B, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft."

The taxiway system at HDE generally provides for the efficient movement of aircraft; however, AC 150/5300-13B, *Airport Design*, provides recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation:

1. **Taxi Method** – Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading of existing intersections should be undertaken to eliminate "judgmental oversteering." This is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.
2. **Curve Design** – Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.
3. **Three-Path Concept** – To maintain pilot situational awareness, taxiway intersections should provide a pilot with a maximum of three choices of travel. Ideally, these are right- and left-angle turns and a continuation straight ahead.
4. **Channelized Taxiing** – To support visibility of airfield signage, taxiway intersections should be designed to meet standard taxiway width and fillet geometry.
5. **Designated Hot Spot and Runway Incursion Mitigation (RIM) Locations** – A hot spot is a location on the airfield with elevated risk of a collision or runway incursion. For areas the FAA designates as a hot spot or RIM location, mitigation measures should be prioritized.
6. **Intersection Angles** – Design turns to be 90 degrees wherever possible. For acute-angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

7. **Runway Incursions** – Design taxiways to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three-node" concept.
   - *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
   - *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
   - *Avoid "High Energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
   - *Increase Visibility*: Right-angle intersections, both between taxiways and runways, provide the best visibility. Acute-angle runway exits provide greater efficiency in runway usage but should not be used as runway entrance or crossing points. A right-angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
   - *Avoid "Dual Purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
   - *Direct Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
   - *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

8. **Runway/Taxiway Intersections**
   - *Right Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for an acute-angled exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so that they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage. The construction of high-speed exits is typically only justified for runways with regular use by jet aircraft in approach categories C and above.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.

9. **Taxiway/Runway/Apron Incursion Prevention** – Apron locations that allow direct access onto a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.

- *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and make lighting and marking more difficult.
- *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
- *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

The existing taxiway system at HDE consists of a full-length parallel taxiway, designated Taxiway A. Taxiway A is 35 feet wide, which exceeds the existing TDG 1A standard of 25 feet but meets the future/ultimate TDG 2A width standards. Taxiway A has a separation distance of 300 feet from the Runway 18-36 centerline. Four connectors serve as exits and connect to the runway at right angles. While the existing taxiway system is generally efficient, there are nonstandard conditions that should be addressed. These are:

- **Direct access** – Direct access from the aircraft parking apron is provided via two taxiways, which leads from apron areas to the runway.
- **Taxiway fillets** – Taxiway fillets are areas of additional pavement designed to maintain the taxiway edge safety margin (TESM) by widening taxiways at the inside of turns. The fillets on the turns of each of the connector taxiways do not meet design standards.

The alternatives in the next section of this study will evaluate different options for correcting these nonstandard conditions.

HOLDING BAY

Holding bays provide an area for aircraft to pull off a taxiway and prepare for departure, while allowing other aircraft that are ready for departure to bypass the holding aircraft. By standard, hold bays should be located at the end of parallel taxiways as close to the runway threshold as possible. They should not extend beyond the lateral edge of the runway threshold to ensure clear safety surfaces surrounding and leading to runways. In addition, each parking area should be independent, with the ability for aircraft to bypass others, both on entrance and exits. The end of Runway 18 has a dedicated area for aircraft to bypass one another; however, it is a nonstandard design and should be reconfigured to meet updated FAA design standards.

INSTRUMENT APPROACH CONSIDERATIONS

Approach minimums should be as low as practical considering possible safety constraints. The best approach minimums practical will ultimately allow aircraft to operate in reduced visibility conditions, while increasing the operational safety and airport capacity.

Currently, HDE has an LPV (GPS) instrument approach providing the lowest visibility minimums down to one mile on both ends of Runway 18-36. This system allows properly equipped aircraft to navigate to each end of the primary runway in reduced visibility conditions. Lower visibility minimums are typically warranted at general aviation airports with a significant level of air taxi and corporate aviation activity and in locations that experience a high level of instrument flight rule (IFR) weather. Certain operations of turbine aircraft, such as some air taxi operators or corporate entities, have policies that require airports to have visibility minimums lower than one mile for them to operate at an airport. IFR weather conditions at HDE account for approximately nine percent of total weather observations collected by the on-site AWOS equipment.

With local businesses considering basing business jets, including those in the Citation family of jets, at HDE, and additional jets projected to base in the future, the airport should consider implementing an LPV (GPS) approach with visibility minimums down to ¾-mile. Prevailing winds at HDE tend to favor the use of Runway 36. It should be noted that Runway 36 does pose surrounding constraints with Highway 6/34, while Runway 18 has a lack of constraining factors. GPS-based LPV approaches do not require the installation of on-site equipment, such as an approach lighting system (ALS), so there is minimal cost to the airport in implementing this type of approach. The greatest impact is on the size of the corresponding RPZ, which would increase if a ¾-mile approach were to be implemented. The alternatives will consider a ¾-mile instrument approach to both ends of Runway 18-36.

Turf runways typically are not compatible with instrument approach procedures; therefore, no consideration is given to establishing instrument approach procedures to Runway 11-29 as long as it remains a turf runway.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Both ends of Runway 18-36 at HDE are equipped with a two-light PAPI that provides pilots with an indication of being above, below, or on the correct descent glidepath. As more turbine aircraft begin to operate at the airport, consideration should be given to upgrading the PAPI-2 on Runway 18-36 to a PAPI-4. There are no visual approach aids available at either end of Runway 11-29 and, as a turf runway, none are recommended.

Runway end identification lights (REILs) are flashing lights located at the runway threshold that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway threshold and distinguish runway end lighting from other lighting on the airport and in the approach areas. REILs are present on both ends of Runway 18-36 and should be planned to be maintained. As a turf runway intended for use by small aircraft, REILS are not recommended for Runway 11-29.

Airfield Marking, Lighting, and Signage

Runway 18-36 has non-precision runway markings, which is consistent with the available instrument approach capabilities of the runway. These markings should be maintained throughout the planning horizon.

Runway 11-29 is a turf runway and, therefore, is not equipped with markings. The runway is designated by boundary cones; however, it is recommended that the runway threshold be identified with a strip of concrete pavement measuring 60 feet wide and 10 feet long, painted white.

Runway and taxiway lighting systems serve as a primary means of navigation in reduced visibility and nighttime operations. Currently, Runway 18-36 is equipped with medium intensity runway lighting (MIRL), a common runway lighting system that can be activated via a pilot-controlled system. This system should be maintained through the planning period. The taxiway system is equipped with blue medium intensity taxiway lighting system (MITL). The airport can also consider the installation of a low intensity runway lighting system (LIRL) for the turf runway; however, the cost of installing such a system usually outweighs any benefit received due to the limited usage of the turf runway.

Airfield signage serves as another means of navigation for pilots. Airfield signage informs pilots of their location on the airport, as well as directs them to major airport facilities, such as runways, taxiways, and aprons. Currently, the airport is not equipped with an airfield signage system. At a minimum, consideration should be given to implementing location signage, which provides information on where the aircraft is on the airfield.

Weather Facilities

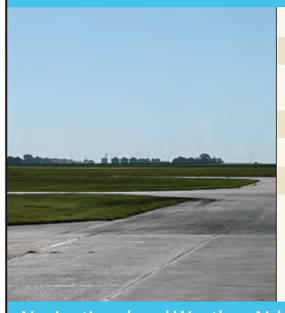
HDE is equipped with a lighted wind cone and segmented circle east of Runway 18-36 and south of Runway 11-29. The wind cone provides pilots with information about wind conditions, while the segmented circle provides traffic pattern information to pilots. The wind cone is located approximately 210 feet from the runway pavement edge, putting it inside the Runway 18-36 ROFA in the ultimate condition. As detailed previously, consideration should be given to relocating the wind cone outside the ultimate ROFA.

The airfield is also equipped with an automated weather observation system (AWOS), which transmits on-site weather condition information to pilots. The AWOS should be maintained in its existing location.

Airside facility requirements are summarized on **Exhibit 18**.

AIRFIELD ALTERNATIVES

Several non-standard conditions exist at HDE, as detailed in the previous sections. Three airfield alternatives were developed to address these non-standard conditions. These alternatives are described below and presented graphically on the next three exhibits.

		Existing	Future	Ultimate	Existing	Future/Ultimate
Runways		18-36	01-19	01-19	11-29	12-30
	Runway Design Code (RDC)	B-I-5000	B-II-4000	C-II-4000	A-I(s)-VIS	A-I(s)-VIS
	Dimensions	4,701 x 75'	Consider extension	Consider extension; increase width to 100'	Consider extension	Consider extension
	Pavement Strength	30,000 lbs. SWL	Maintain	Maintain; 50,000 lbs. DWL	-	-
Safety Areas						
	RSA	Fully contained within airport property	Fully contained within airport property	Acquire uncontrolled property; hold bay obstructs ultimate RSA - mitigation measure required	Fully contained within airport property	Fully contained within airport property
	ROFA	Fully contained within airport property	Fully contained within airport property; hold bay obstructs future ROFA	Acquire uncontrolled property; wind cone and four aircraft parking positions obstructs ultimate ROFA - mitigation measures required	Fully contained within airport property	Fully contained within airport property
	ROFZ	Fully contained within airport property	Fully contained within airport property	Fully contained within airport property	Fully contained within airport property	Fully contained within airport property
	RPZ	A portion of the Runway 36 RPZ is uncontrolled; Highway 6/34 is located within the RPZ - mitigation measures may be necessary.	A portion of the Runway 01 RPZ is uncontrolled; Highway 6/34 and a building structure are located within the RPZ – mitigation measures may be necessary.	A portion of the Runway 01 and Runway 19 RPZ is uncontrolled; Highway 6/34 and a building structure are located within the Runway 01 RPZ – mitigation measures may be necessary.	A portion of the Runway 29 RPZ is uncontrolled; Highway 6/34 is located within the RPZ - mitigation measures may be necessary.	A portion of the Runway 30 is uncontrolled; Highway 6/34 is located within the RPZ - mitigation measures may be necessary.
Taxiways						
	Design Group	1A	2A	Maintain	-	-
	Parallel Taxiway	Taxiway A	Maintain	Maintain	-	-
	Parallel Taxiway Separation from Runway	300'	Maintain	Maintain	-	-
	Widths	35'	Maintain	Maintain	-	-
	Connecting Taxiway Width	30'- 50'	35'	Maintain	-	-
	Holding Position Lines	200'	Maintain	250'	-	-
	Notable Conditions	Direct access from apron; nonstandard fillets; nonstandard hold bay	Consider corrective measures	Consider corrective measures	-	-
Navigational and Weather Aids						
	Instrument Approaches	LPV GPS (1-mile visibility Runway 18-36)	Consider 3/4-mile Approach Runway 01-19	Maintain	-	-
	Approach Aids	PAPI-2; REILs	Upgrade to PAPI-4s; Maintain REILs	Maintain	None	Maintain
Lighting and Marking						
	Runway Lighting	MIRL	Maintain	Maintain	None	Consider LIRL
	Runway Marking	Non-precision	Maintain	Maintain	Boundary cones	Maintain; designate threshold
	Taxiway Lighting	MITL	Maintain	Maintain	-	-
	Runway/Taxiway Signage	No signage	Install location and directional signs	Maintain	No signage	Add Runway 12-30 signage

KEY

DWL - Dual Wheel Loading
GPS - Global Positioning System
LIRL - Low Intensity Runway Lighting
LPV - Localizer Performance With Vertical Guidance
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
REIL - Runway End Identifier Lights
ROFA - Runway Object Free Area
ROFZ - Obstacle Free Zone
RPZ - Runway Protection Zone
RSA - Runway Safety Area
PAPI - Precision Approach Path Indicator
SWL - Single Wheel Loading
VIS - Visual

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AIRFIELD ALTERNATIVE 1

Airfield Alternative 1, depicted on **Exhibit 19**, considers the airfield modifications necessary to correct the nonstandard features in the existing and future condition, as well as an extension to Runway 18. Under this scenario, which is reflective of the future condition, the following actions would be planned:

- ***Runway 18-36 re-designation to Runway 01-19***. This alternative and the two to follow show an update to the runway designation. As described in the previous section, it is recommended that Runway 18-36 be re-designated as Runway 01-19 due to the magnetic declination in the area. This project can be planned to coincide with another runway project, such as pavement rehabilitation or reconstruction, that would necessitate re-marking of the runway. While updating the designation is recommended and presented on each alternative, the runway will continue to be referred to as Runway 18-36 to maintain consistency in discussion and eliminate potential confusion.

- ***799' extension on Runway 18-36 and Taxiway A***. The Runway 18 end is proposed to be extended by 799 feet to the north, bringing the total runway length to 5,500 feet. At this length, the Citation 560 and Gulfstream 280 could take off at 100 and 70 percent useful loads, respectively. The Gulfstream 280 could land in wet or dry conditions when operating under Part 25 or 91k, and Challenger 601 could land in wet or dry conditions under Part 25 but would be restricted for Part 135 operations. The area north of the extended Runway 18 end would need to be cleared and graded to meet the expanded RDC B-II-5000 RSA design standard. With this extension, Taxiway A is proposed to be extended by 799 feet, with additional MIRL and MITL installed on the new runway/taxiway pavement. The PAPI system and REILs on Runway 18 would be relocated with this proposed extension. In addition, the existing PAPI-2 on both runway ends are planned to be upgraded to PAPI-4. The runway extension would require terrain fill prior to construction and the RSA to be filled to meet RSA design standards.

- ***Acquire property within the Runway 18-36 RSAs and RPZs***. With the proposed 799-foot runway extension, the Runway 18 RSA, ROFA, ROFZ, and RPZ would also shift and extend farther beyond the current airport property line, encompassing approximately 2.3 acres, 2.2 acres, 3.2 acres, and 11.5 acres, respectively, of property not owned by the airport. The airport should obtain the property within the RSAs and at a minimum an easement within the RPZ in order to protect these safety areas. In addition, when the taxiway is extended to meet the Runway 18 extension, approximately 4.1 acres of airport property should be acquired.

  The Runway 36 RPZ extends beyond airport boundaries and encompasses approximately 1.4 acres of uncontrolled property that includes a portion of Highway 6/34. Because most of the uncontrolled RPZ contains the highway and its associated right-of-way, there are existing limitations on what types of activities or uses are permitted in this area. However, as outlined previously, the road itself may be considered an incompatible land use within an RPZ, but since the size of the Runway 36 RPZ is not projected to increase, it is unlikely that the FAA would require any action to be taken regarding control over this area.

- ***Shift Runway 11-29 170 feet southeast to clear RSA.*** This option considers shifting Runway 11-29 to the southeast, which would be accomplished by extending Runway 29 by 170 feet and removing 170 feet of turf on the Runway 11 end. At this distance, the RSA associated with Runway 11 would be clear of the Runway 18-36 RSA in the future B-II-5000 condition, and the runway would remain at 2,350 feet long. In addition, this alternative considers the installation of low intensity runway lighting (LIRL) system on the turf runway.

- ***Acquire easement of property within the Runway 11-29 RPZs***. The 170-foot shift of Runway 11-29 also results in a shift of each of the RPZs at the runway ends. At the Runway 29 end, the uncontrolled portion of the RPZ encompasses approximately 0.7 acres. Like the Runway 36 RPZ, this is property that extends over Highway 6/34, so no action is recommended for control of this portion of property. This alternative proposes acquisition of this property fee simple or through easement in order to protect this safety area.

- ***Install no-taxi island on the south apron.*** To eliminate the direct access that currently exists via the taxiway connecting the south aircraft apron to Runway 18-36, a no-taxi island is proposed to be installed. No-taxi islands are turf or painted markings that force pilots taxiing on the apron to make a turn before entering the runway environment, reducing the risk for incursions.

- ***Remove taxilane connector.*** A taxilane connecting from the north apron to Taxiway A provides direct access to Runway 18-36, which is considered non-standard. To resolve this issue, this taxilane connector is proposed to be removed.

- ***Remove/relocate non-standard holding bay.*** The existing holding bay does not meet FAA design standards and, therefore, is planned to be removed. A new hold bay reflective of FAA's updated standards is proposed to be constructed near the extended Runway 18 threshold. This standard design consists of clearly marked entrance/exits with independent parking areas that are either separated by islands or are clearly marked with centerlines to allow aircraft to safely bypass each other.

- ***Increase taxiway connector width.*** Currently, the second taxiway connector from the Runway 36 end measures 30 feet in width, which does not meet taxiway width standards for TDG 2A. This alternative includes a proposed plan to widen the taxiway connector to 35 feet to meet this standard.

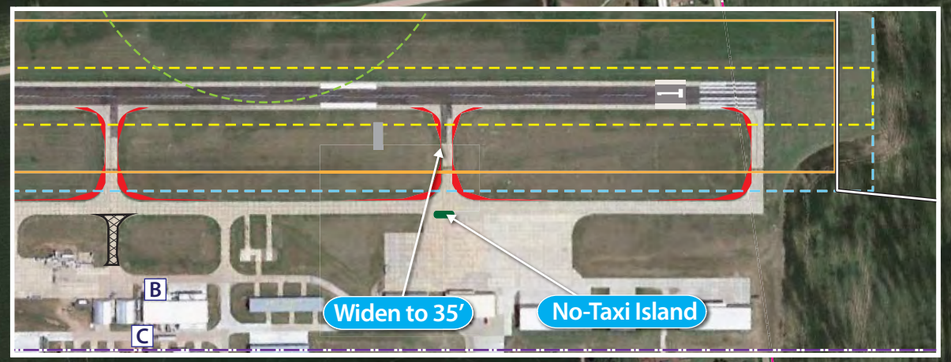
- ***Expand taxiway fillets.*** Additional taxiway fillet pavement, dimensioned to meet TDG 2A design standards, is proposed to provide an added safety margin for taxiing on the airfield.

- ***Add airfield signage.*** Currently, the airport is not equipped with an airfield signage system. This alternative proposes the installation of location signage, which provides information on where the aircraft is on the airfield.

Runway 18-36- RDC B-II-5000
Runway 11-29- RDC A-I(small)-VIS

LEGEND

- Airport Property Line
- Future Property Line
- Existing Easement
- Taxiway Designator
- Taxilane Designator
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Property to be Protected/Acquired
- Property to be Acquired
- AWOS Critical Area
- No-Taxi Island
- Ultimate Pavement
- Pavement to be Removed



N
0 600
SCALE IN FEET
Photo date: 8/2022

Public Road in RPZ
0.7 Acres
Visual approach RPZ
Add LIRL
18th Ave
170' Shift to the east
Ultimate Runway 12-30 (2,350' x 300')
6
1-mile RPZ
799' Extension
Upgrade to PAPI-4
Relocate REILs
2.3 Acres RSA
11.5 Acres
Runway 18-36 (4,701' x 75')
Ultimate Runway 01-19 (5,500' x 75')
3.2 Acres ROFZ
2.2 Acres ROFA
4.1 Acres
Remove Non-standard Hold Bay
Standard Holding Bay
Turf Runway 11-29 (2,350' x 300')
500'
Upgrade to PAPI-4
1-mile RPZ
Public Road in RPZ
1.4 Acres
Airport Access Road
Brewster Road
Visual approach RPZ

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AIRFIELD ALTERNATIVE 2

Airfield Alternative 2 is based upon future RDC B-II-4000 design standards. It should be noted that this alternative shows a comparison of the Runway 36 RPZs associated with the existing 1-mile GPS approach and the future ¾-mile approach in the future condition. Depicted on **Exhibit 20**, this alternative evaluates a second set of options to correct the nonstandard features on the airfield. Under this scenario, the following actions would be planned:

- ***1,599' extension on Runway 18-36 and Taxiway A***. The Runway 18 end is extended by 1,599 feet to the north, bringing the total runway length to 6,300 feet. At this length, the future critical aircraft (Citation 560 XL) would be able to land when operating under Part 135 as well as 100 percent of the fleet at 60 percent useful load. The area north of the existing Runway 18 end will need to be cleared to meet the RSA design standard when the airport transitions to RDC B-II-4000. With this extension, Taxiway A and MIRL would have to be extended by 1,599 feet.

- ***280' displaced threshold on Runway 36 end.*** Alternative 2 examines a different approach to mitigating RPZ incompatibilities on Runway 36 end. There are several options for mitigating this non-standard condition, but the least impactful to the surrounding road network or to the runway itself (i.e., pavement removal to physically shorten the runway), is the application of declared distances. Declared distances are used to define the effective runway length for landing and takeoff when a standard safety area cannot be achieved. The declared distances include:

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

    Displacing the Runway 36 threshold by 280 feet resolves the incompatible land use in the RPZ (Highway 6/34) beyond the Runway 36 end if the airport was to keep the existing 1-mile approach. As a result, it would also reduce the amount of property necessary to be acquired/controlled to protect the RPZ and eliminate the potential of having to reroute Highway 6/34. If the airport were to obtain a ¾-mile approach on the Runway 36 end, a portion of the RPZ would slightly shift more within the airport property and remove the building obstruction. However, it would still encompass Highway 6/34, and an easement of 11.5 acres would be recommended. With these declared distances in place, the usable length of the runway would be lessened for some operations. While all takeoff operations (with the exception of a rejected takeoff from Runway 18) would have the full 6,300 feet of pavement available, landing operations to both runway ends are impacted with 6,020 feet available for landing operations on

Runway 36, as detailed on **Table 29** and **Exhibit 20**. Airside Alternative 2 poses minimal impact in terms of earthwork and construction and fully meets FAA design standards for RPZ; however, the obvious drawback is that it reduces usable runway length during certain operations, potentially making it more restrictive to business jets.

TABLE 29 | Declared Distances for Alternative 2

Parameters	Runway 18	Runway 36
Takeoff Run Available (TORA)[1]	6,020’	6,300'
Takeoff Distance Available (TODA)[2]	6,300'	6,300'
Accelerate Stop Distance Available (ASDA)[3]	6,300'	6,300'
Landing Distance Available (LDA)[3]	6,300'	6,020'

[1] Departure RPZ begins 200 feet from the end of the TORA.
[2] TORA cannot be longer than TODA. Departure surface is set on TODA. TODA can be shortened to mitigate departure surface penetrations; if so, TORA is shortened, too.
[3] Available runway length plus RSA. Approach RPZ begins 200 feet from the landing threshold.

Source: FAA AC 150/5300-13B, Airport Design; Coffman Associates analysis

- ***Acquire RSAs, RPZ on Runway 18 end.*** With the 1,599-foot extension to the north, it would shift the Runway 18 RSA, ROFA, ROFZ, and RPZ beyond the current airport property line, encompassing approximately 5.4 acres, 4.2 acres, 7.8 acres, and 12.5 acres respectively, of property not owned by the airport. The airport should acquire this property in order to protect this safety area. In addition, when the taxiway is extended to meet the runway extension, approximately 9.3 acres of airport property should be acquired.

- ***Shift Runway 11-29 170’ east to clear RSA and extend.*** This option considers shifting Runway 11-29 to the east, which would be accomplished by extending Runway 29 by 170 feet and removing 170 feet of turf on the Runway 11 end. At this distance, the RSA associated with Runway 11 would be clear of the Runway 18-36 RSA in the future B-II-4000 condition. In addition to the shift, this alternative will plan to extend the turf runway by 600 feet to the east.

- ***Acquire easement of 2.6 acres of RPZ on Runway 29 end***. With the 170-foot shift of Runway 11-29 it would also shift the RPZ slightly further encompassing a total of 2.6 acres outside of airport property line. The airport should acquire this property in order to protect this safety area. In addition, Highway 6/34 beyond the Runway 29 end is considered to be an incompatible land use for the RPZ by the FAA; however, since there is no change in size of the RPZ, the sponsor may elect to allow them to remain.

- ***Remove taxiway connector.*** Instead of the addition of a no taxi-island as shown on Alternative 1, this alternative mitigates the direct access with the removal of the taxiway connector.

- ***Remove/relocate taxilane connector.*** Similar to the previous alternative, this alternative also plans to correct the non-standard condition with the removal of the taxilane connector; however, under this scenario, it to be relocated south of its existing location.

- ***Increase taxiway connector width.*** Currently the 2nd taxiway connector from the Runway 36 end measures 30 feet in width, which does not meet FAA design standards. This alternative includes a proposed plan to widen the taxiway connector to 35 feet to meet design standards for TDG 2A.

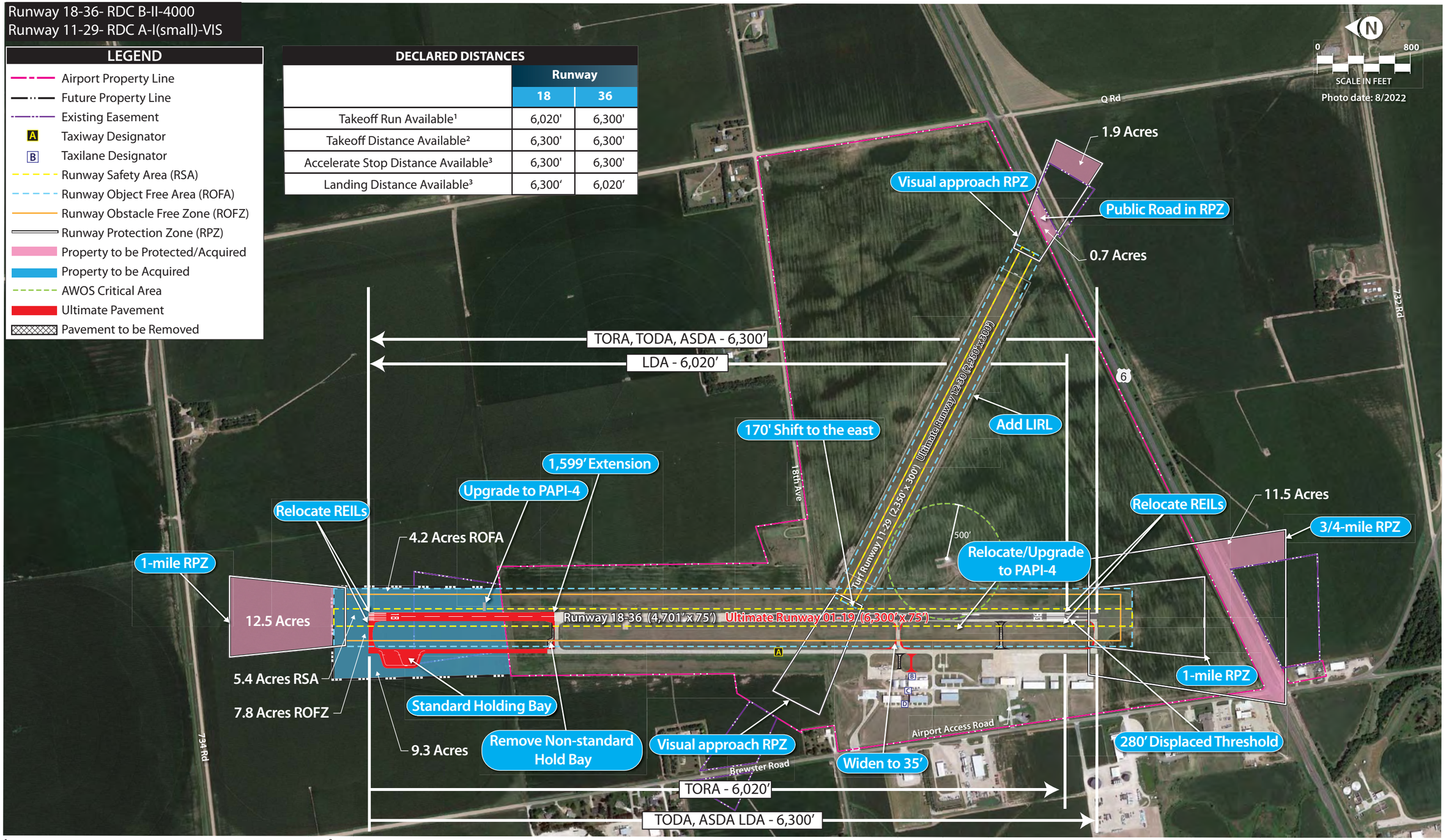
Runway 18-36- RDC B-II-4000
Runway 11-29- RDC A-I(small)-VIS

LEGEND

- Airport Property Line
- Future Property Line
- Existing Easement
- Taxiway Designator
- Taxilane Designator
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Property to be Protected/Acquired
- Property to be Acquired
- AWOS Critical Area
- Ultimate Pavement
- Pavement to be Removed

DECLARED DISTANCES

	Runway	
	18	36
Takeoff Run Available[1]	6,020'	6,300'
Takeoff Distance Available[2]	6,300'	6,300'
Accelerate Stop Distance Available[3]	6,300'	6,300'
Landing Distance Available[3]	6,300'	6,020'



[1] Departure RPZ begins 200 feet from the end of the TORA.
[2] TORA cannot be longer than TODA. Departure surface is set on TODA. TODA can be shortened to mitigate departure surface penetrations; if so, TORA is shortened, too. If present, a clearway is included in the TODA.
[3] Available runway length plus RSA. Approach RPZ set 200 feet from the landing threshold.

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Additional features on Airside Alternative 2 include:

- Relocate PAPI's and REIL's on Runway 18-36
- Upgrade PAPI-2s to PAPI-4s on Runway 18-36
- Change Runway Designation
- Fill RSA on the extended Runway 18
- Remove/Relocate non-standard holding bay
- Add Taxiway Fillets
- Add Runway/Taxiway Signage

AIRFIELD ALTERNATIVE 3

Airfield Alternative 3, depicted on **Exhibit 21**, is based upon ultimate C-II-4000 design standards. It should be noted that this alternative shows a comparison of the Runway 18 and Runway 36 RPZs associated with the existing 1-mile GPS approach and the ultimate ¾-mile approach in the ultimate condition. This alternative considers a new runway orientation for the crosswind runway to mitigate RPZ incompatibilities, reduce the need for easement on the Runway 29 end, and maximize the future development on the east side of the airport. As stated in the previous section, in all weather conditions, no single runway provides 95 percent coverage for wind coverage at 10.5 knots, therefore a crosswind runway is justified. Currently at 10.5 knots Runway 11-29 provides 85.51 percent, and at 13 knot conditions, provides 91.73 percent. Under this alternative, a new turf runway would be planned. To determine the best alignment for the proposed runway as well as consider the advantages and disadvantages. All potential runway headings were evaluated to determine all weather wind coverage, as illustrated on **Exhibit 22**. Of these, a heading of 12/30 was considered to be the least impactful to Highway 6/34, while taking advantage of as much existing airport property as possible. This alignment provides 84.23 percent coverage in 10.5-knot wind conditions, and 90.77 percent in 13-knot wind conditions which would diminish the wind coverage by 1.3 percent; however, when combined with the primary Runway 18-36, the wind coverage is still greater than 95 percent. When the new turf runway is constructed, the runway will be planned to be 60 feet in width to meet the A-I(s) design standard. The following primary actions would be planned with this alternative, which is depicted on **Exhibit 21**.

- ***Pavement to be Removed on Runway 36 End***. Runway 18-36 is planned to be reduced by 271 feet on the Runway 36 end to bring the ROFA onto airport property, as well as remove the obstruction located within the RPZ.

- ***2,570' extension on Runway 18-36 and Taxiway A***. The Runway 18 end is extended by 2,570 feet to the north, bringing the total runway length to 7,000 feet. As discussed previously in Alternative 2 this length would be less restrictive on the Gulfstream 280, Challenger 601, and the Citation 560 during landing and takeoff operations. The area north of the existing Runway 18 end will need to be cleared and graded to meet the RSA design standard when the airport transitions to RDC C-II-4000. With this extension a new taxiway connector will be planned at the Runway 18 threshold. In conjunction with this project, Runway 18-36 will be changed to Runway 01-19. This alternative features an increase in runway pavement strength to 50,000 pounds DWL to accommodate the ultimate critical aircraft, the Gulfstream G280 and Challenger 600/604.

- ***Acquire RSAs and RPZ on Runway 18 and Runway 36 end***. With the 2,570-foot extension and a lower approach it would shift the Runway 18 RSA, ROFA, ROFZ, and RPZ beyond the current airport property line, encompassing approximately 21.7 acres, 21.9 acres, 14.8 acres, and 43.8 acres, respectively, of property not owned by the airport. In addition, when the taxiway is extended to meet the Runway 18 extension, approximately 7.1 acres of airport property extends off airport property. With a lower approach on the Runway 36 end, the RPZ would encompass a larger portion of the RPZ for a total of 11.5 acres. The airport should acquire this property in order to protect this safety area. The 734 Rd is also encompassed within the RPZ and will be rerouted outside of the RPZ.

- ***Ultimate Runway Length for Runway 12-30.*** When the new turf runway is relocated, the ultimate runway length will be 2,550 feet, and the width will be 60 feet to meet the A-I(small) design standard.

- ***Remove/relocate taxiway connectors.*** The second and third taxiway connectors from the 36 end ultimately run directly from the apron to Runway 18-36. To correct these non-standard conditions, this alternative proposes both of the taxiway connectors to be removed/relocated north of their existing locations.

- ***Relocate Wind Cone and Aircraft Parking Positions***. When the airport transitions to an RDC C-II-4000, the safety areas will increase in size. The lighted wind cone and segmented circle located on the east side of Runway 18-36 and south side of Runway 11-29 obstruct the ROFA in the ultimate condition and should be relocated to a point outside the ROFA. This alternative plans for the wind cone to move north of Runway 11-29 near the Runway 11 end. In addition, four existing aircraft parking positions will be removed as they are located in the ultimate ROFA.

Additional features on Airside Alternative 3 include:

- Taxiway A Extension and MIRL
- Relocate PAPI and REIL
- Upgrade PAPI-2s to PAPI-4s on Runway 18-36
- Change Runway Designation
- Fill/Grade RSA on the extended Runway 18
- Remove/Relocate non-standard holding bay
- Add Taxiway Fillets
- Add Runway/Taxiway Signage

LANDSIDE FACILITY REQUIREMENTS

Elements included within this section include general aviation terminal facilities, aircraft hangars and tiedowns, aircraft parking aprons, automobile parking, and airport support facilities.

Runway 18-36- RDC C-II-4000
Runway 11-29- RDC A-I(small)-VIS

LEGEND

- Airport Property Line
- Future Property Line
- Existing Easement
- Taxiway Designator
- Taxilane Designator
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Runway Protection Zone (RPZ)
- Property to be Protected/Acquired
- Property to be Acquired
- AWOS Critical Area
- Ultimate Pavement
- Pavement to be Removed

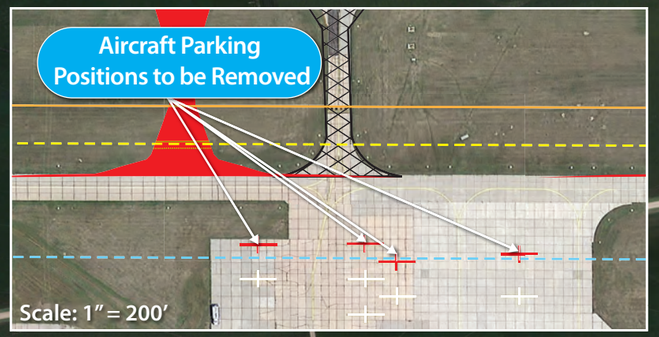

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Photo date: 6/2022

Visual approach RPZ
Add LIRL
Existing Turf Runway 11-29 (2,350' x 300')
Ultimate Turf Runway 11-29 (2,350' x 600')
6
3/4-mile RPZ
1-mile RPZ
3/4-mile RPZ
Relocate REILs
Upgrade to PAPI-4
2,570' Extension
Relocate Lighted Wind Cone/Segmented Circle
18th Ave
11.5 Acres
500'
1-mile RPZ
250' HoldLine
Upgrade to PAPI-4
21.7 Acres RSA
Runway 18-36 (4,701' x 75')
Ultimate Runway 01-19 (7,000' x 100')
34.1 Acres
14.8 Acres ROFZ
50,000 lbs. DWL
271' to be Removed
21.9 Acres ROFA
7.1 Acres
Remove Non-standard Hold Bay
Standard Holding Bay
Airport Access Road
Visual approach RPZ
Reroute Public Road
Brewster Road

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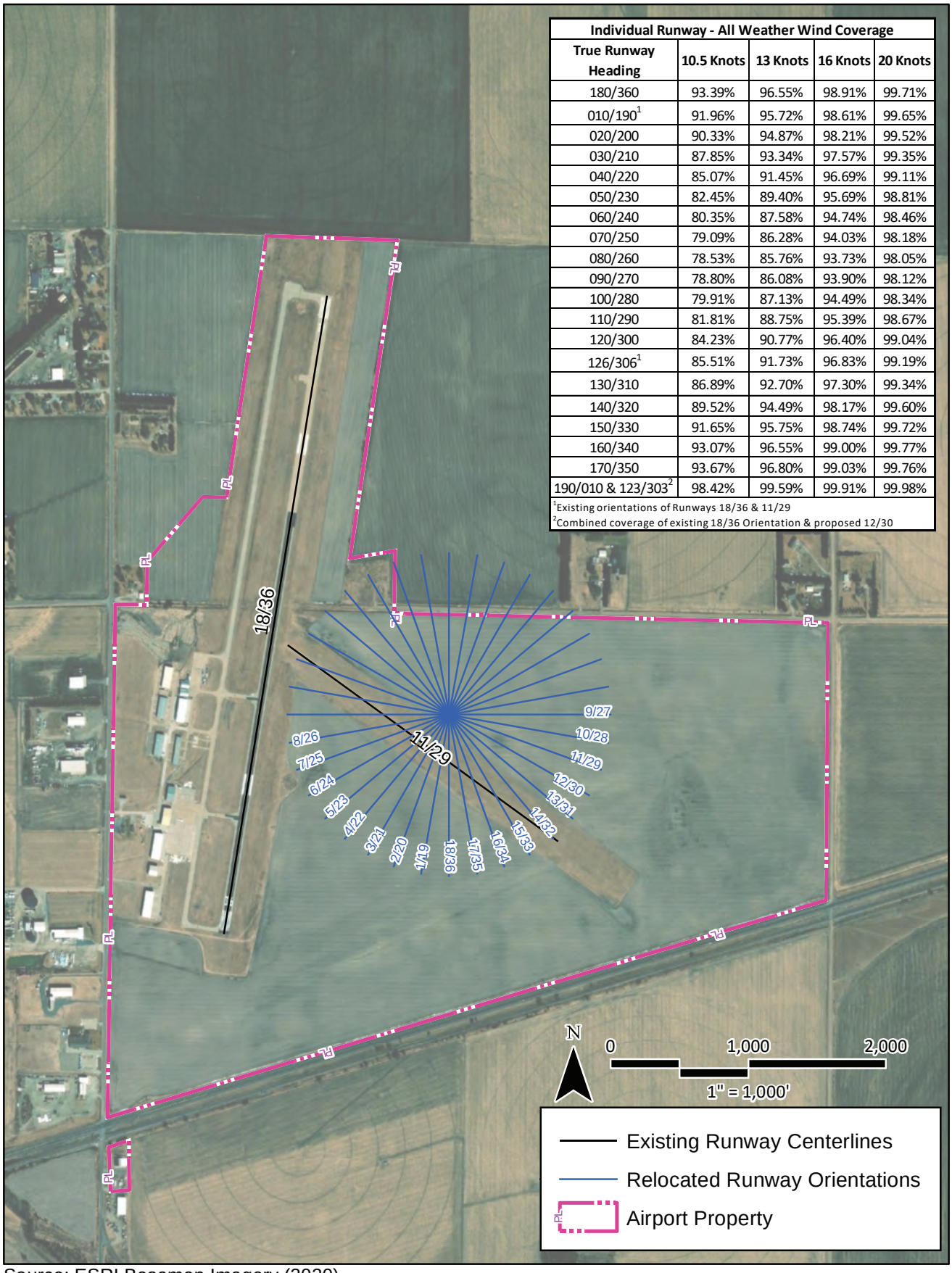
Individual Runway - All Weather Wind Coverage				
True Runway Heading	10.5 Knots	13 Knots	16 Knots	20 Knots
180/360	93.39%	96.55%	98.91%	99.71%
010/190[1]	91.96%	95.72%	98.61%	99.65%
020/200	90.33%	94.87%	98.21%	99.52%
030/210	87.85%	93.34%	97.57%	99.35%
040/220	85.07%	91.45%	96.69%	99.11%
050/230	82.45%	89.40%	95.69%	98.81%
060/240	80.35%	87.58%	94.74%	98.46%
070/250	79.09%	86.28%	94.03%	98.18%
080/260	78.53%	85.76%	93.73%	98.05%
090/270	78.80%	86.08%	93.90%	98.12%
100/280	79.91%	87.13%	94.49%	98.34%
110/290	81.81%	88.75%	95.39%	98.67%
120/300	84.23%	90.77%	96.40%	99.04%
126/306[1]	85.51%	91.73%	96.83%	99.19%
130/310	86.89%	92.70%	97.30%	99.34%
140/320	89.52%	94.49%	98.17%	99.60%
150/330	91.65%	95.75%	98.74%	99.72%
160/340	93.07%	96.55%	99.00%	99.77%
170/350	93.67%	96.80%	99.03%	99.76%
190/010 & 123/303[2]	98.42%	99.59%	99.91%	99.98%

[1]Existing orientations of Runways 18/36 & 11/29
[2]Combined coverage of existing 18/36 Orientation & proposed 12/30



Source: ESRI Basemap Imagery (2020)

TERMINAL BUILDING REQUIREMENTS

The terminal facilities provide space for a variety of activities and pilot services. Existing GA terminal facilities at HDE are contained in a 2,800-square-foot (sf) building, which houses a pilots' lounge, large conference room, restrooms, lobby, and the airport manager's office.

The number of itinerant passengers expected to use terminal services during the design hour are taken into consideration to estimate terminal facility needs. These requirements are based upon a range of designated square feet per design hour passenger, which is typically between 90 and 125 sf. For this study, a planning standard of 125 sf was used to estimate the space required. To determine the number of design hour passengers, the number of itinerant design hour operations is multiplied by the number of passengers expected on the aircraft. Design hour itinerant operations have been estimated at 15 percent of the busy day itinerant operations occurring at the airport. As most of the aircraft operating at the airport allow for multiple passengers, a multiplier of 1.5 was established for the short term, growing to 2.5 by the long term. This is a reasonable multiplier as the airport regularly accommodates itinerant operations, including air taxi, by aircraft with seating capacities of four to 10 passengers – a trend which is expected to continue throughout the planning period.

Table 30 details current and projected terminal building requirements over the planning period. As can be seen, in terms of size, the existing terminal facility is adequate to accommodate airport users through the future/intermediate term before an additional 1,300 sf of space may be required.

TABLE 30 | GA Terminal Services Requirements

	Available	Existing/Short Term	Future/Intermediate Term	Ultimate Term
Design Hour Itinerant Operations	8	9	10	13
Multiplier		1.5	2.0	2.5
Design Hour Itinerant Passengers		14	20	33
Total Building Space (sf)	**2,800**	**1,800**	**2,500**	**4,100**

Source: Coffman Associates analysis

AIRCRAFT STORAGE HANGARS, APRON, AND VEHICLE PARKING REQUIREMENTS

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

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

There are a variety of aircraft storage options typically available at an airport, including shade hangars, T-hangars, linear box hangars, executive/box hangars, and bulk storage conventional hangars. Shade hangars are the most basic form of aircraft protection and are common in warmer climates. These structures provide a roof covering, but no walls or doors.

T-hangars are intended to accommodate one small single engine piston aircraft or, in some cases, one multi-engine piston aircraft. T-hangars are so named because they are in the shape of a "T," providing a space for the aircraft nose and wings, but no space for turning the aircraft within the hangar. Basically, the aircraft can be parked in only one position. T-hangars are commonly "nested" with several individual storage units to maximize hangar space. In these cases, taxiway access is needed on both sides of the nested T-hangar facility. T-hangars are popular with aircraft owners with tighter budgets as they tend to be the least expensive enclosed hangar space to build and lease. There are four T-hangars at HDE providing approximately 35,800 sf of aircraft storage.

Executive and conventional hangars are large, clear span hangars typically located facing the main aircraft apron at airports. Often, executive, and conventional hangars are utilized by airport businesses such as a specialized aviation operator (SASO), an aircraft maintenance business for example. Executive hangars generally range in size from 2,500 to 10,000 sf, while conventional hangars are typically larger than 10,000 sf. Often, a portion of a conventional hangar is utilized for non-aircraft storage needs, such as maintenance or office space. There are two conventional hangars totaling 22,400 sf of storage and four executive hangars at HDE providing approximately 15,700 sf of aircraft storage. These totals do not include hangar space used for aircraft maintenance/repair, like what is provided by Holdrege Aviation (5,000 sf).

Planning for future aircraft storage needs is based on typical owner preferences and standard sizes for hangar space. For determining future aircraft storage needs, a planning standard of 1,200 sf per single engine piston aircraft and 1,500 sf per multi-engine piston aircraft is utilized for T-hangars. For conventional hangars, a planning standard of 3,000 sf is utilized for turboprop aircraft; 5,000 sf is utilized for business jet aircraft storage needs; and 1,500 sf is utilized for helicopter storage needs. In addition, since portions of conventional/executive hangars are also used for aircraft maintenance and servicing, requirements for service hangar area were estimated using a planning standard of 250 sf.

In total, there is approximately 78,900 sf of aircraft storage capacity at HDE. With 26 aircraft currently based at the facility, and more anticipated to base at the airport by the end of the planning period, expansion of hangar facilities should be planned in the short term. Multiple aircraft owners have also indicated their desire to base their aircraft at HDE once adequate hangar facilities become available.

Table 31 details the estimated hangar space requirements over the planning period. Over the long term, an additional 50,100 sf of hangar space is estimated to be needed, with additional capacity needed for each storage type. Options to include these additional facilities will be explored in the next section. Construction of new hangars should be phased to meet existing demand and not tied to a particular date or timeframe. Construction can be undertaken by either the airport sponsor or private developer.

TABLE 31 | Aircraft Storage Requirements

	Current	Existing/Short Term	Future/Intermediate Term	Ultimate Term
Based Aircraft	26	30	35	45
T-hangar Units	24	26	28	35
T-hangar Area (sf)	35,800	37,000	38,100	42,300
Conventional Hangar area (sf)	22,400	25,700	30,500	35,300
Executive (sf)	15,700	29,000	35,300	40,100
Service Hangar Space	5,000	7,500	8,800	11,300
Total Aircraft Storage (sf)	**78,900**	**99,200**	**112,700**	**129,000**

Source: Coffman Associates analysis

Parking apron and parking position requirements have also been calculated. Parking aprons should provide space for locally based aircraft that are not in storage hangars, as well as itinerant aircraft and those that are used for training and air taxi operations. An industry planning standard of 650 square yards (sy) per local aircraft, 800 sy per itinerant aircraft, and 1,600 sy per large turboprop/jet aircraft was applied to determine required aircraft apron space. Aircraft parking position requirements have been calculated at 28 percent of based aircraft for local operations and 25 percent of busy day itinerant operations for transient GA operations. As jet operations are anticipated to increase over the planning period, there may be demand for more turbine aircraft parking positions.

Table 32 details parking apron and position requirements over the planning period. HDE currently has approximately 13,600 sy of aircraft parking apron available, with 11 marked parking positions. As detailed in the table, additional apron pavement is needed during the future/intermediate term, with approximately 10,000 sy anticipated to be required by the ultimate term. Additional marked aircraft parking will also be needed beginning in the short term, with 18 more aircraft parking positions estimated to be needed over the planning period. The alternatives to follow will consider new apron space to meet this projected demand.

Vehicle parking spaces for airport users have also been evaluated. Currently, the airport offers 20 paved parking spaces in front of the terminal, including one handicapped space. Parking space requirements were based upon estimated existing and future itinerant traffic, as well as based aircraft at the airport. This planning study assumes that 25 percent of based aircraft will require a vehicle parking space. **Table 32** details vehicle parking requirements for the airport. An additional 24 vehicle parking spaces are estimated to be needed by the ultimate term to accommodate local and transient airport users.

TABLE 32 | Aircraft Apron and Parking Requirements

	Current	Existing/Short Term	Future/Intermediate Term	Ultimate Term
PARKING POSITIONS				
Local Positions	11	8	10	13
Transient GA Positions	0	7	8	10
Corporate Jet Positions	0	2	3	4
Helicopter Positions	0	1	2	2
Total Parking Positions	**11**	**18**	**23**	**29**
Total Apron Area (sy)	**13,600**	**14,100**	**18,200**	**23,500**
VEHICLE PARKING	**20**	**22**	**29**	**44**

Source: Coffman Associates analysis

AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)

HDE does not have an aircraft rescue and firefighting (ARFF) building or functional equipment located on the airfield. Because the airport is a GA airport, the FAA does not require ARFF services to be provided. The airport is anticipated to remain a GA airport through the planning period, so on-site ARFF facilities are not planned.

AVIATION FUEL STORAGE

Fuel at HDE is dispensed via a tank and a fuel truck. These tanks have capacities of 8,000 gallons for 100LL and 12,000 gallons for Jet A fuel. Monthly fuel flowage data from January 2022 through September 2022 was provided by the airport for 100LL. Estimates for October 2022 through December 2022 were made based on the average of the previous months to obtain a full year's worth of fuel flowage for HDE. Flowage records for Jet A were not available and, therefore, projections for the future were not developed.

Maintaining a 14-day fuel supply would allow the airport to limit the impact of a disruption of fuel delivery. Currently, the airport has enough static fuel storage to meet the 14-day supply criteria for 100LL fuel. Based on these usage assumptions and projected design day operations, no additional storage for 100LL is projected to be needed. **Table 33** summarizes the forecasted fuel storage requirements through the planning period.

TABLE 33 | Fuel Storage Requirements

			PLANNING HORIZON		
	Available	Current Need	Short Term	Intermediate Term	Long Term
100LL					
Daily Usage (gal.)		52	59	67	88
14-Day Supply (gal.)	8,000	290	331	376	489
Annual Usage (gal.)		7,500	7,900	9,000	11,700

Sources: Historic fuel flowage data provided by the airport; fuel supply projections prepared by Coffman Associates.

Perimeter Fencing and Gates

Perimeter fencing is used at airports primarily to secure the aircraft operational area and reduce wildlife incursions. The physical barrier of perimeter fencing has the following functions:

- Gives notice of the legal boundary of the outermost limits of a facility or security-sensitive area.
- Assists in controlling and screening authorized entries into a secured area by deterring entry elsewhere along the boundary.
- Supports surveillance, detection, assessment, and other security functions by providing a zone for installing intrusion-detection equipment and closed-circuit television (CCTV).
- Deters casual intruders from penetrating a secured area by presenting a barrier that requires an overt action to enter.
- Demonstrates the intent of an intruder by their overt action of gaining entry.
- Causes a delay to obtain access to a facility, thereby increasing the possibility of detection.
- Creates a psychological deterrent.

- Optimizes the use of security personnel, while enhancing the capabilities for detection and apprehension of unauthorized individuals.
- Demonstrates a corporate concern for facility security.
- Limits inadvertent access to the aircraft operations area by wildlife.

HDE is partially enclosed with a four-foot post and wire fence around the north end of Runway 18, however there is no fence around the remainder of the airport property. Consideration should be given to installing, at a minimum of 4-foot-high chain link fence out to 500 feet from sensitive areas of the airport and 4-foot-high woven wire fence around the remaining perimeter of airport operations area boundary.

LANDSIDE FACILITY REQUIREMENTS SUMMARY

A summary of the landside facilities projected to be needed at HDE is presented on **Exhibit 23**.

LANDSIDE ALTERNATIVES

The previous sections identified several landside facility needs at HDE. The areas to be evaluated include additional terminal space, aircraft storage space, parking apron, and additional vehicle parking spaces.

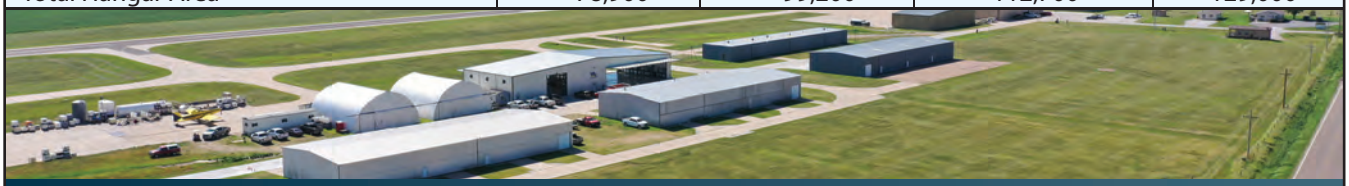
On each landside alternative, consideration is given to the FAA-required Building Restriction Line (BRL). Currently, the airport has a 1-mile approach as its lowest visibility minimum; a 25-foot BRL is set 425 feet from the runway centerline. No building closer than 425 feet should exceed 25 feet. If an instrument approach is established with a ¾-mile or lower visibility minimum, then the 25-foot BRL would be located 675 feet from the runway centerline. Each landside alternative displays both BRLs for comparison purposes. It should be noted that a structure can exceed the BRL height, so long as proper mitigation steps are employed, such as the use of an obstruction light.

LANDSIDE DEVELOPMENT ALTERNATIVE 1

Landside Development Alternative 1, pictured on **Exhibit 24**, focuses on expansion of the existing landside area. This alternative is based on the airport meeting RDC B-II-5000 design standards. Primary actions include:

- ***Terminal expansion***. This alternative considers an option to expand the existing 2,800-sf terminal. The terminal is proposed to be expanded to the west where an open area already exists, bringing the total square footage to 4,100 sf and meeting the long-term need at the airport.
- ***Additional auto parking***. To accommodate a projected need for additional vehicle parking, 1,300 sy of pavement is proposed to be expanded to the north and south of the existing parking lot in front of Holdrege Aviation, which would support an additional 30 auto parking spaces.
- ***Expand existing south apron.*** This alternative proposes expansion of the south apron, with approximately 8,600 sy of new pavement added to the south. This additional apron area could support eight tiedowns for fixed wing aircraft and two helicopter parking positions.

	AVAILABLE	SHORT-TERM	INTERMEDIATE-TERM	LONG-TERM
AIRCRAFT STORAGE HANGAR REQUIREMENTS				
Based Aircraft	26	30	35	45
HANGAR AREA (S.F.)				
T-Hangar Units (#)	24	26	28	35
T-Hangars	35,800	37,000	38,100	42,300
Conventional	22,400	25,700	30,500	35,300
Executive	15,700	29,000	35,300	40,100
Maintenance Area	5,000	7,500	8,800	11,300
Total Hangar Area	78,900	99,200	112,700	129,000



AIRCRAFT PARKING APRON				
Total Aircraft Parking Positions	11	8	10	13
Total Apron Area (sy)	13,600	14,100	18,200	23,500

GENERAL AVIATION TERMINAL FACILITIES AND PARKING				
Building Space (sf)	2,800	1,800	2,500	4,100
Total Vehicle Parking Spaces	20	22	29	44

SUPPORT FACILITIES				
14-Day Fuel Storage - 100LL	8,000	331	376	489

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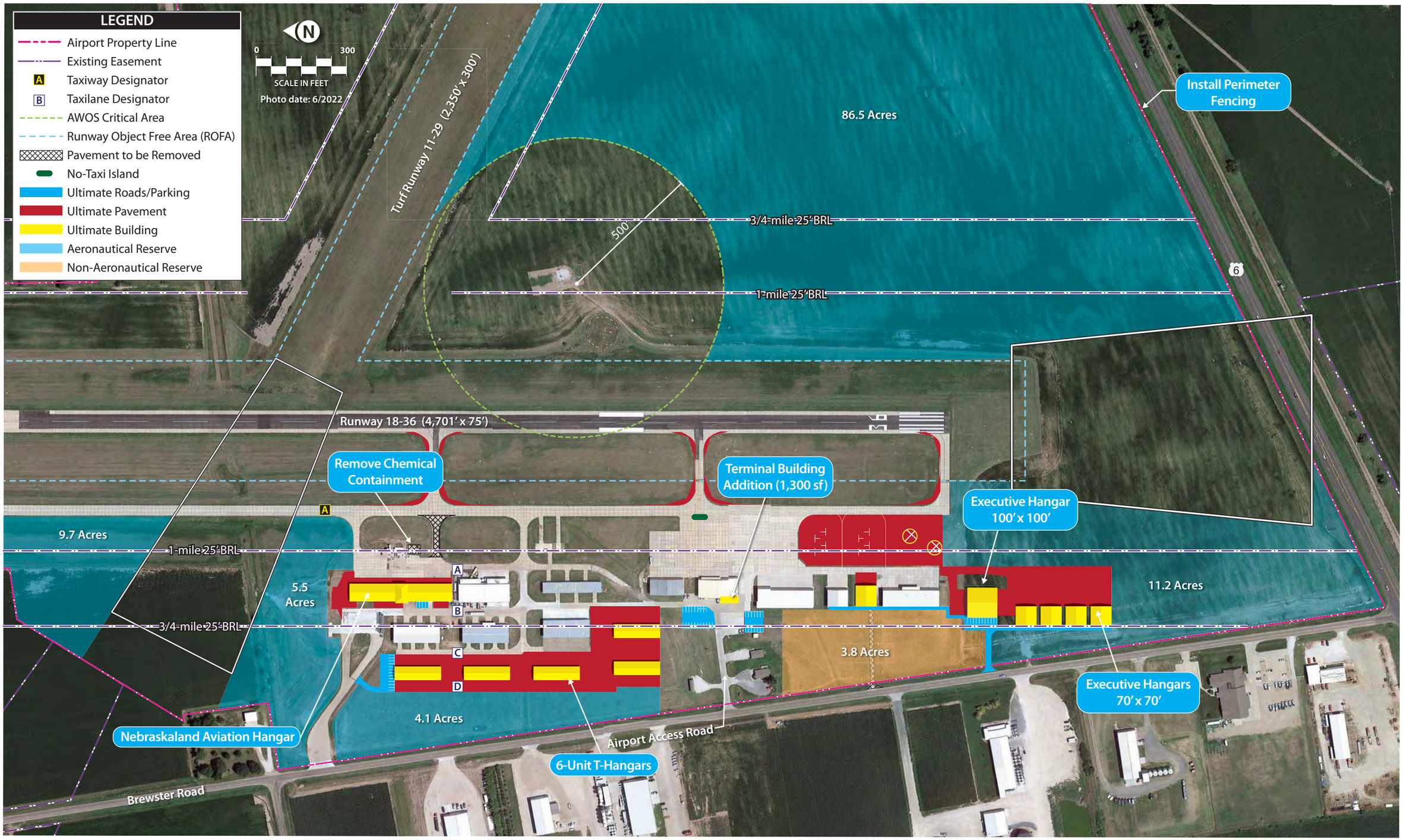

Exhibit 24
LANDSIDE ALTERNATIVE 1

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- ***Construction of executive hangars.*** Five 4,900 sf executive hangars are proposed on the southwest side of the airport, along with one 10,000 sf executive hangar, which could support an aviation-related business or SASO. New apron and taxilane pavement are proposed to provide aircraft access to the hangars, with vehicle access via a new road extending from Brewster Road.
- ***Construction of Nebraskaland Aviation Hangar.*** Plans are currently in place for the construction of the Nebraskaland Aviation Hangar adjacent to the Wells Flying Service hangar. This development will necessitate the removal of two existing executive hangars and the chemical containment facility.
- ***Construction of T-hangars.*** Additional T-hangars are proposed west of the future Nebraskaland Aviation hangar and existing T-hangars. This alternative includes a plan to construct five 6-unit T-hangars and taxilane pavement. An access road with additional auto parking is also proposed for tenant access to this area.
- ***Install perimeter fence.*** Perimeter fencing is used at airports primarily to secure the aircraft operational area from unauthorized personnel and vehicles and reduce wildlife access. The airport is partially enclosed with a four-foot post and wire fence around the north end of Runway 18, however there is no fence around the remainder of the airport property. In addition, a dirt road extending from 18th Avenue allows vehicles to access the airfield. To mitigate this, security fencing is proposed to be installed around the entire airport property, which will be depicted on each of the alternatives. It is recommended for local GA airports in rural locations to install a minimum of 4-foot-high chain link fence out to 500 feet from sensitive areas of the airport, and 4-foot-high woven wire fence around the remaining perimeter of airport operations area boundary.

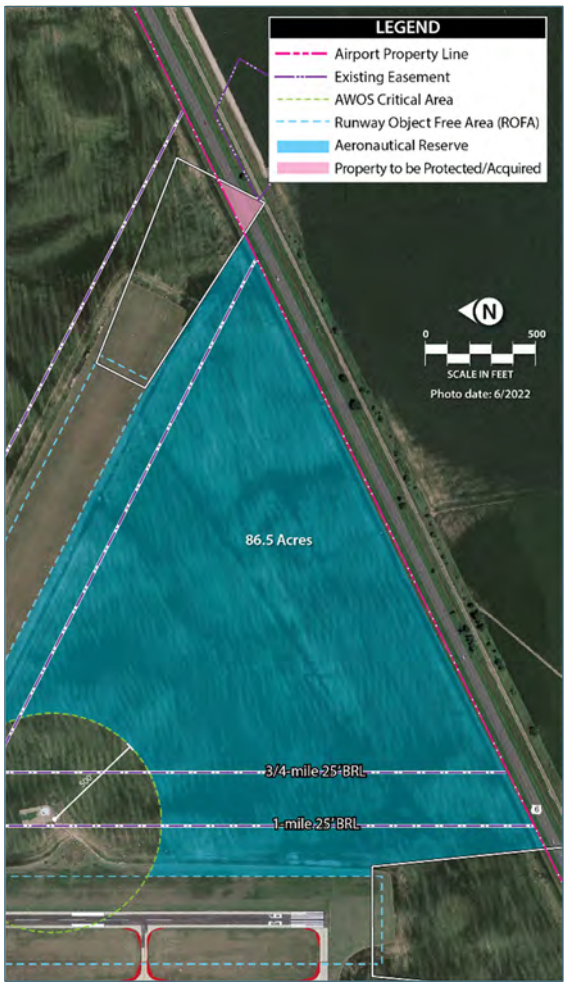

Figure 10 – East Side Aeronautical Development

- ***Reserve areas of airport property***. Areas for future aviation expansion, as well as non-aeronautical development, are also proposed, as depicted on **Exhibit 24**. **Figure 10** also shows the full aeronautical development on the east side of the airport. The blue shaded areas on the west side of the airport encompass approximately 30.5 acres of airport property and are proposed to be reserved for future aviation uses. On the east side, approximately 86.5 acres are also reserved for future aviation use under this alternative. The 3.8-acre area shaded in orange west of the main apron offers little aviation development potential, as it is cut off from the airfield by existing development; therefore, this alternative proposes for this area to be reserved for potential non-aeronautical development.

In total, this alternative proposes 69,000 sf of additional aircraft storage space. Of this, 34,500 sf would be in the form of executive hangars and 34,500 sf in T-hangar storage. The alternative also proposes an addition of 1,300 sf to the terminal building, along with 30 new auto parking spaces.

LANDSIDE DEVELOPMENT ALTERNATIVE 2

Landside Development Alternative 2 is depicted on **Exhibit 25**. This alternative plans for a larger expansion of landside facilities with a new development area on the east side of the airport and a new airport terminal. Primary actions include:

- ***New terminal.*** This alternative considers a new terminal building, 5,000 sf in size, located on the east side of Runway 18-36 on a newly developed apron pavement. A new access road would be planned from Highway 6/34 to the terminal and the east side development.
- ***Additional auto parking***. A new 2,484 sy. auto parking lot will be constructed in front of the new terminal building, which would support an additional 26 auto parking spaces including three handicap parking positions.
- ***Expand existing main apron.*** Similar to Alternative 1, this alternative will expand the existing main apron to the south for an additional 8,600 sy. of pavement. Marked parking for fixed aircraft is proposed, with eight tiedowns and two helicopter parking positions.
- ***New taxilane and 10,000' executive hangar options.*** Two options for 10,000 sf executive hangars are considered under this alternative. The first, option #1, illustrates the executive hangar west of the existing executive hangar and will be accessed via a new taxilane that is in between the existing executive and conventional hangar. Tenants can access this hangar via a new access road from the existing terminal area, and it will include additional auto parking on the side of the hangar. The second option considers the hangar south of the existing T-hangar and will also include a new taxilane for access.
- ***Construction of executive hangars on the south.*** Three additional 10,000 sf executive hangars are planned south of the second option for the 10,000-sf executive hangar. There will be an access road from Brewster Rd with additional auto parking for the south side development.
- ***Construction of Nebraskland Aviation Hangar.*** Similar to Alternative 1, the construction of the Nebraskaland Aviation Hangar is planned located on the second existing apron next to Wells Flying Service hangar. Two existing executive hangars and the chemical containment are also planned to be removed.
- ***Construction of T-hangars.*** West of the future Nebraskaland Aviation hangar and the existing T-hangars are planned to be six 6-unit T-hangars measuring 6,900 sf. Taxilanes D and E will be constructed to provide access to each unit of the T-hangars. West of the new Taxilane D, an access road from Brewster Rd and auto parking spaces will exist.
- ***East side development*.** An approximately 40,000 sy. apron is planned on the east side of Runway 18-36 that could support three new 10-unit T-hangars located on the north side of the apron. Moving to the south side of the apron, two 22,500 sf conventional hangars and two 10,000 sf

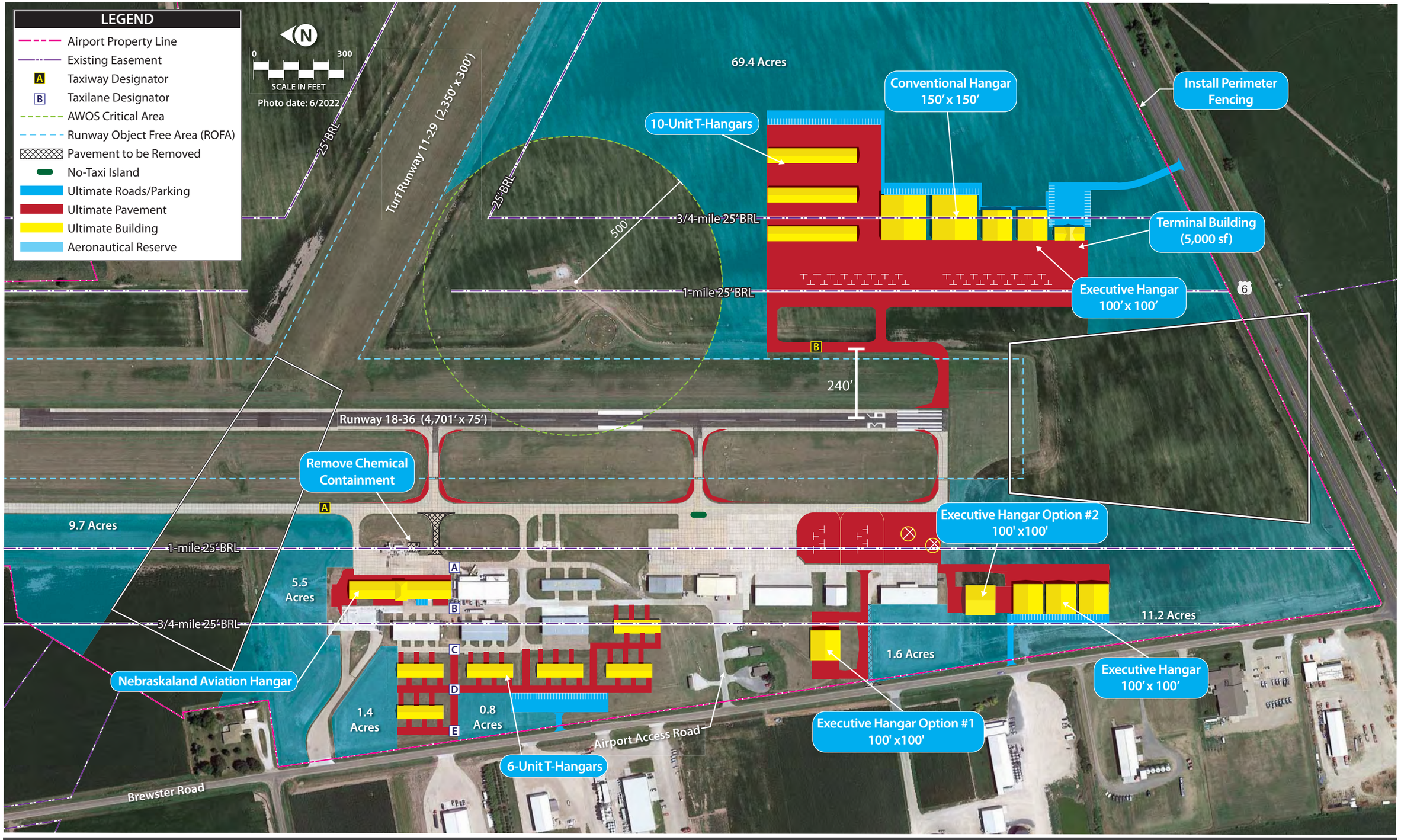

Exhibit 25
LANDSIDE ALTERNATIVE 2

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executive hangars will be constructed. The south edge of the apron will support a new terminal building. In front of the hangar development will be two groups of 16 tiedowns. An access road is planned to extend around the new apron with additional auto parking spots.

- ***Construct partial Taxiway B.*** With the development on the east side of the airport, a new partial Taxiway B is planned to connect to Runway 18-36 as well as the landside development located on the south side of the airport. Taxiway B will have a separation distance of 240 feet from the runway centerline to the parallel taxiway centerline.
- ***Reserve areas of airport property***. Portions of airport property are planned for future aviation. The aviation reserve area encompasses 12.8 acres south of the terminal and 17.4 acres north of the terminal. **Exhibit 25** and **Figure 11** shows additional aviation reserve located on the east side development for a total of 69.4 acres.

This alternative plans for approximately 201,100 sf of additional aircraft storage space. Of this total, 70,000 sf would be in the form of executive hangars, 45,000 sf of conventional hangars, and 86,100 sf in T-hangars. A new 5,000 sf terminal is planned with an additional 26 auto parking spaces.

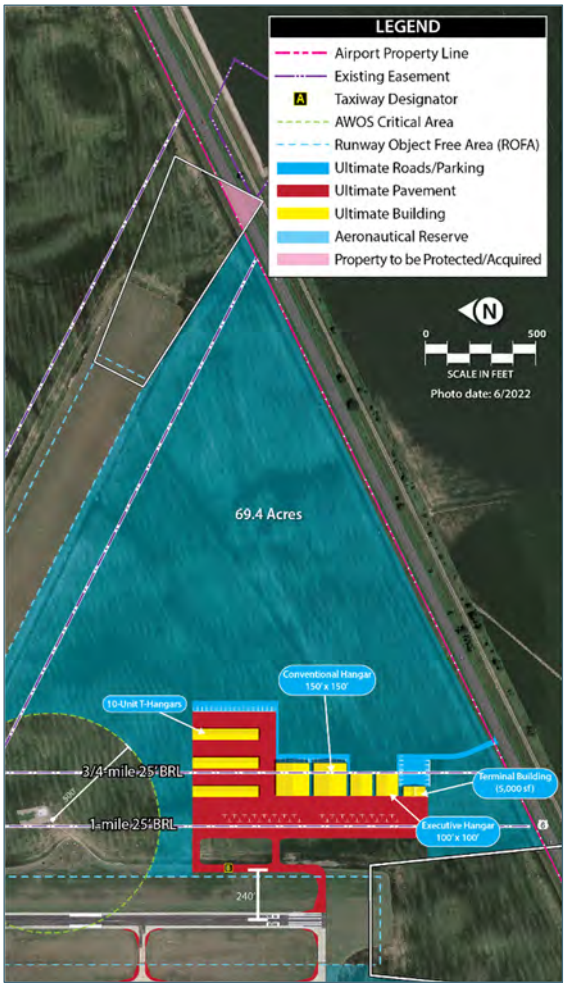

Figure 11 – East Side Aeronautical Development

LANDSIDE DEVELOPMENT ALTERNATIVE 3

Landside Development Alternative 3 is depicted on **Exhibit 26**. This alternative is based on the airport meeting RDC C-II-4000 design standards and reflects Airside Alternative 3, **Exhibit 21**. When the airport transitions to C-II-4000 it would impact the location of the BRL and ultimate ROFA, resulting in a greater portion of the terminal apron being unusable for aircraft parking and landside development. In addition, with the lower approach on Runway 36 end, the RPZ will increase in size, and, therefore, affect the usable land within the RPZ. This alternative plans for a larger expansion of landside facilities on the west side of the airport, with more apron pavement added to support additional hangars and an industrial park on the east side. Primary actions include:

- ***Terminal expansion***. Currently Holdrege Aviation maintenance hangar and the terminal reside under one building occupying approximately 5,000 sf and 2,800 sf, respectively. This alternative plans to develop the total 7,800 sf building as the terminal and relocate the maintenance hangar. The total square footage would be more than adequate through the ultimate-term period and would not need to be relocated or be expanded.

- ***Additional auto parking***. Approximately 1,100 sy. of pavement will be expanded on the existing parking lot in front of the terminal, which would support an additional 24 auto parking spaces.
- ***Expand existing main apron.*** Similar to Alternatives 1 and 2, this alternative will expand the existing main apron to the south for an additional 7,400 sy. of pavement. As mentioned previously with the increase in size of the safety areas and RPZ fewer marked parking positions for fixed aircraft are planned, with five tiedowns and two helicopter parking positions.
- ***New taxilane and executive hangars.*** Similar to Alternative 2, this alternative plans a 10,000-sf executive hangar west of the existing executive hangar that will be accessed via a new taxilane in between the existing executive and conventional hangar. An additional 5,200 sy apron is planned south of the 10,000-sf executive hangar, which will support two 4,900-sf executive hangars and four 2,500-sf executive hangars. An access road is planned south of the executive hangars from Brewster Rd and will include auto parking for tenets.
- ***Removal of existing aircraft parking positions.*** As mentioned previously, C-II design standard calls for larger safety areas and should be free from any obstruction. Four aircraft parking positions located on the main apron are within the ultimate ROFA and are planned to be removed to correct the non-standard condition.
- ***Construction of Nebraskland Aviation Hangar.*** Similar to Alternatives 1 and 2, the construction of the Nebraskaland Aviation Hangar is planned to be located on the second existing apron next to Wells Flying Service hangar. Two existing executive hangars and the chemical containment are also planned to be removed.
- ***Construction of T-hangars.*** Similar to Alternative 1, west of the future Nebraskaland Aviation hangar and the existing T-hangars are planned to five 6-unit, and one 10-unit, T-hangars on the new 23,000 sy. apron. An access road from Brewster Rd to the T-hangars are planned with additional auto parking for tenants.
- ***Industrial park reserve*****.** As seen on **Exhibit 26** and **Figure 12**, east of Runway 18-36 is a reserved area, approximately 72.02 acres, for an industrial park, shaded in pink. In most cases industrial parks are well suited for non-aeronautical use with tenants involved in light manufacturing and/or warehousing. In this location the area has the opportunity to offer highway, rail, and air access.
- ***Reserve areas of airport property***. Similar to previous alternatives, portions of airport property are planned for future aeronautical use. The

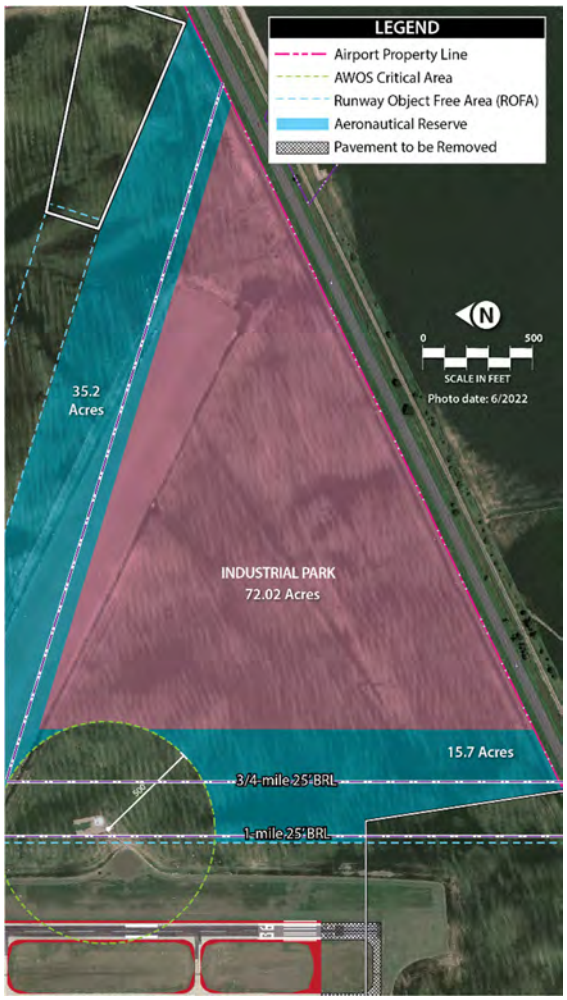

Figure 12 – East Side Aeronautical Development

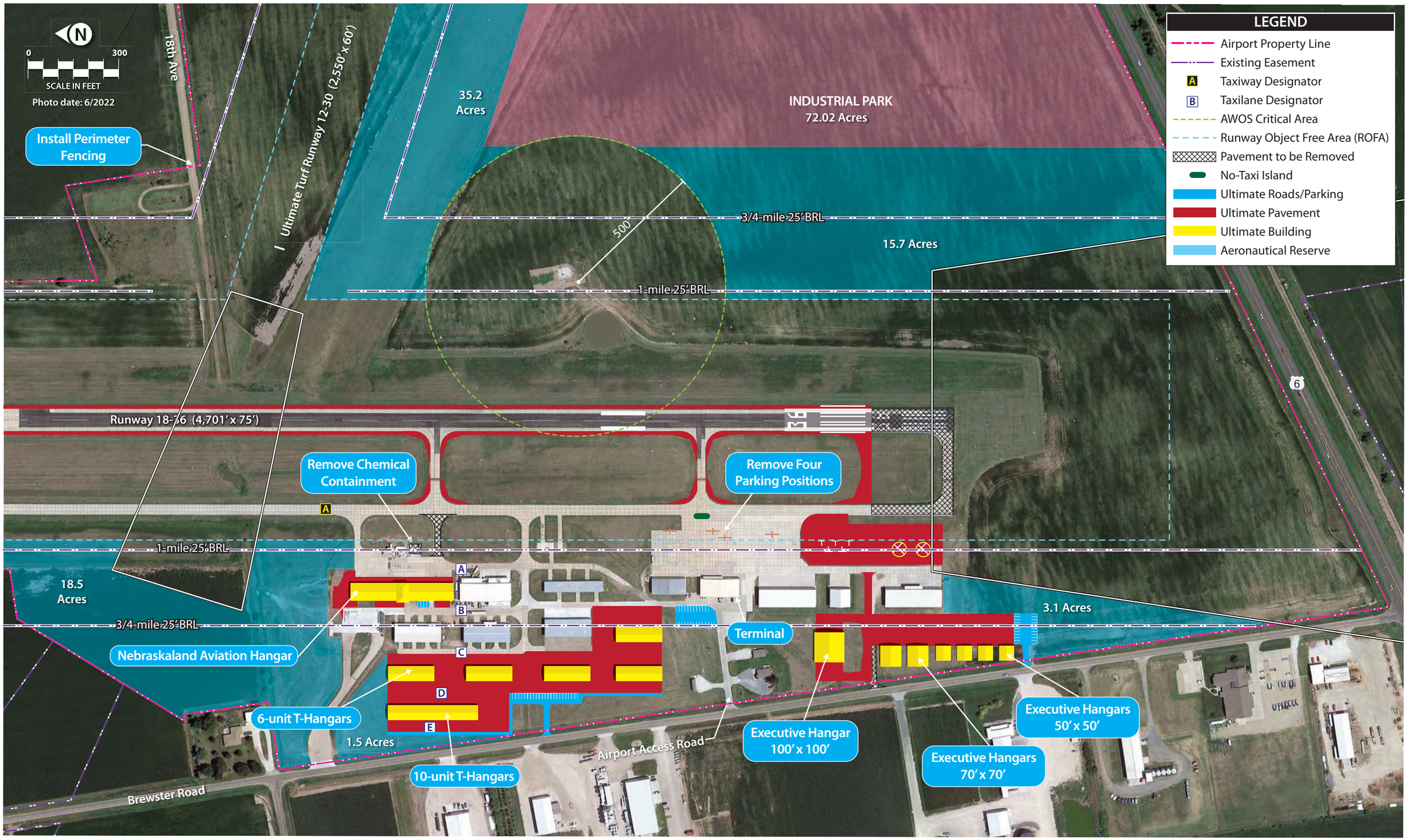

Exhibit 26
LANDSIDE ALTERNATIVE 3

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aviation reserve area comprises of 3.1 acres west of Runway 18-36 and 20 acres north of the Holdrege Aviation. **Exhibit 26** and **Figure 12** depict additional aviation reserve located on the east side development for a total of 50.9 acres.

This alternative plans for approximately 79,200 sf of additional aircraft storage space. Of this total, 29,800 sf would be in the form of executive hangars and 49,400 sf in T-hangars.

It should be noted that hangar layouts depicted are conceptual. The types, sizes, and location for all future hangar development should be dictated by demand and the needs of the hangar developer and its customer(s). The conceptual layout is intended to be used strictly as a guide for the airport sponsor when considering new landside facility developments.