AIRPORT MASTER PLAN UPDATE

DRAFT
November 2018

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CHAPTER 1 - INTRODUCTION

This chapter provides a brief overview of the history of Nashua Municipal Airport- Boire Field (ASH or the Airport), ownership and management, and the master planning process.

1.1 BOIRE FIELD

Figure 1-1 Ensign Paul A. Boire (1921-1943) WWII; Source: Janice Brown NH History Blog

In 1934, the City of Nashua approved the purchase of a farm owned by Joseph Therrien on Pine Hill Road for the development of an airport. The Airport officially held its grand opening on October 12, 1934. "During World War II, airfields throughout the country were re-named in honor of aviators who had given their lives, and Nashua was no exception. On March 23, 1943, U.S. Navy (Reserve) Ensign Paul A. Boire, stationed aboard an aircraft carrier in the Caribbean, died in a crash at sea. Born in 1921, Boire was a 1939 graduate of Nashua High School, where he was a popular student who had played basketball and volleyball and was a member of the school's rifle club. He attended St. Anselm College in Manchester after graduation and also enrolled in the Civil Pilot Training Program at Nashua Airport. He completed the program, and in July 1941 enlisted in the Navy, receiving further flight instruction at Squantum Naval Air Station (Quincy, Massachusetts); Pensacola, Florida; and Norfolk, Virginia. After receiving his commission on April 3, 1942, he served first as a pilot of scout planes and then carrier-based dive bombers. He was just 22 years old when he died and was the first military pilot Nashua lost in the war. The field was dedicated to his memory in September 1945"[1].

1.2 GOVERNANCE

ASH is a publicly-owned, public-use general aviation airport owned by the City of Nashua, located in the Merrimack Valley region of New Hampshire. The city leases the airport to the Nashua Airport Authority (NAA). On January 10, 2017, the Mayor and Board of Alderman of the City of Nashua approved a 99-year lease extension through December 31, 2115. The NAA consists of five directors who are appointed by the Mayor and approved by the Board of Aldermen of the City of Nashua. The NAA is tasked with setting the policy and procedures to operate ASH for the City in conjunction with the rules and regulations of the Federal Aviation Administration (FAA) and the New Hampshire Department of Transportation, Bureau of

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[1] AHS, Inc., New Hampshire Division of Historical Resources Area Form, 2013

Aeronautics (NHDOT/BA). The Airport Manager is responsible for overseeing the daily operations of ASH, and reports directly to the NAA. ASH is currently served by a staff four, consisting of the following positions:

- Airport Manager
- Office Manager
- Maintenance Supervisor
- Maintenance Technician(s)

1.3 AERONAUTICAL ROLE

ASH provides a significant positive contribution to the state and local economy through flight activities including aviation fuel sales and car rentals, tenant leases, business opportunities/jobs, and visitor expenditures in the area. According to the 2015 New Hampshire State Airport System Plan (NHSASP), "ASH is the busiest general avigation airport in NH and also has the largest based aircraft fleet of all the state's airports."

1.3.1 NH AIRPORT STATE SYTEM PLAN

In addition to its role in the National Plan of Integrated Airport Systems (NPIAS), ASH is the only existing airport defined as a National airport in the NHSASP according to the 2015 NHSASP. "Comprised of three commercial service and 22 public-use general aviation airports, the NH airport system consists of 25 facilities that serve the air transportation needs of over 1.3 million NH residents, business users, leisure travelers and the military. The system is an important contributor to state and local economies, supporting thousands of jobs and generating millions of dollars in state tax revenue."[2] The estimated economic contribution by ASH is highlighted in Table 1-1 below.

Table 1-1: Estimated Economic Contribution of ASH (2015)

	Total Employment	*Total Payroll*	*Total Output*	*Total Tax Revenue*
Total Impact	353	$14.99 million	$40.74 million	$1.32 million

Source: NHDOT/BA 2015 NHSASP

1.3.2 NATIONAL PLAN OF INTEGRATED AIRPORT SYSTESMS

ASH is included in the NPIAS. The Airport is one of nearly 3,400 existing and proposed civilian-use airports in the U.S. that the FAA considers significant to the national air transportation system, and thus eligible to receive Federal grants under the AIP. Within the NPIAS, airports are grouped into two major categories: primary or nonprimary as shown in Figure 1-2. ASH is categorized as a nonprimary airport. ASH is further categorized as a reliever airport, designated by the U.S. Secretary of Transportation to relieve congestion at a commercial service airport and to provide more general aviation access to the overall community. To assist in further defining nonprimary airports to the general public, FAA has identified four subcategories

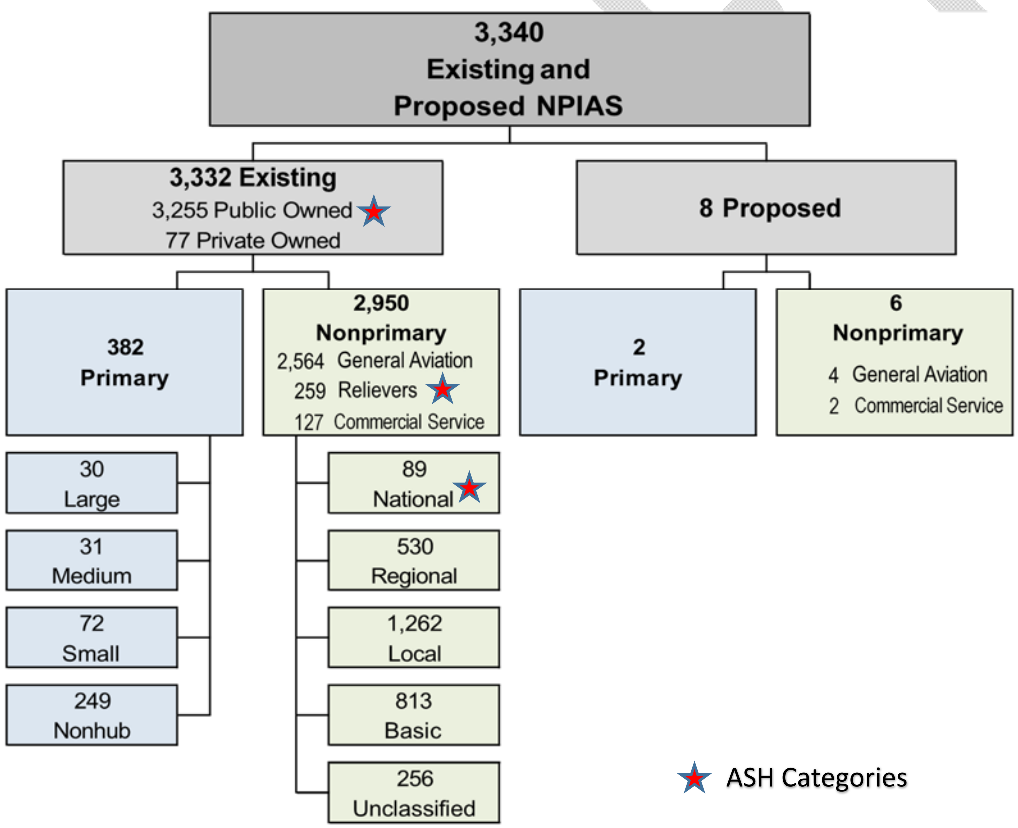
[2] NHDOT/BA 2015 State Airport System Plan

for nonprimary airports based on activity level and role within the aviation system. ASH is further categorized as a *National* airport. To be categorized as *National*, an airport must demonstrate that: 1) it serves the national airport system by supporting communities across the national and international markets in multiple states and throughout the United States; 2) has very high levels of aviation activity with many jets and multiengine propeller aircraft, and 3) meets one of the following minimum criteria for annual aviation activity:

- 5,000 or more instrument operations, 11 or more based jets, and 20 or more international flights, or 500 or more interstate departures.*
- 10,000 or more commercial passenger enplanements and at least 1 scheduled operation by a large certificated air carrier.
- 500 million pounds or more of landed cargo weight.

*ASH criteria met

Figure 1-2: NPIAS Categories of U.S. Civilian Airports



1.4 HISTORY OF PAST PROJECTS

The State of New Hampshire, through its Department of Transportation Bureau of Aeronautics (NHDOT/BA), was selected by the Federal Avigation Administration's (FAA) New England Region to be a member of FAA's Airport Block Grant Program in FY 2008. The Bureau manages the Airport Improvement Program (AIP) grants for all non-primary National Plan of Integrated Airport System (NPIAS) airports and the statewide program. ASH is a non-primary NPIAS airport eligible to receive AIP program funding administered by the NHDOT/BA. Table 1-2 provides a history of federal funded projects at ASH dating back to 1951.

Table 1-2: History of Federally Funded Capital Projects

Project Year	FAA Grant Number	Description of Work	Total Project Cost
1951	9-27-017-4901	Land acquisition; clearing; construct and pave runway extension; segmented circle and windcone; air and runway marking; repair and resealing of the existing runway and taxiway	$59,718
1955	9-27-017-0506	Runway extension 100' x 300'; runway and taxiway markings; grading and turfing runway shoulders	$9,622
1960	9-27-017-5903	Land acquisition; taxiway construction; installation of runway and obstruction marking	$30,188
1960	9-27-017-6004	Construct taxiway 3,850' x 40'; install taxiway signs	$60,000
1964	9-27-017-6305	Extend runway 455' x 100' NW; lighting; reconstruct runway pavement 2,000' x 100'; construct TW 'B' 850' x 40'; construct TW 'C' 350' x 40'; construct TW 'E' 580' x 40'; clearing in clear zones; relocate airport road SE; drainage; runway and taxiway marking	$233,934
1967	9-27-017-C506	Drain swamp area; install medium intensity approach lighting system with sequenced flashing condenser discharge lights	$54,068
1969	9-27-017-C807	Land acquisition for NW clear zone (25 acres); mark and light RW 14-32 1,500' x 100'; relocate MALS, REILS and VASI, obstruction removal, and extend TW 2,140' x 40'; overlay and mark Runway 14-32 (560')	$291,482
1975	7-33-0012-02-75	Aviation easement under approach and clear zone to Runway 14 (79 acres)	$240,000
1982	3-33-0012-01	Acquire land for development	$88,528
1983	3-33-0012-02	Remove and light obstructions; construct taxiways; expand apron; install taxiway sign; acquire land for approaches; improve drainage and install fencing	$604,900
1984	3-33-0012-03	Expand snow removal equipment storage building; acquire snow removal equipment	$525,000
1985	3-33-0012-04	Construct apron	$497,504
1986	3-33-0012-05	Install security fencing; construct runway safety area	$196,813
1987	3-33-0012-06	Rehabilitate and mark Runway 14-32	$796,684
1987	3-33-0012-07	Airport Master Plan Update study	$85,778
1988	3-33-0012-08	Land acquisition- clear zone, Runway 32	$185,058
1988	3-33-0012-09	Conduct noise compatibility plan study	$121,649
1990	3-33-0012-10	Extend taxiway (40' x 1,325' and parking apron (460' x 250'); demolish hangar; install security fencing (2,250 FL)	$584,371
1991	3-33-0012-11	Land acquisition (.5 acres) in the Runway 32 runway protection zone	$94,280
1991	3-33-0012-12	Reconstruct parallel taxiway, diagonal taxiways and stub taxiways (approx. 39,400 SY); construct bypass taxiway (approx. 1,945 SY)	$466,044

Table 1-2: History of Federally Funded Capital Projects (Continued)

Project Year	FAA Grant Number	Description of Work	Total Project Cost
1992	3-33-0012-13	Construct access road (2,500 LF); install security fencing (2,400 LF)	$432,187
1992	3-33-0012-14	EA of Holden property acquisition	$34,750
1993	3-33-0012-15	Land acquisition (approx. 25 acres) for future development	$1,018,074
1996	3-33-0012-16	Apron expansion	$514,000
1997	3-33-0012-17	Environmental assessment of Runway 14L- 32R	$52,000
1999	3-33-0012-18	Boire Field Airport Plan technical supplement	$100,616
1999	3-33-0012-19	Acquire land in the runway protection zone to Runway 32 (approx. ½ acre)	$97,702
2000	3-33-0012-20	Installation of taxiway lighting and signage	$285,200
2001	3-33-0012-21	SRE building expansion/current building upgrade	$475,313
2002	3-33-0012-22	Install 8’ fence with barb wire	$230,929
2002	3-33-0012-23	Design only: 15,000 SY aircraft tie-down, etc.	$99,400
2003	3-33-0012-24	Construction of aircraft apron 17,600 SY, taxilane 25’ x 225’ and relocation of Perimeter Rd	$822,031
2004	3-33-0012-25	Environmental assessment and Phase I design of parallel runway and taxiway	$211,000
2005	3-33-0012-26	Runway relocation feasibility study & obstruction removal of Runway 14 approach area	$307,000
2006	3-33-0012-27	Purchase SRE	$270,000
2007	3-33-0012-28	Prepare Environmental Assessment	$400,000
2008	SBG-12-01-2008	Replace Hazard Beacons and purchase SRE	$291,000
2009	SBG-12-02-2008	Design only: Runway 14-32 Relocation	$1,269,800
2009	SBG-12-03-2009	ARRA: Rehabilitate Terminal Aircraft Parking Apron	$1,596,763
2010	SBG-12-04-2010	Easement Acquisition (13 parcels)	$804,932
2010	SBG-12-05-2010	FAA Reimbursable Agreement for Runway Construction- Phase Services and Equipment Purchase	$976,000
2010	SBG-12-06-2010	Obstruction Removal and Airspace Survey	$712,000
2011	SBG-12-07-2011	Mitigation for Runway Reconstruction	$2,038,000
2011	SBG-12-08-2011	Runway 14-32 Reconstruction- Phase I	$9,448,316
2011	SBG-12-09-2011	Runway 14-32 Reconstruction- Phase II	$7,429,684
2013	SBG-12-10-2013	Conduct WHA, SWPPP Update, SHPO Area Form	$145,000
2013	SBG-12-11-2013	Purchase SRE (blower & tracked dozer)	$564,000
2014	SBG-12-12-2014	Phase I- Replace Perimeter/Wildlife Fence and Gates (approx. 15,000 LF)	$312,736
2014	SBG-12-13-2014	Acquire land for RPZ protection (31 Charron Ave)	$419,800
2014	SBG-12-14-2014	Phase II- Replace Perimeter/Wildlife Fence and Gates (approx. 15,000 LF)	$477,264
2015	SBG-12-15-2015	Acquire land for RPZ protection (79 Pine Hill Rd)	$400,000
2016	SBG-12-16-2016	Prepare Airport Master Plan Update	$445,000
2016	SBG-12-17-2016	Airport Pavement Maintenance and Rehabilitation of Taxiways and Aprons	$1,645,000
		Sum of Capital Project Costs	***$39,551,118***

1.5 MASTER PLANNING HISTORY AT NASHUA MUNICIPAL AIRPORT

The last comprehensive Master Plan update for ASH was completed in 1989. With the construction of the control tower in 1972, and subsequent staffing in later years, accurate operational data was collected and consequently the Airport commissioned an *Airport Master Plan Technical Supplement* in 2000. The primary purpose of the *Airport Master Plan Technical Supplement* was to "update those areas that are directly affected by the inaccurate traffic estimates[3]."

The purpose of this current Airport Master Plan Update (AMPU) is to provide the Airport with its first comprehensive update in nearly 27 years. The objectives of this AMPU are to define the Airport's aviation and infrastructure needs, and to prudently sustain the Airport and meet the growing needs of its aviation operators in the short (0-5 years), medium (6-10 years) and long terms (11-20 years). To achieve these objectives, this Plan will highlight the Airport's current land-use characteristics, operations, finances, regulatory requirements, and constraints, among other topics.

Much of the information used to develop this Master Plan Update has been compiled, in part, from multiple documents and plans including:

- *1989 Master Plan Update;*
- *2000 Master Plan Technical Supplement;*
- *2008 Environmental Assessment;*
- *2008 Part 150 Noise Compatibility Study and Noise Exposure Map;*
- *2009 Runway 14-32 Permitting;*
- *2009 Boire Field Runway Redesign;*
- *2015 Wildlife Hazard Assessment;*
- *2015 NH Division of Historical Resources' Area Inventory Form; and*
- *2015 NH State Airport System Plan (NHSASP).*

1.6 AIRPORT MASTER PLAN UPDATE FUNDING

The FAA, NHDOT/BA and the NAA are assisting in the financing of this Master Plan Update. ASH is eligible to receive Federal funding assistance for this project under the FAA's AIP. AIP funding is provided through a Federal aviation trust fund, funded through "user fees" paid by passengers on commercial flights, aviation fuel tax, cargo fees, and over-flight fees. This project is receiving 90 percent of total project funding through FAA's AIP program. The NHDOT/BA pays for an additional 5 percent of total project costs from its dedicated aeronautical fund, and the NAA finances the remaining 5 percent of total project costs.

[3] Airport Master Plan Technical Supplement, May 2000

1.7 PLANNING PROCESS

Guidance for the airport master planning process comes from the FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, and other relevant FAA ACs, Orders, and Federal Aviation Regulations (FARs), as applicable. This master planning process considers the needs and demands of airport tenants, users, and the general public. The airport master plan process provides opportunities for airport users, political entities, and the public to participate in the development of an airport's aviation plans and goals. These opportunities have been built into this project through public meetings, Client Group meetings, Master Plan Committee meetings, and project updates on the Airport's website.

This airport master plan process will be broken down into phases at logical decisions points:

- Initial data collection and aviation activity forecasts will make up the foundation from which all other decisions in this project are made;
- Aviation facility needs analysis and alternatives development options will be identified for each of the three planning periods (short, intermediate, and long term); and
- Environmental, financial, and graphical depictions of the recommended airport development will complete the process.

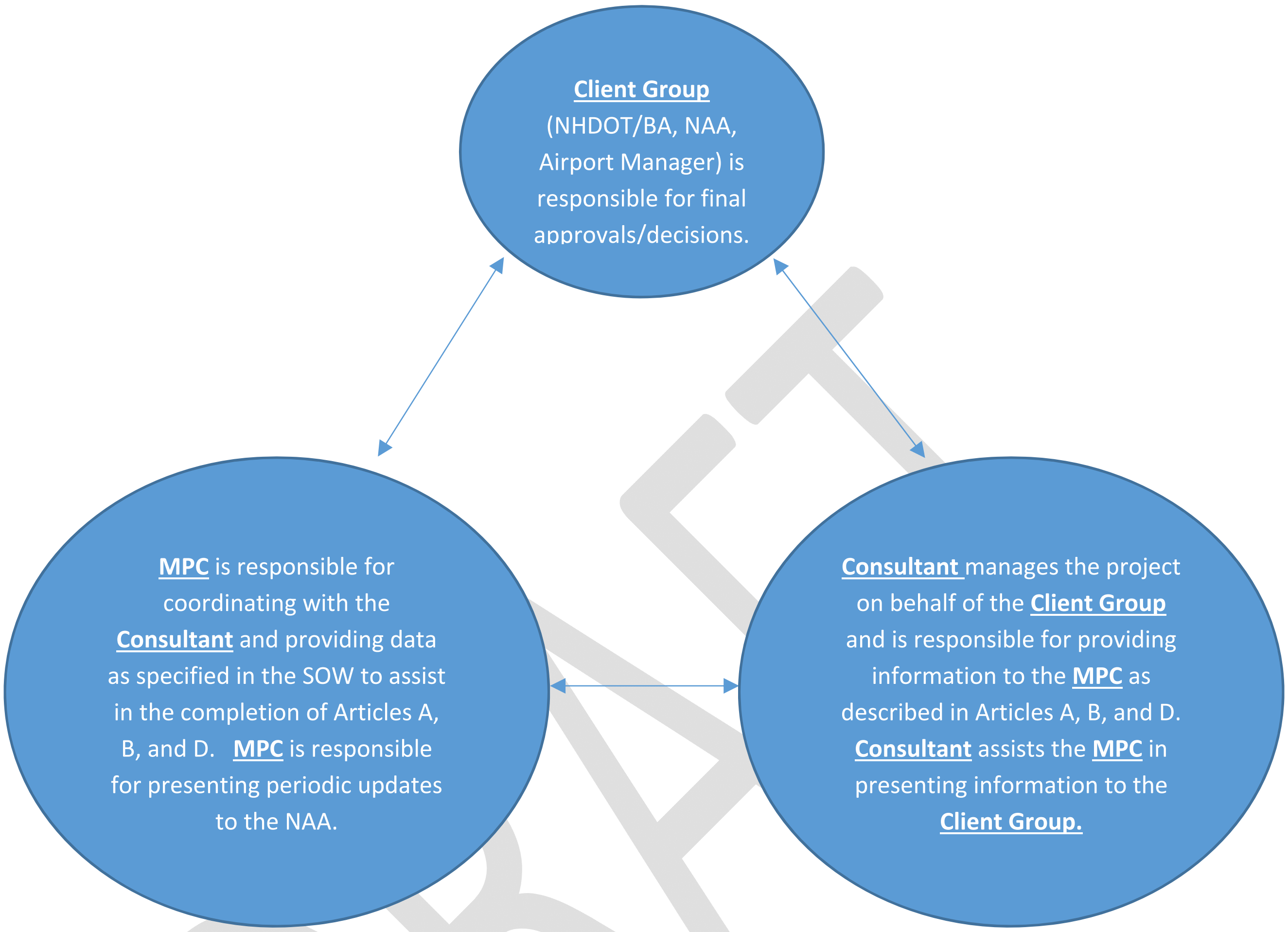
This master planning process will have one component that seeks to help address the understanding of the various FAA grant assurances and certificates that are attached to each FAA grant that ASH accepts. This will be a standalone chapter within the final document that can be used for future training of airport staff and others bound by these requirements.

1.8 ROLES AND RESPONSIBILITIES

The Client Group- consists of representatives from the FAA, NHDOT/BA, NAA, and the Airport Manager. The Client Group is responsible for review of draft documents, interim decisions, and final approvals.

The Master Plan Committee (MPC)- is comprised of 9 members representing the City government, Airport management, NAA, Fixed Base Operators and, airport users. The MPC is responsible for coordinating with the consultant and providing feedback as specified in the scope of work. The MPC is responsible for providing periodic updates to the NAA.

The Consultant- Gale Associates, Inc. is responsible for managing the project on behalf of the Client Group, doing much of the data collection and evaluation, and providing information to the MPC as well as assisting the MPC in presenting information to the Client Group.


Client Group
(NHDOT/BA, NAA, Airport Manager) is responsible for final approvals/decisions.
MPC is responsible for coordinating with the Consultant and providing data as specified in the SOW to assist in the completion of Articles A, B, and D. MPC is responsible for presenting periodic updates to the NAA.
Consultant manages the project on behalf of the Client Group and is responsible for providing information to the MPC as described in Articles A, B, and D. Consultant assists the MPC in presenting information to the Client Group.

CHAPTER 2 INVENTORY OF EXISITING FACITLITIES

Documenting and assessing the existing inventory and condition of Airport facilities provides a comprehensive foundation from which facility requirements and improvement recommendations can be made. An on-site inventory of Airport facilities was conducted in 2017 to supplement information previously obtained through a review of Airport drawings, previous reports, and interviews with airport management and the MPC. See Figure 2-1 and sheet 3 of the Airport Layout Plan (ALP) for a depiction of existing facilities.

2.1 REGIONAL SETTING AND SURROUNDING LAND USE

ASH is a publicly owned, public-use general aviation airport occupying approximately 400 acres of land at 93 Perimeter Road in the northwest portion of the City of Nashua, Hillsborough County. The second largest city in northern New England, Nashua is located in southern New Hampshire abutting the northern Massachusetts border, approximately 40 miles northwest of Boston, Massachusetts. Nashua is bordered by Hollis, NH to the west; Merrimack, NH to the north; Hudson, NH to the east; and Tyngsboro, MA to the south. The Airport is conveniently located, being accessible from the north or south by the Everett Turnpike (Route 3) and from the east or west by Route 101A, connecting it to major and minor feeder routes in the region.

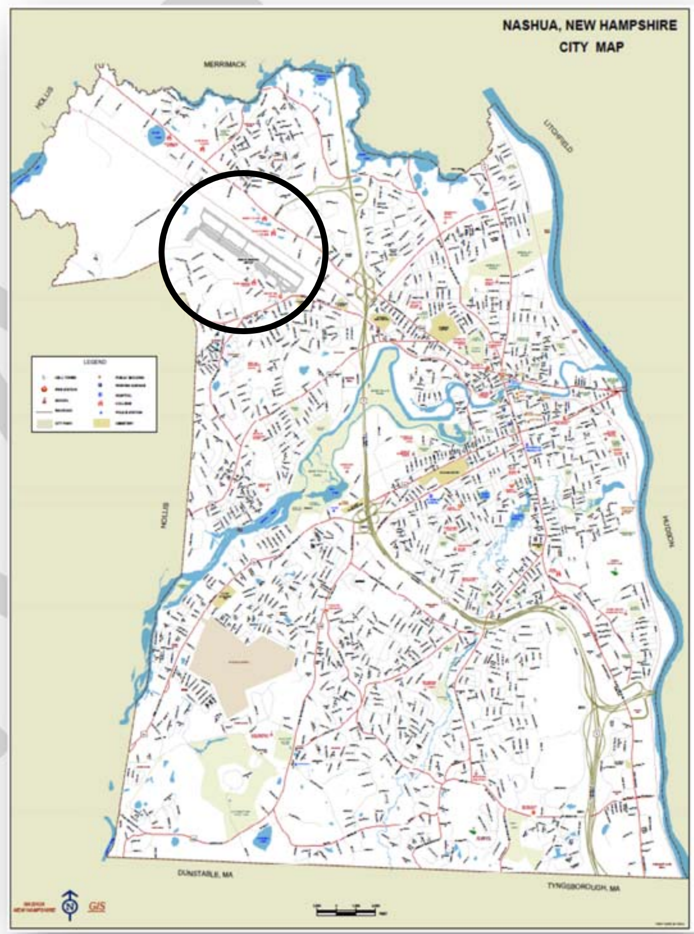
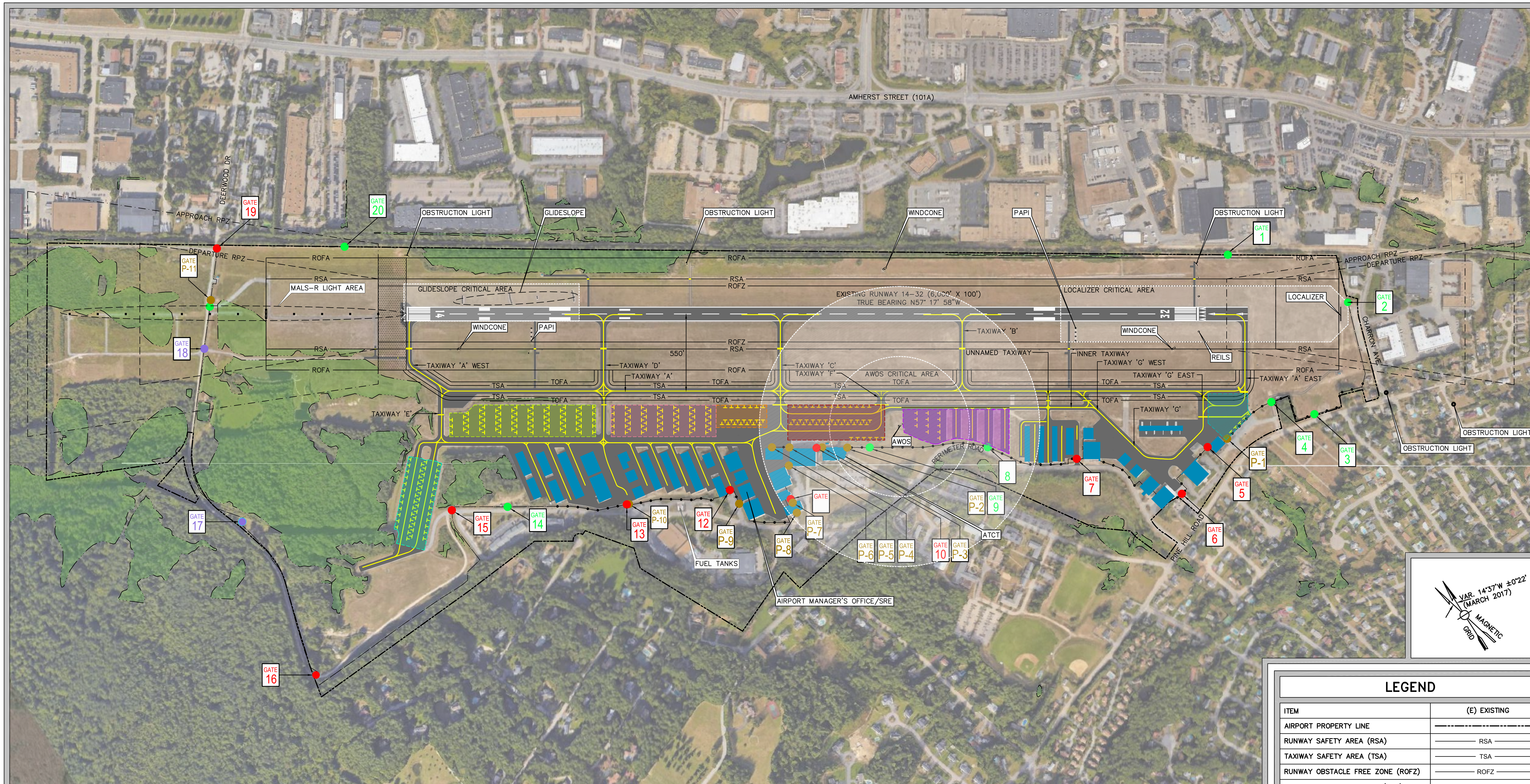


Figure 2-2 Nashua, NH City Map, Source: City of Nashua

The Airport is immediately bounded by Charron Avenue to the east, by the Boston and Maine Railroad to the north, by Deerwood Drive to the west, and by Perimeter Road and Pine Hill Road to the south. Perimeter Road provides access to most of the Airport's facilities.

As the state's southernmost public-use airport, ASH is approximately 8 miles from the New Hampshire/Massachusetts border. ASH is located within the City's Airport Industrial zone (see Figure 2-2), with surrounding areas consisting of the following zoning designations:



NOTES:

1. THERE ARE TWO CRITICAL AREAS FOR THE AUTOMATED WEATHER OBSERVING SYSTEM (AWOS). THE WIND SENSOR ON THE AWOS HAS THE FOLLOWING REQUIREMENTS FOR CLEARANCE:
   A) THE WIND SENSOR SHALL BE MOUNTED BETWEEN 30 AND 33 FEET ABOVE THE AVERAGE GROUND HEIGHT WITHIN A RADIUS OF 500 FEET.
   B) 0–500 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE AT LEAST 15 FEET LOWER THAN THE SENSOR HEIGHT.
   C) 500–1,000 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE AT LEAST 10 FEET LOWER THAN THE HEIGHT OF THE SENSOR.

GATE SIGNS

GATE NUMBER	LOCATION	TYPE
GATE X	● (purple)	SLIDE GATE (MANUAL)
GATE X	● (red)	MOTORIZED SLIDE GATE
GATE X	● (green)	SWING GATE
GATE X	● (brown)	PEDESTRIAN GATE

EXISTING FACILITIES PLAN

SCALE: 1" = 400'

LEGEND

ITEM	(E) EXISTING
AIRPORT PROPERTY LINE	
RUNWAY SAFETY AREA (RSA)	RSA
TAXIWAY SAFETY AREA (TSA)	TSA
RUNWAY OBSTACLE FREE ZONE (ROFZ)	ROFZ
RUNWAY PROTECTION ZONE (RPZ)	RPZ
APPROACH RUNWAY PROTECTION ZONE	
DEPARTURE RUNWAY PROTECTION ZONE	
PRECISION OBSTACLE FREE ZONE	
RUNWAY OBJECT FREE AREA (ROFA)	ROFA
TAXIWAY OBJECT FREE AREA (TOFA)	TOFA
CRITICAL AREA	
WETLANDS	
BUILDINGS	
PAVEMENT	
8' CHAINLINK FENCE	
8' CHAINLINK FENCE WITH BARBWIRE	
ALPHA RAMP	
DELTA RAMP	
ECHO RAMP	
FOXTROT RAMP	
GOLF RAMP	
HOTEL RAMP	
INDIA RAMP	

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PREPARED FOR:

Nashua Airport
BOIRE FIELD

PROJECT: AIRPORT MASTER PLAN UPDATE NHDOT NO. SBG-12-16-2016

OWNER: CITY OF NASHUA, NEW HAMPSHIRE AIRPORT AUTHORITY

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	777042
DESIGNED BY	DCQ
DRAWN BY	DCQ
CHECKED BY	MPC
DATE	JUNE, 2018

GRAPHIC SCALE
0 200 400 800
SCALE: 1" = 400'

SHEET TITLE

EXISTING FACILITIES PLAN

DRAWING NO.

FIG. 2-1

1 OF 1

- R-30: A Suburban Residence
- PI: Park Industrial
- GB: General Business
- LB: Local Business

2.2 GEOMETRY AND DESIGN STANDARDS

FAA AC 150/5300-13A provides design standards and recommendations for the geometric layout and engineering design for runways and runway associated environments such as Runway Safety Areas (RSAs), Obstacle Free Zones (OFZs), Object Free Areas (OFAs), clearways, and stopways, among other elements.

2.2.1 APPROACH AND DEPARTURE REFERENCE CODE

The Airport's Approach and Departure Reference Code (ARC and DRC), formerly referred to as the Airport Reference Code (ARC) at ASH have fluctuated over years as the use of business jets has increased and new aircraft have been introduced to the market. The *Technical Supplement* to the *1989 Master Plan Update* documented the current and future ARC for the Airport as B-II based on the Airport's users at the time and on a forecast of likely users in the future. This ARC changed in 2004 when the Air Traffic Control Tower's 2003 data indicated that more than 500 annual operations were performed by Approach Category "C" aircraft in 2003. As a result, the Airport's ARC was changed from B-II to C-II. In 2007, ahead of the 2008 Environmental Assessment, aircraft operation counts by aircraft type were obtained from the Air Traffic Control Tower and reviewed to determine whether the ARC designation of C-II remained valid. The review indicated that enough aircraft operations were conducted in 2007 by the Gulfstream IV (category D aircraft) to warrant a further change in the ARC.

The current Airplane Design Group (ADG) for ASH is D-II. The ADG is a classification of aircraft based on approach speed, wingspan, and tail height.

An aircraft approach category is a grouping differentiating aircraft based on the speed at which the aircraft approaches a runway for a landing. These categories are defined in Tables 2-1 and 2-2, below.

Table 2-1 Airplane Design Group

Aircraft Approach Category	*Approach Sped*
A	Speed less than 91 knots
B	Speed 91 knots or more but less than 121 knots
C	Speed 121 knots or more but less than 141 knots
D	**Speed 141 knots or more but less than 166 knots**
E	Speed 166 knots or more

***Bold= ASH's Aircraft Approach Category**

Tale 2-2 Aircraft Approach Category

Airport Design Group	*Tail Height [ft. (m)]*	*Wingspan [ft. (m)]*
I	< 20' (<6 m)	<49' (<15m)
II	**20' - < 30' (6m- <9m)**	**49'- <79' (15m- <24m)**
III	30' - < 45' (9m- <13.5m)	79'- <118' (24m- <36m)
IV	45'- <60' (13.5m- <18.5m)	118'- 171' (36m- <52m)
V	60'- <66' (18.5m- <20m)	171'- <214' (52m- <65m)
VI	66'- <80' (20m- <24.5m)	214'- <262' (65m- <80m)

***Bold= ASH's Airport Design Group**

2.3 AIRSIDE FACILITIES

Airside facilities are those facilities associated with the movement, takeoff, and landing of aircraft. At ASH, this consists of the following:

- Runway
- Taxiways
- Taxilanes
- Hangars
- Aprons
- Tie-downs
- Navigational/Visual/Communication Aids

2.3.1 RUNWAY LENGTH

Runway length requirements are determined based on FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design.* During the 2008 Environmental Assessment, the forecast identified the Gulfstream IV (G-IV) as representative of the most demanding aircraft regularly[1] using the Airport. Thus, the G-IV was identified as the Airport's "Design Airplane". In accordance with the AC, the chart taken from the G-IV operation manual indicated the required runway length to be 6,800 feet. However, due to significant impacts to wetlands that would occur as a result of implementing such a length, the NAA, FAA and the NHDOT/BA agreed that a length of 6,000 feet would lessen the runway's environmental impact and would constitute a sufficient improvement over existing conditions (5,500 feet). Consequently, Runway 14-32 was reconstructed in 2015 to 6,000 feet in length. Figure 2-1 illustrates the runway characteristics and existing critical data for Runway 14-32.

Following the completion of the Environmental Assessment in 2009, the preferred alternative included extending the Runway 14 end by 150 feet, paving a 350-foot portion of the Runway 32 runway safety area, and using declared distances to achieve 6,000 feet of available take-off distance when departing from Runway 32. Declared distances are the distances the FAA declares available for use in meeting an airplane's takeoff run available (TORA), takeoff distance available (TODA), accelerated-stop distance

[1] FAA defines regular use of an airport as minimum of 500 operations annually by an aircraft of family of similar aircraft.

available (ASDA), and landing distance available (LDA). Figure 2-3 summarizes the critical data for Runway 14-32.

2.3.2 RUNWAY SAFETY AREAS

A Runway Safety Area (RSA) is a defined surface centered on the runway center line surrounding the runway prepared or suitable under dry conditions for reducing the risk of damage to airplanes or injury to persons in the event of an undershoot, overshoot, or excursion from the runway. In accordance with FAA AC 150/5300-13A, ASH's RSA is 500 feet in width, and 1,000 feet in length beyond each runway end (see Figure 2-1).

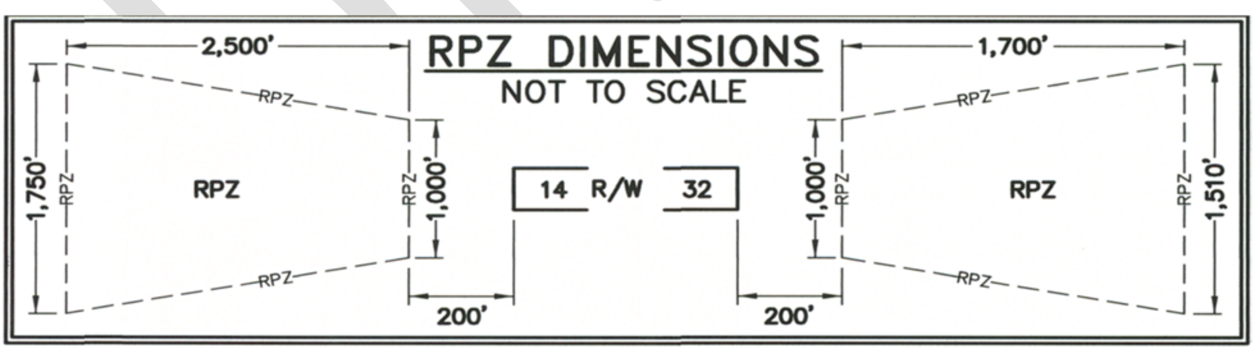
2.3.3 RUNWAY OBJECT FREE AREAS

The Runway Object Free Area (ROFA) is an area centered on the runway centerline. The ROFA clearing standards requires clearing the ROFA of objects protruding above the nearest point of the runway centerline, except where fixed by function. It is acceptable to place objects that are necessary to be located in the ROFA for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the ROFA. In accordance with AC 150/5300-13A, ASH's ROFA is 800 feet in width and 1,000 feet in length beyond each end of the runway (see Figure 2-1).

2.3.4 RUNWAY PROTECTION ZONE

The Runway Protection Zones (RPZ) are trapezoidal areas located at each end of a runway, designed to enhance the protection of people and property on the ground in the event an aircraft overshoots the runway end. Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ. While ASH does not own all of the property under the RPZ, where opportunities have presented themselves, land and avigation easements have been obtained. The dimensions of the RPZ at ASH is shown below on Figure 2-4.

Figure 2-4 Runway Protection Zone Dimensions



2.3.5 RUNWAY OBSTACLE FREE ZONE

The Runway Obstacle Free Zone (ROFZ) is a defined volume of airspace centered above the runway centerline, above a surface whose elevation at any point is the same as the elevation of the nearest point

Figure 2-3 Runway System Data

Facility Item	Runway	
Runway 14-32	*Runway 14*	*Runway 32*
Aircraft Approach Category	D	
Airplane Design Group	II	
Runway Length x Width	6,000' x 100'	
End Latitude	42°47'13" N	42°46'41" N
End Longitude	71°31'25" W	71°30'17" W
End Elevation (MSL)	200.4'	192.0'
Pavement Surface Course	Asphalt	
Pavement Surface Course Condition	Excellent	
Pavement Strength (lbs.)	62,000 (SW) | 80,000 (DW) | 133,000 (DT)	
Runway Instrument Approach Aids	ILS | LOC | RNAV (GPS)	RNAV (GPS) | VOR
Visual Approach Aids	PAPI- 4R	PAPI-4L
Runway Edge Lighting	HIRLS	
Runway Markings	Precision	Precision
Displaced Threshold Length	0'	350'
Takeoff Distance Available (TODA)	6,000'	
Takeoff Run Available (TORA)	6,000'	
Accelerate-Stop Distance Available (ASDA)	5,650'	6,000'
Landing Distance Available (LDA)	5,650'	5,650'
Runway Object Free Area (ROFA) Width	800'	
ROFA Length Beyond End of Runway	1,000'	
Runway Object Free Zone (ROFZ) Width	400'	
ROFZ Length Beyond End of Runway	200'	
Runway Safety Area (RSA) Width	500'	
RSA Length Beyond End of Runway	1,000'	

Source: AirNav, AHS Website, and ALP

Figure 2-3 Continued -Runway System Data (for future changes if applicable)

Runway 14-32	*Runway 14*	*Runway 32*
Aircraft Approach Category		
Airplane Design Group		
Runway Length x Width		
End Latitude		
End Longitude		
End Elevation (MSL)		
Pavement Surface Course		
Pavement Surface Course Condition		
Pavement Strength (lbs.)		
Runway Instrument Approach Aids		
Visual Approach Aids		
Runway Edge Lighting		
Runway Markings		
Displaced Threshold Length		
Takeoff Distance Available (TODA)		
Takeoff Run Available (TORA)		
Accelerate-Stop Distance Available (ASDA)		
Landing Distance Available (LDA)		
Runway Object Free Area (ROFA) Width		
ROFA Length Beyond End of Runway		
Runway Object Free Zone (ROFZ) Width		
ROFZ Length Beyond End of Runway		
Runway Safety Area (RSA) Width		
RSA Length Beyond End of Runway		

on the runway centerline. ASH's ROFZ is 400 feet in width by 200 feet in length beyond the end of the runway (see Figure 2-1).

2.3.6 RUNWAY AND TAXIWAY PAVEMENT MARKINGS

Table 2-3 provides an inventory of the runway and taxiway markings at ASH.

Table 2-3: Inventory of Runway and Taxiway Markings

Runway	*Taxiway/taxilanes*
Chevron markings	Taxiway 'A' Runway holding position marking
Threshold markings	Taxiway 'A' Enhanced centerline markings
Runway 14 end designation markings	Taxiway 'A' Centerline marking
Runway 14 end touchdown zone markings	Taxiway 'A' Edge marking
Runway centerline markings	Taxiway 'B' Runway holding position marking
Aiming point markings	Taxiway 'B' Enhanced centerline markings
Runway edge markings	Taxiway 'B' Centerline marking
Subsequent touchdown zone markings	Taxiway 'C' Runway holding position marking
Runway 32 designation markings	Taxiway 'C' Enhanced centerline markings
Runway 32 threshold markings	Taxiway 'C' Centerline marking
Runway 32 end threshold bar	Taxiway 'C' Non-movement area marking
Runway 32 arrowheads and arrows	Taxiway 'D' Runway holding position marking
	Taxiway 'D' Enhanced centerline markings
	Taxiway 'D' Centerline marking
	Taxiway 'D' Non-movement area marking
	Taxiway 'E' Centerline marking
	Taxiway 'E' Non-movement area marking
	Taxiway 'F' Centerline marking
	Taxiway 'F' Non-movement area marking
	Taxiway 'G' Centerline marking
	Taxiway 'G' Non-movement area marking

Note: All runway markings are striated. No taxiway markings are striated.

2.3.7 TAXIWAY SYSTEM

ASH has an extensive system of taxiways designated with letters from 'A' through 'G,' plus an "unnamed" taxiway, and "Inner" taxiway, which are further defined below and shown on Figure 2-1. The taxiway system provides access to the runway system from the terminal area environment and is designed to increase operational safety and efficiency between arriving and departing aircraft.

Taxiway 'A'- is a full-length parallel taxiway serving Runway 14-32. Taxiway 'A' is 40 feet wide and 6,790 feet in length. The Pavement Area Plan in Appendix A has Taxiway 'A' split up into three sections; Taxiway 'A' West, Taxiway 'A', and Taxiway 'A' East, which coincides with the year of construction or most recent major rehabilitation to each pavement area.

Taxiway 'B'- is a stub taxiway located between Runway 14-32 and Taxiway 'A.' It is located approximately 1,685 feet northeast of the Runway 32 threshold bar. Taxiway 'B' is 40 feet wide and approximately 480 feet in length.

Taxiway 'C'- is a stub taxiway located between Runway 14-32 and the main apron, midfield of the runway, and is intersected by Taxiway 'A'. It is approximately 40 feet wide from Runway 14-32 to Taxiway 'A,' and approximately 52 feet wide from Taxiway 'A' to the apron.

Figure 2-5 Taxiway 'A'

Taxiway 'D'- is a stub taxiway located between Runway 14-32 and the "inner taxiway." It is located approximately 1,406 feet southeast from the Runway 14 threshold bar. Taxiway 'D' is 40 feet wide between Runway 14-32 and Taxiway 'A' and reduces to 35 feet in width between Taxiway 'A' and the "inner taxiway."

Taxiway 'E'- connects to Taxiway 'A' at the Runway 14 end and provides access to India Ramp. It is 40 feet in width and approximately 360 feet long.

Taxiway 'F'- is a stub taxiway between Taxiway 'A' and the "Echo Ramp." Taxiway 'F' is located between the area where Taxiway 'B' and Taxiway 'C' connect to Taxiway 'A.' Taxiway 'F' is approximately 52 feet wide and approximately 79 feet long.

Taxiway 'G'- connects to Taxiway 'A' in two locations: 1) near Runway 32 end; and 2) southeast of the Unnamed Taxiway. Taxiway 'G' has varying widths and is approximately 1,398 feet long. The Pavement Area Plan in Appendix A has Taxiway 'G' split up into three sections; Taxiway 'G' West, Taxiway 'G', and Taxiway 'G' East, which coincides with the year of construction or most recent major rehabilitation to the pavement.

Unnamed Taxiway- is a stub taxiway located between Taxiway 'A' and the taxilanes that provide access to hangars, 13, 15, 17, and 19. The unnamed taxiway intersects with the "inner taxiway." The unnamed taxiway is approximately 20 feet wide and approximately 188 feet long from Taxiway 'A' edge of pavement to the edge of pavement of the taxilanes that provide access to the hangars, and located southwest of Taxiway 'G.'

Inner Taxiway- the "inner taxiway" essentially connects India Ramp to Taxiway 'H.' The "inner taxiway" provides access to the main apron, hangars, terminal building, etc.

2.3.8 TAXILANES

There are several taxilanes providing access from taxiways (usually an apron taxiway) to airplane parking positions and other terminal areas.

2.3.9 HANGARS

Aircraft hangars are buildings designed to store aircraft, many with office, workshop, and lounge space. At ASH, there are 106 T-hangar units with capacity for 106 aircraft, and 12 corporate hangars with capacity for 26 aircraft. The City of Nashua owns the "Brick Hangar" and the SRE building. The remaining hangars and buildings are privately owned. (see Figure 2-1).

Figure 2-6 "Brick Hangar"

2.3.10 APRONS

The function of aircraft aprons is to provide areas for based and transient aircraft parking, as well as aircraft fueling operations. At ASH, there are seven named aprons: "Alpha Ramp", "Delta Ramp", "Echo Ramp", "Foxtrot Ramp", "Golf Ramp", "Hotel Ramp", and "India Ramp", which are shown on Figure 2-1.

2.3.11 PAVED TIE-DOWNS

There are 310 tie-downs at ASH. The tie-downs are located on various aprons and are owned and managed by the Nashua Airport Authority.

2.3.12 NAVIGATIONAL/VISUAL/COMMICATION AIDS

FAA AC 150/5340-30H provides guidance and specifications for the design and installation of airport visual aids. The use of this AC is mandatory for all projects relating to the design and installation of airport visual aids funded with federal grant monies through the Airport Improvement Program (AIP). Navigational aids provide assistance to pilots by providing navigational, visual, and communication guidance to locate the Airport in support of safe operations in the airport environment.

2.3.12.1 Runway Lighting

Runway 14-32 has a L-862 High Intensity Runway Lighting System (HIRLS) with its cables placed in conduit. The HIRL system is a pilot-activated light system consisting of white, red, amber and green stake-mounted lights. The HIRLS system, installed in 2012, is airport owned and is in excellent condition (see Figure 2-1).

2.3.12.2 Runway End Identifier lights

Runway End Identifier Lights (REILs) are located at the Runway 32 end at the displaced threshold bar, and are airport owned. The Runway 14 end is not serviced by REILS (see Figure 2-1).

2.3.12.3 Threshold Lights

Threshold lights are located on the Runway 14 end at the landing threshold of the runway. On the Runway 32 end, thresholds lights are located at the displaced threshold, which is 350 feet from the runway pavement end (see Figure 2-1).

2.3.12.4 Taxiway Lights

Taxiway lights are located on the following taxiways: Taxiway 'A'; Taxiway 'B'; Taxiway 'C'; Taxiway 'D'; and Taxiway 'E'. The taxiway lights are owned and maintained by the Airport (see Figure 2-1).

2.3.12.5 Precision Approach Path Indicator

A precision approach path indicator (PAPI) is a lighting system located near a runway end that consists of light boxes that provide a visual indication of an aircraft's position on the glidepath for the runway. ASH has a 4-light PAPI (3.0-degree approach angle) on Runway 14 which is owned and maintained by the FAA. Runway 32 has a 4-light PAPI (3.0-degree approach angle), which is owned and maintained by the Airport.

2.3.12.6 Medium Intensity Approach Light System with Runway Alignment Indicator Lights

The Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) is a lighting system installed in the Runway 14 approach zone along the extended centerline of the runway. The MALSR consists of a combination of threshold lamps, steady burning light bars and flashers, providing visual information to pilots on runway alignment, height perception, roll guidance, and horizontal references for Category I Precision Approaches. The MALSR servicing Runway 14 is owned and maintained by the FAA (see Figure 2-1).

Figure 2-7 MALSR RW 14 Approach (picture not of ASH)

2.3.12.7 Instrument Landing System Localizer

An Instrument Landing System Localizer (Localizer) is the component of an instrument landing system that provides horizontal guidance, used to guide aircraft along the axis of the runway. ASH has a CAT I Localizer south of the Runway 32 end, which is owned and maintained by the FAA.

Figure 2-8 Localizer Runway 32 End

2.3.12.8 Glide Slope

The Runway 14 end is equipped with an END-FIRE Glide Slope, which is owned and maintained by the FAA. The Glide Slope provides vertical guidance for aircraft during approach and landing.

Figure 2-9 End Fire Glideslope Runway 14 End

2.3.12.9 Airport Rotating Beacon

The Airport owns and maintains a 36-inch rotating beacon on a 60-foot tall tower located near the "Brick Hangar" (Building No. 1) on the southeast side of the airport near Pine Hill Road. The beacon is used to indicate to pilots the location of the Airport at nighttime or during periods of low visibility. The beacon emits two beams of light, one green and the other white (or clear), 180° apart that indicate that ASH is a civilian airport with runway lighting. The beacon is owned and maintained by the Airport.

2.3.12.10 Hazard Beacons and Obstruction Lights

The Airport owns and maintains two hazard beacons and five obstructions lights. Hazard Beacon #1 is located in an easement on the Labombarde property, south of Indian Rock Road in Nashua. Hazard Beacon #2 is located in the right-of-way of Nartoff Road in Hollis. Three obstruction lights are located on Airport property along the railroad tracks (see Figure 2-1). The two off-airport obstruction lights are located at the corner of Charron Avenue and Pine Hill Road; and on Robert Drive, approximately 150 feet off Pine Hill Road, southeast of the Airport (See Figure 2-1).

2.3.12.11 Windcone

A windcone provides visual information on wind direction and speed. ASH has one lighted windcone, located on the northeast side of the runway at approximately midfield, and two non-lighted, supplemental windcones located adjacent to Taxiway ‘A’ West near the Runway 14 end, and Taxiway ‘B’ near the Runway 32 end.

2.3.12.12 Automated Weather Observing System (AWOS)

An Automated Weather Observing System, or AWOS, as defined by the FAA, is a suite of weather sensors, which measure, collect and disseminate weather data to help meteorologists, pilots and flight dispatchers prepare and monitor weather forecasts, plan flight routes, and provide necessary information for correct takeoffs and landings. Specifically, ASH is equipped with an AWOS III P/T, which records wind speed, wind gusts, wind direction, variable wind direction, temperature, dew point, altimeter setting, density altitude, present weather, and lightning detection. The AWOS is owned and maintained by the FAA.

Figure 2-10 AWOS

2.3.12.13 Guidance Signs

ASH has the following inventory of guidance signs located throughout the airfield:

Table 2-4: Inventory of Guidance Signs

Sign Tag	*Location*	*Description*
1	R/W 14-32	R/W 14 and TW 'A' position sign
2	T/W 'A'	T/W ‘A’ and ‘E’ direction sign
3	T/W 'A'	T/W 'A' and 'E' direction sign
4	T/W 'A'	T/W 'A' and 'E' direction sign
5	R/W 14-32	T/W 'A’ direction sign
6	R/W 14-32	T/W 'D' direction sign
7	R/W 14- 32	R/W 14 and TW 'D' position sign
8	T/W 'A'	T/W 'A' and 'D' direction sign
9	T/W 'A'	T/W 'D' and 'A' direction sign
10	T/W 'A'	T/W 'A' and 'D' direction sign
11	T/W 'A'	T/W 'D' and 'A' direction sign
12	R/W 14-32	T/W 'D' direction sign
13	R/W 14-32	T/W 'C' direction
14	R/W 14-32	R/W 14 and TW 'C' position sign

Table 2-4: Inventory of Guidance Signs

Sign Tag	Location	Description
15	T/W 'A'	T/W 'A' and 'C' direction sign
16	T/W 'A'	T/W 'C' and 'A' direction sign
17	T/W 'A'	T/W 'C' and 'A' direction sign
18	T/W 'A'	T/W 'C' direction
19	R/W 14-32	T/W 'B' direction
20	R/W 14- 32	R/W 14 and TW 'B' position sign
21	R/W 14-32	T/W B and A direction
22	T/W 'A'	T/W 'A' and 'B' direction sign
23	T/W "A'	T/W 'B' and 'A' direction
24	T/W 'A'	T/W 'B' direction sign
25	R/W 14-32	T/W 'A' direction sign
26	R/W 14-32	R/W 14 and TW 'A' position sign
27	R/W 14-32	R/W 14 and TW 'A' position sign
28	R/W 14-32	T/W ‘F’ and ‘A’ direction sign
29	T/W 'A'	

2.3.12.14 Instrument Approach Procedures

ASH is served by four standardized instrument approach procedures for Runway 14-32. These procedures utilize both ground-based and satellite-based instrumentation. As part of these procedures, both special alternate minimums and departure procedures apply. Table 2-5 details the currently published instrument approach procedures available at the Airport.

Table 2-5: Published Instrument Approach Procedures

Runway	Approach Type	Primary NAVAID	Visibility (miles)	Minima (AGL)
Runway 14	S-ILS	ILS	½	400
	LOC	LOC	1-1/8	760
	RNAV	GPS	½	400
Runway 32	RNAV	GPS	1	481
	VOR		2	900

Source: FAA Instrument Approach Procedures Published for use between April 27, 2017 & May 2017

2.4 INVENTORY OF LANDSIDE FACILITIES

The landside facilities of an airport are those facilities not related to the movement of aircraft, and provide for the processing of passengers, freight, and ground transportation vehicles. This section presents an overview of these facilities at ASH, including the following:

- Terminal Building
- Fencing
- Automobile Parking
- Miscellaneous Buildings
- Major Utilities
- Access Road (Perimeter Road)

2.4.1 TERMINAL BUILDING

Currently, ASH does not have a traditional terminal building. Airport operations and staff services are conducted in small offices connected to the snow removal equipment (SRE) building. This building currently operates at capacity and is not sufficient to meet user demands.

2.4.2 FENCING

ASH has perimeter fencing; however, the fence line does not correspond with the Airport's property line. The perimeter fence begins at the intersection of Deerwood Drive and the Boston & Maine Railroad, continues along the Boston & Maine Railroad in an easterly direction, then meets the businesses located on the north side of Charron Avenue, and proceeds behind the businesses in a southerly direction. Near the intersection of Charron Avenue and Pine Hill Road, the fence runs along Pine Hill Road in a westerly direction until the intersection of Pine Hill Road and Perimeter Road. From the intersection of Pine Hill Road and Perimeter Road, the fence follows Perimeter Road to the end. It then runs near the southern airport property line to Deerwood Drive, where it eventually terminates back at Deerwood Drive and the Boston & Maine Railroad. The perimeter fence along the Boston & Maine Railroad and Perimeter Road were installed in 2014-2015. The section of fence along Pine Hill Road was installed in 2013, 2014, 2015, and 2016. The portion of fence south of the gate at the end of Perimeter Road, which then runs near the southern airport property line to Deerwood Drive, was installed in 2003. The majority of the fence is 8-foot galvanized chain link, with some 8-foot high, PVC coated portions for aesthetic purposes in public areas.

Figure 2-11 Perimeter Fencing- Gate 15

2.4.3 AUTOMOBILE PARKING

ASH has automobile parking in various locations around the airport (both inside and outside the fence) providing access to the Air Traffic Control Tower, hangars, restaurants, administration and SRE buildings, and FBOs. It is estimated that there are approximately 300 designated aviation related parking spaces throughout the Airport (see Figure 2-1).

2.4.4 MAJOR UTILITIES

2.4.4.1 Water

The Pennichuck Water Company supplies the Airport (administration building, SRE building, and some tenant buildings) with water.

2.4.4.2 Electric Service

Electric services are provided to several airport buildings and tenants by Eversource and Agera Energy.

2.4.4.3 Gas Service

Natural Gas is provided to 79 & 93 Perimeter Road through Direct Energy. Liberty Utilities provides natural gas to 97 Pine Hill Road.

2.4.5 ACCESS ROAD (PERIMETER ROAD)

On-airport access is provided at two points: directly off Pine Hill Road, which serves the hangars at the southeast end of the airport; and via Perimeter Road providing access to hangars, businesses and the main portion of the Airport. While Perimeter Road is owned by the Airport, the City of Nashua provides snow plowing services and minor repairs.

2.5 SUPPORT FACILITIES/SERVICES

ASH has a variety of support facilities and services that assist in providing a safe and efficient airport environment. Aircraft Rescue and Fire Fighting (ARFF) are provided by the City of Nashua, with Station 5 (Airport Fire Station) located adjacent to the Airport at 101 Pine Hill Road. The principal support facilities at ASH include the following:

- Air Traffic Control Tower
- Snow Removal Equipment
- Airport Maintenance
- Fuel
- Fixed Base Operator

2.5.1 AIR TRAFFIC CONTROL TOWER

While the ATCT at ASH was constructed in 1972, it was not until 1988 that the ATCT was staffed and activated for service. It was one of the first to operate as a Non-Federal Owned Air Traffic Control Tower in the early 1990s. The ATCT is located on the southwest side of the Airport at approximately midfield and sits atop Building # 79. The ATCT is staffed 7 days a week from 7:00 AM- 9:00 PM.

Figure 2-12 ATCT

2.5.2 AIRCRAFT RESCUE AND FIRE FIGHTING

ARFF services are provided by the City of Nashua. Station 5- *Airport Fire Station* is located at 101 Pine Hill Road, abutting airport property with direct access to the airfield in case of emergencies. Station 5 is equipped with the following:

- 2010 Pierce Arrow Xt- 1250 Gallons Per Minute (GMP), 750 gallons;
- 2008 Ford 550/C.E.T.- 500 gallons foam; and
- 1996 Pierce Arrow- 1250 GMP, 705.

2.5.3 SNOW REMOVAL

In 2016, ASH developed a *Snow and Ice Control Plan* to "document how Boire Field will work toward mitigating the hazards associated with the regular annual occurrence of snow and ice accumulation[2]". Among other things, the *Snow and Ice Control Plan* prioritizes the entire airfield and supporting parking areas into four (4) segments, as described below, and further outlined in *Snow and Ice Control Plan* located in Appendix B.

Priority 1- areas are those vital to the takeoff, landing and moving of aircraft to and from the runway.

Priority 2- areas are those areas that support Priority 1 areas as well as areas used by on-airport businesses.

Priority 3- areas are those areas that are not used every day, nor are critical to the takeoff and landing of aircraft or on-airport businesses.

Priority 4- areas are those that can wait until all other areas are cleared and in some circumstances, might be serviced on subsequent days after a storm.

ASH has the following inventory of Snow Removal Equipment (SRE):

- 2007 624J John Deere Loader, 30,000 lbs. (SNOW 50)
- 1985 FG-85 Fiat Grader, 35,000 lbs. (SNOW 30)
- 1985 FR-15 Fiat Loader, 30,000 lbs.
- 1996 SL-150 Samsung Loader, 30,000 lbs. (SNOW 11)
- 1979 SMI Rotary Plow, 28,000 lbs. (SNOW 40)
- 1985 MP-3D Sno-Go Rotary Plow, Loader Mount, 7,500 lbs.
- 1988 75-C Michigan Loader, 32,000 lbs. (SNOW 12)
- 2011 MP-3D Sno-Go Rotary Plow, Loader Mount, 8,400 lbs.
- 2014 764HSD John Deere High Speed Dozer, 34,000 lbs. (SNOW 60)
- 1988 1954 International Dump Truck, 48,000 lbs. (SNOW 23)
- 2007 MB Pavement Broom, Loader Mount

[2] Nashua Airport Authority Snow and Ice Control Plan, 2016

- 2009 F350 Ford with Plow and Caster Spreader, 10,600 lbs.
- 2002 K-2500 Chevrolet Pickup with plow, 8,600 lbs.

2.5.4 AIRPORT MANAGEMENT

ASH is staffed with a full-time Airport Manager, Maintenance Supervisor, Airfield Technician, and an Office Manager/Bookkeeper. During the winter months (December-April) the Airport typically hires seasonal help to assist with snow removal activities. Similarly, during the summer months (June-September), part-time seasonal help is hired to assist with maintenance activities. While the Airport does not have a written maintenance plan, there is a mowing plan that is utilized to assist in communications with the ATCT (See Figure 2-13).

2.5.5 FUEL

There are two aboveground aviation fuel tanks at the Airport. They are identified on Figure 2-1 and Sheet 3 of the ALP, and further described as follows:

- One 20,000-gallon above ground tank for 100LL
- One 20,000-gallon above ground tank for Jet-A

Figure 2-14 Fuel Farm

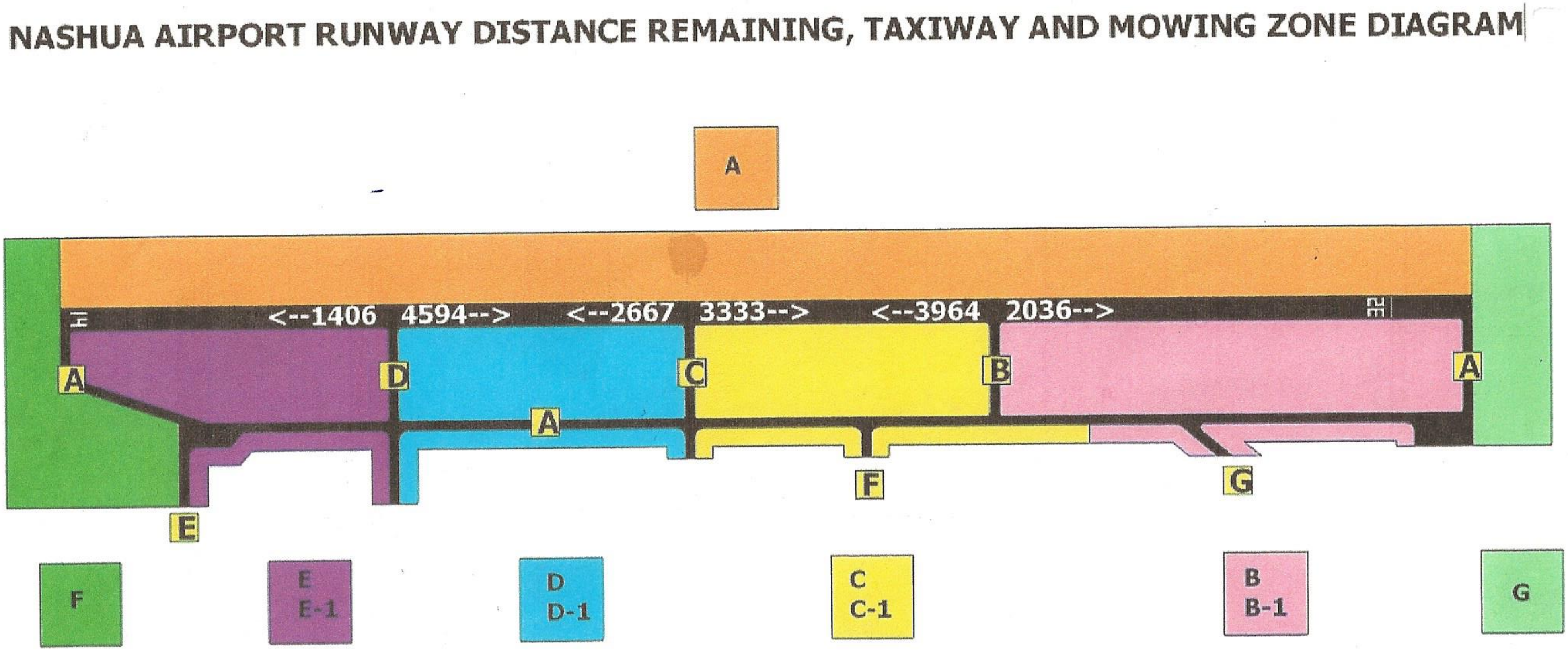
Both the 100 LL and Jet-A fuels are delivered to aircraft by fuel trucks. While the Airport owns the fuel tanks and charges a fuel flowage fee, the equipment and operations are privately owned by the FBOs.

2.5.6 FIXED BASED OPERATOR

A fixed based operator (FBO) is typically a private entity that leases land and/or buildings from the airport to provide various aeronautical services to based and itinerant aircraft. Currently, ASH has one full-service FBO with several “Independent Operators” that collectively provide and support the following services at the Airport:

- Aircraft fuel storage and dispensing;
- Aircraft ground handling, tie-down and hangars;
- Aircraft charter/flight instruction/sales;
- Aircraft maintenance (powerplant/frame); and
- Pilot amenities (i.e. flight planning, pilots lounge, courtesy car, and supplies).

Figure 2-13


NASHUA AIRPORT RUNWAY DISTANCE REMAINING, TAXIWAY AND MOWING ZONE DIAGRAM
A
14
<--1406 4594-->
<--2667 3333-->
<--3964 2036-->
32
A
D
C
B
A
A
F
G
E
F
E
E-1
D
D-1
C
C-1
B
B-1
G

CHAPTER 3 EXISITING ENVIRONMENTAL CONDITIONS AND SENSITIVE AREAS

This chapter provides an overview of the environmental conditions and sensitive areas that have been identified by previous studies and/or investigations at ASH. This information is an integral component to the master planning process as consideration of environmental factors is critical to the evaluation of airport development alternatives and understanding subsequent environmental permitting requirements.

FAA Orders 1050.1F *Environmental Impacts: Policies and Procedures* and 5050.4B *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* provide policy and procedures for compliance with the National Environmental Policy Act (NEPA), and requirements for airport actions pursuant to FAA authority. It is important to note that the environmental analysis included in this Master Plan Update is not a document intended to satisfy the need for formal NEPA analysis. Prior to the implementation of an action, the following list of applicable environmental impact categories outlined in FAA Order 1050.1F must be addressed:

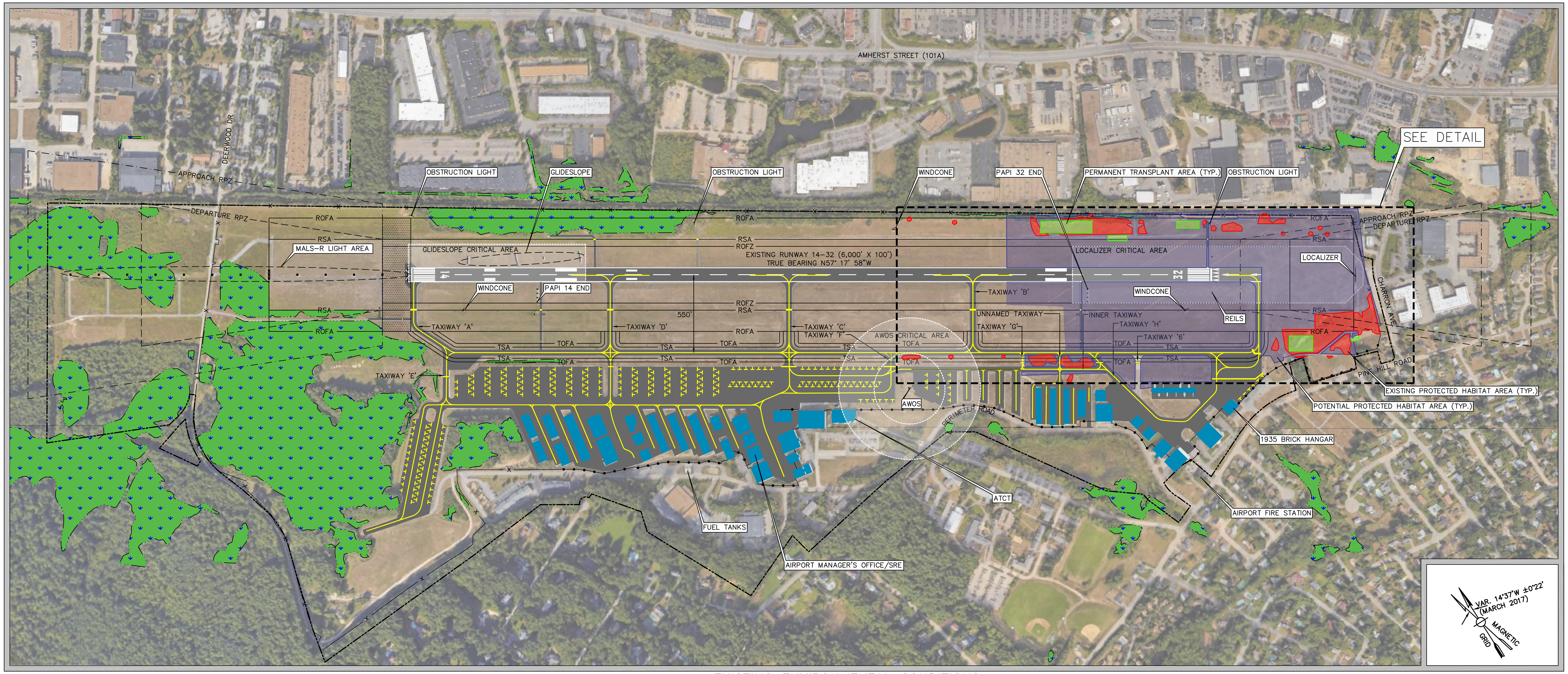
- Air Quality
- Biological resources (including fish, wildlife, and plants)
- Climate
- Coastal resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous materials, solid waste, and pollution prevention
- Historical, architectural, archeological, and cultural resources
- Land use
- Natural resources and energy supply
- Noise and compatible land use
- Socioeconomic, environmental justice, and children's environmental health and safety risks
- Visual effects (including light emissions)
- Water resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

3.1 EXISTING AND PREVIOUSLY IDENTIFIED ENVIRONMENTAL CONDITIONS

The most recent analysis of environmental impact categories occurred during the 2008 Environmental Assessment for the Runway 14-32 runway reconstruction project (AIP 3-33-0012-028-2007). This section focuses solely on the environmental impact categories that were identified as either occurring on airport property or in the vicinity of ASH during the 2008 Environmental Assessment. Where a particular environmental impact category was not affected by the Runway 14-32 reconstruction project, it is not discussed in this chapter.

3.1.1 BIOLOGICAL RESOURCES (INCLUDING FISH, WILDLIFE, AND PLANTS)

According to correspondence dated January 7, 2008, from the U.S. Department of the Interior, Fish and Wildlife Service, in Concord, NH, there were no Federally listed endangered or threatened species recorded as present in the project area at that time. (Appendix C).

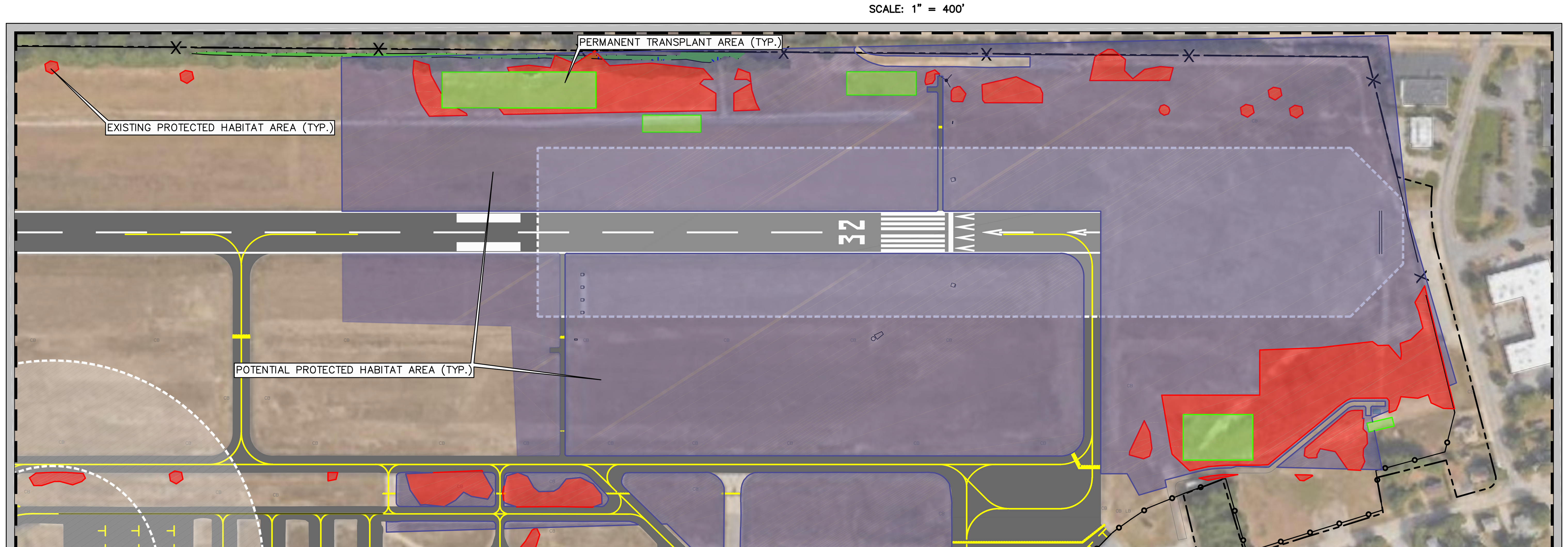


EXISTING ENVIRONMENTAL CONDITIONS

SCALE: 1" = 400'

NOTES:

1. THERE ARE TWO CRITICAL AREAS FOR THE AUTOMATED WEATHER OBSERVING SYSTEM (AWOS). THE WIND SENSOR ON THE AWOS HAS THE FOLLOWING REQUIREMENTS FOR CLEARANCE:
   A) 0–500 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE AT LEAST 15 FEET LOWER THAN THE SENSOR HEIGHT.
   B) 500–1,000 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE NO GREATER THAN 10 FEET ABOVE THE HEIGHT OF THE SENSOR.



DETAIL

SCALE: 1" = 200'

LEGEND

ITEM	(E) EXISTING
AIRPORT PROPERTY LINE	
RUNWAY SAFETY AREA (RSA)	RSA
TAXIWAY SAFETY AREA (TSA)	TSA
RUNWAY OBSTACLE FREE ZONE (ROFZ)	ROFZ
RUNWAY PROTECTION ZONE (RPZ)	RPZ
APPROACH RUNWAY PROTECTION ZONE	
DEPARTURE RUNWAY PROTECTION ZONE	
PRECISION OBSTACLE FREE ZONE	
RUNWAY OBJECT FREE AREA (ROFA)	ROFA
TAXIWAY OBJECT FREE AREA (TOFA)	TOFA
CRITICAL AREA	
WETLANDS	
BUILDINGS	
PAVEMENT	
8' CHAINLINK FENCE	
8' CHAINLINK FENCE WITH BARBWIRE	X
PERMANENT TRANSPLANT AREA	
EXISTING PROTECTED HABITAT AREA	
POTENTIAL PROTECTED HABITAT AREA	

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Boston Baltimore Orlando

PREPARED FOR:

Nashua Airport
BOIRE FIELD

PROJECT: AIRPORT MASTER PLAN UPDATE NHDOT NO. SBG-12-16-2016

OWNER: CITY OF NASHUA, NEW HAMPSHIRE AIRPORT AUTHORITY

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	777042
DESIGNED BY	DCQ
DRAWN BY	DCQ
CHECKED BY	NAI
DATE	DECEMBER, 2016

GRAPHIC SCALE

SCALE: AS SHOWN

SHEET TITLE

EXISTING ENVIRONMENTAL CONDITIONS (DRAFT)

DRAWING NO.

FIG.3-1

2 OF X

A database review was conducted on November 17, 2007 by the New Hampshire Natural Heritage Bureau's (NHNHB) *Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns 2007* for ASH, via the online DataCheck Tool of rare species or exemplary natural communities (Appendix D). NHNHB data indicated that three state-listed endangered or threatened species were known to be present on or in the vicinity of the Airport in 2007. (see Table 3-1):

- Northern blazing star (*Liatris scariosa var. novaeangliae)*- State Endangered
- Wild lupine (*Lupinus perennis)*- State Threatened
- Eastern hognose snake (*Heterodon platirhinos)*- State Threatened

One additional species was identified by GZA GeoEnvironmental (formerly Baystate Environmental Consultants) during their field review of rare species on the Airport prior to the runway reconstruction project in 2012 (Table 3-1).

- Bird's foot violet (*Viola pedata)*- State Threatened

In addition, three other species that are not currently listed but are tracked by NHNHB are located within the vicinity of the Airport, mainly in the area of Stump Pond approximately one mile north of the vegetation management activity areas highlighted in the 2008 Environmental Assessment. These species include (Table 3-1):

- Banded sunfish *(Enneacanthus obesus)*
- Spotted turtle *(Clemmys guttata)*
- Blanding's turtle (*Emydoidea blandingii)*

The NHNHB boundaries around known locations of these species are indicted on Figure 3-1.

Table 3-1: Endangered, Threatened or Tracked Species identified by NH Natural Heritage Bureau (NHNHB) or Baystate Environmental Consultants, Inc. (BEC) relevant to ASH

Species/Community	*Status*	*Habitat*	*Distance from known location at ASH*	*Potential Presence at ASH*	*Source*
Northern Blazing Star	E	Dry, open grassy, early-successional, nutrient poor, sandy soil	Present at ASH	Known to be present	NHNHB
Wild Lupine	T	Dry, sandy soil in open to partially shaded locations	500' from vegetation management	Moderate	NHNHB

Table 3-1: Endangered, Threatened or Tracked Species identified by NH Natural Heritage Bureau (NHNHB) or Baystate Environmental Consultants, Inc. (BEC) relevant to ASH (Continued)

Species/Community	*Status*	*Habitat*	*Distance from known location at ASH*	*Potential Presence at ASH*	*Source*
Eastern Hognose Snake	T	Dry, sandy soils in open fields, river valleys, pine forest and upland hillsides near wetlands or vernal pools	1.5± mile from vegetation management	Moderate	NHNHB
Bird's Foot Violet*	T	*Well drained, sandy soil in open, unshaded locations*	*Present at ASH*	*Known to be present*	*GZA*
Blanding's Turtle	R	*Lakes, ponds, creeks, wet meadows, vernal pools with soft substrates and abundant vegetation*	*Present at ASH*	*Known to be present*	*NHNHB*
Spotted Turtle	R	*Shallow wetlands including swamps, bogs, fens, wet pastures, marshes, pond edges, and small woodland streams*	*1± mile*	*Moderate*	*NHNHB*
Banded Sunfish	R	*Small ponds, backwaters of creeks to small rivers and boggy brooks*	*1± mile*	*Low*	*NHNHB*
	E= Endangered, T= Threatened, R= Tracked by NHNHB, but not listed				
	**Was not identified as being on site by NHNHB, but observed by GZA*				

3.1.1.1 Potential for Rare Species to Occur

A field review of relevant habitat characteristics present at the Airport was conducted by GZA GeoEnvironmental's biologists in November 2007, and the following outlines the potential for the rare species to be found on the Airport.

3.1.1.2 State Listed Species

Northern Blazing Star: The 2007 review of the NHNHB database revealed a population of northern blazing star on the southern portion of the Airport. Based on the report, 401 stems were counted in 2006. During reconstruction of Runway 14-32, this habitat was fenced off during construction (see Figure 3-1) and remains undisturbed today.

Figure 3- 2 Northern Blazing Star

Wild Lupine: The 2007 review of the NHNHB database revealed a population of wild lupine along the railroad tracks to the north of the runway. During the reconstruction of Runway 14-32, 573 plants were transplanted with a 3-inch diameter tree spade (see Figure 3-1).

Figure 3-3 Wild Lupine

Eastern Hognose Snake: The 2007 review of the NHNHB database documented hognose snakes to be present in a grassy area bordering woods near Stump Pond (2± miles from the Airport). In general, the sandy soiled, forested wetlands and grasslands of the Airport are moderately suitable for eastern hognose snakes; however, the closest known location documented of the species is 1.5± miles from the Airport.

Figure 3-4 Eastern Hognose Snake

Bird's Foot Violet: The November 2007 field review confirmed the presence of Bird's Foot Violet in several patches of grassland along the parallel taxiway at the southern end of the Airport, as well as just east of the southern end of the runway. Implementation of the runway reconstruction project was expected to disturb this species. As a result, working with NHNHB, mitigation efforts to transplant individuals of this species to other portions of the airfield exhibiting suitable soils and conditions occurred. The location of this mitigation area is shown on Figure 3-1.

Figure 3-5 Bird's Foot Violet

3.1.1.3 State Tracked Species

Blanding's Turtle: The presence of Blanding's turtle in and near Stump Pond, approximately 2± miles northwest of the Airport, has been documented. There is also a mapped point for the species on Airport property in the thin strip of wetland along the forest edge, north of the Runway 14 end. As part of mitigation during the reconstruction of Runway 14-32, turtle barriers were implemented during construction to keep any of these turtles from entering the construction area.

Figure 3-6 Blanding's Turtle

Spotted Turtle: The 2007 review of the NHNHB database found spotted turtles to be present at Stump Pond located to the west of the Runway 14 end, and at a location approximately 2± miles southwest of the Runway 14 end in the Pennichuck Brook wetland system. Given the species' presence in the expansive wetland system to the west and south of the Airport, the species may potentially be found in the wet depressions on the Airport. During the reconstruction of Runway 14-32, turtle barriers were implemented.

Figure 3-7 Spotted Turtle

Banded Sunfish: The review of the NHNHB database revealed a relatively abundant population of at least 100 individuals in Stump Pond in 1998 (Appendix D). Stump Pond is approximately one mile northwest of the Airport. A specimen was also collected in Pennichuck Brook in 1948. It is extremely unlikely that the wet depressions or the wetlands at the airport could support a population of this species. The wet depressions lack the depth and vegetation required for this species to occur. There is no potential habitat for this species at the Airport.

Figure 3-8 Banded Sunfish

3.1.2 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Historical, architectural, archaeological, and cultural resources encompass a range of sites, properties, and physical resources relating to human activities, society, and cultural institutions. Such resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, structures, objects, and districts, which are considered important to a culture or community. Historical, architectural, archaeological, and cultural resources also include aspects of the physical environment, namely natural features and biota, that are a part of traditional ways of life and practices and are associated with community values and institutions.

In April 2008, as part of the Airport's Environmental Assessment, UMass Archaeological Services conducted a literature review and walkover survey of ASH as part of a Phase 1A Archaeological Assessment Survey. The survey found low sensitivity for archaeological and historical resources at ASH and concluded that the proposed action (Runway and Taxiway Relocation and Expansion Project) was unlikely to affect significant archaeological resources. The Archaeological Assessment Report found that no additional survey or testing was recommended prior to the implementation of the runway reconstruction. On December 2, 2008, the New Hampshire Division of Historical Resources (NHDHR) accepted the findings of the report and concurred with its recommendations (see Appendix E).

In 2013, following the reconstruction of Runway 14-32, as part of mitigation for the runway project, and as requested by the NHDHR, Archaeological and Historical Services, Inc. completed a NHDHR Historic District Area Inventory for ASH. The Area Inventory Form documented the historical development of ASH and included aerial photos of the existing runway configuration, and photos depicting the relationship of the existing runway configuration to ASH's historic buildings/structures. The boundary of the Historic District Form included all of the property administered by the NAA between Perimeter Road on the south and the former Boston and Maine railroad line on the north. In addition, a parcel at the corner of Pine Hill Road and Perimeter Road, owned by the City of Nashua was included because of its close association with the airport. The parcel, 101 Pine Hill Road, includes the Airport Fire Station (built in 1961) and Memorial Park at the entrance to the airport (constructed in 2005).

Two of the buildings included in this study are more than 50 years old, the 1935 brick hangar at 97 Pine Hill Road and the 1961 Airport Fire Station at 101 Pine Hill Road (Figure 3-1). However, as a whole, the historian determined that the "airport lacks sufficient integrity to convey its significance as an early artifact of New Hampshire's aviation history, nor does its current physical condition call to mind its identity as a work-relief project of the 1930s."[1] The historian did recommend that the 1935 hangar, together with its associated ca. 1940 beacon, be "considered as an individually eligible historic resource that readily conveys its significance as an early aviation facility and as a product of 1930s work-relief efforts."[2]

3.1.3 LAND USE

As outlined in the City of Nashua's Land Use Code "Any publicly owned airport or privately-owned airport licensed for commercial operations, existing or which may be developed, shall have an airport approach plan prepared by the New Hampshire Aeronautics Commission in accordance with RSA 424 as last amended. The airport approach plan for Boire Field, adopted by the New Hampshire Aeronautics Commission February 12, 1968, is hereby declared to be part of this section"[3] (see Appendix F).

Increased aircraft activity at ASH has resulted in the need for special zoning restrictions for uses subject to the most recently adopted Part 150 Noise Compatibility Plan prepared for ASH. To avoid land use conflicts with uses that may be incompatible with noise levels generated at the Airport, the regulations of the Noise Overlay District provide for the exclusion of certain land uses, and for soundproofing to be required in the construction of other uses which may be compatible if mitigating action is taken to reduce noise interference with the use.

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[1] AHS, Inc. New Hampshire Division of Historic Resources Area Form, 2013

[2] AHS, Inc. New Hampshire Division of Historic Resources Area Form, 2013

[3] City of Nashua, Land Use Code (NRO'S- Chapter 190)

The Airport property is surrounded by a mix of commercial, industrial and residential uses. To the south and east of the Runway 32 end is largely a mix of commercial and industrial properties. To the southwest of the Airport are residential neighborhoods, while to the north and west of the Airport lies a large open space watershed area owned by the City of Nashua. North and east of the Airport lies additional commercial and retail land uses long Amherst Street (see Figure 3-9).

3.1.4 WATER RESOURCES (INCLUDING WETLANDS, FLOODPLAINS, SURFACE WATERS, GROUNDWATER, AND WILD AND SCENIC RIVERS)

3.1.4.1 Wetlands

During the 2008 Environmental Assessment for the runway reconstruction project, wetlands were delineated by wetland scientists and evaluated relative to the functions and values of the resources. As part of the runway reconstruction project, ASH received an approved Dredge and Fill application through the New Hampshire of Environmental Services (NHDES) to fill 11.63 acres (506,605 sq. ft.) of predominately palustrine wetlands. The remaining wetlands that exist today are shown on Figure 3-1.

3.1.4.2 Floodplain

According to the 1994 Environmental Assessment, "An examination of floodplain maps for the City of Nashua has established that neither the Airport, nor the Holden Property are located in, or are immediately adjacent to the designated floodplain." [4] The 1998 Environmental Assessment states "The only designated 100-Year flood boundary within the Airport property is in the vicinity of the Spectacle Brook wetlands, south of the existing runway" [5] and across the airfield from Perimeter Road. Therefore, due to the location, design and construction of a new stormwater management system to accompany the relocated runway and taxiway, there were no impacts to any regulated floodplain as a result of that project.

3.1.4.3 Surface Waters

The Airport property contributes to two separate watersheds and brooks:

1. Spectacle Brook, located to the southwest of the airfield; and
2. Pennichuck Brook, located to the north of the airfield.

In general, surface water from the Airport is transported through man-made and natural vegetated swales to either underground culvert pipes or infiltration-type catch basins. The western-most area of the Airport drains indirectly to a wetland area near the Runway 14 end of the Airport's parallel taxiway. The remaining stormwater flows are directed through vegetated swales and drainage pipes to Spectacle Brook and its associated wetlands.

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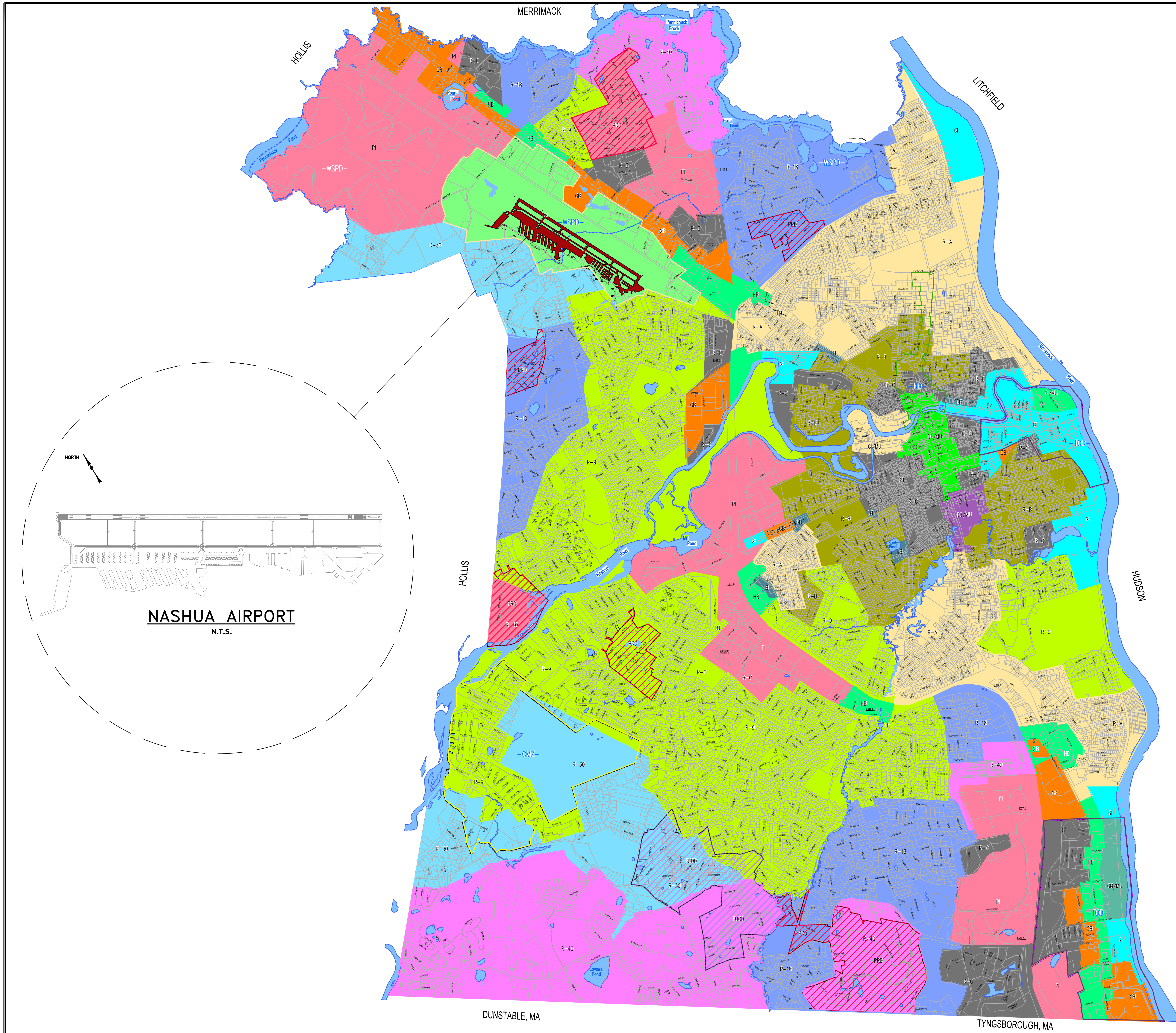
[4] Nashua Municipal Airport, Holden Property, Acquisition, Environmental Assessment, prepared for The Nashua Airport Authority, 1994, Prepared by: Dubois & King, Inc., 100 Perimeter Road, Nashua, New Hampshire

[5] Nashua Municipal Airport, Environmental Assessment for Runway 14-32 Relocation and Reconstruction, 1998, Prepared by: Gale Associates, Inc.



VAR. 14°37'W ±0°22' (MARCH 2017)
GRID
MAGNETIC

LEGEND

ZONING DISTRICT	
	GENERAL BUS / MIXED USE
	D1/MU DOWNTOWN 1 /MIXED USE
	D3/MU DOWNTOWN 3 / MIXED USE
	GI/MU GENERAL INDUSTRIAL / MIXED USE
	R–40 RURAL RESIDENCE
	R–30 A SUBURBAN RESIDENCE
	R–18 B SUBURBAN RESIDENCE
	R–9 C SUBURBAN RESIDENCE
	R–A A URBAN RESIDENCE
	R–B B URBAN RESIDENCE
	R–C C URBAN RESIDENCE
	LB LOCAL BUSINESS
	GB GENERAL BUSINESS
	D–1 DOWNTOWN 1
	D–3 DOWNTOWN 3
	HB HIGHWAY BUSINESS
	PI PARK INDUSTRIAL
	GI GENERAL INDUSTRIAL
	AI AIRPORT INDUSTRIAL
	HISTORIC DISTRICT
	FUOD FLEXIBLE USE OVERLAY DISTRICT
	FHL– GMZ DISTRICT FOUR HILLS LANDFILL GROUNDWATER MANAGEMENT ZONE
	TRANSIT ORIENTED DISTRICT
	WATER SUPPLY PROTECTION DISTRICT
	PRD PLANNED RESIDENTIAL DEV

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PREPARED FOR:

Nashua Airport
BOIRE FIELD

PROJECT: OFF AIRPORT LAND USE DRAWING

OWNER: CITY OF NASHUA, NEW HAMPSHIRE AIRPORT AUTHORITY

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	777042
DESIGNED BY	
DRAWN BY	
CHECKED BY	
DATE	DECEMBER, 2016

GRAPHIC SCALE
0 1000 2000 3000

SHEET TITLE

DRAWING NO.

FIG.3–9

OF X

Almost all developed portions of the airfield, to the south of Deerwood Drive, drain to Spectacle Pond and Spectacle Brook, located southwest of the airfield between Perimeter Road and University Drive. Areas to the north of Deerwood Drive drain to the northwest, leading ultimately to the Pennichuck River via either an intermittent stream flowing to Muddy Brook, upgradient of Pennichuck Pond, or an intermittent stream flowing to the Pennichuck Brook below the outlet of the pond.

3.1.4.4 Wild and Scenic Rivers

There are no wild and scenic rivers in the project area.

CHAPTER 4 FORECAST OF AVIATION DEMAND AND CAPACITY

In order to identify Airport facility needs during the planning period, it is necessary to accurately depict the current aviation use of the Airport, and to project future aviation demand levels. This chapter summarizes current aircraft usage at the Airport, and will document the projected aviation demand for the Airport during the 20-year planning period of this Study.

The forecasts presented in this chapter provide short-term, mid-term, and long-term projections for the years 2022, 2027, and 2037. These represent the 5-, 10-, and 20-year estimates of aviation activity at ASH. It is important, however, to view the projections independently of specific years and to consider the actual growth of activity as the impetus that influences the need for future airport facilities. Similarly, slower than projected growth may warrant deferment of planned improvements. Actual growth activity should be periodically (i.e. annually) compared to projected growth so scheduled corrections can be identified and implemented.

4.1 OVERVIEW OF AVIATION FORECASTS

The objective of forecasting an airport's activity is to identify the factors that influence aviation demand so that future infrastructure and facility needs can be determined. The FAA's Terminal Area Forecast[1] (TAF) is the standard benchmark of an airport's future activity and serves as the basis for FAA planning. Therefore, this forecast uses the most recent TAF (2016-2045) as a starting point for analysis. In addition to the TAF, FAA Aerospace Forecasts[2], air traffic control (tower) counts, historic airport reports, and the New Hampshire State Airport System Plan (NHSASP) will be reviewed and analyzed to further compliment the TAF.

Forecasting aviation activity serves two primary purposes in the development of this Master Plan. Specifically, forecasts provide the basis for:

- Determining the necessary capacity of the airfield and terminal area; and
- Identifying the future facilities required to support demand, including determining the size and implementation, thereof.

The demand for aviation facilities is typically expressed in terms of based aircraft and aircraft operations. Preparation of aviation activity forecasts is essential in assessing the needs and requirements for future aviation development. ASH's aviation forecasts serve as an overall planning guide for identifying airport capacity needs and for the basis of preparing airport alternatives. This forecast consists of layers of information that build upon each other to provide a sound foundation to support final conclusions. These layers include:

- Defining the various forecasting methodologies to be employed;

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[1] FAA Terminal Area Forecasts (https://www.faa.gov/data_research/aviation/taf/)

[2] FAA Aerospace Forecasts (https://www.faa.gov/data_research/aviation/aerospace_forecasts/)

- Historical aviation data upon which forecasting methods rely;
- Analysis of the validity of the forecast;
- Identification and analysis of unique local factors that could affect the forecasts; and
- Provision of a summary of the forecasts findings.

Once the aviation forecasts are complete, relationship between aviation demand, airfield capacity, and facilities can be established. This will be done in the next chapter, *Chapter 5, Facility Requirements.*

The following terms are often used in airport forecasts, and their meanings are often confused with each other even though they are quite different. For clarification, the meaning of each of these terms is presented below.

Based Aircraft- this term refers to where an airplane makes its home or, in the case of ASH, an aircraft whose "home" is at the Airport.

Transient Aircraft- this term refers to an airplane whose "home" is at an airport other than the airport for which the forecast is being produced. In other words, any aircraft that uses ASH, but whose home base is at another airport is a transient aircraft.

Local Operation- a local operation is one where an aircraft operates within 20 nautical miles of the airport for which the forecast is prepared. A local operation can be performed by either a based or transient aircraft.

Itinerant Operation- an itinerant operation is one where an aircraft operates at a greater distance than 20 nautical miles of the airport for which the forecast is prepared. Again, an itinerant operation can be performed by either a based or a transient aircraft.

4.1.1 TERMINAL AREA FORECASTS (TAF)

The TAF represents the FAA's forecast of aviation activity for U.S. airports and provides a summary of historical and forecast statistics on passenger demand and aviation activity. The TAF is prepared to meet the budget and planning needs of the FAA and provide information for use by state and local authorities, the aviation industry, and the public. Forecasts of itinerant general aviation operations and local civil operations at FAA facilities are based primarily on time series analysis. Because military operations forecasts have national security implications, the Department of Defense provides only limited information on future aviation activity. Hence, the TAF projects military activity at its present level except when FAA has specific knowledge of a change. For non- FAA facilities, historic operations in the TAF are taken from Form 5010 (Master Airport Record) data. These operation levels are held constant for the forecast unless otherwise specified by a local or regional FAA official.

4.1.2 FAA AEROSPACE FORECAST

The second set FAA forecasts consulted were the FAA Aerospace Forecasts, FY 2017-2037. The Aerospace Forecast provides an overview of aviation industry trends and expected growth for the commercial passenger carrier, cargo carriers, and general aviation activity sectors. National growth rates in enplanements, operations, fleet growth, and fleet mix for the general aviation fleet are provided over a 20-year forecast horizon.

In its review of 2016, the Aerospace Forecast highlights that the general aviation industry recorded a small decline in deliveries in 2016, with only the business jet segment seeing a year over year increase. General aviation activity at FAA contract tower airports recorded a 0.2 percent decline in 2016 as local activity fell 0.5 percent, more than offsetting a 0.1 percent increase in itinerant operations.

According to the 2017-2037 Aerospace forecast, the long-term outlook for general aviation is stable to optimistic. The active general aviation fleet is forecast to increase 0.1 percent a year between 2016 and 2037, resulting in an increase in the fleet of about 3,400 units. The Forecast expects continued growth of the turbine and rotorcraft fleets, but the largest segment of the fleet, fixed wing piston aircraft, to decrease over the forecast.

4.1.3 NEW HAMPSHIRE STATE AIRPORT SYSTEM PLAN (NHSASP)

In 2015, the NHDOT updated its NHSASP which serves as a guide to maintain and develop the system of airports in New Hampshire. The System Plan provides the state with the resources to monitor the ability of the airports to meet performance measures identified through the aviation system planning process. A major component of the System Plan is the projection of aviation demand at both the local and state levels, which will assist in determining which airports should be earmarked for an upgrade in their roles.

4.2 AIRPORT SERVICE AREA

Defining ASH's service area is an important component in estimating future aviation demand. The service area for airports is heavily influenced by a number of factors, including but not limited to:

- Proximity of an airport to an aircraft owner's home or business;
- Level of convenience, services, and capabilities available at the airport;
- Level of convenience, services, and capabilities available at competing airports; and
- Population and economic characteristics from which the airport draws its users, both existing and potential.

In an effort to define ASH's service area, this report relies on the home address of each based-aircraft owner. Based on the proximity of the home address of each based-aircraft owner, the service area was divided into two categories (see Figure 4-1): 1) Primary Service Area- those within 15 miles of ASH; and 2) Secondary Service Area- those outside 15 miles but within 25 miles of ASH. Using this methodology, approximately 78 percent of based-aircraft owners are located within 15 miles of ASH; 14 percent are located within 25 miles; and 8 percent are located beyond 25 miles of ASH.

Within the Primary, and Secondary Service Areas, the following public-use airports exist:

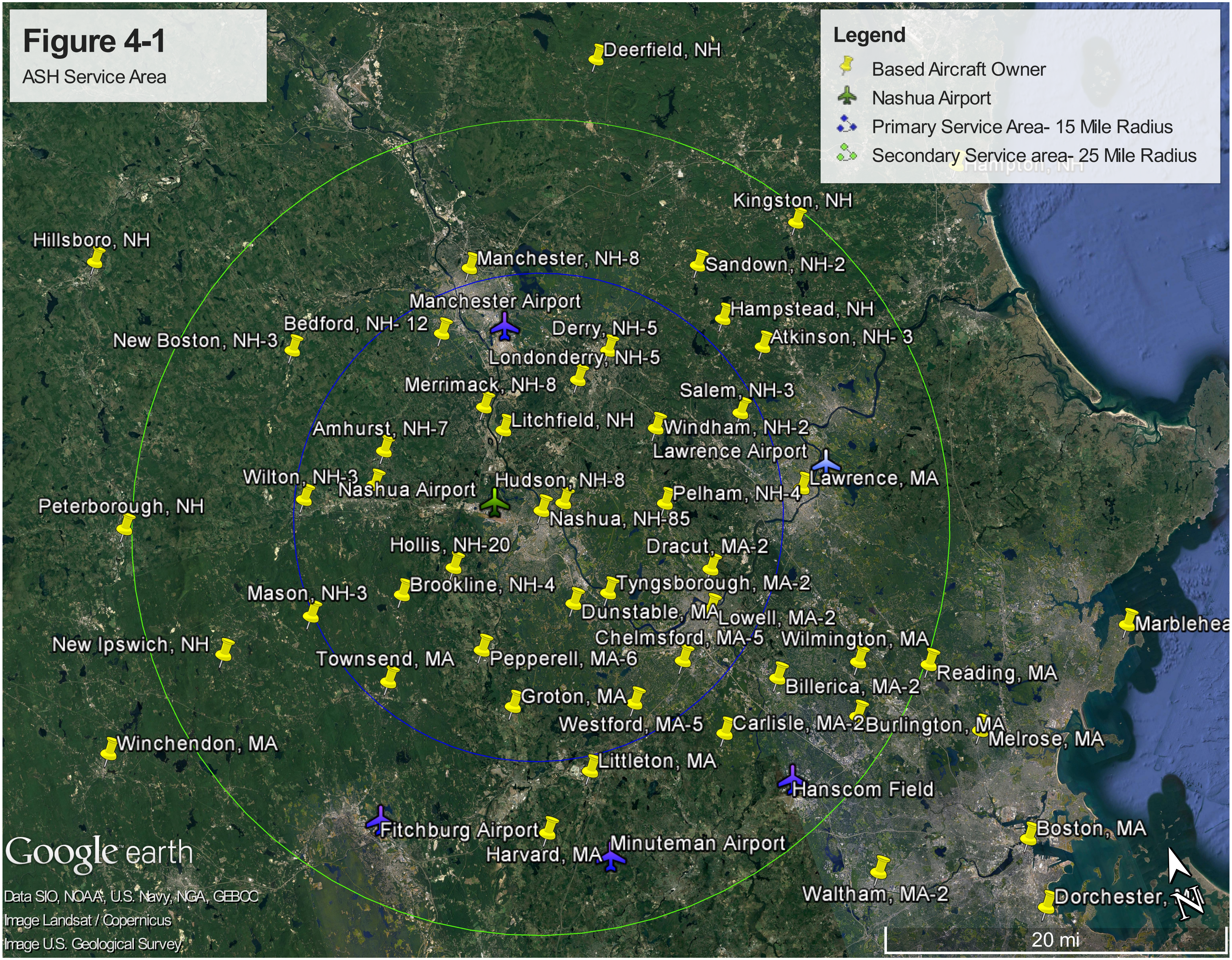


Figure 4-1
ASH Service Area

Primary Service Area

- Manchester-Boston Regional Airport (MHT)- has two runways, 17-35 (9,250' x 150') and 06-24 (7,651' x 150'), and offers numerous facilities for general aviation (GA) aircraft and operators, including full FBO services, conventional and T-hangars, apron tie-down space, and automobile parking areas.

Secondary Service Area

- Fitchburg Municipal Airport (FIT)- has two runways: Runway 14-32 (4,510' x 100'), and Runway 02-20 (3,504' x 75'). FIT offers numerous facilities for GA aircraft and operators, including full FBO services, conventional and T-hangars, apron tie-down space, and automobile parking. FIT primarily serves smaller aircraft but can also accommodate some larger aircraft with wing spans of less than 79 feet.
- Hanscom Field (BED)- is served by two runways: Runway 11-29 (7,011' x 150'), and Runway 05-23 (5,107 x 150'). BED offers numerous facilities for GA aircraft and operators, including full FBO services, conventional and T-hangars, apron-tie down space, and automobile parking. BED serves as a corporate reliever for Boston Logan International Airport.
- Lawrence Municipal Airport (LWM)- is served by two runways: Runway 05-23 (5,001' x 150'), and Runway 14-32 (3,900' x 100'). LWM offers numerous facilities for GA aircraft and operators, including full FBO services, conventional hangars and T-hangars, apron-tie down space, and automobile parking. LWM can accommodate a full range of aircraft, including small to medium size jets.

4.3 SOCIOECONOMIC TRENDS

While ASH's service area extends into portions of Rockingham and Merrimack counties in New Hampshire and Worcester, Middlesex, and Essex counties in Massachusetts, the overwhelming majority of based-aircraft owners reside in Hillsborough county, New Hampshire. For purposes of this section, the socioeconomic trends affecting aviation demand at ASH (population, age, income, and employment) will rely on information gathered for Hillsborough county which will then be compared against state and national trends.

4.3.1 HISTORICAL POPULATION

Historical population growth from 2000-2016 was reviewed on a county, state, and national level. As derived from the U.S. decennial census data collected in 2000 and 2010, Hillsborough County experienced an increase in population of 5.3 percent. During the same period, the state of New Hampshire experienced a 6.6 percent increase, while the U.S. experienced a 9.9 percent increase. The U.S. Census estimates that during the period of 2010-2016, Hillsborough county experienced relatively slow growth with an average annual growth rate (AAGR) of 0.28 percent, while New Hampshire and the U.S. experienced an AAGR of 0.23 percent, and 0.73 percent, respectively (see Table 4-1).

Table 4-1 Historic Population Growth (2010-2016)

Year	Hillsborough County	AAGR%	New Hampshire	AAGR%	United States	AAGR%
2010	401,039		1,316,872		309,348,193	
2011	401,774	0.18	1,318,473	0.12	311,663,358	0.75
2012	402,651	0.22	1,321,182	0.21	313,998,379	0.75
2013	403,308	0.16	1,322,687	0.11	316,204,908	0.70
2014	405,003	0.42	1,328,743	0.46	318,563,456	0.75
2015	406,015	0.25	1,330,111	0.10	320,896,618	0.73
2016	407,761	0.43	1,334,795	0.35	323,127,513	0.70
AAGR		**0.28**		**0.23**		**0.73**

Source: United States Census Bureau

Population growth during the period from 2020-2035 for Hillsborough County is projected to grow by 4.9 percent. During the same period, New Hampshire and the U.S. are projected to experience a 5.4 percent and 11 percent growth. These data are presented in Table 4-2 below.

Table 4-2 Projected Population Growth (2020-2035)

Year	Hillsborough County	New Hampshire	United States
2020	409,478	1,349,908	334,503,000
2025	416,445	1,374,702	347,335,000
2030	424,492	1,402,878	359,402,000
2035	429,538	1,422,530	370,338,000

Source: NH Office of Energy and Planning

4.3.1.1 Median Age of Total Population

According to the New Hampshire Center for Public Studies, by 2030, nearly half a million of the state of New Hampshire's residents will be over the age of 65 and will account for nearly one-third of the total population. During the next 20 years, the fastest-growing age group will be those aged 70-74, but there will also be significant growth in the number of people aged 75 and over. By contrast, the number of people aged 20-34 is expected to decrease.

According to the U.S. Census Bureau, New Hampshire has the third highest median age of the total population in the U.S. As shown in Table 4-3 below, since 2010 median age for Hillsborough County has been increasing at an AAGR 0.8 percent compared to New Hampshire at 0.9 percent and U.S at 0.4 percent. This sector has the potential to affect ASH as pilots are retiring at a rate higher than the rate at which student pilots are beginning to fly and become certified.

Table 4-3 Median Age of the Total Population

Year	*Hillsborough County*	*New Hampshire*	*U.S.*
2010	38.5	40.3	36.9
2011	38.9	*40.7*	37.0
2012	39.2	*41.1*	37.2
2013	39.5	*41.5*	37.3
2014	39.9	*41.8*	37.4
2015	40.1	*42.2*	37.6
AAGR	**0.8%**	**0.9%**	**0.4%**

Source: United States Census Bureau

4.3.2 PER CAPITA PERSONAL INCOME AND WAGES

Per Capita Income (PCI) data provides a measure of the income of a particular region. Generally, higher income leads to higher potential for participation in GA activity. Per Capita Personal Income (historic) data on a county, statewide, and national basis was obtained from the Bureau of Economic Analysis.

The historical trend of PCI from 2005-2015 indicated relatively steady growth throughout the 10-year period. For Hillsborough County, the PCPI grew at an AAGR of 3.1 percent during this period. At the same time, New Hampshire and the U.S. experienced an AAGR of 3.2 percent, and 3.0 percent respectively (see Table 4-4).

Table 4-4 Per Capita Personal Income (2005-2015)

Year	*Hillsborough County*	*New Hampshire*	*United States*
2005	42,327	40,922	35,904
2006	44,576	43,763	38,144
2007	46,802	45,199	39,821
2008	47,871	46,365	41,082
2009	47,096	45,742	39,376
2010	47,795	47,154	40,277
2011	50,766	49,562	42,453
2012	53,524	51,826	44,267
2013	53,124	51,609	44,462
2014	54,578	53,629	46,414
2015	57,180	55,905	48,122
AAGR	**3.1%**	**3.2%**	**3.0%**

Source: Bureau of Economic Analysis

4.3.2.1 Median Household Income

From 2000-2010, Hillsborough County experienced a 30 percent increase in median household income from $53,384 to $69,321. During the same period, the state of New Hampshire and nation experienced increases of 28 percent and 24 percent, respectively. However, during the period from 2010-2015, Hillsborough County has remained generally flat experiencing an AAGR of 0.6 percent with New Hampshire and the nation experiencing an AAGR of 1.1 percent and 0.8 percent as shown in Table 4-5 below. This sector has the potential to affect ASH as the cost of obtaining a pilot's license varies widely depending on a number of factors such as location, type of airplane, flight school, etc.

Table 4-5 Median Household Income (dollars) 2010-2015

Year	Hillsborough County	New Hampshire	U.S.
2010	69,321	63,227	51,914
2011	70,591	64,664	52,762
2012	70,472	64,925	53,046
2013	69,829	64,916	53,046
2014	70,906	65,986	53,482
2015	71,244	66,779	53,889
AAGR	**0.6%**	**1.1%**	**0.8%**

Source: United States Census Bureau

4.3.2.2 Unemployment

This section reviews the historic unemployment rates in the region as compared to the State of New Hampshire and the U.S. As illustrated in Table 4-6, Hillsborough County has fared much better than the United States but has a slight higher percentage of unemployment as comparted to New Hampshire. However, the higher percent of unemployment in Hillsborough County compared to the State is likely the result of Hillsborough County housing the largest population in the state as of the 2010 U.S. Census. Similar to median house income, this sector has the potential to affect ASH as lower levels of unemployment indicate better economic conditions for businesses. In turn, this can potentially lead to an increase in aviation demand, and/or potential for pilots being able to financially support their flying activities.

Table 4-6 Percent of Population Unemployed (16 years and older)

Year	*Hillsborough County*	*New Hampshire*	*U.S.*
2000	2.5	2.7	3.7
2010	4.4	4.1	5.1
2011	4.8	4.4	5.6
2012	4.9	4.6	6.0
2013	5.3	4.8	6.2
2014	4.8	4.4	5.8
2015	4.2	3.9	5.2
AAGR	**4.7%**	**4.3%**	**5.6%**

Source: U.S. Census Bureau

4.3.3 SOCIOECONOMIC CONDITIONS SUMMARY

General aviation airports are influenced by a number of local factors including, but not limited to population, age, income, and unemployment. The previous sections reviewed these sectors of Hillsborough County and compared them to the State of New Hampshire and the United States.

With respect to population, Hillsborough County is expected to grow relatively slowly over the next 15-years experiencing a 4.9 percent increase in population from 2020-2035. Both the State of New Hampshire and the United States are projected to outpace Hillsborough County with increases of 5.4 percent and 11 percent, respectively. Additionally, it is important to note that New Hampshire is the third oldest state in the country when comparing median age against total population at 42.2 years old[3]. Hillsborough County, much like the State of New Hampshire, has generally experienced a similar growth in aging population as previously illustrated in Table 4-3, which is outpacing the United States.

Economically, Hillsborough County has experienced growth in per capita income similar to that of New Hampshire and the United States as illustrated in Table 4-4. According to the U.S. Bureau of Economic Analysis[4], in 2015 the State of New Hampshire experienced a 4.2 percent growth in state personal income, which ranked 20th in the United States. At the local level, Hillsborough County experienced a slightly higher increase with 4.8 percent.

After reviewing the socioeconomic conditions, it appears from the analysis that there are no demographic factors or other local unique circumstances that suggest an unusual or greater than average growth in the region.

[3] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

[4] https://www.bea.gov/newsreleases/regional/spi/2016/pdf/spi0316b_fax.pdf

4.4 HISTORIC AVIATION DATA

This section presents the historical aviation statistics for ASH, including based aircraft and annual operations. This information will be used to help identify and evaluate factors that influence aviation demand, which in turn will be used to determine forecasts of future aviation activity.

4.4.1 ASH BASED AIRCRAFT

Prior to 2009, and the integration of FAA's National Based Aircraft Inventory Program, airport managers were responsible for counting the number of based aircraft and reporting totals to the FAA and state inspectors. These totals would then appear on the airport's master record form, also known as the "5010." At the time, little guidance was provided on how the based aircraft counts should be determined, and there was no method of validating the counts. As a result, based aircraft counts were often unreliable and duplicated.

The FAA defines based aircraft as an aircraft that is operational and airworthy, which is typically based at the facility in question for a majority of the year. Based aircraft categories include single-engine piston, multi-engine piston, jet, and rotorcraft.

According to the New Hampshire Aeronautics Act, Section 422:22 paragraph IV, "Rental of a hangar space, tie down, or other means of storage in this state by a nonresident for more than 90 days cumulatively each registration year shall create a rebuttable presumption that such aircraft must be registered in this state."[5]

Based aircraft are major economic contributors to the airport. They help generate revenues from tie-down fees, hangar leases, fuel sales, and maintenance. Based aircraft forecasts are used to evaluate the size of the ramp, tie-down, and hangar areas.

As previously mentioned, the vast majority of aircraft based at the airport are owned by individuals residing in roughly a 25-mile radius of the airport. According to the 2016 FAA Terminal Area Forecast (TAF) for ASH, the number of based aircraft at the Airport in 2016 was 249. Table 4-7 below presents a comparison of based aircraft over the past 10 years at ASH.

[5] http://www.gencourt.state.nh.us/rsa/html/XXXIX/422/422-22.htm

Table 4-7 Based Aircraft History

Year	*NHDOT Based Aircraft Count*	*AAGR%*	*TAF Based Aircraft Count*	*AAGR%*
2007	314		441	
2008	303	-3.5	364	-17.5
2009	287	-5.3	372	2.2
2010	292	1.7	333	-10.5
2011	290	-0.7	317	-4.8
2012	271	-6.6	294	-7.3
2013	259	-4.4	234	-20.4
2014	237	-8.5	253	8.1
2015	232	-2.1	243	-4.0
2016	218	-6.0	249	2.5
	AACGR	**-3.9**		**-5.7**

Source: NHDOT, FAA TAF 2016

The significant decline in based aircraft at ASH from 2007-2013 is likely attributed to several factors. First, from 2007-2009, the Unites States experienced a *Great Recession,* which marked the longest recession since World War II. The *Great Recession* had a resounding impact on the GA industry as the United States GA inventory declined from 231,606 aircraft in 2007 to approximately 200,000 aircraft in 2013[6].

Secondly, and most unique to ASH was the closing of Daniel Webster College. In 2010, the flight program was phased out, and the college stopped accepting new flight students, while allowing students currently enrolled in the program to complete their education by 2013.

Lastly, a contributing factor in the decline of based aircraft at ASH, more precisely from 2011-2013 may be attributed to the runway reconstruction project that occurred over two calendar years from November of 2011 through September of 2013. During this time, the original runway (Runway 14-32) was replaced by a new 6,000-foot runway 300 feet northeast of the original location.

4.4.2 REGIONAL BASED AIRCRAFT

According to the FAA TAF, the FAA New England Region experienced a slight average annual decrease in based aircraft growth from 2006-2016. The FAA New England Region includes the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

According to the NH State Airport System Plan, from 2004 to 2013, the New England Region experienced a 17 percent decline in based aircraft while New Hampshire saw a 15.5 percent decline. The General Aviation survey data used to produce the national FAA Aerospace Forecasts indicates that between 2010 and 2012 the number of active GA registered aircraft went down by 6.4 percent, from 223,370 to 209,034.

[6] http://www.fi-aeroweb.com/General-Aviation.html

During that same period, New Hampshire experienced a 4.3 percent decline of registered aircraft from 1,173 to 1,122. From 2012 to 2013 New Hampshire saw a 5.4 percent decline. The FAA Aerospace forecast indicates that between 2012 and 2013 the total national general aviation fleet declined by roughly 3 percent, from 209,034 to 202,865.

Table 4-8 presents a comparison of based aircraft average annual compounding growth rate (AACGR) over the past 10 years in the FAA New England Region.

Table 4-8 FAA ANE Based Aircraft History

Year	*ANE Based Aircraft History*	*AAGR%*
2006	6,928	
2007	6,961	0.5
2008	6,663	-4.3
2009	6,705	0.6
2010	5,952	-11.2
2011	5,782	-2.9
2012	5,509	-4.7
2013	5,751	4.4
2014	6,038	5.0
2015	5,486	-9.1
2016	5,539	1.0
	AAGR	-2.1

Source: FAA TAF 2016

4.4.3 NATIONAL BASED AIRCRAFT

At the National level, from 2006-2016 based aircraft also experienced a slight average annual decrease of about 1.6 percent. Table 4-9 presents a comparison of national based aircraft growth over the past 10 years.

Table 4-9 National Based Aircraft History

Year	*National Based Aircraft History*	*AAGR%*
2006	197,301	
2007	199,608	1.2
2008	175,579	-12.0
2009	177,432	1.1
2010	165,472	-6.7
2011	160,374	-3.1
2012	163,333	1.8
2013	166,953	2.2
2014	170,375	2.0
2015	163,994	-3.7
2016	165,480	0.9
	AAGR	**-1.6**

Source: FAA TAF 2016

4.5 HISTORIC ANNUAL AIRCRAFT OPERATIONS

In airport planning terms "airport operation" is defined as the number of arrivals and departures from an airport. Therefore, an airplane that arrives and then departs from an airport is considered to have made two operations. Operations are further classified as either local or itinerant.

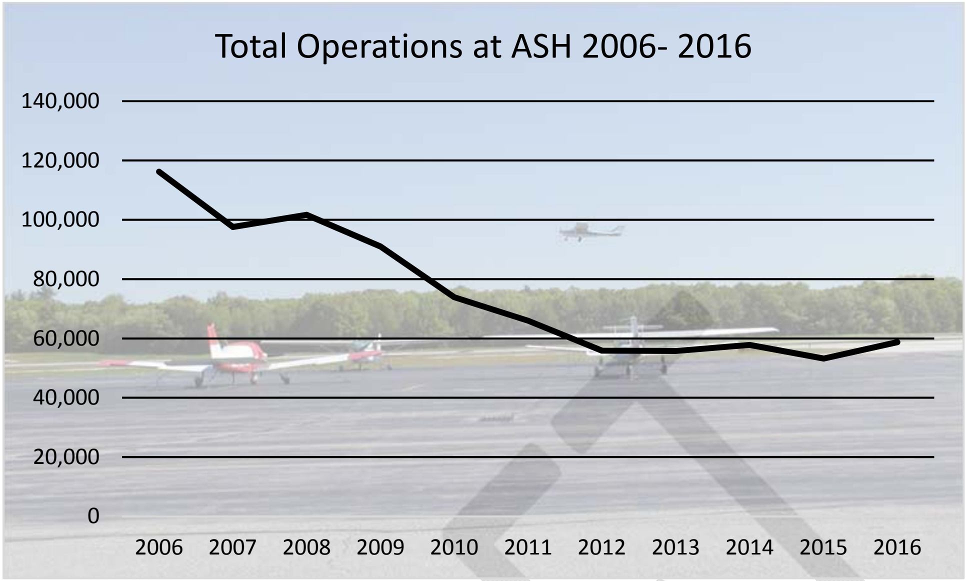
- Local operations are performed by aircraft that: (a) operate in the local traffic pattern or within sight of the airport; (b) are known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the airport; (c) execute simulated instrument approaches or low passes at the airport.
- Itinerant operations are all aircraft operations other than local operations, such as landing or take off of a flight departing from or arriving at another airport greater than 20 miles away.

Aircraft operations are also defined by type, such as air carrier, regional/commuter, air taxi, general aviation, or military. Aircraft operations at the Airport are predominantly general aviation with a small percent of air taxi, and military.

4.5.1 ASH HISTORIC OPERATIONS

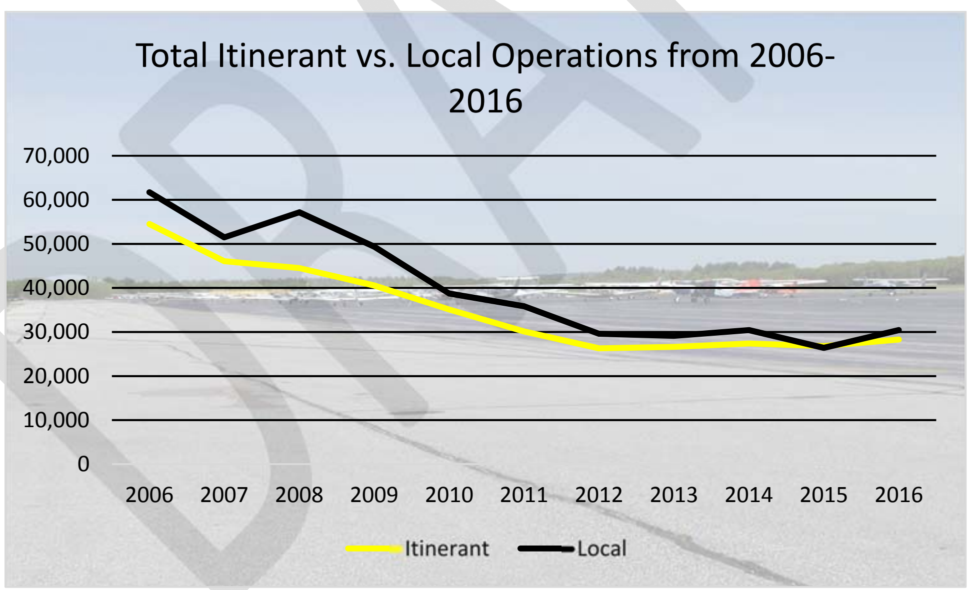
Historic aircraft operations for ASH were obtained from ASH's tower records. According to the data shown in Table 4-10 below, the Airport had a marked decrease in operations between 2006-2016, losing approximately 50 percent of its operations over this period with an average annual loss of 6.1 percent per year. During this same period, ASH has experienced an approximate 48 percent decrease in itinerant operations, and 51 percent decrease in local operations (see Table 4-11).

Table 4-10 Total ASH Operations from 2006- 2016



Source: ASH Tower Records 2006-2016

Table 4-11 ASH Itinerant vs. Local Operations from 2006- 2016

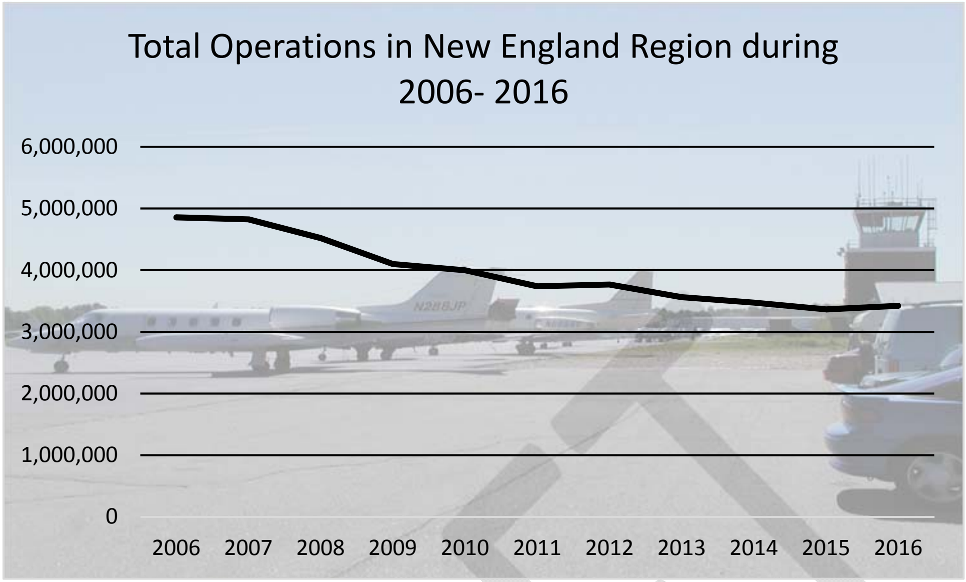


Source: ASH Tower Records 2016-2016, Gale Analysis 2017

4.5.2 NEW ENGLAND REGIONAL TRENDS

Historic aircraft operations for FAA New England Region were obtained from the FAA TAF. According to the data shown in Table 4-12 below, the New England Region experienced a decrease in operations between 2006-2016, losing approximately 30 percent of its operations over this period with an average annual loss of 3.4 percent per year.

Table 4-12 Total New England Region Operations from 2006-2016

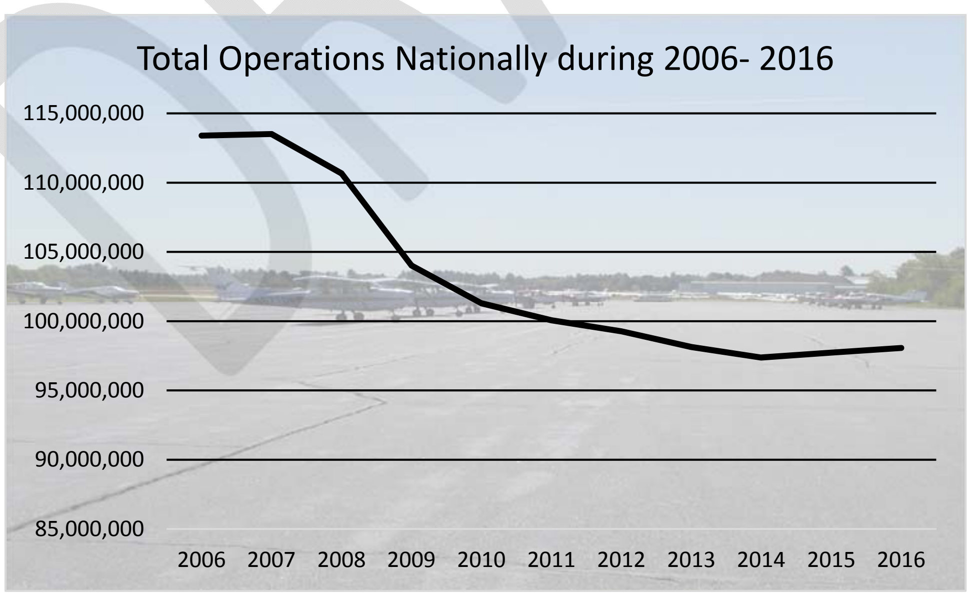


Source: FAA TAF 2006-2016

4.5.3 NATIONAL HISTORIC TRENDS

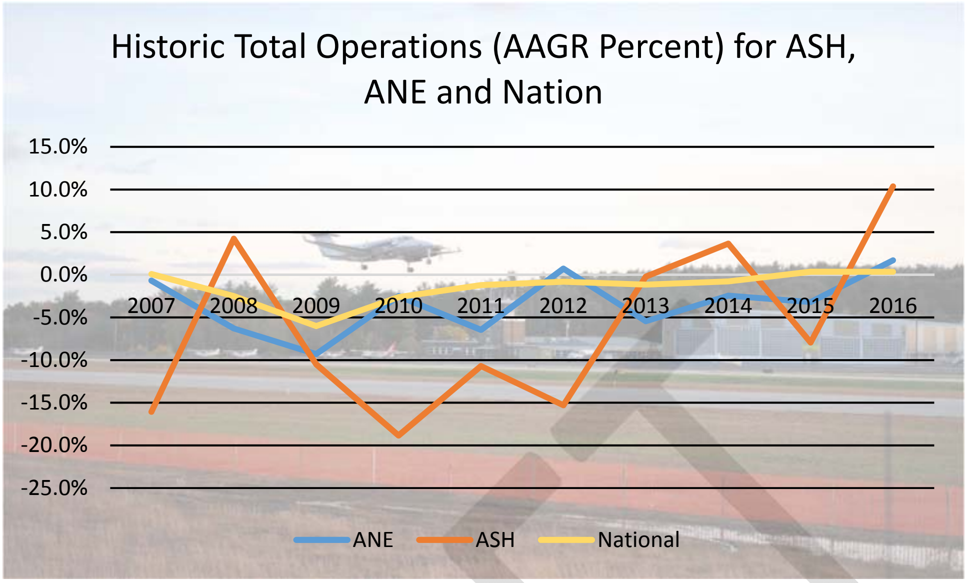
Historic aircraft operations for the Nation were obtained from the FAA's TAF. According to the data shown in Table 4-13 below, the Nation experienced a decrease in operations between 2006-2016, losing approximately 13.5 percent of its operations over this period with an average annual loss of 1.4 percent per year. A comparison of the historic AAGR for ASH, ANE, and Nation is highlighted in Table 4-14 below.

Table 4-13 Total Operations Nationally from 2006- 2016



Source: FAA TAF 2006-2016

Table 4-14 Historic Total Operations (AAGR) ASH, ANE, and Nation

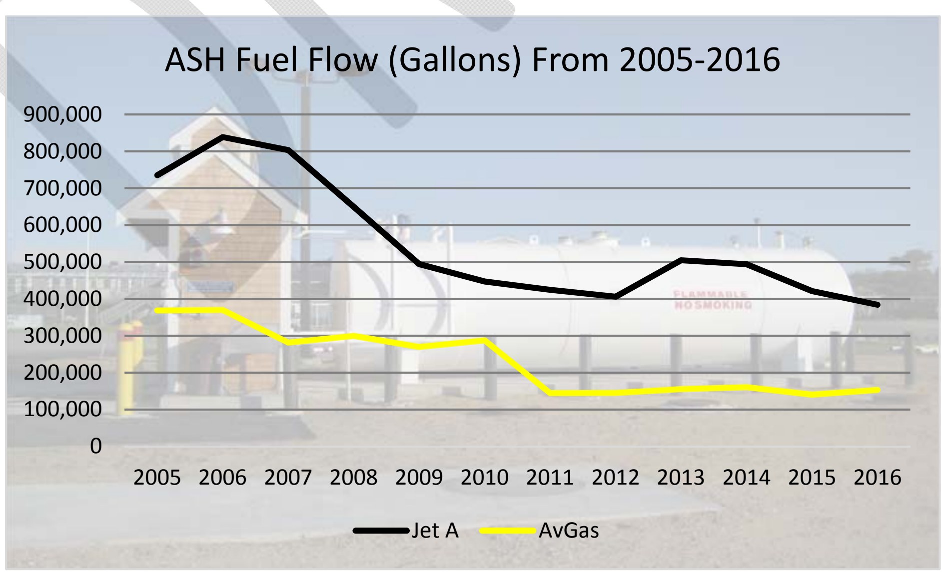


Source: FAA TAF 2006-2016

4.6 ASH JET FUEL AND AVIATION GASOLINE CONSUMPTION

Historic fuel sales data from 2005 to 2016 was obtained from the Airport. Fuel sales are often considered a good indicator of aviation activity at an airport and can help determine future fuel storage needs at an airport. In terms of gallons sold, the data presented in Table 4-15 indicates a significant decrease in fuel sales (both for Jet-A and AvGas) between 2005 and 2016. During this period, jet fuel sales decreased by approximately 48 percent with an average annual decrease of approximately 5 percent. Similarly, AvGas sales decreased by approximately 58 percent between 2005 and 2016 with average annual decrease of approximately 6 percent.

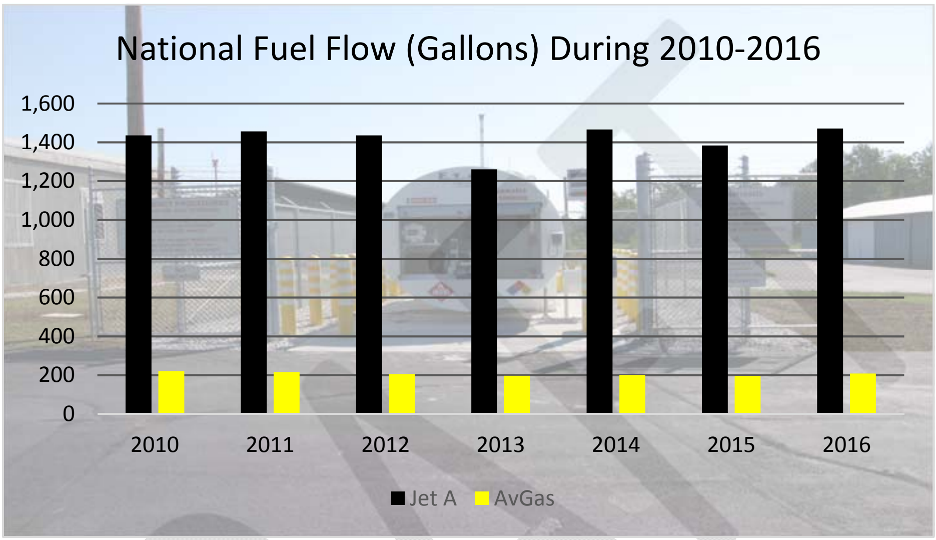
Table 4-15 ASH Fuel Flow 2005-2016



Source: Airport Master Plan Committee, Gale Analysis 2017

As indicated in Table 4-16 below, the FAA Aerospace Forecast (2017-2037) reported that between 2010 and 2016, Jet-A fuel consumption for GA aircraft increased 2.5 percent with an average annual increase of 0.81 percent. AvGas on the other hand was reported to have decreased by approximately 5.9 percent during this same period with an average annual decrease of approximately 0.9 percent. Through the planning period, the FAA Aerospace Forecast anticipates an average annual growth in Jet-A fuel consumption of 1.9 percent, and an average annual decrease of 0.4 percent per year in AvGas.

Table 4-16 National Fuel Flow 2010-2016



Source: FAA Aerospace Forecast 2017-2037

4.7 AVIATION ACTIVITY FORECASTS

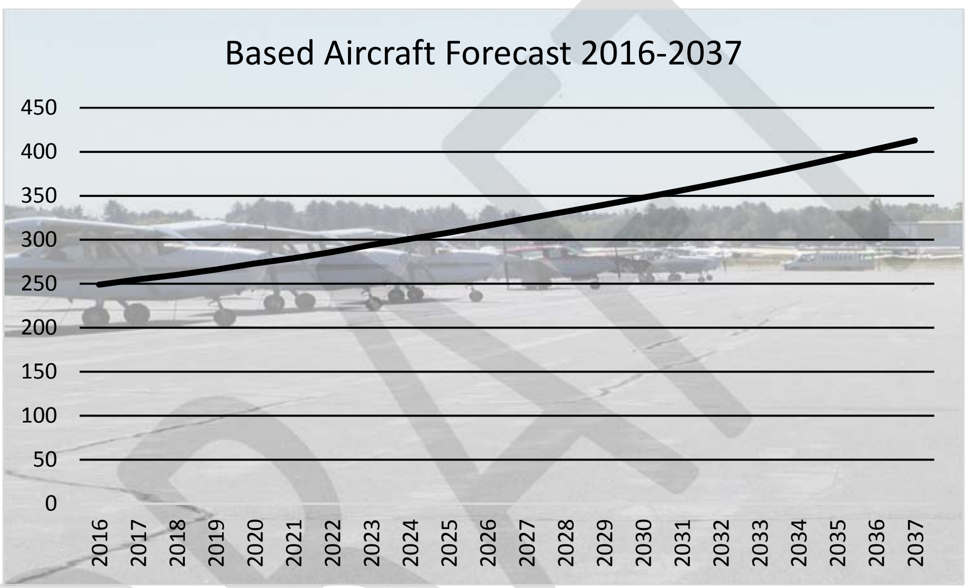
This section presents the aviation activity forecasts for ASH for the planning period of 2017-2037. The forecasts provide short-term, mid-term and long-term projections for the years 2022, 2027, and 2037. These represent the 5-, 10-, and 20-year estimates of aviation activity at the Airport. Activity projections include based aircraft, itinerant operations, local operations, and total operations. Forecasts developed by the Airport are reviewed by the FAA and compared to the FAA TAF projections. FAA Order 5090.3C provides guidance on the FAA review process, and states that the FAA will find a locally developed airport planning forecast acceptable if it meets any of the following three conditions for a general aviation and reliever airport:

1. The forecast differs less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period;
2. The forecast activity levels do not affect the timing or scale of an airport project;
3. The forecast activity levels do not affect the role of the airport as defined in FAA Order 5090.3C.

4.7.1 BASED AIRCRAFT FORECAST BY TYPE

Based on the 2016 TAF growth rates for the Airport, it is projected that based aircraft will grow at an average rate of 2.4 percent per year. On average, this represents approximately 7-8 new based aircraft per year. This growth rate is expected to outpace not only the New England region (0.9 percent per year), but the National growth rate (0.8 percent per year) as well. The forecast uses the TAF 2016 based aircraft data as its baseline, with a total based aircraft of 249. Table 4-17 details the TAF projected based aircraft growth rate out to 2037.

Table 4-17 Based Aircraft Forecast



Source: FAA TAF 2016-2045

As illustrated in Table 4-18, single-engine aircraft are expected to continue to dominate the based aircraft fleet at the Airport, but multi-engine aircraft are projected to increase at a slightly higher rate during the planning period (2.6 percent per year vs. 3.0 percent per year). According to the General Aviation Manufactures Association[7] (GAMA), From 2007 to 2016, the average price of a piston-engine aircraft has increased from approximately $328,000 in 2007 to $712,000 today. At the same time, the average price of turboprops has declined from $3.5 million to $2.9 million. The average price of a business jet is up from $12.5 million to $22.4 million, which is a likely contributor to the projected flat growth for based jet aircraft. Helicopters are projected to remain flat during the planning period according to the TAF.

[7] http://www.fi-aeroweb.com/General-Aviation.html#Fleet

Table 4-18 Based Aircraft Forecast by Type

Year	*Single Engine*	*Multi Engine*	*Jet*	*Helicopter*	*Other*	*Total*
2016	197	25	14	9	4	249
2017	202	26	14	9	4	255
2018	207	26	14	9	4	260
2019	212	27	14	9	4	266
2020	218	28	14	9	4	273
2021	223	29	14	9	4	279
2022	229	30	14	9	4	286
2023	235	32	14	9	4	294
2024	241	33	14	9	4	301
2025	247	34	14	9	4	308
2026	254	35	14	9	4	316
2027	261	36	14	9	4	324
2028	268	37	14	9	4	332
2029	275	38	14	9	4	340
2030	282	39	14	9	4	348
2031	289	40	14	9	4	356
2032	297	41	14	9	4	365
2033	305	42	14	9	4	374
2034	313	43	14	9	4	383
2035	322	44	14	9	4	393
2036	331	45	14	9	4	403
2037	340	46	14	9	4	413
AACGR	**2.6%**	**3.0%**	**0.0%**	**0.0%**	**0.0%**	**2.4%**

Source: FAA TAF 2016-2045

4.7.1.1 Alternative Based Aircraft Forecast

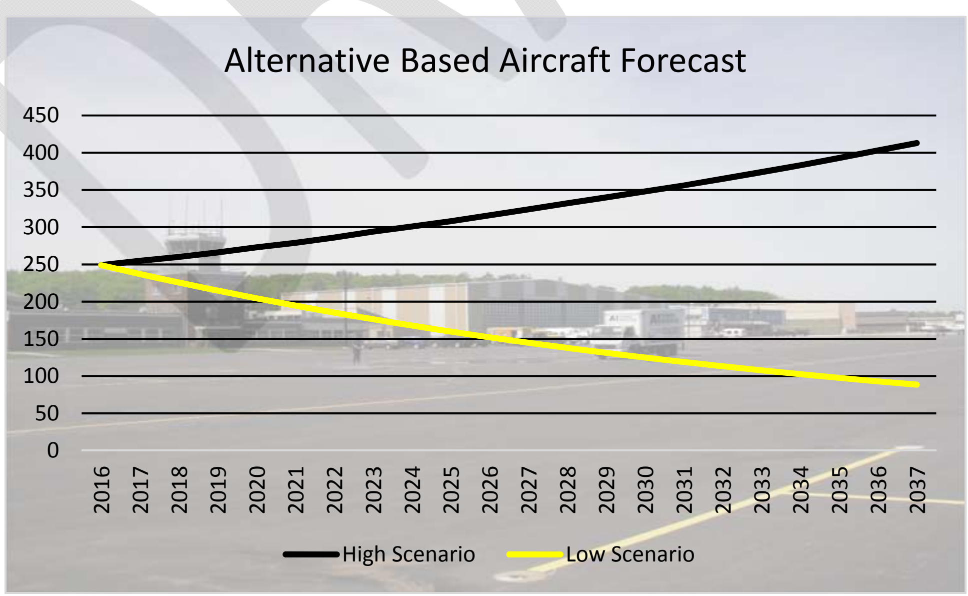
As discussed in Section 4.4.1, based aircraft are major economic contributors to the airport. They help generate revenue from tie-down fees, hangar leases, fuel sales, and maintenance. Providing adequate facilities to accommodate based aircraft growth is important, and it influences the future development needs of the Airport. The alternative based aircraft forecast for ASH develops both "high" and "low" scenarios based on historical growth rates. As previously discussed, it is important to view projections independently of specific years and to consider the actual growth of activity as the impetus that influences the need for future airport facilities. Similarly, slower than projected growth may warrant deferment of planned improvements. Actual growth activity should be periodically (i.e. annually) compared to projected growth, so scheduled corrections can be identified and implemented.

- **High Scenario:** as detailed in Section 4.7.1, the TAF projects growth in the number of based aircraft at an average annual compounding growth rate (AACGR) of 2.4 percent. This rate of growth significantly out paces that expected for both the New England Region (0.9 percent) and Nation (0.8 percent). Thus, an AACGR of 2.4 percent for ASH represents the optimistic growth of based aircraft, which is applied to the TAF total based aircraft number of 249 for 2016 and projected over the period of 2017-2037.

- **Low Scenario:** As detailed in Section 4.4.1, the Airport has experienced a decline in the number of based aircraft at an AACGR of -3.9 percent (NHDOT Based Aircraft Count) to -5.7 percent (TAF Based Aircraft Count) over the past 10-year period. Using an average of the NHDOT Based Aircraft Count and the TAF Based Aircraft Count, this negative growth rate (-4.8 percent) is assumed as the basis for the low scenario for 2017-2037. This -4.8 percent AACGR is applied to the TAF total based aircraft number of 249 for 2016, and projected from 2017-2037. This scenario assumes negative growth in activity over the next 20 years that reflects recent trends at ASH.

As illustrated in Table 4-19, the high scenario projects the number of based aircraft to increase from 249 to 413 within the planning period. This equates to approximately 7-8 aircraft per year. The low scenario projects a decrease in based aircraft from 249 to 89 during the period, which equates to a loss of approximately 8 based aircraft per year.

Table 4-19 Alternative Based Aircraft Forecast



Source: FAA TAF 2016-2045, NHDOT, Gale Analysis 2017

4.7.1.2 Recommended Based Aircraft Growth Rate

To further assist in developing a recommended based aircraft growth rate, this section compares ASH's projected TAF based aircraft compounding growth rate against the TAF growth rate of three airports within ASH's service area (Lawrence, Fitchburg and Hanscom). As illustrated in Table 4-20 below, ASH's TAF based aircraft growth rate is expected to outpace the three comparable airports.

Table 4-20 Projected Based Aircraft Comparisons

Year	*ASH*	*LWM*	*BED*	*FIT*
2016	249	214	350	98
2017	255	218	357	98
2018	260	221	363	98
2019	266	226	371	98
2020	273	229	376	98
2021	279	232	384	98
2022	286	236	388	98
2023	294	241	395	98
2024	301	245	403	98
2025	308	248	410	98
2026	316	252	417	98
2027	324	257	424	98
2028	332	261	431	98
2029	340	266	438	98
2030	348	270	445	98
2031	356	274	452	98
2032	365	279	459	98
2033	374	283	466	98
2034	383	288	473	98
2035	393	292	480	98
2036	403	297	487	98
2037	413	303	494	98
AACGR	**2.4%**	**1.7%**	**1.7%**	**0.0%**

Source: FAA TAF 2016-2045, Gale Analysis 2017

After comparing the AACGR forecast and historic trendline analysis, an average annual compounding growth rate of 1.9 percent was selected for based aircraft through the planning period, which represents the average growth rate for the competing airports within ASH's service area. While the average annual compounding growth rate of 1.9 percent deviates from the TAF's 2.4 percent projection, it remains within

10 percent of the TAF projection. Further, a 1.9 percent AACGR maintains an optimistic outlook of aviation growth at the Airport and is more consistent with what the region is expected to experience. Table 4-21 below compares the recommend 1.9 percent based aircraft AACGR against the high and low scenarios.

Table 4-21 Recommended Based Aircraft Growth Rate

Year	*High Scenario +2.4%*	*Low Scenario -4.8%*	*Recommend +1.9%*
2016	249	249	249
2017	255	237	254
2018	260	226	259
2019	266	215	263
2020	273	205	268
2021	279	195	274
2022	286	185	279
2023	294	176	284
2024	301	168	289
2025	308	160	295
2026	316	152	301
2027	324	145	306
2028	332	138	312
2029	340	131	318
2030	348	125	324
2031	356	119	330
2032	365	113	337
2033	374	108	343
2034	383	103	349
2035	393	98	356
2036	403	93	363
2037	413	89	370

Source: Gale Analysis 2017

4.7.2 AIRCRAFT OPERATIONS FORECAST

The total aircraft operations forecast for ASH for the planning period 2017-2037 is presented in Table 4-22 below. Air Taxi & Commuter operations as well as Military operations are projected to remain flat throughout the planning period, while Itinerant GA operations are expected to decrease slightly at an average annual rate of -0.04 percent per year. On the contrary, Local Civil operations are expected to increase at an average annual rate of 0.5 percent per year throughout the planning period.

Overall, total operations are expected to increase on average by 0.26 percent per year. While an average annual increase of 0.26 percent is below the regional average of 0.39 percent and national average of 0.61 percent, it is in line with the competing airports in ASH's service area. LWM is projecting an average annual increase of 0.2 percent, FIT 0.0 percent, BED 0.2 percent, and MHT 0.45 percent. In the short-term (2022), total operations at ASH are expected to grow by 5.0 percent; in the medium-term (2027) by 6.4 percent; and in the long-term (2037) by 9.3 percent from 2016 total operations.

Table 4-22 Total Projected Aircraft Operations Forecast

Year	*Itinerant Operations*				*Local Operations*			
	Air Taxi & Commuter	**GA**	**Military**	**Total**	**Civil**	**Military**	**Total**	**Total Operations**
2016	370	27,557	31	27,958	29,809	16	29,825	**57,783**
2017	370	26,647	31	27,048	32,831	16	32,847	**59,895**
2018	370	26,637	31	27,038	32,994	16	33,010	**60,048**
2019	370	26,627	31	27,028	33,158	16	33,174	**60,202**
2020	370	26,617	31	27,018	33,325	16	33,341	**60,359**
2021	370	26,607	31	27,008	33,492	16	33,508	**60,516**
2022	370	26,597	31	26,998	33,660	16	33,676	**60,674**
2023	370	26,587	31	26,988	33,829	16	33,845	**60,833**
2024	370	26,577	31	26,978	33,998	16	34,014	**60,992**
2025	370	26,567	31	26,968	34,168	16	34,184	**61,152**
2026	370	26,557	31	26,958	34,339	16	34,355	**61,313**
2027	370	26,547	31	26,948	34,510	16	34,526	**61,474**
2028	370	26,537	31	26,938	34,682	16	34,698	**61,636**
2029	370	26,527	31	26,928	34,855	16	34,871	**61,799**
2030	370	26,517	31	26,918	35,029	16	35,045	**61,963**
2031	370	26,507	31	26,908	35,203	16	35,219	**62,127**
2032	370	26,497	31	26,898	35,378	16	35,394	**62,292**
2033	370	26,487	31	26,888	35,554	16	35,570	**62,458**
2034	370	26,477	31	26,878	35,732	16	35,748	**62,626**
2035	370	26,467	31	26,868	35,910	16	35,926	**62,794**
2036	370	26,457	31	26,858	36,090	16	36,106	**62,964**
2037	370	26,447	31	26,848	36,271	16	36,287	**63,135**
AAGR	**0.0%**	**-0.04%**	**0.0%**	**-0.04%**	**0.5%**	**0.0%**	**0.5%**	**0.26%**

Source: FAA TAF 2016-2045

4.7.2.1 Aircraft Operations Forecast (Local vs. Itinerant Split)

The Airport's Tower count records were analyzed to develop the activity split between local and itinerant operations. As shown in Table 4-23, from 2007- 2016 local operations on average have accounted for approximately 53 percent of total operations, while itinerant operations accounted for approximately 47 percent.

Table 4-23 Historic Itinerant vs. Local Operations

Year	*Itinerant Operations*	*Itinerant Percent*	*Local Operations*	*Local Percent*	*Total Operations*
2007	46,063	47.2	51,484	52.8	97,547
2008	44,510	43.8	57,162	56.2	101,672
2009	40,539	44.5	49,378	54.3	91,017
2010	35,119	47.5	38,749	52.5	73,868
2011	30,119	45.7	35,846	54.3	65,965
2012	26,295	47.1	29,588	52.9	55,883
2013	26,624	47.7	29,140	52.3	55,764
2014	27,379	47.4	30,420	52.6	57,799
2015	26,808	50.4	26,402	49.6	53,210
2016	28,284	48.2	30,442	51.8	58,726

Source: ASH Tower Records, Gale Analysis 2017

As described in section 4.7.2, the TAF projects that itinerant operations at ASH will experience an AAGR of -0.04 percent through the planning period. At the same time, local civil operations are expected to experience an increase in operations with an AAGR of 0.5 percent. Consequently, the itinerant vs. local split is expected to continue to shift in favor of local operations through the planning period as illustrated in Table 4-24 below.

Table 4-24 Forecast of Itinerant vs. Local Operations

Year	*Itinerant Operations*	*Itinerant Percent*	*Local Operations*	*Local Percent*	*Total Operations*
Base Year 2016	28,284	48.2	30,442	51.8	58,726
Forecast					
2022	26,998	44.5	33,676	55.5	60,674
2027	26,948	43.8	34,526	56.2	61,474
2037	26,848	42.5	36,287	57.5	63,135

Source: FAA TAF 2016-2045, Gale Analysis 2017

4.7.2.2 Baseline Operational Fleet Mix

In 2008, the Airport conducted a Noise Technical Report in relation to the proposed relocation and extension of Runway 14-32. In addition to other characteristics compiled, the Noise Technical Report identified the operational fleet mix, which included single-engine, multi-engine, jet, military, and helicopter operations on an average annual day. This information was used to establish the anticipated percent of operational fleet mix for the planning period. Table 4-25 illustrates the operational fleet mix reported in the Noise Technical Report.

Table 4-25 Baseline Operational Fleet Mix

Aircraft Category	*Number of Operations*	*Percent of Fleet Mix*
Single-Engine	233	81
Multi-Engine	39	14
Jet	4	2
Military	0	0
Helicopter	10	3
Total	**286**	**100**

Source: Wyle, 2008

4.7.2.3 Projected Operational Fleet Mix

Operational fleet mix is an important factor in determining the needs for airfield improvements. While ASH supports a variety of aircraft, the majority of the current operations are conducted by single-engine aircraft. As discussed in the previous section, the percent of operational fleet mix is based on the percentage of the average annual day operations baseline established in the 2008 Noise Technical Report and through discussions with airport management. Using the established percentage of fleet mix, Table 4-26 projects the operational fleet mix over the planning period.

Table 4-26 Projected Operational Fleet Mix

Aircraft Category	*2022*	*2027*	*2037*
Single-Engine	49,147	49,795	51,139
Multi-Engine	8,494	8,606	8,839
Jet	1,213	1,229	1,263
Military	0	0	0
Helicopter	1,820	1,844	1,894
Total	**60,674**	**61,474**	**63,135**

Source: Gale Analysis 2017

4.7.2.4 Alternative Projected Aircraft Operations Forecast

Projecting the number of annual operations at GA airports plays an important role in understanding potential sources of revenue, facility needs, and adequacy of existing facilities. The more activity generated at an airport, the more likely revenue streams from collection of tie-downs, fuel sales, and other charges increase. This alternative projected aircraft operations forecast employs the AAGR from three alternative sources: 1) Historic Operations at ASH, 2) Regional Comparison; and 3) FAA Aerospace Forecast.

- **Alternative 1- ASH Historic Operations:** operations at ASH over the past 10 years (2006-2016) have been declining at an AAGR of -6.1 percent. As previously discussed in this Chapter, contributing factors to the decline in operations can likely be attributed to the *Great Recession,* which had a marked impact on GA airports throughout the country. Additionally, and unique to ASH, the closing of Daniel Webster College and its flight program in 2010 played a significant role in the decline in operations at ASH. These two anomalies aren't expected to be reoccurring. Therefore, for purposes of this alternative, the focus is on operations from 2012-2016. During the period of 2012-2016, operations at ASH have declined at an AAGR of -1.9 percent. Using 2016 operations as a base, an AAGR of -1.9 percent is applied to the operations through the planning period (2017-2037). The results are outlined in Table 4-27.

Table 4-27 Alternative 1- ASH Historic Operations

Year	*Itinerant*				*Local Operations*			
	Air Taxi & Commuter	**GA**	**Military**	**Total**	**Civil**	**Military**	**Total**	**Total Operations**
2016	370	27,557	31	27,958	29,809	16	29,825	57,783
2017	363	27,033	30	27,427	29,243	16	29,258	56,685
2018	356	26,520	30	26,906	28,687	15	28,702	55,608
2019	349	26,016	29	26,394	28,142	15	28,157	54,552
2020	343	25,522	29	25,893	27,607	15	27,622	53,515
2021	336	25,037	28	25,401	27,083	15	27,097	52,498
2022	330	24,561	28	24,918	26,568	14	26,582	51,501
2023	324	24,094	27	24,445	26,063	14	26,077	50,522
2024	317	23,637	27	23,980	25,568	14	25,582	49,562
2025	311	23,187	26	23,525	25,082	13	25,096	48,621
2026	305	22,747	26	23,078	24,606	13	24,619	47,697
2027	300	22,315	25	22,639	24,138	13	24,151	46,791
2028	294	21,891	25	22,209	23,680	13	23,692	45,902
2029	288	21,475	24	21,787	23,230	12	23,242	45,030
2030	283	21,067	24	21,373	22,788	12	22,801	44,174
2031	277	20,667	23	20,967	22,355	12	22,367	43,335
2032	272	20,274	23	20,569	21,931	12	21,942	42,511
2033	267	19,889	22	20,178	21,514	12	21,526	41,704

Source: TAF, ATCT Counts, Gale Analysis 2017

Table 4-27 Alternative 1- ASH Historic Operations (Continued)

Year	*Itinerant*				*Local Operations*			
	Air Taxi & Commuter	**GA**	**Military**	**Total**	**Civil**	**Military**	**Total**	**Total Operations**
2034	262	19,511	22	19,795	21,105	11	21,117	40,911
2035	257	19,140	22	19,419	20,704	11	20,715	40,134
2036	252	18,776	21	19,050	20,311	11	20,322	39,371
2037	247	18,420	21	18,688	19,925	11	19,936	38,623
AAGR	**-1.9%**	**-1.9%**	**-1.9%**	**-1.9%**	**-1.9%**	**-1.9%**	**-1.9%**	**-1.9%**

Source: TAF, ATCT Counts, Gale Analysis 2017

- **Alternative 2- Regional Comparison:** this alternative reviewed the TAF projections for airports located within ASH's service area (MHT, FIT, LWM, and BED). The TAF projects an AAGR of 0.45 percent for MHT, 0.0 percent for FIT, 0.2 percent for LWM, and 0.2 percent for BED through the planning period (2017-2037). The average combined AAGR for MHT, FIT, LWM, and BED is 0.2 percent. As such, for purposes of this alternative an AAGR of 0.2 percent is applied to the 2016 total operations through the planning period (2017-2037). The results are outlined in Table 4-28.

Table 4-28 Alternative 2- Regional Comparison

Year	*Itinerant Operations*				*Local Operations*			
	Air Taxi & Commuter	**GA**	**Military**	**Total**	**Civil**	**Military**	**Total**	**Total Operations**
2016	370	27,557	31	27,958	29,809	16	29,825	57,783
2017	371	27,612	31	28,014	29,869	16	29,885	57,899
2018	371	27,667	31	28,070	29,928	16	29,944	58,014
2019	372	27,723	31	28,126	29,988	16	30,004	58,130
2020	373	27,778	31	28,182	30,048	16	30,064	58,247
2021	374	27,834	31	28,239	30,108	16	30,124	58,363
2022	374	27,889	31	28,295	30,169	16	30,185	58,480
2023	375	27,945	31	28,352	30,229	16	30,245	58,597
2024	376	28,001	31	28,408	30,289	16	30,306	58,714
2025	377	28,057	32	28,465	30,350	16	30,366	58,831
2026	377	28,113	32	28,522	30,411	16	30,427	58,949
2027	378	28,169	32	28,579	30,471	16	30,488	59,067
2028	379	28,226	32	28,636	30,532	16	30,549	59,185
2029	380	28,282	32	28,694	30,593	16	30,610	59,304
2030	380	28,339	32	28,751	30,655	16	30,671	59,422

Source: FAA TAF 2016-2045, Gale Analysis 2017

Table 4-28 Alternative 2- Regional Comparison (Continued)

Year	Itinerant Operations				Local Operations			
	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Operations
2031	381	28,395	32	28,809	30,716	16	30,732	59,541
2032	382	28,452	32	28,866	30,777	17	30,794	59,660
2033	383	28,509	32	28,924	30,839	17	30,855	59,779
2034	384	28,566	32	28,982	30,901	17	30,917	59,899
2035	384	28,623	32	29,040	30,962	17	30,979	60,019
2036	385	28,680	32	29,098	31,024	17	31,041	60,139
2037	386	28,738	32	29,156	31,086	17	31,103	60,259
AAGR	**0.20%**	**0.20%**	**0.20%**	**0.20%**	**0.20%**	**0.20%**	**0.20%**	**0.20%**

Source: FAA TAF 2016-2045, Gale Analysis 2017

- **Alternative 3- FAA Aerospace Forecast:** the national forecasts for contract towered airports in the FAA Aerospace Forecasts, Fiscal Years 2016-2037 show aircraft operations growing at an average annual rate of 0.8 percent over the 21-year forecast period. Average annual growth rates for this period by user group are as follows; air carrier, 2.3 percent; air taxi/commuter, -0.9 percent; itinerant general aviation, 0.3 percent; and local civil, 0.4 percent. Table 4-29 illustrates the projected growth by applying the average FAA Aerospace rates to the appropriate user group at ASH. The AAGR for the air carrier user group was excluded from this analysis as ASH does not have air carrier service.

Table 4-29 Alternative 3- FAA Aerospace Forecast

Year	Itinerant Operations				Local Operations			
	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Operations
2016	370	27,557	31	27,958	29,809	16	29,825	57,783
2017	367	27,640	31	28,037	29,928	16	29,944	57,982
2018	363	27,723	31	28,117	30,048	16	30,064	58,181
2019	360	27,806	31	28,197	30,168	16	30,184	58,381
2020	357	27,889	31	28,277	30,289	16	30,305	58,582
2021	354	27,973	31	28,357	30,410	16	30,426	58,783
2022	350	28,057	31	28,438	30,532	16	30,548	58,986
2023	347	28,141	31	28,519	30,654	16	30,670	59,189
2024	344	28,225	31	28,601	30,776	16	30,792	59,393
2025	341	28,310	31	28,682	30,899	16	30,915	59,598
2026	338	28,395	31	28,764	31,023	16	31,039	59,803

Source: FAA Aerospace Forecast 2017-2037

Table 4-29 Alternative 3- FAA Aerospace Forecast (Continued)

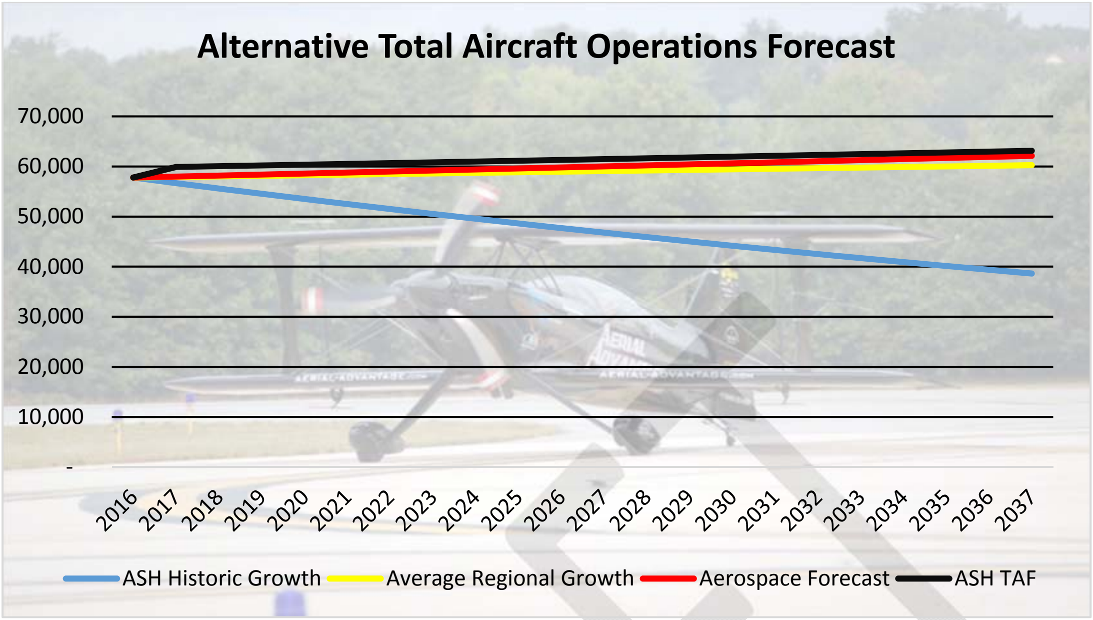
Year	*Itinerant Operations*				*Local Operations*			
	Air Taxi & Commuter	**GA**	**Military**	**Total**	**Civil**	**Military**	**Total**	**Total Operations**
2027	335	28,480	31	28,846	31,147	16	31,163	60,009
2028	332	28,566	31	28,929	31,272	16	31,288	60,216
2029	329	28,651	31	29,011	31,397	16	31,413	60,424
2030	326	28,737	31	29,094	31,522	16	31,538	60,633
2031	323	28,823	31	29,178	31,648	16	31,664	60,842
2032	320	28,910	31	29,261	31,775	16	31,791	61,052
2033	317	28,997	31	29,345	31,902	16	31,918	61,263
2034	314	29084	31	29,429	32,030	16	32,046	61,475
2035	312	29,171	31	29,513	32,158	16	32,174	61,687
2036	309	29,258	31	29,598	32,287	16	32,303	61,901
2037	306	29,346	31	29,683	32,416	16	32,432	62,115
AAGR	**-0.9%**	**0.30%**	**0.0%**	**0.40%**	**0.4%**	**0.0%**	**0.4%**	**0.3%**

Source: FAA Aerospace Forecast 2017-2037

4.7.2.5 Recommended Aircraft Operations Forecast

As detailed in Table 4-30, the TAF for ASH projects an increase of 5,352 operations from 57,783 in 2016 to 63,135 in 2037. This represents a 9.3 percent increase in operations during the planning period with AAGR of 0.26 percent. Alternative 1- *ASH Historic Operations* projects the total number of aircraft operations at the Airport to decrease by 19,160 operations from 57,783 in 2016 to 38,623 in 2037. This represents a 33 percent decrease in operations during the planning period with an AAGR of -1.9 percent. Alternative 2- *Regional Comparison* projects an increase of 2,476 operations from 57,783 in 2016 to 60,259 in 2037. This represents a 4.0 percent increase in operations during the planning period with an AAGR of 0.2 percent. Alternative 3- *FAA Aerospace Forecast* projects an increase of 4,332 from 57,783 in 2016 to 62,115 in 2037. This represents 7.5 percent increase in operations during the planning period with an AAGR of 0.3 percent.

Table 4-30 Alternative Total Aircraft Operations Forecast



Source: FAA Aerospace Forecast 2017-2037, FAA TAF 2016-2045, Gale Analysis

After comparing total aircraft operations at ASH, and applying the three alternative scenarios, there does not appear to be any unique circumstances or influencing factors that suggest a deviation from the TAF as outlined in section 4.7.2. In fact, the difference in projected operations at ASH through the planning period (2017-2037) are negligible when compared to what is expected at competing airports in ASH's service area, and that of the Aerospace Forecast. Therefore, it is recommended that the TAF projections of future aviation activity be used to assess the capacity of existing facilities and determine improvements required to satisfy future activity levels in the following chapters.

Although future aviation activity will rely on the TAF projections, it is recommended that the Airport monitor actual growth activity annually so scheduling of capital improvements can be identified and implemented. Among other things, the implementation of the following, or changes in policies could influence operations at ASH:

- NH HB124, which seeks to repeal all aircraft registration fees collected by the Department of Transportation;
- Aircraft Deicing System;
- Implementation of ASH as a "landing rights airport" in accordance with United States Customs and Border Protection;
- Technological advances in unmanned aerial vehicles (UAVs); and
- Occupancy of Daniel Webster College.

It is important, however, to view the projections independently of specific years and to consider the actual growth of activity as the impetus that influences the need for future airport facilities. Similarly, slower than projected growth may warrant deferment of planned improvements. Actual growth activity should be periodically (i.e. annually) compared to projected growth, so scheduled corrections can be identified and implemented.

4.8 PEAK ACTIVITY ESTIMATES

Many airport facility needs are related to the levels of activity during peak periods. Peak characteristics are typically defined as peak month, average day, and peak hour activity. When projecting future activity levels at an airport, it is important to identify and project peak period activity levels. These projections help facilitate future planning decisions, and highlight an airport's ability to accommodate future aviation activity demand.

The values for average day peak month and for the peak hour have been calculated by taking the number of operations calculated for the peak month and dividing that figure by the number of days in the peak month. In the case of ASH, August represents the peak month with 31 days. It is estimated that 15 percent of the average day peak month would best represent the number of peak hour operations. The calculation of peak activity is illustrated in Table 4-31.

Table 4-31 Peak Activity Estimates

	Total Annual Operations	*Peak Month*	*Average Day Peak Month*	*Peak Hour (ADPM)*
Base Year				
2016	58,726	6,325	204	31
Forecast				
2022	60,674	6,674	215	32
2027	61,474	6,762	218	33
2037	63,135	6,945	224	34

Source: ASH ATCT, Gale Analysis 2017

4.9 SUMMARY OF FORECASTS

Table 4-32 summarizes the recommended aviation demand forecasts for ASH for the 5-, 10-, and 20- year planning periods discussed in this chapter. These projections of future aviation activity will be used to assess the capacity of existing facilities and determine improvements required to satisfy future activity levels in the subsequent chapters of this Master Plan.

Table 4-32 Airport Recommended Forecast Summary

Fiscal Year	*Itinerant*				*Local*			
	Air Carrier	**Air Taxi**	**General Aviation**	**Military**	**Civil**	**Military**	**Total Operations**	**Based Aircraft**
2022	0	370	26,597	31	33,660	16	60,674	279
2027	0	370	26,547	31	34,510	16	61,474	306
2037	0	370	26,447	31	36,271	16	63,135	370

Source: TAF, Gale 2017

4.9.1 DESIGN AIRCRAFT

The selection of design standards for airfield facilities is predicated upon the characteristics of the aircraft that are expected to use the airport. The design aircraft is defined as the most demanding aircraft type operating at the airport with a minimum of 500 annual operations (take-off and landings are considered to be separate operations), as described by the FAA.

As described in Chapter 2, the FAA groups aircraft into five categories (A-E) based upon their approach speeds. Aircraft Categories A-B generally include small propeller aircraft, and smaller business jets with approach speeds of less than 121 knots. Categories C, D, and E generally consist of the remaining business jets and other larger propeller aircraft with approach speeds of 121 knots or more. The FAA establishes six airplane design groups (I-IV), which are predicated on the wingspan and tail height of the aircraft. These categories range from Airplane Design Group (ADG) I through VI (I- aircraft with wingspans of less than 49 feet, to ADG VI for the largest commercial and military aircraft).

The combination of the airplane design group and aircraft approach speed for the design aircraft establishes the approach and departure reference code, which is used to define applicable airfield design standards. Based on discussions with ASH ATCT, the appropriate design aircraft remains the Gulfstream IV, which is included in Aircraft Approach Category D and Airport Design Group II.

CHAPTER 5 – FACILITY REQUIREMENTS

This chapter takes the information collected in Chapter 2, *Inventory of Existing Facilities,* considers the projected demand at the Airport identified in Chapter 4, *Forecast of Aviation Demand and Capacity,* and provides a review of compliance with FAA airport design standards, other airport requirements, and user needs. FAA standards for airport design and Federal Aviation Regulation Part 77, *Objects Affecting Navigable Airspace* (FAR Part 77), are used to analyze facility conditions to identify needed improvements, replacement or expansion. Facility improvements may also be recommended to fill a demand for services, not just to meet design or safety standards.

5.1 AIRSIDE CAPACITY AND REQUIREMENTS

The airport facilities required for the movement of aircraft are generally considered to be airside facilities, and include runways, taxiways, aprons, navigational aids, and airfield lighting systems. This section will review the capacity and utility of the Airport's airside facilities, and their compliance with FAA design standards. As discussed in Chapter 4, Boire Field is classified as a D-II airport with the Gulfstream IV as its Critical Design Aircraft. The Airport is expected to maintain its D-II classification for the duration of the 20-year planning period.

5.1.1 RUNWAY CAPACITY

Airport capacity is typically expressed in terms of the number of aircraft operations that can be conducted in a given period. Capacity is most often expressed as annual capacity (or annual service volume, ASV), and hourly capacity (or throughput) for a particular runway and taxiway configuration. The FAA's Advisory Circular 150/6050-5, *Airport Capacity and Delay*, utilizes computer models developed by the FAA to evaluate airport capacity and reduce aircraft delay. These models use an airport's ASV to approximate the capacity of the runway, while accounting for differences in runway configuration, fluctuations in aircraft fleet mix, touch and go activity levels, and weather conditions, among other factors.

The FAA models estimate the Airport's ASV capacity to be up to 230,000 operations per year. The Airport's annual operations volume in 2016 was 57,000 (rounded), and the forecasted annual operations are not expected to reach over 63,500 over the planning period. Therefore, runway capacity is not an existing problem, nor does it appear that it will become a problem during the planning period. Further, according to FAA requirements, the Airport's runway capacity is considered adequate until operations reach 60% of its ASV, or 138,000 annual operations.

Finding: The runway capacity at the Airport is sufficient to meet the needs of the Airport for the duration of the planning period.

5.1.2 RUNWAY REQUIREMENTS

Runway dimensional requirements are based upon the Airport Reference Code (ARC) for the runway during the planning period. The FAA has prescribed standards for the layout of airport facilities including runways, taxiways, approach surfaces, etc. based on the ARC. Runway dimensional requirements for

Runway 14-32 and the Airport's current compliance status are presented in Table 5-1. These standards are discussed individually in the following sections.

Table 5-1
Runway 14-32 Dimensional Requirements

Facility	*FAA Design Criteria (D-II)*	*Existing Runway 14-32 (D-II)*	*Runway 14-32 Compliance*
Runway centerline to holdline	250'	250' (RW 14); 550' (RW 32)	Complies
Runway centerline to parallel taxiway centerline	400' (RW 14) 300' (RW 32)	550'	Complies
Runway centerline to edge of aircraft parking	400' (RW 14) 300' (RW 32)	600'	Complies
Runway Protection Zone:			
Length	2,500' (RW 14); 1,700' (RW 32)	2,500' (RW 14); 1,700' (RW 32)	Complies
Inner Width (200' beyond runway)	1,000' (RW 14); 1,000' (RW 32)	1,000' (RW 14); 1,000' (RW 32)	Complies
Outer Width	1,750' (RW 14); 1,510' (RW 32)	1,750' (RW 14); 1,510' (RW 32)	Complies
Runway pavement width	100'	100'	Complies
Runway safety area width	500'	500'	Complies
Runway safety area length beyond runway end	1,000'	1,000'	Complies
Runway object-free area width	800'	800'	Complies
Runway object-free area length beyond runway end	1,000'	1,000'	Complies
Runway obstacle-free zone width	400'	800'	Complies
Runway obstacle-free zone length beyond runway end	200'	200'	Complies

Source: AC 150/5300-13A

Finding: The dimensions of Runway 14-32 are in compliance with current FAA regulations.

5.1.2.1 Runway Length Requirements

As previously discussed, runway dimensional requirements are predicated on the capacity and safety requirements of a family of aircraft or a specific aircraft using the runway. During the 2008 Environmental Assessment, the forecast identified the Gulfstream IV (G-IV) as representative of the most demanding aircraft regularly using the Airport. The G-IV has an ARC of D-II (i.e., wingspans over 49 feet but under 79 feet, tail heights over 20 feet but under 30 feet, and approach speeds 141 knots or more but less than 166 knots).

In accordance with the AC, the chart taken from the G-IV operation manual indicated the required runway length to be 6,800 feet. However, due to significant impacts to wetlands that would occur as a result of implementing such a length, the Nashua Airport Authority (NAA), FAA and the NHDOT/BA agreed that a length of 6,000 feet would lessen the runway's environmental impact and would constitute a sufficient improvement over the existing conditions (5,500 feet). Consequently, Runway 14-32 was reconstructed in 2015 to 6,000 feet in length. Table 5-2 summarizes available runway distances at the airport.

Table 5-2: Available Runway Lengths at ASH

Runway End	*Pavement Length (feet)*	*Threshold Displacement (feet)*	*Maximum Takeoff Length (feet)*	*Maximum Landing Length (feet)*
14	6,000	0	6,000	5,650
32	6,000	350	6,000	5,650

Source: Gale Analysis

Finding: The Runway length of 6,000 feet is adequately serving the existing fleet of aircraft utilizing the airport.

5.1.2.2 Runway Approach Requirements

This section reviews the current and preferred (if applicable) runway approach types and will provide an overview of the protected surfaces associated with the new runway approaches, if applicable.

Existing Approaches:

Currently, Runway 14 has an *Instrument Landing System (ILS) Approach*. This means that Runway 14 provides precision lateral and vertical guidance to adequality equipped aircraft approaching and landing on runway 14. This approach is supported by the following navigational/visual/communication aids:

- Runway lighting (HIRLS – High Intensity Runway Light System)
- Threshold lights
- Precision Approach Path Indicator (PAPI)
- Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR)
- Instrument Landing System Localizer (providing horizontal guidance)
- END-FIRE Glide Slope (providing vertical guidance)
- Airport Rotating Beacon
- Automated Weather Observing System (AWOS)

Currently, Runway 32 has a *Localizer Performance with Vertical Guidance (GPS) Approach.* In this case, the Runway 32 RNVA (GPS) has four types of minima: LPV, LNAV/VNAV, LNAV, or circling. The Runway 32 End is supported by the following navigational/visual/communication aids:

- Runway lighting (HIRLS)
- Runway End Identifier Lights
- Threshold lights (located at the displaced threshold)

- Precision Approach Path Indicator (PAPI)
- Airport Rotating Beacon
- Automated Weather Observing System (AWOS)

Table 5-3 outlines the required standards for Instrument Approach Procedures.

Table 5-3 Standards for Instrument Approach Procedures

Visibility Minimums	*< ¾ statute mile*	*¾ to < 1 statue mile*	*≥ 1 statute mile straight-in*	*Circling*
Height Above Touchdown Zone	< 250’	≥ 250	≥ 250’	≥ 350’
TERPS Chapter 3, Section 3	34:1 clear	20:1 clear	20:1 clear, or penetrations lighted for night minimums	
Precision Obstacle Free Zone	Required	Recommended		
Minimum Runway Length	4,200’ (paved)	3,200’ (paved)		
Runway Markings	Precision	Non-Precision	Non-Precision	Visual (Basic)
Holding Position Sign & Markings	Precision	Non-Precision	Non-Precision	Visual (Basic)
Runway Edge Lights	HIRL/MIRL	HIRL/MIRL	MIRL/LIRL	MIRL/LIRL (Required only for night minimums)
Parallel Taxiway	Required	Required	Recommended	Recommended
Approach Lights	MALSR, SSALR, or ALSF	Recommended	Recommended	Not Required
Airport Layout Plan	Required	Required	Required	Required

Source: FAA AC 150/5300-13A, Table 3-4

Findings: The visibility minimum for the Runway 14 end is ½ mile, meeting the minimum criteria for < ¾ statute mile approach procedures, whereas the visibility minimum for the Runway 32 end is 1 mile, meeting the minimum criteria for ≥1 statute mile straight-in approach procedures. In 2013, the NAA requested a waiver for the distance from the holdline on Taxiway ‘A’ to the Runway 14-32 centerline. The constructed holdline is 560 feet from the Runway 14-32 centerline as a result of the 34:1 TERPS approach surface. The waiver request was denied by the NHDOT.

Recommendation: Continue working to ensure the approach surfaces remain free of obstructions. Add a stub taxiway to Taxiway ‘A’ that would permit a holdline 250 feet from the Runway 14-32 centerline. This would require aircraft to back taxi.

5.1.2.3 Part 77 Requirements

The airspace surrounding public use airports is governed by regulations found within 14 Code of Federal Regulations (CFR) Part 77. This regulation is known by its more common title as **14 CFR, Federal Aviation Regulation (FAR) Part 77- Objects Affecting Navigable Airspace** (Part 77), which was promulgated by the FAA, and includes areas around airports (sometimes called Imaginary or Protected Surfaces) that must be kept clear of penetrating objects, called “obstructions”. By accepting FAA funding, an airport agrees to make all reasonable efforts to keep its Part 77 protected surfaces clear of obstructions. Part 77 also includes guidance for analysis and marking of penetrating objects in specific cases. Obstructions are defined by Part 77 as:

“any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment and materials used therein, and apparatus of a permanent or temporary character; and alteration of any permanent or temporary existing structure by a change in its height (including appurtenances), or lateral dimensions, including equipment or materials used therein.”

Part 77 specifies the dimensions of imaginary surfaces for each individual airport based on the type and size of aircraft using the facility, the runway surface treatment, as well as the type of navigation and approach aids available to pilots. Five imaginary surfaces are identified and defined under Part 77, they are:

- Primary Surface
- Approach Surface
- Transitional Surface
- Horizontal Surface
- Conical Surface

Figure 5-1 depicts the relationship of these surfaces to a typical runway. Dimensions for each of these surfaces are stipulated in Part 77. Depending upon the application of criteria outlined in the regulation, surface dimensions may vary from runway to runway. The surfaces are defined as follows:

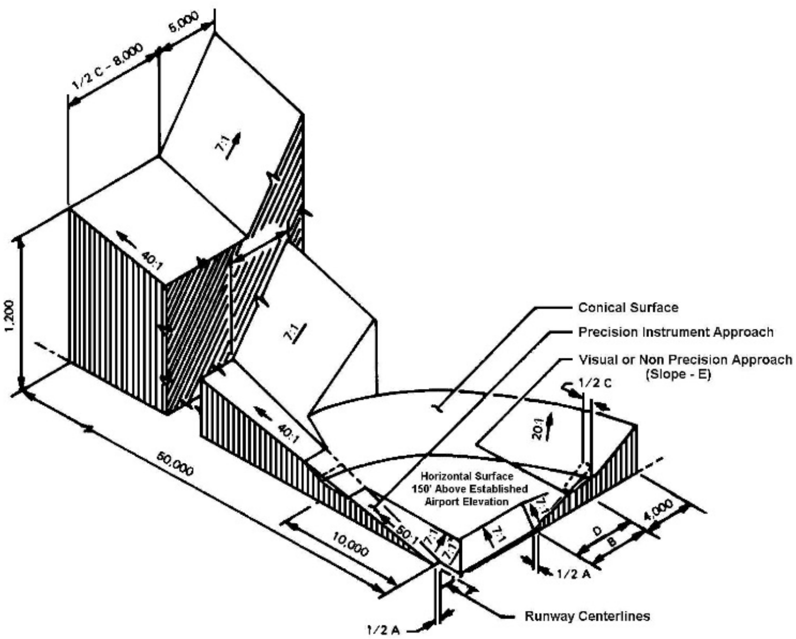


Figure 5-1 Part 77 Surfaces

- Primary Surface- A rectangular shaped surface longitudinally centered on the runway centerline with the same elevation as the nearest corresponding point on the runway centerline. The primary surface dimensions will vary depending on the runway approach type and the type of runway surface.

- Approach Surface- A trapezoidal shaped surface centered on the runway centerline and extending outward and upward from each end of the primary surface at a prescribed slope angle. Approach surface dimensions and slope angle will vary according to the runway approach type.

- Transitional Surface- This surface is an inclined plane running parallel to the runway centerline beginning at the edges of the primary and approach surfaces. It then extends upward and outward at a slope of seven feet horizontally for every one-foot vertically (7:1) from the sides of the primary and approach surfaces to the horizontal surfaces (150' above the Airport elevation).

- Horizontal Surface- This surface is an oval shaped, horizontal plane established by Part 77 to be 150 feet above the Airport elevation. It is established by swinging arcs from the intersection of the extended runway centerline and primary surface at each end of the runway then closing each area with tangent lines. In areas where the primary approach and transitional surfaces may overlap, the surface with the lowest elevation is the controlling surface.

- Conical Surface- This surface extends upward and outward from the edge of the horizontal surface at a slope of twenty-feet horizontally for every one-foot vertically (20:1) for 4,000 horizontal feet from the edge of the horizontal surface.

The Part 77 surface dimensions and their compliance status for Runway 14-32 at the Airport is shown below in Table 5-4. The Part 77 surfaces are shown on Sheet X of the ALP set, *FAR Part 77 Surfaces Plan.* Compliance, as defined in Table 5-4, means that the surface is unobstructed by penetrating objects, or that penetrating objects are property mitigated through FAA approved lighting or other means.

Table 5-4 Runway 14-32 Part 77 Compliance

Protected Surfaces		*Dimensions (Precision Instrument RW 14*	*Dimensions (Non-Precision Instrument RW 32*	*Compliance*
Primary Surface	Width	1,000'	1,000'	
	Length beyond R/W End	200'	200'	Contains Vegetative Obstructions
Approach				
	Width at Inner end	1,000'	1,000'	Contains Vegetative Obstructions
	Width at Outer end	16,000'	3,500'	Clear
	Length	*	10,000'	
	Slope	*	34:1	
Transitional surface slope		7:1	7:1	Contains Vegetative Obstructions
Horizontal surface radius		10,000'	10,000'	Contains Vegetative Obstructions
Conical surface	Slope	20:1	20:1	Contains Vegetative Obstructions
	Radius	4,000'	4,000'	Contains Vegetative Obstructions

Source: AC 150/5300-13A

**Precision instrument approach slope is 50:1 for inner 10,000 feet and 40:1 for an additional 40,000 feet*

5.1.2.4 TERPS Approach Requirements

Terminal Instrument Procedures (TERPS) regulations recommend minimum obstacle clearances considered by the FAA to supply a satisfactory level of vertical protection to aircraft approaching the Airport. These are not requirements, but rather guidelines for enhancing aircraft safety. Table 5-5 shows the dimensional standards for TERPS approach surfaces.

Table 5-5 Approach/Departure Standards Table

Runway		*Dimensional Standards*				*Slope*
		Start of Surface	*Inner Width*	*Length*	*Outer Width*	
14	Category 7 – Approach end of runways expected to accommodate instrument approaches having visibility minimums < ¾ statute mile.	200' from runway end	800'	10,000'	3,800'	34:1
32	Category 6 – Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ ¾ but <1 statute mile.	200' from runway end	800'	10,000'	3,800'	20:1

Source: AC 150/5300-13A, Table 3-2 Approach/Departure Standards Table

Recommendations: Because the Part 77 surfaces are the most restrictive and should be cleared of obstructions, it is recommended that the Airport continue its efforts to obtain property rights (fee simple or easement acquisition) on off-airport properties, and continue efforts to work with owners to clear, mark, or light identified obstructions to the Airport's Part 77 surfaces; however, the Airport is currently cleared to TERPS standards as a result of obstruction removal performed under NHDOT No. SBG-12-06-2010.

5.1.3 TURF RUNWAY

The Nashua Airport Authority and Airport Management have expressed interest in providing airport users with a turf runway. In the years prior to the reconstruction of Runway 14-32, the grass area located northeast of Runway 14-32 was utilized by smaller aircraft (less than 12,500 lbs., and approach speeds less than 91 knots) with authorization from the Air Traffic Control Tower (ATCT) that pilots could "land at their own risk". Operations on the grass were always sequential/staggered with Runway 14-32. The ATCT assisted aircraft landing on the grass with navigation across Runway 14-32, and subsequently onto one of the cross taxiways. In addition, the helicopter school used to make frequent use of the turf runway for "auto-rotation practice" and hovering practice.

The Authority and Airport Management have stated that operations on the proposed turf runway would require authorization from the ATCT and would not be conducted concurrently with operations occurring on Runway 14-32. Because of its turf surface and shorter available landing length than Runway 14-32, the turf runway would be limited to small aircraft use only. In accordance with FAA 150/5300-13A, the Turf Runway Dimensional Requirements are presented in Table 5-6 below.

Table 5-6 Turf Runway Dimensional Requirements

Facility	*Required Dimensions*
Runway turf width	60’
Runway safety area width	120’
Runway safety area length beyond runway end	240’
Runway object-free area width	250’
Runway object-free area length beyond runway end	240’
Runway obstacle-free zone width	120’
Runway protection zone at both runway ends	Length- 1,000’; Inner width 250’; Outer Width 450’

Source: AC 150/5300-13A, Appendix 7
**Small Aircraft Exclusively*

In May of 2017, the NHDOT released a list of obligations for NIPIAS Airports to consider when approached by pilots inquiring about landing on the grass at the airport. Other than in the case of an emergency, NHDOT/BA does not recommend grass landings for the following reasons:

- FAA Grant Assurance #29 requires the ALP to show “the location and nature of all existing and proposed airport facilities and structures (such as runways, taxiways, aprons, terminal buildings, hangars and roads).”
- FAA Grant Assurance #29 discourages changes or alternations to the airport or the facilities that the Secretary determines adversely affects the safety, utility, or efficiency of any federally funded property on the airport and which is not in conformity with the airport layout plan as approved by the Secretary.
- FAR Part 91.3 (a) states that “The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.”
- FAR Part 91.13 (a) states that “No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another.”
- NHDOT/BA Landing Hazard guidelines state that “landing in the grass is at the pilot’s own risk and can be done in an emergency. Because the grass alongside the runway contains runway lights, signs, drainage system components, drainage swales, small bumps and ruts, etc., these could all be hazards to landing or departing aircraft. Additionally, if the grass had been wet, the ground may be soft after snowmelt, or if there are snowbanks still in the grass, these could also impede a safe aircraft landing in the grass”.
- NHDOT/BA Environmental Concerns state that “If there are any threatened or endangered species in the grassy areas, the USFWS and/or NHDFG could go after the pilot and/or the airport for a species ‘take’.”
- NHDOT/BA guidelines state that “FAA/FSDO will have the last say on the interpretation of pilots’ rights or actions.”

Findings: FAA AC 150/5300-13A provides the following guidance for Turf Runways:

1) **Runway length: Due to the nature of turf runways, landing, takeoff, and accelerate-stop distances are longer than for paved runways. It is recommended that distances for aircraft (landing, takeoff, and accelerate-stop) be increased by a factor of 1.2.**
2) **Runway width: Runway width standards are the same as for paved runways. Runway safety area standards also apply.**
3) **Grading: It is recommended that turf runways be graded to provide at least a 2.0 percent slope away from the center of the runway for a minimum distance of 40 feet (12m) on either side of the centerline of the landing strip and a 5.0 percent slope from that point to the edge of the RSA to provide rapid drainage.**
4) **Compaction: Turf runway should be compacted to the same standards required for the RSA for paved runways.**
5) **Vertical curves: Grade changes should not exceed 3.0 percent and the length of the vertical curve must equal at least 300 feet for each 1.0 percent change.**
6) **Thresholds: Thresholds should be permanently identified to ensure that airspace evaluation is valid for the runway.**
7) **Landing strip boundary markers: Low mass cones, frangible reflectors, and Low Intensity Runway Lights (LIRL) may all be used to mark the landing strip boundary.**
8) **Hold Markings: Hold position markings should be provided to ensure adequate runway clearance for holding aircraft.**
9) **Types of turf: Soil and climate will determine the selection of grasses that may be grown.**

Recommendation: During the development of this Chapter, the Master Plan Committee determined that it would not be feasible at this time to pursue the designation of a turf runway given the many constraints at the airport. In the future, if the airport wishes to pursue the designation of a turf runway, they would need to coordinate with the NHDOT/BA and FAA to obtain approval for the turf runway on an approved Airport Layout Plan.

5.1.4 TAXIWAY CAPACITY

Taxiway capacity calculations are typically computed only at airports where aircraft operational demand levels are very high and have taxiways that cross active runways where a capacity-limiting condition would exist. Since these situations aren't applicable at the Airport, taxiway capacities are considered adequate through the planning period. ASH has an extensive system of taxiways designated with letters 'A' through 'G', plus an "Unnamed" taxiway and "Inner" taxiway.

5.1.4.1 Taxiway 'A' Requirements

Taxiway 'A' is the Airport's primary, full-length parallel taxiway. FAA design standards require that Taxiway 'A' comply with the following requirements outlined in Table 5-7 below.

Table 5-7 Taxiway 'A' Compliance

Facility	*Design Criteria*	*Dimensions*	*Compliance*
Taxiway Width	35'	35'	Complies
Edge Safety Margin	7.5'	7.5'	Complies
Shoulder Width	15'	15'	Complies
TOFA Width	131'	131'	Complies
TW Centerline to RW Centerline Width	400'	550'	Complies

Source: AC 150/5300-13A

5.1.4.2 Taxiway Pavements

In 2017, the Airport developed a Pavement Maintenance Plan (See Appendix A) to establish a set of policies and procedures for the Airport to be in compliance with the Airport Improvement Program (AIP) assurances for pavements that have been constructed, reconstructed, or repaired with federal financial assistance. Table 5-8 below outlines the dimensions, type of pavement, and year of construction or most recent major rehabilitation of each taxiway.

Table 5-8 Taxiway Pavements

Taxiway	*Dimensions*	*Type of Pavement*	*Year of Construction or most recent Major Rehab.*
Taxiway 'A'	5,206' x 40'	Flexible	Overlay Pavement East of T/W 'C'- 2012 West of T/W 'C'- 2013
Taxiway 'A' West	690' x 40'	Flexible	2012
Taxiway 'A' East	895' x 40'	Flexible	2012
Taxiway 'B'	480' x 40'	Flexible	2012
Taxiway 'C'	480' x 40' 80' x 50'	Flexible	2012 1991
Taxiway 'D'	480' x 40' 295' x 35'	Flexible	2012 Overlay Pavement 2013
Taxiway 'E'	306' x 40'	Flexible	1985/1991/1996
Taxiway 'F'	80' x 50'	Flexible	1991
Taxiway 'G'	1,075' x Varying widths	Flexible	Overlay Pavement 2017
Taxiway 'G' West	215' x Varying widths	Flexible	1991
Taxiway 'G' East	100' x 80'	Flexible	2012
Inner Taxiway	1,470' x 30'-35'	Flexible	1991

Source: Gale Associates Analysis 2017

Recommendation: Relocate and reconstruct Taxiway 'A', 150' closer to Runway 14-32 (400' of runway-to-taxiway separation is required). This will provide the Airport with additional room for expansion of facilities. As additional pavement areas become eligible for replacement/repair, address as needed. Upon shifting and reconstructing Taxiway 'A', it is the preference of the Airport that Taxiway 'C', and Taxiway 'D' remain in their current location and configuration. This will likely require the Airport to file a "Modification of Standard" applicable to airport design with the NHDOT/BA and FAA.

5.1.5 APRON CAPACITY

There are seven aircraft parking aprons at the Airport, which cumulatively accommodate up to 310 aircraft. Table 5-9 outlines the dimensions, type of pavement, and year of construction or most recent major rehabilitation of each apron.

Table 5-9 Apron Pavements

Apron	*Dimensions*	*Type of Pavement*	*Year of Construction or most recent Major Rehab.*
Alpha Ramp	205,315 SF	Flexible	2017
Alpha Ramp (East)	27,000 SF	Flexible	2012
Delta Ramp	174,950 SF	Flexible	Abandoned by Airport
Echo Ramp	209,500 SF	Flexible	2009
Foxtrot Ramp	97,300 SF	Flexible	1983
Golf Ramp	245,850 SF	Flexible	1986
Hotel Ramp	289,490 SF	Flexible	1985/1996
India Ramp	187,600 SF	Flexible	2003

Source: Airport Management, Gale Associates Analysis 2017

In 2016, the Airport had 249 based aircraft. In 2037, at the end of the planning period, the based aircraft fleet is forecasted to grow by 121 additional aircraft to 370. Assuming that 50 percent of the based aircraft will require tie-downs at the end of the planning period, 185 aircraft tie-downs will be needed to accommodate projected demand.

Additionally, transient aircraft make use of the parking aprons. The Airport experienced 58,726 operations in 2016, with 28,284 (48.9 percent) being performed by itinerant aircraft. In order to identify the number of required tie-down spaces for potential transient aircraft, the formula listed below was used. The number of required tie-down spaces is derived by multiplying the number of operations per peak month (6,325) by the percent of itinerant aircraft at the Airport (48.9 percent), divided by the number of days in the month (31) multiplied by 110 percent and then divided by 2, assuming that half of the itinerant operations will require apron space.

$$\{[6{,}325 \times 48.9\%\}/31] \times 110\%\}/2$$

= 55 transient aircraft parking spaces

The calculation concludes that 55 transient tie-down spaces will be needed to accommodate the transient fleet during the planning period. Based upon the calculations it is reasonable to conclude that the Airport will require 240 tie-down spaces to accommodate aircraft through the planning period. Since the Airport currently has 310 tie-down spaces, additional spaces are not recommended at this time.

Recommendation: No additional tie-down spaces are recommended at this time. Pavements for existing tie-down spaces should be reconstructed as they near the end of their design life. If Taxiway 'A' is shifted 150 feet closer to Runway 14-32 (compliant 400 feet of runway-to-taxiway separation), there will be additional space available for an increase in tie-down spaces when demand is warranted, which should be reserved.

5.1.6 NAVIGATIONAL AND APPROACH AIDS

Aids to navigation provide pilots with information to assist in locating the Airport and give horizontal and/or vertical guidance during landing operations. Additionally, navigational aids (NAVAIDs) are critical during poor or inclement weather conditions. The Airport is equipped with lighting instruments, precision approach path indicator, glide slope, rotating beacon, etc. to assist pilots with navigational guidance. Each of these are further described below.

5.1.6.1 Rotating Beacon

A tower-mounted rotating beacon is located near the "Brick Hangar" (Building No. 1) on the southeast side of the airport near Pine Hill Road. The beacon was refurbished in 1987 and was eligible for reconstruction in 2002. Through discussions with Air Traffic Control Tower personnel, the rotating beacon is meeting the needs of the Airport.

Recommendation: Maintain the existing rotating beacon and replace when its condition requires.

5.1.6.2 Hazard Beacons and Obstruction Lights

The Airport owns and maintains two hazard beacons and five obstruction lights. Hazard Beacon #1 is located in an easement on the Labombarde property, south of Indian Rock Road in Nashua. Hazard Beacon #2 is located in the right-of-way of Nartoff Road in Hollis. There are obstructions lights located on Airport property along the railroad tracks. The two off-airport obstruction lights are located at the corner of Charron Avenue and Pine Hill Road; and on Robert Drive, approximately 150 feet off Pine Hill Road, southeast of the Airport. The three obstruction lights along the railroad tracks were installed in 2012 and are eligible for replacement in 2032. Hazard Beacon #1, Hazard Beacon #2, and the two off-airport obstruction lights were installed in 2008 and are eligible for replacement in 2028.

Recommendation: Monitor the conditions of the beacons and obstructions lights, and replace/repair as needed.

5.1.6.3 Lighted Windcone

The Airport has one lighted windcone, located on the northeast side of the runway at approximately midfield. The Airport Manager has noted that this windcone does not accurately reflect the winds, especially when they are from the east due to the presence of trees in proximity to its location. Additionally, the Airport is equipped with two non-lighted, supplemental windcones located adjacent to Taxiway 'A' West near the Runway 14 end, and Taxiway 'B' near the Runway 32 end. All three windcones were installed in 2012 and are eligible for replacement in 2032.

Recommendation: Identify a more suitable location to represent the wind direction and speed for airport users and maintain the existing non-lighted windcones as needed.

5.1.6.4 Runway Lighting

Runway 14-32 has an L-862 High Intensity Runway Lighting System (HIRLS). The HIRL system is a pilot-activated light system consisting of white, red, amber, and green stake-mounted lights. The HIRLS system, installed in 2012, is airport owned and is in excellent condition.

Recommendation: Maintain the existing runway lighting and replace when their condition requires.

5.1.6.5 Precision Approach Path Indicator

ASH has a 4-light PAPI (3.0-degree approach angle) on Runway 14, which is owned and maintained by the FAA. Runway 32 has a 4-light PAPI (3.0-degree approach angle), which is owned and maintained by the Airport. The Runway 14 end PAPI was installed in 2012 and is good condition. The Runway 32 PAPI was installed in 2012 and is in good condition.

Recommendation: Maintain the existing PAPI's and replace when their condition requires.

5.1.6.6 Runway End Identifier Lights

Runway End Identifier Lights (REILs) are located at the Runway 32 end at the displaced threshold bar, and are airport owned. The REILs were installed in 2012 and are in excellent condition.

Recommendation: Maintain the REILS and replace when their condition requires.

5.1.6.7 Threshold Lights

Threshold lights are located on the Runway 14 end at the landing threshold of the runway. On the Runway 32 end, threshold lights are located at the displaced threshold, which is 350 feet from the runway pavement end. The Threshold lights were installed in 2012 and are in excellent condition.

Recommendation: Maintain the existing threshold lights and replace when their condition requires.

5.1.6.8 Medium Approach Light System with Runway Alignment Indicator Lights

The Medium Approach Light System with Runway Alignment Indicator Lights (MALSR) is a lighting system installed in the Runway 14 approach along the extended centerline of the runway. The MALSR consists of a combination of threshold lamps, steady burning light bars and flashers, providing visual information to pilots on runway alignment, height perception, roll guidance, and horizontal references for Category I Precision Approach. The MALSR was installed in 2012, is owned and maintained by the FAA, and is in excellent condition.

Recommendation: Maintain the existing MALSR and replace when its condition requires.

5.1.6.9 Instrument Landing System Localizer

An Instrument Landing System Localizer (Localizer) is the component of an instrument landing system that provides horizontal guidance, used to guide aircraft along the axis of the runway. ASH has a CAT I Localizer south of the Runway 32 end, which is owned and maintained by the FAA. It was installed in 2012 and is in excellent condition.

Recommendation: Maintain the existing Localizer and replace when its condition requires.

5.1.6.10 Instrument Landing System Glide Slope

The Runway 14 end is equipped with an END-FIRE Glide Slope, which is owned and maintained by the FAA. The Glide Slope provides vertical guidance for aircraft during approach and landing. The Glide Slope was installed in 2012 and is in excellent condition.

Recommendation: Maintain the existing END-FIRE Glide Slope and replace when its condition requires.

5.1.6.11 Automated Weather Observing System (AWOS)

The Airport is equipped with an Automated Weather Observing System (AWOS) III P/T, which records wind speeds, wind gusts, wind direction, variable wind direction, temperature, dew point, altimeter setting, density altitude, present weather, and lightning detection. The AWOS is owned and maintained by the FAA. In its current location, the AWOS critical area[1] contains obstructions, including the air traffic control tower.

Recommendation: Identify a suitable area to relocate the AWOS so that critical areas are free of obstructions. Maintain the AWOS and replace when its condition requires.

5.2 LANDSIDE CAPACITY AND REQUIREMENTS

Airport facilities that are not required for the movement of aircraft are considered landside facilities. These facilities usually consist of administration and maintenance buildings, hangars, and automobile parking areas. This section will provide a review of the capacity and functionality of the Airport's landside facilities.

5.2.1 ADMINISTRATION/INFORMATION BUILDING

The primary purpose of an administration/information building is to serve passengers utilizing the airport. Currently, the Airport does not have an administration/information building, and the FBOs are providing terminal facilities to airport users. Administrative functions at the airport are conducted in office space

[1] There are two critical areas for the AWOS. The wind sensor on the AWOS has the following requirements for clearance:

A) 0-500 feet from the sensor, all objects shall be at least 15 feet lower than the sensor height.

B) 500-1,000 feet from the sensor, all objects shall be no greater than 10 feet above the height of the sensor.

located within the SRE building. There are two offices, which are utilized by the Airport Manager and Office Manager, with additional space for the Maintenance Supervisor. From a capacity viewpoint, the administrative offices need to be larger, have a view of the airfield for security purposes, and be more visible to accommodate its various uses and potential future uses, such as:

- Airport Manager's office.
- Reception office.
- Car rental office.
- Restrooms.
- Conference or meeting room.
- Pilots' lounge and briefing room.
- Airport operations counter space (i.e., monitoring fueling, aircraft movements).
- Observation lounge/deck.

Recommendation: It is recommended that a new administration/information building be constructed to accommodate current and future demand when logistically and financially feasible, in an effort to provide a "front door" for the airport. It is possible that the former Daniel Webster College building could be repurposed to serve in this capacity, or a potential stand-alone building could be constructed in the vicinity of the former Daniel Webster College building.

5.2.2 HANGARS

Demand for aircraft hangars depends on a number of variables, including airport location, aircraft type, cost, seasonal and climatic conditions. Presently, there are 106 T-hangar units with capacity for 106 aircraft, and 12 corporate hangars with capacity for 26 aircraft. Assuming 50 percent of aircraft are utilizing tie-downs, with a fleet of 370 at the end of the planning period, a theoretical need for an additional 53 hangar spaces, totaling 185, is conceivable.

Recommendation: Construct additional hangar spaces to accommodate user needs throughout the planning period, as demand warrants.

5.2.3 AIR TRAFFIC CONTROL TOWER

The Air Traffic Control Tower (ATCT) is located on the southwest side of the Airport at approximately midfield and sits atop Building #79. The ATCT was opened in 1988 and is staffed 7 days a week from 7:00 AM to 9:00 PM. Discussion concerning future needs of the ATCT were conducted with Airport management, members of the NAA, and with the ATCT Manager. Among other concerns, it was learned that the ATCT has considerable line-of-sight issues of controlled movement areas at the airport, trees along Perimeter Road obstructing the tower's view of circling aircraft approaching the Runway 32 end, and visibility issues with aircraft approaching from the south and west.

Recommendation: Relocate and/or replace the existing ATCT so that the ATCT has an unobstructed view of all controlled movement areas of an airport, including all runway, taxiways, and any other landing areas, and of air traffic in the vicinity of the airport. Note: all air traffic control tower relocations must

be sited through the Airport Facilities Terminal Integration Laboratory (AFTIL) based on the current version of FAA Order 6480.4A, Air Traffic Control Tower Siting Process.

5.2.4 ON-CALL CUSTOMS

Consultation regarding qualification criteria for attainment of Customs and Border Patrol (CBP) facilities at the Airport was conducted with the CBP Portland office, on November 15, 2017. CBP indicated that the Airport would not likely meet the requirements to be designated as a CBP Port of Entry (POE), but that the Airport may qualify for the User Fee Airport (UFA) Program. CBP Portland further confirmed that "on call" services are not offered, and that the only way the Airport can offer CBP services to users is to be designated as either a POE or a UFA. Below are the basic CBP requirements that an airport must meet to be considered for designation as a POE or UFA[2].

Ports of Entry:

A "Port of Entry" is an officially designated location (seaports, airports, and or land border locations) where CBP officers or employees are assigned to accept entries of merchandise, clear passengers, collect duties, and enforce the various provisions of CBP and related laws. The following are considered the minimum basic criteria for establishing a port of entry.

The applicant or requesting community must:

- Prepare a report that shows how the benefits to be derived justify the Federal Government expense.
- Be serviced by at least one other major mode of transportation.
- Have a minimum population of 300,000 within the immediate service area (approximately a 70-mile radius).

The actual workload in the area must be one or a combination of the following:

- 15,000 international air passengers (airport).
- 2,000 scheduled international arrivals (airport).
- 2,500 consumption entries (each valued over $2,000), with no more than half being attributed to any one party (airport, seaport, land border port).
- 350 vessels (seaport).
- 150,000 vehicles (land border port).
- Any appropriate combination of the above.

Facilities provided without cost to the Federal Government, must include:

- Wharfage and anchorage adequate for oceangoing cargo/passenger vessels (if a water port).
- Cargo and passenger facilities.

[2] https://www.cbp.gov/trade/trade-community/programs-outreach/ports

- Warehousing space for the secure storage of imported cargo pending final CBP inspection and release.
- The commitment of optimal use of electronic data input equipment and software to permit integration with any CBP system for electronic processing of commercial entries.
- Administrative office space, cargo inspection areas, primary and secondary inspection rooms, and storage areas, and any other space necessary for regular CBP operations.
- Identification of location and distance of nearest CBP ports.

The Federal Government provides Land Border inspection facilities.

User Fee Airport (UFA) Program:

A UFA is a small airport which has been approved by the Commissioner of CBP to receive, for a fee, the services of a CBP officer for the processing of aircraft entering the United States and their passengers and cargo. The applicant must meet the following criteria for UFA consideration:

- The volume or value of business at the airport is insufficient to justify the availability of inspectional services at such airport on a non-reimbursable basis.
- The current Governor of the State in which such airport is located supports such designation in writing to the Commissioner of CBP.
- The requestor (e.g. airport authority) agrees to reimburse CBP for all costs associated with the services, including all expenses of staffing a minimum of one full-time inspector.
- The requestor completes an Agriculture Compliance Agreement (ACA) with fixed base operators and garbage haulers for handling the international garbage.

The basic steps required in considering an application for designation as an UFA include:

- Receipt of a letter from the current Governor of the state supporting the user fee airport designation addressed to the Commissioner.
- An initial site visit in which CBP officials discuss workload and services.
- A final site visit in which CBP officials verify that facilities are 85% complete and adequate for inspectional services to be provided.
- A successful site visit in which CBP officials discuss workload and services and verify that facilities are adequate for inspectional services to be provided.
- Completing a Memorandum of Agreement (MOA) with CBP, which states the responsibilities, fees and hours of service.
- Completing an ACA with CBP for handling international garbage.

An approved UFA receiving CBP services is responsible for payment of the following fees:

- Per Inspector - $140,874 for the first year and $123,438 for succeeding years.
- Affected Domestic Producer costs per inspector - $17,042 to $21,062 (1st year) and $13,620 to $17,640 for succeeding years depending on the location.
- Other associated costs such as overtime.

Per discussions with CBP, dimensional requirements for a UFA facility can be provided following the completion of an initial site visit.

Recommendation: Consider dedicating space in a new administration/information building or constructing a stand-alone facility to accommodate CBP services. Due to the low activity at ASH, the CBP would require the Airport provide all capital and operational funding. This funding could be cost-shared and/or passed on to users.

5.3 SUPPORT FACILITY CAPACITY AND REQUIREMENTS

Support facilities are those facilities on the Airport that help to ensure efficient operation of the Airport. The Airport has fueling facilities, snow-removal and grass mowing equipment, access roads, security fencing, and other facilities, which all must be maintained and upgraded as needed so that day-to-day operations may continue.

5.3.1 AUTOMOBILE PARKING

ASH has automobile parking in various locations around the airport (both inside and outside the fence) providing access to the Air Traffic Control Tower, hangars, restaurants, administration building and SRE buildings, and FBOs. It is estimated that there are approximately 300 designated aviation-related parking spaces throughout the Airport. Through discussions with airport personnel and users, it has been expressed that the Airport lacks an adequate number of parking spaces and/or designated areas within the fence. Parking is relatively disjointed, and often, vehicles are parked wherever people believe they are “out of the way”. The lack of designated vehicle parking spaces located inside the fence has the potential to create conflicts with moving aircraft.

Recommendation: The Airport has identified several potential areas inside the fence that could be used to provide additional automobile parking. Designate areas for parking inside the fence that provide clear delineation between automobile parking and aircraft movement areas.

5.3.2 SNOW REMOVAL EQUIPMENT

The FAA AC 150/5220-20A, *Airport Snow and Ice Control Equipment,* provides guidance in determining the type and size of needed Snow Removal Equipment (SRE) necessary for airports. These determinations are based upon the total area of high priority clearing areas, the number of annual operations, and the average amount of annual snowfall.

The AC states that non-commercial service airports with over 10,000 operations and at least 15 inches (38cm) of annual snowfall should have a minimum of one high-speed rotary plow supported by two snow plows of equal snow removal capacity[3]. In 2016, the Airport had 58,726 operations and had an average annual snow fall of approximately 56 inches. Based on this data, and the guidelines set forth in AC

[3]https://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/14837

150/522-20A, the Airport is eligible for one high-speed rotary plow and two displacement plows of equal capacity.

The Airport currently owns the SRE listed in Table 5-10.

Table 5-10 SRE Owned by ASH

	SRE Type	*Year*	*Manufacturer*	*Purchased w/FAA Assistance*	*Eligible for AIP Replacement*
1	Grader	1985	Fiatallis	Yes	Yes
2	Loader (w/bucket and plow)	1985	Fiatallis	Yes	Yes
3	Loader (w/bucket and plow)	1996	Samsung	No	Purchased by Airport
4	Rotary Plow (Vehicle)	1979	SMI	No	Purchased from Manchester Airport by Airport
5	Rotary Plow (loader mount)	1985	Snogo	Yes	Yes
6	Loader (w/bucket and Plow)	1988	Michigan	No	Purchased from Federal Surplus
7	Pickup Truck (w/Plow)	2002	Chevrolet	No	Purchased by Airport
8	Carrier Vehicle (Front-End Loader)	2006	John Deere	Yes	Yes
9	Rotary Broom (loader mount)	2006	MB-Company	Yes	Yes
10	Pickup Truck (w/Plow)	2008	Ford	Yes	Yes
11	High Speed Dozer (w/18' snow pusher)	2013	John Deere	Yes	No
12	Rotary Plow	2013	Snogo	Yes	No

Source: Airport, Gale Associates Analysis

Eligible Snow Removal Equipment Under AIP:

Based on the results of FAA's SRE Calculation spreadsheet (See Figure 5-2), Boire Field qualifies for Snow Removal Equipment contained in Table 5-11.

Figure 5-2 ASH Snow Removal Equipment Calculations

Snow Removal Equipment Calculations

* Data entry required

Airport Name: Boire Field
Location: Nashua, New Hampshire
*Average Annual Snow Fall: 20
*Type of Airport: General Aviation
*Annual Operations: >40,000

Users requiring assistance or reasonable accommodation may contact the FAA Central Region at 816-329-2600

Refer to AC 150/5220-20, Airport Snow and Ice Control Equipment, and AC 150/5200-30, Airport Winter Safety and Operations for specific guidance.

Time allowed for removal per AC 150/5200-30: **2** hours

Critical Snow Removal Areas:

***Primary Runway (usually one)**

length (ft)		width (ft)		=	sq. ft.
6,000	length (ft) x	100	width (ft)	=	600,000 sq. ft.
	length (ft) x		width (ft)	=	0 sq. ft.

***Parallel taxiway and one or two principle connecting taxiways**

length (ft)		width (ft)		=	sq. ft.
6,800	length (ft) x	35	width (ft)	=	238,000 sq. ft.
840	length (ft) x	35	width (ft)	=	29,400 sq. ft.
600	length (ft) x	35	width (ft)	=	21,000 sq. ft.
500	length (ft) x	35	width (ft)	=	17,500 sq. ft.

***Terminal, Cargo, and General Aviation Aprons**

Critical apron area assumed as 1/2 of the apron.

% Req'		length (ft)		width (ft)		=	sq. ft.
50	% Req' x	1,900	length (ft) x	240	width (ft)	=	228,000 sq. ft.
50	% Req' x	261	length (ft) x	250	width (ft)	=	32,625 sq. ft.
50	% Req' x	1,040	length (ft) x	240	width (ft)	=	124,800 sq. ft.
50	% Req' x	657	length (ft) x	240	width (ft)	=	78,840 sq. ft.
50	% Req' x		length (ft) x		width (ft)	=	0 sq. ft.

Other critical areas (ie. emergency or ARFF access roads)

length (ft)		width (ft)		=	sq. ft.
467	length (ft) x	12	width (ft)	=	5,604 sq. ft.
467	length (ft) x	12	width (ft)	=	5,604 sq. ft.
4,100	length (ft) x	20	width (ft)	=	82,000 sq. ft.
				Total Area=	**1,463,373** sq. ft.

*Snow Depth (in): 1
*Snow Density (lbs/cu ft): 25

Tons of Snow: **1,524** tons

Rotary Plow

*Rotary Plow Efficiency %: 70
Minimum Rotary Plow snow removal rate: **1,088** tons/hr

Displacement Plow

*Operating Speed (mph): 20
*Plow Efficiency %: 75
*Plow Cutting Angle (degrees): 30

Effective Blade Length (ft) Required: **9.2** ft.
Actual Blade Length (ft) Required: **11.0** ft.

Snowfall Maps can be found here:

Iowa:
http://www.hprcc.unl.edu/wrcc/states/ia.html

Kansas:
http://www.hprcc.unl.edu/wrcc/states/ks.html

Missouri:
http://www.hprcc.unl.edu/wrcc/states/mo.html

Nebraska:
http://www.hprcc.unl.edu/wrcc/states/ne.html

Eligible Items	Max Quantity	Size		Notes
Rotary Plow	2	1,088	tons/hr Total	Class 1 (up to 600 tons/hr, 50' casting distance)
Displacement Plow	4	11	ft, Total	Up to 2 times the # of snow blowers (displacement plows should have equal capacity as max rotary plow capacity)
Sweeper	1			1 Sweeper per 750,000 sq. ft. of pavement (rounded up)
Hopper Spreader	1			1 Hopper Spreader per 750,000 sq. ft. of pavement
Front End Loader	1			1 Front End Loader per 500,000 sq. ft. of critical apron space

- Refer to Figure 2-6 AC 150/5220-20 for GVW & HP rating @ carrier vehicles.
- Refer to AC 150/5220-20, Chapter 6, Paragraph 38for minimum equipment requirements at Commercial Service and General Aviation airports. Program Guidance Letter, PGL 08-04 limits non Primary airports to one SRE vehicle

This program assumes at least 15" annual snow fall.

Rev Date: 01-5-2012

Table 5-11 SRE Eligible at ASH

Snow Removal Equipment (Type)	*Quantity*	*Eligible for Replacement*	*Year Eligible*
Carrier vehicle for Rotary Plow	1	No	2023
Class III Rotary Plow	1	No	2023
Carrier Vehicle for Displacement Plow	2	(1) Yes (1) Yes	(1) 2013 (1) 2018
Displacement Plows	2	(1) Yes (1) Yes	(1) 2016 (1) 2018
Carrier Vehicle for Rotary Sweeper	1	Yes	2016
Rotary Sweeper (Loader Mount)	1	Yes	2016
Hopper Spreader	1	Yes	2013
Front End Loader	1	Yes	2016

Source: FAA Snow Removal Equipment Calculations

Through the AIP program, the Airport is currently pursuing a Grader with Wing Plow in FFY 2017.

Recommendation: Purchase and replace SRE as necessary and maintain existing SRE.

5.3.3 SNOW REMOVAL EQUIPMENT STORAGE

The existing SRE building at ASH is approximately 11,000 square feet and consists of four bays (two in the front and two in the back) for SRE ingress/egress. Airport personnel have expressed that the size of the SRE building is not adequately meeting their needs in terms of space, storage, and ability to perform maintenance.

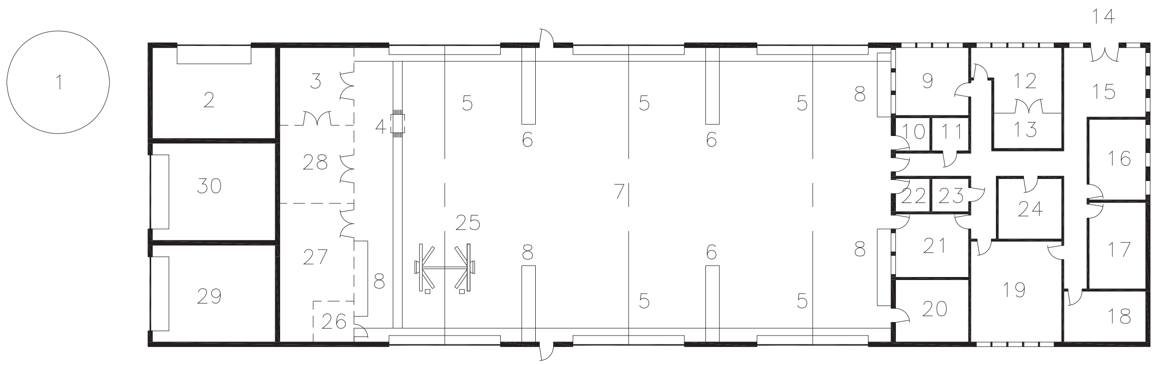
According to FAA AC 150/5220-18A, the classification of airport "size" is defined according to the total paved runway area identified by the airport operator's winter storm management plan that will be cleared of snow, ice, and/or slush. The total paved area in turn determines the size of the building. As such, with 600,000 square feet of runway, ASH is classified as a *Medium Airport*, having at least 420,000 but less than 700,000 square feet of total paved runway.

As previously discussed, ASH is eligible for the following fleet of equipment:

- 2 Carrier Vehicles/Plows
- 1 Carrier Vehicle/Sweeper
- 1 Hopper Spreader
- 1 Front End Loader

Based on the Airport's fleet size, typical eligible storage space would fall into the *Small-to-Medium-Sized Fleet*, with a typical building layout inclusive with a 5 drive-through bay design, expressed in Figure 3-1 of AC 150/5220-18A (see Figure 5-3).

Figure 5-3 SRE Building Layout



LEGEND

1. LIQUID DEICER TANK
2. HEATED SAND STORAGE
3. PARTS CLEANING/DEGREASER/ BLAST CABINET/PAINT BOOTH
4. BRIDGE CRANE
5. EQUIPMENT PARKING
6. SNOW REMOVAL EQUIPMENT STORAGE
7. VEHICLE WASH/STEAM BAY
8. MECHANIC'S WORK BENCHES
9. SNOW DESK
10. MEN'S REST ROOM
11. MECHANICAL ROOM (HVAC)
12. ELECTRICAL EQUIPMENT REPAIR
13. ELECTRICAL PARTS STORAGE
14. BUILDING ENTRANCE
15. ADMINISTRATION/RECEPTION AREA
16. AIRPORT OPERATIONS MANAGER
17. MEN'S REST ROOM/LOCKERS/SHOWERS
18. WOMEN'S REST ROOM/LOCKERS/SHOWERS
19. CONFERENCE/BREAK ROOM & KITCHEN
20. SPECIAL TOOLS
21. GARAGE SUPERVISOR'S OFFICE
22. WOMEN'S REST ROOM
23. MECHANICAL ROOM (PHONE, ELECTRICAL)
24 REFERENCE LIBRARY
25. MAINTENANCE AREA
26. USED AUTOMOTIVE FLUID STORAGE
27. LARGE/SMALL PARTS STORAGE
28. MACHINE SHOP/WELDING AREA
29. DRY DEICER STORAGE AREA
30. UREA STORAGE AREA

GRAPHIC SCALE (FEET)

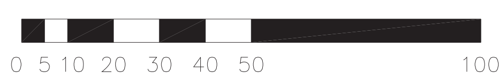


Figure 3-1. Small- to Medium-Sized Fleet – Typical Building Layout for Drive-through Design

Findings: According to the Airport's 1989 Master Plan, the SRE building was constructed in 1985. Further, according to the Airport's history of federally funded projects, the SRE building was expanded in 2001. It should be noted that the minimum useful life for buildings is 40 years.

Recommendation: Determine how much additional space is necessary to the meet the needs of the Airport and consider expanding the existing SRE storage or constructing a new SRE building adequate for the size of the Airport and its eligible SRE.

5.3.4 FUEL FACILITIES

There are two aboveground aviation fuel tanks located at the Airport providing 100-LL fuel and Jet-A fuel. Both types of fuel are delivered to aircraft by fuel trucks. The Airport owns the fuel tanks and charges a fuel flowage fee; however, the equipment and operations are privately owned by the FBOs. The Airport has expressed an interest in providing self-serve fuel, which would make fuel accessible to airport users after hours.

Recommendation: Consider adding a self-fueling facility for 100-LL as a means of reducing personnel costs and providing fuel 24 hours per day for airport users.

5.3.5 AIRPORT FENCING

The Airport currently has full perimeter fencing that was installed as part of various projects over the years. A majority of the fence is 8-foot galvanized chain link, with some 8-foot high, PVC coated portions for aesthetic purposes in public areas. Through discussions with Airport personnel, it has been reported that vegetation is currently growing through portions of the fence in the Runway 14 end, northeast of Airport Perimeter Road abutting the railroad tracks. A detailed diagram of fencing around the airport can be found in the Existing Facilities Plan (Figure 2-1). While the Airport does have a full perimeter fence, in the Runway 14 end, the fence follows the path of Deerwood Drive. As such, the MALSR Light Area north of Deerwood Drive is not fenced in. In addition, the Airport has discussed purchasing two properties along Pine Hill Road. At such time, the Airport should consider realigning the fence to encompass these two areas.

Recommendation: Maintain the exiting fencing through timely inspections and keep vegetation from growing too close or within existing fencing. Expand the perimeter fence to enclose the MALSR Light Area north of Deerwood Drive with 8-foot galvanized chain link fence with 3-strand barbed wire outriggers and realign the existing fence along Pine Hill Road to include future land acquisition.

5.3.6 AIRCRAFT RESCUE AND FIREFIGHTING EQUIPMENT/FACILITIES

Aircraft rescue and firefighting services are provided by the City of Nashua. Station 5- *Airport Fire Station* is located at 101 Pine Hill Road, abutting airport property with direct access to the airfield in case of emergencies.

Recommendation: Continue to maintain communication with Station 5 so that expectations, responsibilities, and communications between Station 5 and the Airport are cohesive.

5.3.7 DEICING FACILITY

Through discussions with Airport personnel, FBOs, and airport users about promoting growth, it was determined that the Airport is often overlooked due to its lack of deicing capabilities. It has been reported that aircraft operators are "worried about being stuck at the airport following a storm". As a result, the Airport is interested in providing deicing services to its users.

Presently, the Multi-Sector General Permit (MSGP) for Stormwater Discharges associated with Industrial Activity, and 40 Code of Federal Regulations 449, Subpart A- Airport Deicing, apply only to discharges of pollutants from deicing operations at Primary Airports. Boire Field is classified as a General Aviation Airport, with only smaller corporate jets and no scheduled air carrier service. It is not estimated that ASH will experience the type of jet traffic that would demand extensive deicing. Through discussions with other General Aviation airports providing deicing operations, it is estimated that total deicing fluid used annually at Boire Field would be less than 200 gallons.

Gale Associates contacted the U.S. Environmental Protection Agency (EPA), Region 1 out of Boston, MA for further guidance regarding applicable regulations. According to the EPA, deicing operations described at Boire Field would be limited to the use of Type-I biodegradable deicing fluid, and requirements would be focused on source reduction and runoff management, documentation of deicing operations in the Airport's Stormwater Pollution Prevention Plan (SWPPP), and additional inspections (at least monthly during deicing season). No discharge monitoring would be required. In addition, the Airport would be required to pay particular attention Parts 8.S.4-8.S.6 of the 2015 MSGP (see Appendix G), which includes the following:

- Good Housekeeping Measures.
- Management of Runoff.
- Additional SWPPP Requirements.
- Additional Inspection Requirements.

Certain deicing components are eligible for AIP funding, while others are not. Regarding AIP eligibility, the AIP Handbook[4] lists the following as ineligible:

- Storage facilities and buildings for aircraft de-icing equipment, vehicles, and fluids are only eligible at commercial service airports (Table C-2).
- Aircraft deicing fluids (Table C-3).
- A ground de-icing pad (paved areas, drainage collection structures, treatment and discharge systems, lighting, paved access for deicing vehicles and aircraft) (Table D-1).

[4] Order 5100.38D, Airport Improvement Program Handbook

The AIP Handbook lists the following as eligible:

- Aircraft deicing equipment, provided that the equipment is owned by the airport and is made available on a non-exclusive basis (Vehicles and equipment for aircraft deicing and anti-icing on the ground are eligible at any NPIAS airport) (Table M-1).

Consequently, the Airport will be responsible for funding deicing equipment, vehicle, and fluid storage buildings, as well as fluids, a deicing pad, and all associated amenities. The deicing equipment itself will be eligible for reimbursement. Additional requirements for the installation of these facilities include, but are not limited to:

- The deicing facility must be shown on the CIP.
- An environmental finding must be issued for the de-icing facility (CATEX, FONSI, or ROD).
- The Airport must update its SWPPP to include provisions for management of deicing operations.
- The airport must comply with all federal, state, and local regulations governing the disposal of runoff from any deicing operations.

Recommendation: Designate an area suitable for deicing operations and update the Airport's SWPPP to address deicing operations per the MSGP.

5.3.8 AIRPORT SIGNAGE

Presently, signage directing visitors to the Airport is extremely limited. With the exception of a couple of signs located on Daniel Webster Highway, signage directing and indicating that visitors have arrived at the Nashua Airport is located on the corner of Pine Hill Road and Perimeter Road. This is approximately 7/10 of a mile away from the airport's administrative offices, restaurant, FBO, ATCT, etc. It has been indicated that the Airport lacks sufficient signage to help the general public navigate to the actual "heart" of the Airport.

Recommendation: The Airport should consider investing in signage that would provide assistance to the general public in better navigating to the variety of offices and businesses located at the Airport.

5.4 CONCLUSION

The Airport is a quality facility offering a wide variety of General Aviation services to the region. Improvements to the facility are needed to meet basic safety requirements per the applicable FAA standards and to provide adequate space for the Airport's current and future aircraft fleet, as well as, airport tenants and visitors.

Facilities Exceeding Useful Life

Short-Term (2018-2022) Improvement Requirements

- Rotating Beacon was refurbished in 1987 and was eligible for reconstruction in 2002.
- Taxiway 'A' relocation (400') to meet Runway-to-Taxiway separation requirements.

- Foxtrot Ramp (1983) was eligible for reconstruction in 2003.
- Taxiway 'E' (1996) was eligible for reconstruction in 2016.
- Taxiway 'F' (1991) was eligible for reconstruction in 2011
- Taxiway 'G' West (1991) was eligible for reconstruction in 2011.
- Inner Taxiway (1991) was eligible for reconstruction in 2011.
- Golf Ramp (1986) was eligible for reconstruction in 2006.
- Hotel Ramp (1996) was eligible for reconstruction in 2016.

Mid-Term (2023-2027) Improvement Requirements

- India Ramp (2003) will be eligible for reconstruction in 2023.
- Delta Ramp reconfiguration to accommodate future hangars as demand warrants.

Long-Term (2028-2037) Improvement Requirements

- The two off-airport obstruction lights located at the corner of Charron Avenue and Pine Hill Road and on Robert Drive (2008) will be eligible for replacement in 2028.
- Hazard Beacon #1 (2008) will be eligible for replacement in 2028.
- Hazard Beacon #2 (2008) will be eligible for replacement in 2028.
- Echo Ramp (2009) will be eligible for reconstruction in 2029.
- Runway 14-32 (2012), including associated lighting and PAPIs, will be eligible for replacement in 2032.
- Taxiway 'B' (2012) will be eligible for reconstruction in 2032.
- Taxiway 'C' (2012) will be eligible for reconstruction in 2032.
- Taxiway 'D' (2012) will be eligible for reconstruction in 2032.
- Taxiway 'G' East (2012) will be eligible for reconstruction in 2032.
- The three Obstruction lights along the railroad tracks (2012) will be eligible for replacement in 2032.
- Alpha Ramp East (2012) will be eligible for reconstruction in 2032.
- Alpha Ramp (2017) will be eligible for reconstruction in 2037.
- Taxiway 'G' (2017) will be eligible for reconstruction in 2037.

Other Considerations

- Continue to work with abutters to acquire easements and clear vegetative obstructions to the Airport's FAR Part 77 Surfaces.
- Relocate the AWOS so that obstructions are removed or minimized.
- Relocate windcone to a more suitable location.
- Establish designated parking inside the fence that provides clear delineation between automobile parking and aircraft movement areas.
- Purchase and replace snow removal equipment as it becomes eligible and necessary.
- Maintain airport fencing and conduct vegetation removal in and around existing fencing.
- Offer deicing.
- Improve off-airport signage that is user-friendly for the general public.

- Construct administration/information building near the Air Traffic Control Tower that will serve was the “front door” of the Airport or relocate the Airport Manager’s office into the old Daniel Webster College building.
- Replace the “grass tie-down” area to accommodate future construction of box hangars as demand warrants.
- Develop T-Hangars in the area of India ramp as demand warrants.
- Construct an on-call customs center at the Airport to handle international flights.
- Construct a self-serve fuel facility providing 100-LL.
- Expand SRE building or relocate to a new facility and location.
- Construct additional tie-down spaces to Echo Ramp as demand warrants.
- Construct additional tie-down spaces to Foxtrot Ramp as demand warrants.
- Construct additional tie-down spaces to Golf Ramp as demand warrants.
- Construct additional tie-down spaces to Hotel Ramp as demand warrants.
- Coordinate with the Airport Facilities Terminal Integration Laboratory regarding the siting of a potential new air traffic control tower.

CHAPTER 6 – FUTURE AIRPORT DEVELOPMENT

The purpose of this chapter is to document the Airport's sources of revenue, identify its service area and competing interests, and provide an overview of the Airport's ability to accommodate future development and growth.

6.1 BUSINESSES LOCATED AT THE AIRPORT

A significant contributing factor to the Airport's future development is the growth of on-airport businesses that rely on Airport facilities for day-to-day operations or attract airport users. Below is a listing of businesses, including a brief description of the services provided, currently located on Airport property[1]:

- **Air Direct Holdings, LLC** is a flight school providing flight training, charter service, banner tow, and maintenance services.
- **Blue Sky Aircraft Services** is an aircraft engine servicing and maintenance company.
- **Brouillette Aviation Training** is a flight school offering private pilot and instrument flight training, introductory/scenic flights, pilot recurrency training, rusty pilot refresher training, spin training, crosswind landing skill mastery, spousal indoctrination/co-pilot/pinch-hitter flights, and aircraft rental.
- **C&R Helicopters** is an FAA Part 141 certified private and commercial helicopter flight school providing training, sales, and service.
- **East Coast Aero Club** is a flight school and aircraft rental company offering training in the following areas: private pilot training, instrument rating, commercial pilot certificate, complex endorsement, multi-engine rating instruction, certified flight instructor (CFI), certified flight instructor – instrument (CFII), multi-engine instructor, airline transport pilot (ATP), and aerobatic and tailwheel.
- **East Point Executive Center** offers coworking space and private office suites.
- **Exclusive Air, Inc.** is a charter flight broker offering a variety of aircraft options from small jets, which can accommodate up to 7 passengers for short flights, to large jets, which can accommodate up to 16 passengers for transcontinental flights.
- **Infinity Aviation** is a full-service Fixed Based Operator offering aircraft maintenance and repairs, jet charter sales and management, aircraft sales, hangar rentals, and fuel sales.
- **Leland Aero Service, LLC** provides aircraft repair, inspection and modification services.
- **Macair** provides hangar leases, executive office suites and is user-friendly to private and charter operators.
- **Midfield Café** is an American diner offering breakfast, brunch and lunch items and a view of the airfield.
- **Nashua Jet Aviation** offers short-term or long-term hangar rentals.

[1] http://www.nashuaairport.com/airport-businesses.html

- **The Nashua Airport Authority** is a corporation in the State of New Hampshire and consists of a board of five directors appointed by the Mayor. The Nashua Airport Authority is the owner and operator of ASH.
- **OIA Air Corp** is a private aircraft charter offering a private, secure facility with heated, indoor parking for vehicles.
- **PilotWorkshop.com** is an online pilot proficiency training school.
- **Scientific Solutions** is a pioneer in defense applications of active SONAR, maintaining a diverse team of engineers which thrives on the novel challenges presented by early research and prototype work.

6.2 CITY ZONING RECOMMENDATIONS

Current Zoning for the City of Nashua contains an Airport Approach Zone overlay district to avoid land use conflicts with users, which may be incompatible with uses, and noise levels produced at Boire Field. This ordinance was adopted in 1968, and certain sections of the ordinance contain outdated information since the extension of Runway 14-32 in 2012. The following is a listing of recommended updates to the Airport Approach Zone:

- Section C (1) states, "This airport approach plan, prepared under the authority of RSA 424:3, is based upon the ultimate development of a general aviation type airport with a runway 14/32 5,550 feet and a primary surface 5,900 feet by 1,000 feet."

  Recommendation: This section should be updated to include, "This airport approach plan, prepared under of RSA 424:3 is based upon the existing general aviation type airport with a runway 14/32 6,000 feet and a primary surface of 6,400 feet by 1,000 feet."

- Section C (3)(a) states, "In the approach zone to Runway 32 (SE end), which is 500 feet wide at a point 200 feet from the end of the runway and 2,500 feet wide at a point 10,200 feet from the end of the runway, at an inclined plane of 40:1 slope."

  Recommendation: This section should be updated to include, "In the approach zone to Runway 32 (SE end), which is 1,000 feet wide at a point 200 feet from the end of the runway and 3,500 feet wide at a point 10,200 feet from the end of the runway, at an inclined plane of 34:1 slope."

- Section C (3)(b) states, "In the approach zone to Runway 14 (NW end), which is 1,000 feet wide at a point 200 feet from the end of the run way and 7,000 feet wide at a point 10,200 feet from the end of the runway, an inclined plane of 50:1 slope, widening thereafter to 16,000 feet at a point 50,200 feet from the end of the runway, an inclined plane of 40:1 slope."

  Recommendation: This section should be updated to include, "In the approach zone to Runway 14 (NW end), which is 1,000 feet wide at a point 200 feet from the end of the runway and 4,000 feet wide at a point 10,200 feet from the end of the runway, an inclined plane of 50:1 slope, widening thereafter to 16,000 feet at a point 50,200 feet from the end of the runway, an inclined plane of 40:1 slope."

- Section C (4) states, "The airport reference point is located on the center line of the runway, 2,750 feet from the southeast end of the runway, and the airport elevation is 199 feet above mean sea level."

  Recommendation: This section should be updated to include, "The airport reference point is located on the centerline of the runway 3,000 feet from the southeast end of the runway, and the airport elevation is 200.4 feet above mean sea level."

6.3 AIRPORT SERVICE AREA

As discussed in Chapter 4 *Forecast of Aviation Demand,* for purposes of this report, the Airport's service area is divided into two categories: The Primary Service Area, which includes based aircraft owners who reside within 15 miles of ASH, and the Secondary Service Area, which includes based aircraft owners who reside outside of 15 miles but within 25 miles of ASH. Approximately 63 percent of aircraft owners reside within 15 miles of ASH, approximately 24 percent of aircraft owners reside outside of 15 miles but within 25 miles of ASH, and approximately 13 percent of aircraft owners reside beyond 25 miles from ASH.

Competing airports within ASH's Primary and Secondary Services Areas include:

- Manchester-Boston Regional Airport (MHT), located approximately 11 miles from ASH, has two runways, 17-35 (9,250' x 150') and 06-24 (7,651' x 150'), and offers the following GA amenities:
  - Full FBO services (aircraft fueling, deicing, maintenance and avionics services; executive passenger lounge and conference rooms, pilot and crew lounge, flight planning area, and customs service facilities);
  - Conventional and T-hangars;
  - Apron tie-down space;
  - Automobile parking areas.
- Fitchburg Municipal Airport (FIT), located approximately 20 miles from ASH, has two runways, 14-32 (4,510' x 100') and 02-20 (3,504' x 75'), and offers the following GA amenities:
  - Full FBO services (aircraft fueling, maintenance, flight planning);
  - Conventional and T-hangars;
  - Apron tie-down space;
  - Automobile Parking.
- Lawrence Municipal Airport (LWM), located approximately 20 miles from ASH, has two runways, 05-23 (5,001' x 150') and 14-32 (3,900' x 100'), and offers the following GA amenities:
  - Full FBO services (aircraft fueling, deicing, maintenance; pilots lounge and flight planning area);
  - Conventional and T-Hangars;
  - Apron tie-down space;
  - Automobile parking.

- Hanscom Field (BED), located approximately 25 miles from ASH, has two runways, 11-29 (7,011' x 150') and 05-23 (5,107 x 150'), and offers the following GA amenities:
  - Full FBO services (aircraft fueling, deicing, aircraft maintenance; conference and meeting rooms, pilots lounge and flight planning);
  - Conventional and T-hangars;
  - Apron tie-down space;
  - Automobile parking areas.

6.4 SOCIOECONOMIC CHARACTERISTICS

As outlined in Chapter 4, *Forecast of Aviation Demand*, there are a variety of socioeconomic trends that have the potential to impact aviation demand at ASH. Some of these factors include population and median age; and income factors, such as per capita income, household income, and unemployment.

U.S. Census Bureau projections predict that the county of Hillsborough will experience a population increase of 4.9 percent through 2035, which is slightly slower than the projected population growth rate of 5.4 percent for the state of NH, and significantly slower than the projected population growth rate of 11 percent for the U.S. overall. Additionally, the median age of Hillsborough County saw an increase from 38.5 years to 40.1 years from 2010-2015. As previously stated, this sector has the potential to affect ASH as pilots are retiring at a rate higher than the rate at which student pilots are beginning to fly and become certified.

Per Capita Income (PCI) and household income rates are also significant contributing factors to overall participation in GA activities as the costs associated with obtaining a pilot's license can be substantial. The average PCI in Hillsborough County from 2005-2015 increased slightly, by 3.1 percent, while the state of NH experienced a 3.2 percent increase in PCI, and the nation saw an increase of 3.0 percent in PCI. The average household income in Hillsborough County also experienced a slight increase of 0.6 percent from 2010-2015, while the state of NH and U.S. experienced increases to average household income of 1.1 percent and 0.8 percent, respectively.

Similar to income, unemployment rates have the potential to affect ASH as lower rates of unemployment are indicative of favorable economic conditions for businesses, which can lead to increases in aviation demand and the financial ability of citizens to have more disposable income. From 2000-2015, the percent of unemployed people in Hillsborough County increased from 2.5 percent to 4.2 percent, while the percent of unemployed people in NH increased from 2.7 percent to 3.9 percent, and the percent of unemployed people in the U.S. overall rose from 3.7 percent to 5.2 percent.

Based on these socioeconomic conditions, it is reasonable to conclude that no unique circumstances exist at this time that would contribute to unusual growth at ASH.

6.5 RENTAL RATES EVALUATION

In an effort to compare its lease rates, fuel flowage fees, landing fees, tie-downs, etc. against competing airports in the region, the Airport conducted an outreach effort to obtain this information from neighboring airports.

Table 6-1 Rates Evaluation

	LWM	FIT	CON
LAND LEASE RATES	$.465/sqft.	Varies	$13-14/sqft.
FUEL FLOWAGE	$0.05/gallon	$0.00[1]	$0.07/gallon AvGas/$0.28/ gallon Jet A
LANDING FEES	$10-$96, depending on weight	$10-$80, depending on weight	$12-$300, depending on aircraft category
TIE-DOWNS	$75 single/$100 twins	$80/month	$45/month
OVERNIGHT PARKING	$7.50	$10-$80, depending on weight	$12-$300, depending on aircraft category

[1] FIT conducts its own fueling operations

6.6 TERMINAL FACILITIES EVALUATION

The purpose of this section is to evaluate potential locations for corporate hangars, T-hangar, and tie-downs.

6.6.1 CORPORATE HANGARS

Presently, there are 12 privately owned corporate hangars located at ASH with capacity for 26 aircraft. The corporate hangars are located in various locations throughout the airfield, which are identified in Figure 2-1 Existing Facilities Plan. As demand for corporate hangars present themselves, the Airport wants to be positioned to accept the growth. “Delta” Ramp, locally known as the “bone yard”, is an abandoned apron located southeast of the Air Traffic Control Tower approximately 174,950 square feet in size. The Airport has identified “Delta” Ramp as the most likely suitable area for the development of corporate hangars. In addition, the Airport has identified the area located south of “Alpha” Ramp as suitable for the construct of additional corporate hangars as well reconstruction of the hangar area located adjacent to Taxiway ‘G’ for future corporate hangars.

6.6.2 T-HANGARS

Presently, there are 106 privately owned T-hangar units located at ASH with general capacity for 106 aircraft. With the exception of five T-hangar units, the majority of T-hangars are located in the northwest portion of the Airport (see Figure 2-1 Existing Facilities Plan). As demand for T-hangar units present themselves, the Airport wants to be positioned to accept the growth. Where majority of the Airport is currently built-out in terms of T-hangar development, the Airport has identified the area located at the end of "India" Ramp at the northwest end of the Airport (see Figure 8-4 India Ramp Options) as the most likely suitable area for the development of T-hangars. With the proposed shifting of Taxiway 'A', the Airport considered extensions to the existing T-hangars located off "Golf" Ramp, and "Hotel" Ramp, but ultimately reject this concept as it would interfere with the relocation of the AWOS and ATCT line of site. As demand for T-hangars warrants, the Airport wishes to reserve existing "India" Ramp to accommodate future T-hangar development.

6.6.3 TIE-DOWNS

Presently, there are 310 tie-downs located at ASH, which are owned and managed by the Nashua Airport Authority. As outlined in Chapter 5 *Facility Requirements,* it is anticipated that the Airport will require 240 tie-down spaces to accommodate aircraft through the planning period. Where the Airport has 310 tie-down spaces, additional tie-down spaces are not recommended at this time. However, the Airport intends on shifting Taxiway 'A' 150 feet closer to Runway 14-32 (maintaining a compliant 400 feet of runway-to-taxiway separation). Shifting of Taxiway 'A' will provide the Airport with additional room for apron expansion ("Echo", "Foxtrot", "Golf", and "Hotel" Ramps) as demand at the Airport warrants.

6.6.4 ADMINISTRATION/INFORMATION BUILDING

The Airport does not currently have a stand-alone administration building. Airport management and staff conduct business out of small offices attached to the SRE building. This presents a variety of problems for airport staff, airport users, and the general public:

- The building is not visible or easily accessible to the public;
- Visitors are required to navigate through airport fencing to gain access to airport management offices;
- There is not adequate space for staff or desired user amenities; and
- The current building has no view of the airfield, which is both a safety and aesthetic concern.

After careful consideration, the Airport has identified three potential options to address its need for improvements to its administration building, which include the following:

- Upgrading the former Daniel Webster building to include the desired amenities: The former Daniel Webster Building is located at midfield, has adequate accommodations for parking, is easily accessible from Perimeter Road, and is home to the ATCT[2].

[2] Since the writing of this chapter, the Daniel Webster College building has been sold to SNHU, and this option is likely no longer viable.

- Expanding the former Daniel Webster building to include the desired amenities: This would provide the same benefits as upgrading the current facility, while allowing the current occupant to continue operations[3].
- Constructing a new facility southeast of the former Daniel Webster building: There is sufficient available land in this area to construct an administration/information facility large enough to accommodate all airport needs. A new facility built in this location would give airport users, management, and the public immediate access to the airfield.

6.7 DEICING, SELF-SERVE FUEL, AND SOLAR PANELS EVALUATION

6.7.1 DEICING

As discussed in Chapter 5, Facility Requirements, the Airport believes it is often overlooked by corporate jet owners due to its lack of deicing capabilities. An important component to installing a deicing facility is determining a suitable location that considers all USEPA regulations regarding source reduction and runoff management, Stormwater Pollution Prevention Plan documentation, and monitoring. The Airport has reviewed possible locations and determined that the best location for a deicing facility would be in the tie-down area adjacent to the Infinity Aviation building (see Figure 8-1 Ultimate Airport Layout Plan). This location was selected as the most suitable because Infinity Aviation, one of the Airport's FBOs, will likely be responsible for operating, maintaining, and monitoring the system, and ease of access for pilots.

6.7.2 SELF-SERVE FUEL

As discussed in Chapter 5, Facility Requirements, there are two aboveground aviation fuel tanks owned by the Airport providing 100LL fuel and Jet-A fuel. The Airport is interested in providing self-serve fuel to increase availability to users after hours.

Aircraft self-serve fueling facilities are designed on aprons. Wingtip and object clearance rules that apply to taxiways and taxilanes also apply to taxiways and taxilanes on aprons. Considerations for aircraft self-serve fuel include meeting the standards of taxiway and taxilane object free area, and wingtip clearance for a particular Airplane Design Group, as outlined in FAA AC 150/5300-13A.

6.7.3 SOLAR PANELS

A solar photovoltaic system (solar PV), is a power system designed to supply usable solar power by means photovoltaics. It consists of an arrangement of several components, including solar panels to absorb and convert sunlight into electricity, a solar inverter to change the electric current from DC to AC, as well as mounting, cabling and other electrical accessories to set up a working system. As the cost of solar PV systems drop, and incentives increase, airports across the country have been exploring opportunities to utilize empty space located at their airports.

[3] Since the writing of this chapter, the Daniel Webster College building has been sold to SNHU, and this option is likely no longer viable.

Solar panels are typically ground mounted but may also be mounted on rooftops and other structures. There are a variety of siting requirements for airports to consider when planning for the layout of solar panels:

- Solar panels must not be constructed in the Runway Safety Area, Runway Object Free Area, Runway Obstacle Free Zone, Taxiway Safety Area, Taxiway Object Free Area, Navaid critical areas, or the Clearway.
- Solar panels must not penetrate the imaginary surfaces that define the lower limits of the airspace (Part 77).
- Solar panels must not create glare that impacts airspace safety. A solar glare analysis is mandatory.
- The Airport shall complete a notice of proposed construction form (7460-1) and submit the form to the FAA for all proposed solar projects at the Airport.

Sponsors of a federally-obligated airports must seek FAA review and approval to depict certain proposed solar installations (e.g., ground-based installations and collocated installations that increase the footprint of the collocated building or structure) on its ALP, before construction begins. A sponsor of a federally-obligated airport must notify the FAA of its intent to construct any solar installation by filing FAA Form 7460-1, “Notice of Proposed Construction or Alteration” online under 14 CFR Part 77 for a Non-Rulemaking case. This includes the intent to permit airport tenants, including Federal agencies, to build such installations.

6.7.4 ON-CALL CUSTOMS

As previously discussed in Chapter 5 Facility Requirements, Customs and Border Patrol (CBP) was contacted regarding qualification criteria for on-call customs services. While the Airport would not qualify for a “Port of Entry” designation, it would be eligible to participate in the “User Fee Airport (UFA) Program” as long as it could meet the criteria outlined in Section 5.2.4 On-Call Customs.

6.8 FUTURE ROLE OF ASH IN NPIAS

Eighty-eight percent of NPIAS airports are classified as nonprimary airports and serve mainly general aviation activity. According to NPIAS, ASH is categorized as a non-primary, reliever airport, and is further defined as a national airport. NPIAS defines national airports as “located in metropolitan areas near major business centers and support flying throughout the nation and world. These airports provide pilots with attractive alternatives to the busy primary airports. National airports have very high levels of activity with many jets and multiengine propeller aircraft.”

According to the FAA Airport Categories definition, reliever airports “are airports designated by the FAA to relieve congestion at Commercial Service Airports and to provide improved general aviation access to the overall community."[4] Theoretically, if an emergency occurred in ASH's service area, aircraft from larger airports, such as MHT, could be safely diverted to ASH.

6.9 INDIA RAMP DEVELOPMENT

The Airport is considering alternatives to develop the unused area to the south of "India" Ramp. Possible development scenarios include the construction of T-Hangars and/or the construction of a solar farm.

Hangars

The infrastructure required to construct T-Hangars off "India" Ramp include taxilanes from "India" Ramp to the T-Hangars and associated parking areas for vehicles. The T-Hangars will require utilities which are electrical power, sewer and water. The T-Hangars may use propane tanks for heat or natural gas if available on Perimeter Road. The drainage system around the proposed T-Hangars will also need to be updated to take into account the added impervious areas which are the proposed pavements and T-Hangars.

To assure appropriate use of hangars, an airport sponsor should:

- Manage the use of hangars through an airport leasing program that requires a written lease agreement or permit;
- Monitor the use of hangars on airport and take steps to prevent unapproved non-aeronautical uses;
- Ensure that the length of time on a waiting list of those in need of a hangar for aircraft storage is minimized; and
- In cases where temporary non-aeronautical use of a vacant hangar is permitted, ensure that non-aviation users pay a fair market rental for the use of the hangar, and that the hangar can be returned to aviation use when needed.

Solar Project

The infrastructure required to construct a solar farm off of "India" Ramp would be an access road from "India" Ramp to the solar farm with the associated parking areas for maintenance vehicles and safety vehicles. The Solar Farm shall be placed on terrain that is flat or gently rolling and have an unobstructed view to the south. Drainage in this area would need to be updated. Electrical conduits would also be constructed from the Solar Farm to an area off Perimeter Road where the AC disconnect, Main Utility Breaker panel and the utility meter will be located. The utility meter will account for the amount of electricity that will be transferred to the user.

In order for the Airport to lease land for non-aeronautical purposes (such as electricity generation), it must consult with the FAA and NHDOT/BA. Airport property is dedicated for airport purpose, including non-aeronautical, but aviation-compatible uses to generate airport revenue. The FAA must ensure solar power

[4] https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

use agreements for airport property for sale or lease demonstrate that such use provides prudent financial benefit to the airport and to civil aviation.

In some cases, extensive solar power uses of airport property will require FAA approval of a land release request. If so, the sponsor must submit documentation describing, among other items, the airport's obligations to the land based on how it was acquired, the type of land release request, and justification for the release. The Airport must also demonstrate that fair market value will be obtained in return for the release and explain what will be done with the revenue that is generated by the release. The proposed action subsequent to the release must be shown to be in compliance with the ALP. In most cases, the FAA prefers that airport land not needed for aeronautical uses be leased rather than sold to provide continuous income for airport purposes and preserve the property for future aviation usage so long as the use is compatible with airport operations.

CHAPTER 7 – ECONOMIC SUSTAINABILITY

This chapter provides an overview of the airport's attempts to maintain economic viability while investing in infrastructure developments to promote future growth. This can be achieved through a combination of efforts including revenue generation through partnerships with local businesses and organizations, upgrades to facilities to attract users, and conveyance of airport value to the public through outreach and hosting of community events. As a federally obligated airport, ASH must manage these factors within the constraints of FAA regulations.

As defined in FAA's 2015 research study entitled, "Lessons Learned from Airport Sustainability Plans", "*airports view sustainability as a process of continuous improvement, not an end goal. When embraced as a process of continuous improvement, sustainability initiatives can contribute to almost every facet of airport operations and thus can serve to facilitate future growth.*"

7.1 ECONOMIC BENEFITS OF ASH

Because of its location, Nashua Airport is home to approximately 23 businesses ranging from service based to light industrial. Though known for aviation related businesses, the Airport also encompasses several zoned commercial areas that are not directly on the airport. With its easy access to and from highways, and central location, the Airport provides a vital link for businesses and corporate travelers.

As previously discussed, Nashua Airport was recognized in the New Hampshire State Airport System Plan (NHSASP) as a "National" airport. National airports, as defined in the NHSASP, are "*those that have the capability to provide all services and facility infrastructure required by users and communities served by General Aviation Basic, Local, and Regional Airports. More importantly, National Airports can also provide aircraft access to national and sometimes international markets, depending upon the local business climate and the needs of their most sophisticated based and transient aircraft operators. Typically, General Aviation- National Airports are those where growth and expansion have driven improvements to airside and landside facilities in order to accommodate increases in demand by sophisticated aircraft and business/corporate aircraft operators.*"

The estimated economic contribution by ASH is highlighted in Table 7-1 below.

Table 7-1: Estimated Economic Contribution of ASH 2015

	Total Employment	*Total Payroll*	*Total Output*	*Total Tax Revenue*
Total Impact	33	$14.99 million	$40.75 million	$1.32 million

Source: NHDOT/BA 2015 NHSASP

7.1.1 CONVEYING THE VALUE OF THE AIRPORT

One aspect of the Airport that stands out is its lack of a sound marketing plan to promote visibility in the region and beyond. Creating and implementing an enhanced, vertical marketing effort appears to be a low-cost method of potentially adding increased activity and revenue without having to expend significant funds.

The following recommendations are cost-effective marketing strategies aimed at bolstering the presence of the Airport:

- Consider branding, marketing, and promoting the airport.
- Develop networks of public and private sector partnerships to promote the growth of regional economic activities that will benefit the airport.
- Cross marking with hotel/motel/resorts/colleges/chamber of commerce, etc., and have the Airport's website displayed on their sites as part of co-marketing efforts.
- Work with Regional Planning Commissions, economic development authorities charged with attracting new business and fostering economic growth.

Marketing-Land Development

Nashua Airport has the availability for aviation and/or non-aviation use. The following recommendations are strategies to market the availability of office space for lease:

- Market the availability of developable aviation and non-aviation land through Regional Planning Commissions and economic development authorities.
- Create a "developer's tool kit" to assist those interested in developing uses compatible with Airport operations. The kit should outline, among other things, local land use requirements, environmental permits required, and development resources (i.e. city sewer, public water, etc.) available for each developable parcel.
- Identify the type of development desired (i.e. warehouse, manufacturing, storage, etc.).

Service Improvements

In an effort place Nashua Airport in a stronger position to compete for lucrative corporate and business travelers and grow revenues, the establishment of an administration/information building with the following supporting amenities may serve as an attractant:

- Ready access to business centers (car rental or courtesy car).
- Business meeting locations on the airport.
- Food/catering, and other professional aviation services.

7.2 PROPOSED ADMINISTRATION/INFORMATION BUILDING

An Airport administration/information building serves as the "front door" of an airport and a gateway to the community for pilots and passengers by facilitating the safe, efficient, and convenient transfer of visitors and their baggage to and from aircraft and various modes of ground transportation. At ASH, the proposed administration/information building will contain a directory of FBOs to provide pilots with easy access to maintenance, fuel, and other required services. The administration/information building will also serve as a welcome center to visitors, offering informational pamphlets for local attractions, restaurants, businesses, lodging and other accommodations.

FBOs will continue to provide support services to airport users, including but not limited to:

- Pilot amenities (i.e., flight planning, pilots lounge, courtesy car, and supplies).
- Aircraft fuel storage and dispensing.
- Aircraft ground handling, tie-down and hangars.
- Aircraft charter/flight instruction/sales.
- Aircraft maintenance (powerplant/frame).

7.1.1 POTENTIAL ADMINISTRATION/INFORMATION BUILDING LOCATIONS

As identified in previous chapters, airport management currently operates out of small offices located within the SRE building. In order to access the facility, users must first navigate to the inconspicuous location and then go through airport fencing to enter the building. This facility is not meeting the demands of airport staff, airport users, or the general public due to inaccessibility and inadequate space. Relocating the administration/information to one of the locations identified in Section 6.6.4, *Administration/Information Building*, would make the facility the focal point of the airport and resolve many of these issues.

7.2.2 ECONOMIC BENEFITS OF ASH

One aspect to achieving sustainability involves working collaboratively with the public to provide facilities that are mutually beneficial to local businesses, the Airport, and the community. Establishing partnerships with local businesses provides the Airport with several benefits including, but not limited to: reliable revenue from long-term leases, sustained aircraft operations to justify FAA funding for improvement projects, and exposure of the Airport to aviation clients and the general population. Similarly, by establishing physical locations at ASH, business owners profit from access to urban conveniences, accessibility to major highways for easy travel, and many aviation-related amenities required for successful operation. There are several businesses located at the Airport, providing a variety of valuable services to the City of Nashua and surrounding community.

As indicated in Table 7-1, ASH contributes significantly to the state and local economy, and in 2015 generated 33 jobs, $1.32 million in tax revenue, $14.99 million in payroll, and $40.74 million in total output. Contributions such as these are made possible through growth of aviation businesses that utilize ASH to provide the community with flight and flight-support activities. For these businesses to operate effectively, the airport must commit to constructing and maintaining the many airside, landside, and support facilities contained within Chapter 5, Facility Requirements.

Airside Facilities are required for the movement of aircraft and include runways, taxiways, aprons, navigational aids, and airfield lighting systems. Businesses rely on these facilities for takeoffs, landings, transient parking, and safe navigation to the airport and around the airfield. Landside facilities are those facilities not required for the movement of aircraft and include administration/information and maintenance buildings, hangars, and other miscellaneous facilities. The primary purpose of an administration/information building is to provide passengers and the public with a “front door” to the airport. Maintenance buildings are used to provide airport users with a place to have their aircraft serviced, inspected, and upgraded, while hangar buildings are used to store aircraft in a secure location.

ASH has a variety of support facilities that help to facilitate efficient operation of the Airport, and each amenity provides users and businesses with a different benefit. These include things such as on-site snow removal and grass mowing equipment to ensure pilots can travel around the airfield without damage to aircraft by ice, snow, or vegetative overgrowth; storage buildings to extend the life of snow removal and mowing equipment; access roads so that users can travel easily to various airport facilities; and security fencing to prevent theft, vandalism, and runway incursions by people or wildlife. It is imperative for the Airport to maintain these facilities so that companies can successfully operate their businesses, thereby sustaining their economic contributions to the community.

Though ASH offers many valuable amenities, airport businesses would greatly benefit from the addition of several facilities, including but not limited to, a stand-alone administration/information building for public accessibility; self-serve fueling facilities for convenient aircraft fueling; deicing facilities to remove ice from aircraft for safe flights; and improved signage to assist visitors in navigating to the Airport. These facilities would greatly enhance the airport, making it more attractive and user-friendly.

7.2.3 COMMUNITY EVENTS

Hosting aeronautical and non-aeronautical events at ASH can provide a tremendous benefit to the Airport, its users, and the community. In addition to potential sources of revenue, the Airport has the opportunity to engage the community, generate goodwill amongst neighbors, and perhaps spark local interest in aviation.

Nashua airport is regularly approached by various groups and organizations to host aeronautical and non-aeronautical events. Below are some examples of events that have occurred at the Airport:

- Wings and Wheels: Over the past four years, the Airport has hosted the Wings and Wheels (formerly Touch-A-Truck). This even has drawn upwards of 4,000 attendees and includes magic shows, a bounce house, and dozens of vehicles on display. Attendees are encouraged to bring a non-perishable food item to be donated to charity, and during the 2017 event, the Airport raised over $550.00 in food donations for the "End 68 Hours of Hunger" program.
- Boire Field Movie Night: The airport hosts Boire Field Movie Night in cooperation with the City of Nashua Summer Fun Committee. This event draws upward of 500 participants each year.

Figure 7-1 Wings and Wheels

Figure 7-2 Boire Field Movie Night

- Fly-In Events: The Airport hosts several fly-in events each year, attracting pilots and spectators from across the region. These events include, but are not limited to: The Collings Foundation Fly-In and the Bonanza Fly-In, as well as historical aircraft fly-ins.

7.2.4 NON-AERONAUTICAL USE REQUEST CHECK LIST

Public-use airports that receive federal grant assistances are obligated to keep their airports open for aeronautical purposes. Given the amount of land that airports typical occupy, sponsors are frequently approached by the public to use a portion of the airport for some non-aeronautical purposes. To ensure compliance with the airports' obligations under the federal grants, sponsors are required to receive approval from either the FAA or the NHDOT/BA. The NHDOT/BA assists Block Grant recipients in reviewing and approving or disapproving non-aeronautical requests. In order to protect the continued safe use of airports for aeronautical purposes, airport sponsors must submit sufficient information for NHDOT/BA to be able to complete the review and issue a finding. Appendix H provides a sample request for non-aeronautical use of obligated airports.