RUTLAND - SOUTHERN VERMONT REGIONAL AIRPORT (RUT)

AIRPORT MASTER PLAN

February 2022

Prepared By:

VERMONT AGENCY OF TRANSPORTATION

CHA

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AGENCY OF TRANSPORTATION

Rutland-Southern Vermont Regional Airport

Master Plan Update

Final Report

February 2022

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Inventory of Existing Conditions

1 Inventory of Existing Conditions

Understanding the background of an airport and the region it serves is essential to making informed decisions pertaining to airport-related improvements. Therefore, to develop a well-rounded understanding of the Rutland – Southern Vermont Regional Airport (RUT), an inventory of key airport elements was conducted and discussed in the subsequent sections.

1.1 Airport Role

RUT is a public-use airport owned by the State of Vermont and maintained by the Vermont Agency of Transportation (VTrans). According to the Federal Aviation Administration's (FAA) 2021 – 2025 *National Plan of Integrated Airport Systems (NPIAS) Report*, RUT is designated as a Nonprimary Commercial Service airport and is currently classified with a role of "regional". As defined in the NPIAS, a regional airport, "supports regional economies with interstate and some long-distance flying and have high levels of activity, including some jets and multiengine propeller aircraft."

Additionally, RUT is currently one of only two airports within the State of Vermont which holds a Federal Aviation Regulation (FAR) Part 139 Airport Operating Certificate with the FAA.[1] According to the FAA, FAR Part 139 Airport Operating Certificates are specific to airports that:

- Serve scheduled and unscheduled air carrier aircraft with more than 30 seats;
- Serve scheduled air carrier operations in aircraft with more than 9 seats but less than 31 seats; and
- The FAA Administrator requires to have a certificate.

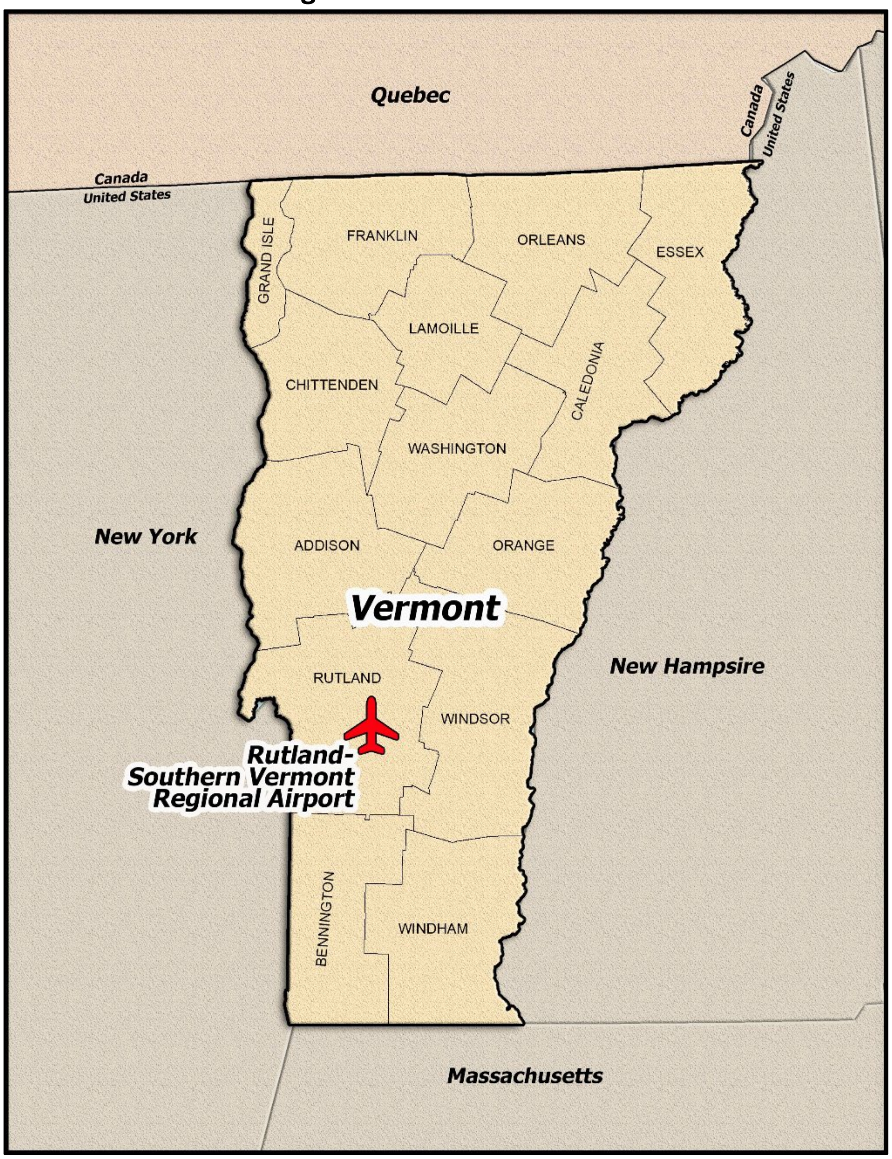
As commercial air service is currently provided at the Airport, RUT undergoes an annual FAA inspection to ensure the airport meets the minimum safety requirements listed under FAR Part 139. Although the FAA may waive certain inspection requirements based upon the volume of commercial service activity, examples of FAR Part 139 requirements include stringent safety security requirements, chemical and refueling practices and documentation, and appropriate level of Airport Rescue and Fire Fighting services.

[1]The Rutland-Southern Vermont Regional Airport and the Burlington International Airport are currently the only two airports in the State of Vermont with FAR Part 139 Airport Operating Certificates.

1.2 Airport Location & State Transportation Network

RUT is located in the Town of North Clarendon, approximately five miles south of the City of Rutland. The Town of North Clarendon and the City of Rutland are both located within Rutland County and situated approximately 50 miles southwest of Montpelier, VT; 65 miles south-southeast of Burlington, VT; 75 miles northeast of Albany, NY; and 125 miles northwest of Boston, MA. The Airport is accessible on the ground via U.S. Route 7, and Vermont State Routes 7b and 103. **Figure 1-1** depicts the location of RUT respective to the State of Vermont and the Rutland Region.

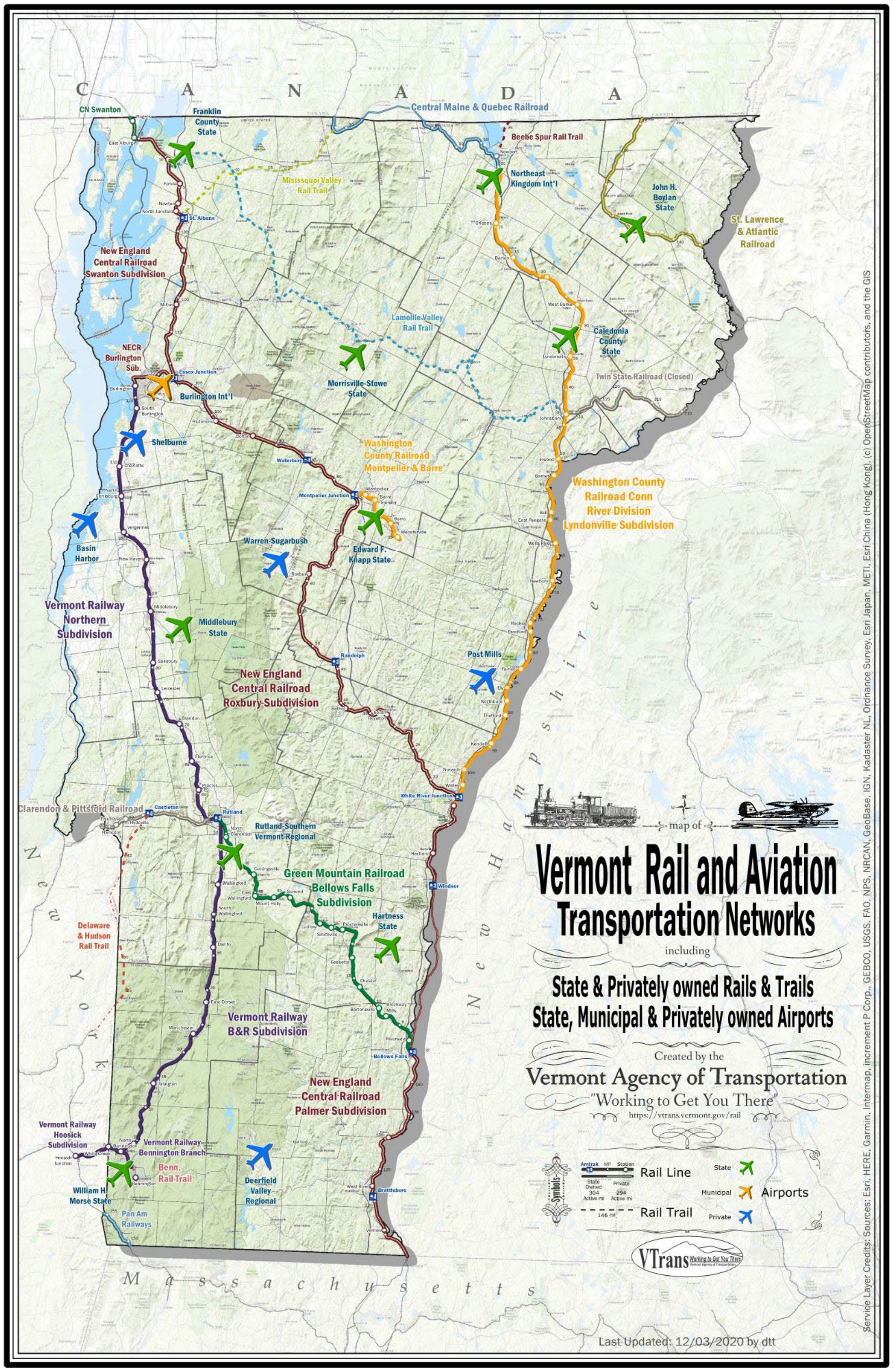
Figure 1-1 – RUT Location



Source: CHA, 2021

In addition to owning and maintaining a network of airports within the State, VTrans also ensures safe and efficient transportation of people and goods through the State's railway infrastructure. **Figure 1-2** depicts the agency's network of airports along with the State's railway system.

Figure 1-2 – Vermont Rail & Aviation Transportation Networks



Source: Vermont Agency of Transportation

1.3 Airport Facilities

A primary role of master planning is developing a detailed listing of recommended facilities and improvements for implementation over the planning period. As such, the first step in this process is to inventory existing facilities and review their current condition.

Airport facilities are often described as either airside or landside, depending upon the type of operation they support. Airside facilities are those related to the landing, takeoff, and taxiing of aircraft in the airport environment. Examples of airside facilities include: the runway and taxiway system; airfield lighting, marking and visual aids; and aircraft parking and apron areas. Landside facilities are those related to the transition from air to ground movement or vice versa. Examples of landside facilities include: the airport terminal building, aircraft refueling area, aircraft storage, and vehicle parking.

1.3.1 Airside Facilities

1.3.1.1 Runway 1-19

RUT operates under a dual-runway system. Runway 1-19 serves as the primary runway and is 5,304 feet long by 100 feet wide. The runway is grooved, constructed of asphalt, and is listed in good condition. The runway's load-bearing capacity is estimated at 40,000 pounds for single-wheel aircraft and 68,000 pounds for double-wheel aircraft. Due to the Instrument Landing System, the Runway 19 end maintains precision markings in good condition while the Runway end 1 maintains non-precision markings also in good condition.

Runway 1-19 also has declared distances published for each runway. However, upon examination of the runway conditions and the 2007 Runway Safety Area Determination, this Master Plan recommends updating of the Runway 1-19 declared distances to those noted within **Table 1-1**.

Table 1-1 – Runway 1-19 Declared Distances (Published vs. Recommended)

Declared Distance	Published (FAA)		Recommended Update	
	Runway 1	Runway 19	Runway 1	Runway 19
Takeoff Run Available (TORA)	5,304'	5,004'	5,304'	5,304'
Takeoff Distance Available (TODA)	5,304'	5,004'	5,304'	5,304'
Accelerate Stop Distance (ASDA)	5,304'	5,004'	4,900'	5,304'
Landing Distance Available (LDA)	5,304'	5,004'	4,600'	5,304'

Source: FAA 5010-1 Form, CHA 2021

Additional information related to declared distances and runway safety area standards is discussed within **Chapter 3*, Facility Requirements*.**

1.3.1.2 Runway 13-31

Runway 13-31 serves as a secondary, crosswind runway and is 3,169 feet long by 75 feet wide. The runway is not equipped with instrument approach procedures and is, therefore, only available for visual landings. The runway is primarily used by single-engine aircraft with a restriction of less than 10 passenger seats. Runway 13-31 does not have published declared distances.

1.3.1.3 Taxiways

Both Runway 1-19 and 13-31 are served by parallel taxiway systems that provide aircraft access between the terminal area and each runway. Taxiway ‘A’ is located on the eastern side of Runway 1-19 and is 50 feet in width. A portion of Taxiway ‘A’ (between Taxiways ‘B’ and ‘J’) was recently reconstructed to provide standard full-length capability. Taxiway ‘B’ is located on the northern side of Runway 13-31 and is 35 feet in width. Full parallel taxiway length is provided between the Runway 13 end and Taxiway ‘H’.

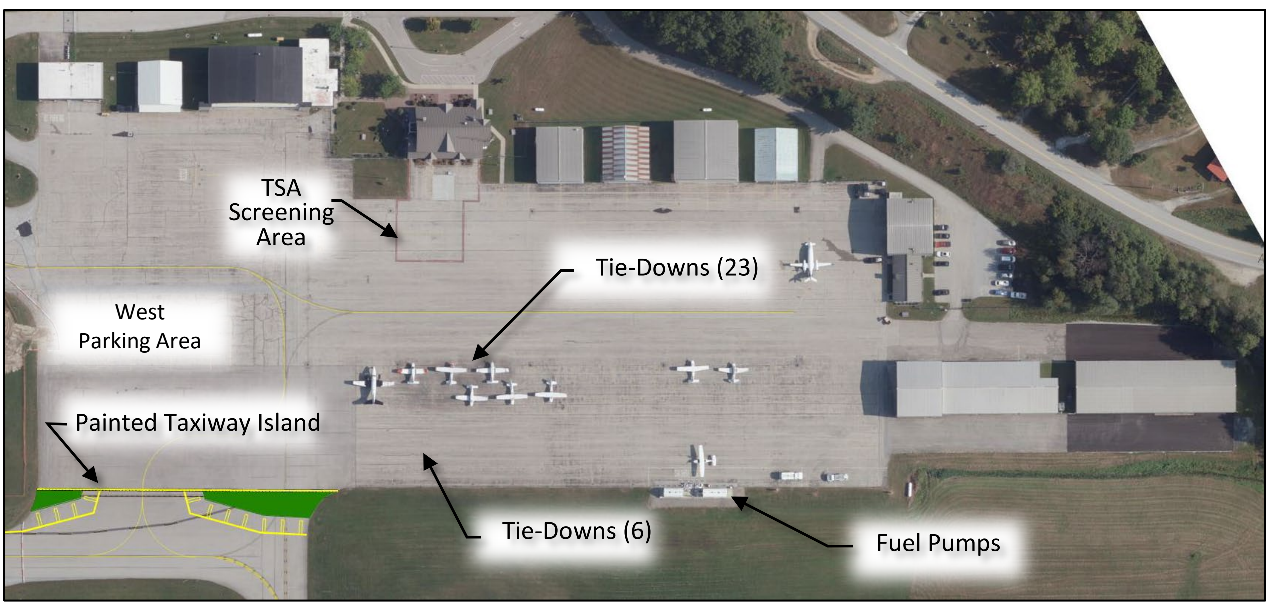
Additionally, as part of the 2020 pavement marking plan at RUT, a painted taxiway island was installed between the east end of Taxiway ‘B’ and the main apron. The painted island prohibits direct aircraft access from Runway 13-31 to the main apron (via Taxiway ‘H’) and provides enhanced aircraft turning guidance when taxiing from Taxiway ‘B’ to the main apron.

Figure 1-4 depicts the existing runway and taxiway system at RUT, including the painted island at the end of Taxiway ‘B’.

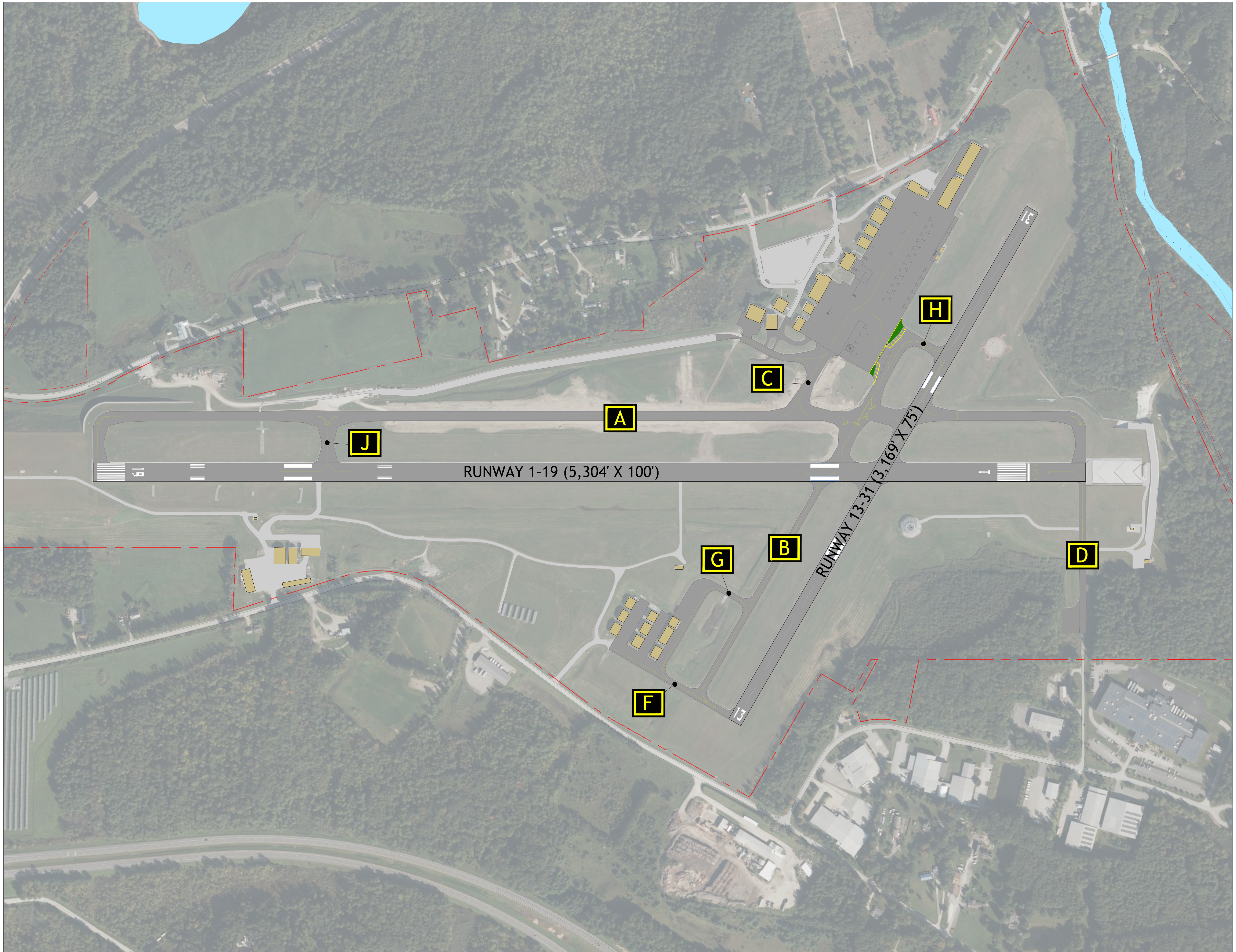
1.3.1.4 Aprons

There is one main apron at RUT located within the terminal area. The main apron is located on the east side of the airport and is accessible via Taxiways ‘B’, ‘C’ and ‘H’. The apron encompasses approximately 39,250 square yards and is constructed of asphalt. The northern edge of the apron abuts several hangars, including the terminal building and Transportation Security Administration (TSA) screening area, while the southern portion contains space for aircraft movement and tie-downs. **Figure 1-3** depicts each portion of the main apron and **Table 1-2** provides a corresponding breakdown of each existing area.

Figure 1-3 – Main Apron



Source: CHA 2021



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GRAPHIC SCALE (FEET)

0 250 500 1000

LEGEND

Airport Property Boundary

Figure 1-4

Runway & Taxiway System

Table 1-2 – Apron Areas

Apron Area	Area (SF)
Tie-Downs *Mid-Apron (22 Tie Downs)* *Southern Edge (6 Tie-Downs)*	 34,200 9,000
West Apron Parking	22,320
Airline Staging	5,265
Aircraft Fuel Pumps Fuel Truck Parking	2,250 3,420
Additional Aircraft Parking & Staging	83,250
Aircraft Maneuvering (e.g., Taxilanes)	19,3545
Total	**353,250**

Source: CHA 2021

1.3.1.5 Automated Weather Observing System

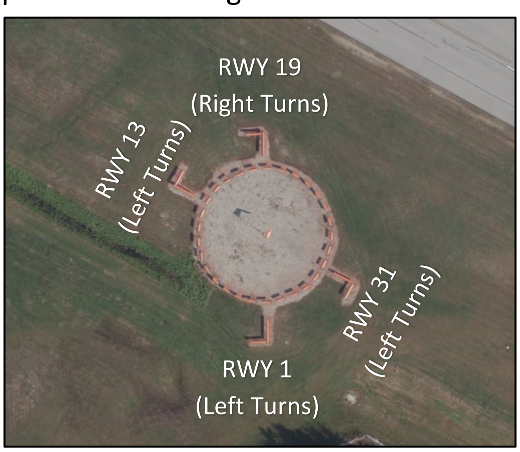
An Automated Weather Observing System (AWOS) provides pilots with current meteorological conditions, such as wind speed, direction, and cloud ceiling. An AWOS is located at RUT west of Runway 1-19, adjacent to the west hangars. The AWOS is maintained by the National Weather Service (NWS) and uploaded directly in the NWS database for public review.

1.3.1.6 Visual Aides & Lighting

An airport rotating beacon light universally indicates the location and presence of an airport. The Airport's beacon is equipped with an optical system that projects two beams of light (one green and one white), 180 degrees apart. Additionally, operation of the beacon during daylight hours may indicate the airport is under Instrument Meteorological Conditions (IMC). RUT's rotating beacon is located northwest of the terminal building, directly west of the main parking lot.

Source: VTrans

A segmented circle is a 100-foot diameter circular area sited at an airport that aids pilots in locating the wind cone (i.e., windsock) and direction of the traffic pattern. RUT's segmented circle is located south of the main apron between Taxiway A and the Runway 31 end. As indicated by each 90-degree marker extending from the circle, Runways 1, 13, and 31 have standard, left-hand traffic patterns whereas Runway 19 has a non-standard right-hand traffic pattern. A lighted wind cone is located in the center of the segmented circle, which provides pilots general wind direction and speed.



Runway 1 is equipped with a two-box pulsating Visual Approach Slope Indicator (VASI) located on the right side of the runway. Unlike most VASIs, the Runway 1 system provides pulsating light signals to pilots as opposed to a constant light signal. This system is currently shutoff due to obstructions (e.g., Bear Mountain) within its Obstacle Clearance Slope (OCS). Additional information pertaining to the P-VASI obstructions and visual approach equipment recommendations is contained within **Appendix A**.

Runway 19 is equipped with a 4-box Precision Approach Path Indicator (PAPI) located on the left side of the runway along with a Medium Approach Light System with Runway Alignment Indicator Lights (MALSR) to accompany the Runway 19 Instrument Landing System (ILS). The MALSR consists of a combination of threshold lamps, steady burning light bars and flashers. The system is used to provide visual information to pilots on runway alignment, height perception, roll guidance, and horizontal references during Category I precision instrument approaches.

Runway 13 is equipped with a with Runway End Identifier Lights (REILs) that provide identification of the runway approach end at night and during IMC. The REIL system consists of a pair of synchronized white flashing lights located on both sides of the runway threshold.

Both Runway 1-19 and Runway 13-31 are equipped with Medium Intensity Runway Lights (MIRLs).

1.3.1.7 Runway Markings & Instrument Approach Procedures

Runway markings denote runway direction, type of approach associated with the runway (e.g., visual, non-precision, precision), runway width, and provide aiming guidance to pilots. Currently, Runway 1 has non-precision markings in good condition and Runway 19 has precision markings in good condition. Runway 13-31 has basic markings in good condition.

Additionally, instrument approach procedures (IAPs) are utilized by aircraft when operating in poor or limited visibility conditions. IAPs use both ground- and/or satellite-based technology (i.e., GPS) technology. Based on current FAA classifications, there are three types of approach categories: visual, non-precision, and precision.

- ***Visual:*** Approaches performed under visual flight rules only, when meteorological conditions include a cloud ceiling height of 1,000 feet or greater and visibility of 3 miles or greater.
- ***Precision Approach**:* Instrument approach procedures providing vertical guidance less than 250 feet above the threshold and visibility minimums lower than ¾ mile.
- ***Non-Precision Approach:*** Instrument approach procedures providing only lateral guidance with a ceiling minimum of 400 feet above the threshold.

Runways 1 and 19 have published IAPs whereas Runways 13 and 31 do not have IAPs and are considered visual approach runways. The following provides a description of each type of IAP at the Airport.

RNAV (GPS) Approaches

An RNAV (Area Navigation) approach is a non-precision, GPS-based IAP that uses satellite technology to provide aircraft navigation to the runway environment. This type of approach is widely used as RNAV (GPS) approaches do not require ground-based navigational equipment.

The Runway 1 RNAV (GPS) only provides lateral guidance and is offset 15 degrees from the runway heading due to terrain south of the Airport. Runway 19 has two types of RNAV approaches: an RNAV (GPS) Y and RNAV (GPS) Z. Although both Runway 19 approaches provide lateral and vertical landing guidance to Runway 19, the RNAV (GPS) Y approach requires higher landing visibility minimums for aircraft that cannot maintain a climb gradient of at least 420 feet per nautical mile during the missed approach procedure.

Instrument Landing System

Runway 19 is also equipped with a Category I Instrument Landing System (ILS). ILS approaches utilize ground-based navigational equipment (e.g., a localizer and glideslope) to provide both lateral and vertical guidance to the runway. ILS approaches generally provide lower landing visibility minimums than most non-precision and/or GPS-based approaches. Runway 19 also has two types of ILS approaches available: an ILS Y and ILS Z. Similar to the Runway 19 RNAV approaches, the ILS Y approach requires higher landing visibility minimums for aircraft that cannot maintain a climb gradient of at least 425 feet per nautical mile during the missed approach procedure.

Additionally, each ILS approach can also be performed using only lateral navigation guidance provided by the localizer. Pilots must refer to the respective IAP chart when performing a localizer-only approach to ensure minimum landing visibility is maintained.

Alternate Minimums & Departure Procedures

An alternate airport is often required during instrument flight planning. Before an airport can be listed as an alternate, however, it must meet minimum runway and IAP criteria. While the FAA specifies standard alternate airport minimum criteria, some airports have non-standard minimums. RUT has non-standard alternate minimums for each IAP. Pilots must refer to the respective IAP chart to ensure the Airport meets minimum alternate requirements.

Furthermore, when a runway contains objects that penetrate the 40:1 Departure Surface, a Departure procedure may be evaluated. A departure procedure may reduce the runway takeoff distance available, require non-standard aircraft climb rates, or require non-standard departure minimums. Runway 1, 19, and 31 each have Departure Procedures in place to ensure obstacle avoidance. Pilots must refer to the respective IAP chart to ensure their aircraft can perform the Departure Procedure. **Table 1-3** lists the minimums for each IAP.

Table 1-3 – RUT Approach Procedures

Approach Procedure	Category A		Category B		Category C		Category D	
	Minimum Ceiling (AGL)	Minimum Visibility (MI)	Minimum Ceiling (AGL)	Minimum Visibility (MI)	Minimum Ceiling (AGL)	Minimum Visibility (MI)	Minimum Ceiling (AGL)	Minimum Visibility (MI)
RWY 1 – RNAV (GPS)								
LP	2420	1 ¼	2420	1 ½	2420	3	2420	3
LNAV	3100	1 ¼	3100	1 ½	3100	3	3100	3
Circling	3100	1 ¼	3100	1 ½	3100	3	3100	3
RWY 19 – ILS Y								
S-ILS	2162	5	2162	5	2162	5	2162	5
S-LOC	2160	¾	2160	1	2160	3	2160	3
Circling	2160	1 ¼	2160	1 ½	2520	3	2760	3
RWY 19 – ILS Z								
S-ILS	1451	1 ½	1451	1 ½	1451	1 ½	1451	1 ½
S-LOC	1520	½	1520	½	1520	$1^{5/8}$	1520	1 $^{5/8}$
Circling	2160	1 ¼	2160	1 ½	2520	3	2760	3
RWY 19 – RNAV (GPS) Y								
LPV	2270	5	2270	5	2270	5	N/A	N/A
LNAV/VNAV	2223	5	2223	5	2223	5	N/A	N/A
LNAV MDA	2560	¾	2560	1	2560	3	N/A	N/A
Circling	2560	1 ¼	2560	1 ½	2560	3	N/A	N/A
RWY 19 – RNAV Z								
LP	1201	¾	1201	¾	1201	¾	N/A	N/A
LNAV/VNAV	2150	5	2150	5	2150	5	N/A	N/A
LNAV MDA	1820	¾	1820	1	1820	2 ½	N/A	N/A
Circling	2560	1 ¼	2560	1 ½	2560	3	N/A	N/A

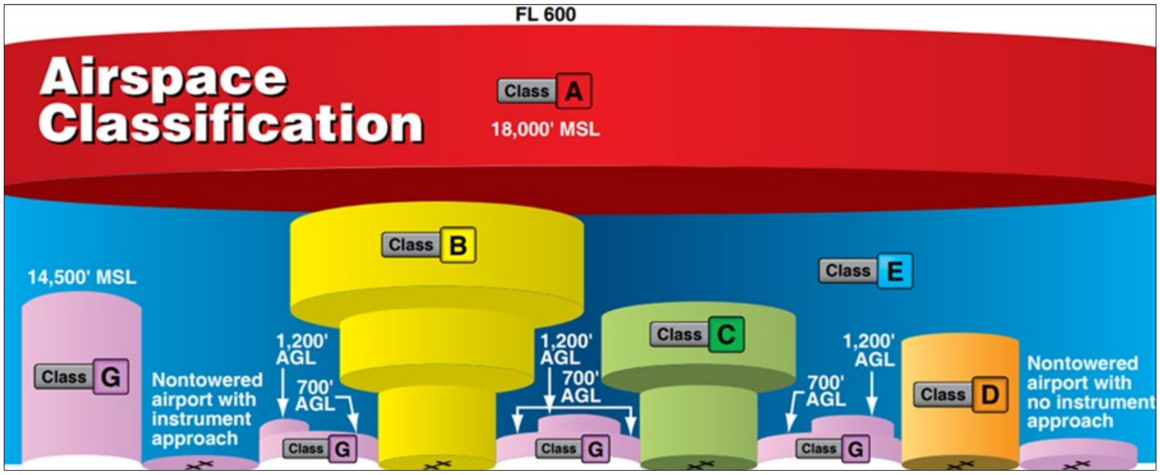
Source: FAA Terminal Procedures Publication
AGL – Above Ground Level (Feet)
MI – Statute Mile

1.3.1.1 Airspace

There are two types of flight operations within the National Airspace System (NAS) which aircraft operate under: Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). VFR operations rely on maintaining visual separation from aircraft and objects and require minimum weather conditions. Conversely, IFR operations rely on radar detection, instrument navigation, and separation by Air Traffic Control (ATC). IFR flights permit operations below VFR weather minimums (i.e., during instrument meteorological conditions). As discussed, Runway 1-19 has published IAPs to support arrivals into the Airport when operating under IFR.

The NAS classifies airspace uses a lettering-system (e.g., Class A, B, C, D, E, and G) and includes controlled and uncontrolled areas of airspace. Class A airspace is a controlled airspace and is generally reserved for business and commercial aircraft as it begins at 18,000 feet above Mean Seal Level (MSL). Class A airspace requires operation under an IFR flight plan and communication with ATC. The Class B, C, and D airspaces are also considered controlled airspace and are generally centered around larger airports. Communication with ATC must be established prior to entering the Class B, C, or D airspaces. The Class E and G airspaces encompass the majority of the NAS below 18,000 feet MSL. Although Class E airspace is controlled, ATC communication is not required under VFR operations. Class G airspace is always uncontrolled. **Figure 1-5** depicts the NAS.

Figure 1-5 – National Airspace System

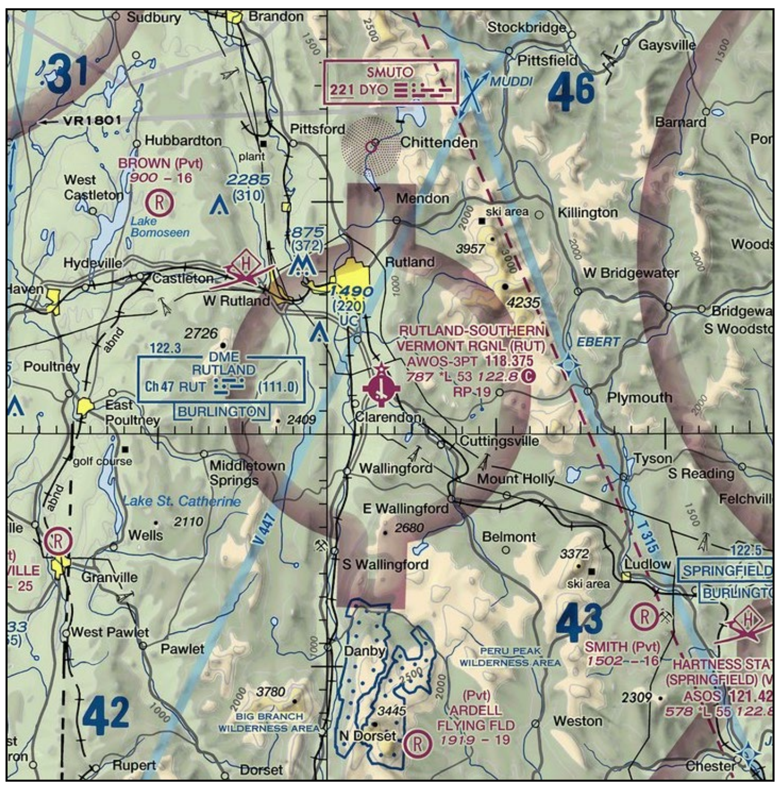


Source: Chapter 15, *FAA Airplane Flying Handbook*

Most non-towered GA airports are located within Class G airspace extending from the ground to either 700 feet or 1,200 feet Above Ground Level (AGL) where it then becomes Class E airspace. In some locations, however, Class E begins at the surface and extends vertically to 18,000 feet feet mean sea level.

As denoted by the faded magenta circle surrounding RUT on the FAA aeronautical sectional chart, RUT is located located within Class G airspace. Above the RUT Class G airspace, Class E airspace begins at 700 feet AGL and extends vertically to the Class A airspace at 18,000 feet MSL. **Figure 1-6** depicts the RUT airspace.

Figure 1-6 – RUT Airspace



Source: FAA Sectional Aeronautical Chart (Vermont, August 2021), CHA, 2021.

1.4 Landside Facilities

There are a total of 25 buildings located at RUT consisting of aircraft hangars, the passenger terminal building, the Fixed Base Operator (FBO) building, and office space. **Table 1-4** lists the on-airport buildings at RUT along with their approximate area. **Figure 1-7** and **Figure 1-8** depict the existing building locations.

Table 1-4 – RUT Buildings

No.	Description	Area (SF)
1	Corporate (Private)	6,700
2	C.A.P.	4,000
3	Corporate (S.D. Air)	4,200
4	ARFF	3,900
5	Corporate (C.A.P.)	2,400
6	Community (VTrans)	7,550
7	Terminal Bldg.	-
8	Corporate (Private)	3,180
9	Corporate (Private)	3,200
10	Corporate (Columbia)	4,720
11	Corporate (Private)	2.880
12	Community (Columbia)	3.150
13	FBO (Columbia)	1,700

No.	Description	Area (SF)
14	Community (Columbia)	3,100
15	T-Hangar (Columbia)	5 Stalls
16	T-Hangar (Columbia)	7 Stalls
West Side Hangars		
17	Corporate (Private)	2,930
18	Corporate (Private)	2,700
19	Corporate (Private)	2,400
20	Corporate (Private)	3,100
21	Corporate (Private)	2,900
22	Corporate (Private)	2,400
23	Corporate (Private)	2,200
24	Corporate (Private)	4,170
25	Corporate (Private)	2,240

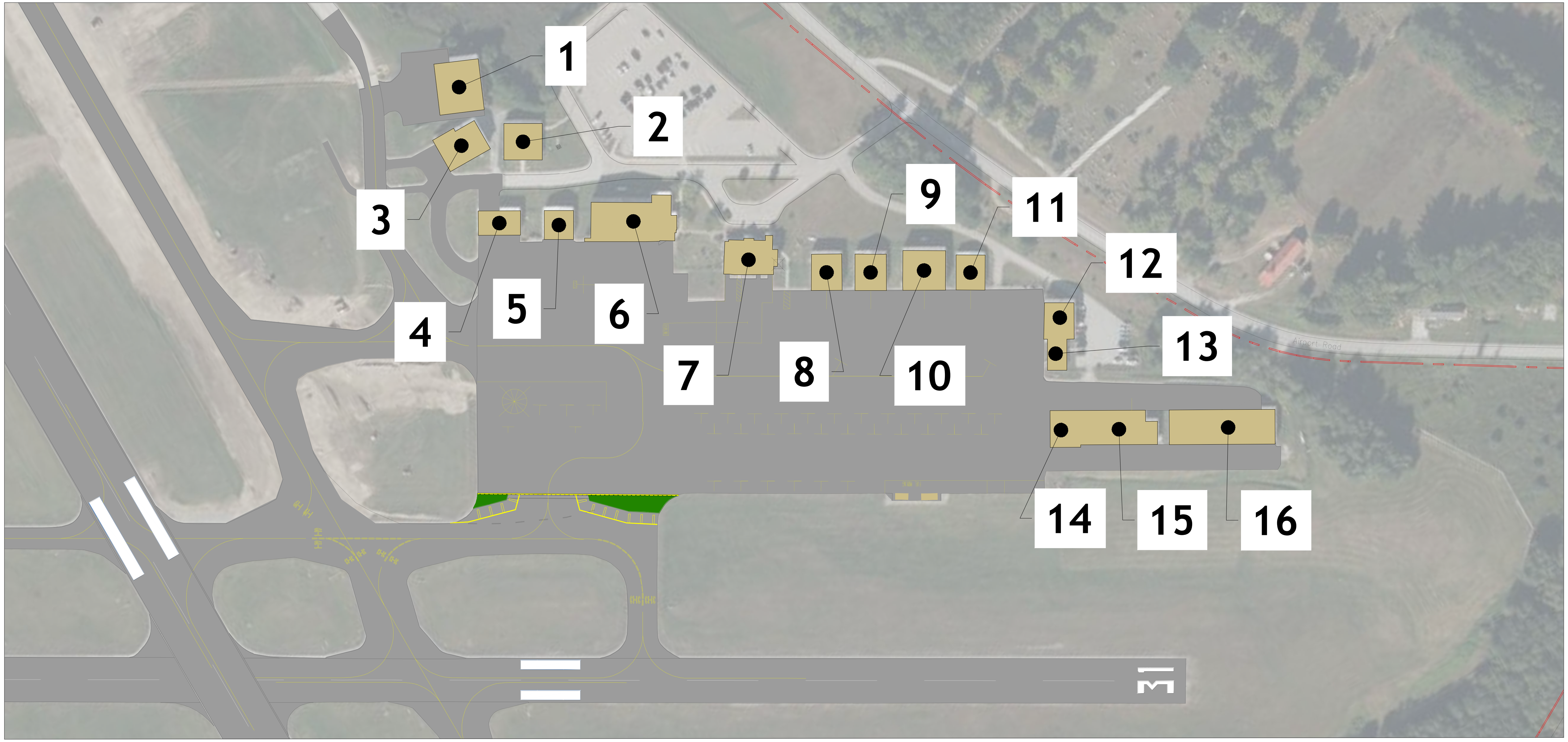
Source: VTrans, CHA, 2021.

1.4.1.1 Airport Terminal Building

The Airport terminal building is a two-story structure located on the north side of the main apron with access from Airport Road. The terminal building is owned and maintained by VTrans and contains airline ticketing and security office space, TSA passenger and baggage screening, passenger holding space, a baggage claim and waiting area, restrooms, a mechanical room, and a restaurant located on the second floor.


Source: VTrans

According to VTrans, the building was constructed in the early 1980s and is in need of repairs (e.g., new siding, roof patching, HVAC). **Table 1-5** lists the approximate area of each space located on the first floor of the terminal building.



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GRAPHIC SCALE (FEET)
0 100 200 400

LEGEND

Airport Property Boundary

No.	Description	Approx. Size
1	Corporate (Private)	6,700
2	Civil Air Patrol	4,000
3	S.D. Air (Aircraft Maintenance)	4,200
4	Aircraft Rescue and Fire Fighting	3,900
5	Civil Air Patrol	2,400
6	VTrans	7,550
7	Terminal Building	-
8	Corporate (Private)	3,180

No.	Description	Approx. Size
9	Corporate (Private)	3,200
10	Columbia Air (FBO)	4,720
11	Corporate (Private)	2,880
12	Columbia Air (FBO)	3,150
13	Columbia Air (FBO)	1,700
14	Columbia Air (FBO)	3,100
15	T-Hangar (5 Stalls)	-
16	T-Hangar (7 Stalls)	-

Figure 1-7
Main Apron
Existing Buildings

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GRAPHIC SCALE (FEET)
0 100 200 400

LEGEND

Airport Property Boundary

No.	Description	Approx. Size
17	Corporate (Private)	2,930
18	Corporate (Private)	2,700
19	Corporate (Private)	2,400
20	Corporate (Private)	3,100
21	Corporate (Private)	2,900
22	Corporate (Private)	2,400
23	Corporate (Private)	2,200
24	Corporate (Private)	4,170
25	Corporate (Private)	2,240

Figure 1-8
West Hangar Area
Existing Buildings

Table 1-5 – Passenger Terminal Building Areas

Area	Area (SF)*
Airline Ticket Space	125
Airline/Office Space	150
TSA Passenger & Baggage Screening	160
Passenger Holding Space	475
Outbound Baggage Handling Space	205
Baggage Claim & Passenger Waiting	700
Security Office Space	85
Lobby & Circulation Space	880
Mechanical	235
Restrooms	440

*Areas are approximate and measured from passenger building floor plan.
Source: VTrans, TSA, CHA, 2021

1.4.1.2 FBO Building

The FBO building is located along the eastern edge of the apron. This building is approximately 1,700 square feet and operated by Columbia Air Services, which provides all FBO services on the Airport. A box hangar is attached on the northern side of the FBO building.


Source: VTrans

1.4.1.3 Aircraft Refueling

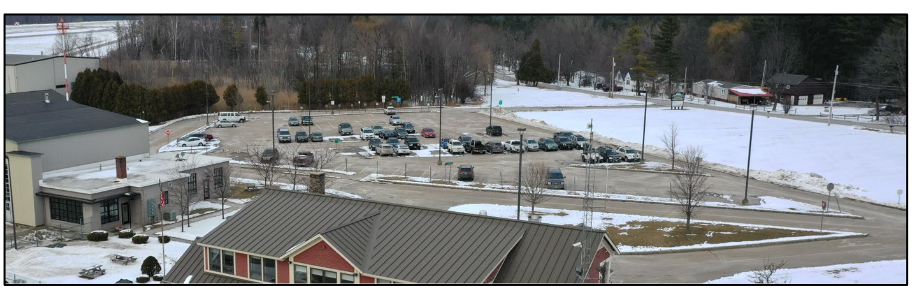
Two fuel tanks (100 Low Lead and Jet-A) owned and operated by Columbia Air Services are located along the southern edge of the apron. The northernmost tank holds 12,000 gallons of 100LL fuel and the southernmost tank holds 15,000 gallons of Jet-A fuel. Aircraft can be serviced by one of the Columbia's two aircraft refueling trucks or self-serve at the fuel pump.


Source: VTrans

1.4.1.4 Vehicle Parking

Vehicle parking for tenants, visitors, and employees is located off of Airport Road at the entrance of the Airport. There are approximately 150 parking spaces in the lot adjacent to the terminal building/hangars, for use by all airport customers. The lot is also used as a park-n-ride.

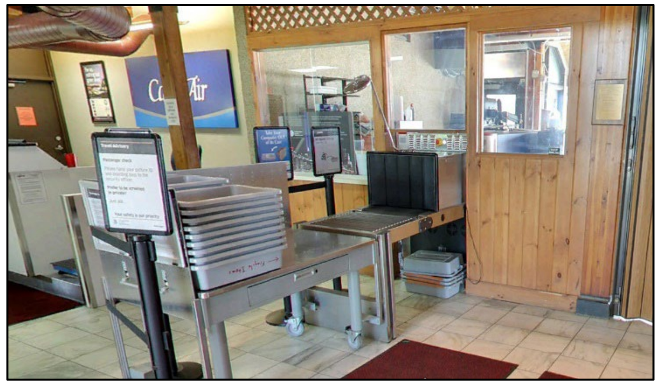
Additional vehicle parking for Columbia Air Services is located east of Hangar 12 and the FBO building. This parking lot contains enough space for approximately 10-12 vehicles.


Source: VTrans


Source: VTrans

1.4.1.5 Airport Security

As RUT provides regularly scheduled commercial service, the airport has complete perimeter fencing with four access points (two located on the main apron, one located west of Runway 1 end, and one located west of Runway 19 end) via manual and automatic gates. Additionally, the Main Apron has a Transportation Security Administration (TSA) delineated area directly adjacent to the terminal building.


Source: Google Earth

1.5 Existing Airport Activity Data

Although RUT is serviced by six daily commercial operations (three arrivals and three departures), the Airport is active with predominately general aviation activity from both public and private users. The majority of the activity is generated by light, private, recreational, and training aircraft utilizing single- and multi-engine piston aircraft.

An aircraft operation is defined as either a landing or a takeoff. Thus, each flight includes at least two operations; one takeoff and one landing. According to the 2019 FAA Terminal Area Forecast (TAF), there were approximately 13,000 annual operations at RUT in 2017, which amounts to an average of 18 landings per day. Of that total, operations were split relatively evenly between local and itinerant operations. Local flights are conducted mostly by based aircraft, and primarily include single- and multi-engine piston aircraft. Itinerant operations (i.e., those arriving from outside of the local area) are conducted by a mix of based and transient aircraft.

The number of based aircraft at an airport is used to determine the need for aircraft hangar space, apron area, and other related facilities. Based aircraft include those owned by individuals, businesses, or organizations that are stored at the Airport on a regular basis. According to FAA 5010 Records, RUT has a total of 26 based aircraft. Of that total, there are 25 are single-engine piston aircraft and one multi-engine piston aircraft. Although there are no jet aircraft currently based at RUT, the Airport regularly accommodates itinerant jet aircraft. **Table 1-6** provides a depiction of the types of aircraft based at RUT along with aircraft that frequently utilize the Airport.

Table 1-6 – Aircraft Utilizing RUT

Single Engine Piston	Multi Engine Piston	Other
		

Chapter 2

Forecasts of Aviation Demand

2 Forecast of Aviation Demand

2.1 Introduction

Forecasts of aviation demand are a key element in all airport planning. Demand forecasts, based upon the desires and needs of the service area, provide a basis for determining the type, size, and timing of aviation facility development and are a platform upon which this Master Planning Study will be based. Consequently, these forecasts influence virtually all phases of the planning process.

This 20-year forecast incorporates an in-depth look at Rutland-Southern Vermont Regional Airport's (RUT's) potential airline passenger demand, along with the general aviation (GA) demand components. It is important to note that to take advantage of the Federal Aviation Administration's (FAA)primary airport entitlement program, 10,000 or more annual enplanements are required. Primary airport funding provides roughly $1 million Airport Improvement Program (AIP) entitlement funding to airports meeting this activity criteria.

Rutland was designated an Essential Air Service (EAS) city in 1978 when the full U.S. deregulation of the airlines took place. This entitled Rutland to receive guaranteed airline service through a federal subsidy. Thus, the airline forecasts have been tempered by the fact that non-market forces are at work with the subsidy process. The airline demand forecasts examine both historical and potential future airline passenger scenarios. The first phase involves the identification of the Airport's potential market, its size, and demand characteristics. The key is to determine whether this market can support 10,000 or more enplanements. The second phase of the forecast is to determine whether the existing carrier (Cape Air) serving RUT can accommodate 10,000 enplanements or more, given its aircraft equipment and schedule.

With the above information established, a conventional forecast of airline demand can be undertaken. This involves the following components:

- ✈ **Annual Enplanements**: A boarding passenger for an airline aircraft departure.
- ✈ **Annual Airline Operations**: Landings or takeoffs performed by an airline aircraft.
- ✈ **Load Factors, Aircraft Types**: The percentage of seats filled relative to the aircraft capacity; Aircraft types involve the airline fleet mix
- ✈ **Potential Air Cargo Activity**: Includes any specialty cargo and niche operations at an airport.

In addition to these items, the following GA activity components are included in these forecasts:

- ✈ **Based Aircraft**: – Defined as a GA aircraft which is stationed at an airport on a permanent basis.
    - o Based Aircraft Fleet Mix
- ✈ **General Aviation Enplaned Passengers**: – Air travelers who have boarded departing GA aircraft.

- **General Aviation Aircraft Operations**: Either a takeoff or a landing of a GA aircraft and includes:
    - Total Annual Operations
    - Local vs. Itinerant Operations
    - Fleet Mix Operations
    - Peak Period (Monthly, Daily, Hourly) Operations
- **Military Aviation Operations**: Either a takeoff or a landing of a military aircraft.

It is important to note that, for the purposes of this Study, annual instrument approaches were evaluated and projected throughout the forecast period. After the formation of the preferred forecast, the critical aircraft for RUT was determined.

2.2 Forecast of Airline Demand

This section of the forecast is organized to examine the following topics concerning actual and potential airline demand at RUT:

- Airline Passenger History at RUT
- Market Factors
- Unconstrained Airline Passenger Generation
- Comparable Market Analysis
- Discussions with the Airline Serving RUT (e.g., Cape Air)
- Discussions with Tradewind Aviation
- Airline Demand Forecast Components
    - Annual Enplanements
    - Annual Aircraft Operations
    - Fleet Mix
- Steps Needed to Attain Potential Demand

2.2.1 Airline Passenger History at RUT

Table 2-1 presents the historical number of airline passenger enplanements at RUT from years 2010 through 2018. As shown, there has been a steady decline in the population, while airline traffic has fluctuated over the period. Because Cape Air began serving RUT in 2007 and is the sole carrier at the Airport, all of the enplanements shown in **Table 2-1** were on that carrier. While 2011 had the highest amount of enplanements since 2010, the Airport has not reached 6,000 enplanements. With a declining population base, it becomes hard to maintain and grow airline traffic levels into the future.

Table 2-1 – Historical Airline Enplanements and Population

Year	RUT Enplanements	Rutland Co. Population
2010	5,530	61,578
2011	5,997	61,220
2012	5,916	60,791
2013	5,321	60,480
2014	5,407	60,031
2015	5,379	59,547
2016	5,146	59,113
2017	5,024	59,000
2018	5,656	58,672

Source: FAA Enplanement statistics for calendar years: Online at (https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/previous_years/, and https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/)**.** Accessed 9/10/19. Population from U.S. Census Bureau.

2.2.2 Market Factors

Several factors make the Rutland market unique. These include daily AMTRAK service, daily airline service, and no Interstate highway system within 35 miles. Access to Rutland encourages use of rail and air service. In this regard, passenger rail service is provided on the Ethan Allen Express with one daily round trip from Rutland to New York City (Penn Station). The trip takes 5.5 hours. The airline service is provided by Cape Air with three round trips per day to Boston Logan International Airport.

AMTRAK serves Rutland, as does Green Mountain Railroad foliage tours. In 2017, the rail service carried 14,267 passengers[2]. Assuming boardings and alightings are balanced, this means 7,133 passengers departed toward New York City using the rail system. It is unknown if passengers got off the train prior to reaching the end of the line. However, the fact that there is a market for passenger service from Rutland to New York is demonstrated by the ridership. Whether some of these passengers could be converted to air transportation service would likely be dictated by the airline cost and the time in transit. The rail cost is roughly $100 for a one-way ticket. By trimming the time in transit from 5.5 hours to less than one hour, it is possible that the cost of an airline ticket could be significantly higher than rail and still be competitive.

For RUT, airline passengers who desired to drive to an alternate city to begin the airline portion of their trips (passenger leakage), the average airfare[3] since 2013 for Albany International Airport (ALB), Bradley International Airport (BDL), Burlington International Airport (BTV), and Boston Logan International Airport (BOS) are shown below:

[2] Source: Amtrak Fact Sheet, Fiscal Year 2017 State of Vermont, https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/, Accessed 10/22/19

[3] Source: Bureau of Transportation Statistics, USDO**T:** https://www.transtats.bts.gov/AIRFARES/

- ALB - $415
- BDL - $387
- BTV - $376
- BOS - $356

A cost model (**Table 2-2**) for driving indicated that from Rutland, it costs about $92 to drive to Albany, NY (mileage at $0.55/mile plus time at $27.20/hour[4]). Using the same method, it costs $71 to drive to Burlington, and $154 to drive to Hartford. Given the published $89 one-way fare to BOS, the combined difference between average air fares and driving costs favor the use of RUT over the alternatives. The closest cost competitor is Burlington, with a $91 drive and airfare difference ($71 drive cost, plus $376-$356=$20 airfare difference). If the value of time increases from the average rate of $27.20 per hour, it adds to the overall benefit of flying from RUT.

Table 2-2– Drive/Fly Model Comparisons for BOS vs Alternative Airport Service

Rutland To:	ALB	BTV	BDL	BOS*
Driving Distance	92	70	157	
Driving Cost	$50.60	$38.50	$86.35	
Driving Time	1.54	1.21	2.5	
Cost of Time	$41.89	$32.91	$68.00	
Total Driving Cost	$92.49	$71.41	$154.35	$89.00
Average Fare Level	$415	$376	$387	$356
Difference from BOS	$59	$20	$31	$0
Driving + Fare Level Increase vs BOS	$151.49	$91.41	$185.35	$89.00
Cape Air/BOS Average **Benefit**	**$62.49**	**$2.41**	**$96.35**	**$0.00**

* Instead of driving cost, the published air fare from Cape Air is used for comparison purposes.

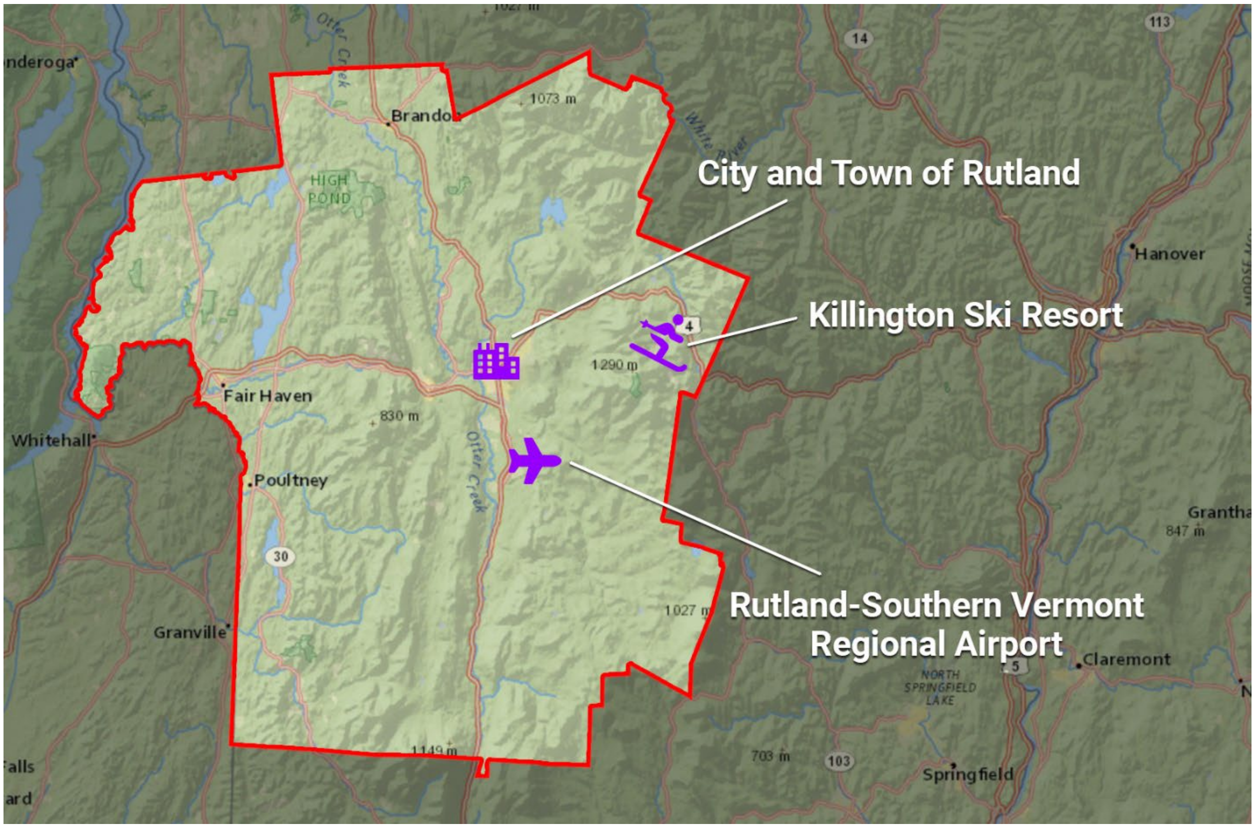
On average, it would pay to use Boston-Logan International rather than to drive to any of the alternative airports, unless there was a specific fare in a specific market that was much lower than those from BOS.

2.2.3 Unconstrained Airline Passenger Generation

The first step in forecasting potential airline demand is to estimate the number of airline travelers that originate in the Rutland service area. For purposes of this study, Rutland County was considered the catchment area for airline enplanements, and includes the city and town of Rutland, as well as the Killington Ski Resort (**Figure 2-1**). The Airport is somewhat centrally located in the County. In 2018, the population of Rutland County was 58,672, according to the U.S. Census Bureau.

[4] Source: Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis, US Department of Transportation (USDOT) memorandum, 2015.

Figure 2-1 – Rutland Air Service Catchment Area



One way to estimate or project the unconstrained number of air passengers originating from Rutland County is to base the number of enplanements on the average inclination of U.S. residents to use airline transportation. While this average is subject to wide variations because of local economic variations, it does present a baseline that could be considered normal if Vermont conformed to national averages.

In 2018 there were an estimated 778.0 million domestic air passenger enplanements in the United States.[5] The population in the United States in 2018 was approximately 327.2 million, which results in an average of 2.38 enplanements per U.S. resident. The FAA provides data that can be used to analyze the number of transfer passengers at the nation's hub airports.[6] In this regard, it is estimated that about one-third of passenger enplanements are double counted because they travel through a hub airport and must change planes to reach their final destination. In other words, they are counted as an enplanement at their originating airport and again at the hub airport. Thus, the connections represent approximately 33 percent of total enplanements.

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[5] Source: Bureau of Transportation Statistics, USDOT: https://www.bts.dot.gov/annual-passengers-all-us-scheduled-airline-flights-domestic-international-and-foreign-airline, Accessed 11/15/19.

[6] Research Site: Bureau of Transportation Statistics, USDOT; Airline Origin and Destination Survey: https://www.transtats.bts.gov/DatabaseInfo.asp?DB_ID=125, Accessed 12/4/19.

Using this information, the enplanement ratio of 2.38 enplanements per U.S. resident overstates the generation of new passengers by approximately 33 percent. Reducing the ratio by that amount reveals that there is an actual average of 1.59 enplanements per U.S. resident. Using this ratio, the number of potential enplanements originating from Rutland County would be as follows:

1.59 enplanements per resident x 58,672 residents = 93,300 annual enplanements.

Under these assumptions, there are an estimated 93,300 passenger enplanements that originate in from Rutland County each year and use RUT and other local/regional airports (e.g. ALB, BTV, BDL). The question that an airline must answer before providing service to RUT is: how many of these air travelers can be captured at RUT for their air trips over and above the current level?

2.2.4 Comparable Market Analysis

When there is no reliable track record of airline service, it is often beneficial to develop a comparable market analysis. In this regard, a model was developed that analyzed 92 cities with existing airline service to determine enplanement levels, population, drive time distance from the nearest hub airports, and the type of airline service offered. These airports were mostly located in small markets with varying levels of passenger enplanements. Similarly, the population centers were smaller, averaging about 263,400.

To approximate the potential airline service capture at RUT, the comparative model was narrowed to consider 13 of the 92 cities that were most like Rutland. These smaller cities with airline service featured turboprop or other propeller-driven aircraft. These cities better reflected the potential capture of airline passengers for a community such as Rutland.

Using the comparative model, the relationship between population and distance from the local airport to the nearest hub airport was formulated. The resulting linear formula (in the form of Y=m*X + B) showed the following:

Y = 115 x 0.004359 + (-0.27947) or Y = 0.221815

Where:

Y= Per Capita Airline Passenger Enplanements

m= Drive Time Distance to Hub Airport – 115 Minutes to ALB

Using the population of Rutland County (service area) and multiplying by the per capita factor yields an estimate of potential passengers that could be captured at RUT. With a population of 58,672 times the per capita factor of 0.221815 results in 13,000 potential enplanements. This amount is significantly less than the estimated total airline passenger generation of the County (93,300 annual enplanements), but it is similar to the potential capture rate of airports with comparable profiles.

If BTV is used instead of ALB as the nearest hub airport, the drive time is reduced to 101 minutes. While BTV does not have Southwest Airlines or as many choices in flights, it is likely that airline passengers are split between BTV and ALB. Also, because the drive time is slightly less than ALB, the reduction changes the results of the formula to reflect less of a capture rate at RUT. Substituting 101 minutes into the formula above results in a per capita capture rate of 0.160789. When multiplied by the service area population, the potential airline enplanement total drops to 9,400.

If an average of the high and low projections (ALB vs. BTV) is taken [((13,000 plus 9,400)/2) = 11,200], the actual capture of potential passengers could exceed 10,000, assuming RUT conformed to similar airports used in the model. However, because the lower estimate of potential passengers is just below 10,000, the feasibility of exceeding that number rests on airline service quality and flight frequency.

2.2.5 Discussions with Cape Air

The forecasts of airline traffic are heavily influenced by the type and level of service provided by Cape Air. For RUT and most other non-primary airline airports, there is a desire to reach 10,000 annual enplanements because that threshold triggers additional entitlement funding. Below that threshold, each NPIAS airport is entitled to $150,000 per year to spend on capital improvements and in some cases, revenue enhancement projects. Above that threshold, the entitlement is $1 million per year. Thus, there is a clear incentive to raise the number of passenger enplanements at RUT.

Prior to developing the Master Plan forecasts, discussions were held with Cape Air's Senior Vice President of Planning.[7] Topics in the discussion were aimed at determining the highest number of passengers that could reasonably be carried by the airline, given its capacity limitations. Cape Air's representative explained that, in the quest for 10,000 enplanements, Rutland-Southern Vermont Regional Airport's EAS designation is only for three daily round trips in aircraft with nine seats. Therefore, there is a structural barrier to achieving 10,000 enplanements. The USDOT only authorizes 9,855 departing seats per year from RUT. Assuming a 100 percent load factor, the community would still fall short of the desired 10,000 enplanements. In 2018, Cape Air flew 9,153 departing seats and enplaned 5,656 passengers at Rutland for an approximated 61.8 percent load factor.

Lebanon, NH, has Cape Air service and enplanes more than 10,000 passengers. The answer to the discrepancy between Lebanon and RUT is that, early in the Essential Air Service (EAS) program, USDOT authorized six daily roundtrips from Lebanon compared to RUT's three. Those flight authorizations are not anticipated to change, because a change at one city would cause many airports to request FAA for changes at all other EAS cities, setting a potentially difficult precedent for the EAS program.

Cape Air has ordered 100 new nine-passenger aircraft from Tecnam, an Italian aircraft manufacturer. These aircraft, the P2012 Traveller, will replace the 83 Cessna 402s that make up the bulk of the Cape Air fleet. The transition started late in 2019 with 20 new aircraft delivered to Cape Air. From there, deliveries of one per month will continue over the next several years.

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[7] Source: Telephone conversation with Andrew Bonney, Sr. Vice-President of Planning for Cape Air. 8/12/19.

With all of the Cessna 402s paid off, Cape Air will be in a position to place these older aircraft in low-cost markets with on-demand charter needs. Cape Air believes that RUT could generate between 10 and 15 percent more passengers through this method. Block hour costs for these aircraft are significantly less than for the new aircraft, thus providing a competitive advantage for attracting charter business. If an additional 15 percent could be attracted to RUT, that would raise overall enplanements to 6,500, which would still be short of the desired 10,000 enplanements.

2.2.6 Discussions with Tradewind Aviation

Another theme discussed for increasing airline usage is potential increased seasonal service to local ski areas. For example, Tradewind Aviation provides seasonal service from White Plains (NY) to Morrisville-Stowe State Airport (MVL) in Vermont on the weekends. The passengers are mostly visiting the ski resort or second homes in the area. This is a premium service and as such, air fares are costlier than those for subsidized Essential Air Service routes. Tradewind uses the single-engine Pilatus PC-12 turboprop aircraft, configured to eight passenger seats.

Discussions with representatives of Tradewind Aviation indicated that they are interested in servicing RUT in the “off season,” which includes the winter months. This is the period when a portion of their aircraft fleet is not serving summer vacation destinations of Martha’s Vineyard and Nantucket Island. MVL is also a seasonal service point, but primarily in the winter months.

If RUT is to be added to their route structure, it is likely that a subsidy would be needed. Tradewind representatives indicated they could envision a six-month service with three flights per day between RUT and White Plains, NY. The cost of this service would vary because it would depend on passenger demand and ticket prices. As such, Tradewind would require a revenue guarantee for providing service so that shortfalls in revenue would be made up by the Airport sponsor. Note that the FAA does not fund these types of revenue guarantees. Airport sponsors using this option typically self-fund, seek various forms of economic development grants, or community programs for a local economic development organization. Often these programs are temporary and intended to stimulate demand until they may become financially sustainable.

2.2.7 Airline Enplanements Forecast

Forecasts were developed for three airline activity components for a 20-year planning period (2018 through 2038). The year 2018 was the last full year of actual data available when developing the forecasts. For this Master Plan, three projections of demand were made. The first was a constrained projection of activity, given the EAS patterns of the past, and the other two were dynamic projections that considered potential changes to airline service patterns.

2.2.7.1 Airline Enplanement Forecast – Constrained

FAA guidelines indicate that forecasts should differ from the FAA’s Terminal Area Forecasts (TAF) by less than less than 10 percent in the 5-year forecast and 15 percent in the 10-year period. Therefore, the Constrained Enplanement Forecast used the TAF as the recommended forecast, with the other projections being considered as the high scenarios. **Table 2-3** presents the Recommended Airline Enplanement Forecast.

Table 2-3 - Recommended Forecast of Airline Enplanements

Airline Enplanements	Fiscal Year	Airport Forecast	TAF	(% Difference)
Base yr.	2018	5,430	5,430	0.0%
Base yr. + 5yrs.	2023	5,430	5,430	0.0%
Base yr. + 10yrs.	2028	5,430	5,430	0.0%
Base yr. + 15yrs.	2033	5,430	5,430	0.0%
Base yr. + 20yrs.	2038	5,430	5,430	0.0%
CAGR	**-**	**0.00%**	**0.00%**	**-**

2.2.7.2 Airline Enplanement Projection – High Range

As mentioned, Cape Air serves RUT with nine-seat aircraft, three times daily to BOS. The total possible airline traffic, assuming no flights were cancelled and 100 percent load factors, would be 9,855 enplanements per year. With a cap on the seats available set by USDOT, the only question about the constrained forecast would be how high the load factor percentage could go. For 2018, the average load factor at RUT was 61.8 percent.

Since 2014, the average domestic load factor for all airlines has hovered between 84 and 85 percent.[8] If Cape Air could reach this average with three flights per day, the total number of passenger enplanements would crest at 8,377. Historical activity at RUT indicates that this load factor has not been achieved; however, if the current 61.8 percent could be raised to 73 percent (half of the difference between existing RUT load factors and the national average), the following passenger projections could be expected (**Table 2-4**):

Table 2-4 - EAS Unconstrained Forecast of Enplanements

Year	Available Seats	Load Factor	EAS Enplanements	+ 15 % On-Demand Charter	Total Enplanements
Historical					
2010	9,243	59.8%	5,530	-	
2011	9,009	66.6%	5,997	-	
2012	9,504	62.2%	5,916	-	
2013	8,883	59.9%	5,321	-	
2014	8,973	60.3%	5,407	-	
2015	9,144	58.8%	5,379	-	
2016	9,099	56.6%	5,146	-	
2017	8,892	56.5%	5,024	-	
2018	9,153	61.8%	5,656	-	
Forecast					
2023	9,855	65%	6,406	961	7,367
2028	9,855	70%	6,899	1,035	7,933
2038	9,855	73%	7,194	1,079	8,273
CAGR	0%	-	1.21%	-	1.92%

CAGR – Compound Annual Growth Rate

Source: Available seats derived from published airline schedule. Load factor derived from enplanements divided by available seats. Forecast from Consultant estimate.

[8] Source: USDOT, Bureau of Transportation Statistics: https://www.transtats.bts.gov/Data_Elements.aspx?Data=5 accessed 9/10/19

The projection assumes that conditions in RUT will move toward national averages over the long term. This scenario represents RUT's preferred enplanements forecast, but is not recommended base on differences from the TAF. It assumes gradual growth throughout the planning period until the load factor limit is reached in 2038. As shown, there are on-demand charter passengers that add 15 percent more enplanements to the EAS passenger totals.

2.2.7.3 Airline Enplanement Projection – Unconstrained Market Capture

From **Section 2.2.3**, the discussion of unconstrained market capture used a comparative analysis to estimate the potential airline enplanement demand. From that analysis, it was determined that if all leaked passengers from Rutland County used ALB in New York, the potential capture at RUT was 13,000 enplanements. Similarly, if all leaked passengers used BTV, which is closer, the potential capture at RUT was reduced to 9,400 enplanements. Because there are leaked passengers from Rutland County at both airports, an average of the two potential estimates was developed for RUT. This produced a projection potential of 11,200 enplanements at the Airport.

This projection assumes that additional scheduled airline aircraft departures and seats are available (beyond the three existing departures per day). Growth over the planning period would begin at the time of new scheduled airline service and continue up to the 11,200-enplanement potential. If the new airline service was added in 2020, increases would begin at that time. For this projection, it was assumed that the additional service would begin no later than 2023. Using these assumptions, the unconstrained market capture forecast would include the following growth characteristics:

Enplanements

- 2018: 5,656
- 2023: 9,400
- 2028: 11,200
- 2038: 11,200

Similar to the history of enplanements at RUT, there is fluctuation of projected enplanements, but limited growth. For the future, it is assumed that if additional scheduled service is instituted, growth will quickly move toward the unconstrained capture potential; however, growth beyond the unconstrained capture potential is dictated by available seats and population growth. In this regard, there has been negative growth in Rutland County population for the last decade. Without some turnaround in that trend, it is likely that the unconstrained capture potential for enplanements will not grow past the existing projections. Therefore, the unconstrained forecast of potential enplanements is not the recommended airline forecast for this Master Plan.

2.2.8 Airline Operations Forecast

When developing the airline operations forecast, the year 2018 was the last full year of actual data available when developing the forecasts. Two projections of airline operations were developed, with one being constrained and one being unconstrained by the EAS Program.

2.2.8.1 Airline Aircraft Operations Forecast – Constrained by EAS Program

In this scenario, EAS aircraft operations would also be constrained by the USDOT to three per day. This would create 1,095 annual scheduled flights for a total of 2,190 annual EAS operations (i.e., 1,095 takeoffs and 1,095 departures). assuming that all scheduled flights are completed[9].

In addition to the scheduled airline operations, the forecast of enplanements includes non-scheduled charter flights, as discussed by Cape Air. These flights would add about 15 percent to the total operations conducted under the EAS program. They are included in the following projection:

Table 2-5 - EAS Constrained Forecast of Airline Operations

Year	Available Seats	Departures	Operations	+ On-Demand Charter Total Operations
Historical				
2010	9,243	1,027	2,054	-
2011	9,009	1,001	2,002	-
2012	9,504	1,056	2,112	-
2013	8,883	987	1,974	-
2014	8,973	997	1,994	-
2015	9,144	1,016	2,032	-
2016	9,099	1,011	2,022	-
2017	8,496	944	1,888	-
2018	9,090	1,010	2,020	-
Forecast				
2023	9,855	1,095	2,190	2,520
2028	9,855	1,095	2,190	2,520
2038	9,855	1,095	2,190	2,520

Source: Bureau of Transportation Statistics: https://www.transtats.bts.gov/data_elements.aspx?data=2, accessed 1/30/20.

For the purposes of this study, this scenario has been chosen to represent the recommended airline operations forecast for RUT.

2.2.8.2 Airline Aircraft Operations Forecast – Unconstrained Market Capture

The airline aircraft operations forecast for the unconstrained market capture scenario follows a similar path as the constrained EAS program. That is, there will be a limited number of available seats in the market. Assuming the existing 61.8 percent load factor grows to 73.0 percent, the following number of operations are forecast for RUT under this scenario:

[9] It should be noted that environmental and mechanical factors may prevent the actual completion of these flights; however, for planning purposes, it is assumed that all flights would be performed as scheduled.

Table 2-6 - Unconstrained Airline Operations Projection

Year	Available Seats	Departures	Operations	+ On-Demand Charter
Historical				
2018	9,090	1,010	2,020	
Forecasts				
2023	12,870	1,430	2,860	3,289
2028	15,345	1,705	3,410	3,922
2038	15,345	1,705	3,410	3,922
CAGR	**2.65%**	**2.65%**	**2.65%**	**3.37%**

Thus, to attain more than 10,000 enplanements, RUT would have to attract an additional 1,200 operations (600 flights) per year. If the additional flights are seasonal, they would have to increase proportionately during the season (winter). Because it is unrealistic that RUT will obtain the additional 1,200 operations, this scenario was not chosen to represent the preferred airline operations forecast for the Airport.

2.2.9 Airline Aircraft Fleet Mix Forecast

For the future, the Cape Air order of 100 new nine-passenger P2012 Traveller aircraft from Tecnam, will replace the 83 Cessna 402s that make up the bulk of the Cape Air fleet. This already began in 2019 and will continue with deliveries of one per month over the next several years. Both the Cessna 402 and the P2012 Traveller are nine-passenger aircraft. Thus, although the brand of aircraft will change, the operating characteristics will remain similar.

Tradewind Aviation uses the Pilatus PC-12 in their scheduled charter service. This aircraft has seating for between six and eight passengers, depending upon the configuration. Tradewind does have additional business jet aircraft for non-scheduled charter flights; however, these aircraft seat only six passengers and would not be used in scheduled service.

Under the EAS constrained airline forecasts, RUT can anticipate a steady service of nine-seat aircraft (or less) throughout the planning period. This will likely be the Tecnam, P2012 Traveller or similar aircraft. Thus, the size of the future aircraft will be that of a twin-engine propeller aircraft. If an airline such as Tradewind Aviation enters the market, they would use eight passenger, single engine, Pilatus PC-12 aircraft. Although some other EAS cities have larger aircraft in service (even regional jets), these cities are much more self-supporting than RUT. It is important to note that no carrier with more than nine seats has bid on the RUT EAS route.

2.2.10 Potential Air Cargo Activity

In 2018, there was an average of 270 pounds of air freight and mail carried on each Cape Air flight. This average is unlikely to change over time, because of the size and cargo capacity of the aircraft. The new P2012 will not increase cargo space significantly. With a useful load capacity of 2,937 pounds, there are limits to the amount of air cargo that the aircraft can carry, once the aircraft is filled with passengers and baggage.

In addition to Cape Air, both UPS and FedEx have charter air cargo flights through Wiggins Airways. In 2019, a total of 483,394 pounds of freight and mail was deplaned at RUT from these sources, while 119,408 pounds of freight was enplaned. It is assumed that these volumes will continue in the future with little change. No additional facilities are needed to accommodate this air cargo. Therefore, the forecast air cargo activity includes the following:

Table 2-7 - Air Cargo Forecast (Pounds)

Year	Cape Air Departures	Enplaned Air Cargo	Wiggins Enplaned Cargo	Total Air Cargo
Historical				
2018	1,010	272,700	119,408	392,108
Forecasts				
2023	1,095	295,700	120,000	415,700
2028	1,095	295,700	120,000	415,700
2038	1,095	295,700	120,000	415,700
CAGR	0.40%	0.40%	0.03%	0.29%

2.2.11 Steps Needed to Attain Potential Demand

The only way to exceed 10,000 enplanements at RUT is to add more seats to the market. The available capacity of the current service pattern provides a maximum of 9,855 departing seats per year. Lebanon, NH enplanes just over 10,000 passengers but has more than 18,700 available seats in the market each year. Lebanon is served by Cape Air, so it can be achieved with nine-seat aircraft.

In the most recent round of EAS airline selections, Cape Air and Boutique Air competed to serve RUT. Both carriers offered 21 weekly roundtrips to BOS. Cape Air uses nine-seat aircraft, while Boutique Air proposed to use eight-seat aircraft. Thus, scheduled seats from Cape Air were estimated at 9,855, while Boutique Air proposed 8,736. Although Boutique Air touted the resuscitation of air service in EAS communities with their new aircraft, they simply could not reach the 10,000-passenger mark at RUT with their proposal. Cape Air was selected by USDOT over the City of Rutland's choice of Boutique Air for a variety of reasons – cost being the most important. Cape Air's proposed subsidy was for $1.73 million per year, while Boutique Air proposed $2.02 million per year.

If the city of Rutland or the State of Vermont wanted to increase passenger enplanements at RUT, actions available to them are limited. The most direct action would be to subsidize new flights either with Cape Air, or Tradewind Aviation, or both. Other carriers, such as Boutique Air, could be contacted; however, Boutique Air's fleet/cost structure is the same as that of Tradewind (Pilatus PC-12s).

Following the Lebanon, NH model, flights to White Plains, NY could bolster traffic, but at a cost. Cape Air indicated that a year-round flight would cost roughly one-third of their proposed subsidy, or $567,600. To subsidize three roundtrips for six months would cost roughly $851,400. Thus, to gain $850,000 in additional FAA entitlement grants, the Airport sponsor would have to spend about the same amount, which is not a viable option.

Tradewind Aviation indicated a similar cost amount. That is, use of their Pilatus equipment for six months in serving White Plains with three roundtrips per day would likely cost $1.6 million in subsidies.[10] Tradewind's policy is to avoid competition with the automobile. Thus, island destinations are their best markets.

Considering "out-of-the-box" solutions such as vacation destination carriers like Allegiant Air, Spirit Airlines, Sun Country Airlines, etc., the infrastructure at RUT is unable to accommodate the types of jet aircraft that these carriers use (i.e., Airbus 319, Airbus 320, Boeing 737) in terms of runway length (5,300 feet) and terminal building space (less than 5,000 square feet). The inability to lengthen the runway limits the size and capacity of jet aircraft using RUT for the longer term. Even if they could be served, demand from Canada would be limited by other more northern choices for low fare carriers at BTV and Plattsburgh International Airport, NY. As such, it is highly unlikely that larger airline aircraft used by these carriers could be accommodated.

Given the above issues, the attainment of 10,000 annual enplanements at RUT appears unlikely in the near future. The best option (perhaps the only option for RUT to reach their passenger goals) would be the attraction of a carrier willing to serve the New York City area on a non-subsidized basis.

2.3 Forecast of General Aviation Demand

General aviation (GA) is defined as all civil aviation not classified as commercial or military. Forecasts of aviation demand can be developed for a variety of activity indicators. These indicators include the type and number of aircraft operations, along with the number of aircraft based at the Airport. General aviation activity makes up the bulk of aircraft operations at RUT. Forecasts of general aviation demand help in the planning of non-airline facilities at the Airport. Major forecasting topics addressed in this section include:

- Aviation Demand Elements
- Forecast Methodologies
- General Aviation Demand Forecasts
- General Aviation Enplanements
- Military Operational Activity Forecasts

2.3.1 Aviation Demand Elements

Forecasts of aviation demand can be developed for a variety of activity indicators. In the case of RUT, demand elements revolve primarily around existing and future general aviation activity. Military operations forecasts are included (even though they are not considered general aviation), but these are a fraction of overall general aviation totals. Basic activity indicators include the type and number of aircraft operations, along with the number of aircraft based at the Airport. Other important elements are derived from these basic indicators. Twenty-year aviation activity forecasts were prepared for the following aviation elements:

[10] Source: Costs provided by Tradewind Aviation.

- Based Aircraft – General aviation aircraft which are stationed at an airport on a permanent basis.
- General Aviation Aircraft Operations: A takeoff or a landing of a general aviation aircraft.
  - Total Annual
  - Local Versus Itinerant
  - Peak Period (Monthly, Daily, Hourly)
- General Aviation Fleet Mixes – the characteristics of a population of aircraft
  - Based Aircraft Fleet Mix
  - GA Operations Fleet Mix
- General Aviation Enplaned Passengers – Air travelers who have boarded departing general aviation aircraft.
- Military Aircraft Operations: Either a takeoff or a landing of a military aircraft.

Table 2-8 presents the historical aircraft operational activity at RUT. It is noteworthy that at RUT, general aviation accounted for 86 percent of all aircraft operations, Air Taxi, which can include scheduled and on-demand flights for hire, accounted for 13.8 percent and the military conducted 0.2 percent of operations in 2018. In addition, it is important to note that there are currently[11] 27 aircraft based at the Airport. (as of November 2019).

Table 2-8 – RUT Historical Aviation Activity, 2008-2018

Year [1]	Itinerant Operations					Local Operations			Total Ops
	AC	AT	GA	Mil	Total	Civil	Mil	Total	
2008	1,144	4,650	7,264	800	13,858	8,877	0	8,877	22,735
2009	102	7,100	10,670	1,000	18,872	13,000	0	13,000	31,872
2010	102	7,100	10,670	1,000	18,872	13,000	0	13,000	31,872
2011	0	7,100	10,670	1,000	18,770	13,000	0	13,000	31,770
2012	0	7,100	10,670	1,000	18,770	13,000	0	13,000	31,770
2013	0	7,100	10,670	1,000	18,770	13,000	0	13,000	31,770
2014	0	7,100	10,670	1,000	18,770	13,000	0	13,000	31,770
2015	0	7,100	10,670	1,000	18,770	13,000	0	13,000	31,770
2016	0	1,104	5,061	30	6,195	6,187	0	6,187	12,382
2017	0	1,813	5,061	30	6,904	6,187	0	6,187	13,091
2018	0	1,813	5,061	30	6,904	6,187	0	6,187	13,091
CAGR 2008-2018	**N/A**	**-9.0%**	**-3.5%**	**-28.0%**	**-6.7%**	**-3.5%**	**N/A**	**-3.5%**	**-5.4%**

Source: 2018 FAA Terminal Area Forecast
Legend: AC = Air Carrier; AT = Air Taxi; GA = General Aviation; Mil = Military
[1]Fiscal Year: (October-September)
[2]CAGR: Compound Annual Growth Rate (2008-2018)

[11] As of November 2019.

2.3.2 Forecast Methodologies

A twenty-year forecast of aviation demand carries inherent uncertainties. These uncertainties about the future grow as the timeframe extends. For this reason, a number of projections were developed that used different methods of prediction. Some methods used when the developing the forecast of GA activity were based upon local socioeconomic factors, while others were based on national forecasts or used historical trends. Using a variety of projection methods is beneficial when the forecast results show a consensus. That is, if the various projections all project similar trends and activity, even though they were generated using different data and methods, greater confidence is gained in the resulting forecast.

To achieve a forecasting consensus, all projection methods employed traditional means of extrapolating historical aviation trends at the Airport or in the Airport service area into future time frames. In this regard, the airport service area for general aviation demand was assumed to be Rutland County; therefore, the economic base of the County was used in generating growth rates for aviation activity at RUT.

For the purposes of this Study, based aircraft and GA operations were projected throughout the planning horizon (through 2038) using the following methodologies: market share projection, socioeconomic regression analysis, and trend analysis.

Additional methodologies were implemented when projecting GA enplanements and military operations and will be provided in **Section 2.3.6** and **Section 2.3.7**, respectively.

2.3.2.1 Market Share Projection

Market share projections were developed by calculating historical shares of RUT aviation activity and projecting these respective shares into future time frames. This method of projection reflects demand based upon trends occurring in the service area and the entire U.S. Market share projections reflect historical trends and may include static (constant) or dynamic (increasing or decreasing) future market shares. It is essentially a "top-down" method of forecasting where other forecasts of activity for larger areas are used as drivers of the local share of that demand. Socioeconomic and per capita projections[12], on the other hand, are considered "bottom-up" methodologies and are based upon local factors. Market share projections reflect historical trends and may include increasing, constant, or decreasing future market shares. **Table 2-10** presents the market share projections of based aircraft for RUT.

2.3.2.2 Socioeconomic Regression Analysis

The socioeconomic regression projection is based upon an assumed causal relationship between population, income, or employment and the aviation activity in a particular area. This projection of demand is obtained by relating socioeconomic data via regression analysis to aviation activity. Typically, R-squared statistic values greater than 0.64 are considered significant. The resulting set of regression equations produces a projection of aviation activity when they are coupled with independent projections of future socioeconomic data. **Table 2-9** presents a summary of the

[12] Socioeconomic and per capita projections are based upon local factors.

historical and forecast socioeconomic variables used in developing the general aviation forecasts for RUT. **Table 2-10** presents the socioeconomic regression projections of based aircraft for RUT.

Table 2-9 – Service Area Socioeconomic Growth Projections

Year	Population	PCPI ($2012)	Employment
Historical			
2008	62,368	$42,009	40,099
2009	61,946	$41,795	38,712
2010	61,573	$42,067	38,432
2011	61,196	$43,477	38,226
2012	60,776	$43,872	38,522
2013	60,487	$44,221	38,491
2014	60,068	$44,490	38,430
2015	59,566	$46,339	38,383
2016	59,172	$46,890	37,910
2017	59,087	$47,113	37,761
2018	58,976	$47,901	38,194
Forecasts			
2023	58,422	$52,581	39,426
2028	57,873	$57,153	40,499
2038	56,792	$64,183	41,914
CAGR 2018-2038:	**-0.2%**	**1.5%**	**0.5%**

Source: Woods & Poole Complete Economic and Demographic Data Source (2019 CEEDS)

The projected socioeconomic parameters utilized population, income (in the form of Per Capita Personal Income - PCPI), and employment statistics as the independent socioeconomic variables. Data was obtained from Woods & Poole Complete Economic and Demographic Data Source (2019 CEEDS).

2.3.2.3 Trend Analysis

Trend projections use historical GA activity data to formulate predictions of future activity. For this study, two trend analysis methods were used to project baseline aviation activity: double exponential smoothing and least squares linear trending.

The double exponential smoothing process produces projections by combining the forecast for the previous period with an adjustment for past errors. It is desirable to correct for past errors when the error has resulted from changes in the trend. In this case, correcting for past errors will put the forecast back on track. Double exponential smoothing is appropriate when the time series contains a linear trend. It acts by calculating two smoothed series - a single and a double smoothed value. Both will lag behind any trend; however, the difference between them indicates the size of the trend. This difference is used to adjust the forecast for the trend.

The second trend method used was least squares linear trend. This method uses aviation activity regressed against time to produce a projection. No assumptions about the causes of trends are included in the trend analysis projections. **Table 2-10** presents the trend analysis projections of based aircraft for RUT.

2.3.3 Based Aircraft Forecast

A based aircraft is an aircraft that is operational, airworthy, and based at the facility for a majority of the year. Forecasting based aircraft at RUT proceeded through an analysis of historical data followed by projecting into future years. For this study, existing and historical based aircraft information was taken from the FAA's Form 5010-1, *Airport Master Record*, supplemented by input from airport management and the FAA's Terminal Area Forecasts (TAF).

2.3.3.1 Historical Based Aircraft Trends

Figure 2-2 presents a graphic illustration of the based aircraft growth trends since 2008. Historical based aircraft at RUT have fluctuated but have an overall average annual growth rate (AAGR) of -6.2 percent over the period. That is, based aircraft have been steadily declining over the last 10 years.

Figure 2-2 – Based Aircraft History

Source: 2018 FAA Terminal Area Forecast, 5010 data

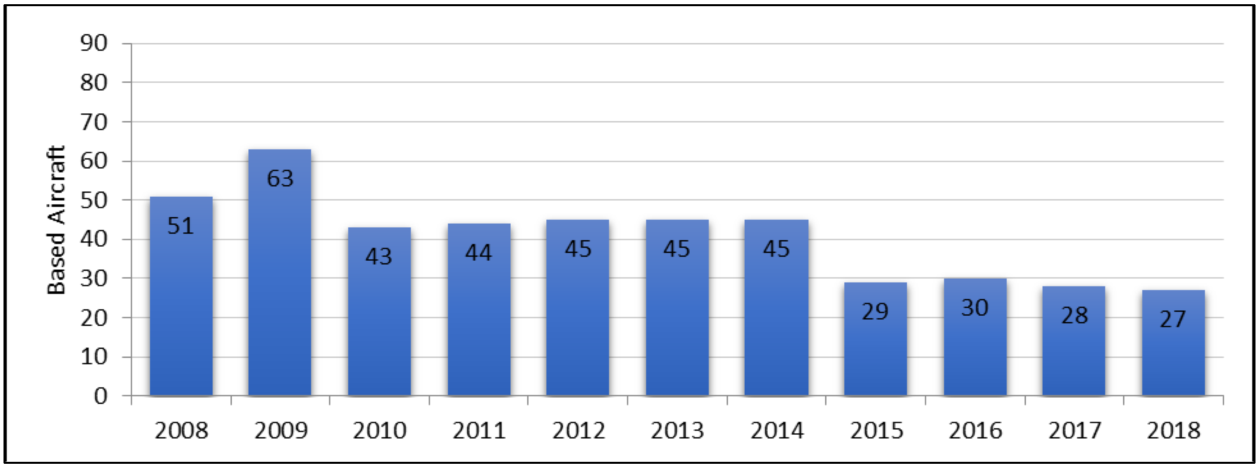
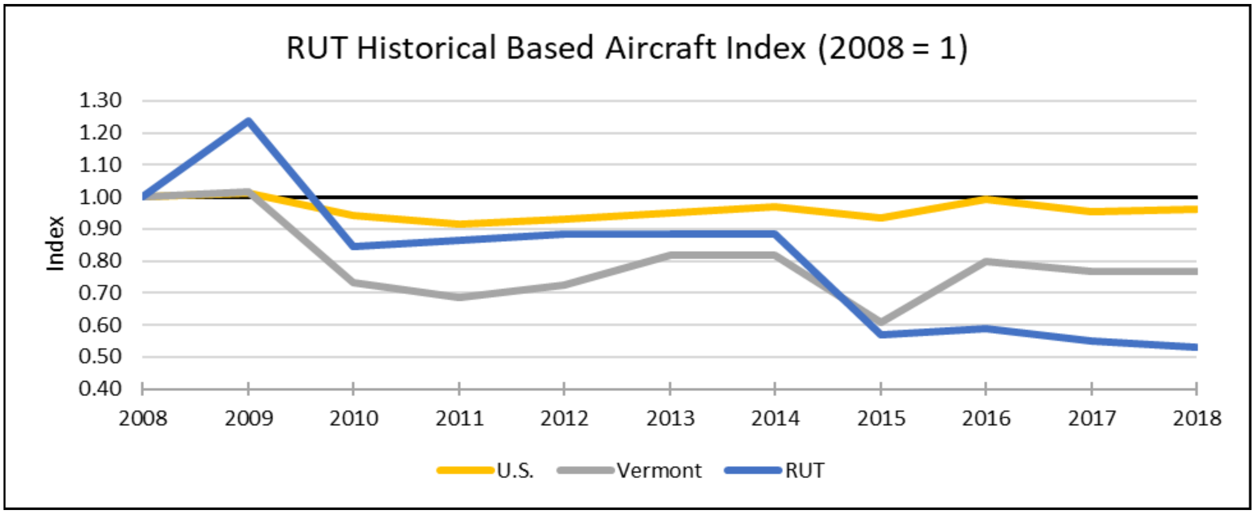


Figure 2-3 shows the indexed trends in based aircraft compared to state and national based aircraft (TAF). The number of aircraft based at RUT is dependent, in part, upon the economic health of the region.

Figure 2-3 – Historical Based Aircraft Growth Comparisons



Source: FAA's Terminal Area Forecasts (TAF)

2.3.3.2 Forecast Projections of Based Aircraft

Table 2-10 presents a summary of nine projections of RUT based aircraft demand generated by using the market share, socioeconomic regression, and trend analysis projection techniques. In addition, two derived projections (High/Low Average and Multi-Average) were developed. The High/Low Average is simply that - the mean of the high and low projections. The Multi-Average is the mean of all projections, therefore reducing the effects of outlier high or low projections. As shown, many of the projections show negative growth throughout the period. The Constant Market Share was the high projection, indicating that most of the other projections reflected the historical declines in based aircraft; t Because the Constant Market Share Projection agreed with the growth rates shown in TAF, it was selected as the preferred forecast.

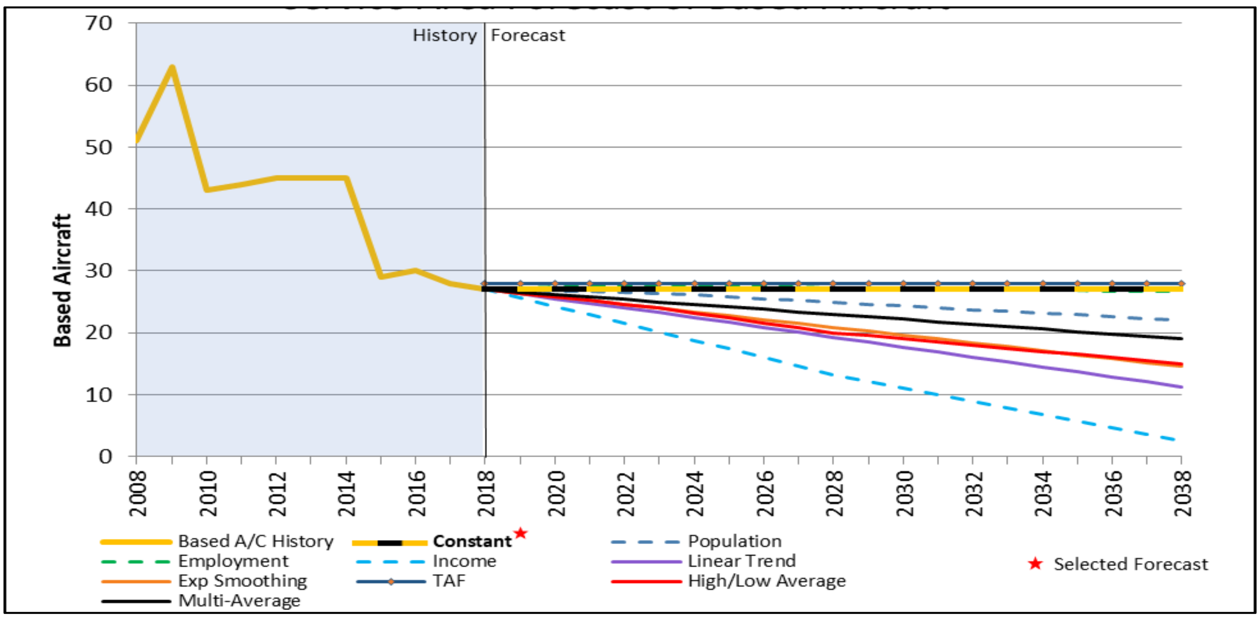
Based aircraft for the preferred forecast are anticipated to stay at the current level throughout the forecast. **Figure 2-4** shows the based aircraft projections in graphic form.

Table 2-10 – Comparisons of Based Aircraft Forecasts

Projection/Forecast	2018	2023	2028	2038	Average Growth	New Aircraft
Market Share						
Constant	27	27	27	27	0.0%	0
Socioeconomic						
Population	27	26	25	22	-1.0%	-5
Employment	27	28	27	27	-0.1%	0
Income	27	20	13	3	-11.0%	-24
Trend Analysis						
Linear Trend	27	23	19	11	-4.3%	-16
Exp Smoothing	27	24	21	15	-3.0%	-12
Other Forecasts						
TAF	28	28	28	28	0.0%	0
Derived Projections						
High/Low Average	27	24	20	15	-2.9%	-12
Multi-Average	27	25	23	19	-1.7%	-8
Preferred Forecast	**27**	**27**	**27**	**27**	0.0%	0

Source: Consultant forecast estimates, 2019.

Figure 2-4 – Service Area Forecast of Based Aircraft Projection



Source: Consultant forecast estimates, 2019.

2.3.4 Annual General Aviation Operations Forecast

As discussed previously, an aircraft operation is defined as either a takeoff or a landing, with a takeoff and landing each being considered a single operation. The annual general aviation operations forecast was derived for both local and itinerant operations using an operations-per-based-aircraft (OPBA) ratio. By definition, local operations are performed by aircraft that operate within the local traffic pattern or within sight of an airport. They can also be assigned to aircraft arriving or departing from local practice areas within 20 miles of an airport. In essence, local operations are associated with pilot training. Itinerant operations, on the other hand, are all other aircraft operations other than local operations.

For this study, historical operational data from the TAF were used to develop OPBA ratios that could then be forecast throughout the planning period. **Table 2-11** presents OPBA ratios for local and itinerant operations at RUT. OPBA for itinerant aircraft slightly increased through the period.

Table 2-11 – Forecast of Local and Itinerant General Aviation Operations

Year	Based Aircraft	Local		Itinerant		Total	
		Ops	OPBA	Ops	OPBA	Ops	OPBA
Historical							
2013	45	13,000	289	10,670	237	23,670	526
2014	45	13,000	289	10,670	237	23,670	526
2015	29	13,000	448	10,670	368	23,670	816
2016	30	6,187	206	5,061	169	11,248	375
2017	28	6,187	221	5,061	181	11,248	402
2018	27	6,187	229	5,061	187	11,248	417
Forecast							
2023	27	6,187	229	5,093	189	11,280	418
2028	27	5,535	205	5,803	215	11,338	420
2038	27	5,130	190	6,414	238	11,544	428
CAGR:	**0.00%**	**-0.93%**	**-0.93%**	**1.19%**	**1.19%**	**0.13%**	**0.13%**

Source: Historical Data from Airport TAF, FAA Form 5010. Forecast from Consultant estimates.

2.3.4.1 GA Operational Peaking Characteristics

Since many general aviation landside and airfield facility needs are related to the levels of activity during peak periods, forecasts were developed for peak month, design day, and peak hour general aviation operations at RUT. Typically, non-towered general aviation airports, such as RUT, do not keep accurate records of peak period activity. Thus, an industry-accepted method of estimation was used to predict peak period activity that does not require a census of hourly operations totals. **Table 2-12** presents the forecast of peak hour and peak month operations at RUT. The approach used in developing the peak period operations forecasts is outlined as follows:

- Peak Month GA Operations – This level of activity is defined as the month when peak aircraft operations occur. Peak Month percentages were estimated using the assumption that peak month operations are 10 percent greater than average month operations.
- Design Day Operations – This level of operations is defined as the average day within the peak month. This indicator can be developed by dividing peak month operations by the number of days in the peak month (i.e., 30 or 31). For conservative forecasting purposes, a 30-day month was selected rather than a 31-day month.
- Peak Hour Operations – This level of operations is defined as the peak hour within the design day. For airports with between 50 and 300 design day operations, general aviation

peak hour operations tend to be 20 percent of design day operations.[13] As the design day operations decrease, the peak hour percentage increases and vice versa.

Table 2-12 – Forecast of General Aviation Peak Period Operations

Year	Annual GA Operations	GA Peak Month Operations	GA Design Day Operations	GA Peak Hour Operations
Historical				
2018	11,248	1,031	34	7
Forecast				
2023	11,280	1,034	34	7
2028	11,338	1,039	35	7
2038	11,544	1,058	35	7
CAGR:	**0.13%**	**0.13%**	**0.15%**	**0.15%**

Source: TAF data for 2018, Forecast - Consultant estimates; totals are rounded

2.3.5 General Aviation Fleet Mixes

An aircraft fleet mix refers to the characteristics of a population of aircraft. General aviation aircraft are classified with regard to specific physical traits such as aircraft type (whether fixed wing or rotorcraft), their weight, and number and type of engines. Aircraft having dissimilar physical and operating traits require varying types and amounts of airport facilities. For this reason, it is important to estimate the type of aircraft that will be operating and based at RUT. For the purposes of this Study, fleet mix categories included: single engine, multi-engine, turbojet, rotorcraft, and "other."

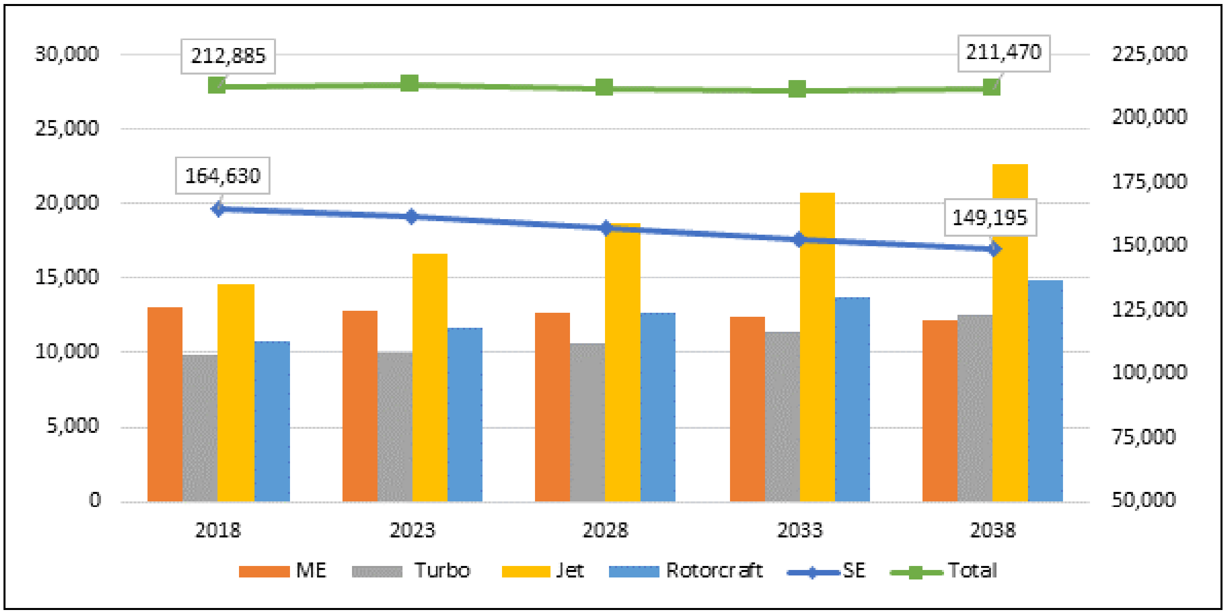
2.3.5.1 Based Aircraft Fleet Mix

In the forecasting process, the based aircraft fleet mix is used as one component to help determine operational fleet mix forecasts. It is also used to determine the future runway design category. The current fleet mix data was gathered from the most recent FAA Form 5010.

Projection of the fleet mix involved the consideration of the effects of the national trends in aircraft manufacturing and the service area registered aircraft fleet mix. **Figure 2-5** shows the projected national fleet mix for general aviation aircraft. **Table 2-13** shows the forecast in tabular form for the 20-year period.

[13] Source: Consultant estimate based on independent research of airport tower survey data.

Figure 2-5 – US Fleet Mix Active GA and Air Taxi Aircraft Forecast



Note: SE = Single-Engine; ME = Multi-Engine

Source: FAA Aerospace Forecast 2019-2039; Table 28 Active General Aviation

Table 2-13 – US Active Fleet Mix Forecast

Year	Single-Engine	Multi-Engine	Jet	Rotorcraft	Other	Total
Historical						
2016	164,605	17,876	13,751	10,577	4,986	211,794
2017	164,280	18,058	14,217	10,511	4,692	211,757
2018	164,878	18,003	14,585	10,705	4,715	212,885
Forecast						
2023	161,983	17,873	16,610	11,655	4,820	212,940
2028	157,600	17,940	18,695	12,645	4,865	211,745
2038	150,583	18,413	22,660	14,925	4,890	211,470
CAGR[1]	**-0.45%**	**0.11%**	**2.23%**	**1.68%**	**0.18%**	**-0.03%**

[1] CAGR: Compound Annual Growth Rate (2018-2038)
Source: FAA Aerospace Forecast 2019-39

Table 2-14 presents the forecast of based aircraft fleet mix anticipated for RUT. As shown, the current aircraft mix is anticipated to change slightly over the period with an increase of 2 jet aircraft and a decrease of 2 single-engine aircraft.

Table 2-14 – RUT GA Based Aircraft Fleet Mix

Year	Single-Engine	Multi-Engine	Jet	Helicopter	Other	Total
Historical						
2018	25	1	0	0	1	27
Forecast						
2023	25	1	0	0	1	27
2028	24	1	1	0	1	27
2038	23	1	2	0	1	27
CAGR:	**-0.42%**	**0.00%**	**n/a**	**0.00%**	**0.00%**	**0.00%**

Source: Historical data from FAA Form 5010, Forecast from Consultant estimates

2.3.5.2 GA Operational Fleet Mix

The operational fleet mix forecast presents a breakdown of aircraft operations by aircraft type. presents the forecast of operational fleet mix for general aviation aircraft using RUT. The operational fleet mix forecast was derived from the based aircraft fleet mix (**Table 2-15**). Historical data from FlightAware and growth rates from the FAA Aerospace US Active Fleet Mix Forecast 2019-2038 were used to estimate the number of operations by type of aircraft.

Table 2-15 – Forecast of General Aviation Operational Fleet Mix

Year	Single	Multi	Jet	Helicopter	Other	Total
Historical						
2018	7,776	1,709	1,638	46	80	**11,248**
Forecast						
2023	7,602	1,718	1,829	50	81	11,280
2028	7,433	1,728	2,042	54	81	11,338
2038	7,105	1,747	2,546	64	83	11,544
CAGR:	**-0.45%**	**0.11%**	**2.23%**	**1.68%**	**0.18%**	**0.13%**

Source: FAA Aerospace US Active Fleet Mix Forecast 2019-38 growth rates, and FlightAware Operational Mix

2.3.6 General Aviation Enplanements Forecast

Forecasts of annual general aviation enplaned passengers can be used by Airport management and FBOs to determine the need and sizing for landside facilities such as the general aviation terminal building, automobile parking areas, and access roads. This activity indicator is often ignored due to the lack of historical data.

To forecast general aviation enplaned passengers, an aircraft occupancy rate was multiplied by the number of itinerant general aviation departures from RUT. The Aircraft Owners and Pilots Association (AOPA) estimated that an average of 2.5 passengers per general aviation itinerant departure was a reasonable estimate of aircraft occupancy. This estimate has been accepted in numerous forecasts approved by the FAA. For this study, this factor was applied to all forecasted itinerant departures and 10 percent of local departures. Local departures are considered training operations and do not add to the landside facility use; therefore, only a fraction of those operations were counted as contributing passengers to the landside facility use. **Table 2-16** shows the projected number of general aviation enplanements, which include the corporate/air taxi plus smaller general aviation aircraft population.

Table 2-16 – Forecast of General Aviation Enplanements

Year	Itinerant GA Departures	10% Local GA Departures	Enplanements Per Departure	Total Enplanements
Historical				
2018	2,531	309	2.50	7,100
Forecast				
2023	2,546	309	2.5	7,139
2028	2,901	277	2.5	7,945
2038	3,207	257	2.5	8,659

* Totals are rounded.

Source: FAA historical operational data. Consultant estimates based upon average occupancy times aircraft departures.

2.3.7 Military Aviation Operations Forecast

Military activity shows little or no correlation to community socioeconomic data or other recognized air traffic indicators. The level of military operations is a function of Department of Defense Policy and Congressional funding. The closest military aviation installation is located at Burlington International (158th Fighter Wing of the VT Air National Guard and the Army Aviation Support Facility of the VT Army National Guard). For forecasting purposes, the most recent year of historical activity was held constant throughout the planning period (**Table 2-17**).

Table 2-17 – Forecast of Military Operations

Year	Itinerant Military Operations	Local Military Operations	Total Military Operations
Historical			
2014	1,000	0	1,000
2015	1,000	0	1,000
2016	30	0	30
2017	30	0	30
2018	30	0	30
Forecast			
2023	30	0	30
2028	30	0	30
2038	30	0	30

Source: TAF historical operational data.

2.4 Annual Instrument Approach Forecast

The forecast of annual instrument approaches (AIAs) provides further guidance in determining requirements for the type, extent, and timing of future navigational aid (NAVAID) equipment, as well as dimensional standards for airfield design. Instrument approaches occur when instrument flight rules (IFR) operations are conducted during instrument meteorological conditions (IMC), which exist whenever the cloud ceiling is at or below 1,000 feet above ground level and/or visibility is less than three (3) miles. Many IFR operations occur in clear weather as a result of IFR flight plan filings by the pilots.

Table 2-18 summarizes the forecast of annual instrument approaches at RUT throughout the planning period. The forecast was developed by using the relationship between total operations, instrument operations, instrument approaches, and IMC percentage of time. In 2018, total instrument operations were assumed to be close to 37 percent of total operations, based upon

FlightAware data. Instrument approaches during all weather conditions are one half of total instrument operations (departures make up the other 50 percent). IMC at RUT exist approximately 10.0 percent of the time. This factor was used to lower the number of instrument approaches during all weather conditions to those instrument approaches conducted during IMC at RUT.

Table 2-18 – Forecast of Annual Instrument Approaches

Year	Total Operations [1]	Instrument Operations	Instrument Approaches	Instrument Approaches in IMC Conditions
Historical				
2018	13,091	4,900	2,450	245
Forecast				
2023	13,500	5,053	2,526	253
2028	13,558	5,075	2,537	254
2038	13,764	5,152	2,576	258

[1] Includes, Airline, General Aviation and Military operations
Source: Forecast- FlightAware, Consultant estimates

2.5 Critical Aircraft Determination

The "Critical Aircraft" at an airport is the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is defined as 500 annual operations, excluding touch-and-go operations.

The Runway Design Code (RDC) used in airport planning is derived from the features of the most demanding aircraft using the airport on a regular basis coupled with the best available instrument approach minimums. The first component, depicted by a letter, is the Aircraft Approach Category (AAC) which relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the Airplane Design Group (ADG) which relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by Runway Visual Range (RVR) values. **Table 2-19** displays the RDC criteria used in airport planning.

Table 2-19 – Runway Design Code Characteristics – Aircraft Approach Category (AAC)

Category	Approach Speed	
A	Approach speed less than 91 knots	
B	Approach speed 91 knots or more but less than 121 knots	
C	Approach speed 121 knots or more but less than 141 knots	
D	Approach speed 141 knots or more but less than 166 knots	
E	Approach speed 166 knots or more	
Group	**Tail Height (and/or)**	**Wingspan**
I	< 20′	< 49′
II	20′ - < 30′	49′ - < 79′
III	30′ - < 45′	79′ - < 118′
IV	45′ - < 60′	118′ - < 171′
V	60′ - < 66′	171′ - < 214′
VI	66′ - < 80′	214′ - < 262′
RVR (feet)	**Flight Visibility Category (statute mile)**	
VIS	**Visual Approaches**	
5,000	Not lower than 1 mile	
4,000	Lower than 1 mile but not lower than ¾ mile (APV ≥ 3/4 but < 1 mile)	
2,400	Lower than 3/4 mile but not lower than 1/2 mile (CAT-I PA)	
1,600	Lower than 1/2 mile but not lower than 1/4 mile (CAT-II PA)	
1,200	Lower than 1/4 mile (CAT-III PA)	

Source: FAA AC 150/5300-13A

In reviewing data (**Table 2-20**), the existing design aircraft is a variant of a B-II business jet. In 2018, operations by category B or higher aircraft exceeded 4,000 in total.

Table 2-20 – IFR Operations by Aircraft Type for RUT

Aircraft Design Type	2018
A-I	702
A-II	103
B-I	2,856
B-II	985
C-I	50
C-II	104
C-III	24
D-I	28
D-II	8
D-III	6
No Data-No Data	58
Grand Total	**4,924**

Source: Flightaware.com

Currently, the most demanding aircraft to use RUT on a regular basis is the Cessna Excel/XLS type aircraft. In 2018, there were 220 C or higher aircraft operations – roughly 34 percent of jet operations. Given the forecast increase of 908 jet operations in the future, it is anticipated that at least 308 of these jet operations will be category C or higher (for a total of 528 by 2038). For the future, then, it is anticipated that the critical aircraft designation would increase to category C aircraft by the third forecast period.

From a wingspan perspective, the category II and higher aircraft types recorded 1,230 operations in 2018 (**Table 2-21**); therefore, the designated critical aircraft type for the primary runway at RUT will be the C-II.

Table 2-21 – Aircraft Operations by Category B or Higher (2018)

Aircraft	2018
A-II	**103**
Pilatus PC-12	103
B-II	**985**
Beech 200 Super King	37
Beech F90 King Air	4
Beech Super King Air 350	46
Cessna 208 Caravan	390
Cessna Citation CJ3	22
Cessna Citation CJ4	49
Cessna Citation II/Bravo	14
Cessna Citation Latitude	31
Cessna Citation Sovereign	30
Cessna Citation V/Ultra/Encore	40
Cessna Citation X	17
Cessna Conquest	11
Cessna Excel/XLS	99
Dassault Falcon 2000	26
Dassault Falcon 900	8
Dassault Falcon/Mystère 20	6
Dassault Falcon/Mystère 50	6
Embraer EMB110	83
Embraer EMB-545 Legacy 450	2
Embraer Phenom 300	49
Hawker 4000	2
Raytheon 300 Super King Air	13
C-II	**104**
Bombardier (Canadair) Challenger 300	46
Bombardier Challenger 300	17
Bombardier Challenger 600/601/604	19
Embraer ERJ 135/140/Legacy	2
Gulfstream G150	6
Gulfstream G280	2
IAI 1126 Galaxy/Gulfstream G200	2
IAI Astra 1125	4
Learjet 75	6
C-III	**24**
Bombardier BD-700 Global 5000	19
Bombardier BD-700 Global Express	4
Embraer 170	1
D-II	**8**
Gulfstream IV/G400	8
D-III	**6**
Gulfstream	2
Gulfstream V/G500	4
Grand Total	**1,230**

Source: Flightaware.com Data

2.6 Summary of Aviation Demand Forecasts

Table 2-22 presents a summary of the preferred aviation demand forecasts for Rutland-Southern Vermont Regional Airport. These forecasts are considered reasonable and achievable and, thus will be used throughout the Master Plan to help in the development of facility requirements and the identification of alternatives.

Table 2-22 – Aviation Demand Forecast Summary

ITEM	2018	2023	2028	2038	2018-2023	2018-2028	2018-2038
Forecast of Aviation Demand	**Base Year**	**Base Yr. + 5yrs.**	**Base Yr. + 10yrs.**	**Base Yr. + 20yrs.**	**Base yr. to +5**	**Base yr. to +10**	**Base yr. to +20**
Enplanements							
Airline Enplanements	5,656	5,430	5,430	5,430	0%	0%	0%
GA Enplanements	7,100	7,139	7,945	8,659	0.1%	1.1%	1.0%
Total Enplanements	**12,756**	**13,545**	**14,844**	**15,853**	**1.2%**	**1.5%**	**1.1%**
Operations							
Itinerant Operations							
Air Taxi/Airline	1,813	2,190	2,190	2,190	3.9%	1.9%	0.9%
General Aviation	5,061	5,093	5,803	6,414	0.1%	1.4%	1.2%
Military	30	30	30	30	0.0%	0.0%	0.0%
Local Operations							
General Aviation	6,187	6,187	5,535	5,130	0.0%	-1.1%	-0.9%
Total Operations	**13,091**	**13,500**	**13,558**	**13,764**	**0.6%**	**0.4%**	**0.3%**
OPBA	**485**	**500**	**502**	**510**	**0.6%**	**0.4%**	**0.3%**
Instrument Operations	**245**	**253**	**254**	**258**	**0.6%**	**0.4%**	**0.3%**
Based Aircraft							
Single Engine	25	25	24	23	0.0%	-0.4%	-0.4%
Multi Engine	1	1	1	1	0.0%	0.0%	0.0%
Jet	0	0	1	2	0.0%	n/a	n/a
Rotorcraft	0	0	0	0	0.0%	0.0%	0.0%
Other	1	1	1	1	0.0%	0.0%	0.0%
Total Airport Based Aircraft	**27**	**27**	**27**	**27**	**0.0%**	**0.0%**	**0.0%**
GA Peaking Characteristics							
Peak Month Operations	1,031	1,034	1,039	1,058	0.1%	0.1%	0.1%
Design Day Operations	34	34	35	35	0.0%	0.3%	0.1%
Peak Hour Operations	7	7	7	7	0.0%	0.3%	0.1%

Source: Consultant forecast estimates, 2019

2.7 Comparison with FAA Terminal Area Forecasts

A comparison of the preferred Airport Master Plan forecast to the FAA's 2018 Terminal Area Forecast (TAF) is presented in **Table 2-23**, **Table 2-24** and **Table 2-25**, with the graphs of the comparisons shown below each table. The FAA's 2018 Terminal Area Forecast shows zero annual growth in enplanements, based aircraft or operations throughout the period. The preferred Master Plan projects zero growth in airline enplanements and based aircraft; however, the preferred forecast projects approximately a 0.17 percent increase in operations over the period. The high, low and average projections from the 2018 Vermont Aviation System Plan Update (VASP) are also shown **Figure 2-6** and **Figure 2-7.** Growth rates from the VASP projections were applied to base year operations and based aircraft. It should be noted that proactive development of hangars may change the forecast upwards, as RUT may gain market share in its larger service area. Pricing points are important in this strategy.

Table 2-23 – Comparing Airport Planning and TAF Forecast of Enplanements

Airline Enplanements	Fiscal Year	Airport Forecast	TAF	(% Difference)
Base yr.	2018	5,430	5,430	0.0%
Base yr. + 5yrs.	2023	5,430	5,430	0.0%
Base yr. + 10yrs.	2028	5,430	5,430	0.0%
Base yr. + 15yrs.	2033	5,430	5,430	0.0%
Base yr. + 20yrs.	2038	5,430	5,430	0.0%
CAGR	-	**0.00%**	**0.00%**	-

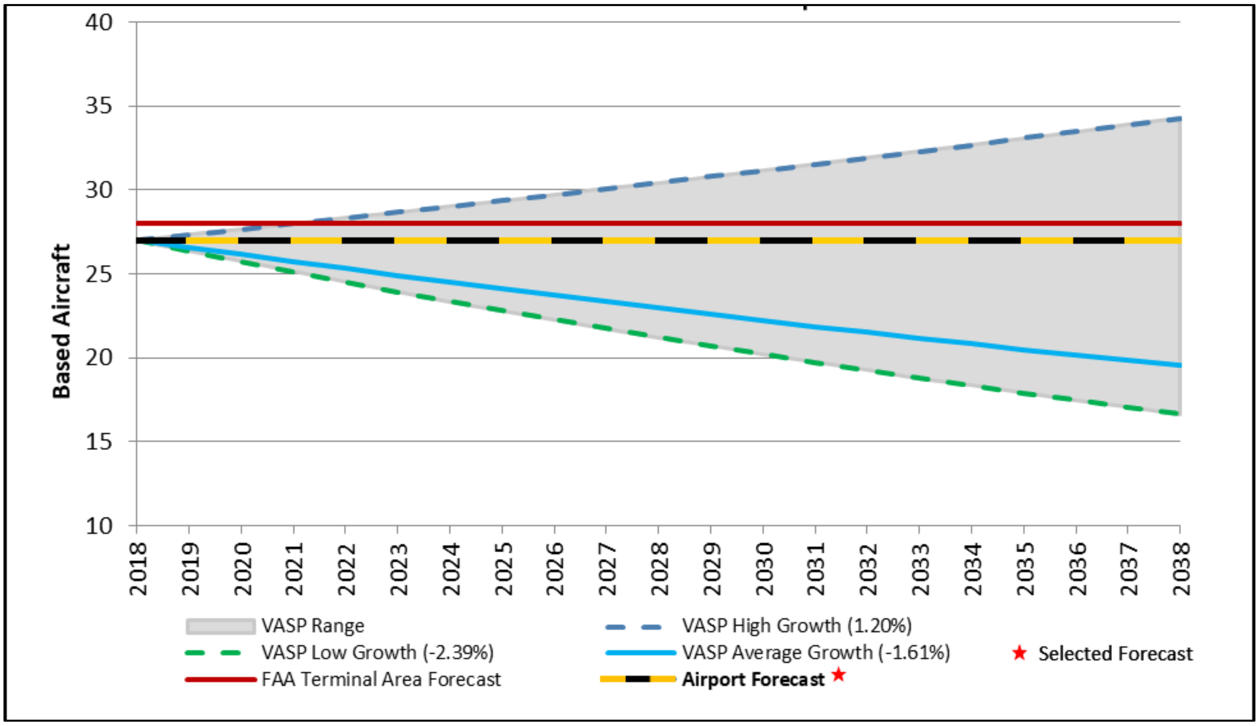
Source: Airport TAF, Consultant forecast estimates, 2019

Table 2-24 – Comparing Airport Planning and TAF Forecast of Based Aircraft

Based Aircraft	Fiscal Year	Airport Forecast	TAF	(% Difference)
Base yr.	2018	27	28	-3.6%
Base yr. + 5yrs.	2023	27	28	-3.6%
Base yr. + 10yrs.	2028	27	28	-3.6%
Base yr. + 15yrs.	2033	27	28	-3.6%
Base yr. + 20yrs.	2038	27	28	-3.6%
CAGR	-	**0.00%**	**0.00%**	-

Source: Airport TAF, Consultant forecast estimates, 2019

Figure 2-6 – Based Aircraft Forecast Comparison



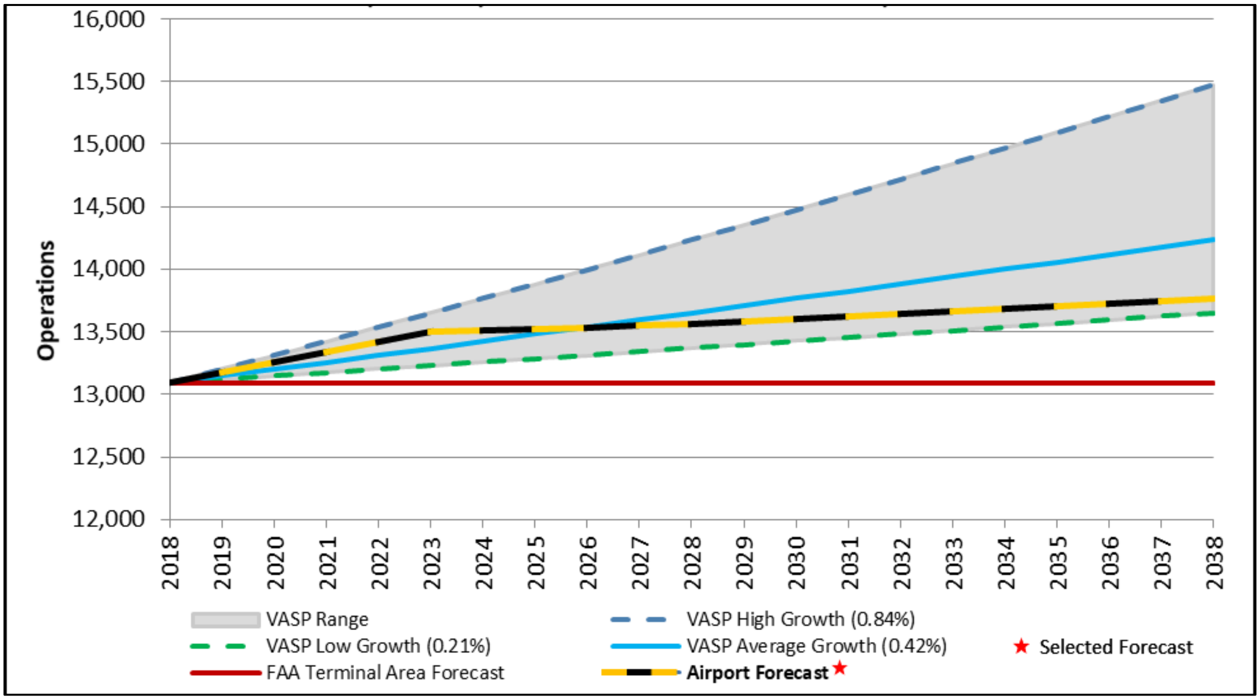
Source: 2018 Vermont Aviation System Plan Update (VASP), Airport TAF, Consultant forecast estimates, 2019

Table 2-25 – Comparing Airport Planning and TAF Forecast of Operations

Operations	Fiscal Year	Airport Forecast	TAF	(% Difference)
Base yr.	2018	13,091	13,091	0%
Base yr. + 5yrs.	2023	13,500	13,091	3.1%
Base yr. + 10yrs.	2028	13,558	13,091	3.6%
Base yr. + 15yrs.	2033	13,661	13,091	4.4%
Base yr. + 20yrs.	2038	13,764	13,091	5.1%
CAGR	-	**0.25%**	**0.00%**	-

Source: Airport TAF, Consultant forecast estimates, 2019

Figure 2-7 – Airport Operations Forecast Comparison



Source: 2018 Vermont Aviation System Plan Update (VASP), Airport TAF, Consultant forecast estimates, 2019

Chapter 3

Facility Requirements

3 Facility Requirements

This chapter analyzes the ability of the Rutland – Southern Vermont Regional Airport (RUT) and its existing facilities to accommodate the current and anticipated levels of activity as described in **Chapter 2, *Forecast of Aviation Activity*.** The identified facilities include the following general categories:

- Airside Facility Requirements
- Landside Facility Requirements
- Airport Security

The demand/capacity and facility requirement analysis provide a basis for assessing the capability of existing Airport facilities to accommodate current and future levels of activity. The evaluation of this relationship frequently results in the identification of deficiencies that can be alleviated through planning and development activities. Analyses of various airside and landside functional areas were performed with the guidance of several publications, including Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-13A, *Airport Design*; AC 150/5060-5, *Airport Capacity and Delay*; and FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*. The facility requirement calculations were developed for the planning period of 2018 through 2038 and were based on various forecast components. They should be regarded as generalized planning tools. Should the forecast prove conservative, the schedule for proposed developments should be advanced. Likewise, if traffic growth does not materialize, deferral of additional facilities may be practical.

3.1 Forecasts Summary

Table 3-1 provides a summary of the preferred forecasts presented in **Chapter 2**, which have been used to estimate when activity levels will trigger the need for various improvements. In addition, this table provides forecasted peak operations (with a peak month of July), by month, day, and hour. Note that some airfield facilities are recommended for safety improvements, and not dependent on a specific airport activity level.

Table 3-1 – Forecast Summary

	Planning Period (Year)			
Activity	**2018**	**2023**	**2028**	**2038**
Annual Operations	13,091	13,500	13,558	13,764
Peak Operations				
Peak Month	1,031	1,034	1,039	1,058
Peak Day (PMAD)	34	34	35	35
Peak Hour	7	7	7	7
Based Aircraft	27	27	27	27

Source: R.A. Wiedemann & Associates, 2019
Note PMAD – Peak Month Average Day

3.2 Airside Facility Requirements

It is important for airports to assess their existing infrastructure to determine the need for future improvements and associated airfield requirements. The airside facility requirements analysis includes an examination and evaluation of:

- Design Aircraft
- Runway Design Standards
- Taxiway Design Standards
- Airfield Capacity
- Runway Length Analysis
- Wind Coverage
- Airfield Pavement
- Lighting and Visual Aids
- Instrument Approach Procedures

The following provides a description of each item and an evaluation of existing and future requirements according to current FAA and industry standards.

3.2.1 Design Aircraft

The design, or critical, aircraft is defined as the most demanding aircraft operating or projected to operate on the airport's runway, taxiway, or apron. According to the FAA, the design aircraft can be either a specific aircraft model or a composite of several aircraft and must account for a minimum of 500 annual itinerant operations (i.e., an average of five landings per week). As defined within the **Chapter 2**, the design aircraft is classified using three parameters:

- ***Aircraft Approach Category (AAC):*** Consists of a letter (e.g., A through E) corresponding to the design aircraft's approach speed.
- ***Airplane Design Group (ADG):*** Consists of a Roman numeral (e.g., I through VI) corresponding to the design aircraft's wingspan or tail height, whichever is most restrictive.
- ***Taxiway Design Group (TDG):*** Consists of a number (e.g., 1 through 7) corresponding to the Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance.

The identified ACC and ADG are combined to form the Runway Design Code (RDC), which specifies the appropriate design standards for the runway. In addition to the ACC and ADG, the RDC consists of a third component related to runway visibility minimums, expressed as Runway Visual Range (RVR).

After determining the RDC for each runway, the airport itself is classified with an Airport Reference Code (ARC). The ARC is used for airport planning and design purposes and is signified by the highest RDC at the airport. The ARC uses the same classification system as the RDC, minus the runway visibility component. Since Runway 1-19 is classified with an RDC of C-II-2400, the ARC for RUT will be C-II. It is recommended that ARC C-II is maintained throughout the planning period.

Table 3-2 summaries the classifications applicable to RUT throughout the planning period.

Table 3-2 – Runway Design Code Analysis Summary

Runway	AAC	ADG	RVR
1-19	C	II	2400 (i.e., Lower than 3/4 mile but not lower than ½ mile)
13-31	B	II	VIS (i.e., Visual Approach)
Airport	**AAC**	**ADG**	**RVR**
Airport	C	II	5000 (i.e., not lower than 1 mile)

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

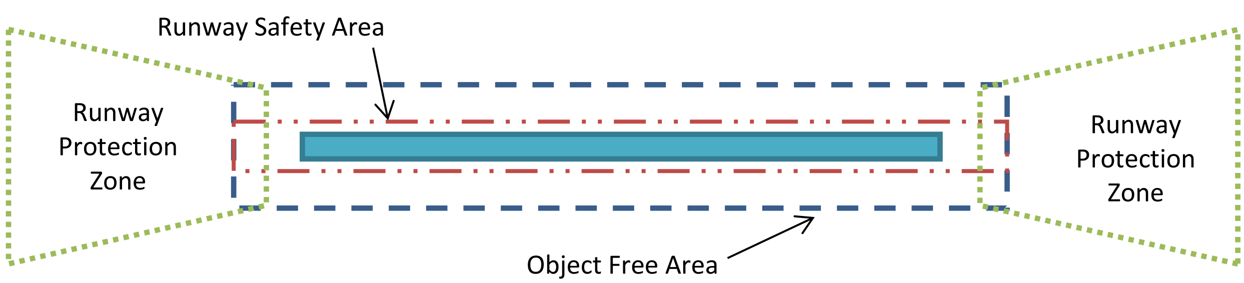
3.2.2 FAA Design Standards

AC 150/5300-13A identifies safety areas and zones surrounding runways and taxiways that must be protected from objects, hazards, or obstacles that may impact safety. The key standards that protect the runway and taxiway areas consist of the following:

- ***Runway Safety Area (RSA) & Taxiway Safety Area (TSA):*** The RSA is a defined surface surrounding a runway prepared for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway. This area must also support snow removal, aircraft rescue, and firefighting vehicles/equipment. The RSA should be free of objects, except for those that must be located in the area because of their function. The TSA is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft deviating from the taxiway. RSA and TSA are graded, drained, and maintained, and typically consisted of a stabilized mowed grass area. Safety area enhancement projects are considered high priority by the FAA.
- ***Runway Object Free Area (ROFA) and Taxiway Object Free Area (TOFA):*** The ROFA and TOFA are areas centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by remaining clear of objects (e.g., roads, buildings, parked aircraft, etc.), except for those that need to be within the area due to their function. There are no surface requirements for an OFA.

- ***Runway Protection Zone (RPZ):*** The RPZ is a trapezoidal area generally offset 200 feet from each runway end and/or displaced threshold that is used to enhance the protection of people and property on the ground. The FAA encourages airport property ownership and compatible land uses within each RPZ and clearing of all above ground objects. Homes, other buildings, and wildlife attractants are considered incompatible land uses within an RPZ. Trees are not specifically prohibited (if not an airspace penetration) but are discouraged within the RPZ.
- ***Runway Object Free Zone (ROFZ):*** The ROFZ is centered about the runway with an elevation the same as the nearest point on the runway centerline. Objects that are not fixed-by-function are not permissible within the ROFZ. For runways providing visibility minimums less than ¾ mile (e.g., Runway 19), a Precision OFZ (POFZ) is also applicable. According to the FAA, when a POFZ is in effect, a wing of an aircraft on a taxiway waiting for runway clearance may penetrate the POFZ, but neither the fuselage nor the tail may infringe on the POFZ.

The diagram below depicts the discussed FAA design standards.



The spatial dimensions of the RSA/TSA, ROFA/TOFA, and RPZ are defined by the RDC. **Table 3-3** presents the current FAA design standards applicable to RUT.

Table 3-3 – Runway and Taxiway Design Standards

Airfield Area	Runway 1-19 (RDC C-II-2400)	Runway 13-31 (RDC B-II-5000)
Runway Width	100’	75’
RSA		
- Width	400’	150’
- Length Beyond Runway End*	600’/EMAS	300’/300’
- Length Prior to Threshold	600’/600’	300’/300’
ROFA		
- Width	800’	500’
- Length Beyond Runway End*	1,000’/EMAS	300’/300’
- Length Prior to Threshold	600’/600’	300’/300’
ROFZ		
- Width	400’	250’
- Length Beyond Runway End	200’	200’
Approach RPZ		
- Length	1,700’/2,500’	1,000’
- Inner Width	500’/1,000’	500’
- Outer Width	1,010’/1,750’	700’
Departure RPZ		
- Length	1,700’	1,000’
- Inner Width	500’	500’
- Outer Width	1,010’	700’
Runway Centerline to		
- Parallel Taxiway Centerline	300’	240’
- Edge of Aircraft Parking	400’	250’
Taxiway Width	50’	35’
Taxiway Centerline to		
- Fixed or Movable Object	65.5’	65.5’
Taxilane Centerline to		
- Fixed or Movable Object	97’	97’
TSA	79’	79’
TOFA	131’	131’
Taxilane OFA	115’	115’

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

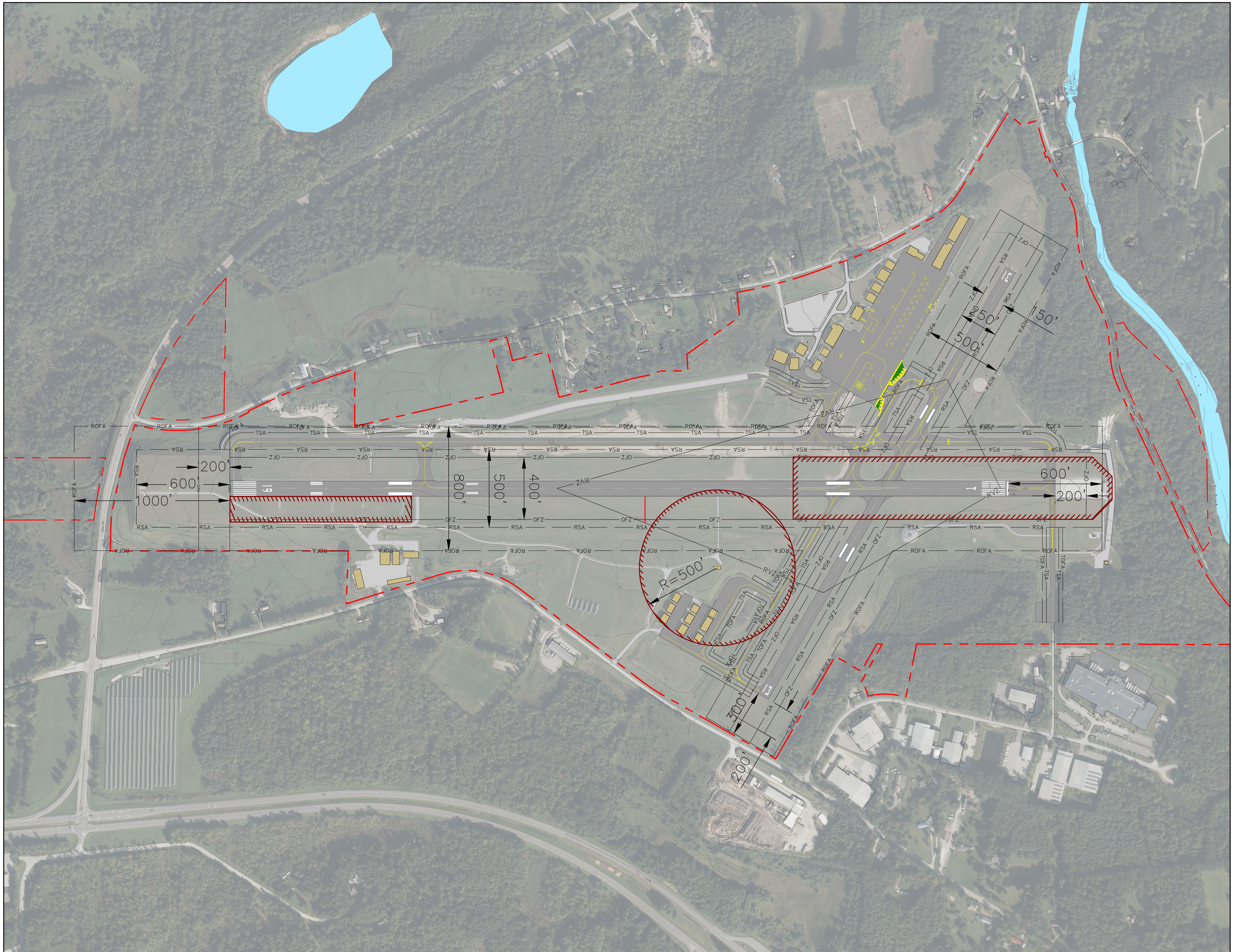
*RSA/ROFA length beyond runway based on RSA Determination dated April 7, 2007

3.2.3 Runway Design Standards

Using the FAA design standards listed in **Table 3-3**, this chapter reviews the existing runway conditions at RUT and discusses any related deficiencies. **Figure 3-1** depicts Runway 1-19 and Runway 13-31 safety and object free areas.

3.2.3.1 Runway Width

The current width of Runway 1-19 is 100 feet, which meets the requirements of RDC C-II-2400, as listed on **Table 3-3**. The current width of Runway 13-31 is 75 feet which meets the requirements of RDC B-II-VIS. As such, the current runway widths are adequate and should be maintained throughout the planning period.



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GRAPHIC SCALE (FEET)

0 300 600 1200

LEGEND

- Airport Property Boundary
- ### Ground Contour (Feet MSL)
- ROFA Runway Object Free Area
- RSA Runway Safety Area
- TOFA Taxiway Object Free Area
- TSA Taxiway Safety Area
- OFZ Obstacle Free Zone
- RVZ Runway Visibility Zone
- Utility Pole
- Navaid Critical Area

Figure 3-1
RUT Safety Areas

3.2.3.2 Runway Safety Area (RSA)

According to AC 150/5300-13A, standard RDC C-II runway dimensions include a length beyond the runway end of 1,000 feet, a length prior to the runway end of 600 feet, and may have a width as narrow as 400 feet. Runway 1 is equipped with a 300-foot Engineered Materials Arresting System (EMAS), effectively reducing the required RSA length beyond the departure end to 600 feet. Approximately 600 feet beyond the Runway 19 end, the terrain decreases substantially to Vermont State Route 103 and does not provide the standard 1,000' length. However, this non-standard length was found acceptable as part of a 2007 RSA Determination by the FAA. As activity levels and the design aircraft are not forecast to substantially change during the planning period, the RSA determination will likely remain valid. If the FAA determination is changed and a full 1,000-foot RSA is necessary, it would then be recommended that the north end of the runway be equipped with an EMAS bed similar to the south end.

The RSA near the the Runway 1 end contains a portion of the decommissioned VOR unit and service road. Near the Runway 19 end, the glideslope electrical vault is also located within the RSA. Additionally, a small portion of the RSA near the approach lighting system is located outside of airport property but is located on publicly owned land.

The Runway 13-31 RSA is 150 feet in width and extends 300 feet beyond both approach and departure ends. A small non-standard area exists at the edge of the Runway 31 RSA due to the presence of a drop-off in elevation leading to a drainage outlet. Additionally, the airport security fence was relocated to circumvent the drainage outlet and is thus also located within the Runway 31 RSA.

3.2.3.3 Runway Object Free Area (ROFA)

The Runway 1-19 OFA is 800 feet in width and extends 1,000 feet beyond each runway end. In addition to the objects located within RSA, the Runway 1-19 ROFA contains the localizer electrical vault and an embankment located along the west side of the runway. Although the ROFA extends 1,000 feet beyond the runway end and is located over Vermont State Route 103 and several trees, the ROFA remains well above these areas and free of objects below.

The Runway 13-31 OFA is 500 feet in width and extends 300 feet beyond each runway end. Similar to the Runway 19 RSA, the ROFA for Runway 19 also extends beyond the airport property. However, the terrain is well below the runway elevation and thus has no penetrations.

Similar to the Runway 13-31 RSA, an existing drainage outlet, airport security fencing, and trees are located within the Runway 31 ROFA. Furthermore, the Segmented Circle is within the bounds of the Runway 13-31 ROFA but is lower than the runway elevation and is not an ROFA penetration.

3.2.3.4 Runway Visibility Zone

The RVZ at RUT is entirely contained within the runway and taxiway environment. As the current runway layout is deemed adequate, the RVZ will remain the same throughout the planning period. The VOR is currently situated within the bounds of the RVZ. However, it has been decommissioned and is expected to be demolished in the future. Additionally, the northwestern portion of the RVZ is impeded by the higher terrain on which the AWOS is located, directly east of the West side Hangars. As Runway 13 is the least used runway end at RUT and has a parallel taxiway, the benefit/cost for removal is likely low as it may be impractical to lower the terrain.

3.2.3.5 Runway Protection Zone (RPZ)

The Runway Protection Zones (RPZ) begins 200-feet from each runway end/threshold. Airport ownership and control of the RPZs, either through easement or acquisition, is desirable to ensure compatible land uses, airspace, and ground protection within the area. As the RPZs are primarily designated to protect people and property on the ground, the FAA considers the clearing of all objects within RPZs a safety benefit. Currently, all RPZs extend beyond airport property. **Figure 3-2** and **Figure 3-3** depict the Runway 1-19 and Runway 13-31 RPZs.

As Runway 1 has a has 300-foot displaced threshold, the Approach and Departure RPZs begin at different locations. The Runway 1 Approach RPZ begins 200 feet from the runway's displaced threshold whereas the Departure RPZ begins 200 feet from the end of the runway. The Runway 1 RPZs share the dimensions (e.g., 500-foot inner width, 1,010-foot outer width, and 1,700-foot length). A portion of each RPZ extends beyond the airport property boundary, but is located a within vacant, forested area. A public road (Gorge Road) runs east to west within the RPZ.

The Runway 19 RPZs both begin 200 feet beyond the runway end. However, the Runway 19 Approach RPZ is larger due to the landing visibility minimum provided by the Instrument Landing System (ILS). The Runway 19 Approach RPZ has an inner width of 1,000 feet, an outer width of 1,750 feet, and extends 2,500 feet whereas the Runway 19 Departure RPZ has an inner width of 500 feet, an outer width of 1,010 feet, and extends 1,700-feet. It is important to note that the Departure RPZ is located entirely within the Approach RPZ boundary. The Runway 19 RPZs contains a small portion of a commercial property located on the western edge with established avigation easements. A portion of Vermont State Route 103 and Airport Road are located within the RPZs.

The Approach and Departure RPZs for Runways 13 and 31 have an inner width of 500 feet, an outer width of 700 feet, and extend 1,000 feet. The Runway 13 RPZs contains portions of an industrial complex as well as a public road (Vermont State Route 7b). Runway 31 is the only runway end with private residential property and dwellings within its RPZ. Figure 3-3 shows approximately 14 residential buildings/structures underly the Runway 31 RPZ. It is recommended that avigation easements are pursed over this property to ensure protection of the airspace within the RPZ.

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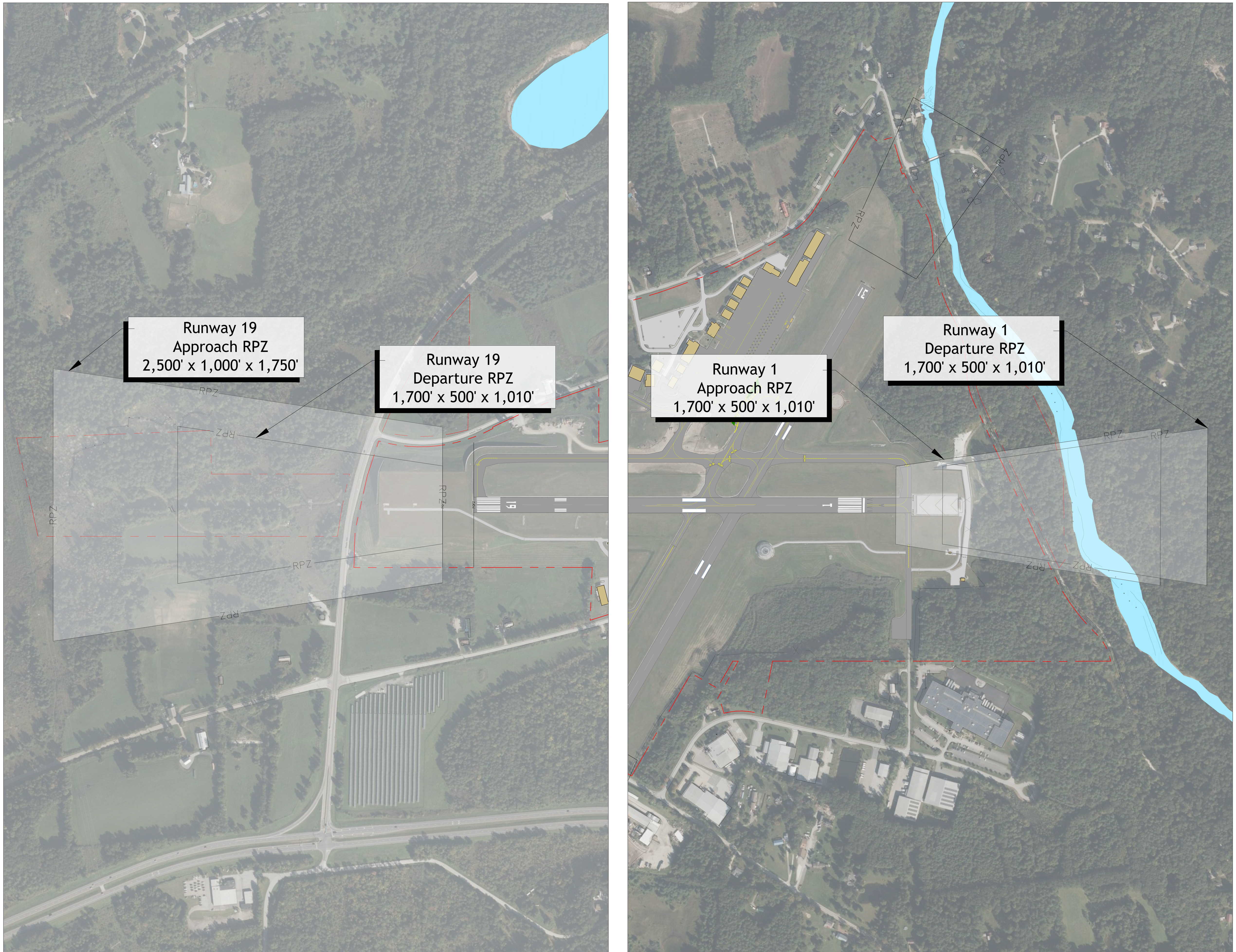


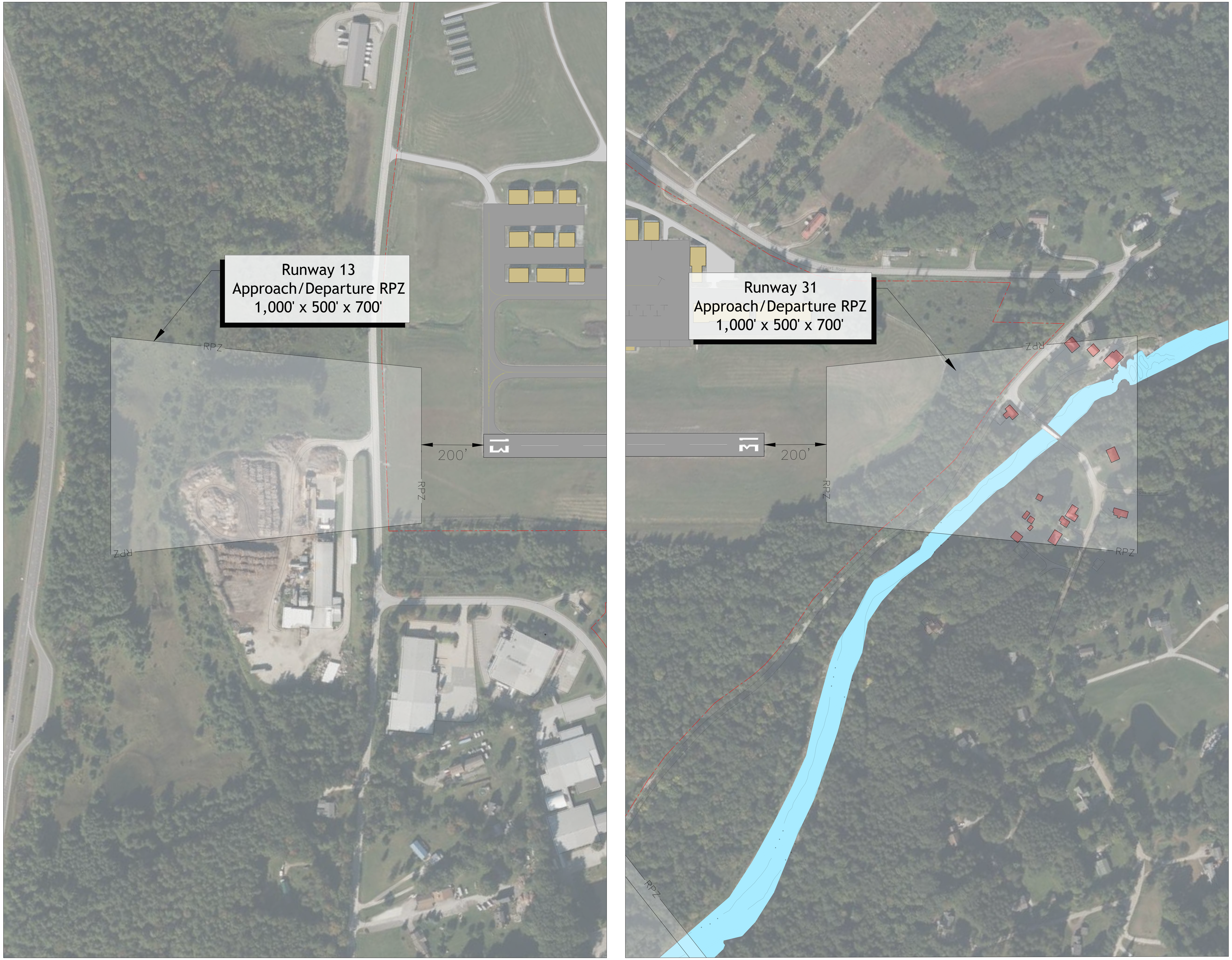
GRAPHIC SCALE (FEET)

0 300 600 1200

LEGEND

- Airport Property Boundary
- Ground Contour (Feet MSL)
- RPZ Runway Protection Zone
- Utility Pole

Figure 3-2
Runway 1-19
Runway Protection Zones



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MASTER PLAN UPDATE

GRAPHIC SCALE (FEET)

0 150 300 600

LEGEND

Airport Property Boundary

Runway Protection Zone

Residential Building

Figure 3-3
Runway 13-31
Runway Protection Zones

3.2.4 Taxiway Design Standards

Using the FAA design standards presented in **Table 3-3**, the following sections review the existing taxiway conditions at RUT and discuss deficiencies related to each taxiway standard.

3.2.4.1 Taxiway Width & Safety Area Standards

There are currently eight named taxiways at RUT as shown in **Table 3-4**. The current width of the taxiways at RUT vary from 30 feet to 50 feet. These widths comply with or exceed the requirements for TDG 2. Taxiway A is 50 feet to serve the large aircraft using Runway 1-19. Note that recent FAA changes to taxiway width standards only require a 35 feet width on all taxiways at RUT.

Table 3-4 - Taxiways

Taxiway	TDG	Width	Taxiway Safety Area	Taxiway Object Free Area
A	3	50 FT	118 FT	186 FT
B	2	35 FT	79 FT	131 FT
D	2	35 FT	79 FT	131 FT
E	2	35 FT	79 FT	131 FT
F	2	30 FT	79 FT	131 FT
G	2	35 FT	79 FT	131 FT
H	3	50 FT	118 FT	186 FT
J	3	50 FT	118 FT	186 FT

Source: CHA, 2021

Currently, Runway 31 is the only runway end without a full-length taxiway connection. Runway 1 and Runway 19 end are served by Taxiway ‘A’; and Runway 13 end is served by Taxiway ‘G’. It is recommended that Taxiway ‘B’ be fully extended to the end of Runway 31 to provide a full parallel taxiway for improved airfield safety. Full parallel taxiways are recommended by the FAA but are not a design standard requirement.

Based on the design aircraft wingspan, the taxiways at RUT are TDG 2, which requires a TSA width of 79 feet and a TOFA width of 131 feet. A review of site conditions determined that the TSA surface conditions satisfy the FAA standard to support both aircraft and vehicles within the area. All objects within the TOFA are fixed-by-function.

3.2.5 Airfield Capacity

Airfield capacity is defined as the maximum rate that aircraft can arrive at, or depart from, an airfield with an acceptable level of delay. It is a measure of the number of operations that can be accommodated at an airport during a given time period, which is determined based on the available airfield system (e.g., runways, taxiways, NAVAIDs, etc.) and airport activity characteristics.

The current guidance provided by the FAA to evaluate airfield capacity is described in AC 150/5060-5, *Airport Capacity and Delay*. The following provides a brief definition of the two key capacity parameters:

- ✈ ***Annual Service Volume (ASV):*** A reasonable estimate of the airport's annual maximum capacity, accounting for annual weather characteristics, runway use, aircraft fleet mix, and other conditions.
- ✈ ***Hourly Airfield Capacity:*** The maximum number of aircraft operations that can take place on the runway system in one hour. As airport activity occurs in certain peaks throughout the day, accommodating the peak hour activity is most critical.

AC 150/5060-5 provides the estimated ASV and hourly airfield capacity for VFR and IFR operations based on various runway configurations and the type of aircraft operating, or projected to operate, at the airport. **Table 3-5** presents the ASV and hourly airfield capacity for the single runway configuration and type of aircraft operating at RUT. The table also list the forecast activity level.

Table 3-5 – ASV and Hourly Capacity

ASV*	Hourly Operations (VFR)*	Hourly Operations (IFR)*	2038 Annual Operations	2038 Peak Hour Operations
200,000	77	57	13,764	7

Source: AC 150/5060-5, *Airport Capacity and Delay*; CHA
*ASV based on runway configuration #9 with a mix index of 21-50

Based on the runway configuration and operating aircraft at RUT, the ASV is 200,000 operations and the hourly airfield capacity is 77 operations for VFR and 57 operations for IFR. A total of 13,764 annual operations and seven peak hour operations are projected at RUT by the end of the planning period. Therefore, the Airport has surplus airfield capacity to accommodate existing and projected growth in operations. Airfield improvements are not needed to increase operational capacity.

3.2.5.1 Runway Length

Runway length requirements are based on a variety of conditions including: airport elevation, mean daily maximum air temperature, runway gradient, and the gross takeoff and landing weights of the design aircraft expected to regularly use the runway (i.e., at least 500 annual itinerant operations).

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, outlines the process for determining recommended runway length at an airport. In summary, this process involves: identifying the design aircraft, or family of aircraft, and its maximum certified takeoff weight (MTOW); calculating the recommended runway length for the design aircraft based on the appropriate "runway length curves"; and, if appropriate, adjusting the recommended runway length for aircraft and runway characteristics (e.g., runway gradient, wet runway conditions).

As discussed in **Chapter 2**, the design aircraft for RUT has been identified as a variant of an ARC B-II aircraft currently, but forecasted to be ARC C-II in the future. The most demanding aircraft to use RUT on a regular basis is the Cessna Excel with a MTOW of 20,200 pounds and is listed as a large aircraft with fewer than 10 passenger seats. Runway length requirements for this particular aircraft are listed in **Table 3-6**.

Table 3-6 - Critical Aircraft Runway Length Requirements

Aircraft Type	Runway Length Requirements*	
	Takeoff	Landing
Cessna Excel	3,560	3,180
Bombardier Challenger 300	4,810	2,600

S* = At Sea Level, International Standard Atmosphere, MTOW
Source: Aircraft manufacture published performance tables

The primary Runway 1-19 provides 5,304 feet of length for takeoff, and 5,003 feet of length for landing due to the Runway 1 displaced threshold. As there is no change in the critical aircraft forecasted, it is expected that RUT sufficiently meets the runway length requirements throughout the planning period. Although, some jet operations may be hindered by the runway length, such operations are not anticipated to exceed 500 annually, or justify a runway extension on this runway.

3.2.6 Wind Coverage

Local wind conditions at an airport can have a significant role in runway use as aircraft operate most efficiently when landing and departing into the wind. Runways not oriented to take full advantage of the prevailing wind patterns are used infrequently. Pilots must ensure that the crosswind component, or wind component perpendicular to the direction of travel, is not beyond the limits of the aircraft. Crosswind components differ depending on the size of aircraft and the associated ARC for the runway. According to FAA criteria, an airport should provide at least 95 percent wind coverage for aircraft categories anticipated to use the airport regularly.

The 95 percent wind coverage is computed on the basis of a crosswind not exceeding 10.5 knots for ARC A-I and B-I; 13 knots for ARC A-II and B-II; 16 knots for ARC A-III, B-III, and C-I through D-III. Given the ARC for RUT is forecasted to ARC C-II, **Table 3-7** provides the combined runway coverage for the all-weather, VFR, and IFR weather wind conditions for a 10.5, 13 and 16-knot crosswind for the Airport's runway.

Table 3-7 – All Weather Wind Coverage

Weather Condition	10.5 Knots	13 Knots	16 Knots
Runway 1-19	92.90%	96.53%	99.06%
Runway 13-31	97.89%	99.16%	-
Combined	99.18%	99.80%	-

Source: NOAA National Climatic Data Center
Rutland – Southern Vermont Regional Airport 2011 – 2020

Table 3-8 – VFR Wind Coverage

Weather Condition	10.5 Knots	13 Knots	16 Knots
Runway 1-19	92.60%	96.40%	99.06%
Runway 13-31	97.80%	99.12%	-
Combined	99.13%	99.79%	-

Source: NOAA National Climatic Data Center
Rutland – Southern Vermont Regional Airport 2011 – 2020

Table 3-9 – IFR Wind Coverage

Weather Condition	10.5 Knots	13 Knots	16 Knots
Runway 1-19	96.41%	97.90%	99.04%
Runway 13-31	98.90%	97.90%	-
Combined	99.71%	99.88%	-

Source: NOAA National Climatic Data Center
Rutland – Southern Vermont Regional Airport 2011 – 2020

As shown on **Table 3-7** and **Table 3-8**, the 10.5 knot crosswind component for Runway 1-19 provides less than 95 percent wind coverage during all weather and VFR conditions. However, this coverage is achieved when combined with Runway 13-31. Adequate wind coverage is provided for all other crosswind component categories. As such, the current runway configuration at RUT is warranted and is recommended to be maintained throughout the forecast period.

3.2.7 Airfield Pavement

3.2.7.1 Airfield Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft of significant weight. The design strength of the pavement at an airport is typically determined by the strength of both the pavement section and subgrade, the weight of the aircraft utilizing the airfield, and the number of operations from these aircraft.

Currently, both runways provide adequate strength for unlimited use by small aircraft (under 12,500 lbs.), regular use by mid-size corporate aircraft (e.g., 30,000 lbs.), and occasional use by larger aircraft. Thus, the current pavement section provided adequate weight bearing throughout the planning period.

Each runway at an airport is given a Pavement Classification Number (PCN) consisting of 5 alpha-numeric symbols. Runway 1-19 has a PCN (Pavement Classification Number) ranking of 30/F/D/X/U:

- The number (30) refers to the load-carrying capacity of the pavement (in thousands of pounds)
- 'F' signifies flexible pavement (Asphalt)
- 'D' refers to the subgrade strength (Ultra Low Strength)
- 'X' refers to the tire pressure on the surface (High)
- 'U' refers to the method in which the PCN was calculated (Physical Test)

Runway 13-31 has a PCN of 5/F/D/X/U:

- The number (5) refers to the load-carrying capacity of the pavement in pounds in thousands
- 'F' signifies flexible pavement (Asphalt)
- 'D' refers to the subgrade strength (Ultra Low Strength)
- 'X' refers to the tire pressure on the surface (High)
- 'U' refers to the method in which the PCN was calculated (Physical Test)

3.2.8 Runway Lighting & Navigational Aids

Runway lighting, marking, and instrumentation allows for the safe operation of aircraft during nighttime hours and low visibility conditions.

As previously discussed in **Chapter 1**, both Runway 1-19 and Runway 13-31 are equipped with Medium Intensity Runway Lights (MIRLs). Runway 1 is equipped with a two-box pulsating Visual Approach Slope Indicator (P-VASI) that is currently disabled due to terrain obstructions. Runway 19 is equipped with a 4-box Precision Approach Path Indicator (PAPI) as well as a Medium Approach Light System with Runway Alignment Indicator Lights (MALSR) to accompany the Instrument Landing System (ILS). Runway 13 is equipped with Runway End Identifier Lights (REILs).

As shown, future recommended lighting and navigation aids include the removal of the VASI and addition of a PAPI on Runway 1. Adding REILs to Runway 1 is also recommended. Due to westerly winds often experienced at the airport, both REILs and a PAPI are recommended for Runway 31. **Table 3-10** displays lighting and navigational aids currently at RUT, and recommended additions in the forecast period.

Table 3-10 – Existing & Recommended NAVAIDs

Existing Lighting and Navigational Aids	Runway End
Runway End Identifier Lights (REIL)	13
Precision Approach Path Indicator (PAPI) or VASI	1, 19
Instrument Approach Procedure (IAP)	1, 19
Recommended Lighting and Navigational Aids	
Runway End Identifier Lights (REIL)	1, 31
Precision Approach Path Indicator (PAPI)	1, 31
Instrument Approach Procedure (IAP)	Adequate

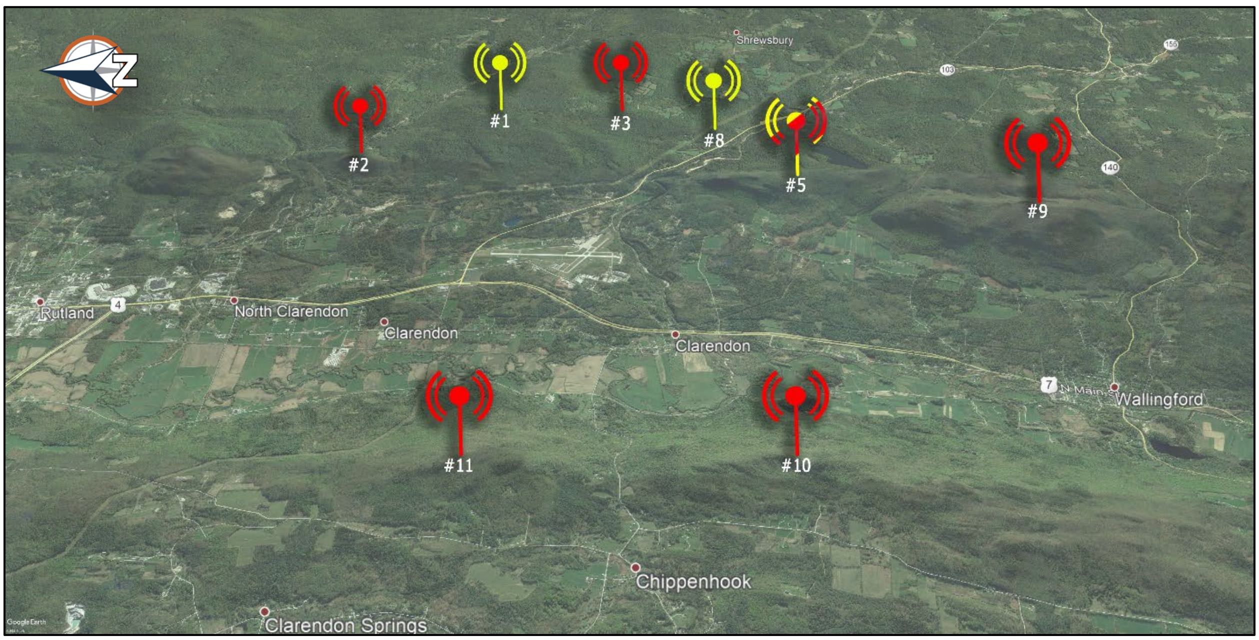
Source: CHA, 2021

3.2.9 Obstruction Beacons

In Vermont, the mountainous terrain complicates the provision of airfield lighting and night airport operations. Airports within or adjacent to high terrain have more challenging operating conditions for visual flight operations. Undeveloped mountainous areas often have little to no artificial lighting on the ground. Thus, even during nights with good visibility, it is more difficult for pilots to visually distinguish their height above the ground and over undulating terrain. In these locations, nighttime flying and airport operations are benefited by obstruction or hazard beacons installed within the areas of high terrain surrounding the airport. These beacons visually identify the high ground, ridges, and hill tops, and reduce the risk of controlled flight into terrain.

There are currently eight (8) hazard beacons located within the mountainous areas surrounding RUT. Of that total, however, only two (2) are currently in operation and one (1) is reported with intermittent operation. **Figure 3-4** depicts the existing hazard beacon locations and **Table 3-11** lists their operational status.

Figure 3-4 – Hazard Beacons Surrounding RUT



Although the FAA acknowledges the value of hazard beacons, lighting of natural terrain is not currently required per FAA standards. As such, repairs and maintenance costs are ineligible for FAA funding and would require full funding by VTrans. Therefore, it is recommended that a Hazard Beacon Study is conducted to examine the location, benefit, and cost of repairing the inoperative beacons, including consideration of environmental impacts, access and easement requirements, and associated property needs.

Table 3-11 – RUT Hazard Beacons

Beacon #	Beacon Name	Status
1	Poor Farm	Operational
2	Round Hill	Not Operational
3	Adams Farm	Not Operational
5	Spring Lake Ranch	Intermittent
8	Lincoln Hill	Operational
9	Bear Mountain	Not Operational
10	Raiche Farm	Not Operational
11	Walker Mountain	Not Operational

Source: VTrans, CHA, Google Earth, 2021

Upon identifying the benefit/cost, a minimum number of beacons may be identified along with a removal plan for the inoperative beacons to provide enhanced nighttime and poor visibility flying within the RUT airspace.

3.2.10 Instrument Approach Procedures

Instrument Approach Procedures (IAPs) are published by the FAA for specific runway ends. RUT has a total of five published IAPs for Runway 1-19, four of which are for approaches to Runway 19. Additionally, Runway 19 is the only runway end equipped with a full precision instrument approach. However, due to terrain obstructions to the south and the length of Runway 13-31, the master plan does not recommend pursuing additional IAPs for RUT.

3.3 Landside Facility Requirements

The landside facility requirements examine existing airport facilities and structures that accommodate the movement and storage of aircraft, and provide facilities to support pilots, passengers, and airport employees. The landside facility requirements analysis includes an examination and evaluation of:

- Aircraft Storage Space
- Passenger Terminal Building Space
- Fuel Storage Requirements
- Vehicle Parking Requirements
- Airport Security and Fencing

The following sections provides a description of each item and an evaluation of existing and future requirements according to current FAA and industry standards.

3.3.1 Aircraft Storage Space

Due to various weather conditions, hangars are highly desirable in the State of Vermont as snowstorms, frost, and intense cold can cause icing on parked aircraft, which can be extremely disrupting to aircraft operations. Additionally, during warmer months, heat and sun exposure can damage avionics and fade paint, and thunderstorms and hail can cause considerable damage. For GA airports, while virtually all aircraft owners would prefer hangar storage over tie-downs, hangar requirements are generally a function of the number and type of based aircraft, hangar rental/construction costs, and area climate.

As discussed within **Chapter 2**, RUT is not forecast to experience a growth in based aircraft. However, as shown on **Table 3-12,** the based aircraft fleet mix is anticipated to change slightly with the loss of a single-engine aircraft and addition of a jet aircraft.

Table 3-12 – RUT Current and Forecasted Based Aircraft

Aircraft Type	2018	2023	2028	2032	2028
Single-Engine	25	25	24	24	23
Multi-Engine	1	1	1	1	1
Jet	0	0	1	1	2
Helicopter	0	0	0	0	0
Other	1	1	1	1	1
Total	**27**	**27**	**27**	**27**	**27**

Source: R.A. Weidman & Associates, 2019

Based on airport records, it is estimated that 17 of the based aircraft are currently hangared while the remaining 10 aircraft lease tie-down space. For planning purposes, it is reasonable to assume that all based aircraft may transition into hangar space throughout the forecast period. Additionally, all multi-engine and jet aircraft will require hangar storage throughout the planning period. Thus, an estimate of future demand should be incorporated into the master plan.

Using approximate aircraft storage area requirements by aircraft type (i.e., single-engine, multi-engine, etc.), **Table 3-13** lists the estimated storage space requirements for the Airport.

Table 3-13 – Estimated Aircraft Storage Area Requirements

	2018		2023		2028		2032		2038	
Aircraft Type	No.	Area (SF)	No.	Area (SF)	No.	Area (SF)	No.	Area (SF)	No.	Area (SF)
Single-Engine	15	24,000	17	27,200	19	30,400	21	33,600	23	36,800
Multi-Engine	1	2,000	1	2,000	1	2,000	1	2,000	1	2,000
Jet	0	0	0	0	1	6,500	1	6,500	2	13,000
Other	1	1,600	1	1,600	1	1,600	1	1,600	1	1,600
Total	**17**	**27,600**	**19**	**30,800**	**22**	**40,500**	**24**	**43,700**	**27**	**53,400**

Source: CHA, 2021

Using the planning assumptions above, the estimated hangar storage area would grow from 27,600 to 53,400 square feet during the planning period, for a potential deficit of 25,800 square feet. As discussed within **Chapter 1**, there are several corporate and community hangars located at RUT totaling approximately 70,000 square feet of space. Much of this space, however, is used by itinerant aircraft (e.g., airline, cargo, and other visiting aircraft), for maintenance activities and by private owners and businesses. These hangars have limited ability to accommodate additional based and/or transient aircraft.

Based upon conversations with VTrans, the northern three T-hangar stalls of Hangar 16 are currently vacant and available for lease through the hangar owner (Mountain Aviation T-Hangar Association). This vacancy equates to approximately 5,000 square feet of available aircraft hangar space.

With an estimated existing surplus of approximately 5,000 square feet of hangar storage, and an estimated need for an additional 25,800 square feet of available aircraft storage space by the end of the planning period, the forecast hangar deficit is approximately 20,800 square feet. As such, it is likely that RUT will continue to experience requests for private hangar construction throughout the forecast period.

In addition to this forecast demand, there is a benefit to planning for other opportunities that could arise. Business relocations, lower lease costs for airport property, etc. can occasional result is unforeseen hangar projects. It is recommended that the master plan identify and reserve locations for hangar developments beyond the need estimated by the traditional planning process above.

3.3.2 Aircraft Tie-Downs

Aircraft aprons provide parking and tie-down positions for airline activity, based and itinerant aircraft, and staging areas for aircraft stored in conventional hangars. As discussed within **Chapter 1**, there are a total of 29 tie-down spaces located on the main apron. Currently, approximately 10 based aircraft (i.e., 37 percent) lease monthly tie-down space from Columbia Air Services.

To calculate an estimated number of required tie-down parking positions for visiting aircraft, flight data for transient aircraft can be used if available. Alternatively, for smaller communities, a simple minimum of 5 to 10 tiedowns can be use where detail data is not available.

Using the above factors, **Table 3-14** lists the estimated number of required tie-downs at RUT. Currently, RUT requires roughly 20 tiedowns; however, that demand would decrease if based aircraft owners transition to hangar storage and such hangar space was developed. With 29 existing tiedown, there is a surplus of tiedown positions at RUT.

Table 3-14 – Estimated Tie-Down Demand

Aircraft Type	2018	2023	2028	2032	2028
Visiting (itinerant aircraft)	10	10	10	10	10
Tie-Downs for Based Aircraft	10	8	5	3	0
Total	**20**	**18**	**15**	**13**	**10**

Source: CHA, 2020

3.3.3 Apron Parking Requirements

There is approximately 39,000 square yards of space on the main apron. Included within this space are the aircraft tie-downs, airline staging area, fueling apron, hangar staging areas, and aircraft maneuvering areas (i.e., taxilane). Currently, the main apron functional uses are roughly divided into the following areas:

- Airline Apron: 2,000 SY
- Fueling Area: 2,000 SY
- Hangar Staging Apron: 10,000 SY
- Tiedowns & Taxilanes: 25,000 SY

For the airline, fueling, and hangar staging areas, it appears that the area provided is adequate both currently and in the future. For the tiedown and taxilane area, this evaluation identified that the 25,000 SY available is greater than required. Specifically, for 10 based aircraft, 400 SY/per aircraft, or 4,000 square yards total would typically be adequate. For up to 10 visiting aircraft, including some jets, 1,000 square yards/per aircraft, or 10,000 square yards total would typically be adequate. In total, approximately 14,000 square yards is a reasonable estimate of need for aircraft parking, with approximately 25,000 square years available. Thus, this review identifies that the main apron will have surplus area throughout the planning period.

However, VTrans has indicated that during high levels of airport activity it can become difficult for visiting jet aircraft to maneuver near the eastern portion of the apron due aircraft parked within this area. It is recommended that apron reconfiguration options are examined to mitigate potential long-term congestion issues.

3.3.4 Fuel Storage Requirements

Two above-ground fuel storage tanks are located on the southern edge of the main apron. The airport currently has fueling capabilities to provide Jet-A and 100LL AVGas, from its facility operated by the FBO. The two fuel tanks storage provide 15,000 gallons of AVGas, and 12,000 gallons of Jet-A.

The FBO may consider providing additional capacity for Jet-A fuel if they secure fueling contracts with based or itinerant aircraft users that require additional storage. However, currently capacity is adequate.

3.3.5 Passenger Terminal Building Requirements

As discussed within **Chapter 1**, the passenger terminal building at RUT accommodates the arrival and departure of airline passengers currently being service by Cape Air. Cape Air provides three daily, roundtrip flights from Rutland to Boston, MA using Cessna 402 aircraft. Each aircraft can seat up to nine passengers.

Sizing requirements for passenger terminal buildings are, generally speaking, a function of peak passenger enplanements. At RUT, peak passenger activity occurs during the processing (i.e., enplaning and deplaning) of one of the daily Cape Air flights. As such, the peak hour enplanements are limited to nine passengers based on the existing and future aircraft size, which is forecast to remain at under 10 passenger seats. As such, the current functional building spaces are sufficient to handle passenger enplanement processing.

However, the terminal building is in need repairs and maintenance including:

- Siding/facade replacement
- Window & door replacement
- HVAC systems replacement
- Upgraded lighting/electrical system (LED)
- Internal building refinishing, including bathrooms, offices, and public areas

Furthermore, there are several mechanical functions outside of the terminal building such as an insufficient water pump and supply and potential new pump or well.

Although the building footprint appears to provide sufficient space for its functional purposes, it is recommended that a comprehensive renovation of the passenger terminal building is considered during the planning period.

3.3.6 Vehicle Parking Requirements

Vehicle parking facilities are intended to provide space for design hour passengers/pilots, visitors, employees, etc. Consideration should also be made for off-peak passenger/pilots leaving a vehicle in the lot for more than the normal period. The requirement for airline passenger and employee parking was calculated using a metric of 1.5 spaces for every peak day operation (i.e., 34 x 1.5). Additionally, as the restaurant located on the second floor of the terminal building can accommodate approximately 45 patrons, 35 parking spaces were added. **Table 3-15** identified the future vehicle parking space requirement.

Table 3-15 – Estimated Apron Space

Vehicle Space	Existing Parking Spaces (Approx.)	2018	2023	2028	2032	2028
Airline Passenger/Employee	150	51	51	53	53	53
Restaurant Patron		35	35	35	35	35
Total			**86**	**86**	**88**	**88**

Source: CHA, 2021

Observations/vehicle counts has consistently show parked vehicles to be under 50 vehicles. Thus, it is concluded that RUT provides sufficient parking to accommodate airline and airport visitors. Note that additional parking space is located east of the Columbia Air Services FBO building.

3.3.7 Airport Security and Fencing

RUT provides airport fencing throughout the airfield accessible by electronic keypads in key locations and locks in others. It is not expected that RUT will be needing additional security fencing throughout the planning period beyond regular maintenance.

3.4 Facility Requirements Summary

Table 3-16 provides a summary of the recommendations discussed within this chapter. These recommendations are carried forward to the Airfield Alternatives where, if applicable, solutions are presented.

Table 3-16 – Facility Recommendations

Facility	Recommendation
Runways	• Address non-standard objects within the RSA and ROFA
Taxiways	• Address non-standard objects within the TSA and TOFA • Develop partial or full parallel Taxiway B connecting to Runway 31 end to improve safety • Address non-standard FAA taxiway configuration that currently provide direct runway-to-apron connections.
Navigational Aids	• Add REILs to Runways 1 and 31 • Add a PAPI to Runways 1 and 31
Hangar and Apron Parking	• Construct additional hangar space • Consider reconfiguration of main apron tiedown layout
Terminal Building	• Comprehensive renovation of the existing passenger terminal • Rehabilitation of terminal parking lot (to include transit loading/unloading)
Other	• Construct SRE building within north area • Construct airport vehicle access road

Source: CHA, 2021

Chapter 4

Development Alternatives

4 Development Alternatives

The primary focus of this element of the Master Plan Update for the Rutland-Southern Vermont Regional Airport (RUT) is the identification and evaluation of development alternatives considered as key components of the overall Airport's improvement strategy. This chapter provides development strategies to accommodate future aviation demand identified in **Chapter 2, *Forecasts of Aviation Demand***, as well as the deficiencies and constraints identified in **Chapter 3, *Facility Requirements*.** The overall goal of this analysis, as stated in Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, is to:

- Identify alternative concepts to address previously identified facility requirements
- Evaluate these alternatives, individually and collectively, so there is a clear understanding of strengths, weaknesses, and implications of each
- Select a reasonable alternative

Development alternatives, or concepts, may focus on demand/capacity relationships, operational safety, and/or improving the Airport's revenue stream. Additionally, it may be necessary to include development concepts for future years beyond the term of the planning period, in order to protect areas reserved for future runway or taxiway development, facility expansion, etc.

The development concepts presented in this chapter are organized based on specific areas at the Airport. From this effort, and using the previously determined facility requirements, the most reasonable and feasible alternative was identified for each area. The alternatives identified represent a level of detail consistent with FAA guidance for a master planning effort. The alternatives have been designed to address the airport facility deficits identified in **Chapter 3** and are presented as follows:

- Taxiway Extension Alternative
- P-VASI/PAPI Alternatives
- Hangar & Apron Layout Alternatives

The goal of this chapter is to identify a range of alternatives for airfield and landside development that are consistent with the FAA guidelines and standards and goals of RUT. The alternatives are based on a review of the Airport's needs as well as current environmental, physical, and financial constraints. Note that prior to the development of any airport project, an environmental analysis and permitting may be required. The following sections summarize previous findings related to facility requirements and the objectives of the alternative development process.

4.1 Influencing Development Factors

There are several factors that influence the evaluation of the alternatives and determine the final recommended development plan. These factors include:

- ***FAA Design Standards and Guidance:*** Airfield recommendations and designs consistent with the guidance provided by FAA AC 150/5300-13A, Airport Design. At RUT, key considerations include navigational aids, taxiways, and required clearances from aprons and hangars.
- ***Environmental Impacts:*** Evaluation of the potential impacts on the environment, as Airport improvements may impact wetlands, water quality, and flooding.
- ***Consistency with Master Plan Objectives:***
    - Aviation Demand – Accommodating projected operations and design aircraft
    - Apron Capacity – Satisfying the projected needs and constraints of the apron area
    - Hangar Layout – Identifying areas for future hangar development
- ***Construction and Maintenance Costs***: The overall project feasibility, associated costs, constructability.

Table 4-1 summarizes the facility requirements identified in the previous chapter.

Table 4-1 – Facility Recommendations

Facility	Recommendation
Runways	• Address non-standard objects within the RSA and ROFA
Taxiways	• Address non-standard objects within the TSA and TOFA • Develop partial or full parallel Taxiway B connecting to Runway 31 end to improve safety • Address non-standard FAA taxiway configuration that currently provide direct runway-to-apron connections.
Navigational Aids	• Add REILs to Runways 1 and 31 • Add a PAPI to Runways 1 and 31
Hangar and Apron Parking	• Construct additional hangar space • Consider reconfiguration of main apron tiedown layout
Terminal Building	• Comprehensive renovation of the existing passenger terminal • Rehabilitation of terminal parking lot (to include transit loading/unloading)
Other	• Construct SRE building within north area • Construct airport vehicle access road

Source: CHA, 2021

4.2 Development Alternatives

4.2.1 Airspace Obstructions

The airspace above an airport is protected via various imaginary surfaces that restrict the heights of objects. Most often, penetrations to the surfaces are caused by trees and terrain. While it is preferable to clear and remove all penetrations to the surfaces, it is often not feasible to do so. As such, airports utilize various methods of protecting airport users, such as declared distances, published departure procedures, obstruction lights, etc.

The surfaces analyzed for RUT's airspace included the approach and departure surfaces of each runway end as specified in the FAA Engineering Brief 99A (EB99A), *Changes to Tables 3-2 and 3-4 of the Advisory Circular 150.5300-13A, Airport Design,* and the Federal Aviation Regulation Part 77, *Object Identification Surfaces*. However, for planning purposes, penetrations to the Part 77 Imaginary Surfaces are not considered design standards, and thus do not require tree clearing mitigation. Locations of the tree and terrain obstructions are depicted in the official Airport Layout Plan (Sheets 6 thru 9). It is important to note that the individual tree points listed on the ALP (Sheet 10, *Obstruction Data Sheet*) represent groups or areas of trees within that vicinity. As such, there are many more tree penetrations than listed in the data tables. The disposition recommending 'to remove' tree obstructions would encompass an area, not just the listed tree location.

The Runway 1 end currently has tree penetrations to its three imaginary surfaces: the EB99A 20:1 Approach and 40:1 Departure Surfaces (also known as Obstacle Clearance Surfaces (OCS)), and the 34:1 Part 77 Approach Surface. The trees within the airport property are recommended to be removed, which will result in clearing the critical 20:1 Approach OCS. The remaining trees located further out in the approach will be retained. The majority of these trees are penetrations to the 40:1 Runway 19 Departure OCS, which is currently mitigated via published takeoff minimums and obstacle departure procedures. Furthermore, it would be impractical to clear the large area of off-airport trees to the south of the runway which are located on private property.

The Runway 19 end currently has tree penetrations to two imaginary surfaces: the 50:1 Part 77 Approach Surface and the 40:1 Departure OCS. The close in tree penetrations are recommended to be removed as they are located within property with avigation easements. Similar to the Runway 1 end, the remaining trees will be left as is, as the majority are penetrations to the 40:1 OCS which is mitigated via published takeoff minimums and obstacle departure procedures.

The Runway 13 end has tree penetrations to its two imaginary surfaces: the 20:1 Part 77 Approach Surface and the 20:1 Approach OCS. Neither Runway 13 nor 31 have a departure surface due to it being a visual-only runway. The obstructions within the existing avigation easements are recommended to be removed. Attaining additional avigation easements located around the outer edge of the RPZ is also recommended in order to clear the remaining 20:1 tree obstructions. This would result in clearing of all tree obstruction on the Runway 13 end.

Similar to Runway 13, **the Runway 31** end has tree penetrations to both the 20:1 Part 77 Approach Surface and the 20:1 Approach OCS. All trees within the airport property are recommended to be removed. The remaining obstructions are mitigated via the Lincoln Hill

Hazard Beacon #8, as depicted in **Figure 3-4**. As such, it is recommended that the beacon be maintained in working order to protect nighttime landing on Runway 31.

4.2.2 Taxiway Extension & Main Apron Reconfiguration

Runway 31 is currently the only runway end at RUT that is not served by a full-length parallel taxiway. Aircraft departing Runway 31 must "back taxi" on the runway prior to departure. Although Taxiway 'B' serves the majority of the Runway 13-31 length, the parallel taxiway terminates at Taxiway 'H'.

Therefore, **Figure 3-2** depicts a full-length extension (35-foot width) of Taxiway 'B' to the Runway 31 end. This concept enhances safety by eliminating the need for aircraft back taxi operations to Runway 31. Additionally, extension of Taxiway 'B' also provides additional ingress/egress and increases aircraft maneuvering and staging within the main apron during peak periods. Following the ADG II standards on the eastern portion of Taxiway 'B', the extension results in a Taxiway Object Free Area (TOFA) that abuts the main apron. Thus, the fuel farm may potentially cause an obstruction and need to be relocated. VTrans will explore multiple options to meet design standards to accommodate the taxiway extension project.

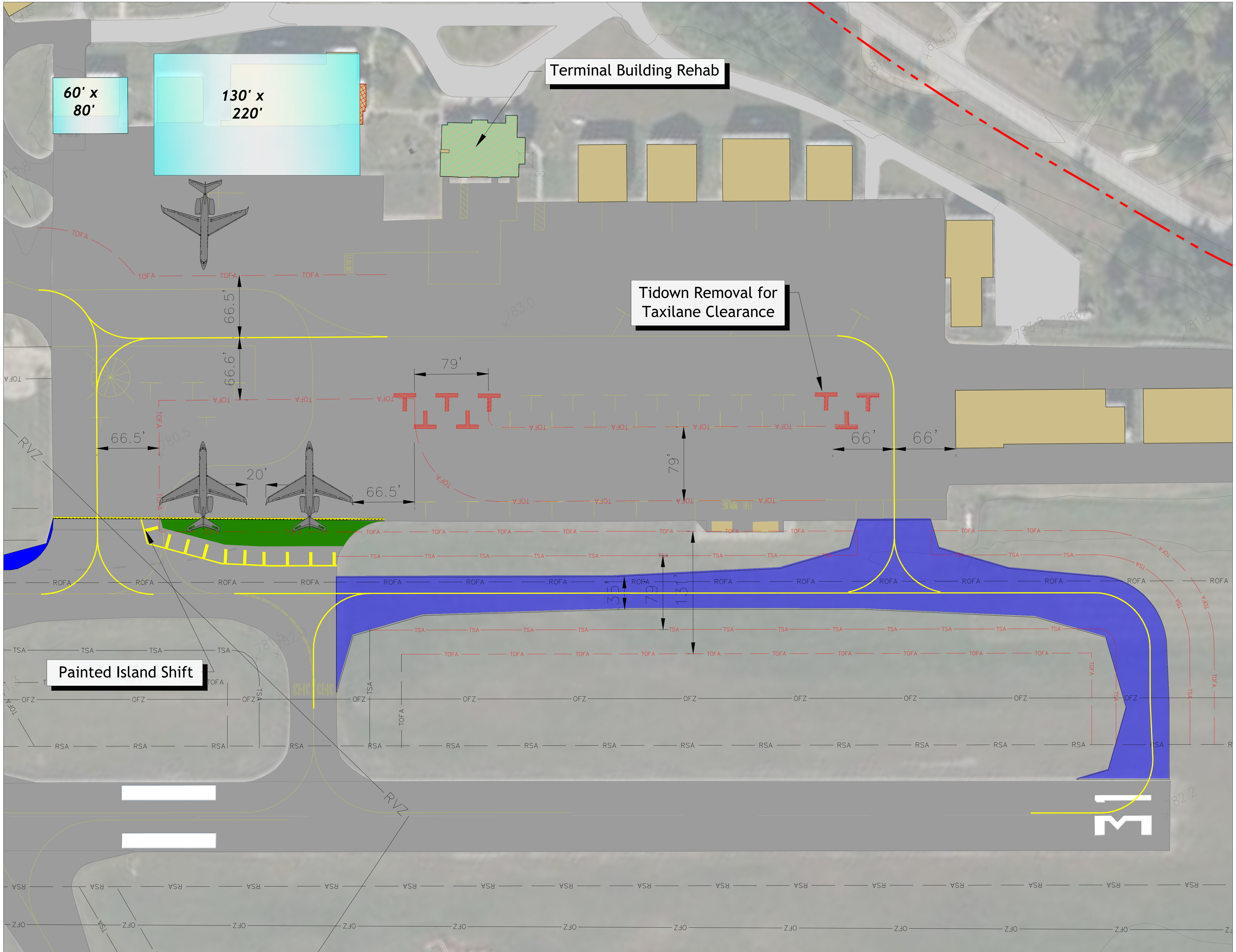
This concept also depicts a shift of the painted island between the main apron and Taxiway 'H' to provide additional aircraft parking area. A modified (e.g., larger) Taxiway Design Group (TDG) 2 Taxilane OFA is shown for larger aircraft, particularly TDG 3 aircraft.

Lastly, to accommodate large aircraft storage without sacrificing existing tie-downs, a large (130' x 220') hangar encompassing the footprint of both the existing flight school hangar and the Civil Air Patrol (CAP) hangar is depicted. The Aircraft Rescue and Fire Fighting (ARFF) facility, which is nearing the end of its useful life, is shown replaced by a medium sized hangar. This facility could house the current ARFF equipment. Within each concept, rehabilitation of the existing terminal building is recommended.

4.2.3 P-VASI Relocation

The Pulsating Visual Approach Slope Indicator (P-VASI) on the Runway 1 approach end has been temporarily disabled due to terrain obstructions (i.e., Bear Mountain to the south is within the bounds of the P-VASI aiming angle). Additionally, the current location of the system does not adhere to FAA siting standards provided by Order JO 6850.2B, *Visual Guidance Lighting Systems,* for the Threshold Crossing Height (TCH).

An analysis was conducted to evaluate potential alternatives that would allow for resuming the use of a visual guidance slope indicator for Runway 1. The recommended option includes upgrading the equipment to a standard 4-box Precision Approach Path Indicator (PAPI) and shifting the location to 915 feet from the Runway 1 end while retaining the current 3.5 degree aiming angle. However, this relocation does not provide a clear Obstacle Clearance Surface for the full four-mile distance required. Thus, as allowed by FAA Engineering Brief 95, *Additional Siting and Survey Considerations for Precision Approach Path Indictor (PAPI) and Other Visual Glide Slope Indicators (VGSI)*, a Notice to Airmen (NOTAM) is recommended to be published, thus restricting the use of future PAPI to approximately 2.5 miles beyond the Runway 1 end. The full evaluation is provided in **Appendix A**. FAA approval would be needed prior to installation.



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MASTER PLAN UPDATE

GRAPHIC SCALE (FEET)

0 50 100 200

LEGEND

- Airport Property Boundary
- Ground Contour (Feet MSL)
- Future Hangar Development
- Future Apron/Taxiway
- Tiedown/Building Removal
- Future Taxiway/lane Centerline
- Future Runway Object Free Area/Safety Area
- Future Taxiway/Taxilane Object Free Area/Safety Area
- Utility Pole
- NAVAID Critical Area

Figure 4-1

Taxiway Extension & Main Apron Configuration

4.2.4 Hangar Development

As discussed within **Chapter 2**, the current number of based aircraft at RUT (27) is forecast to remain constant throughout the planning period. However, it is anticipated that the Airport will experience a slight change in fleet mix along with an increase of itinerant aircraft operations. These factors are expected to result in increasing demand for aircraft storage space. As such, the following concepts depict potential areas for hangar development and expansion. It is important to note that all development will be market-driven based on the demands and funded by the aircraft owner or developer. Additionally, priority for aviation development is given to all potential development areas. However, certain areas capable of facilitating non-aviation use are depicted where appropriate.

When determining potential hangar layouts, the Vermont Agency of Transportation (VTrans) standards were used including a 20-foot hangar separation and dimensions for small, medium, and large corporate hangars:

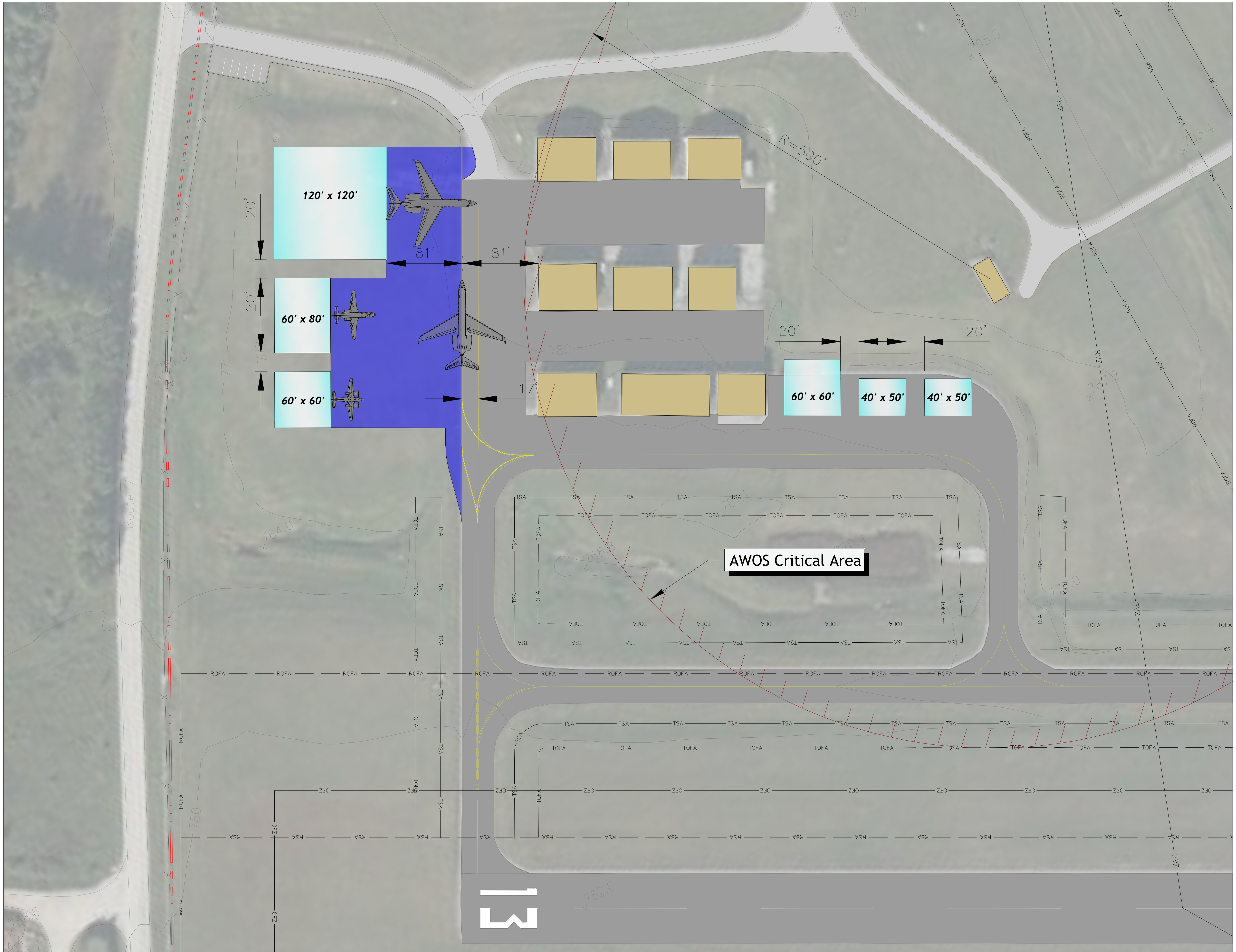
- Small Hangar: 60’ x 60’
- Medium Hangar: 60’ x 80’
- Large Hangar: 120’ x 120’

While the above dimensions are shown within each concept, areas where specific hangar dimensions provide an alternate option are shown.

4.2.4.1 West Hangar Development

The west hangar area is located north of the Runway 13 end and currently contains nine box hangars east of Taxiway ‘F’. These hangars vary in size and dimension (e.g., 40’ x 50’ to 45’ x 95’) and are privately owned. Although rolling terrain and drainage swales are located within much of western portions of the airfield, the northwestern edge of Taxiway ‘F’ contains relatively even terrain (approximately 8,200 square yards that was previously graded) capable of supporting limited development. The terrain between the depicted hangars and Vermont State Route 7B decreases up to 17 feet. Therefore, significant grading would be required for extensive development.

As such, **Figure 4-2** depicts a small, medium, and large corporate hangar within this area. Aircraft access is provided via Taxiways ‘B’, ‘F’, and ‘G’. Taxiways ‘B’ and ‘F’ are 35 feet in width and meet FAA design criteria for Airplane Design Group (ADG) II and TDG 2. As the large hangar (120’ x 120’) can accommodate up to ADG III aircraft (e.g., Gulfstream V), a potential 17-foot westerly shift of the Taxiway ‘F’ centerline (north of Taxiway ‘G’) is shown for safety area clearance. However, the Taxilane Safety Area (TSA) and TOFA are not determining factors in hangar placements as it is the responsibility of the users to safely maneuver within the apron. It is important to note that should the west hangar area experience significant ADG III activity, the remaining portions of Taxiways ‘B’ and ‘F’ contain sufficient area to accommodate greater safety area widths. Note that the layout illustrated in Figure 4-2 could be refined by future developers/tenants; however, the depiction provides a logical “full-buildout” of the site meeting FAA standard.



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GRAPHIC SCALE (FEET)

0 50 100 200

LEGEND

LEGEND

- Airport Property Boundary
- Ground Contour (Feet MSL)
- Future Hangar Development
- Future Apron/Taxiway
- Utility Pole
- NAVAID Critical Area

Figure 4-2
West Hangar Development

Additionally, there is adequate space directly east of the existing box hangars for an additional three 40’ x 50’ hangars. Although this area is located within the AWOS critical area, the hangars would likely remain below wind sensing equipment. Additional siting study may be required.

4.2.4.2 East Hangar Development

To accommodate development near the existing terminal area, **Figure 4-3**, **Figure 4-4**, and **Figure 4-5** depict hangar expansion east of Taxiway ‘A’. Within each concept, the hangars are located south of a wetland area and drainage swale and beyond 500 feet of the Runway 1-19 centerline. Portions of each hangar, however, would penetrate the Runway 1-19 Transitional Airspace Surface. FAA coordination would need to occur prior to constructing each hangar, including submission of an FAA 7460-1 form to initiate an FAA airspace review. Potential mitigation may include obstruction lighting on each hangar.

Additionally, each concept shows the potential replacement of the existing Aircraft Rescue & Firefighting (ARFF) building with a medium size hangar and the replacement of Hangars #5 and #6 with a large (130’ x 220’) corporate hangar.

East Hangar Development - Concept 1

Figure 4-3 depicts corporate hangar expansion (e.g., medium and large) along the eastern edge of Taxiway ‘A’. This concept utilizes a north/south hangar configuration to minimize future pavement, disturbance of the vehicle access road (formally Taxiway ‘E’), and avoidance of wetlands. TDG 2 standards are shown for each proposed taxiway.

East Hangar Development - Concept 2

Similar to Concept 1, **Figure 4-4** also depicts corporate hangar expansion (e.g., small, medium, and large) along the eastern edge of Taxiway ‘A’. This concept depicts all hangars with a west facing orientation and a common 100-foot-wide apron area west of the hangars. This concept requires greater pavement area with associated additional costs and stormwater accommodation.

It is important to note that FAA design criteria requires 500 feet of separation between the runway centerline and aircraft parking if the runway provides lower than ¾ mile landing visibility. Although Runway 1 provides ½ mile landing visibility, this minimum only pertains to aircraft with approach speeds of 120 knots or less (i.e., Category A and B). As these speeds mostly pertain to single- and multi-engine piston aircraft, 400 feet of runway to aircraft parking separation would be permissible within this concept.

East Hangar Development - Concept 3

A final concept for this area, **Figure 4-5**, provides an option with the least amount of additional pavement, grading, and costs. This concept utilizes an east facing hangar configuration and requires a portion of the vehicle access road to be converted into taxiway. Presently, two existing hangars in this area retain use of Taxiway “E”, which also serves as access for vehicles. Thus, a potential disadvantage of this concept is the dual use of pavement for vehicles and aircraft. Additionally, as a result of the location of the taxiway safety areas, aircraft parking in front of each hangar may be limited or unavailable.

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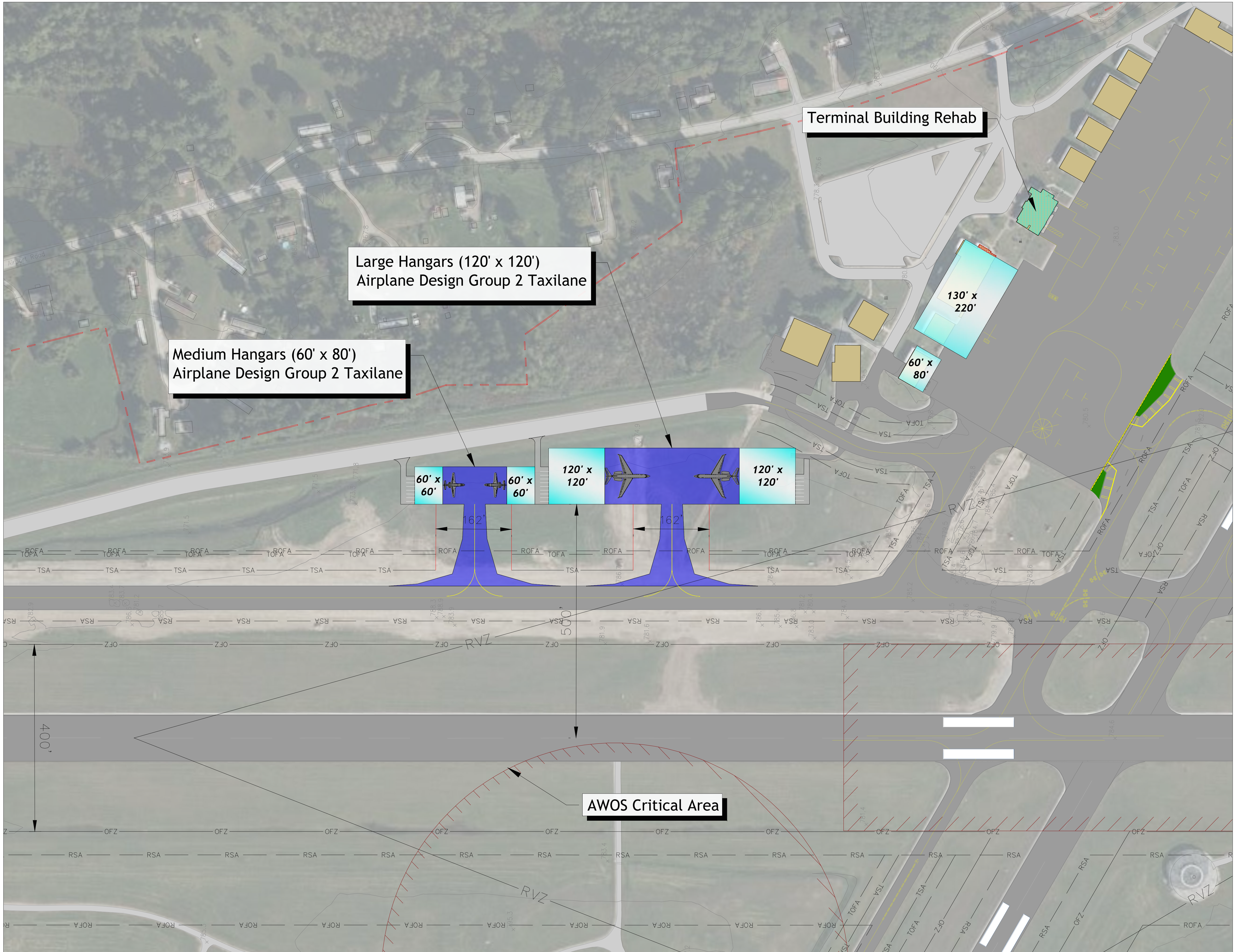

GRAPHIC SCALE (FEET)
0 100 200 400

LEGEND

- Airport Property Boundary
- Ground Contour (Feet MSL)
- Future Hangar Development
- Future Apron/Taxiway
- Pavement/Building Removal
- TOFA / TSA Future Taxiway/Taxilane Object Free Area/Safety Area
- Utility Pole
- NAVAID Critical Area

Figure 4-3
East Hangar Development
Concept 1

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GRAPHIC SCALE (FEET)
0 100 200 400

LEGEND

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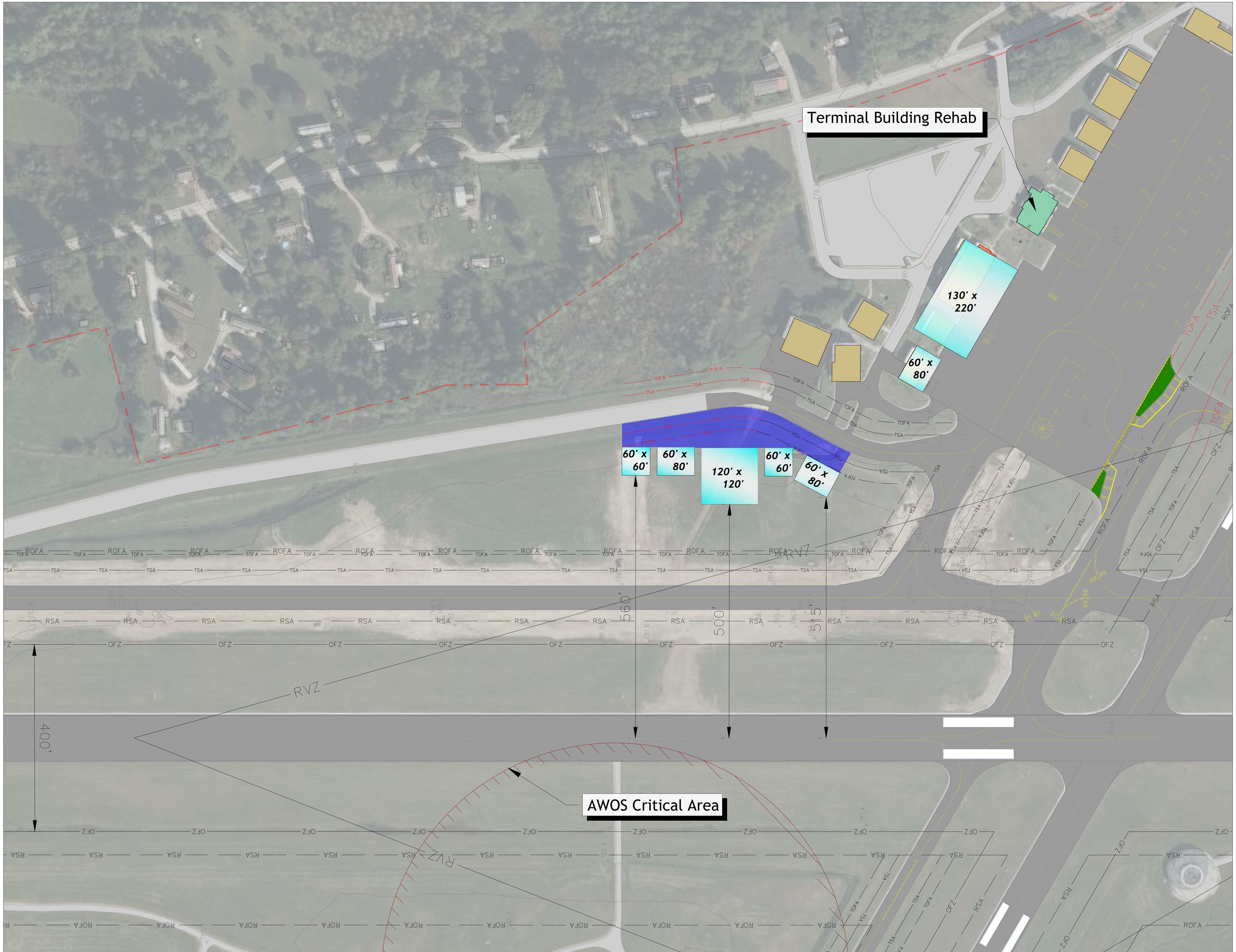
Figure 4-4
East Hangar Development Concept 2



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GRAPHIC SCALE (FEET)

0 100 200 400

LEGEND

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- Pavement/Building Removal
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- Utility Pole
- NAVAID Critical Area

Figure 4-5

East Hangar Development Concept 3

4.2.5 Terminal Building Rehabilitation

As discussed within **Chapter 2**, the current layout of the terminal building satisfies the existing and forecasted needs for ground access, auto parking, and curbside drop-off. Additionally, space is adequate to accommodate peak hour passenger levels. However, the physical condition of the building requires extensive repairs and maintenance including:

- ✈ Siding/facade replacement
- ✈ Window & door replacement
- ✈ HVAC systems replacement
- ✈ Upgraded lighting/electrical system (LED)
- ✈ Internal building refinishing, including bathrooms, offices, and public areas

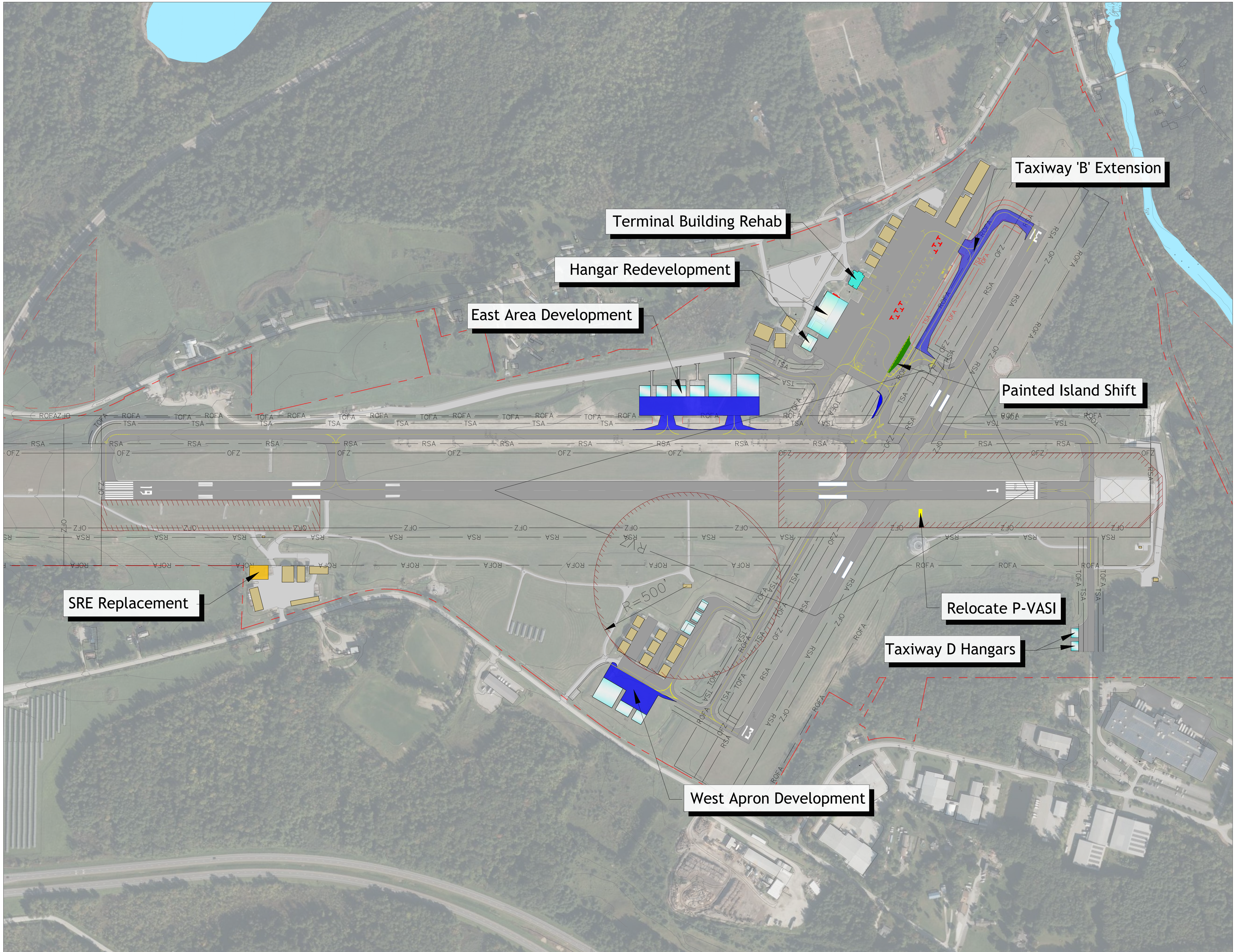
As such, a full interior renovation with replacement of interior wall, floors, etc. is desirable, but not critical. However, short-term planning should account for replacement of the certain building systems, such as HVAC and enhancement of interior lighting to LED. It is recommended that a comprehensive renovation of the passenger terminal buildings is included during the planning period as depicted in **Figure 3-2**.

4.3 Recommended Plan

The Recommended Plan (**Figure 4-6)** depicts the alternatives recommended to be pursued as development projects in the future and lays the foundation for the Airport Layout Drawing. The following briefly summarizes each recommended development area along with the preferred concept where applicable.

- ✈ ***Taxiway Extension:*** It is recommended that Taxiway 'B' is extended to to the Runway 31 end in order to eliminate the need to back taxi on the runway and improve overall airfield safety. Based on the modest level of activity at RUT in general, and as Runway 13-31 is a crosswind runway, the taxiway extension is a long-term or lower priority recommendation. As mentioned, an FAA Modification to Design standards would be required due to the location of the fuel farm within the future TOFA.
- ✈ ***P-VASI Relocation:*** It is recommended that the P-VASI be relocated to adhere to FAA Design Standards and upgraded to a PAPI in the short-term planning period. Additional information can be found within the P-VASI study located within **Appendix A**.
- ✈ ***West Hangar Development:*** It is recommended that hangars be constructed west of Taxiway 'F', east the existing box hangars. Additionally, there is space east of the existing hangars for an additional three small hangars.
- ✈ ***West Hangar Development:*** East Hangar Development – Concept 2 was selected as the recommended alternative as it offers the most versatile layout of the shared apron space with the fewest impacts.

To maximize flexibility of private development, VTrans should support both development sites in the short-term planning period.



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GRAPHIC SCALE (FEET)
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LEGEND

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- Future Runway Object Free Area/Safety Area
- Future Taxiway/Taxilane Object Free Area/Safety Area
- Utility Pole
- NAVAID Critical Area

Figure 4-6
Recommended Development Plan

Chapter 5

Financial Plan

5 Financial Plan

This chapter focuses on methods of financing the State of Vermont's share of the Rutland-Southern Vermont Regional Airport's (RUT) capital improvement program. The financial plan includes a forecast of revenues and expenses that can be used to determine how much airport-generated funding will be available to pay for the local share of Airport's capital development program over the planning period. This forecast assumes that the current rates and charges will keep pace with inflation and projects revenues and expenses into the future based upon a combination of short historical trends and Vermont Agency of Transportation (VTrans) policy objectives.

The Financial Plan produced two forecasts: revenues and expenses. The first involved a baseline projection showing the results of a status quo development process. Without the development of revenue producing facilities, this projection is assumed reasonable. The second projection involved all incremental revenues and expense features related to airport improvement projects and policies. This method of financial forecasting allows analyses of which projects have the greatest impacts on the Airport's bottom line.

This chapter is organized to include the following topics:

- Capital Development Projects
- Historical Revenues and Expenses
- Forecast of Operating Revenues & Expenses
- Forecast of Total Net Revenues
- Suggested Revenue Enhancements and Accounting Improvements
- Summary and Findings
- Appendix A – Hangar Development Options
- Appendix B – Lease Analysis

5.1 Airport Capital Improvement Plan

The Recommended Plan contains many capital projects that are designed to maintain and improve the Airport over the next 20 years. These projects and their costs are described in **Table 5-1** by year and phase. All costs are estimated in 2021 dollars. As shown, the total of all development is estimated to cost $27.9 million. This is an ambitious program which would require roughly $1.4 million annually from State and Federal sources. Not included in these requirements are any of the needed hangar development – all of which is assumed to come from private enterprise investment.

Table 5-1 – RUT Airport Capital Improvement Plan

Project	Estimated	Federal (90%)	VTrans (10%)
Short-Term (0 - 5 Years)			
Pavement Rehabilitation Design (Runway 1-19)	$489,000	$440,100	$48,900
Pavement Rehabilitation Construction (Runway 1-19)	$4,075,000	$3,667,500	$407,500
PAPI Relocation/Replacement (4-Box)	$200,000	$180,000	$20,000
AARF truck	$180,000	$162,000	$18,000
ARFF Suits	$20,000	$18,000	$2,000
SRE Extension/ARFF	$540,000	$486,000	$54,000
Pavement Rehabilitation Design (Main Apron)	$174,775	$157,298	$17,478
Pavement Rehabilitation Construction (Main Apron)	$1,747,754	$1,572,979	$174,775
Security Fence Relocation *(East of Service Road)* (1200 LF)	$218,780	$196,902	$21,878
Water Service Improvements	$250,000	$225,000	$25,000
Terminal Parking Lot Rehabilitation Design	$56,280	$50,652	$5,628
Terminal Parking Lot Rehabilitation Construction	$562,800	$506,520	$56,280
Easement Acquisition (38 Acres)	$500,000	$450,000	$50,000
Obstruction Removal*	$500,000*	$450,000*	$50,000*
Total	**$9,014,389**	**$8,112,950**	**$901,439**
Mid-Term (6 - 11 Years)			
Wildlife Management Plan	$150,000	$135,000	$15,000
Obstruction Beacon Replacement (Feasibility Study/Design/Construction)	$1,000,000	$900,000	$100,000
Environmental Assessment (Tree Removal)	$175,000	$157,500	$17,500
Pavement Rehabilitation Design (Runway 13-31, Taxiway H, Tree Clearing)	$228,000	$205,200	$22,800
Pavement Rehabilitation Construction (Runway 13-31, Taxiway H, Tree Clearing)	$2,280,000	$2,052,000	$228,000
West Side Hangar Development		**Privately Funded**	
Taxiway B Extension Design	$157,766	$141,989	$15,777
Taxiway B Extension Construction	$1,577,660	$1,419,894	$157,766
ARFF Suits	$20,000	$18,000	$2,000
Terminal Building Rehabilitation	$1,300,000	$1,170,000	$130,000
Total	**$6,888,426**	**$6,199,583**	**$688,843**

Source: CHA, VTrans, 2021

* Obstruction Removal Project was added after completion approval of financial plan and is not included in totals.

Table 4-1 – RUT Airport Capital Improvement Plan *(Continued)*

Long-Term (12 - 20 Years)			
Pavement Rehabilitation Design (Taxiway B, F, G, West Apron)	$250,041	$225,037	$25,004
Pavement Rehabilitation Construction (Taxiway B, F, G, West Apron)	$2,500,408	$2,250,367	$250,041
East Side Hangar Development	**Privately Funded**		
Airport Vehicle Access Road	$743,800	$669,420	$74,380
Pavement Rehabilitation Design (Taxiway A, J)	$2,979,000	$2,681,100	$297,900
Pavement Rehabilitation Construction (Taxiway A, J)	$1,989,760	$1,790,784	$198,976
ARFF Suits	$20,000	$18,000	$2,000
EMAS Replacement	$3,000,000	$2,700,000	$300,000
Pavement Rehabilitation Design (Taxiway D)	$53,300	$47,970	$5,330
Pavement Rehabilitation Construction (Taxiway D)	$533,000	$479,700	$53,300
Pavement Rehabilitation Design (Taxiway C)	$59,616	$53,654	$5,962
Pavement Rehabilitation Construction (Taxiway C)	$596,160	$536,544	$59,616
Total	**$12,475,044**	**$11,227,540**	**$1,247,504**
Grand Total	**$27,888,859**	**$25,099,973**	**$2,788,886**

Source: CHA, VTrans, 2021

Although the $1.3 million Terminal Building Rehabilitation is shown as being funded by an FAA grant, it should be noted that RUT is not a primary airport (enplaning more than 10,000 annually), and thus, does not receive the minimum $1 million annual entitlement funding. Even though RUT is a commercial service airport, it only receives its non-primary airport entitlement funding of $150,000 per year. The new FAA Reauthorization Act provides a minimum annual entitlement of $600,000 for each airport with annual passenger enplanements between 8,000 and 10,000. Thus, if the Airport exceeds 8,000 enplanements, funding for the terminal building with FAA grants will be more realistic. However, until that occurs, VTrans should plan on funding the rehabilitation with state funding, even though it is eligible for federal funding.

With this understanding of the capital financial need, the following sections of this Chapter present the methods used to develop estimates of future net revenues. Any positive net revenues can be applied to the local share capital development needs.

5.2 Historical Revenues & Expenses

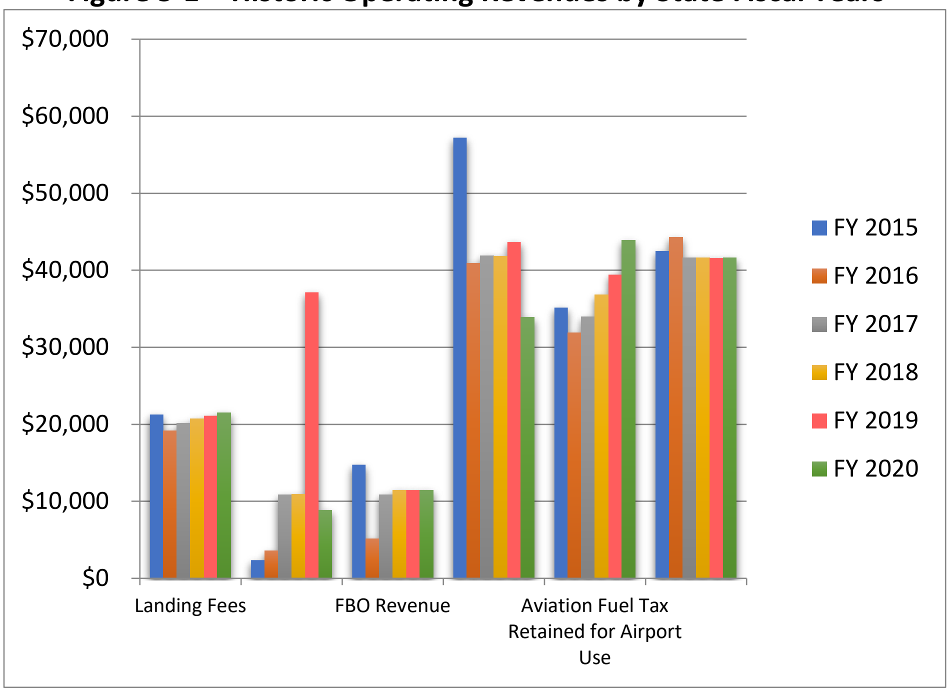
RUT is owned and operated by VTrans, using a shared airport manager overseeing operations at other state-owned airports. **Table 5-2** presents a summary of the revenues and expenses at RUT from 2015 through 2020. As shown, there has historically been an operating deficit at the Airport, ranging from a low of $146,700 (2015) to a high of $333,800 (2017) during the period.

5.2.1 Operating Revenues

Airport Operating Revenues are defined as those streams of revenues that are generated from the core business activities of the Airport. They do not include grants for capital development programs. Rather, they are the result of ongoing airport operations. At RUT, operating revenues are generated from the following activities:

- ***Landing Fees:*** As part of their operating agreement, Cape Air pays landing fees at RUT. Since 2015, these fees have been around $21,000.
- ***Terminal Fees:*** This account includes revenues from the lease of terminal space.
- ***FBO Revenue:*** Includes revenue from the FBO lease.
- ***Cargo and Hangar Rentals:*** Includes revenue from hangar rents and ground leases.
- ***Aviation Fuel Tax:*** Includes all revenue from the return of aviation fuel taxes to the Airport.
- ***TSA Reimbursement:*** Includes reimbursement for Law Enforcement Officers and other eligible charges to TSA.

Figure 5-1 - Historic Operating Revenues by State Fiscal Years



Note: Fiscal Years are for State of Vermont

Table 5-2 presents a summary of the yearly Operating Revenues from 2015 through 2020. As shown, Airport revenues have fluctuated between $145,000 and $194,500.

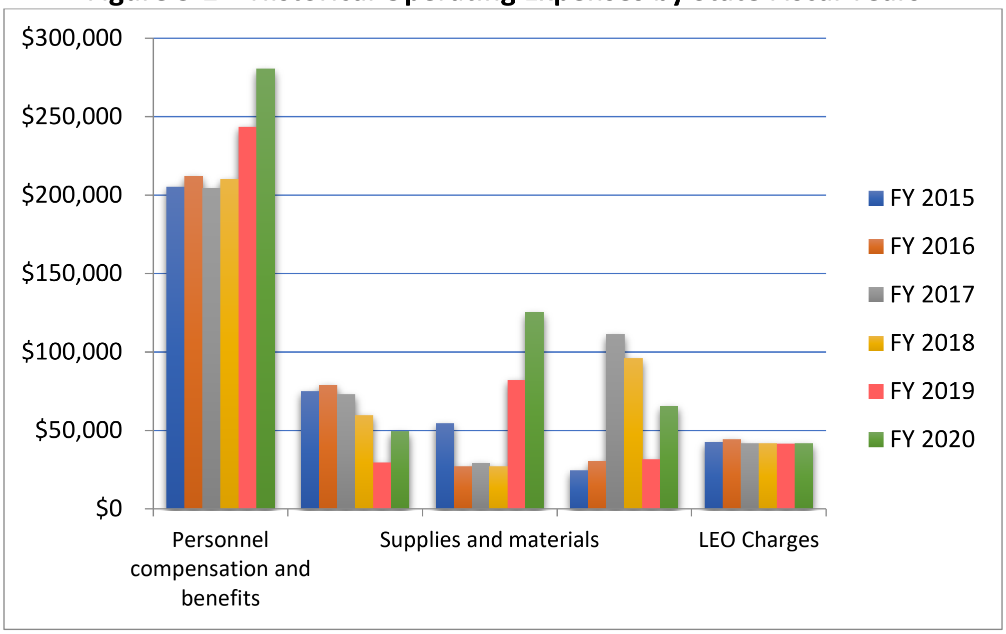
5.2.2 Operating Expenses

Like revenues, Operating Expenses are defined as those expenses generated by the core business activities of the Airport. They do not include capital expenditures. At RUT, Operating Expenses are generated by the following:

- ***Personnel Compensation & Benefits:*** Includes expenses related to the airport manager and staff for the overall management and upkeep of the Airport.
- ***Communications & Utilities:*** Expenses for this category include the cost electricity, heat, water, and sewer in addition to phones and internet connections.

- ***Supplies & Materials:*** This expense category includes the cost of supplies and materials that are routinely used for the operation and non-capital maintenance of the Airport. These can include office supplies, janitorial, and regularly used materials.
- ***Contractual Services:*** This expense item includes all services not provided by the State for the operation of the Airport. This does not include FBO services offered to the public.
- ***Law Enforcement Officer (LEO Charges):*** The LEO Charges expense covers the payments to local law enforcement for their assistance of TSA in the passenger screening process. This is a flow-through payment from the TSA reimbursement line item in Operating Revenues. Thus, it is revenue and expense neutral.

Figure 5-2 - Historical Operating Expenses by State Fiscal Years



Note: Fiscal Years are for State of Vermont

Table 5-2 presents a summary of the yearly Operating Expenses from 2015 through 2020. As shown, Airport expenses have fluctuated in a range between $348,300 and $561,800.

Table 5-2 – RUT Historical Operating Revenues & Expenses (2015 – 2020)

Operating Revenues	2015	2016	2017	2018	2019	2020
Landing Fees	$21,273	$19,182	$20,139	$20,748	$21,126	$21,504
Terminal Fees	$2,385	$3,560	$10,836	$10,900	$37,160	$8,845
FBO Revenue	$14,731	$5,131	$10,887	$11,463	$11,463	$11,463
Cargo and Hangar Rentals	$57,197	$40,942	$41,876	$41,829	$43,667	$33,872
Aviation Fuel Tax Retained for Airport Use	$35,135	$31,878	$33,955	$36,828	$39,448	$43,886
TSA Reimbursement	$42,485	$44,300	$41,600	$41,600	$41,600	$41,600
Total Operating Revenue	**$173,206**	**$144,993**	**$159,293**	**$163,368**	**$194,464**	**$161,170**
Operating Expenses	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Personnel compensation and benefits	$205,385	$212,074	$204,388	$210,168	$243,404	$280,435
Communications and utilities	$74,764	$78,916	$72,856	$59,599	$29,474	$49,094
Supplies and materials	$54,246	$26,888	$29,086	$27,076	$82,110	$125,114
Contractual services	$24,525	$30,450	$111,252	$95,917	$31,667	$65,545
LEO Charges	$42,485	$44,300	$41,600	$41,600	$41,600	$41,600
Total Operating Expenses	**$401,405**	**$392,628**	**$459,182**	**$392,760**	**$386,655**	**$561,788**
Operating Income (Loss)	($228,199)	($247,635)	($299,889)	($229,392)	($192,191)	($400,618)

Source: VTrans, 2021

5.2.3 Non-Operating Revenues & Expenses

Non-operating revenues and expenses are those revenues and costs that are not earned or incurred by the core operation of the enterprise. Non-operating revenues at RUT include grants and intergovernmental transfers (subsidies). Non-operating expenses include items such as depreciation, amortization, and debt service for capital improvements. For RUT, data was available only for non-operating revenues in the form of Airport Improvement Program (AIP) Federal grants. It was assumed that a 10 percent local match was provided by the State. Grant funding from 2015 through 2020 included the following (**Table 5-3**):

Table 5-3 – RUT Non-Operating Revenues (2015 – 2020)

Year	AIP Grant	VT Match	Total
2015	$150,000	$16,667	$166,667
2016	$3,989,242	$443,249	$4,432,491
2017	$2,490,778	$276,753	$2,767,531
2018	$545,165	$60,574	$605,739
2019	$0	$0	$0
2020	$28,560	$3,173	$31,733

Source: VTrans, 2021

5.3 Forecast of Operating Revenues & Expenses

The forecast of operating revenues and expenses presents a look at future revenues and expenses, influenced primarily by historical activity and revenue-producing capital investments. To determine the historical trend, the percent change from FY2015 to FY2019 was examined to calculate the average percent change in revenues and expenses. Thus, any major fluctuation during any one year did not unduly affect the overall trend.

Historically, the rate of inflation/CPI has been used to escalate prices when making forecasts of revenues and expenses. For this forecast, a rate of 3.0 percent was used to represent the effects of monetary inflation.

5.3.1 Operating Revenues Forecast Assumptions

It is assumed that airline use of the Airport will continue to be the primary source of income for the foreseeable future. This usage ties in landing fees, terminal fees, TSA reimbursement, and a portion of the aviation fuel taxes collected each year. Another item to note is that the FBO collects some revenues but this money is not passed on to VTrans. The following assumptions were used in developing the Baseline Revenue portion of the forecast:

- ***Landing Fees:*** Future growth in this category is limited by the fact that the Essential Air Service carrier is under subsidy and the lowest bidder wins the contract. It was assumed that these revenues would grow at half the rate of inflation.
- ***Terminal Fees:*** Similar to landing fees, this account is funded primarily by the airline serving the Airport. Therefore, growth was projected at half the rate of inflation.
- ***FBO Revenue:*** The FBO lease agreement specifies the annual rates charged to the FBO for hangar rents and other facilities. The lease specifies that the rates will be increased by the CPI at five-year intervals. Assuming a three percent rate of inflation, this amounts to an increase of 15.9 percent every five years.
- ***Cargo and Hangar Rentals:*** Future growth in this category was tied to the rate of inflation and the amount of new hangar space projected to be developed within the planning period. It should be noted that VTrans lease footprints use a 10-foot buffer around the building structure. No new hangar construction is assumed for the Baseline Forecast. **Table 5-4** shows the enhanced revenue potential from the proactive development of new hangar space.
- ***Aviation Fuel Tax:*** Future growth in this account was tied to the rate of inflation and the number of gallons projected to be sold annually.
  - Potential additional aviation fuel tax is that amount of tax generated by new based aircraft developed by private enterprise.
  - Potential Fuel Flowage Fee: This additional revenue is speculative but shows potential income generated from a $0.10 per gallon fuel flowage fee on the Airport.
- ***TSA Reimbursement:*** This account includes reimbursement for LEO charges to TSA. These revenues equal the expenses for LEO.

Table 5-4 – Potential Additional Private Hangar Development

West Side Full Build	Sq.Ft.	+10' Buffer	Land Envelope
120' by 120'	14,400	16,900	117%
60' by 80'	4,800	5,600	117%

60' by 80'	4,800	5,600	117%
60' by 60'	3,600	4,900	136%
40' by 50'	2,000	3,000	150%
40' by 50'	2,000	3,000	150%
TOTALS	31,600	39,000	123%
East Side Full Build	**Sq.Ft.**	**+10' Buffer**	**Land Envelope**
120' by 120'	14,400	16,900	117%
120' by 120'	14,400	16,900	117%
60' by 60'	3,600	4,900	136%
60' by 60'	3,600	4,900	136%
60' by 60'	3,600	4,900	136%
60' by 60'	3,600	4,900	136%
TOTALS	43,200	53,400	124%
Airport Totals	**74,800**	**92,400**	**124%**
Assume 50% Developed by 2040	**37,400**	**46,200**	**124%**

Source: R.A. Wiedemann & Associates, 2021

As shown in **Table 5-4**, potential ground leases for private hangar development could reach roughly 46,000 square feet by 2040 if proactive measures are taken. Revenues from these leases are shown in the forecast as potential additional lease revenue, relative to the baseline projection. In addition to these revenues, there are additional potential aviation fuel tax revenues that could accrue to the Airport as a result of the new aircraft basing in the proactive hangar development. In addition, a revenue item was added for a potential fuel flowage fee.

5.3.2 Operating Expenses Forecast Assumptions

The following assumptions were used in developing the Expense portion of the forecast:

- ***Personnel Compensation & Benefits:*** This category has been increasing at an average of than four percent per year since 2015. However, a recent agreement was reached with the unionized workers (Vermont State Employees' Association) to provide an increase of 2.25 percent for 2022.[14] For this reason, a similar rate increase was projected throughout the planning period.
- ***Communications and Utilities:*** This expense category has been decreasing in recent years. However, a continuation of that decrease cannot be expected in the future. For conservative purposes, forecasts used the latest year cost and increased that by the CPI rate.
- ***Supplies and Materials:*** This expense category fluctuated significantly from year to year through its history. As a result, there was no trend that could be detected. Therefore, the

[14] Source: "**Administration Freezes Pay for Some State Workers, Suspends Paid Leave Program",** Grace Elletson, May 2020. **https://vtdigger.org/2020/05/31/administration-freezes-pay-for-some-state-workers-suspends-paid-leave-program/**, accessed July 8, 2021.

forecast used an average of the history as a starting point, and then increasing at the CPI rate for the future.

- ***Contractual Services:*** Similar to Supplies and Materials, this expense item fluctuated from year to year through its history, with no clear trend. Therefore, the forecast used an average of the history as a starting point, and then increasing at the CPI rate for the future.
- ***LEO Charges:*** Forecasts for these charges were held constant since they are reimbursed by TSA. For revenue and expense forecasting, this category is a net-zero influence.

5.4 Forecasts Summary

Drawing on the above assumptions for both revenues and expenses, and taking a conservative approach to Airport financial performance, a Baseline Forecast was developed. The projection of revenues and expenses was forecast through FY 2040. As shown in **Table 5-5**, the historical years of 2019 and 2020 were included because of the anomalies caused by the 2020 pandemic. Operating revenues are anticipated to grow from $161,200 in 2020 to $246,800 by FY 2040, an overall increase of 53 percent for the period. Baseline operating expenses are expected to increase from $561,800 in FY 2020 to $781,800 in FY 2040, an overall growth of 39 percent.

Cumulative operating revenues show a 20-year cumulative total of $4.15 million, while Operating Expenses have a cumulative total of $12.60 million. The gap is $8.45 million, which must be made up with State funding.

Table 5-5 – Baseline Net Operating Revenue Forecast

Operating Revenues	2019	2020	2025	2030	2040
Landing Fees	$21,126	$21,504	$22,814	$24,929	$28,900
Terminal Fees	$37,160	$8,845	$13,844	$16,049	$21,568
FBO Revenue	$11,463	$11,463	$12,849	$14,896	$20,019
Cargo and Hangar Rentals	$43,667	$33,872	$48,622	$56,366	$75,751
Aviation Fuel Tax Retained for Airport Use	$39,448	$43,886	$46,559	$50,876	$58,979
TSA Reimbursement	$41,600	$41,600	$41,600	$41,600	$41,600
Total Operating Revenue	**$194,464**	**$161,170**	**$186,287**	**$204,716**	**$246,818**
Operating Expenses	**2019**	**2020**	**2025**	**2030**	**2040**
Personnel compensation and benefits	$243,404	$280,435	$306,501	$342,569	$427,938
Communications and utilities	$29,474	$49,094	$68,431	$79,330	$106,613
Supplies and materials	$82,110	$125,114	$64,604	$74,894	$100,651
Contractual services	$31,667	$65,545	$67,418	$78,156	$105,035
LEO Charges	$41,600	$41,600	$41,600	$41,600	$41,600
Total Operating Expenses	**$386,655**	**$561,788**	**$548,554**	**$616,549**	**$781,838**
Operating Income (Loss)	**($192,191)**	**($400,618)**	**($362,267)**	**($411,833)**	**($535,020)**

Source: R.A. Wiedemann & Associates, 2021

As revenue enhancements are included, a second forecast was created that shows additional potential hangar revenues, fuel taxes, and fuel flowage fees. For financial planning purposes, the incremental revenues gained from these new potential facilities and new potential fuel taxes and fees were identified separately from baseline revenues.

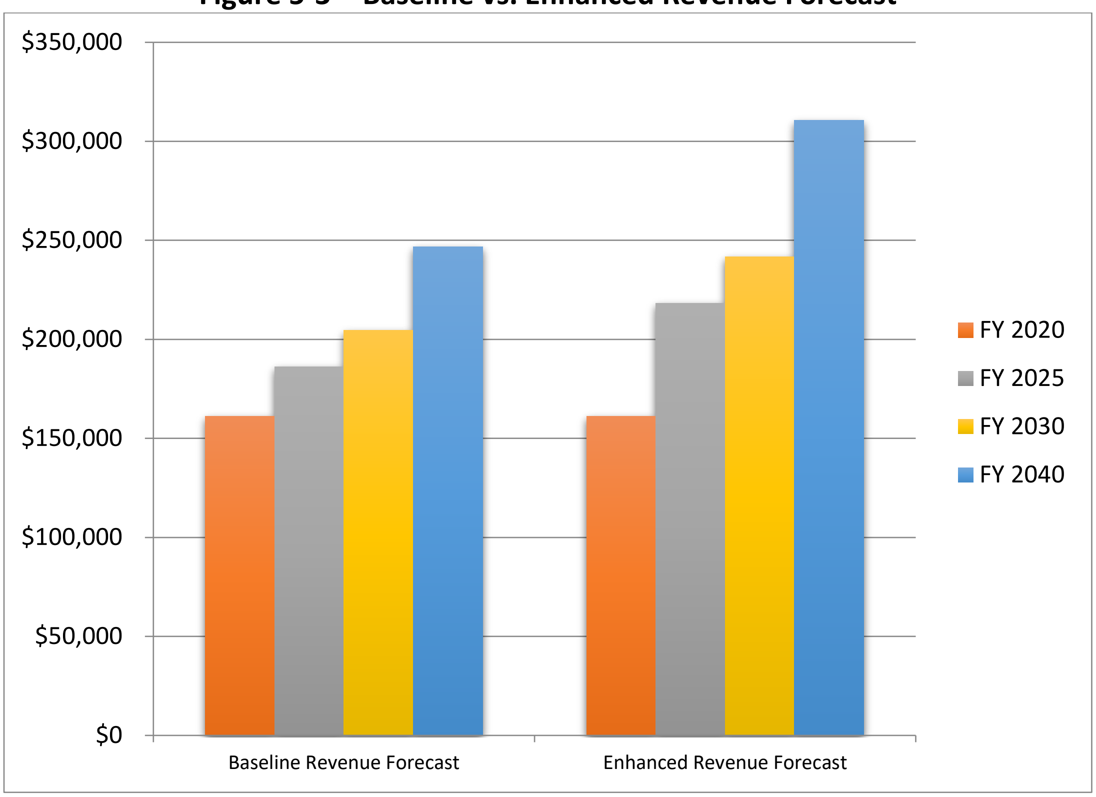
Table 5-6 presents the summary of operating revenues and expenses generated by the Airport with these revenue enhancements. As shown, enhanced revenues have the potential to reduce net operating deficits by almost $64,000 in 2040.

Table 5-6 – Enhanced Net Revenue Forecast

Operating Revenues	2019	2020	2025	2030	2040
Landing Fees	$21,126	$21,504	$22,814	$24,929	$28,900
Terminal Fees	$37,160	$8,845	$13,844	$16,049	$21,568
FBO Revenue	$11,463	$11,463	$12,849	$14,896	$20,019
Cargo and Hangar Rentals	$43,667	$33,872	$48,622	$56,366	$75,751
Potential Additional Hangar Revenue	***$0***	***$0***	***$6,824***	***$9,943***	***$22,531***
Aviation Fuel Tax Retained for Airport Use	$39,448	$43,886	$46,559	$50,876	$58,979
Potential Additional Fuel Tax	***$0***	***$0***	***$8,143***	***$9,680***	***$20,435***
Potential Fuel Flowage Fee	***$0***	***$0***	***$16,931***	***$17,431***	***$20,931***
TSA Reimbursement	$41,600	$41,600	$41,600	$41,600	$41,600
Total Operating Revenue	**$194,464**	**$161,170**	**$218,185**	**$241,769**	**$310,716**
Operating Expenses					
Personnel compensation and benefits	$243,404	$280,435	$306,501	$342,569	$427,938
Communications and utilities	$29,474	$49,094	$68,431	$79,330	$106,613
Supplies and materials	$82,110	$125,114	$64,604	$74,894	$100,651
Contractual services	$31,667	$65,545	$67,418	$78,156	$105,035
LEO Charges	$41,600	$41,600	$41,600	$41,600	$41,600
Total Operating Expenses	**$386,655**	**$561,788**	**$548,554**	**$616,549**	**$781,838**
Operating Income (Loss)	($192,191)	($400,618)	($330,369)	($374,780)	($471,122)

Source: R.A. Wiedemann & Associates, 2021

Figure 5-3 - Baseline vs. Enhanced Revenue Forecast



On a cumulative basis, the enhanced net operating revenues increase by $750,000 over the Baseline forecasts within the 20-year planning period. This would reduce the overall cumulative net operating deficit to $7.70 million for the enhanced scenario.

5.5 Forecasts of Total Net Revenues

A forecast of Total Net Revenues can be generated by combining the estimated ACIP funding needs with the net operating revenues for each forecast year. Funding needs for the local share of CIP items have been adjusted for inflation, which is already included in the Net Operating Revenue stream.

It should be noted that even if RUT exceeds the 8,000-enplanement threshold, which would entitle the Airport to $600,000 in capital spending each year, this infusion of funding does not impact the State/Local share funding requirement of VTrans. **Table 5-7** presents the results of the Baseline Revenue Forecast. There is an $11.82 million shortfall in funding over the 20-year period.

Table 5-7 – Total Net Revenues: Baseline Scenario

Year	Revenues	Expenses	State Share CIP	Total Net Revenues
2021	$173,953	$500,100	$196,997	($523,144)
2022	$177,580	$511,752	$196,997	($531,169)
2023	$180,681	$523,706	$196,997	($540,023)
2024	$184,467	$535,971	$196,997	($548,500)
2025	$186,287	$548,554	$196,997	($559,264)
2026	$190,242	$561,464	$174,510	($545,732)
2027	$192,172	$574,709	$174,510	($557,047)
2028	$198,351	$588,299	$174,510	($564,458)
2029	$200,398	$602,242	$174,510	($576,354)
2030	$204,716	$616,549	$174,510	($586,344)
2031	$206,888	$631,228	$198,252	($622,592)
2032	$211,400	$646,290	$198,252	($633,142)
2033	$216,077	$661,744	$198,252	($643,919)
2034	$220,794	$677,602	$198,252	($655,060)
2035	$223,239	$693,874	$198,252	($668,887)
2036	$228,170	$710,570	$198,252	($680,652)
2037	$230,764	$727,703	$198,252	($695,191)
2038	$238,672	$745,284	$198,252	($704,864)
2039	$241,424	$763,325	$198,252	($720,153)
2040	$246,818	$781,838	$198,252	($523,144)

Source: R.A. Wiedemann & Associates, 2021

Given a cumulative benefit of $750,000 for the enhanced revenue scenario (described earlier), implementation of those recommendations could reduce the overall shortfall to $11.54 million over the 20-year planning period.

5.5.1 Suggested Revenue Enhancements & Accounting Improvements

In performing the financial analysis, several potential revenue enhancement and accounting improvements were identified that could possibly be improved. These included the following:

- ***Reversion Clauses:*** A reversion clause in a lease agreement transfers the title of the property to the lessor upon expiration of the lease. At airports, reversion clauses are common, and the length of term of the lease is usually tied to the amount of investment in capital improvements. Generally speaking, larger investments have longer lease terms to provide the investor time to realize full use of the facility. It is recommended that 40 years be the longest lease period (which would include all renewals). Appendix B includes an example of lease language for reversion clauses.
- ***Transportation Security Administration (TSA) Rents:*** The TSA currently pays electric usage for screening space at RUT at the rate of $1,064.52 per year, reimbursed to the State. At most commercial service, it would be customary to charge TSA for any additional space needed (e.g., offices, storage, etc.) apart from their screening facilities.
- ***Fuel Flowage Fee:*** Currently, VTrans does not charge fuel flowage fees at RUT. The jet fuel flowage fee is set at $0.00 per gallon in the FBO agreement. It is customary in the aviation industry to charge fuel flowage fees to all users of fuel on the airport, both the FBO and self-fuelers. For smaller airports, these fees usually range between $0.05 and $0.15 per gallon. Therefore, it is suggested that a fuel flowage fee be instituted at RUT as soon as practical. This may require the expiration of the current FBO lease where language specifically setting the price is mentioned. If the fuel flowage fee is removed from the leases, it can be set airport-wide via ordinance or in some cases, through the airport rules and regulations.
- ***Airport Revenues and Expenses:*** It may be beneficial to formally record and report RUT revenues and expenses each year, so that the amount of operational subsidy can be determined from the state program. In addition, any progress in reducing deficits would be readily identifiable.
- ***Hangar Development:*** VTrans should continue to seek private investors for aircraft hangar development at the Airport. VTrans is developing a program which helps to fast-track the permitting process at VT airports. Any movement toward making the hangar development process painless for investors will help the Airport's revenue base from increased ground leases, fuel sales, and other miscellaneous revenues.

5.6 Summary & Findings

It can be concluded that unless new leases are negotiated with the FBO, the potential revenue for RUT will be limited over the next 20 years. In addition, the standard practice of VTrans is to allow private enterprise to construct hangars at RUT. Appendix A shows the potential benefits from State-funded hangar development. Should that not occur, the forecasts of revenues and expenses will likely follow the path outlined in this chapter.

Under the Baseline Forecast scenario, the State would need to fund a shortfall of almost $12 million over the 20-year period. This amount includes the CIP totals of $3.37 million (using inflated dollars). Should revenue enhancements be adopted, such as the encouragement of new hangar development by private enterprise (over and above projected facility needs), there will be an increase in potential revenues from ground leases and additional fuel taxes returned to the Airport. If a fuel flowage fee is instituted, it will further offset annual Operating Expenses.

As mentioned, even if RUT exceeds the 8,000-enplanement threshold, which would entitle the Airport to $600,000 in capital spending each year, this infusion of funding does not impact the local share funding requirement of VTrans. Thus, there is likely to be an overall annual deficit for the foreseeable future. As long as VTrans is willing to fund the annual deficit at RUT, including the CIP, the master plan recommendation can be considered feasible.

Appendix A

P-VASI Siting Memo

Appendix A - *P-VASI Siting Memo*

Runway 1 at the Rutland - Southern Vermont Regional Airport (RUT) is equipped with a pulsating Visual Approach Slope Indicator (P-VASI) located on the right side of the runway. Unlike most VASIs, the Runway 1 system provides pulsating light indications to pilots on the runway approach as opposed to a constant light signal common to most visual guidance lighting systems. The Runway 1 P-VASI system, however, has been temporarily disabled due to a non-standard threshold crossing height (TCH) and high terrain within the runway's approach corridor.

The following discusses visual guidance lighting systems siting criteria along with a brief examination of potential mitigative concepts to restore operation of the P-VASI system at RUT.

Siting Criteria

Federal Aviation Administration (FAA) Order JO 6850.2B provides siting criteria for the installation of visual guidance lighting systems at airports. It is important to note that the FAA does not provide specific guidance related to P-VASI systems. Therefore, siting criteria related to the installation of Precision Approach Path Indicator (PAPI) systems is used.

FAA Order JO 6850.2B identifies two primary elements when siting visual guidance lighting systems:

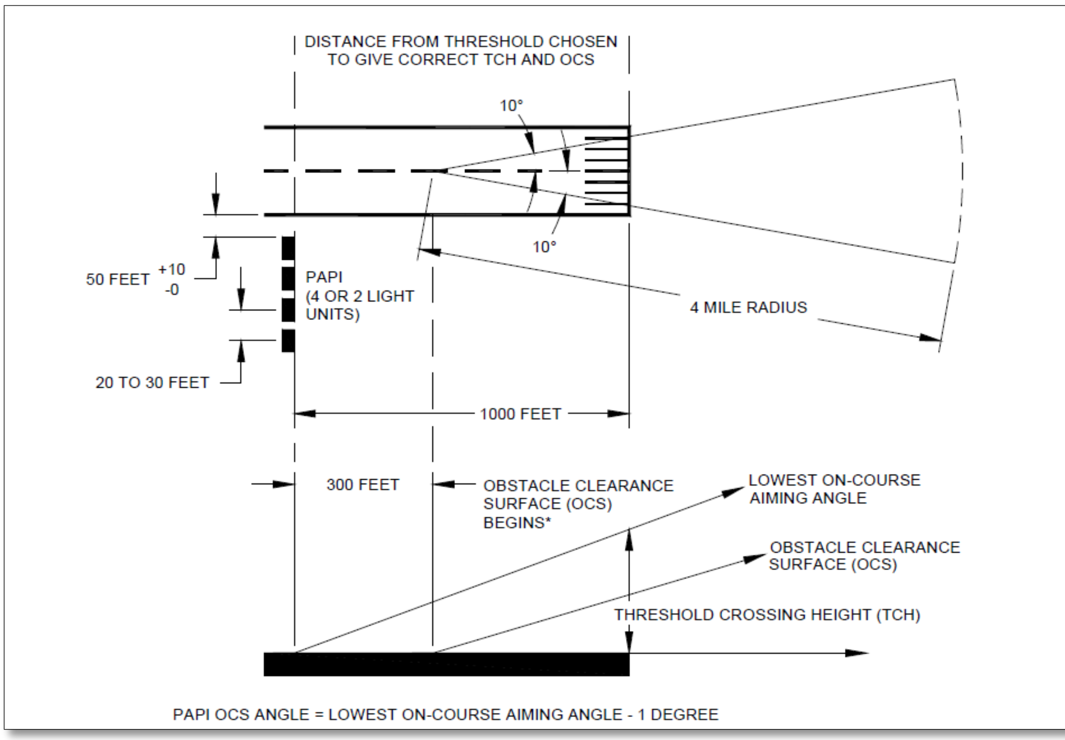
Threshold Crossing Height

The TCH is the height of the lowest on-course signal at a point directly above the intersection of the runway centerline and the runway threshold. The TCH is based upon the height group of the aircraft using the runway. Based on the FAA criteria shown below, Height Group 1 is used for Runway 1 with a resulting TCH of 40 feet with an allowable range of 20 to 45 feet. For this review, the maximum 45-foot TCH was assumed.

Representative Aircraft Type	Approximate Cockpit-To-Wheel Height	Visual Threshold Crossing Height	Remarks
Height group 1 General aviation Small commuters Corporate turbojets	 10 feet or less	40 feet +5, -20 12 meters +2, -6	Many runways less than 6,000 feet long with reduced widths and/or restricted weight bearing, which would normally prohibit landings by larger aircraft.

<u>Obstacle Clearance Surface</u>

The Obstacle Clearance Surface (OCS) is a surface that must remain clear of all obstructions (i.e., trees, powerlines, light poles, etc.). The surface begins 300 feet in front of the visual guidance lighting system and extends outward and upward at a slope one degree less than the aiming angle/glidepath for four statute miles. The aiming angle is typically set at a 3-degree glidepath; however, it can be set as high as 4 degrees for non-jet runways in order to provide obstruction clearance (the current angle is set at 3.5 degrees). The lateral extents of the OCS flare 10 degrees outward from both sides of the glidepath centerline but may be reduced to six degrees if required for obstruction clearance. The figure below depicts the OCS as detailed within FAA Order JO 6850.2B.



Proposed P-VASI Location

The current location of the existing Runway 1 P-VASI results in a TCH below the minimum of 20 feet, but more importantly contains terrain penetrations (i.e., Bear Mountain) to the OCS. Therefore, to determine a location that provides a standard TCH and clear OCS, the following considerations were made:

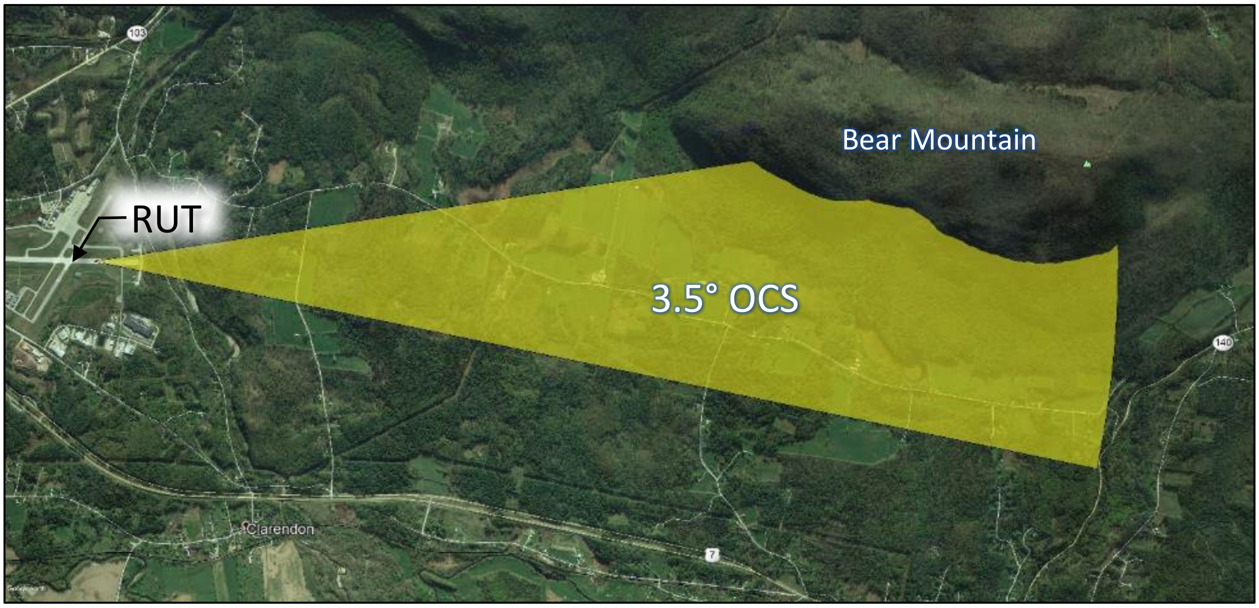
1. The TCH is corrected to a maximum of 45 feet, and then refined by two feet to account for a down sloping runway for an updated TCH of 43 feet
2. Review of various glide path angles, such as 4 degrees (or 14.3 feet to 1-foot slope)
3. Revised the location of the P-VASI unit

    (e.g., 43 feet x 14.3 feet = 615 feet from the runway end)

Based on the above considerations, the following examines various options.

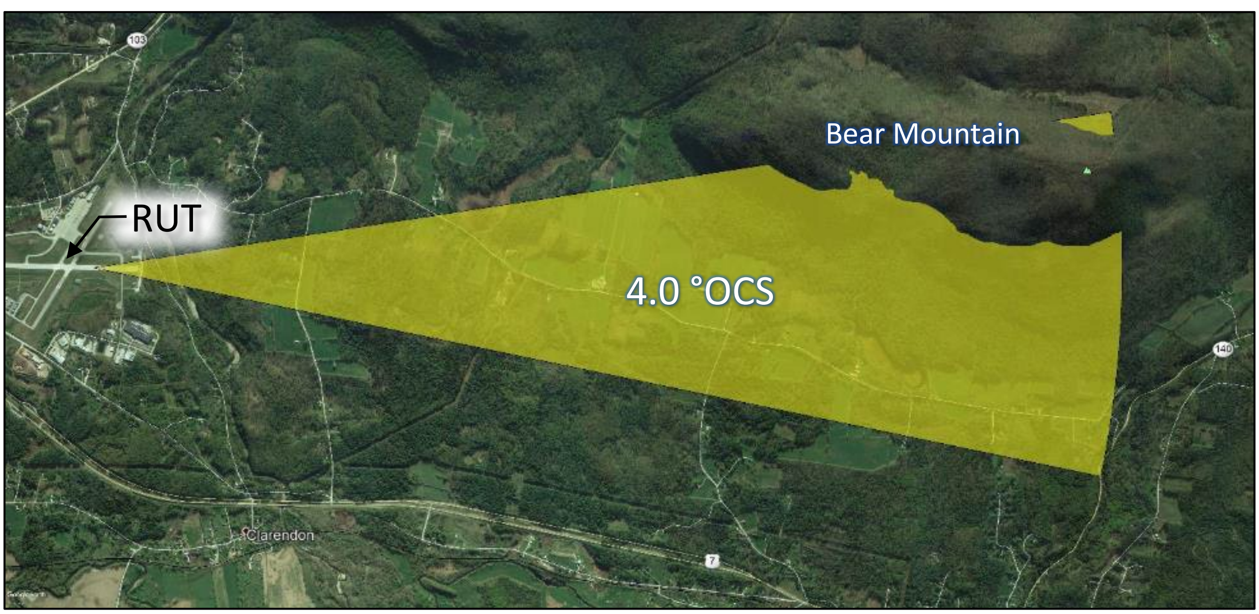
Option 1: Runway Heading at 3.5° Aiming Angle

This option is similar to the existing P-VASI configuration and retains the current 3.5-degree glidepath aiming angle. However, this option shifts the unit to approximately 915 feet north of the Runway 1 end (615 feet + 300 feet), per the previously described siting criteria. Using these parameters, a portion of Bear Mountain remains within the OCS. Therefore, Option 1 is non-standard, and may not be considered feasible by the FAA.

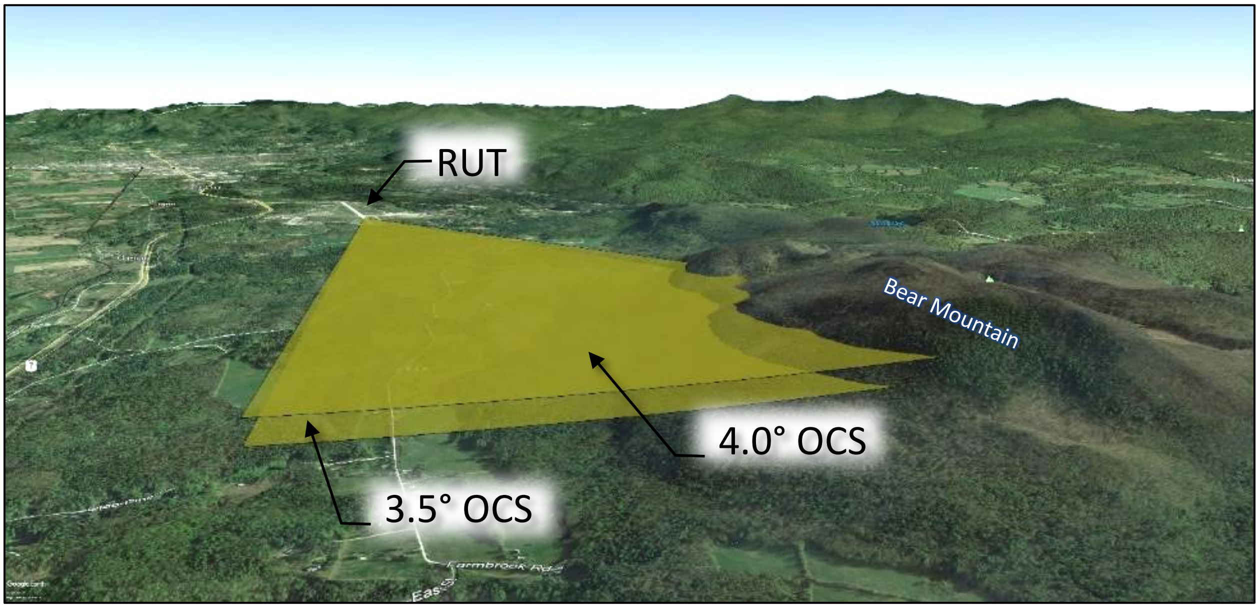


Option 2: Runway Heading at 4.0° Aiming Angle

Option 2 also shifts the unit northward. This option, however, increases the glidepath aiming angle from 3.5 degrees to the maximum allowable aiming angle of 4.0 degrees. As shown, Bear Mountain remains within the OCS despite the increased aiming angle.

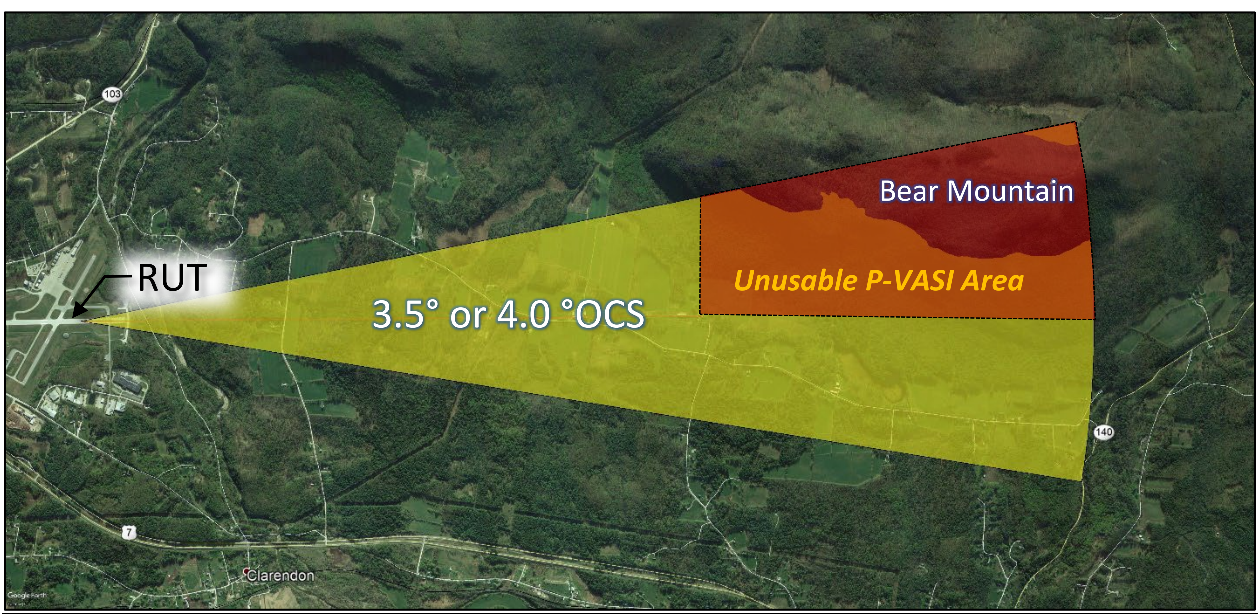


The figure below depicts the location and glidepath aiming angles of Option 1 and Option 2. Despite the increased height provided by the additional half degree of glidepath, Bear Mountain remains an obstacle to both surfaces. Therefore, Option 2 may not be feasible. Furthermore, the Runway 1-19 critical aircraft is a corporate jet and is, therefore, considered a 'jet runway' with a resulting slope of 3.0 degrees per FAA guidance.



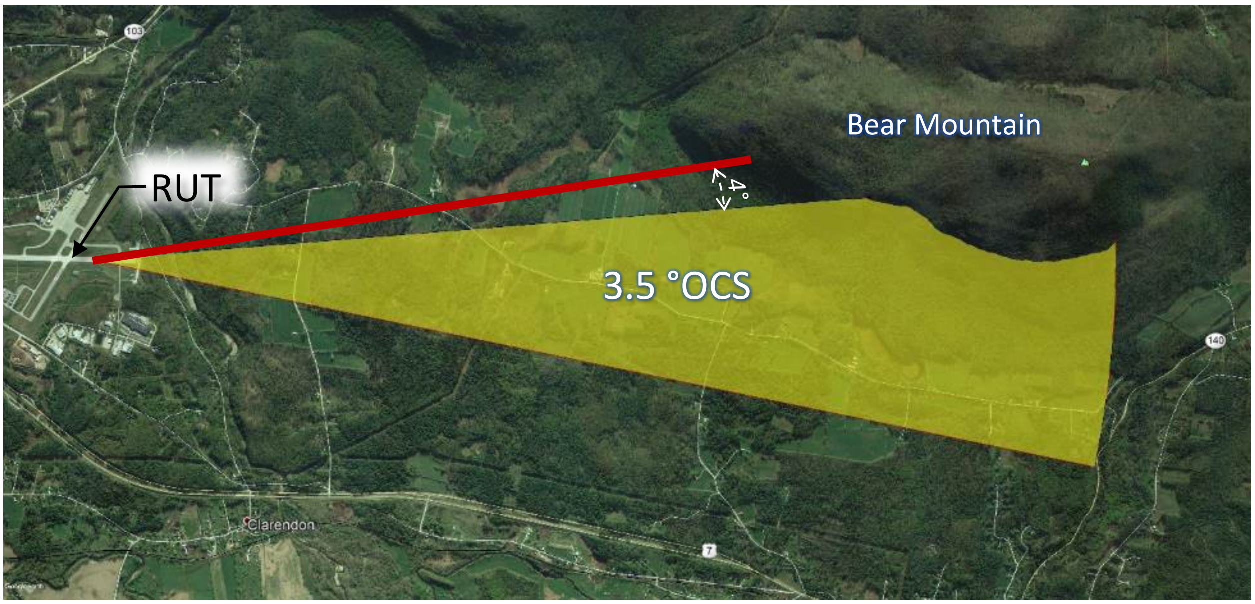
Option 3: Runway Heading at 3.5° Aiming Angle & Airport Master Record Remark

Option 3 examines the same glidepath aiming angles as within Option 1 and 2 but issues a remark within the Airport's Airport Master Record and FAA Chart Supplement stating that the P-VASI is unusable beyond 2.5 statute miles right of the Runway 1 centerline. The figure below depicts the unusable area. A similar note was issued for the existing P-VASI system prior to disabling the unit. As the additional glidepath aiming angles do not provide a clear OCS, this concept may not be feasible.



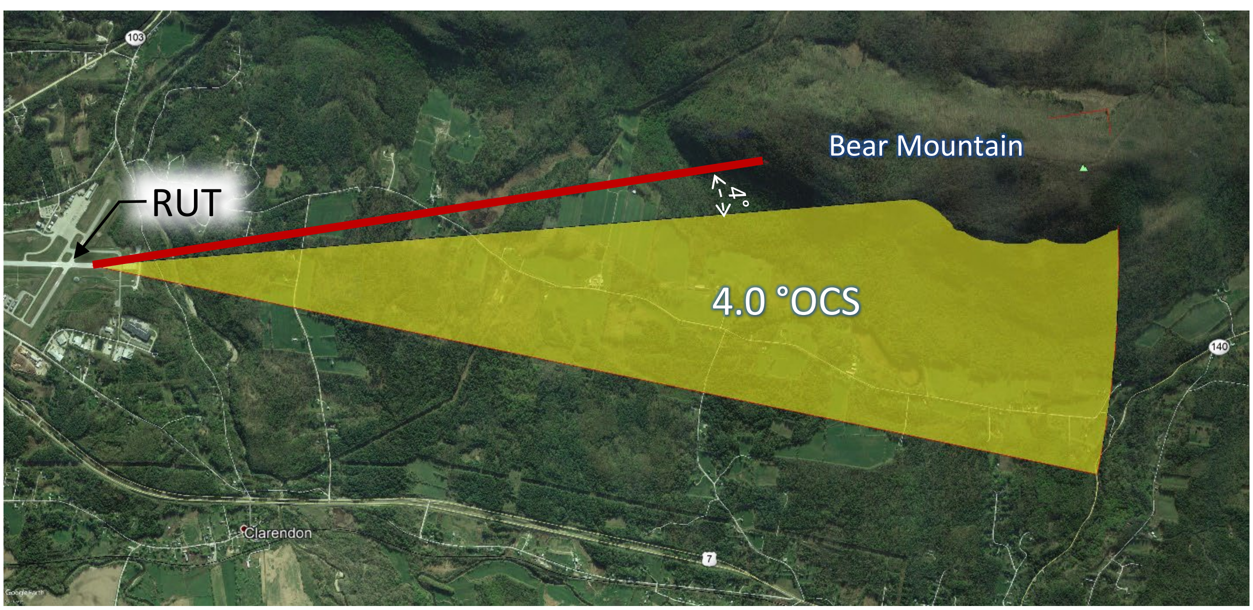
Option 4: Runway Heading at 3.5° Aiming Angle & Reduced (6°) Offset

As previously mentioned, FAA Order JO 6850.2B allows for the narrowing of the OCS from 10-degree centerline offset to six degrees when required for obstacle clearance, with publication of a Notice to Airmen (NOTAM). This option uses the existing 3.5-degree glidepath aiming angle but reduces the eastern flare of the OCS to six degrees from the runway centerline. The figure below depicts the OCS with the reduced flare along the east side of the standard 10-degree flare. As shown, the reduced OCS flare does not provide sufficient obstacle clearance.

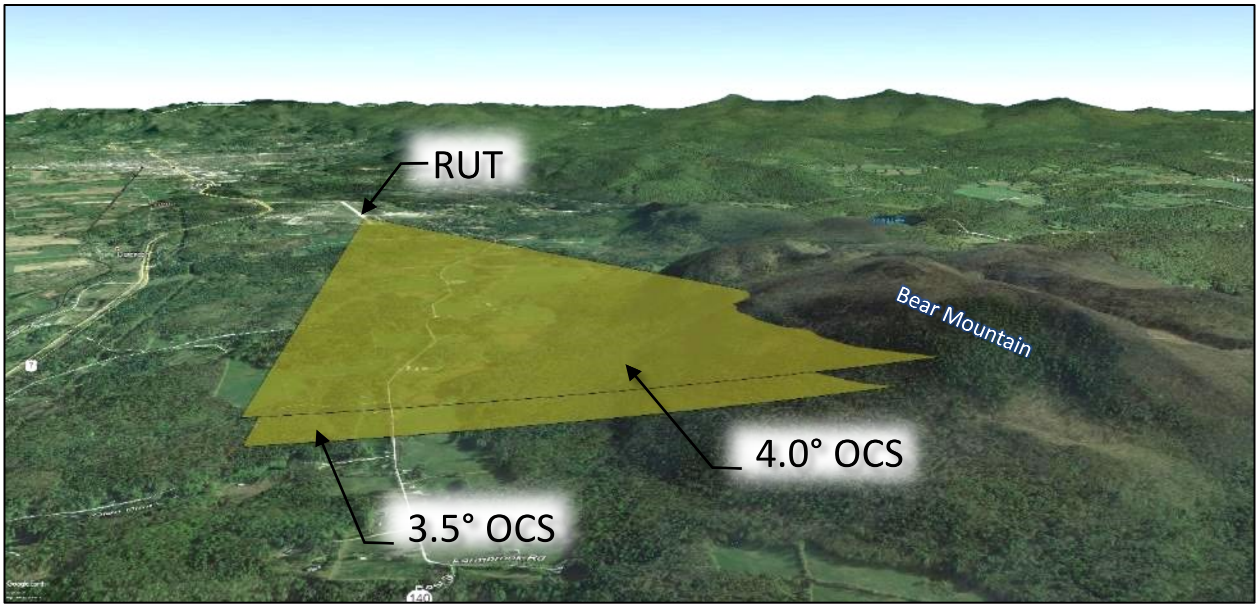


Option 5: Runway Heading at 4.0° Aiming Angle & Reduced (6°) Offset

Similar to Option 4, Option 5 narrows the east flare of the OCS to 6 degrees offset from the centerline but increases the aiming angle to four degrees.

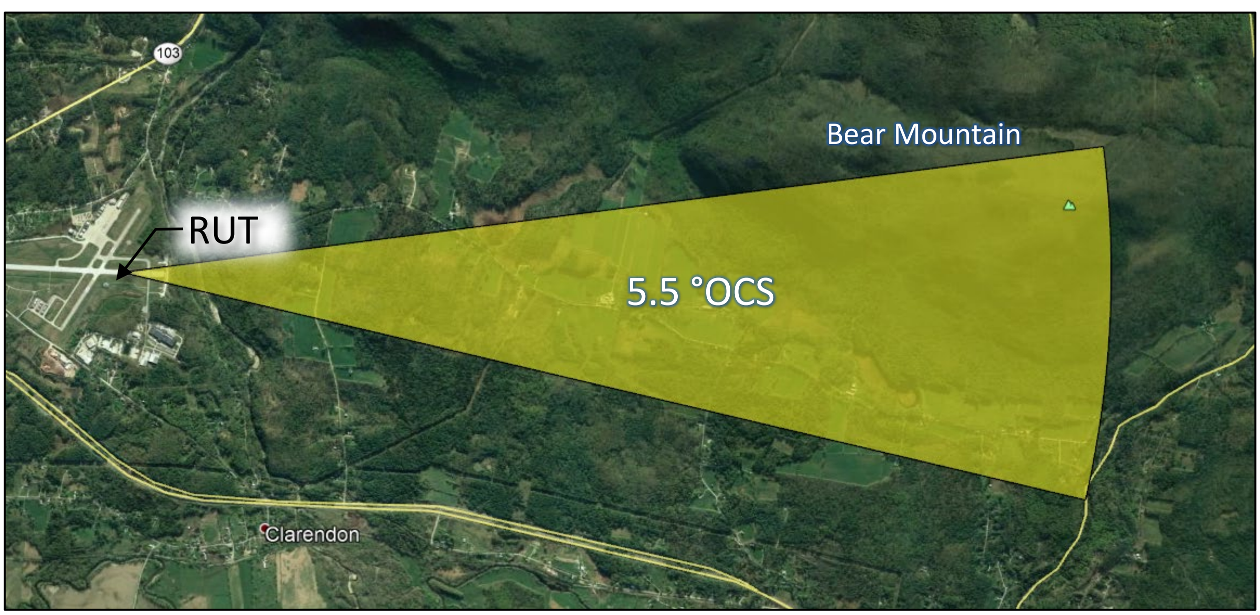


The figure below depicts the location and glidepaths of Option 4 and Option 5. Despite the reduced flare and increased height provided by the addition half degree of glidepath, Bear Mountain remains an obstacle to both surfaces. Therefore, Option 4 and Option 5 may not be feasible.



Option 6: Runway Heading at 5.5° Aiming Angle

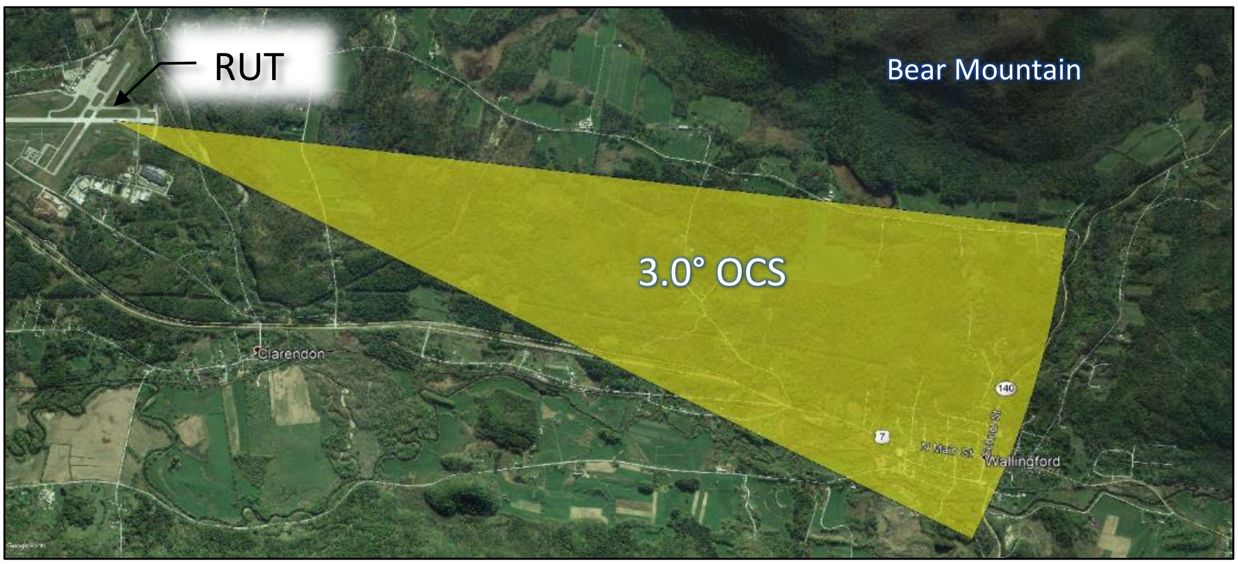
This option aims to completely clear Bear Mountain, which requires a glidepath aiming angle of 5.5 degrees. This would exceed both allowable glidepath aiming angles for jet runways and per FAA standards. As jet aircraft generally fly a 3.0-degree slope, this slope may be well beyond the capability of the critical aircraft. While the preliminary analysis depicted in the figure below shows that a 5.5-degree glidepath aiming angle does not contain OCS terrain penetrations, it is



likely that close-in and Bear Mountain tree obstructions would still exist. If the FAA considers this option potentially viable, additional review of the close-in penetrations would be needed.

Option 7: Offset Heading at 3.0°, 3.5°, 4.0° Aiming Angle

Option 7 uses the glidepath heading coincident with the Runway 1 RNAV (GPS) instrument approach procedure. To avoid obstacles, the Runway 1 RNAV approach procedure is offset with a final approach heading of 029 degrees. This option examined 3.0-, 3.5- and 4.0-degree aiming angles, all of which provide a clear OCS. Although preliminary analysis did not indicate terrain penetrations, it is important to note that regardless of the OCS aiming angle there will be close-in tree penetrations which would require mitigation should this option be pursued. Additionally, as an offset alignment would be non-standard, FAA coordination and approval would be required.



Summary

The following provides a summary of each option.

Option	Description	Clear OCS	FAA Standard
1	Runway Heading at 3.5° Aiming Angle	No	Yes
2	Runway Heading at 4.0° Aiming Angle	No	Yes*
3	Runway Heading at 3.5° Aiming Angle & Airport Master Record Remark	No	Yes
4	***Runway Heading at 3.5° Aiming Angle & Reduced (6°) Offset***	***No***	***Yes***
5	Runway Heading at 4.0° Aiming Angle & Reduced (6°) Offset	No	Yes*
6	Runway Heading at 5.5° Aiming Angle	Yes	No*
7	Option 7: Offset Heading at 3.0°, 3.5°, 4.0° Aiming Angle	Yes	No

*Runway 1-19 is considered a 'jet-runway' and would not likely support an aiming angle greater than 3.5°

**Recommended Option

Source: CHA, 2021

Recommendation

As discussed, none of the discussed options provide a clear OCS while maintaining standard PAPI siting criteria. While minimizing terrain and obstructions to the OCS is preferred, it is also important to consider the type of aircraft utilizing Runway 1/19. As the runway is considered a jet runway, increasing the aiming angle greater than 3.5° may be not feasible for RUT's most demanding aircraft.

As such, it is recommended that ***Option 4 (Runway Heading at 3.5° Aiming Angle & Reduced (6°) Offset)*** be pursued. As Bear Mountain continues to penetrate the OCS, it is also recommended that the existing obstruction lighting located on the mountain be repaired or new obstruction lights be installed to mitigate the portions of terrain that penetrates the proposed OCS.

Appendix B

Hangar Development Options

Appendix B - *Hangar Development Options*

Several options exist for the development of new hangar space. While the **Chapter 2, *Facility Requirements*** portion of the Master Plan did not forecast a need for more hangar space, the changing fleet mix (decline in single-engine aircraft and growth of business jet activity) indicates some potential to build-out landside areas for additional hangar space. The changing fleet mix of based aircraft includes two new business jets over the planning period. Those aircraft will require new conventional hangar space. Confirmation of this demand would be required in the form of waiting lists and pre-construction deposits for new hangar space. It is anticipated that new hangar development could proactively attract new based aircraft from the region.

The primary methods for hangar development at most airports include the following:

- Public (City/State) Development of New Hangars
- Ground Lease with Private Hangar Developer
- Combination of Public and Private Hangar Development

Public Development of New Hangars

Table B-1 indicates the approximate cost of developing a 10,000 square foot conventional hangar at the Airport. No T-Hangars were included because of the lack of future demand for those smaller aircraft. As shown, the conventional hangar would have to rent for roughly $12.00 per square foot per year. This assumes a financing package of 20 years at 5 percent interest. Currently, rents for conventional hangar space vary on the Airport, ranging from $9.00 per square foot to $12.00 per square foot. This means development of hangars on the Airport could be competitive to finance through borrowing.

Table B-1 - City Hangar Development Model – 20 Year

Hangar Type	Construction Cost	Annual Debt Service	Debt Coverage
10,000 sf Conv. Hangar	$1,500,000	$118,800	$11.88/sf/yr.

Source: R.A. Wiedemann & Associates, 2021

The primary consideration is whether the State has capital to invest in hangars, and whether the State wants to wait 20 years to get its money back.

Private Development of New Hangars

If the City/State does not desire to develop new hangars or cannot identify the needed capital for development, private development of all new hangars may be necessary. This type of development occurs at many general aviation airports, partially due to the ability of private developers build at lower costs than government contracting. Without the requirements of prevailing wage laws, use of pre-engineered buildings, etc., private development costs are estimated at 2/3 that of government development costs for the same project. Reversion clauses are recommended in land leases so that improvements on the property revert to the Airport Sponsor upon expiration of the lease. Once a hangar reverts to the Sponsor ownership, it is incumbent on the Sponsor to seek rental rates as close to market value as can be negotiated. It is understood that this may be difficult with tenants who have constructed their hangars and now must pay more for them after many years of leases. However, the value of the hangar or other property is that it adjoins the Airport runway system. Thus, its location is functional to its value. Likewise, extending the lease should have some value above prevailing ground lease rates. **Table B-2** presents the pro forma for private development of new hangars at RUT.

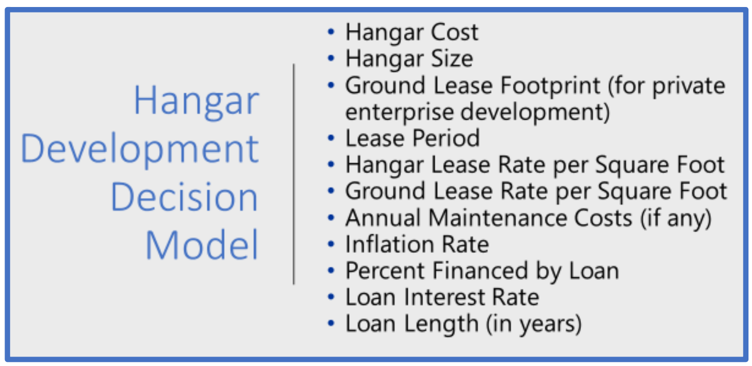
Table B-2 - Private Development of Hangars: 20 Year Proforma

Item	Conventional Hangar
Hangar Square Feet	10,000 s.f.
Cost of Hangar (2/3 cost of State)	$800,000
Term	20 years
Cumulative Ground Lease @ $0.27/s.f. with 3% annual escalation times 121% of hangar envelope (10' buffer)	$85,300
Private Developer Profit Margin @ 15%	$132,800
Total Cost (hangar + ground lease)	$1,018,100
Private Developer Breakeven	$10.18/SF/year

Source: R.A. Wiedemann & Associates, 2021

This proforma assumes that the lease footprint will include a 10-foot buffer around the hangar structure. In addition, the proforma does not include operating costs and overhead for the private hangar developer. Thus, our analysis shows the lowest breakeven potential prices for a private developer of roughly $10+ per square foot per year for conventional hangar space. This compares to the public development breakeven proforma pricing of $9-$12 per square foot per year for conventional hangar space.

Figure B-1 – Inputs to Hangar Decision Model



Combination of Public and Private Hangar Development

The development of hangars at RUT may be a combination of public and private development because there is generally a shortage of capital at both the State and at municipalities. With all the public projects needing investment such as roads, sewers, schools, and so forth, it is difficult to find capital that has not already been reserved for a project.

Given the cost of hangar development, combined with the market rate structure, conventional hangar development is feasible for the State. The only question would involve vacancy rates. However, using waiting lists and customer deposits for reserved space, this risk can be minimized.

Appendix C

Lease Analysis

Appendix C - *Lease Analysis*

This analysis is based on a lease provided by management for an on-airport Fixed Base Operator (FBO). A checklist was utilized to evaluate whether the lease includes provisions for the specific range of issues relevant to typical FBO leases. This checklist does not evaluate the specific conditions of each lease section, but only verifies that it has been used in the lease.

Columbia Air Services

Lease Agreement Checklist					
Lease Type: Ground Lease Business Type: Fixed Base Operator (FBO) Lease Length: 32 Pages Premises: Airport Property					
Included Lease Elements					
Lease Term	√	Lease Rent	√	Escalation Clause	√
Use of Premises	√	Taxes and Fees	√	Damage to Facilities	√
Operation & Maintenance	√	Liens	√	Insurance Obligations	√
Construction of Improvements	√	Defaults	√	Environmental	√
Reversion Clause	X	Assignments and Subletting	√	Living Clauses	√
Lessor Rights, Reservations, and Obligations	√	Regulatory Compliance	√	Force Majeure	X
Lessee Rights, Reservations, and Obligations	√	Hold Harmless Provision	√	Holdover	√
Security Requirements	X	Nondiscrimination	√	Term Extension Options	√
Checklist Score: 21/24					

As shown, the FBO lease at RUT covers a variety of leasehold scenarios and addresses many standard lease-related issues. The issues identified in red were found to be either deficient or left unaddressed in the lease.

Columbia Air Services

Moving forward, there are a number of issues within the FBO lease that should be addressed. Such changes should be left up to the discretion of the Airport sponsor, keeping in mind that no lease can give a single tenant an advantage over its on-airport competition, and that exclusive rights are a violation of federal grant assurances. Some of these issues cannot be corrected until the current lease expires. Others may be subject to correction strategies and incentives offered by the Airport in the near term. The following areas of the analyzed lease should be added/corrected:

- ***Security Requirements:*** As a Part 139 airport with controlled access, at a minimum, the lease should reference the FBO's compliance with controlled entry policies at the Airport. This would involve all operations areas on the leased premises in order to prevent unauthorized access of persons and vehicles. All security measures must comply with regulations stipulated by the TSA and Homeland Security.
- ***Force Majeure:*** This clause frees both the Airport and tenant from liability or obligation when an extraordinary event or circumstance beyond the control of the parties, such as a strike, riot, crime, or an act of God.
- ***Hangar Reversion Clause:*** Many lease documents for long-term ground leases at airports contain a provision known as a Reversion Clause. FAA Order 5190.6a requires airports to make all facilities and services available on a fair and reasonable term without unjust discrimination. A perpetual lease would violate this condition. Generally, the ownership of improvements made by the tenant will revert to the airport sponsor at the end of the lease period, which can vary from 20 to 40 years, depending upon the number of renewal periods granted. Lease terms typically depend upon on some or all of the following:
    - The amount of tenant investment
    - The useful life assessment of the building involved
    - The length of time required by the investor to recoup his/her capital investment

A long-term lease lets the tenant get financing to build the improvement and gives them adequate time to receive a return on their investment. At the conclusion of the initial lease term, the airport sponsor can assess the improved value of the property and structures and exercise the right to lease both the land and improvements at their prevailing market rent, assuming that a reversion clause is included in the ground lease and they choose not to extend the lease.

A sample reversion clause for use in ground leases at Rutland – Southern Vermont Regional Airport follows:

- ***Ownership of Improvements:*** All buildings and improvements constructed upon the premises by Lessee shall remain the property of Lessee unless said property becomes the property of Lessor under the following conditions, terms, and provisions:
    - *Removal of Buildings:* No building or permanent fixture may be removed from the premises.
    - *Assumption:* All buildings and improvements of whatever nature remaining upon the leased premises at the end of the primary term, or any extension thereof, of this lease shall automatically become the property of Lessor absolutely in fee without any cost to Lessor.
    - *Building Life:* It is agreed that the life of the building to be constructed by Lessee on the property herein leased is thirty (30) years.

Before adopting a leasing policy that addresses reversion, there are a number of issues that should be considered, including:

- ✈ Ensure the reversion policy is consistently applied to all existing and prospective tenants.
- ✈ Determine if reverted improvements will be attractive to prospective tenants.
- ✈ Refer to the Airport's Master Plan to find out if structures and their locations meet current and future airport development needs.
- ✈ Confirm that the reversion policy agrees with the FAA Airport Compliance Manual stated in FAA Order 5190.6B.
- ✈ Ensure that there is no discrimination between prospective tenants and current tenants whose property has reverted.

For the reversion options under which the airport sponsor takes title to a building, a number of issues must be considered:

- ✈ The State gains more control over the airport and its structures.
- ✈ The State gains additional revenue.
- ✈ The State must commit staff and resources to manage and maintain the additional buildings; some buildings may take more resources than others.

If reverted buildings are not salvageable or the land is needed for other purposes, the following options should be considered:

- ✈ Lease the building back to the tenant, who then makes a new investment.
- ✈ Lease the building to a new tenant who will make an investment.
- ✈ Develop the land for other needed purposes.

A reversion clause can also state that tenants remove (demolish) any improvements (structures) that they have made to the property they lease. This can be beneficial to the sponsor if the sponsor believes that the hangar may be in too much disrepair to salvage when the lease expires. This can save the airport cost of demolishing buildings that are in structural failure. This can also be beneficial to the tenant if the tenant believes the building materials can be used or sold.

Reversion clauses have become normal in the aviation industry for a number of reasons. These include maximizing future revenue streams and maintaining a level of control over the development and maintenance of facilities on the airport. Each airport has its own lease language and different approaches to the issue. At Rutland Airport, the lease language can be developed to support the reversion of property improvements to the State. Rutland Airport will have greater financial production with the reversion clauses in their leases than without. Even if there are individual cases where a negotiated lease term for a ground lease is increased or modified to postpone actual property reversion, the prime motivation for encouraging tenants to extend/renegotiate their ground lease is the reversion clause. The reversion clause is an important tool as it relates to the Airport's future revenue stream and should be considered in new leases.

Fuel Flowage Fee:
Although there are provisions in the lease for a fuel flowage fee, the current lease sets the fee to $0.00 per gallon. VTrans should work to take the fuel flowage fee rate out of the lease for the future. This may have to wait until the expiration of the lease or if there is a renegotiation of other circumstances. Since fuel flowage fees should apply to all users of fuel on the Airport (self-fuelers and FBOs), it is best to set the fuel flowage fee using the Airport rules and regulations or by ordinance. One method used in Delaware is to charge the fuel wholesalers the fee, so that all on-airport distributers and users of aviation fuel are charged when the fuel is sold. This makes collections of the fee easier as well.

Strategies for Correcting Lease Issues

The lease structure changes outlined in this document can be easily implemented into future lease agreements. For the current lease agreements that do not adhere to the practices outlined in this document, there are limited options to change. To adjust the terms in current leases, the Airport can utilize one of the following methods:

- ***Renegotiation of Lease Terms:*** This could be initiated by either the tenant or the Airport, seeking to add an amendment to the current lease. If the Airport is initiating the renegotiation, an incentive will need to be offered to the tenant in exchange for adhering to the new lease policy. That incentive may be a lease extension that is not already included in the current lease.
- ***Upon Assignment or Subletting of Current Lease:*** A tenant cannot assign or sublet the lease terms without the express approval of the Airport. A scenario involving a negotiation for an assignment of a lease agreement, the Airport would have the opportunity to update the lease terms to the new Airport lease policy.
- ***Default of Current Lease:*** If a tenant does not adhere to the obligations of their specific leasehold agreement, either through non-payment of rent or violations of the Airport's Rules and Regulations, the Airport can institute the standard leasing policy for future agreements.
- ***Expiration of Current Lease Term:*** When the term of any lease expires, and the tenant is unable to utilize an extension option, that lease can be discarded if it does not conform to the new leasing policy of the Airport.

In general, changes to leases are rare except where both parties stand to gain relative to their interests. Thus, VTrans should be ready with new terms and conditions, should the current FBO desire to renegotiate its lease.